FINDING OF NO SIGNIFICANT IMPACT

Use of Outer Continental Shelf Sand from Borrow Area F2 in the Town of Longboat Key (Florida) Beach Renourishment Project

Introduction

Pursuant to the National Environmental Policy Act (NEPA) and Council on Environmental Quality (CEQ) regulations implementing NEPA (40 CFR 1500-1508), the Town of Longboat Key, in coordination with the Bureau of Ocean Energy Management (BOEM), prepared an environmental assessment (EA) to determine whether authorizing use of Outer Continental Shelf (OCS) sand from Borrow Area F2 (BA-F2) in the Town of Longboat Key Beach Renourishment Project would have a significant effect on the human environment and whether an environmental impact statement (EIS) should be prepared. Pursuant to the Department of the Interior (DOI) regulations implementing NEPA (43 CFR 46), BOEM has independently reviewed the EA and has determined that the potential impacts of the proposed action have been adequately addressed.

Proposed Action

The overall proposed project utilizes five borrow areas (BA-F2, BA-3, BA IX, BA X and an upland borrow site) and two rehandling areas (RH 1 and RH 2) to complete a potential total dredge volume of 1,302,000 cubic yards (c.y.) of sand by the end of 2014. BA-F2 is located in federal waters approximately 12 mi offshore of Anna Maria Island (AMI) in Manatee County, FL. The other four borrow areas, BA-3, BA IX, and BA, are all located within state waters or on land (upland borrow site) (Figure 1, Attachment 1).

BOEM's proposed action is the issuance of a negotiated agreement to authorize use of BA-F2 so that the project proponent, Longboat Key, can obtain up to 466,500 cubic yards of sand resources for a beach nourishment project. The remaining 835,500 c.y. of sand is not under BOEM's jurisdiction. The project is needed to provide storm protection from the north end of Longboat Key (R44, Manatee County) to the south end of Longboat Key (R29, Sarasota County).

The purpose of BOEM's proposed action is to respond to a request for use of OCS sand under the authority granted to the Department of the Interior by the Outer Continental Shelf Lands Act (OCSLA). The legal authority for the issuance of negotiated noncompetitive leases for OCS sand and gravel is provided by OCSLA (43 U.S.C. 1337(k)(2)).

Alternatives to the Proposed Action

Sand sources sought for this latest project include a combination of regionally-limited State of Florida and federal Outer Continental Shelf (OCS) offshore resources. Federal resources include BA-F2, an offshore sand ridge lying in the direct route of a planned liquid natural gas pipeline project (Port Dolphin). As part of the mitigation for Port Dolphin project-related impacts, funds have been set aside to reimburse the Town for the design and dredging of impacted sand resources prior to the planned construction of the Port Dolphin pipeline, currently slated for construction during summer of 2013. As a result, Longboat Key is seeking to utilize these federal resources prior to construction of the pipeline when a portion of BA-F2 will become inaccessible. The remaining volume within BA-F2 but outside of the pipeline route (up to 227,000 c.y.) will be utilized following pipeline placement.

Longboat Key also investigated multiple borrow areas within State waters; however, many were eliminated based on sediment quality or sediment color reasons. The two practical proposed alternatives for this project were A) the No Action alternative and B) Authorization to use the Outer Continental Shelf (OCS) borrow area.

Longboat Key reviewed two practical alternatives to the proposed action. The first practical alternative to BOEM's proposed action is to not issue the negotiated agreement. The potential impacts resulting from BOEM's no action actually depend on the course of action subsequently pursued by Longboat Key, which could include identification of a different offshore sand source or solely the use of State water resources. In the case of the no project option, coastal erosion would continue, sea turtle and shorebird nesting habitat would deteriorate, and the likelihood and frequency of property and storm damage would increase.

The second practical alternative includes authorization by BOEM to access OCS resources in the borrow area known as BA-F2 for the extent of the negotiated agreement. These sand resources would contribute to the restoration of the beach to the fill template from the north end of Longboat Key (R44, Manatee County) to the south end of Longboat Key (R29, Sarasota County). An interim nourishment phase is planned for Funding Year (FY) 2011/2012 utilizing offshore Borrow area B3 (in state waters) and a portion of BA-F2 (in Federal waters). The interim nourishment would place approximately 310,000 c.y. of sand from R44 to R46a and R47.5 to R50 in Manatee County and R12 to R17 in Sarasota County. An island-wide project is also planned for FY 2013/2014 or later that would place sand along 9.8 mi of shoreline. During this phase the remaining 227,000 c.y. of sand within the federal borrow area would be potentially utilized (Longboat Key may utilize less than the total 227,000 c.y. authorized). This alternative includes mitigation and monitoring as part of the action.

Environmental Effects
This EA, compiled by Longboat Key (and its agents) and BOEM, has been prepared to review potential environmental effects resulting from the issuance of a negotiated agreement, and to determine if the proposed action, in light of new information, would have a significant effect on the human environment and whether an EIS must be prepared.

The connected actions of the conveyance and placement of the sand moved from BA-F2 have been addressed in the current EA (Attachment 1).

Based on the effects analysis presented in the attached EA (Attachment 1), no significant impacts were identified. The EA and FONSI identify all mitigation and monitoring that is necessary to avoid, minimize, and/or reduce and track any foreseeable adverse impacts that may result from all phases of construction (pgs. 79-82 and Attachment 7). A subset of mitigation, monitoring, and reporting requirements, specific to activities under BOEM jurisdiction, will be incorporated into the negotiated agreement to avoid, minimize, and/or reduce and track any foreseeable adverse impacts.

Significance Review

Pursuant to 40 CFR 1508.27, BOEM evaluated the significance of potential environmental effects considering both CEQ context and intensity factors. The potential significance of environmental effects has been analyzed in both spatial and temporal context. Potential effects are generally considered reversible because they will be minor to moderate, localized, and short-lived. No long-term significant or cumulatively adverse effects were identified. The ten intensity factors were considered in the EA and are specifically addressed below:

1. Impacts that may be both beneficial and adverse.
Potential adverse effects to the physical environment, biological resources, cultural resources, and socioeconomic resources have been considered. Adverse effects to benthic habitat and communities in the borrow area are expected to be reversible. Adverse effects on fish habitat and fishes are expected within the dredged area due to reduction of benthic habitat and changes in shoal topography and in the fill placement area due to burial of existing benthic habitat. There would be beneficial impacts from a reduced risk of serious damage to economically-important infrastructure due to the increased area of the shoreline buffer zone. Furthermore, over the long-term, there would be newly created shorebird and sea turtle nesting habitat. Potential effects to sea turtles, migratory birds, marine mammals, and cultural resources in the vicinity of operations have been reduced through tested mitigation such as avoidance of nesting birds, sea turtle deflector use, marine mammal observers, and cultural resource buffers.

Effects to sea turtles, marine mammals, nesting and courting shorebirds, and water quality will be monitored. Although nearshore hardbottom habitat will be impacted within the fill templates of the proposed project activities through direct burial, these impacts were previously mitigated for during the 2005/06 beach nourishment project through the construction of a compensatory artificial reef resulting in no additional adverse impact. Therefore, there will be no additional mitigation for impacts to hardbottom resources, although a nearshore hardbottom monitoring program will be implemented to monitor for impacts beyond those previously mitigated for.

Temporary displacement of birds near the shoal site or beach placement could occur. Birds may be attracted to feeding near the hopper as it is being filled at the borrow area or near discharge pipelines on the beach. Impacts would be short-term, localized and temporary and should have no lasting effects on bird populations in the area. Potential impacts to the piping plover on the beach have been accounted for through terms and conditions required by the USFWS (Attachment 4). Temporary reduction of water quality is expected due to turbidity during dredging and placement operations. Small, localized, temporary increases in concentrations of air pollutant emissions are expected but the short-term impact by emissions from the dredge or the tugs would not affect the overall air quality of the area. A temporary increase in noise level and a temporary reduction in the aesthetic value offshore during construction in the vicinity of the dredging would occur. For safety reasons, navigational and recreational resources located in the vicinity of the dredging operation would temporarily be unavailable for public use. There are no known archaeological resources within the borrow site F2, however, due to a corrupted data line (line 155), no dredging will be authorized in the buffer area noted in the figure (Attachment 3). An unexpected finds clause would be implemented in the case an archaeological resource is discovered during operations.

2. *The degree to which the proposed action affects public health or safety.*
The proposed activities are not expected to significantly affect public health. Construction noise will temporarily increase ambient noise levels and equipment emissions would decrease air quality in the immediate vicinity of placement activities. The public is typically prevented from entering the segment of beach under construction, so recreational activities will not be occurring in close proximity to operations.

3. *Unique characteristics of the geographic area such as proximity to historic or cultural resources, park lands, prime farmlands, wetlands, wild and scenic rivers, or ecologically critical areas.*
No prime or unique farmland, designated Wild and Scenic reaches, or wetlands would be impacted by implementation of this project. No critical habitat for the listed species is located within the project area. The Gulf of Mexico Fishery Management Council (GMFMC) has included BA-F2, along with all of the Gulf of Mexico sea floor, as Essential Fish Habitat (EFH). Dredging may affect feeding success of EFH species due to turbidity and loss of benthic prey. Impacts to EFH would occur in BA-F2, but the limited spatial and temporal extent of dredging suggests these impacts will not adversely affect EFH on a broad scale. Potential impacts to nearshore hardbottom and benthic communities will be minimized by placing pipeline corridors in areas devoid of hardbottom. Nearshore hardbottom impacts were previously mitigated for in the 2005/2006 nourishment cycle. Therefore, no additional mitigation was required (Attachment 5).

4. *The degree to which the effects on the quality of the human environment are likely to be highly controversial.*
No effects are expected that are scientifically controversial. Effects from beach nourishment projects, including dredging on the OCS, are well studied. The effects analyses in the EA has relied on the best available scientific information, including information collected from previous dredging and nourishment activities in and adjacent to the project area. Numerous studies and monitoring efforts have been undertaken along the coast of Florida evaluating the effects of dredging and beach nourishment on shoreline change, benthic communities, nesting and swimming sea turtles, and shorebirds.

5. *The degree to which the possible effects on the human environment are highly uncertain or involve unique or unknown risks.*
Beach nourishment is a common solution to coastal erosion problems along the Florida coast. Beach nourishment in Manatee and (neighboring) Sarasota Counties has been ongoing since the early 1990's. A 1993 restoration project included nourishment of 9.3 mi of shoreline with 3,336,000 c.y. of sand dredged from the ebb shoals of Longboat Pass and New Pass. The Mid-Key interim beach nourishment project was completed in 1997, placing 891,000 c.y. of sand from an offshore State borrow area, labeled V-A, along 3.1 mi of shoreline. Longboat Pass was dredged for maintenance in 1997 and approximately 280,000 c.y. of fill was placed along the Manatee County shoreline. In 2001, 105,300 c.y. of coarse grey sand was placed along the shoreline in Sarasota County. The sand was dredged from offshore State Borrow area V-A and was constructed to mitigate sand losses caused by the passing of Hurricane Gordon in September 2000. New Pass was dredged for maintenance in 2003 as part of the USACE maintenance dredging program and approximately 99,800 c.y. of sand was placed on the south end of

Longboat Key in Sarasota County. In 2005/06 1,789,332 c.y. of sand was placed on 10 mi of shoreline of Manatee and Sarasota Counties. The most recent project was an emergency nourishment that was constructed along the north end of Longboat Key in the spring of 2011. The project placed 133,000 c.y. of sand from the State borrow area BA-IX along a 4,015-ft of eroding beach on the north end of Longboat Key. No significant adverse effects have been documented during or as a result of these past operations. Consultation with the NMFS Protected Resource Division (PRD) under Section 7 of the Endangered Species Act (ESA) was completed and a Biological Opinion (BO) has been issued (Attachment 6). The terms and conditions required per the NMFS BO issued to BOEM include the conditions in the NMFS GRBO (2003) (involving the use of hopper dredges in channels and borrow areas along the U.S. Gulf coast). These conditions include the use of turtle deflectors, maintaining protected wildlife species' observers on the dredge ships, participation in the Right Whale Early Warning System, implementation of the NMFS' Southeast Region Vessel Strike Avoidance Measures and Reporting for Mariners, maintaining a 500-yard buffer between the vessel and any North Atlantic right whale [50 CFR 224.103(c)], and operating vessels at 10 knots or less during the right whale calving season (15 Nov- 15 April) when traveling between the shoreline to 5 nautical miles. Other conditions in the NMFS BO for BOEM, to limit the take of sea turtles, include relocation trawling, minimal use of dredge/construction lighting from 1 March to 31 October, participation in the sea turtle stranding network, and a 400-ft buffer zone establishment around hardgrounds/hardbottom. Additionally, the NMFS' Sea Turtle and Smalltooth Sawfish Construction Conditions were also included as conditions in the BO. Consultation with the USFWS under Section 7 of the Endangered Species Act (ESA) was completed on June 13, 2011. The USFWS determined that the minimization measures, Reasonable and Prudent Measures, and Terms and Conditions in the State Programmatic Biological Opinion are applicable to the project and must be followed for sea turtles and manatees. (Attachment 4). Further conservation measures were agreed upon between Longboat Key and USFWS during the consultation for protection of the piping plover. The project design is typical of beach nourishment activities. Mitigation and monitoring efforts are similar to that undertaken for past projects and have been demonstrated to be effective. The effects of the proposed action are not expected to be highly uncertain, and the proposed activities do not involve any unique or unknown risks.

6. *The degree to which the action may establish a precedent for future actions with significant effects or represents a decision in principle about a future consideration.*

No precedent for future action or decision in principle for future consideration is being made in BOEM's decision to authorize re-use of BA-F2. BOEM considers each use of a borrow area on the OCS as a new Federal action. The Bureau's authorization of the use of the borrow area does not dictate the outcome of future leasing decisions. Future actions will also be subject to the requirements of NEPA and other applicable environmental laws.

7. *Whether the action is related to other actions with individually insignificant but cumulatively significant impacts.*

Significance may exist if it is reasonable to anticipate cumulatively significant impacts that result from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions. The EA identifies those actions and potential impacts related to underlying activities. The EA and previous NEPA documents conclude that the activities related to the proposed action are not reasonably anticipated to incrementally add to the effects of other activities to the extent of producing significant effects. Because the seafloor is expected to equilibrate and sand moving along shore will slowly accumulate in BA-F2, the proposed project provides an incremental, but localized effect on the reduction of offshore sand resources. Although there will be a short-term and local decline in benthic habitat and populations, both are expected to recover within a few years. No significant cumulative impacts to benthic habitat are expected from the use of the borrow site.

8. *The degree to which the action may adversely affect districts, sites, highways, structures, or objects listed in or eligible for listing in the National Register of Historic Places or may cause loss or destruction of significant scientific, cultural, or historical resources.*

The proposed action is not expected to adversely affect historic resources. Seafloor-disturbing activities (e.g., dredging, anchoring, pipeline emplacement and relocation) may occur during proposed construction activities. An archaeological clearance survey was performed and no historic or cultural properties identified in BA-F2 or the placement area. However, due to a corrupted data line (number 155), no dredging will be authorized in the buffer area noted in the figure (Attachment 3). Refer to Attachment 3 for the consultation correspondence with the Division of Historic Resources/State Historic Preservation Office (DHR/SHPO) and all prior documentation covering survey data for submerged cultural resources in the project area.

BOEM will also work with DHR/SHPO should shipwreck remains be unexpectedly discovered (30 CFR 250.194 and 30 CFR 250.1010). Therefore, no significant impacts to cultural resources in the project area (borrow, rehandling, placement or pump-out areas), as result of the proposed action, are anticipated with implementation of the measures to protect existing identified resources, cease of work if an unexpected discovery occurs, and immediate notification to DHR/SHPO so they can determine if the resource is significant or not and make the determination of the best means to protect the resource. All of these activities have been completed in accordance with the National Historic Preservation Act (NHPA), as amended; the Archeological and Historic Preservation Act (AHPA), as amended; and Executive Order 11593. The project is in full compliance with the NHPA, as well as the AHPA and E.O. 11593.

9. *The degree to which the action may adversely affect an endangered or threatened species or its habitat that has been determined to be critical under the Endangered Species Act of 1973.*

Nesting and swimming sea turtles, smalltooth sawfish and manatees present in the project area during and after construction operations may be adversely affected. BOEM will comply with all requirements of biological opinions and concurrences associated with this project provided under the Endangered Species Act (ESA) from both U.S. Fish and Wildlife Service (U.S. FWS) (dated June 13, 2011) (Attachment 4) and National Marine Fisheries Service (NMFS) (dated April 24, 2012) (Attachment 6). BOEM and the USACE will also work concurrently to implement the Standard Conditions in the U.S. FWS Statewide Programmatic BO, the NMFS 2003 GRBO, and the NMFS Sea Turtle and Smalltooth Sawfish Construction Conditions.

These conditions and any other turtle and smalltooth sawfish safety precautions would be maintained to also comply with the NMFS biological opinion issued in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, on the Bureau of Ocean Energy Management's (BOEM) proposed action to issue an offshore sand lease to the Town of Longboat Key (Town) (dated April 24, 2012). If a hopper dredge is used for the dredging operations, potential impacts to sea turtles could occur. To minimize the risk to sea turtles, standard sea turtle protection conditions will be implemented such as the use of a state-of-the-art rigid deflector draghead at all times, inflow screens, and/or monitoring of the operation. In addition, relocation trawling will be implemented to minimize entrainment of sea turtles in hopper dredges. According to the NMFS Biological Opinion, Gulf sturgeon, Sperm whales, Humpback whales, Fin whales, Blue whales, Sei whales, and North Atlantic right whales occur only rarely in the project area and therefore the likelihood of adverse impacts are very low and the chances of the proposed action affecting them are discountable.

The USFWS determined that the placement of material on the Longboat Key shoreline from BA-F2 may affect, but is not likely to adversely affect the piping plover provided the inclusion of the additional conditions. In the past, non-breeding piping plovers have been documented on Longboat Key. Longboat Key has agreed to conditions as defined in the USFWS Biological Opinion dated June 13, 2011 (Attachment 4). With the inclusion of the USFWS conservation recommendations and additional conditions in the project plans, the USFWS has determined that the proposed project may affect but is not likely to adversely affect the piping plover.

This project was fully coordinated under the ESA and is in full compliance with the Act. Longboat Key has consulted with the USFWS and NMFS and Longboat Key and BOEM prepared and submitted a Biological Assessment to the USFWS and NMFS. If the identified action is subsequently modified in a manner that causes an effect to the listed species or critical habitat in a manner or to an extent not previously considered, or if a new species is listed or critical habitat designated that may be affected by the identified action, consultation will need to be reinitiated.

10. Whether the action threatens a violation of Federal, State, or local law or requirements imposed for the protection of the environment.

Longboat Key must comply with all applicable Federal, State, and local laws and requirements. BOEM and the USACE have acquired authorizations for ESA and MSA from NMFS and USFWS. A Joint Coastal Permit (JCP) and consistency concurrence from the Florida Department of Environmental Protection (FDEP) has been issued for the proposed action. The JCP is available online at http://bcs.dep.state.fl.us/env-prmt/multiple/issued. The JCP includes mitigation and monitoring requirements that are applicable to the connected state activities but not to BOEM's proposed action. Migratory birds may be adversely affected by the proposed action. Therefore, the state permit requirements, shorebird surveys will be required beginning 1 April (or 10 days prior to project commencement) and through the project period. Any migratory bird nesting areas will be marked with a 300-ft buffer zone and all construction activities will be prohibited in this zone. The buffer may be extended if birds appear agitated.

The proposed action is in compliance with the Marine Mammal Protection Act. Marine mammals are not likely to be adversely affected by the project and incorporation of safeguards to protect threatened and endangered species during project construction would also protect marine mammals in the area. Water quality will be monitored to ensure state water quality standards are not violated.

Consultations and Public Involvement

The request for use of BA-F2, clearly describing BOEM's proposed action, and the application for a USACE Permit was made available to the public on May 3, 2011 for a 30-day comment period. No specific comments were received. The USACE served as the lead Federal agency in coordinating with the USFWS, FDEP, Florida State Clearinghouse and BOEM had a consulting role. BOEM has coordinated separately with the NMFS and Florida SHPO in support of this leasing decision. Pertinent correspondence with Federal and state agencies are provided in Attachments 3-6. After signature of this Finding of No Significant Impact (FONSI), a Notice of Availability of the FONSI and EA will be prepared and published by BOEM in the Federal Register or by other appropriate means. The EA and FONSI will be posted to BOEM web site [http://www.boem.gov/Non-Energy-Minerals/Marine-Minerals-Program.aspx].

Conclusion

BOEM has considered the consequences of issuing a negotiated agreement to authorize use of OCS sand from BA-F2. BOEM independently reviewed the attached EA (Attachment 1) and finds that it complies with the relevant provisions of the CEQ regulations implementing NEPA, DOI regulations implementing NEPA, and other Marine Mineral Program requirements. Based on the NEPA and consultation process coordinated cooperatively by USACE and BOEM, appropriate terms and conditions enforceable by BOEM will be incorporated into the negotiated agreement to avoid, minimize, and/or mitigate any foreseeable adverse impacts.

Based on the evaluation of potential impacts and mitigating measures discussed in the EA, BOEM finds that entering into a negotiated agreement, with the implementation of the mitigating measures, does not constitute a major Federal action significantly affecting the quality of the human environment, in the sense of NEPA Section 102(2)(C), and will not require preparation of an EIS.

Geoffrey L. Wikel for 6/29/2012

James F. Bennett
Chief, Division of Environmental
Assessment

Date

Appendix A
Mitigation, Monitoring, and Reporting Requirements

The following mitigation measures, monitoring requirements, and reporting requirements are proposed by BOEM to avoid, minimize, reduce, or eliminate environmental impacts associated with the Proposed Action (herein referred to as the "Project"). Mitigation measures, monitoring requirements, and reporting requirements in the form of terms and conditions are added to the negotiated agreement and are considered enforceable as part of the agreement.

Plans and Performance Requirements

The Town of Longboat Key will include this MOA as a reference document in the advertised "Construction Solicitation and Specifications Plan" (hereinafter referred to as the "Plan"). Longboat Key will ensure that all operations at BA-F2 are conducted in accordance with the final approved Plan and all terms and conditions in this MOA, as well as all applicable statutes, regulations, orders and any guidelines or directives specified or referenced herein. Longboat Key will send BOEM a copy of the plans and its modification when publically available.

The dredging method from BA-F2 will be consistent with the NEPA and authorizing documents, as well as the project permits. Longboat Key will allow BOEM to review and comment on modifications to the Plan that may affect the project area, including the use of submerged or floated pipelines to directly convey sediment from the borrow area to the placement site. Said comments shall be delivered in a timely fashion in order to not delay the Longboat Key's construction contract or schedule.

If dredging and/or conveyance methods are not wholly consistent with that evaluated in relevant NEPA documents and environmental and cultural resource consultations, and authorized by the Joint Coastal Permit (JCP), additional environmental review may be necessary. If additional NEPA consultations, coordination and/or Federal Permits would impact or otherwise supplement the provisions of the MOA, an amendment may be required.

Prior to the commencement of construction, Longboat Key shall provide a summary of the construction schedule. Longboat Key, at the reasonable request of BOEM or the Bureau of Safety and Environmental Enforcement (BSEE), shall allow access, at the site of any operation subject to safety regulations, to any authorized Federal inspector and shall provide BOEM or BSEE any documents and records that are pertinent to occupational or public health, safety, or environmental protection as may be requested.

National Marine Fisheries (NMFS) Endangered Species Act (ESA) Compliance

BOEM is the lead agency on behalf of the Federal government to ensure the Project complies with all terms and conditions of the NMFS Biological Opinion (dated April 24, 2012) (Attachment 6). Longboat Key will instruct its contractor(s) to implement the mitigation terms, conditions, and measures required by the NMFS (see attachment 6). In the case that the USACE is not able to provide the required inspection of the turtle deflector equipment, the Town of Longboat Key will be required to provide a third party contractor to do the inspection. Copies of all relevant correspondence, monitoring, and reporting shall be provided to BOEM within 14 days of issuance at dredgeinfo@boem.gov.

Coastal Zone Management Act Compliance

Longboat Key is responsible for compliance with the Specific Conditions of the Joint Coastal Permit, including implementation of water quality monitoring, marine turtle conditions, shorebird monitoring, marine mammal special conditions, the Dune Vegetation Monitoring Plan, Nearshore Biological Monitoring, the Sediment Quality Control/Quality Assurance Plan, and the Physical Monitoring Plan. Construction shall not commence until the pre-construction requirements have been completed. Copies of all relevant correspondence, monitoring, and reporting shall be provided to BOEM at dredgeinfo@boem.gov.

Pre-Construction Notification of Activity in or near the Borrow Area

Longboat Key will invite BOEM to attend a pre-construction meeting that describes Longboat Key's and/or its agents' plan and schedule to construct the Project.

Longboat Key will notify BOEM at dredgeinfo@boem.gov of the commencement and termination of operations at BA-F2 within 24 hours after Longboat Key receives such notification from its contractor(s) for the Project. BOEM will notify Longboat Key in a timely manner of any OCS activity within the jurisdiction of the DOI that may adversely affect Longboat Key's ability to use OCS sand for the Project.

Dredge Positioning

During all phases of the Project, Longboat Key will ensure that the dredge and any bottom disturbing equipment is outfitted with an onboard global positioning system (GPS) capable of maintaining and recording location within an accuracy range of no more than plus or minus 3 meters. The GPS must be installed as close to the cutterhead or draghead as practicable. During dredging operations, Longboat Key and/or its agents will immediately notify BOEM at dredgeinfo@boem.gov if dredging occurs outside of the approved borrow area.

Anchoring, spudding, or other bottom disturbing activities are not authorized outside of the approved borrow area on the OCS.

Longboat Key and/or it's agents will provide BOEM all Dredging Quality Management (DQM) data acquired during the project using procedures jointly developed by the USACE's National Dredging Quality Management Data Program Support Center and BOEM. Longboat Key will submit the DQM data to dredgeinfo@boem.gov biweekly. A complete DQM dataset, Dredge Pack, or equivalent data will be submitted within 45 days of completion of the Project. If available, Longboat Key will also submit Automatic Identification System (AIS) data for vessels qualifying under the International Maritime Organization's (IMO) International Convention for the Safety of Life at Sea.

Submittal of Production and Volume Information

Longboat Key and/or its agents, in cooperation with the dredge operator, shall submit to BOEM on a biweekly basis a summary of the dredge track lines, outlining any deviations from the original Plan. A color-coded plot of the cutterhead or drag arms will be submitted, showing any horizontal or vertical dredge violations. The dredge track lines shall show dredge status: hotelling, dredging, transiting, or unloading. This map will be provided in PDF format.

Longboat Key and/or its agents will provide at least a biweekly update of the construction progress including estimated volumetric production rates to BOEM. The biweekly deliverables will be provided electronically to dredgeinfo@boem.gov. The project completion report, as described below, will also include production and volume information, including Daily Operational Reports.

Local Notice to Mariners

Longboat Key and/or its agents shall require its contractor(s) for the Project to place a notice in the U.S. Coast Guard Local Notice to Mariners regarding the timeframe and location of dredging and construction operations in advance of commencement of dredging.

Marine Pollution Control and Contingency Plan

Longboat Key and/or its agents will require its contractor(s) and subcontractor(s) to prepare for and take all necessary precautions to prevent discharges of oil and releases of waste and hazardous materials that may impair water quality. In the event of an occurrence, notification and response will be in accordance with applicable requirements of 40 C.F.R. 300. All dredging and support operations shall be compliant with U.S. Coast Guard regulations and the U.S. Environmental Protection Agency's Vessel General Permit, as applicable. Longboat Key and/or its agents will notify BOEM of any occurrences and remedial actions and provide copies of reports of the incident and resultant actions at dredgeinfo@boem.gov.

Encounter of Ordnance

If any ordnance is encountered while conducting dredging activities at BA-F2, the USACE will report the discovery within 24 hours to: Chief, BOEM Leasing Division, at (703) 787-1215 and dredgeinfo@boem.gov.

Bathymetric Surveys

Longboat Key and/or its agents will provide BOEM with pre- and post-dredging bathymetric surveys of BA-F2. The pre-dredging survey will be conducted within 30 days prior to dredging. The post-dredging survey will be conducted within 30 days after the completion of dredging. Additional bathymetric surveys are recommended in the years 1 and year 3 following the completion of dredging. Hydrographic surveys will be performed in accordance with the USACE Hydrographic Surveying Manual EM 1110-2-1003 unless specified otherwise. Interferometric swath or multibeam bathymetry data is preferred over single-beam data. All bathymetric data shall be roll, pitch, heave, and tide corrected using best practices. Three equidistant cross-tie lines will be established parallel to the same baseline. All survey lines will extend at least 50 m beyond the edge of the dredge areas. All data shall be collected in such a manner that post-dredging bathymetry surveys are compatible with the pre-dredging bathymetric survey data to enable the latter to be subtracted from the former to calculate the volume of sand removed, the shape of the excavation, and nature of post-dredging bathymetric change.

Copies of pre-dredging and post-dredging hydrographic data will be submitted to BOEM via dredgeinfo@boem.gov within thirty (30) days after each survey is completed. The delivery format for data submission is an ASCII file containing x, y, z data. The horizontal data will be provided in the North American Datum of 1983 (NAD '83) Florida State Plane, U.S. survey feet. Vertical data will be provided in the North American Vertical Datum of 1988 (NAVD '88), U.S. survey feet unless otherwise specified. An 8.5x11" plan view plot of the pre- and post-construction data will be provided showing the individual survey points, as well as contour lines at appropriate elevation intervals. These plots will be provided in PDF format. Survey metadata will also be provided.

Archaeological Resources

Onshore Prehistoric or Historic Resources
If Longboat Key discovers any previously unknown historic or archeological remains while accomplishing activity onshore, Longboat Key will notify BOEM of any finding. Longboat Key will initiate the Federal and State coordination required to determine if the remains warrant a recovery effort or if the site is eligible for listing in the National Register of Historic Places.

Offshore Prehistoric or Historic Resources
Refer to Attachment 3 for to the consultation correspondence with the Division of Historic Resources/State Historic Preservation Office (DHR/SHPO) and all prior documentation covering survey data for submerged cultural resources in the project area. Due to a corrupted data line 155, no dredging will be authorized in the buffer area noted in the figure (Attachment 3).

In the event that the dredge operators discover any archaeological resource while conducting dredging operations in BA-F2 or in the vicinity of pump-out operations, Longboat Key shall require that dredge and/or pump-out operations be halted immediately within 305 m (1000 ft) of the area of discovery. Longboat Key shall then immediately report the discovery to Mr. James F. Bennett, Chief, Division of Environmental Assessment, BOEM, at (703) 787-1660. If investigations determine that the resource is significant, the parties shall together determine how best to protect it.

Project Completion Report

A project completion report will be submitted by Longboat Key to BOEM within 120 days following completion of the activities authorized under this MOA. This report and supporting materials should be sent to: Chief, Leasing Division, BOEM, 381 Elden Street, HM 3120, Herndon, Virginia 20170 and dredgeinfo@boem.gov. The report shall contain, at a minimum, the following information:

- the names and titles of the project managers overseeing the effort (for Longboat Key, the engineering firm (if applicable), and the contractor), including contact information (phone numbers, mailing addresses, and email addresses);
- the location and description of the project, including the final total volume of material extracted from the borrow area and the volume of material actually placed on the beach or shoreline (including a description of the volume calculation method used to determine these volumes);
- ASCII files containing the x,y,z and time stamp of the cutterhead or drag arm locations;

- a narrative describing the final, as-built features, boundaries, and acreage, including the restored beach width and length;
- a table, an example of which is illustrated below, showing the various key project cost elements;

	Cost Incurred as of Construction Completion ($)
Construction	
Engineering and Design	
Inspections/Contract Administration	
Total	

- a table, an example of which is illustrated below, showing the various items of work construction, final quantities, and monetary amounts;

Item No.	Item	Estimated Quantity	Final Quantity
1	Mobilization and Demobilization		
2	Beach Fill		
3	Any beach or offshore hard structure placed or removed		

- a listing of construction and construction oversight information, including the prime and subcontractor(s), contract costs, etc.;
- a list of all major equipment used to construct the project;
- a narrative discussing the construction sequences and activities, and, if applicable, any problems encountered and solutions;
- a list and description of any construction change orders issued, if applicable;
- a list and description of any safety-related issues or accidents reported during the life of the project;
- a narrative and any appropriate tables describing any environmental surveys or efforts associated with the project and costs associated with these surveys or efforts;
- a table listing significant construction dates beginning with bid opening and ending with final acceptance of the project by Longboat Key;
- digital appendices containing the as-built drawings, beach-fill cross-sections, and survey data;
- any additional pertinent comments.

Environmental and Reporting Compliance

Longboat Key and/or their agents will designate in advance of construction a single point of contact responsible for facilitation of compliance with all MOA requirements. The contact information will be provided to BOEM at least 30 days in advance of dredging and construction operations at dredgeinfo@boem.gov.

Failure to reasonably comply with these requirements may be a basis for BOEM to refer compliance issues to BSEE for appropriate enforcement measures. Failure to comply with these requirements in a timely and responsible fashion may delay future requests from the Longboat Key to BOEM for an authorization to use OCS sand resources.

FINAL
September 2011

ENVIRONMENTAL ASSESSMENT

For the Issuance of a Non-Competitive Lease for Use of Outer Continental Shelf Sands for the Town of Longboat Key Beach Renourishment Project
Longboat Key, Florida

United States Department of the Interior
Bureau of Ocean Energy Management

FINAL Environmental Assessment
for the
Issuance of a Non-Competitive Lease for
Use of Outer Continental Shelf Sands for the
Town of Longboat Key
Beach Renourishment Project

Prepared for:

United States Department of Interior
Bureau of Ocean Energy Management

Funded by:
Town of Longboat Key

Prepared by:

Coastal Planning & Engineering, Inc.
A Shaw Company
2481 N.W. Boca Raton Blvd.
Boca Raton, FL 33431

September 2011

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CHAPTER 1 – INTRODUCTION

Since 1995, the Town of Longboat Key (Town) has proactively managed their coastal resources by developing and implementing a Comprehensive Beach Management Program. One of the main components of this program is the periodic nourishment of the Town‟s beaches with offshore sand resources.

1.1 Where will the Proposed Action take place?

Longboat Key is situated across the border between Manatee and Sarasota Counties on the central gulf coast of Florida. The northern five mi of the island are within Manatee County and the southern six mi of the island are within Sarasota County. Longboat Key is a low-lying, well-developed barrier island that is separated from the mainland by Sarasota Bay. It is approximately three mi seaward of the mainland at the widest part of the Bay. Longboat Key is separated from Anna Maria Island by Longboat Pass at the north end and from Lido Key by New Pass at the south end. The proposed beach nourishment projects, for which the offshore sand resource is intended, are located along the shoreline of Longboat Key from Florida Department of Environmental Protection (FDEP) monuments R44 in Manatee County and R29 in Sarasota County. Borrow area (BA) F2 is located in federal waters, about 12 mi directly west of Anna Maria Island (AMI), Florida (Figure 1).

1.2 What is the Proposed Action?

In accordance with its Beach Management Program, the Town is seeking to complete multiple nourishments of Longboat Key. The goal of the nourishments is to restore the beach to the fill template designed for the 2005/06 beach nourishment from the north end of Longboat Key (R44, Manatee County) to the south end of Longboat Key (R29, Sarasota County). An interim nourishment phase is planned for Funding Year (FY) 2011/2012 utilizing offshore BA-B3 (in State waters) and a portion of BA-F2 (in federal waters) that lies along the Port Dolphin pipeline route (Figure 2). The interim nourishment would place approximately 310,000 cy of sand from R44 to R46a and R47.5 to R50 in Manatee County and R12 to R17 in Sarasota County. An island-wide project is also planned for FY 2013/2014 or later that would place sand along 9.8 mi of shoreline. These future island-wide project renourishments would also utilize BA-F2 resources along with State borrow sites.

BOEM proposes to issue a negotiated agreement that would authorize use of OCS sand resources in the Longboat Key Beach Nourishment Project. Any future use of federal borrow resources, outside of the length of the negotiated agreement, would require further NEPA review. The Town of Longboat Key has also submitted an application to the Corps requesting a permit for dredging State-water borrow areas and placement operations.

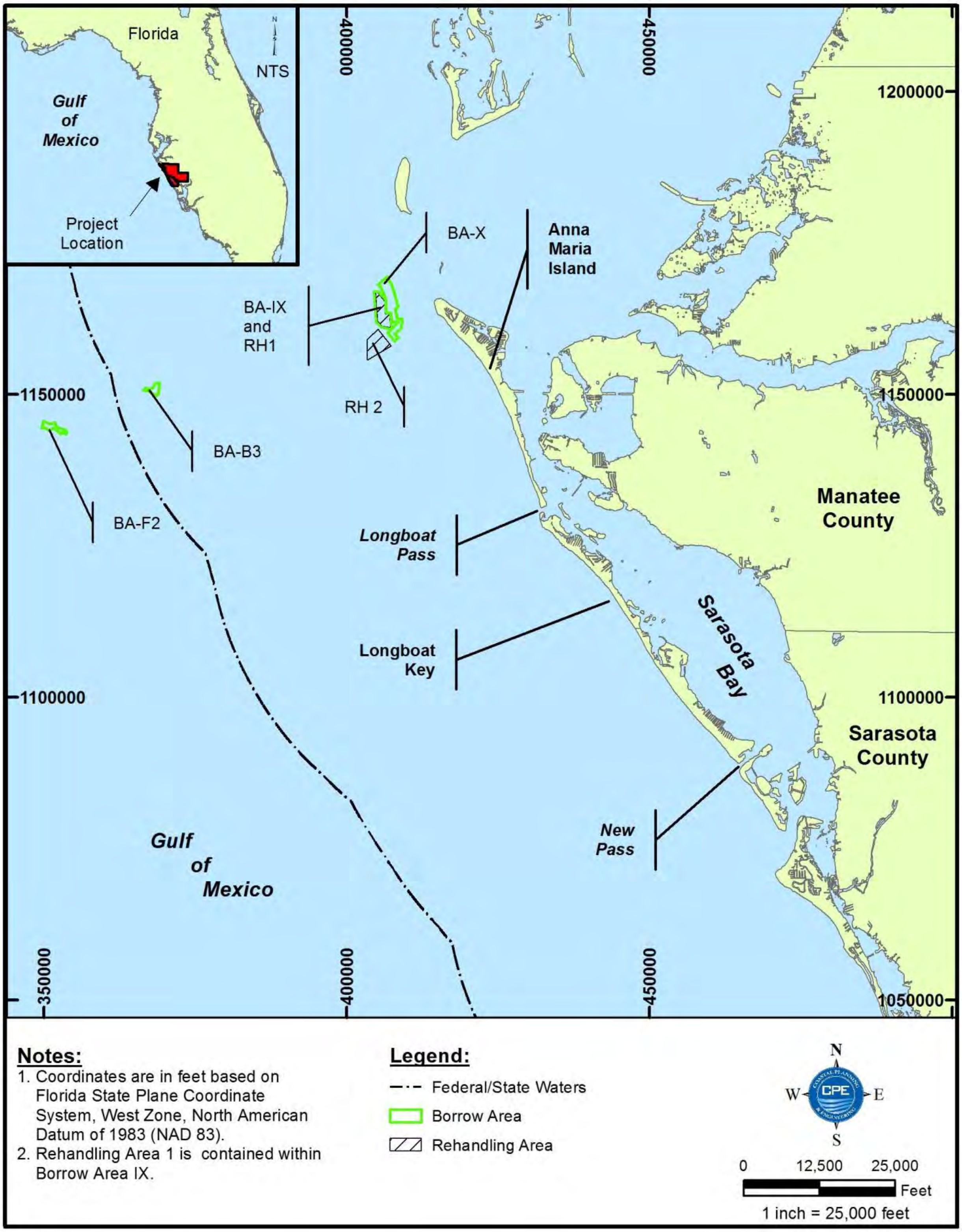


Figure 1. Project location map for the Longboat Key Beach Renourishment Project depicting proposed offshore and inshore borrow areas (BA) and rehandling areas (RA).

The scope of activities, when considering connected actions, include the dredging of the sand from the proposed State-water borrow areas, the conveyance of the sand from the borrow area to the shoreline (including location of pump-out corridors, anchoring, etc.) and the placement of the sand along the shoreline of Longboat Key.

1.2.1 Dredging Operations

Borrow Areas

Four borrow areas (F2, B3, IX, and X) are proposed as sand resources for Longboat Key:

1) **BA-F2** is located in federal waters approximately 12 mi offshore of Anna Maria Island (AMI) in Manatee County, Florida (Figure 1). The use of this borrow area will require approval from BOEM with the issuance of a negotiated agreement. This borrow area will be used during the interim and island-wide phases of this project.

2) **BA-B3** is on State of Florida sovereign submerged lands approximately 9 mi offshore of AMI (Figure 1). The use of this borrow area will require approval from the CORPS and FDEP for dredging. This borrow area will be used during the interim and island-wide phases of this project.

3) **BA-IX** is located on State of Florida sovereign submerged lands less than 2 mi northwest of AMI (Figure 1). This is a previously permitted borrow area that was used for the 2005/06 island-wide renourishment of Longboat Key. The use of this borrow area will require approval from the CORPS and FDEP for dredging.

4) **BA-X** is also located on State of Florida sovereign submerged lands less than 2 mi northwest of AMI (Figure 1). This borrow area is a newly designed borrow area also proposed as a sand resource. The use of this borrow area will require approval from the CORPS and FDEP for dredging.

Borrow areas F2 and B3 are located within the proposed Port Dolphin pipeline corridor and will be dredged first in order to remove the sand prior to the planned pipeline construction in July, 2013. Hopper dredges will excavate and transport the sand to the seaward end of the submerged pipeline for placement in the fill area. The volumes of material to be dredged for the interim project are included within Table 1.

Table 1. Volume to be dredged for interim nourishment project, per borrow area.

BORROW AREA	Total Volume per Borrow Area	Minimum Volume to be Dredged from Port Dolphin Corridor*	Duration of Dredging
F2	668,200 cy	196,300 cy	31 days†
B3	141,100 cy	76,400 cy	

†Assuming 10,000 cy of sand are excavated per dredge day. Weather, equipment failure, etc. may prolong this timeframe. *The total volume of sand needed for the interim project is approximately 310,000 cy. Column 3 in the table specified the amounts that will come directly from within the Port Dolphin pipeline corridor. The remaining volume will come from portions of F2 and B3 that are outside the pipeline corridor.

Borrow area IX abuts BA-X, which lies directly east of BA-IX. Borrow area IX was used during the 2005/06 beach nourishment project. The remaining volume in BA-IX has been calculated as 2,120,000 cy. Approximately 133,000 cy were dredged from this borrow area during a separately permitted emergency nourishment at the north end of Longboat Key in the spring of 2011 (see Section 1.2.3). Borrow area X contains approximately 3,753,000 cy (Table 2). Because of the fine white sand located in BA-F2, the remainder of this borrow area (up to ~400,000 cy) will likely be dredged first, followed by dredging from BA-IX. Any remaining volume required to fill the template will be obtained from BA-X.

Dredging BA-X and the shallow portions of BA-IX by medium sized hopper dredges may be precluded by the shallow nature of these borrow areas. Dredging of these areas by small hopper dredges is feasible, but the transport of the sand to Longboat Key is usually not cost effective. Because of the shallow borrow areas, two rehandling areas have been proposed. The sand would be excavated by a shallow-draft hopper dredge or cutterhead dredge from BA-X and the shallow portions of BA-IX and deposited by bottom dumping using a hopper, or discharging from a vertically oriented cutterhead discharge pipe into either of the rehandling areas. Rehandling Area 1 (RA1) is the excavated portion of BA-IX and Rehandling Area 2 (RA2) is a section of the Gulf of Mexico approximately 1 mi southwest of BA-IX and BA-X. The sand would be deposited in these areas, to be re-dredged and transported to the beach pipeline by a deeper-draft, medium or large hopper dredge.

Similar to dredging operations during the interim nourishment phase, approximately 10,000 cy of sand may be transported from the rehandling areas to the beach pipeline each day of dredging, taking approximately 87 days to complete. However, speed of transport from the shallow portions of the borrow areas to the rehandling areas will depend on the type of dredge used. A small hopper dredge may accomplish 20 cycles per day to transport 20,000 cy of sand, whereas a cutterhead may move as much as 40,000 cy per day. These smaller dredges may work ahead of or concurrently with the larger hopper dredge moving sand to the beach.

In addition to offshore sand sources, approximately 200,000 cy of sand will be trucked in from either E.R. Jahna‟s Green Cay mine or Surface Prep Supply mine in Davenport as part of the island-wide nourishment. The trucking operation will occur twice within the duration of the permit in order to limit the volume of sand on those profiles and avoid impacts to nearshore hardbottoms.

Table 2. Borrow area volumes available for the island-wide nourishment phase.

BORROW AREA	Available Volume Per Borrow Area
Upland source (trucked)	~200,000 cy
F2†	471,900 cy
IX	2,120,000 cy
X	3,753,000 cy

†Accessible volume remaining after placement of Port Dolphin natural gas pipeline.

Pipeline Corridors

Twelve previously cleared pipeline corridors may be utilized for the proposed interim nourishment and future island-wide nourishment. The pipeline corridors extend from the shoreline out to the 30-ft depth contour and range in width from 400 ft to 2,500 ft. Although the corridors are primarily softbottom, sidescan sonar surveys revealed several patches of hardbottom within the corridors; however, the contractor will be instructed to avoid these resources in a manner that was successfully implemented in 2005/06. The pipeline would be laid and removed as project progress is made along the shoreline. There exists the potential for two pipelines to be deployed, within previously cleared corridors, at one time if the contractor has the resources to do so.

Placement

The interim nourishment phase planned for 2011/2012 will place approximately 310,000 cy of sand from BA-B3 and a portion of BA-F2 from R44 to R46a and R47.5 to R50 in Manatee County and R12 to R17 in Sarasota County. A hopper dredge will be used to remove the sand and transport the dredged material to the beach pipeline (described above). FY 2013/2014 or later will place sand along the entire shoreline of Longboat Key (9.8 mi). These future island-wide project renourishments would also utilize remaining BA-F2 resources along with State borrow sites. Material dredged from the State borrow areas (BA-IX and BA-X) may be rehandled as described above. If rehandled, the dredged material from these sites will be re-dredged from the rehandling storage site and transported to the beach pipeline by a deeper-draft, medium or large hopper dredge. Sand placed within Reach 2 (R-47 to R-50.5) will be trucked in from a land-based source. Land-based equipment such as bulldozers, front-end loaders or other heavy equipment will then be used to shape the beach fill into the proposed construction templates.

1.2.2 Impact Factors

The following is a summary of factors that may produce impacts during the proposed activities. Impacts are discussed in greater detail in Chapter 4.

Sedimentation and Turbidity

During construction, elevated turbidity and sedimentation levels will occur at the dredge and fill sites but are not anticipated to extend beyond the duration of construction activities. Sedimentation is a concern because it may smother corals on adjacent reefs or hardbottom resources and reduced water clarity deprives corals of light necessary for photosynthesis (Rogers, 1990; SFCRI, 2006). Turbidity monitoring will be conducted at the dredge and fill sites to ensure turbidity levels outside the designated mixing zone do not exceed 29.0 NTU above background. In addition, buffer zones around hardbottom resources greatly reduce the potential for negative impact to occur due to increased turbidity and sedimentation.

Burial

In the nearshore zone, burial of 1.4 ac of hardbottom resources are anticipated from construction of the island-wide phase of the project; because of the location of the interim nourishment fill placements, no impacts to hardbottom resources are anticipated from that phase of the project. The hardbottom resources that fall within the equilibrium toe of fill (ETOF) of the island-wide nourishment have been mitigated for in the previous beach project (2005/06);

therefore, no hardbottom mitigation measures are proposed for this project. A biological monitoring plan was drafted by CPE and submitted to FDEP as part of the response to RAI #2 on April 25, 2011; FDEP approved this plan in a letter dated May 26, 2011. This Hardbottom Monitoring & Mitigation Plan (Appendix 1) will be implemented by CPE biologists to assess the nearshore hardbottom resources prior to and following construction as part of permit compliance. This plan includes hardbottom resource mapping to determine the acreage of direct hardbottom impact and transect monitoring to quantitatively identify any indirect impacts from sedimentation to the benthic communities.

Entrainment

Sea turtle entrainment is a potential impact of dredging operations; therefore, the use of turtle trawlers during hopper dredge operations are proposed to reduce sea turtle mortality (Clausner *et al.,* 2004; Dickerson *et al.,* 1990; Dickerson *et al.,* 2004) Shrimp trawlers have been successfully used to capture sea turtles for relocation and research since the early 1980s (Bargo *et al.*, 2005, Clausner *et al.*, 2004; Dickerson *et al., 2004*). For research, turtles are generally captured for tagging purposes; however, relocation is implemented during periods when hopper dredging is imminent or ongoing (NMFS NE Biological Opinion F/NER/2003/00302). During dredging for the 2005/2006 renourishment of Longboat Key, the turtle relocation trawler captured and removed 129 turtles from the dredging areas using the methods described above. This included 74 loggerheads (*Caretta caretta*), 41 Kemps ridley (*Lepidochelys kempii*), 12 greens (*Chelonia mydas*), and two hawksbills (*Eretmochelys imbricata*).

Other fauna that may be impacted by dredge entrainment include fish, invertebrates, and manatees. Dredging operations are shutdown when manatees are observed within 50 ft of the dredge to reduce injury or mortality as mandated by the FWC 2009 Standard Manatee Conditions for In-Water Work (Attached to Biological Assessment, Appendix 2).

Strike

The most significant threat to the Florida manatee is death or serious injury from watercraft strikes. In Florida, an average of 72 manatee deaths were attributed to watercrafts in a five year period between 2006 and 2010 (FWC, 2011). During construction, vessels will travel between the borrow areas, the rehandling areas, the seaward end of the pipeline corridor, and back and forth to port. Manatee protection measures will be implemented to minimize potential impacts to manatees during construction which include all vessels maintaining idle speed within the construction area and no wake speed when the draft of the vessel provides less than 4 ft of clearance from the bottom (Attached to Biological Assessment, Appendix 2). All sightings of manatees shall be documented and submitted to Florida Fish and Wildlife Conservation Commission Bureau of Protected Species and to the USFWS as mandated by the FWC 2009 Standard Manatee Conditions for In-Water Work (Attached to Biological Assessment, Appendix 2). Other marine mammals such as whales are not likely to occur within the project area.

Pollutants and Contamination

During the dredging process accidental leaks and spills of fuel, lubricants, and other contaminants from dredges, scows, and work vessels could occur. Accidental discharges have typically been small volumes (CORPS, 2006), and it is reasonable to assume that the increased potential for accidental discharges would have a minimal impact to surface water quality. The proposed activities would also dredge sediments that have been approved for disposal on the beach, partly on the assumption of very low pollutant concentrations and negligible toxicity. Accordingly, the proposed project is not expected to have significant impacts on water resources related to chemical pollutants.

Noise

It has been hypothesized that the noise associated with dredging activities can trigger an avoidance reaction in marine mammals and may interrupt fish migrations (Clarke *et al.,* 2004; *Southall et al..,* 2007; Thomsen *et al*., 2009). Noise is generated from vessel travel between sites and the dredge process. Southall *et al*.. (2007) reviewed several studies that observed changes in behavior or avoidance in several dolphin species due to increased noise levels from approaching research vessels and boat traffic. Clarke *et al.* (2004) found that cutterhead dredging operations are relatively quiet compared to other sounds in aquatic environments, whereas hopper dredges produce somewhat more intense sounds. If dredging activities cause local fauna to abandon an area for long periods of time (months-long dredging projects), measurable impacts may occur. Thomsen *et al.* (2009) conducted a field study to better understand if and how dredge-related noise is likely to disturb marine fauna. This study found that the low-frequency dredge noise would potentially affect low- and mid-frequency cetaceans, such as bottlenose dolphins. Fish with swim bladders appear to be more affected than those without (Thomsen *et al., 2009)* and so far, studies indicated that invertebrate hearing is poor compared to other marine life (Thomsen *et. al.,*2009); however, little is known about invertebrate hearing capabilities at all.

1.2.3 Related or Concurrent Activities

Longboat Key

An emergency nourishment was permitted for the severely eroded north end of Longboat Key and was constructed in the spring of 2011. The project placed 133,000 cy of white sand from BA-IX along a 4,015-ft (1,224-m) length of eroding beach on the north end of Longboat Key. The project's main objective was to restore the beach from R43 to R47.5 in Manatee County.

Anna Maria Island

The City of Anna Maria was nourished in 2002 between R7 and R10 and the central portion of Anna Maria Island was nourished between R12 and R36 in 1992/93, 2002, and 2005/2006. Another nourishment was constructed in the spring of 2011 along Coquina Beach (R35+790 to R41+365) on Anna Maria Island.

Longboat Pass Maintenance Dredging

Periodic maintenance dredging of Longboat Pass, located between Longboat Key and Anna Maria Island, also occurs. The pass is a federally maintained waterway between the Sarasota Bay system and the Gulf of Mexico. It is periodically surveyed and, when shoaling occurs to a point where actual depths are less than the designed project depths, dredging by the U.S. Army Corps of Engineers in cooperation with the West Coast Inland Navigation District (WCIND) occurs. Dredging of this pass aides in navigation and provides sand to nearby beaches where erosional effects are greatest. A comprehensive Inlet Management Plan is currently being formulated for the pass.

1.3 Background

1.3.1 History of Beach Renourishment in the Town of Longboat Key

Longboat Key is located in Sarasota and Manatee Counties on the central Gulf coast of Florida and consists of approximately 10 mi of shoreline. The island is characterized by residential and tourist development and has been renourished several times since 1993.

The 1993 restoration project included nourishment of 9.3 mi of shoreline with white sand fill dredged from the ebb shoals of Longboat Pass and New Pass. Fill was placed between R47 in Manatee County and R29 in Sarasota County. The project began in February 1993 and was completed in August 1993 with a total volume placed of 3,336,000 cy. The project also removed 5,751 tons of derelict groins and coastal structures and created one artificial reef.

The Mid-Key interim beach nourishment project was completed in 1997 and extended from R62A in Manatee County to R14 in Sarasota County. 891,000 cy of coarse grey sand was dredged from an offshore borrow area, labeled V-A, for placement along the 3.1 mi of shoreline. Nourishment began in October 1996 and was completed in February 1997.

Longboat Pass and New Pass were dredged for maintenance in July and August-September 1997, respectively. Approximately 109,000 cy of fill from Longboat Pass were placed from R44+48“ to R46A and R48+722“ to R51 in Manatee County for a total of one mile of fill. Approximately 171,200 cy dredged from New Pass were placed along 0.8 mi from R22+584“ to R27+415“ in Sarasota County.

In early 1998, 2,000 cy of sand were dredged from Greer Island (also known as Beer Can Island) channel and placed on the north side of North Shore Drive, near R45 in Manatee County.

The 2001 Beach Nourishment Project was constructed between April 24 and May 2, 2001 with 105,300 cy of coarse grey sand placed from R10.5 to R14 in Sarasota County. The sand was dredged from offshore Borrow area V-A and was constructed to mitigate sand losses caused by the passing of Hurricane Gordon in September 2000.

New Pass was dredged for maintenance in 2003 as part of the CORPS maintenance dredging program. Approximately 99,800 cy of sand was placed on the south end of Longboat Key from T22 to R28 in Sarasota County.

The 2005/06 renourishment placed 1,789,332 cy of sand on 10 mi of shoreline from FDEP monument R44-170“ in Manatee County to R29+400“ in Sarasota County. The project began in April 2005 and was completed in July 2006. The fill design for this nourishment included sections of the island be filled with a dual layer of both coarse and white sand while other sections were filled with white sand only. In the dual layer sections, white sand was placed on top of coarse sand from elevation +3 to +6 ft NAVD. Of the total volume placed, 737,683 cy was course grey sand dredged from BA-VIA and 1,051,649 cy was fine white sand dredged from BA-IX. The dual layered fill was placed in three sections, extending from the northern tip of Greer Island (R44-170“) to R50.5, T1 to R7, and R9 to T15. White sand fill only was placed in the gaps between the dual layer fill sections for the extent of the fill template (R44-170" to R29+400"). The purpose of the coarse sand was to slow the rate of erosion at the hotspot erosion areas of the island.

As described in Section 1.2.3, an emergency nourishment was constructed along the severely eroded north end of Longboat Key in the spring of 2011. The project placed 133,000 cy of white sand from BA-IX along a 4,015-ft (1,224-m) length of eroding beach on the north end of Longboat Key.

1.3.2 History of Port Dolphin LNG Pipeline and Relevance to Proposed Action

On March 29, 2007, Port Dolphin Energy LLC (Port Dolphin) submitted to the U.S. Coast Guard (USCG) and Maritime Administration (MARAD) an application under the Deepwater Port Act of 1974 (DWPA) for all federal authorizations required for license to own, construct, and operate a deepwater port off the coast of Florida. On June 15, 2007, USCG notified Port Dolphin that the application contained sufficient information to continue processing, and on June 25, 2007, the USCG and Maritime Administration issued a Notice of Application in the Federal Register summarizing the application.

The proposed deepwater port, named Port Dolphin, would be located in federal waters of the Outer Continental Shelf (OCS) in lease blocks designated by the U.S. Department of the Interior, Bureau of Ocean Energy Management (BOEM). These blocks are located approximately 28 mi (45 km) off the west coast of Florida, to the southwest of Tampa Bay, in 100 ft water depth. Port Dolphin would consist of a permanently moored unloading buoy system with two submersible buoys separated by distance of approximately 3 mi. The buoys would be designed to moor a specialized type of liquefied natural gas (LNG) vessel called a Shuttle and Regasification Vessel (SRV). When the SRVs are not present, the buoys would be submerged on a special landing pad on the seabed, 60 to 70 ft below the sea surface. SRVs are equipped to vaporize cryogenic LNG cargo to natural gas through an onboard closed-loop vaporization system, and to meter gas for send-out by means of the unloading buoy to a 36-in flowline to a Y-intersection, and then to a 36-in pipeline approximately 42 mi in length that would connect onshore in Manatee County, Florida, with the Gulfstream Natural Gas System, LLC, and Tampa Electric Company (TECO) Bayside pipeline. Only SRVs would call on Port Dolphin. Initially, Port Dolphin would be capable of a natural gas throughput of 400 million standard cubic feet per day (MMscfd) and would eventually be capable of an average of 800 MMscfd with a peak capacity of 1,200 MMscfd. Construction of Port Dolphin would be expected to take 11 months. Port Dolphin deepwater port would be designed, constructed, and operated in accordance with applicable codes and standards and would have an expected operating life of approximately 25 years.

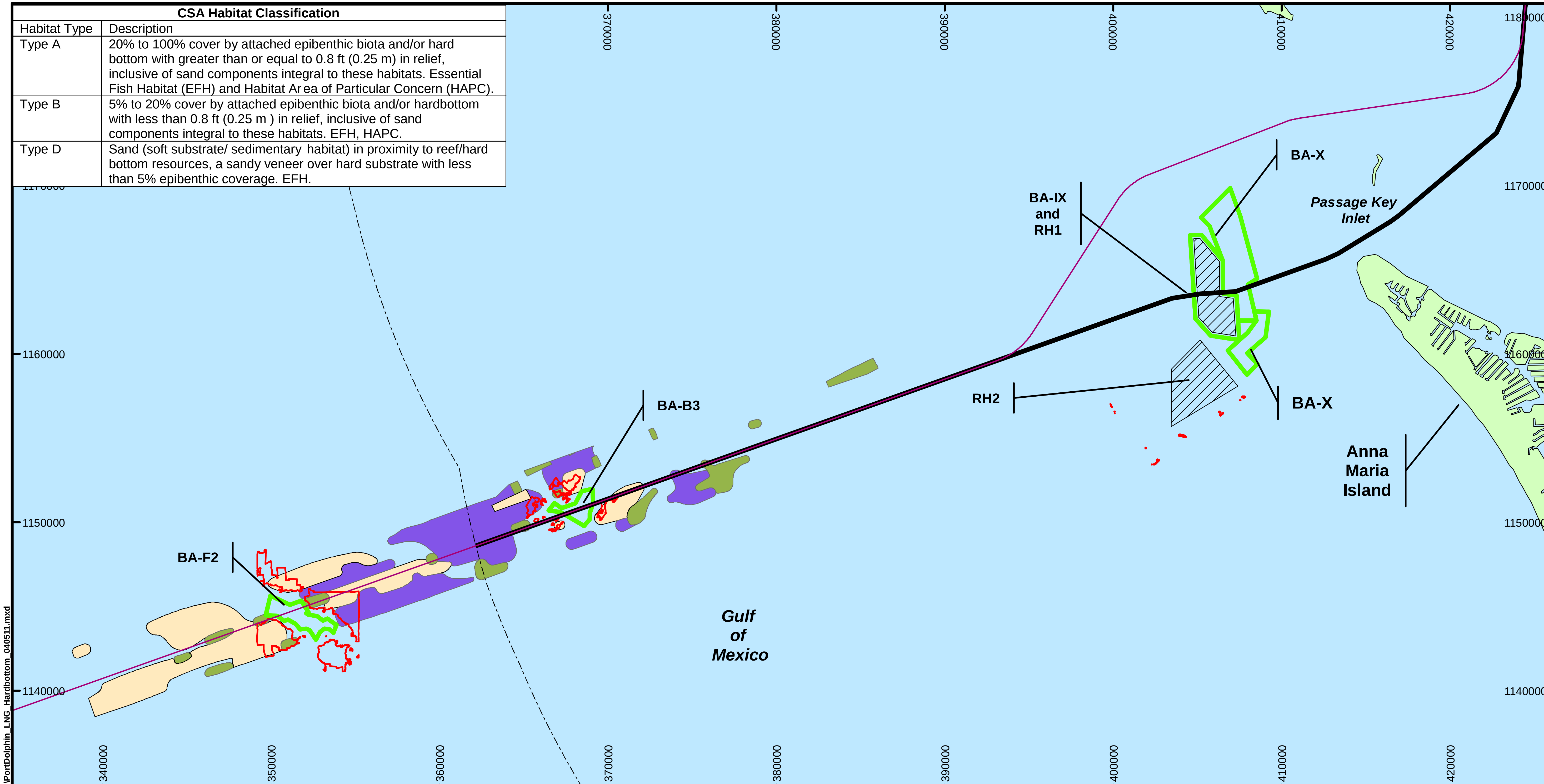
A benthic survey was conducted in the Port Dolphin project area between August 17 and December 14, 2006 to determine potential impacts to benthic resources along the proposed route. This included sidescan sonar surveys, a photo-documentation survey, and diver surveys along a 3,000 ft corridor. This information was included in the original application. The original preferred pipeline route passed through the Terra Ceia Aquatic Preserve in Tampa Bay. After discussion with the Florida Department of Environmental Protection (FDEP), Port Dolphin submitted Port Dolphin LLC Deepwater Port License Application, Addendum I to the USCG and

MARAD in December 2007, which provided an alternative route to avoid traversing the Terra Ceia Aquatic Preserve (Appendix 3).

An additional benthic survey was conducted along the 3,000 ft of the proposed re-route pipeline corridor, located north of the original survey (Figure 2). This included photo-documentation and *in situ* diver surveys in order to collect the qualitative and quantitative data necessary to characterize and delineate all the defined marine habitats and seagrass communities within the proposed re-route area. The photo-documentation included collection of descriptive and qualitative video and still photographic data to document hardbottom, softbottom and seagrass resources, as well as plan-view photographs collected every 656 ft (200 m). The qualitative habitat classification revealed the dominant habitat to be sand and softbottom resources within the re-route area, along with small patches of hardbottom resources. Diver surveys were subsequently conducted to collect quantitative data on the representative habitats.

The Town of Longboat Key became aware of the Port Dolphin project in May 2008 when the Draft Environmental Impact Statement was released. Town concerns were expressed regarding the position of the proposed pipeline corridor over permitted and future sand resources. Further discussion resulted in the submittal of the Port Dolphin LLC Deepwater Port License Application, Addendum II on December 18, 2008 (Appendix 4). Addendum II provided an additional pipeline re-route to avoid already permitted sand resources as requested by Manatee County and the Town of Longboat Key.

CSA Habitat Classification	
Habitat Type	Description
Type A	20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).
Type B	5% to 20% cover by attached epibenthic biota and/or hardbottom with less than 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.
Type D	Sand (soft substrate/ sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.



G:\Enterprise\Sarasota\848915 LBK MMS EA\ Mxd\PortDolphin LNG Hardbottom 040511.mxd

Notes:
1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Sidescan sonar hardbottom identified near F2 by CPE, Oct 20-23, 2009 and October 20, 2010.
3. Sidescan sonar hardbottom identified near B3 by CPE, December 7, 2008.
4. Habitat classification defined by CSA International, INC. in the 2007 *Port DolphinTerra Ceia Re-route Survey of Marine Benthic Habitats Within the Proposed Port Dolphin Pipeline Corridor Within Tampa Bay, FL* report prepared for Port Dolphin, LLC.

Legend:
- Federal/State Waters
- Borrow Area
- Rehandling Area
- SSS Hardbottom 2008-2010
- Port Dolphin LNG Pipeline
- Preferred Pipline Route Modification

CSA Habitat Classification
- Type A
- Type B
- Type D

N

0 3,000 6,000 Feet

1 inch = 6,000 feet

TITLE:

Hardbottom Habitat within the Port Dolphin LNG Pipeline

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 04/05/11	BY: LAA	COMM NO. : 848926	Figure 2

The Town of Longboat Key is currently working to obtain authorization to utilize sand resources in federal waters that will become inaccessible once construction of the Port Dolphin LLC Deepwater Port begins. To aid in the permitting and extraction of sand from offshore borrow areas falling within the proposed pipeline route, a Memorandum of Agreement was established between the State of Florida, Department of Environmental Protection and Fish and Wildlife Conservation Commission, and Port Dolphin Energy, LLC (Appendix 5). The purpose of the agreement is to mitigate and compensate for impacts caused by the Port Dolphin pipeline. Impacts covered include those to restoration or nourishment sand resources within the vicinity if the pipeline. To that end, the agreement states that an Escrow Account shall be established with the Florida Department of Financial Services to receive, invest, administer and distribute funds associated with the development, permitting and activities required for sand extraction within an 800-ft wide corridor centered on the centerline of the proposed pipeline (termed "Sand Recovery Area"). The agreement specifies funds for Sand Development and Permitting, and Sand Extraction be distributed to both the Town of Longboat Key and Manatee County, granted that these entities successfully permit and extract sand resources from the Sand Recovery Area prior to the commencement of construction of the pipeline.

1.4 What are the Purpose and Need for the Proposed Action?

The purpose of the BOEM proposed action is to respond to a request for use of OCS sand under the authority granted to the Department of the Interior by the Outer Continental Shelf Lands Act (OCSLA). The proposed action is necessary because the Secretary of the Interior delegated the authority granted in the OCSLA to the BOEM to authorize the use of OCS sand resources for the purpose of shore protection and beach restoration. The beach nourishment project is needed because Longboat Key beach has been eroding at a significant rate since 2004. The 2005/06 nourishment placed 1.79 million cy of sand along the Longboat Key shoreline. The beaches of Longboat Key were affected by three hurricanes between August 15 and September 15, 2008. The waves and elevated tides resulting from these storms caused an accelerated erosion of the dry beach, and higher than average offshore movement of sand. Erosion has necessitated the closure the North Shore Road public beach access (R44.7). This is detrimental to the Town‟s economy as the beaches are an important source of revenue and provide stability for beachfront infrastructure and development. To mitigate for erosion and restore Longboat Key‟s beaches in accordance with its Beach Management Program, the Town desires to continue its renourishment program with the goal of restoring the beach to the fill template designed for the 2005/06 beach nourishment from the north end of Longboat Key (R44, Manatee County) to the south end of Longboat Key (R29, Sarasota County).

Appropriate sand sources for use in beach nourishment projects in south Florida have begun to dwindle in recent years, with sand searches pushing farther and farther from project areas, with some projects going so far as exploring non-domestic sand sources. To meet the needs of continued beach nourishment, the Town initiated sand search investigations to locate potential "white sand" deposits with appropriate, beach-compatible grain size offshore of Sarasota and Manatee Counties. A federal sand resource, BA-F2, was identified during Phase II investigations; however, it was revealed that this sand source, together with portions of a sand source in State waters, was in the path of the proposed Port Dolphin LNG pipeline route. After some investigation and negotiations between State agencies, Town of Longboat Key, Manatee

County, and Port Dolphin, LLC, the need to extract sand resources from BA-F2 before the resource was rendered unobtainable by placement of the Port Dolphin pipeline was determined.

1.5 Scoping and Consultation History

The initial Longboat Key Beach Restoration Project was constructed from February through August 1993, with a total volume placed of 3,336,000 cy of white sand fill dredged from the ebb shoals of Longboat Pass and New Pass. In 1995, the Town developed a Comprehensive Beach Management Program (CBMP) to proactively manage their beach resources. This includes the periodic nourishment of the Town"s beaches with offshore sand resources.

Multiple nourishments have been conducted since the development of the CBMP, with the most recent nourishment completed in 2005/06. In 2010, three permit applications were under review for projects on Longboat Key: an island-wide beach renourishment, a north end emergency nourishment, and breakwaters at the north end of the island. The application for an emergency nourishment at the north end of the island was submitted on March 24, 2010. On May 10, 2010, the Corps submitted a letter to FWS requesting formal consultation. The applicant proposed to place 133,000 cy of white sand from BA-IX along a 4,015-ft (1,224-m) length of eroding beach on the north end of Longboat Key. The project's main objective is to restore the beach from R43 to R47.5. On May 27, 2010, FWS submitted a draft BO for the Corps to review. On May 28, 2010, the applicant provided comments on the draft BO. The final BO for nourishment of the north end of Longboat Key (R43 to R47.5) was provided to the Corps June 11, 2010. A permit for this project was received from the FDEP on September 13, 2010. The FDEP issued a Notice to Proceed on January 12, 2011; the project was constructed in the spring of 2011.

An application to construct segmented breakwaters at the north end of Longboat Key was submitted on May 21, 2009. However, a request was submitted to FDEP on January 17, 2011 to put the breakwater project application on hold while the Town evaluates the coastal processes of the north end through an inlet management study.

The island-wide beach renourishment application was submitted on May 6, 2009. A modification request was submitted (1/28/11) that requested authorization to construct an interim nourishment in FY 2011/2012 with 310,000 cy of sand from the offshore borrow areas F2 and B3 while continuing to pursue a 10-year permit for the Town of Longboat Key for continued, multiple renourishments using borrow areas IX and X, as well as F2. Authorization for a trucking operation utilizing sand from either E.R. Jahna"s Green Cay mine or Surface Prep Supply mine in Davenport was also requested. After submittal of a Biological Assessment and Essential Fish Habitat Assessment to the USFWS and NMFS, the BOEM requested formal consultation with NMFS Protected Resources Division on March 16, 2011. The Corps released the Public Notice for the project on May 3, 2011 and requested formal consultation with the USFWS. USFWS responded on June 8, 2011 with permission to apply the Statewide Programmatic Biological Opinion (SPBO) for the project (Appendix 9). After Requests for Additional Information, the FDEP issued a notice of completeness for the permit application on August 5, 2011. The NMFS biological opinion and conservation recommendations for Essential Fish Habitat are still pending at the time of this document"s preparation.

Table 3 provides details for each beach nourishment permit application since 2005.

Table 3. Recent permitting history for beach nourishments on Longboat Key.

DATE	TOTAL VOLUME (cy)	LIMITS	BORROW AREAS (STATE WATERS)	BORROW AREAS (FEDERAL WATERS)	FDEP PERMIT No.	CORPS PERMIT No.	USFWS BIOLOGICAL OPINION	USED NMFS GULF REGIONAL BO FOR HOPPER DREDGING?	BOEM AUTHORIZATION
2005/2006	1.7M	R44 to R29	VIA, IX	None	02022009-001	1991-296 (IP-MN)	4-1-04-F-4529	Yes	Not Required
2010/2011	133,000	R44 to R47	IX	None	0300119-001	2010-01056(IP-MEP)	41910-2010-F-0301	Yes	Not Required
2009 application	~2.0 M	R44 to R29	VIA, and or IX	None	0296464-001	2009-03350(IP-MEP)	41910-2010-F-0009	Requested	Not required
2011 modification	300,000 in FY11/12 and 865,000 in FY13/14	R44 to R50.5 and R12 to R17 (FY11/12) and R44 to R50, R67 to R3, R13 to R17, and R21 to R29 (FY13/14)	B3 (FY11/12), and IX, X, and upland sources (FY13/14). Rehandling areas (RH1 and RH2) requested (FY13/14).	F2 (FY11/12 and FY13/14)	0296464-001	2009-03350(IP-MEP)	41910-2010-F-0009	Requested for portion of project using borrow areas in State waters	Required for use of borrow areas in federal waters

1.6 Authority

Although a single project is proposed by the Town of Longboat Key, there are distinct federal actions which result from BOEM‟s and the U.S. Army Corps of Engineers, Jacksonville District‟s (CORPS‟s) distinct federal authorities. BOEM and the CORPS have regulatory authority over different aspects of the proposed project. The project will be permitted but not funded by the CORPS. The proposed project requires authorization from BOEM for the use of Outer Continental Shelf (OCS) sand resources under the Outer Continental Shelf Lands Act, as well as a permit from the CORPS under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act for dredging of any state borrow area, conveyance, and placement of sand resources. However, the CORPS does not have Section 10 jurisdiction over the proposed OCS borrow area since it is located further than nine (9) nautical miles offshore.

The Outer Continental Shelf Lands Act (OCSLA), Public Law 103-426, enacted October 31, 1994, grants BOEM the authority to convey, on a non-competitive basis, the rights to OCS sand, gravel, or shell resources for shore protection, beach or wetlands restoration, or for use in construction projects funded in whole or part or authorized by the federal government. These resources fall under the purview of the Secretary of the Interior who oversees the use of OCS sand and gravel resources, and BOEM as the agency charged with this oversight by the Secretary. The National Environmental Policy Act (NEPA) and Title 40 of the Code of Federal Regulations, Parts 1500-1508 (40 CFR 1500-1508) require federal agencies to consider the potential environmental consequences of proposed actions and alternatives. Executive Order (EO) 11514, Protection and Enhancement of Environmental Quality (amended by EO 11991), provides a policy directing the federal government to take leadership in protecting and enhancing the environment. After an evaluation required by NEPA, BOEM may issue a non-competitive negotiated agreement for the use of the OCS sand source.

This Environmental Assessment (EA) evaluates the proposed action in sufficient detail to determine to what extent it may affect any component of the human environment as per NEPA and the Council on Environmental Quality (CEQ) Regulations.

Although BOEM has no involvement in the Longboat Key North End Nourishment or Anna Maria Island nourishment projects, those actions and resulting impacts are considered herein as cumulative actions and analyzed in section 4.1.3 Cumulative Impacts.

CHAPTER 2 – WHAT ARE THE PROPOSED ALTERNATIVES?

Sand sources sought for this project include a combination of regionally-limited State of Florida and federal Outer Continental Shelf (OCS) offshore resources. Federal resources include an area termed BA-F2, an offshore sand ridge lying in the direct route of a planned liquid natural gas pipeline project (Port Dolphin). As part of the mitigation for Port Dolphin project-related impacts, funds have been set aside to reimburse the Town for the design and dredging of impacted sand resources prior to the planned construction of the Port Dolphin pipeline, currently slated for construction during summer of 2013. As a result, the Town of Longboat Key is seeking to lease these federal resources prior to construction of the pipeline when a portion of F2 will become inaccessible.

The Town investigated multiple borrow areas within State waters; however, many were eliminated based on sediment quality or sediment color reasons. The borrow areas and alternatives being considered for this project (*No Action* vs. *Proposed Action to Use OCS Borrow Area Resources*) are described in more detail below.

2.1 Authorization to Use Outer Continental Shelf Borrow Area (Preferred Alternative)

This alternative includes authorization by BOEM to access OCS resources in the borrow area known as F2 for the extent of the lease agreement. These sand resources would contribute to the restoration of the beach to the fill template designed for the 2005/06 beach nourishment from the north end of Longboat Key (R44, Manatee County) to the south end of Longboat Key (R29, Sarasota County). An interim nourishment phase is planned for Funding Year (FY) 2011/2012 utilizing offshore borrow area B3 (in State waters) and a portion of BA-F2 (in federal waters). The interim nourishment would place approximately 310,000 cy of sand from R44 to R46a and R47.5 to R50 in Manatee County and R12 to R17 in Sarasota County. An island-wide project is also planned for FY 2013/2014 or later that would place sand along 9.8 mi of shoreline. This alternative includes mitigation and monitoring as part of the action. As such, the effects of mitigation (when warranted) will be analyzed.

2.2 No Action

BOEM considers the following as an alternative to the proposed action:

Do Not Authorize Use of OCS Sands: Under this alternative, the Town of Longboat Key would not be authorized to access offshore sands in BA-F2. The project proponents could either:

(a) re-evaluate the project to choose another sand source in state waters to restore the project placement location, or
(b) locate an onshore source of comparable high-quality sand, or
(c) no project completion

Option A would not minimize overall environmental effects because of the need to protect the shoreline associated with the project by either constructing new or augmenting existing protection mechanisms for the beaches. Option B is not considered to be viable as sources of approved onshore sand are limited. Additionally, even if a sufficient amount of high-quality sand is located onshore, Option B is likely to result in increased environmental disruption/effect from the onshore excavation of the source and overland transport. Option C would result in a continuation of beach loss. Longboat Key beach has been eroding at a significant rate since 2004, and recent storm events have only exacerbated the problem. Further loss of the island‟s beach will be detrimental to the Town‟s economy (see Section 1.4).

CHAPTER 3 – WHAT IS THE SETTING OF THE PROPOSED ACTION?

Chapter 3 describes the setting of the proposed action including physical, biological and cultural resources.

3.1 Physical Environment

3.1.1 Geology and Geomorphology

Developing an understanding of the geologic setting of the project area is important because it provides contextual information that sets limits to potential sand resources. A description of the regional geologic setting defines the framework bedrock seafloor surfaces and the sediments that sit on them. The nature of a sedimentary deposit determines sand quality, distribution, and its potential use for beach nourishment. It is thus necessary to understand the general continental shelf environments because the distribution of beach-quality sands on the seabed is not random, but spatially well-defined in terms of stratigraphy, composition, age and erosional-depositional history (Finkl *et al.*, 2009).

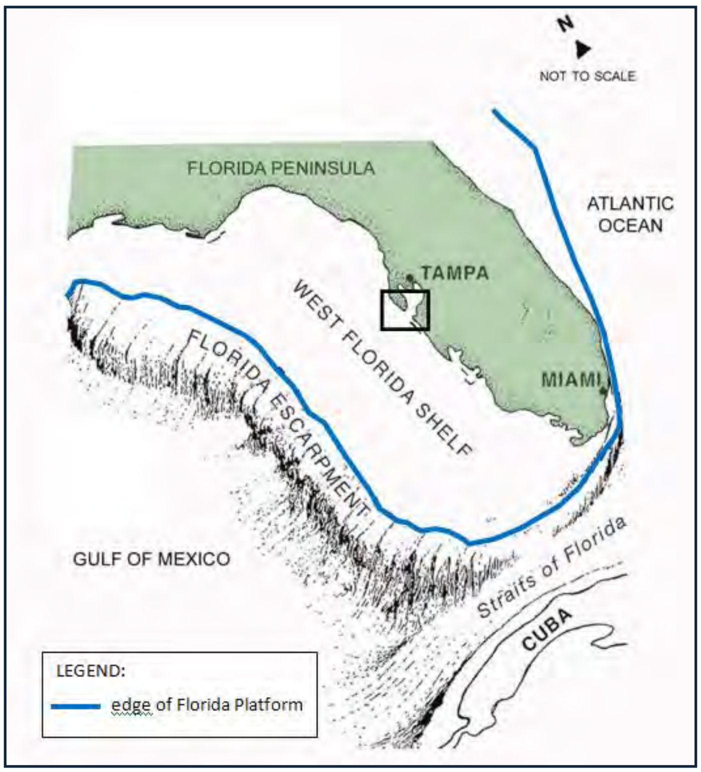


Figure 3. Illustration of the West Florida Shelf.

The western coast of Florida is part of a large primary geological feature referred to as the eastern Gulf of Mexico Sedimentary Basin, which is further divided into the North Gulf Coast Sedimentary Province and the Florida Peninsula Sedimentary Province (Schmidt and Clark, 1980). The Florida Peninsula, a large carbonate platform containing a thick, non-clastic sedimentary sequence predominantly composed of carbonates and anhydrites, was constructed between the Middle Jurassic (180 MYA) and the Late Miocene (5 MYA). This ancient carbonate platform forms the proximal portion of the west Florida shelf-slope system and exerts large-scale control on coastal geomorphology, the availability of sediments, and wave energy (Hine *et al.*, 2003). During the same time or during a later emergence, there appears to have been a tilting of the plateau along its longitudinal axis causing a partial submergence of the

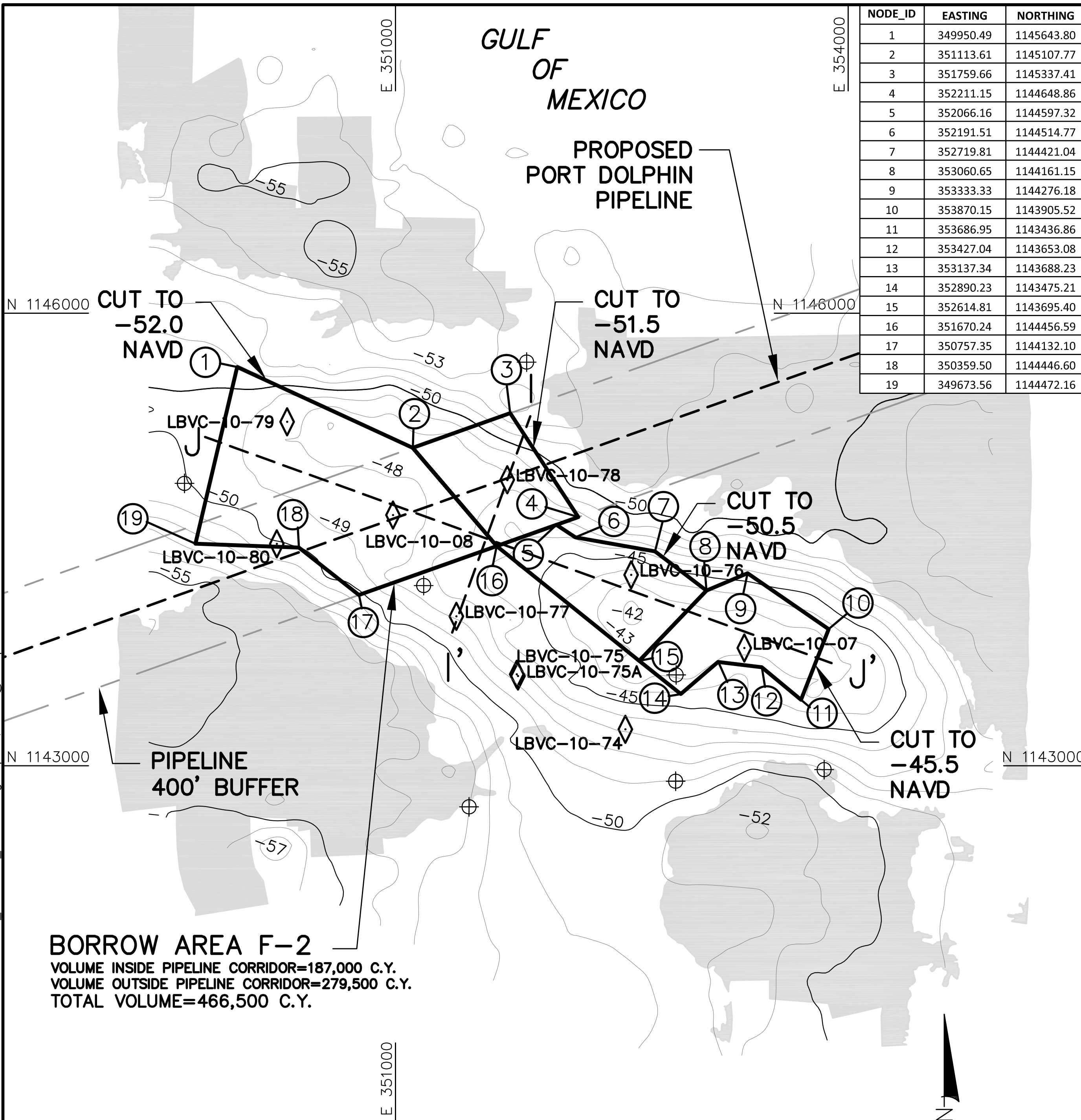
West Coast, partly accounting for the wide estuaries and offshore channels found along the west coast of Florida (Figure 3).

The underlying antecedent topography of the Tertiary (2–65 MYA) limestone surfaces, as well as their hardground exposures, significantly influence the orientation and geographic location of Holocene (last 10,000 years) barrier islands and sand ridges along the west coast of Florida, as discussed by Evans *et al.* (1985) and Hine *et al.* (1986). Coastal orientation is generally NW-SE along the southwest coast of Florida. However, there are major offsets at Indian Rocks (Pinellas County), Sanibel Island (Lee County) and Cape Romano (Collier County). The underlying pre-Quaternary (1.8 MYA) surface is composed of irregular karstic limestones that partially control barrier island development, position, and tidal inlet opening (Gibeaut and Davis, 1988; Stapor *et al.*, 1991). The present coastal barrier islands likely formed close to their present location during the latest, relatively stable, stages of the Holocene transgression approximately 4,000 to 5,000 years ago (Bland, 1985; Davis, 1997; Evans *et al.*, 1985). Historic shoreline data for recently evolved coastal barrier islands and stratigraphic data based on core logs from older barrier islands indicate that they formed in response to a gentle wave climate that transported sediments onshore to shallow water where they shoaled upward to intertidal and supratidal levels (Locker *et al*., 2003).

Potential sand resources on the continental shelf off the west coast of Florida, which were previously mapped by Finkl *et al*. (2007), were reviewed during the Phase I geotechnical investigations for the Town of Longboat Key Beach Renourishment Project. The area mapped by Finkl *et al*. (2007) spans about 300 mi alongshore Dixie County on the southern margin of the Big Bend to southern Collier County on the northwest flank of Florida Bay. Morphosedimentary bodies in this sand resource zone include sand flats in the form of shoreface-attached sand sheets, ebb-tidal delta complexes, and ridge fields. The ebb-tidal delta complexes are associated with major estuaries (*e.g*. Tampa Bay, Caloosahatchee River) but are of limited areal extent. Shoreface-attached sand sheets are also of relatively minor areal extent. Ridge fields occur farther offshore and are interspersed by rock platform – sand sheet complexes. Generally, beach quality sands on the west coast of Florida are located in bathymetric highs or ridges.

These sand ridges generally occur in water depths from 26-66 ft and are associated with modern shelf processes and relict geological and geomorphological controls (*e.g*. bedrock slope). The ridges off the southwest coast of Florida may be associated with cuspate forelands and sedimentary headlands or with reworked paleo-ebb tidal shoals and barriers. The ridges are obliquely oriented to the coast, although shore parallel and shore transverse ridges occur in restricted locations.

Multiple sand ridge fields occupy different parts of the West Florida Shelf. Although the sand ridges display similarities, there are notable differences in orientation, morphology, and composition. Due to limited thickness (3-8 ft) of some of the ridges first explored, it was initially thought that sand ridges offshore of the southwest Gulf coast could not provide sufficient volumes to support projected beach nourishment requirements. Today, however, exploitation of thinner ridges is feasible using hopper dredges that are designed to dredge long shallow cuts.



NODE_ID	EASTING	NORTHING
1	349950.49	1145643.80
2	351113.61	1145107.77
3	351759.66	1145337.41
4	352211.15	1144648.86
5	352066.16	1144597.32
6	352191.51	1144514.77
7	352719.81	1144421.04
8	353060.65	1144161.15
9	353333.33	1144276.18
10	353870.15	1143905.52
11	353686.95	1143436.86
12	353427.04	1143653.08
13	353137.34	1143688.23
14	352890.23	1143475.21
15	352614.81	1143695.40
16	351670.24	1144456.59
17	350757.35	1144132.10
18	350359.50	1144446.60
19	349673.56	1144472.16

BORROW AREA F−2

VOLUME INSIDE PIPELINE CORRIDOR=187,000 C.Y.
VOLUME OUTSIDE PIPELINE CORRIDOR=279,500 C.Y.
TOTAL VOLUME=466,500 C.Y.

LEGEND:

- ◊ LBVC−10−65 — CPE 2010 VIBRACORE
- ⊕ — TAR 2010 MAGNETIC ANOMALIES
- CPE 2010 DIGITIZED HARDBOTTOM
- ▨ — CULTURAL RESOURCE AVOIDANCE AREA− NO DREDGE ZONE

NOTES:

1. COORDINATES ARE IN FEET BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83).
2. ELEVATIONS ARE IN FEET REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. DATE OF CPE BATHYMETRIC SURVEY: OCTOBER, 2009 AND AUGUST, 2010.

NOT FOR CONSTRUCTION
FOR REGULATORY REVIEW ONLY

MELANY LARENAS P.G. NO. PG2397 DATE

REVISIONS

DATE	BY	DESCRIPTION
4/14/11	HV	PERMIT UPDATES

2011 LONGBOAT KEY
BEACH NOURISHMENT PROJECT
BORROW AREA F-2 BATHYMETRY

COASTAL PLANNING & ENGINEERING, INC.
2481 N.W. BOCA RATON BOULEVARD
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PH. (561) 391-8102
FAX (561) 391-9116
C.O.A. FL. #4028
C.O.A. LA. #2531
www.CoastalPlanning.net

DATE: 11/11/10
BY: KD
COMM NO.: 8489.18
SHEET: 12

P:\Sarasota\Longboat Key\848918 North End JCP Permit\CAD\PERMITS\848918 BA X F2 and B3 PV and XS_REVISED_040811.dwg - Apr 25, 2011 @ 1:09pm - kdennis

A hopper dredge will be used to access a previously unknown sand resource, since named Borrow area (BA) F2 that was discovered during review of Port Dolphin pipeline data. The description, photographs, and textural analysis of sand from Port Dolphin vibracores indicated at least 4 ft of beach-compatible sand with a grain size of 0.17 mm. Comparison of the vibracore data to Port Dolphin‟s seismic data show a hill that reaches thicknesses of up to 18 ft, indicating a significant volume of beach-compatible sand**.** Additional vibracore investigations conducted in January and April 2010 by CPE confirmed beach compatible sand is present in BA-F2 (Figure 4).

3.1.2 Physical Oceanography and Water Quality

Physical Oceanography

The OCS Borrow area F2 lies in the Gulf of Mexico and is subject to open ocean conditions and regular tidal activity. Tides near Borrow area F2 are mixed. Typical observed tides near the Gulf shoreline of Longboat Key appear in Figure 5. For the majority of the 14-day spring-neap cycle, there are two (2) high and two (2) low tides each day, with different high tide and low tide elevations. However, during a small portion of the 14-day cycle, there is only one high tide and one low tide each day. Although the mean tidal range in the Gulf is 1.5 feet, based on the established tidal datums, the tide range during spring tides can exceed 3 ft, as shown in Figure 5. Tidal currents near BA-F2 are small, typically in the range of 0.2 to 0.6 ft/sec (Westerink *et al.*, 1993). The principal current directions are 75° during flood and 225° during ebb, and are indicative of flow into and out of Tampa Bay. The currents are generally ebb dominated, approaching 0.6 ft/sec during spring tides. During neap tides, peak currents are on the order 0.2 ft/sec.

Wave data for the area surrounding BA-F2 comes primarily from the National Oceanographic and Atmospheric Administration (NOAA) WAVEWATCH hindcast, from 2000 to present. Historic data was obtained from the U.S. Army Corps (Corps) Wave Information System (WIS) hindcast, from 1980 to 1999. Both of these hindcasts come from WIS Station 272, located 14 mi offshore at 27.45155°N, 82.91727°W, at a depth of -51 feet NAVD. Based on the NOAA (2009) wave hindcast, the prevailing wave directions are from the west, the west-northwest, the south, and the south-southeast. Although there are high percentages of oblique waves coming from the southerly direction bands, the waves coming from the northerly direction bands during average conditions tend to be higher (Figure 6). The highest and longest waves under average conditions occur during the winter months and during the peak of hurricane season, when distant storms can increase the wave height (Figure 7). The root mean square wave height is approximately 2.4 ft, with an average peak period of 4.5 sec. During the fall and winter months, the prevailing waves are from the northerly direction bands. During the late spring and summer months, the prevailing waves are from the southerly direction bands.

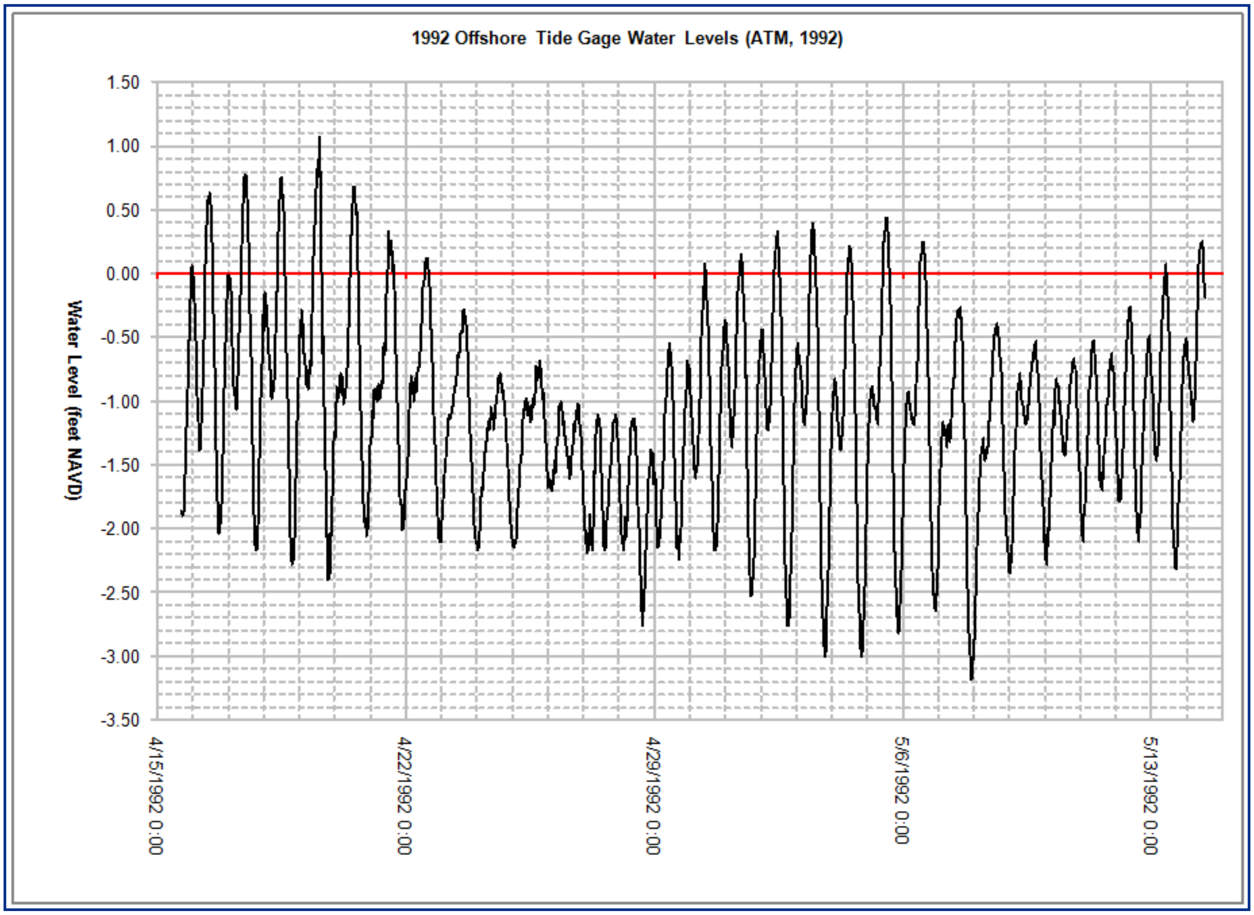


Figure 5. Observed tides offshore of Longboat Key (ATM, 1992).

The highest and longest waves under storm conditions occur during hurricane season. The highest estimated wave recorded since 1980 was 20 ft, generated by Hurricane Opal on October 4, 1995. The highest estimated wave after 1999 was 17 ft, generated by Hurricane Frances on September 4, 2004 (Figure 7). The longest wave periods estimated during the average hurricane season are on the order of 16 sec. During the winter months, storm waves range from 10-16 ft, with wave periods ranging from 9-12 sec.

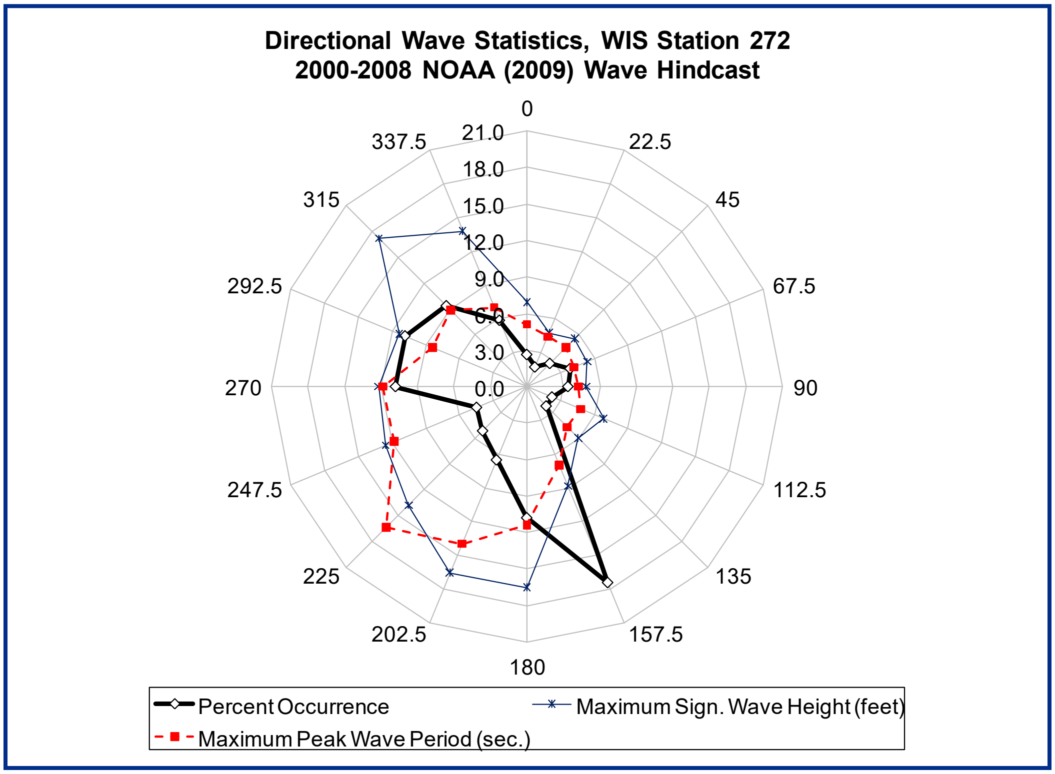


Figure 6. Percent occurrence of all waves and maximum wave statistics by direction band at WIS Station 272.

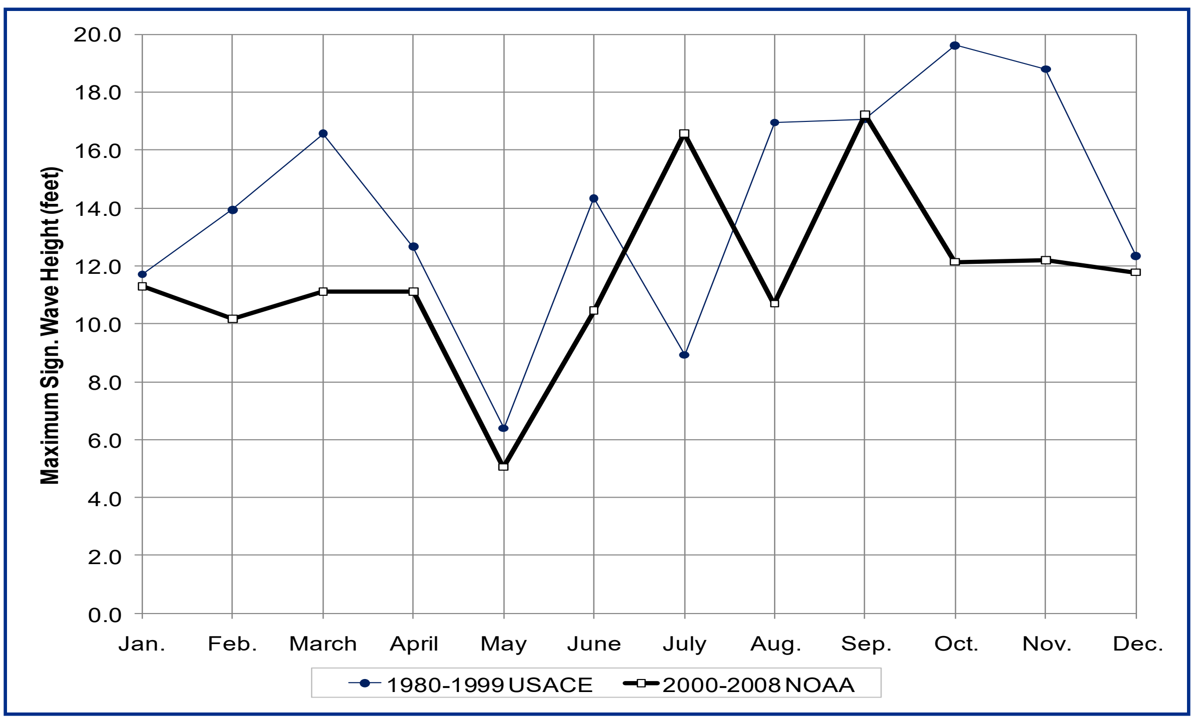


Figure 7. Maximum monthly wave height statistics.

Water Quality

In 1998, the Florida Department of Health began a pilot program in which 11 coastal counties conducted beach water sampling every two years. The program was expanded in 2000 to include all 34 coastal counties. In August 2002, each county began weekly sampling. These samples are analyzed for *Enterococci* and fecal coliform bacteria. Along the beaches of Anna Maria Island inshore of BA-F2, only one warning/advisory was issued in the past two years due to hazardous levels of these bacteria (FDOH, 2004). The warning was issued for Bradenton Beach on July 14, 2008. Both *Enteroccus* and fecal coliform were found in Moderate levels (*Enterococcus* = 36-104 species per 100 ml seawater; fecal coliform = 200-399 organisms per 100 ml seawater).

The Gulf of Mexico is also occasionally subject to red tides, or outbreaks of high concentrations of the dinoflagellate *Karenia brevis*. The National Oceanic and Atmospheric Administration (NOAA) National Ocean Service and the National Environmental Satellite Data and Information Service administer the Harmful Algal Bloom Operational Forecast System (HAB-OFS) that provides notification of harmful algal blooms to state and local coastal managers in the Gulf of Mexico. According to the HAB-OFS Bulletin Archive, the last widespread harmful algal bloom in southwest Florida occurred in 2006. The bloom began in northern Sarasota and southern Lee Counties in June, and persisted until February 2007, eventually stretching from Pinellas County to Collier County, and even to parts of Monroe County. Low concentrations of *K. brevis* were observed between October and December 2007 in various southwest Florida Counties; however, no impact warning was issued for the Longboat Key area. Patchy blooms were identified in Sarasota County in November 2008, and, more recently, in January 2010 (NOAA, 2010a).

"Red Tides" are caused by the explosive growth and accumulation of certain microscopic algae, primarily the dinoflagellate *Kirenia brevis*. This species of algae produces neurotoxins known as brevetoxins, which can be harmful to humans and wildlife.

Natural turbidity around the project area during average conditions ranges from 2-12 NTU (Hanes and Stubbs, 1994). Concurrent with permit-mandated biological monitoring of benthic hardbottom communities offshore of Longboat Key for the 2005/06 Town of Longboat Key Beach Renourishment Project, CPE biologists also measured turbidity at the surface and from bottom samples over nearshore monitoring sites. During sampling conducted biannually in the summers of 2008 and 2009, surface samples ranged 0.20-1.05 NTU; bottom samples ranged from 0.29-1.28 NTU (CPE, 2010). During higher wave conditions, turbidity values ranging from 30-65 NTUs can occur (Appendix B of Hanes and Stubbs, 1994).

Nearshore salinity was also measured concurrently with biological monitoring of hardbottom communities off Longboat Key. Surface values at monitoring stations ranged from 35.0-37.1 ppt; bottom samples ranged from 34.5-37.1 ppt (CPE, 2010).

Based on the 2006-2009 records at the St. Petersburg tide gage, water temperatures in the area range from 58-95°F (14-35°C), with an average temperature of 79°F (26°C). The lowest water temperatures occur in January and February, and the highest water temperatures occur in July and August (NOAA 2008b).

3.1.3 Climate

Climate within the project area is subtropical, with long, hot summers, relatively mild winters of short duration, and plentiful precipitation. Local thunderstorms and tropical storm systems result in the greatest monthly rainfall averages occurring during the summer months. January and February are the coldest months, and July and August are the warmest months. Based on the 2006-2009 records at the St. Petersburg tide gage, air temperatures typically range from 33°F to 96°F (1°C to 35°C), with an average temperature of 73°F (23°C).

The project area is prone to hurricanes, which bring strong, damaging winds, torrential rains, and tidal storm surges that flood low-lying areas. Between 1871 and 2009, 32 hurricanes came within 60 mi of the Sarasota area, equivalent to a recurrence interval of approximately 4.3 years. Seven of these storms made a direct hit, equivalent to a recurrence interval of approximately 20 years (Hurricane City, 2009). September is typically the peak of the hurricane season around the project area.

The majority of erosion and sediment transport near borrow area F2 and the region"s beaches is governed by waves, tides, and currents. Relative sea level rise, which includes subsidence and eustatic (global) sea level rise, is, at most, a minor process. Based on water level measurements at the St. Petersburg Tide Gage between 1947 and 2006, relative sea level rise was 2.36 ± 0.29 mm/yr (0.0077 ± 0.001 ft/yr). The corresponding rate of shoreline retreat "R" based on the Bruun Rule is 0.4 ft/yr. Given the average shoreline change on Longboat Key since July 2006 (7.6 ft/yr of retreat, CPE, 2009a), sea level rise accounts for only 5% of the total shoreline change.

Bruun Rule: $R=SL/(h+dc)$

where

R = shoreline retreat attributable to sea level rise
h = berm elevation (+5 NAVD berm)
dc = depth of closure (16 feet NAVD)
L = average horizontal distance between the berm and the depth of closure (998 ft)
S = relative sea level rise (0.0077 ft/yr)

3.1.4 Air Quality

Primary pollutants are generated daily and emitted directly from a source into the atmosphere. Primary pollutants include carbon monoxide (CO), nitrogen dioxide (NO_2), nitric oxide (NO), sulfur dioxide (SO_2), particulates (PM- 10 and PM-2.5), and hydrocarbons (HC). Hydrocarbons are also known as volatile organic compounds (VOC). Secondary pollutants are created over time as a result of chemical and photochemical reactions in the atmosphere. Ozone (O_3) is a secondary pollutant, formed when NO_x reacts with HC in the presence of sunlight.

The Clean Air Act, last amended in 1990, requires the U.S. Environmental Protection Agency (EPA) to set National Ambient Air Quality Standards (NAAQS) (40 CFR part 50) for pollutants considered harmful to public health and the environment. The Clean Air Act established two types of national air quality standards: primary ambient air quality standards that are designed to protect public health with an adequate margin of safety; and secondary ambient air quality standards that are designed to protect public welfare-related values including property, materials, and plant and animal life (USEPA, 2010a). The EPA has established NAAQS for six principal pollutants, called "criteria" pollutants. In Florida, ambient air quality standards at least as stringent as the national secondary standards have been adopted by the FDEP. Florida has adopted the same standards, except where noted (Table 4). Ambient air quality data from Sarasota County in 2006 for five of the six criteria pollutants are also included (Sarasota County does not have a lead monitoring program) (FDEP, 2006). All areas within the state are designated with respect to each of the six pollutants as: "attainment" (in compliance with the standards); "non-attainment" (not in compliance with the standards); or "unclassifiable" (insufficient data to classify). All areas of Florida are now classified as attainment areas (USEPA, 2010b). The project placement area along Longboat Key shoreline is located within an attainment area; Sarasota and Manatee Counties, included in the Southwest and Central Florida Intrastate Air Quality Control Regions, respectively, are both included in attainment areas. Borrow area F2 is located outside the boundary of State waters, in Federal outer continental shelf (OCS) waters, and its attainment status is therefore categorized as "unclassified". The project is exempt from the Clean Air Act conformity requirements because it is located in a Federal attainment area and an unclassified area. The area is presumed to meet National Ambient Air Quality Standards, and therefore, there is no requirement to prepare a general conformity determination.

Table 4. Ambient Air Quality Standards and 2006 air quality data from Sarasota County (FDEP, 2006)

AIR POLLUTANT	NATIONAL AND STATE AMBIENT AIR QUALITY STANDARDS		SARASOTA COUNTY - 2006[1]
	Primary	Secondary	
Ozone (O_3)	0.12 ppm, 1-hr	same as primary	0.11 ppm, 1-hr[2]
	0.075 ppm, 8-hr (2008 std) 0.08 ppm, 8-hr (1997 std)		.087 ppb, 8-hr[2]
Carbon Monoxide (CO)	35 ppm, 1-hr	none	3 ppm, 1-hr[3]
	9 ppm, 8-hr		2 ppm, 8-hr[3]
Nitrogen Dioxide (NO_2)	100 ppb, 1-hr	none	44 ppb, 1-hr[4]
	53 ppb, annual[5]	same as primary	5 ppb, annual[4,5]
Sulfur Dioxide (SO_2)	0.14 ppm (FL 0.10 ppm), 24-hr	0.5 ppm, 3-hr	.003 ppm, 24-hr[4]
	0.03 ppm (FL 0.02 ppm), annual[5]		.001 ppm, annual[4,5]
	(FL 0.5 ppm, 3-hr)		.009, 3-hr[4]
	75 ppb, 1-hr		NA
Suspended Particulate Matter (PM10)	150 $\mu g/m^3$, 24-hr	same as primary	72 µg/m3, 24-hr[4]
Lead (Pb)	0.15 $\mu g/m^3$, rolling 3-mo avg	same as primary	NA
	1.5 $\mu g/m^3$, quarterly avg		NA

[1]Sarasota data source: FDEP, 2006 (Unless otherwise noted, Sarasota values are the highest concentration recorded in 2006)
[2] data recorded at Lido Park, 450 McKinley Dr., Sarasota, FL 34236
[3] data recorded at 2000 Main St., Sarasota, FL 34236
[4] data recorded at Paw Park, 4570 17th St., Sarasota, FL 34235
[5] arithmetic average

The Air Quality Index (AQI) has been developed by the EPA to provide a simplified method to advise the public daily of any possible adverse health effects due to air pollution. The AQI uses measured levels of five criteria pollutants (lead is excluded because it is only a quarterly average standard). These are combined to create a single number that can be translated into a descriptor word that describes the air quality: good, moderate, unhealthy for sensitive groups, unhealthy, and very unhealthy. Tables 5 and 6 present the AQI data for Sarasota and Manatee Counties, respectively, from 1999 to 2006 (FDEP, 2006). The air quality in both counties qualified as "good" or "moderate" 99% of the time.

Table 5. Air Quality Index (AQI) data in Sarasota County, 1999 – 2006 (FDEP, 2006).

SARASOTA COUNTY	NUMBER OF DAYS				
YEAR	Good (≤ 50)	Moderate (51 - 100)	Unhealthy for sensitive group (101 - 150)	Unhealthy (151 - 200)	Very unhealthy (201 - 300)
2006	316	48	1	-	-
2005	327	36	2	-	-
2004	333	27	4	-	-
2003	328	32	3	-	-
2002	340	25	-	-	-
2001	318	42	4	1	-
2000	243	118	5	-	-
1999	268	95	2	-	-

Table 6. Air Quality Index (AQI) data in Manatee County, 1999 – 2006 (FDEP, 2006).

MANATEE COUNTY	NUMBER OF DAYS				
YEAR	Good (≤ 50)	Moderate (51 - 100)	Unhealthy for sensitive group (101 - 150)	Unhealthy (151 - 200)	Very unhealthy (201 - 300)
2006	331	33	1	-	-
2005	329	36	-	-	-
2004	314	49	3	-	-
2003	342	22	1	-	-
2002	345	20	-	-	-
2001	330	31	4	-	-
2000	248	115	3	-	-
1999	259	105	1	-	-

3.2 Biological Resources

3.2.1 Shoreline Habitats

Longboat Key is one of the many barrier islands, or linear islands of sand, that parallel much of the coastline of Florida. Barrier islands are dynamic environments, with topographic and vegetation profiles dictated by the interaction of plant growth and physical processes such as wind-driven sand movement and salt spray, and wave-driven erosion and accretion. Typically, the waterward profile of these islands is composed of a sandy beach backed by vegetated dunes. Barrier islands along the southwest coast of Florida naturally migrate landward, and experience growth of spits from headlands, overwash, and breaching. (Johnson and Barbour, 1990). However, due to encroachment of condominiums and hotels, and interruptions in the shoreline caused by seawalls, artificially maintained inlets, and other coastal armoring, these natural processes can be stunted. Dune formation is often limited and erosion of beaches occurs in many places. Longboat Key is an example of this situation. A description of the current state of each shoreline habitat occurring along Longboat Key is provided below.

Dune System

A dune is any area landward of the active beach where dune grasses are the dominant plants (Rogers and Nash, 2003). They are dynamic geologic features that continually increase and decrease in elevation due to accretion from windblown sand and erosion from multiple factors including seasonal fluctuations, storm activity, and inlet erosion. Dunes offer protection from severe storms; however, even the largest dunes are poor protection from long-term or chronic erosion (Rogers and Nash, 2003).

Dune vegetation is essential to hold a dune in place and consists of hearty plants that are adapted to tolerate extreme conditions (Duever, 1983). They thrive in soils that are low in nutrients and moisture, and may be exposed to ocean overwash and severe fluctuations in temperature. Zonation of dune vegetation is a factor of salt spray and windblown sand which decrease in concentration with distance from the ocean. Typical vegetation zones from the ocean landward are: pioneer dune plants, grassland species, shrub thicket, and maritime forest (Rogers and Nash, 2003).

Common foredune vegetation in Sarasota and Manatee Counties includes sea oats (*Uniola paniculata*), saltmeadow cordgrass (*Spartina patens*), railroad vine (*Ipomoea pes-caprae*), and beach-elder (*Iva imbricata*). Common backdune species include sea grapes (*Coccoloba uvifera*), blanket flower (*Gaillardia pulchella*), and necklace pod (*Sophora tomentosa*). However, the extent of dune habitat is limited in the project area due to the developed nature of Longboat

Key‟s shoreline. Currently, narrow low dunes are present throughout the length of the island, interrupted in some places by seawalls.

Beach Environment

Eroded material from the dune contributes to the sandy beach, which is typically made up of the dry beach (consisting of the upper and mid-littoral beach between the toe of dune and mean high water line) and the wet beach or swash zone. In the upper beach, burrowing organisms, such as sand fleas, isopods, ghost crabs (*Ocypode quadrata*) and transient organisms dominate the fauna. The mid-littoral beach is occupied by polychaetes, isopods, haustoriid amphipods and interstitial organisms that feed on bacteria and unicellular algae. The swash zone inhabitants include polychaete worms, coquina clams (*Donax variabilis*), and mole crabs (*Emerita talpoida*). In Florida, the ghost crab, mole crab, and coquina clam are all considered indicator species for health of beach habitat by Florida‟s Comprehensive Wildlife Conservation Strategy (Irlandi and Arnold, 2008). The developed nature of Longboat Key limits the extent and quality of beach habitat along the island, and the beach is highly eroded in some places within the project area.

Beach Wrack

Beach wrack is an important biological component of most beaches, and is made up of aged, stranded seagrass and marine algae that can be mixed with shells, echinoderms, crustaceans, sponges, coral pieces, and driftwood to name a few, and is an important source of organic material for intertidal communities (Jackson *et al.*, 2002). Wrack is inhabited by numerous amphipods and insects (Josselyn and Mathieson, 1980) and creates an energetic link between marine and terrestrial systems (Pennings *et al.,* 2000). It serves as a foraging area for upland species and reduction of wrack reduces the prey available to vertebrate predators, such as shorebirds (Dugan *et al.*, 2003).

Shorebirds were surveyed between 2005 and 2007 as a permit requirement associated with the 2005/2006 beach renourishment. The most abundant shorebirds during these surveys were the laughing gull (*Larus atricilla*), black-bellied plover (*Pluvialis squatarola*), and ruddy turnstone (*Arenaria interpres*). The federally threatened piping plover (*Charadrius melodus*) has also been observed on Longboat Key. Piping plovers utilize Florida‟s coast as wintering habitat (Haig and Oring, 1985) and can spend up to 10 months on wintering grounds (USFWS, 2003), thus emphasizing the importance of suitable wintering habitat. During the overwintering timeframe, they spend the majority of their time foraging (Nicholls and Baldassarre, 1990); therefore, the wrack line provides an important foraging resource for piping plovers, as well as other shorebirds wintering on the Gulf coast of Florida (USFWS, 2003).

Red knots (*Caldrius canutus*) are also known to overwinter on the beaches of Longboat Key. This species has experienced steep declines in recent years due to the overharvesting of its primary food source, horseshoe crab (*Limulus polyphemus*) eggs (Niles *et al*., 2008), and is now a candidate for federal protection under the Endangered Species Act. Although the red knot may forage for horseshoe crab eggs along Florida beaches, their primary source of these eggs is in Delaware Bay. In Florida, red knots also feed on small crustaceans including *D. variabilis*. During a 2005-2006 winter survey along Longboat Key, a flock of 750 red knots were observed on Longboat Key (Niles *et al*., 2006); red knots have not been observed in these numbers since the 2006 beach nourishment (Nancy Douglass, FWC, pers. comm., January 2011).

Wrack lines also facilitate the accumulation of dunes. Windblown sand accumulates around the wrack line at the high tide line and dune plant seeds that are trapped in the wrack begin to germinate in the moist, nutrient-rich environment. The dune plants continue to stabilize the sand for further growth and can potentially produce a primary dune (Hemminga and Nieuwenhuize, 1990).

Substantial ecological effects of large-scale disturbance and removal of organic material, food resources, and habitat are associated with beach grooming (Dugan *et al.*, 2003; Hubbard and Dugan, 2003). Although permits provide rules to protect nesting sea turtles, there are no protections included for other imperiled shore-dependent species such as birds and mice. Wrack provides nesting and protective habitat for shorebirds. Beach nesting birds often nest on the open beach and their only protection is camouflage. Shorebirds use the wrack as a safe haven from predators by hiding under it or camouflaging in it (FWC, 2010). Wrack removal eliminates this habitat and may result in take by crushing and/or removing nests and chicks. Sections of Longboat Key are mechanically raked as permitted by the FDEP; these permits are issued without consideration of impacts to wildlife. Approximately 3.2 mi of the 10-mi shoreline has wrack mechanically removed on a daily to monthly basis. There is no wrack removal program implemented by the Town of Longboat Key; however, individual properties hold field permits from the FDEP (*pers comm.* Steve West) which allow raking. Table 7 presents the properties permitted to mechanically rake the beach on Longboat Key, the linear footage of shoreline for each property, and raking frequency. The total beach frontage on Longboat Key is approximately 10 mi long and the amount of beach frontage permitted for wrack removal is currently 3.22 mi (17,025 linear ft).

The Town will post educational signage at public access areas indicating the importance and contribution of beach wrack to the coastal biological community. The Town will also publish information on the importance of wrack on the Longboat Key website along with a link to the FWC news release entitled *That Bunch of Seaweed on the Beach Teems with Life*.
http://www.myfwc.com/NEWSROOM/09/statewide/News_09_X_BeachWrack.htm

Table 7. Private properties with field permits to rake the beach in the Town of Longboat Key*.

PROPERTY	BEACH FRONTAGE (linear ft)	FREQUENCY OF RAKING/WRACK REMOVAL
Inn on the Beach (LBK Club)	1500.00	once a month
L'ambiance	981.25	once a month
Pierre	512.50	once a month
Sanctuary Condo	887.50	once a month
Longboat Key Towers	712.50	once a month
Regent Place	Included in Beaches frontage	once a week
Beaches	2175.00	once a month
Regent Court	Included in Beaches frontage	once a month
Privateer	575.00	once a month
Beachplace Condo	1418.75	once a week
Promenade Condo	1131.25	once a week
Water Club Association	Included in Promenade frontage	3 times/wk (MWF)
Players Club Condo	543.75	3 times/wk (MWF)
Tencon Condo	162.50	3 times/wk (MWF)
Colony Beach and Tennis Club	787.50	6 days a week
Aquarius Condo	225.00	3 times/wk (MWF)
Seaplace Association Inc.	2162.50	once a week
Sunset Beach Club	412.50	once a week
Vizcaya	500.00	quarterly
Sea Gate Club Condo Assoc.	350.00	quarterly
Islands West	375.00	quarterly
Veinte	312.50	No raking since 2005
Beachcomber (I & II)	318.75	No raking since Jan 2007
Sand Cay Beach Resort	312.50	No raking since 2005
Westchester	668.75	once a month
TOTAL	**17025.00 linear ft**	**= 3.22 mi**

* Field permit information provided by Steve West (FDEP).

3.2.2 Water-Column

The action area includes the marine water column of the Gulf of Mexico. Estuarine water column is also present in the vicinity. Both the marine and estuarine water column in the Gulf of Mexico are considered Essential Fish Habitat (EFH) and support a variety of fish species, including those managed by the Gulf of Mexico Fisheries Management Council (GMFMC) (see Section 3.2.5). The marine water column within the action area also provides habitat and travel corridors for threatened and endangered species such as whales and manatees (see Section 3.2.4).

3.2.3 Benthic Habitat

Softbottom Resources

Softbottom, subtidal habitats consisting of various percentages of sand, sand-gravel and shell comprise the dominant benthic habitat along both Florida coasts. Softbottom habitat is found directly within the action area as well as adjacent sea bottom in both marine and nearby estuarine waters.

Unvegetated Softbottom Communities. Softbottoms within the proposed action area are essentially flat, sand sheets. The west Florida margin is made up of carbonate rocks intercalated with evaporates which have been deposited mostly continuously since the Jurassic. Most of the west Florida continental shelf is veneered with a surficial sand sheet of coarse carbonates comprised mostly of mollusk fragments, although the inner 10 mi or so is also veneered with quartz sand mixed with varying amounts of carbonates (Doyle and Sparks, 1980). The unvegetated, softbottom subtidal areas are important habitats for benthic organisms living on (epibenthos) or within (infauna) the sediment, providing for high species diversity. Spatial and temporal gradients (*i.e.* salinity, temperature, water quality and sediment type) affect both community composition and diversity. The fauna is typically dominated by polychaete worms, crustaceans and mollusks (Myers and Ewel, 1990). The benthos is an important element in the food web, providing food for wading birds, shorebirds and fish.

Epibenthic softbottom communities were sampled and described at four sites in the vicinity of the proposed action area, including three previously permitted borrow sites (Longboat Key, the ship channel off Egmont Key, and Manasota Key site) and an undredged site (Sarasota) (Blake *et al.*, 1996). A total of 41 different taxa were observed during the study, indicating the low species richness and constancy of biotic composition within the dynamic sandy habitat in this area. Throughout the course of the study, the iridescent swimming crab (*Portunus gibbesii*) and the common sand dollar (*Mellita tenuis*) remained the dominant epibenthic species at both dredged and undredged locations. Approximately 120 hours of underwater video was recorded over the study sites during which observations of flora and fauna were rare.

Benthic infaunal communities were also sampled and described as part of the Blake *et al.* (1996) study, which revealed much higher taxonomic richness and abundances compared to the epibenthic community: 620 infaunal taxa were found compared to 41 epibenthic taxa. Annelids, mollusks, and arthropods contributed 44%, 22%, and 27% of the taxa, respectively. These three taxonomic groups represented 93% of the taxa and 89% of all fauna (Figure 8). Results indicated that three of the borrow sites studied supported a healthy, diverse infaunal community.

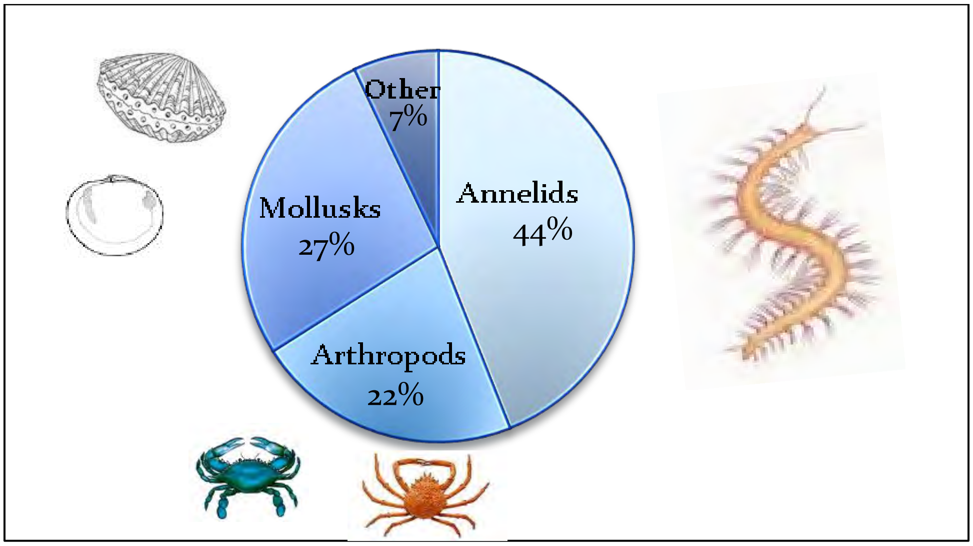
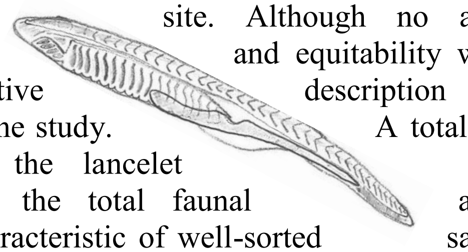


Figure 8. Benthic infaunal results of Blake *et al.* (1996) study.

However, the Blake study only looked at one post-dredging sample of the Longboat Key site. A limited, independent study was conducted two years earlier by Mote Marine Laboratory on the proposed borrow site. Although no analysis of faunal abundance, species richness, diversity and equitability were conducted, the results at least provide a qualitative description of the infaunal assemblage in that area at the time of the study. A total of 50 species were found; the dominant species was the lancelet *Branchiostoma floridae*, which comprised 65% of the total faunal abundance. The dominant fauna in both studies are characteristic of well-sorted sandy environments typical of the nearshore (Blake *et al.*, 1996).



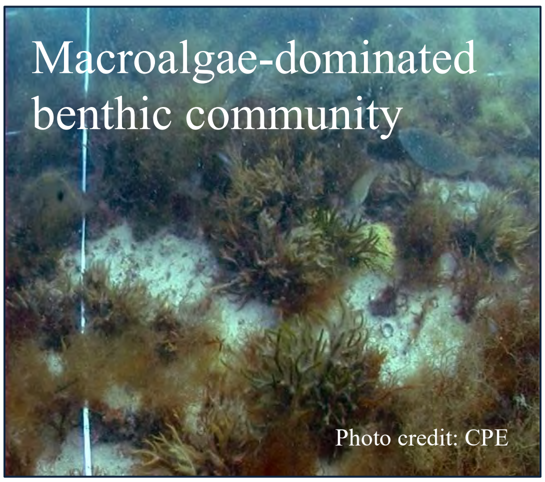
Submerged Aquatic Vegetation. The proposed action area and vicinity include sandy, softbottom habitat. Submerged aquatic vegetation occurs near the project area, within adjacent passes and Sarasota Bay, and can occasionally be found in small patches offshore. Seagrass resources are an essential component of the marine ecosystem and provide significant habitat for a diverse group of organisms and foraging resources for manatees and sea turtles (Zieman and Zieman, 1989). They act as nursery grounds for fish and invertebrates, maintain water quality, act as contaminant sinks, and form the basis of the marine detrital food web. However, no seagrass resources have been observed within the beach placement or borrow area sites based on surveys conducted by FWRI (Figure 9a) and towed video surveys by CSA in 2006.

Hardbottom Resources

Nearshore. Hardbottom resources in the nearshore habitat of Florida are generally considered high-latitude reefs (above 25°N). North of the Keys, the nearshore reefs can be designated as marginal reefs due to their location at the biogeographic limits of coral survival. Marginal reefs broadly describe settings where coral communities or framework reefs occur close to well-understood environmental thresholds for coral survival (Kleypas *et al.,* 1999) and can also include areas characterized by sub-optimal or fluctuating environmental conditions

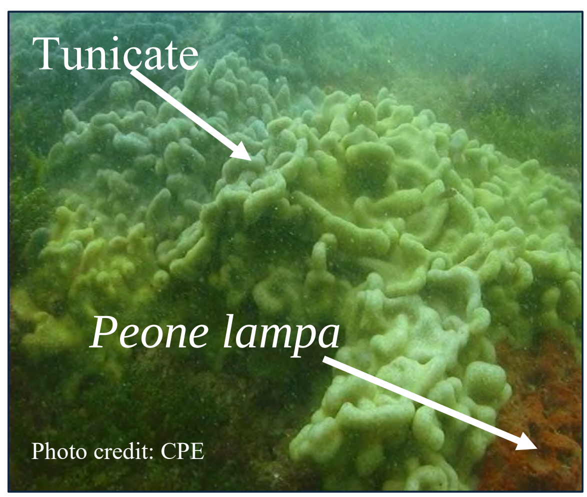
(Perry and Larcombe, 2003). The central west coast of Florida nearshore hardbottom resources are generally dominated by macroalgae and invertebrates such as sponges and tunicates. Scleractinian (stony) corals and octocorals are also present to varying degrees but do not dominate the fauna.

In 2002, CPE conducted a sidescan sonar survey of the nearshore region between Florida Department of Environmental Protection (FDEP) survey control monuments R42 (Longboat Pass in Manatee County) and R29.5 (New Pass in Sarasota County), along approximately 10 mi of shoreline. The survey documented three hardbottom formations located in the nearshore between R49 and R51.5 representing approximately 14 ac. The hardbottom formations are generally low relief (< 1 ft) and ephemeral in nature. (Figures 9a-9d)



As part of the 2005/2006 island-wide beach renourishment, the permit-mandated biological monitoring program required *in situ* diver delineation of the hardbottom formation that occurred inshore of the equilibrium toe of fill (between R49 and R49.5) as well as characterization of the benthic community found there. Quantitative analysis between 2006 and 2009 revealed a community dominated by turf and macroalgae species (CPE, 2010b). The macroalgae community primarily consisted of *Hypnea, Gracilaria, Codium*, and *Sargassum* species. *Dictyota, Caulerpa*, and *Padina* were also frequently observed (CPE, 2010b). A total of 21 macroalgae genera were identified on the nearshore natural hardbottom throughout monitoring (CPE, 2010b).

While macroalgae was the overall dominant functional group, tunicates and sponges dominated the invertebrate community. In 2008 and spring of 2009, mat tunicate cover was unusually high, accounting for up to 17% of the total cover on some transects. This sudden increase was seen in other gulf-coast hardbottom communities such as those off Siesta Key in Sarasota County and Sand Key in Pinellas County during the same time period. The August 2009 survey, however, revealed a return to previously existing conditions. The sponge community mainly consisted of bioeroding sponges *Cliona celata* and *Pione lampa*.



Coral cover in the nearshore benthic community was generally less than 1% of the total cover assessed. *Leptogorgia virgulata* and *Leptogorgia hebes* were the only octocoral species

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Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 1990 Hardbottom
- 1993 Hardbottom
- 1995 Hardbottom
- 2003 Hardbottom
- 2006 Hardbottom
- 2007 Hardbottom
- 2008 Hardbottom
- Artificial Reef Sites
- 2002 SSS Potential Hardbottom
- 2002 Diver Resource Investigation Locations
- FDEP Monuments
- 2013/2014 Island-wide Nourishment Phase Project Limits

2006 FWRI Seagrass

- Continuous
- Discontinuous

2011/2012 Interim Nourishment Phase Fill Area

- Construction Toe of Fill
- Equilibrium Toe of Fill

0 500 1,000 Feet

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 9a

Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 2002 SSS Potential Hardbottom
- FDEP Monuments
- 2006 FWRI Seagrass
- Continuous
- Discontinuous
- 2013/2014 Island-wide Nourishment Phase Project Limits

Feet
0 500 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 07/07/11	BY: HMV	COMM NO. : 8489.15	**Figure 9b**

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Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 2002 SSS Potential Hardbottom
- 2002 Diver Resource Investigation Locations
- FDEP Monuments
- 2006 FWRI Seagrass
  - Continuous
  - Discontinuous
- 2013/2014 Island-wide Nourishment Phase Project Limit
- 2011/2012 Interim Nourishment Phase Fill Area
  - Construction Toe of Fill
  - Equilibrium Toe of Fill

Feet: 0, 500, 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 07/07/11	BY: HMV	COMM NO. : 8489.15	Figure 9c

Matchline Figure 9c

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Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 2002 SSS Potential Hardbottom
- 2002 Diver Resource Investigation Locations
- FDEP Monuments
- 2006 FWRI Seagrass
  - Continuous
  - Discontinuous
- 2013/2014 Island-wide Nourishment Phase Project Limits
- 2011/2012 Interim Nourishment Phase Fill Area
- Construction Toe of Fill
- Equilibrium Toe of Fill

Feet
0 500 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
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PH. (561) 391-8102
FAX (561) 391 9116

DATE: 07/07/11	BY: HMV	COMM NO. : 8489.15	Figure 9d

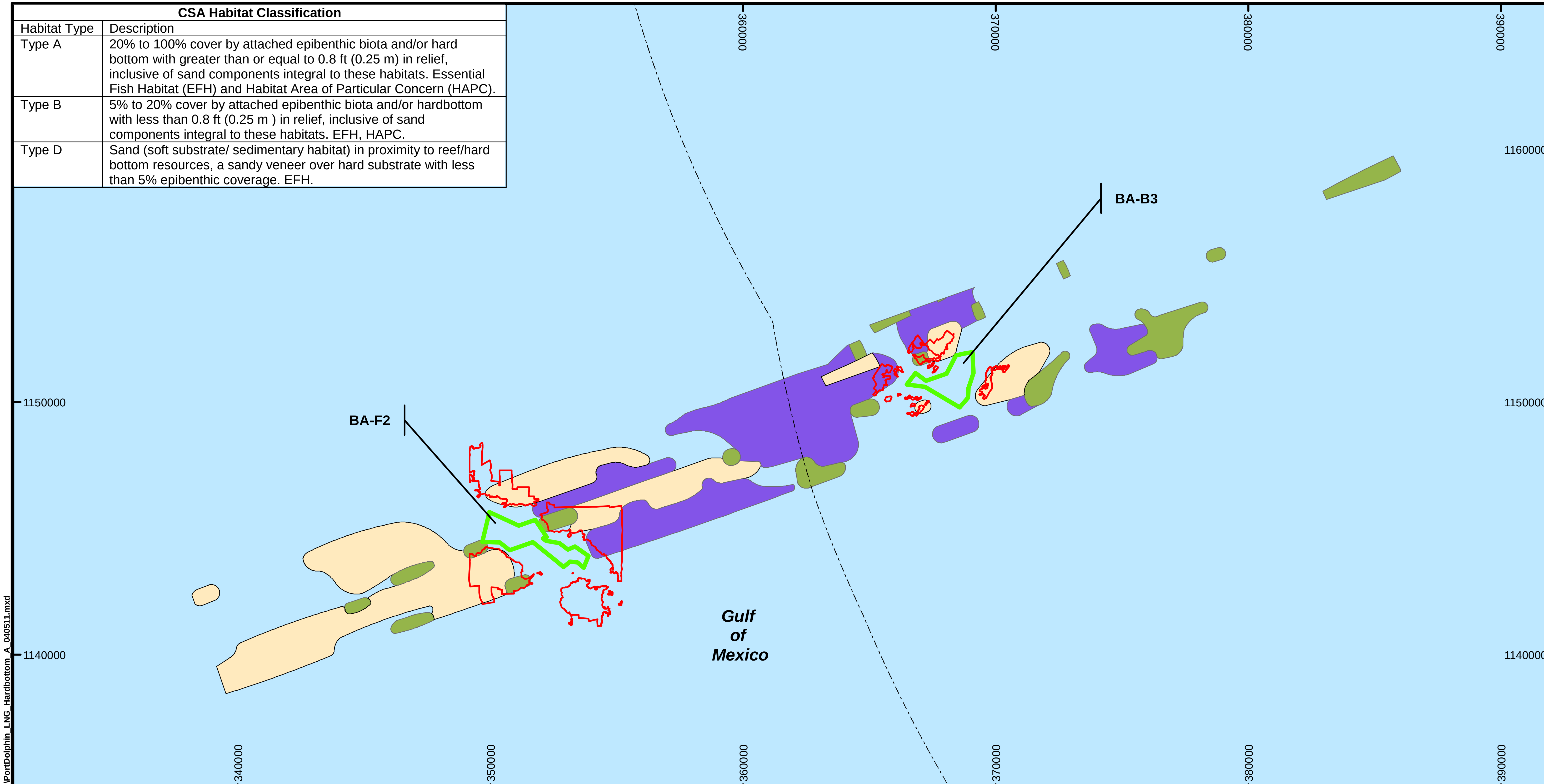
observed. The stony coral community was dominated by *Solenastrea* spp., but also included *Siderastrea siderea*, *Phyllangia americana*, *Oculina robusta,* and *Cladocora arbuscula*. It should be noted that the poor water clarity characteristic of this area and the abundance of floating macroalgae can influence benthic observations, especially for stony coral colonies since the average colony size is less than 3 cm.

Offshore. Hardbottom formations have been identified through sidescan sonar surveys conducted by CPE of the area surrounding BA-F2 (CPE, 2010a; Figures 10a-10b). Hardbottom resources in the vicinity of BA-F2 were assessed by Continental Shelf Associates, Inc. (CSA) between August and December 2006 using towed video and *in situ* diver verification. The benthic resources in proximity to BA-F2 were characterized by CSA as having between 20% to 100% epibenthic cover (habitat A), 5% and 20% epibenthic cover (habitat B), and less than 5% epibenthic cover (habitat C) (Figure 10a); all are considered essential fish habitat (EFH). The towed video and diver photo-documentation revealed the hardbottom resources to be dominated by macroalgae and supporting stony corals, including *Solenastrea hyades.* Macroalgae genera observed included *Caulerpa, Gracilaria, Codium, Halimeda* and *Hypnea. Caulerpa* was the most abundant macroalgae observed in the photo-documentation.

CPE has conducted benthic assessments of offshore hardbottom communities near borrow areas associated with other projects along the central gulf coast. Offshore of Siesta Key in Sarasota County, south of BA-F2, CPE biologists characterized and monitored multiple hardbottom formations adjacent to borrow areas used for the nourishment of South Siesta Key. These formations were low-relief (<1 ft) and supported macroalgae-dominated benthic communities. Scleractinian, or stony, corals were present at all formations, but octocorals were rare to absent, depending on the site. The most abundant stony coral species included *Solenastrea hyades*, *Oculina robusta, and Siderastrea spp*. All areas showed strong seasonality in benthic composition, primarily in macroalgae phyla abundance. Green (Chlorophyta) algae of the genus *Caulerpa* dominated during the warmer months, and then died back when cold water temperatures set in, leaving various red algae (Rhodophyta) dominant.

During a borrow area study offshore of Sand Key in Pinellas County, north of BA-F2 and the mouth of Tampa Bay, several anomalies identified through sidescan sonar were investigated. Habitat quality and quantity varied between sites, with areas of both high and low relief observed. The low-relief areas appeared ephemeral and sand-scoured with little benthic growth. Areas with higher relief (>1 ft) supported more stable benthic

CSA Habitat Classification	
Habitat Type	Description
Type A	20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).
Type B	5% to 20% cover by attached epibenthic biota and/or hardbottom with less than 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.
Type D	Sand (soft substrate/ sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.



Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Sidescan sonar hardbottom identified near F2 by CPE, Oct 20-23, 2009 and October 20, 2010.
3. Sidescan sonar hardbottom identified near B3 by CPE, December 7, 2008.
4. Habitat classification defined by CSA International, INC. in the 2007 *Port DolphinTerra Ceia Re-route Survey of Marine Benthic Habitats Within the Proposed Port Dolphin Pipeline Corridor Within Tampa Bay, FL* report prepared for Port Dolphin, LLC.

Legend:

- Federal/State Waters
- SSS Hardbottom 2008-2010
- Borrow Area

CSA Habitat Classification

- Type A
- Type B
- Type D

N

0 2,000 4,000 Feet

1 inch = 4,000 feet

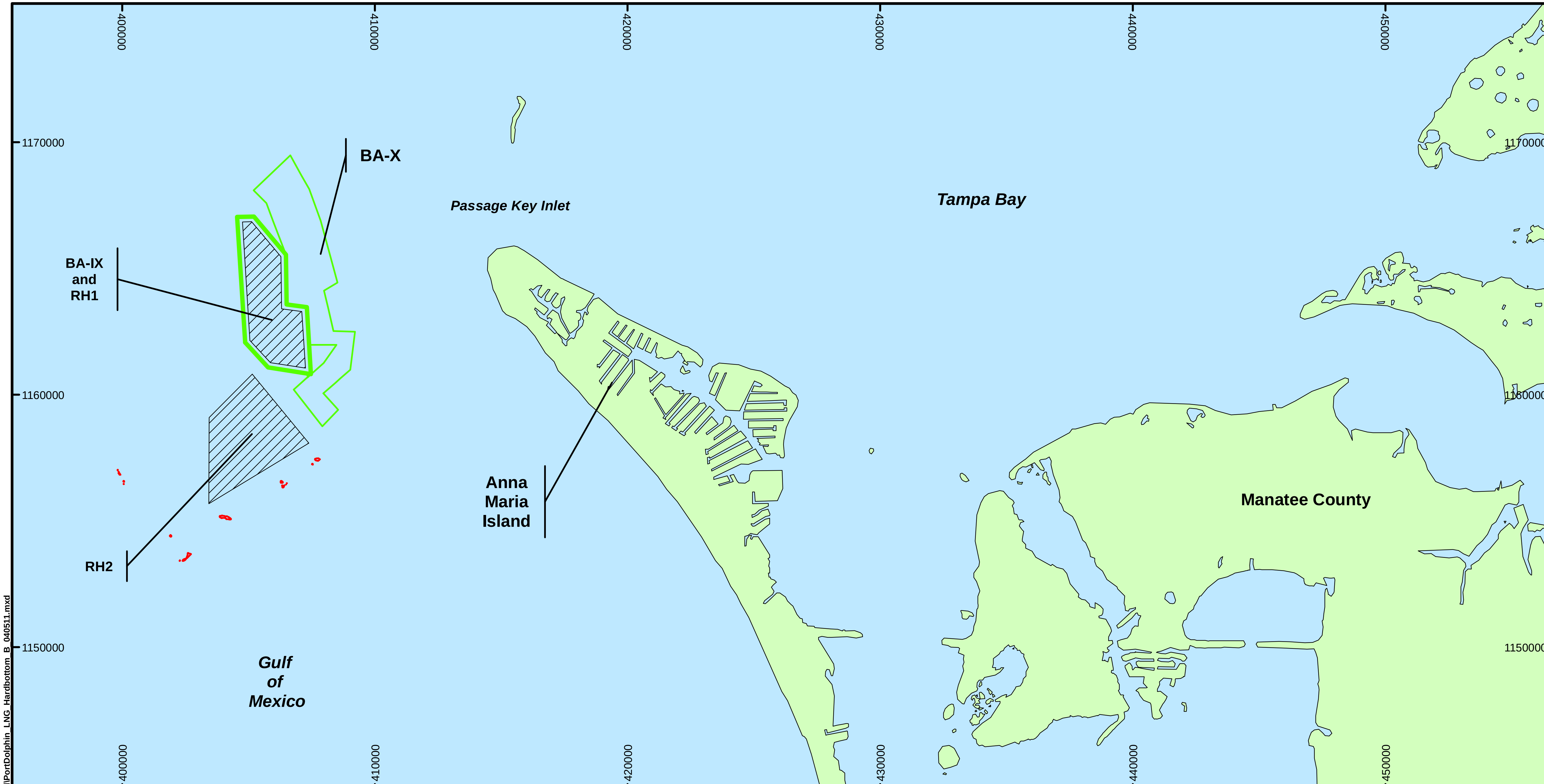
TITLE:

Offshore Hardbottom Longboat Key Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 04/05/11	BY: LAA	COMM NO. : 848926	**Figure 10a**

G:\Enterprise\Sarasota\848915_LBK_MMS_EA_Mxd\PortDolphin_LNG_Hardbottom_A_040511.mxd



Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Sidescan sonar hardbottom identified near F2 by CPE, Oct 20-23, 2009 and October 20, 2010.
3. Sidescan sonar hardbottom identified near B3 by CPE, December 7, 2008.

Legend:

- Federal/State Waters
- Borrow Area
- Rehandling Area
- SSS Hardbottom 2008-2010

N

0 2,000 4,000 Feet

1 inch = 4,000 feet

TITLE:

Offshore Hardbottom Longboat Key Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 04/05/11 | BY: LAA | COMM NO. : 848926 | **Figure 10b**

G:\Enterprise\Sarasota\848915_LBK_MMS_EA_Mxd\PortDolphin_LNG_Hardbottom_B_040511.mxd communities comprised of macroalgae, stony corals, octocorals, sponges and tunicates. Unlike the sites off Siesta Key, these hardbottom formations were not all macroalgae-dominated; rather, a more even distribution of benthos was observed. However, only a single snapshot assessment was conducted – no seasonal monitoring data were collected. A 200‟ buffer was included in the design of BA-F2 to minimize potential impacts to the hardbottom resources. It is likely that the hardbottom communities near BA-F2 are similar in composition to many of these documented communities.

In January 2010, an archeological remote sensing survey of BA-F2 was conducted, which included magnetometer, sidescan sonar and seismic (sub-bottom) profiling. The investigation did not identify any hardbottom benthic communities within the scanned area. The details of the investigation are summarized in Section 3.3 and described in the Cultural Resources Report provided in Appendix 6.

3.2.4 Threatened and Endangered Species

Table 8 below provides federally listed threatened and endangered species that have the potential to occur within the proposed action area based on each species‟ distribution and habitat preference, as determined by NOAA Fisheries Service Gulf of Mexico Region and USFWS. A Biological Assessment has been prepared and coordinated with the USFWS and the NMFS, pursuant to Section 7 of the Endangered Species Act of 1973, and is provided as Appendix 2 of this document.

Table 8. Federally endangered and threatened species potentially occurring within the proposed action area.

SCIENTIFIC NAME	COMMON NAME	FEDERAL LISTING
FISH		
Acipenser oxyrinchus desotoi	Gulf sturgeon	T
Pristis pectinata	Smalltooth sawfish	E
Priistic perotteti	Largetooth sawfish	E
REPTILES		
Caretta caretta	Atlantic loggerhead turtle	T
Chelonia mydas	Atlantic green turtle	E[1]
Dermochelys coriacea	Leatherback turtle	E
Eretmochelys imbricata	Hawksbill turtle	E
Lepidochelys kempii	Kemp‟s Ridley Turtle	E
BIRDS		
Charadrius melodus	Piping plover	T
MAMMALS		
Balaena glacialis	Northern Right whale	E
Balaenoptera borealis	Sei whale	E
Balaenoptera musculus	Blue whale	E
Balaenoptera physalus	Finback whale	E
Megaptera novaeangliae	Humpback whale	E
Physeter macrocephalus	Sperm whale	E
Trichechus manatus latirostris	Florida manatee	E
INVERTEBRATES		
Acropora cervicornis	Staghorn coral	T
Acropora palmata	Elkhorn coral	T

Notes: E=Endangered; T=Threatened

[1]Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific coast of Mexico, which are listed as endangered.

Species Not Likely to be Impacted

Although these species all have the potential to occur in the region, elkhorn and staghorn coral (*Acropora palmata* and *A. cervicornis*) are not expected to be found within the proposed action area and vicinity due to their known limited range. Both elkhorn and staghorn coral are found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela (NOAA, 2010b). These corals also occur in the western Gulf of Mexico, but are absent from U.S. waters in the eastern Gulf.

Gulf sturgeon *(Acipenser oxyrinchus desotoi)* are anadromous fish, inhabiting coastal rivers from Louisiana to Florida during the warmer months, and the Gulf of Mexico and its estuaries and bays in the cooler months. The Gulf sturgeon is found in the Gulf of Mexico primarily from Tampa Bay, Florida, west to the mouth of the Mississippi River (NMFS, 2003). However, Gulf sturgeon are not likely to occur south of Tampa Bay, and are thus not expected to be impacted by project-related activities.

Largetooth sawfish (*Pristis perotteti*) have recently been listed as endangered under the Endangered Species Act (July 12, 2011). These fish occupy similar habitat to smalltooth sawfish, generally being restricted to shallow coastal, estuarine, and freshwater. They are often found in brackish waters near river mouths and large bays, lying on mud bottoms or muddy sand (Bigelow and Schroeder, 1953), and are highly mangrove-associated (Burgess *et al*., 2009). Historically, this species was thought to inhabit warm temperate to tropical marine waters in the eastern and western Atlantic, and from the Caribbean and Gulf of Mexico south to Brazil; however, evidence suggests it rarely occurred in Florida waters (Burgess *et al*., 2009). Largetooth sawfish are currently thought to primarily occur in freshwater habitats in Mexico, Central and South America, and West Africa. The range of this species has significantly retracted on both sides of the Atlantic and the trend in abundance is declining. Since largetooth sawfish have not been seen in the U.S. since 1961 (76 FR 40834), it is highly unlikely that this species is found within the project area and is therefore not expected to be impacted by project-related activities.

Smalltooth Sawfish

Smalltooth sawfish (*Pristis pectinata*) were once widespread throughout Florida and were commonly encountered from Texas to North Carolina. Currently, smalltooth sawfish can only be found with any regularity in south Florida between the Caloosahatchee River and the Florida Keys, with center of abundance in the Ten Thousand Islands and Florida Bay region of Everglades National Park (Carlson et al., 2007). Based on the contraction in range and anecdotal data, it is likely that the population is currently at a level less than 5% of its size at the time of European settlement (NMFS, 2006). A smalltooth sawfish was taken during dredging operations in Tampa Harbor Entrance Channel in 2006 (NMFS, 2007), and thus it is possible to for this fish species to occur in and around the Tampa Bay area; however, the probability of this species occurring within the proposed action area and vicinity is low due to the extreme reduction in population and contracted range, and the fact that they prefer bay and estuarine habitat.

Marine Mammals

Whales. Table 8 lists six federally endangered whale species that may be found in the coastal waters of the Florida gulf coast. The sei whale (*Balaenoptera borealis*), blue whale (*Balaenoptera musculus*), finback whale (*Balaenoptera physalus*), humpback whale (*Megaptera novaeangliae*), and sperm whale (*Physeter macrocephalus*) have all been classified as endangered species since 1970 under the precursors to the 1973 Endangered Species Act, and are also protected under the Marine Mammal

Mother and calf **right whales** (*Balaena glacialis*) were spotted off of Bradenton Beach, Florida, in February 2006.

Protection Act of 1972 which prohibits the “taking” (harassing, hunting, capturing, or killing) of marine mammals. The North Atlantic Sei whale population is part of the Nova Scotian stock, with most observations occurring around the Scotian Shelf, Georges Banks and the Gulf of Maine (Waring *et al.,* 2010). Strandings of sei whales occurred along the northern Gulf of Mexico in the 1970‟s, indicating the southernmost range for this species (Mead, 1977). Sei whale presence in the Gulf of Mexico is rare (NMFS, 1998) because they tend not to enter semi-enclosed bays (NMFS, 1998b); these large whales typically stay over the deeper waters off the continental shelf and are not likely to be found in the project area. Blue whale distribution is largely governed by food requirements; thus, populations are seasonally migratory. Movement toward the subtropics in the fall allows blue whales to reduce their energy expenditure while fasting, avoid ice entrapment in some areas, and engage in mating activities in warmer waters of lower latitudes (NMFS, 1998a). This species has been reported off Florida and in the Gulf of Mexico although their distribution in southern waters remains largely unknown (Yochem and Leatherwood, 1985). Blue whales are rare in the shelf waters of the U.S. and not likely to be seen in the project area. Although fin whales have been observed in the Gulf of Mexico, there is currently no stock information regarding the occurrence or abundance if this species there (Gambell, 1985). Humpback whales are found in oceans around the world. While on their wintering grounds, humpback whales can be found over shallow bars and shelf waters. Principal wintering grounds are located in the West Indies. In particular, protected breeding grounds for the humpback whale include portions of the Virgin Islands and Puerto Rico (NMFS, 1991). Sperm whales are found in all of the world‟s oceans, except for the Arctic region, and are one of the most common whales in the Gulf of Mexico. However, they prefer deep waters and generally remain along the edge of continental shelves in water 3,000 ft (914 m) to 6,000 ft (1,829 m) deep or further out to sea (Waring *et al*., 1993; Rice, 1998), and are not likely to be seen in the project area. Although not listed by NMFS Southeast Regional Office as likely to occur in the Gulf of Mexico, right whales (*Balaena glacialis*) have occasionally been sighted offshore of the Town of Longboat Key beach nourishment project area, and have the potential to occur in the proposed action area. This species primarily occurs in coastal or shelf waters, and a mother and calf were sighted off of Bradenton Beach, just north of Longboat Key, in February 2006 (Staats, 2006).

Manatees. Florida manatees (*Trichechus manatus latirostris*) were listed as endangered in 1967 under the Federal Endangered Species Preservation Act of 1966 and are currently protected by the ESA of 1973, the Marine Mammal Protection Act of 1972, and the Florida Manatee Sanctuary Act of 1978. They inhabit shallow waters (5-20 ft) of varying salinity levels including coastal bays, lagoons, estuaries and inland river systems. Sheltered areas such as bays, sounds, coves and canals are important for resting, feeding and reproductive activities (Humphrey, 1992).

During the winter months, the entire U.S. manatee population typically moves to the waters surrounding Florida to seek refuge from the cold in springs and warm-water sources (Humphrey, 1992). The designation of critical habitat in Florida includes waterways throughout one-half of the state with two types of manatee protection areas: manatee sanctuaries (all waterborne activities are regulated) and refuges (certain waterborne activities are regulated). In Manatee and Sarasota Counties, manatee critical habitat is located in the Manatee River downstream from the Lake Manatee Dam and in the Myakka River downstream from Myakka River State Park, respectively (42 FR 47841). There are no manatee sanctuaries, refuges or critical habitat near

Borrow area F2 or the fill placement site of the project. However, manatees are common in the nearshore areas off Longboat Key, and can frequently be seen traveling up and down the coastline. It is possible that manatees may be present in or near the borrow areas, the fill area, and the pipeline corridors during construction.

The most significant threat to the Florida manatee is death or serious injury from watercraft strikes. In Florida, 83 manatee deaths were attributed to watercraft in 2010, comprising 11% of total manatee mortality state-wide (FWC, 2011). They frequently forage over seagrass beds which may be navigation routes for boaters. Seagrass is not located directly within the Longboat Key nourishment project area; however, extensive seagrass beds are found within adjacent Sarasota Bay (FWRI, 2010b). Since 1974, FWC has reported 53 manatee deaths within proximity of Longboat Key, including natural deaths and those caused by watercraft strikes. In 2009, five manatee deaths occurred in Manatee County due to watercraft strike; four deaths were reported in Sarasota County. The majority of these mortalities were located within Sarasota Bay and the estuarine waters behind Longboat Key. Four deaths from watercraft strike were reported in both Manatee and Sarasota Counties in 2010. No seagrass has been reported in the offshore borrow areas for the Longboat Key nourishment projects, and it is unlikely that a manatee would be observed near BA-F2 due to the distance from shore. No seagrass has been reported in the nearshore waters off Longboat Key or within the proposed borrow areas; however, manatees may use dredge routes as a travel corridor and are frequently seen in the nearshore. During construction, there is the potential for manatee strike in the nearshore as project vessels travel between borrow areas, rehandling areas, and the seaward end of the pipeline corridor. Manatee protection measures will be implemented as stipulated by the FWC 2009 *Standard Manatee Construction Conditions for In-Water Work* (Attached to Appendix 2). These conditions include operation of vessels at „idle speed/no wake" at all times while in the immediate area and when the draft of the vessels provides less than four feet of clearance from the bottom, immediate shutdown of all in-water operations if a manatee comes within 50 ft of construction activities, posting of temporary signs concerning manatees prior to and during all in-water activities, use of turbidity barriers that manatees cannot become entangled in, and reporting any collisions or injury to a manatee to FWC and USFWS. These protection measures will be implemented to avoid or minimize the risk of such events.

Non-ESA Listed Marine Mammals. There are several species of dolphins (Risso‟s, Atlantic Spotted and Bottlenose) that could potentially occur within the proposed project area that are not listed by the Endangered Species Act (Table 9). Risso‟s dolphin occurs in the Gulf of Mexico throughout oceanic waters but also along the continental slope. Risso‟s dolphins have stranded on the Florida Gulf Coast (2006 and 2007) and on two separate occasions, dolphins have been released, after successful rehabilitation, near Tampa Bay and Sarasota Bay (Waring *et. al.,* 2010). In the Gulf of Mexico, Atlantic spotted dolphins occur primarily from continental shelf waters (10-200 m deep) to slope waters (< 500 m deep). This species may move to inshore waters during the spring. There are three different stocks of bottlenose dolphins that may occur in the project area. The structure of the bottlenose dolphin stocks in the Gulf of Mexico is uncertain and complex, and is in part due to management needs. The eastern coastal bottlenose stock extends from Key West, Florida to the Missisippi River Delta and occurs in waters from shore, barrier islands, and bays to the 20-m isobath. Portions of the Eastern coastal stock may co-occur with the bay, sound and estuarine stock and also with the continental shelf stock. Waring *et* *al*., 2010. Fazioli *et al.* (2006) conducted photo-identification surveys of coastal waters off Tampa Bay, Sarasota Bay and Charlotte Harbor/Pine Island Sound and found that waters were inhabited by both "inshore" and "Gulf" dolphins. The Bay, Sound and Estuarine stock of bottlenose dolphins are known to have year-round residents in some areas including Tampa Bay and Sarasota Bay. These year-round residents also co-occur with non-resident dolphins in the same area. The continental shelf bottlenose dolphin stock inhabits waters from 20-200 m deep from the U.S. Mexican border to the Florida Keys and includes a mix of "offshore" and "coastal" types of bottlenose dolphins. A mix of the different stocks of bottlenose dolphins are likely to be found in the project area. Waring *et al.* (2010).

Table 9. Marine mammals not listed by the Endangered Species Act potentially occurring within the proposed action area.

COMMON NAME	SCIENTIFIC NAME
Risso‟s Dolphin	*Grampus griseus*
Atlantic Spotted Dolphin	*Stenella frontalis*
Bottlenose Dolphin (Eastern stock)	*Tursiops truncatus*
Bottlenose Dolphin (Continental Shelf stock)	*Tursiops truncatus*
Bottlenose Dolphin (Bay, Sound & Estuarine stock)	*Tursiops truncatus*

Sea Turtles

Sea turtles are protected under the Endangered Species Act of 1973, the Marine Turtle Protection Act Chapter 370.12 (Florida Administrative Code), and the Sarasota County Sea Turtle Protection Ordinance (No 97-082). Five species of sea turtle are found in the Gulf of Mexico: loggerhead (*Caretta caretta*), green (*Chelonia mydas*), Kemp‟s ridley (*Lepidochelys kempii*), hawksbill (*Eretmochelys imbricata*), and leatherback (*Dermochelys coriacea*). The hawksbill turtle is usually associated with reefs or similar habitat and is thought to be rare in the northeastern Gulf of Mexico. Juvenile loggerhead, Kemp‟s ridley, and green sea turtles utilize the nearshore waters of the central gulf coast of Florida as developmental habitat; however, loggerhead and Kemp‟s ridley turtles have also been documented in the deeper offshore waters of the northeastern Gulf of Mexico (Davis *et al.*, 2000). Leatherback sea turtles are the most oceanic of the sea turtles occurring in the offshore waters of the Gulf of Mexico beyond the 50 m isobath utilizing the deep waters for feeding, resting, and as migratory corridors. They are also present on the continental shelf of the Gulf (Davis *et al.*, 2000; Fritts *et al.,* 1983).


Photo credit: CPE

Loggerhead turtles account for the majority of sea turtle nesting on Longboat Key. Between 2005 and 2009, there has been an average of 184 nests laid along the entire length of Longboat Key, with 216 nests laid in 2009 (Table 10). Green sea turtles also nest along Longboat Key, although in far fewer numbers. Mote Marine Lab has reported a total of four green sea turtle nests on Longboat Key since 2001, with two of the nests observed in 2007. Though leatherbacks nest in Florida, nesting along the central Gulf coast is rare. The first leatherback nesting event documented along the central west coast shoreline of Florida was a nest deposited on May 31, 2001, on Longboat Key in Sarasota County (Tucker, MML, pers. comm., 2010).

Table 10. Loggerhead sea turtle nests observed on Longboat Key from 2002-2009.

YEAR	NO. NESTS	Percent of Total Nesting Activity by Loggerheads
2002	213	100%
2003	293	99.7%
2004	161	99.4%
2005	151	100%
2006	160	100%
2007	143	98.6%
2008	252	99.6%
2009	216	100%

Piping Plover

http://www.google.com/imgres?imgurl=http://www.prairiestateoutdoors.com/images/uploads/piping_plover.

Although several state-listed shore and waterfowl are present along the Gulf coast of Florida and can be found within the project area, the only federally listed bird species found within the project area is the piping plover (*Charadrius melodus*). Piping plovers are small, migratory shorebirds that breed in only three geographic regions of North America: on sandy beaches along the Atlantic Ocean, on sandy shorelines throughout the Great Lakes region, and on the river-bank systems and prairie wetlands of the Northern Great Plains (Haig, 1992). The Great Lakes population is listed as endangered under the ESA, whereas the Atlantic Coast and Great Plains populations are listed as threatened (December 11, 1985). Though this species does not breed in Florida, individuals from all three breeding populations over-winter in Florida.

No federally designated critical habitat for the piping plover exists in the project area. However, this species is known to overwinter along the area‟s beaches and have been observed on Longboat Key. As part of the Town of Longboat Key Compliance Monitoring in response to previous beach nourishments, Steven Sauers Environmental Management reported a total of four piping plovers as a result of daily and/or weekly shorebird surveys conducted during February through September between 2005 and 2007 (Sauers, pers. comm., 2009). Data collected by the Eckerd College beach nesting birds survey program between April and August 2007-2009 included observations of seven piping plovers, all of which were observed in 2009 (Sauers, pers. comm., 2009).

More information on threatened and endangered species can be found in the Biological Assessment for the Town of Longboat Key Beach Renourishment Project, found in Appendix 2.

Migratory Birds

Although not all are listed species, many migratory birds utilize Longboat Key and other areas in Florida. These species include neotropical migratory birds, also known as nearctic-neotropical migrants. These are species that nest in the United States and Canada ("nearctic" region) and migrate south to the tropical regions of Mexico, Central America, South America, and the Caribbean ("neotropics") during the winter (DOD, 2011). Over half of all bird species nesting in the US, including songbirds, waterfowl, birds of prey, waterbirds and shorebirds are classified as neotropical migratory birds. Migration distances vary greatly between species and between individual birds of the same species. The shortest migrations are made by birds that breed in the southern United States and winter in Mexico or the West Indies, a trip which can be as short as a few hundred miles. Some of the longest migrations are made by shorebirds that nest in the arctic tundra of northernmost Canada and winter as far south as Tierra del Fuego (the southernmost part of South America). This covers a distance of approximately 10,000 miles. The red knot, a species found on Longboat Key, is an example of a migratory bird that endures this long migration. The red knot (*Calidris canutus rufa*) is currently a candidate species for listing under the Endangered Species Act.

Migratory birds are protected under the Migratory Bird Treaty Act (MBTA) of 1918 (USFWS, 2004). The legislative definition of migratory birds are species that in the course of their annual migration traverse certain parts of the United States, Canada, Mexico, Russia, or Japan. This includes not only neotropical (long-distance) migrants, but also temperate (short-distance) migrants and resident species. This act implemented the 1916 convention between the United States and Great Britain for the protection of birds migrating between the U.S. and Canada. Similar conventions between the United States and Mexico (1936), Japan (1972) and the Union of Soviet Socialists Republics (1976) further expanded the scope of international protection of migratory birds. Each new treaty has been incorporated into the MBTA as an amendment and the provisions of the new treaty are implemented domestically. These four treaties and their enabling legislation, the MBTA, established federal responsibilities for the protection of nearly all species of birds, their eggs and nests. The MBTA made it illegal for people to "take" migratory birds, their eggs, feathers or nests. Take is defined in the MBTA to include by any means or in any manner, any attempt at hunting, pursuing, wounding, killing, possessing or transporting any migratory bird, nest, egg, or part thereof. In total, 836 bird species are protected by the MBTA, 58 of which are currently legally hunted as game birds (USFWS, 2004). The U.S. Fish and Wildlife Service (USFWS) is the principal federal agency charged with protecting and enhancing the populations and habitats of migratory birds.

Migratory birds face a number of threats to their long-term survival. Reductions in habitat quantity and quality, the primary causes of negative population trends in many species, are exacerbated by the direct loss of bird life from an array of external environmental hazards, many of which are anthropogenic in nature (USFWS, 2002).

Shorebirds were surveyed on Longboat Key between 2005 and 2007 as a permit requirement associated with the 2005/2006 beach renourishment, many of which are considered migratory. The most abundant shorebirds during these surveys were the laughing gull (*Larus atricilla*), black-bellied plover (*Pluvialis squatarola*), and ruddy turnstone (*Arenaria interpres*) (Sauers, 2009). A list of birds observed on nearby Anna Maria Island (AMI), which contains similar habitats and is located directly to the north of Longboat Key, is presented in Table 11. Many of the species observed on AMI between 1999 and 2010 are considered to be migratory, including the red knot, which is known to overwinter on the beaches of Longboat Key. This species has experienced steep declines in recent years due to the overharvesting of its primary food source, horseshoe crab (*Limulus polyphemus*) eggs (Niles *et al*., 2008), and is now a candidate for federal protection under the Endangered Species Act. During a 2005-2006 winter survey along

Longboat Key, a flock of 750 red knots were observed on Longboat Key (Niles *et al*., 2006); red knots have not been observed in these numbers since the 2006 beach nourishment (Nancy Douglass, FWC, pers. comm., January 2011).

Table 11. Birds observed along Anna Maria Island shoreline, 1999-2010 (S. Fox, pers. comm., 2010).

COMMON NAME	SCIENTIFIC NAME
Nesters	
American Oystercatcher	*Haematopus palliates*
Black Skimmer	*Rynchops niger*
Snowy Plover	*Charadrius alexandrinus*
Least Tern	*Sterna antillarum*
Commonly observed roosting, feeding, resting	
Brown Pelican	*Pelecanus occidentalis*
Laughing Gull	*Larus atricilla*
Royal Tern	*Sterna maxima*
Sandwich Tern	*Sterna sandvicensis*
Sanderling	*Calidris alba*
Willet	*Catoptrophorus semipalmatus*
Black-Bellied Plover	*Pluvialis squatarola*
Ruddy Turnstone	*Arenaria interpres*
Double-Crested Cormorant	*Phalacrocorax auritus*
White Ibis	*Eudocimus albus*
Great White Egret	*Ardea alba*
Snowy Egret	*Egretta thula*
Great Blue Heron	*Ardea herodias*
Yellow-Crowned Night Heron	*Nyctanassa violacea*
Osprey	*Pandion haliaetus*
Forster‟s Tern	*Sterna forsteri*
Black-Crowned Night Heron	*Nycticorax nycticorax*
Piping Plover	*Charadrius melodus*
Semipalmated Plover	*Charadrius semipalmatus*
Fish Crows	*Corvus ossifragus*
Occasionally observed roosting, feeding, resting	
White Pelican	*Pelecanus erythrorhynchos*
Ring-Billed Gull	*Larus delawarensis*
Herring Gull	*Larus argentatus*
Red Knot	*Calidris canutus*
Short-Billed Dowitchers	*Limnodromus griseus*
Common Loon	*Gavia immer*
Red-Breasted Merganser	*Mergus serrator*
Little Blue Heron	*Egretta caerulea*
Tricolored Heron	*Egretta tricolor*
Reddish Egret	*Egretta rufescens*
Green Heron	*Butorides virescens*
Wood Stork	*Mycteria americana*
Northern Gannet	*Morus bassanus*
Dunlin	*Calidris alpina*
Roseate Spoonbill	*Platalea ajaja*
Wilson‟s Plover	*Charadrius wilsona*

3.2.5 Essential Fish Habitat

The Fishery Conservation and Management Act of 1976, amended Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) by the Sustainable Fisheries Act of 1996, and the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of 2006, set forth a new mandate to identify and protect important marine and anadromous fish species and their habitats. The U.S. Congress enacted the Magnuson-Stevens Act to support the government‟s goal of sustainable fisheries. Crucial to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. This goal is achieved through identifying and describing EFH, describing non-fishing and fishing threats, and suggesting measures to conserve and enhance EFH.

A summary of Essential Fish Habitat in the action area is provided here. A full Essential Fish Habitat Assessment is included as Appendix 7 to this EA.

Essential Fish Habitat in the Gulf of Mexico. Essential Fish Habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802 (10)). EFH is separated into estuarine and marine components. For the estuarine component in the Gulf of Mexico, EFH is defined as "all estuarine waters and substrates (mud, sand, shell, rock and associated biological communities), including the sub-tidal vegetation (seagrasses and algae) and adjacent inter-tidal vegetation (marshes and mangroves)". In the marine waters of the Gulf of Mexico, EFH was defined by the GMFMC in 1998 as "all marine waters and substrates (mud, sand, shell, rock, hardbottom, and associated biological communities) from the shoreline to the seaward limit of the EEZ [Exclusive Economic Zone]" (GMFMC, 1998). In 2005 the GMFMC proposed to amend the definition of EFH, removing EFH description and identification from waters between 100 fm and the seaward limit of the EEZ (GMFMC, 2005). The GMFMC has identified various estuarine and marine areas as EFH based on the life stages of designated managed species. GMFMC EFH areas are listed in Table 12 below.

Table 12. Representative categories of estuarine and marine EFH areas identified in the Fishery Management Plan Amendment of the Gulf of Mexico Fishery Management Council (GMFMC).

ESTUARINE AREAS	MARINE AREAS
Estuarine emergent wetlands	Water column
Mangrove wetlands	Vegetated bottoms
Submerged aquatic vegetation	Non-vegetated bottoms
Algal flats	Live bottoms
Mud, sand, shell and rock substrates	Coral reefs
Estuarine water column	Geologic features
	Continental Shelf features

Essential Fish Habitat Found Within Project Area. The project area includes both estuarine and marine EFH. Estuarine water column and sandy, unvegetated marine habitat are found at the entrances of Longboat Pass at the north end of Longboat Key and New Pass at the south end of Longboat Key. Extensive submerged aquatic vegetation (SAV) occurs within

Sarasota Bay, and some patchy SAV resources are located within Longboat Pass, and New Pass (Sarasota County, 2010; Figures 9a-9d); however, no seagrass resources are located within the beach placement or borrow area sites.

Marine EFH within the project area includes the marine water column and non-vegetated bottoms in the borrow areas and fill placement area, and live bottom (*i.e.*, hardbottom) resources located nearshore at the north end of the island and also offshore near BA-F2. A 1.5-ac artificial reef was deployed to mitigate for projected burial of nearshore hardbottom due to equilibration of the 2005/2006 nourishment project. According to Jeff Rester of the Gulf States Marine Fisheries Commission, the Gulf of Mexico Fishery Management Council has determined that artificial reefs are subject to EFH consultation process, but they are not identified as separate EFH habitat (Rester, pers. comm., 2010; GMFMC, 2004).

Habitat Areas of Particular Concern. The rules set forth by the Magnuson-Stevens Act also direct the Fishery Management Councils to consider a second, more limited habitat designation for each species in addition to EFH. Habitat Areas of Particular Concern (HAPC) are subsets of identified EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. In general, HAPCs include high-value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish (NMFS, 2008). In the *Final Gulf Council EFH Amendment*, the GMFMC identifies specific HAPC sites in the Gulf of Mexico. These designated HAPC sites replace the broad habitat classifications identified as HAPC in the 1998 Generic Amendment (GMFMC, 2005; 1998).

No designated HAPC exists within the vicinity of project area.

Managed Species in the Gulf of Mexico. There are Fishery Management Plans (FMPs) in the Gulf region for shrimp, red drum, reef fishes, coastal migratory pelagics (CMP), stone crabs, spiny lobsters, coral and coral reefs, and highly migratory species (*e.g.*, billfish, swordfish, tuna, and sharks). Species identified by the GMFMC to be representative of the species that commonly occur throughout all of the estuarine and marine waters of the Gulf of Mexico are listed in Table 3 of the EFH (Appendix 7) under their respective FMP‟s. In total, the GMFMC manages 55 species, not including species included in the coral complex (NMFS, 2008a). In the Gulf of Mexico, highly migratory species (HMS) such as Atlantic tunas, swordfish, sharks, and billfish are federally managed by NOAA‟s National Marine Fisheries Service (NMFS).

Managed Species in the Project Area. The project area includes EFH designated for all seven fisheries managed by the GMFMC: Shrimp, Red Drum, Reef Fish, Stone Crab, Spiny Lobster, Coral and Coral Reef, and CMP (GMFMC, 2005; NMFS, 2008a). Essential Fish Habitat for highly migratory species (HMS) managed by NMFS is also located within the project area (NMFS, 2008a). Section 4.2 of the Essential Fish Habitat Assessment (Appendix 7) presents the EFH designations for these fisheries within the Gulf of Mexico as defined by the GMFMC and NMFS and also provides basic ecological information for species which are most likely to occur in the action area (GMFMC, 2005).

3.3 Cultural Resources

3.3.1 Archeological Resources

In compliance with federal mandates established in the National Historic Preservation Act of 1966, as amended, the Archaeological and Historic Preservation Act of 1979, as amended, the Abandoned Shipwreck Act of 1987, the Advisory Council on Historic Preservation revised 36 CFR, Part 800, Regulations, and BOEM Guidelines for Archaeological Resource Field Surveys, an archeological remote-sensing survey of BA-F2 was conducted in 2010, which included magnetometer, sidescan sonar and sub-bottom profiling (CPE, 2010a). Analysis of BA-F2 remote-sensing data identified a total of seven magnetic anomalies. None of those signatures were considered to represent shipwreck remains or other potentially significant submerged cultural resources. Sonar identified no bottom surface contacts in the area and no evidence of relict land forms or other potentially significant features were apparent in the sub-bottom profiler data. A previous survey carried out in 2006 by Laura A. Landry & Associates, Inc., for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay pipeline covered most of BA-F2. That survey identified four magnetic anomalies in BA-F2. One of those corresponded approximately to one of the seven anomalies identified during the 2010 survey and none of the 2006 anomalies were considered to be potentially significant. The full details of the investigation are described in the Cultural Resources Report provided in Appendix 6.

3.3.2 Recreational Resources

Florida is the number one U.S. destination for marine recreation, including saltwater boating. Florida ranks first in the nation in recreational boat registrations, with nearly one million registered or titled pleasure boats in 2005 (Sidman *et al*., 2007). According to BoatInfoWorld.com, Sarasota County has a total of 1,146 boats. Of that total, 1,062 fell under the recreational boat category (Boat Info World, 2011).

Longboat Key is a popular destination for vacationers. The white sandy beaches of Longboat Key stretch for 11 mi along the Florida‟s west coast. Longboat‟s hotels, resorts and beach houses maintain their own beaches, but there are public beaches, too, including the popular Whitney Beach. Greer Island (also known as Beer Can Island), located at the northern tip of Longboat Key, has 2,000 ft of primitive sandy beach accessible by shallow draft boat, or by walkers at low-tide. Other public access points to the beach are designated by blue and white "Beach Access" signs. The Joan M. Durante Park is a 32-acre site wetland restoration project located on Longboat Key. Visitors walk along the trail to explore the wetland and coastal hammock forest, which provides access to a diverse mix of plants, animals and ecosystems typical of coastal Southwest Florida. The trail is marked with environmental education trail markers as well as plant identification signs.

Tourists and residents enjoy recreational activities such as swimming at the beaches, shelling, biking, beach walking, boating, diving and fishing. There are two marinas located on Longboat Key. Artificial reefs have been constructed in Sarasota County to increase and enhance recreational fishing and scuba diving areas as well as to create and restore marine habitat lost to coastal development. There are three enhancement/fish haven artificial reefs located in Sarasota Bay, east of Longboat Key, and two recreational artificial reefs located approximately 12 mi offshore of Longboat Key in the Gulf of Mexico (FWRI and SCNR, 2004). Local sport fishermen also utilize offshore and nearshore waters for catches of tarpon, spotted seatrout, snook, sheepshead, red drum, cobia, king and Spanish mackerel, Spanish sardine, pompano, grouper and snapper. The species most commonly caught in offshore federally managed waters in the Gulf of Mexico in 2006 were red snapper, gag, red grouper, white grunt, and gray snapper (NMFS, 2007). In 2008, the total recreational fishing catch for the Gulf coast of Florida was 136,678,033. Table 13 lists the most abundant recreational fishery landings on the Gulf coast of Florida in 2008 (NMFS, 2010). Manatee and Sarasota Counties sold 24,144 and 25,381 recreational saltwater fishing licenses during the 2009 fiscal year, respectively (Hughes, 2011).

Table 13. Most abundant recreational fishery landings on Florida's Gulf coast in 2008 (NMFS, 2010)

COMMON NAME	TOTAL CATCH	POUNDS
Herrings	44,544,906	485
Pinfish	15,578,971	3,492,790
Spotted seatrout	10,578,025	2,422,591
Grouper	8,211,157	4,196,894
Gray snapper	7,413,071	1,571,177
White grunt	4,036,236	1,325,970
Spanish mackerel	3,909,051	2,474,679
Red drum	2,802,384	1,990,319
Blue runner	2,252,865	865,140
Black sea bass	2,185,476	250,815
Crevalle jack	1,892,985	275,729
Red snapper	1,664,071	2,002,081
Sheepshead	1,556,765	1,611,816
Mullet	1,532,497	1,338,250
Sharks, skates and rays	1,415,445	352,291
Sand seatrout	1,253,137	390,664
Greater Amberjack	212,156	882,711

According to results of a 2006 survey of recreational boaters, Longboat Pass only accounts for 7% of the route usage of the five major passes in Sarasota County and adjacent areas (ranking last). New Pass at the south end of Longboat Key receives more boat traffic than Longboat Pass and ranks second, accounting for 30% of recreational boat usage. Predominant vessel type owned by respondents was Open Fisherman (flats, skiff, johnboat) accounting for 39.7%, followed by Power Cruisers (27.4%). Most respondents were year-round residents of Florida. Average age of respondents was 56. Fishing and cruising ranked as top boater activities (66.9%, 63.5%, respectively) (Sidman et al., 2007).

There are eight beach access points located between R46A and New Pass (R29) (Table 14). These provide ingress to 14,900 ft (4,543 m) of publicly accessible beach. Hotels, motels, resorts, and inns with six or more units each provide an additional 3,700 ft (1,128 m) of public beach. All beach seaward of the Erosion Control Line (ECL) is publicly owned. Access to the beach is free of charge and free public parking is available. The public beach access allows lateral access to the adjacent beaches seaward of private upland property.

Table 14. Location and accessibility of public beach access points on Longboat Key.

LOCATION	PARKING
2825 Gulf of Mexico Drive	Parking available at Town Hall (501 Bay Isles Rd.)
3175 Gulf of Mexico Drive	Parking available on site
3355 Gulf of Mexico Drive	Parking available on site
3495 Gulf of Mexico Drive	Handicap Accessible on site, also parking across street
4001 Gulf of Mexico Drive	Parking available at Bayfront Park (4052 GMD)
4711 Gulf of Mexico Drive	Handicap Accessible parking on site
4795 Gulf of Mexico Drive	Handicap Accessible parking on site
6399 Gulfside Road	Parking available at General Harris Street
6847 Gulf of Mexico Drive	Parking available at Broadway Access
100 Broadway Street	Handicap Accessible parking on site
7055 Seabreeze Avenue	No parking available

Another access at North Shore Road (R44.7) has been closed due to severe erosion in that location.

3.3.3 Economic Resources

According to the Longboat Key Chamber of Commerce (2010), Longboat Key has approximately 8,000 year-round residents, and an additional 12,000 seasonal residents. There are approximately 8,100 residential homes (including condominium units, single family homes and manufactured homes) and 1,500 tourist units. Tourism is a huge economic resource to Longboat Key, with the island population reaching 22,000 at the peak of the tourist season. There are numerous restaurants on Longboat Key, including Moore's, Mar Vista, The Lazy Lobster, The Dry Dock, Pattigeorge's Restaurant, Chart House, the Longboat Key Club Restaurant, Euphemia Haye, Maison Blanche, Bayou Tavern, and Harry's. There are also full-service grocery stores, including Publix, and pharmacies, located on the central portion of the island. Together, the commercial and retail businesses generate tax revenue for Longboat Key.

Recreational saltwater fishing is a major economic driver, generating more than $30 billion in economic impact and supporting nearly 350,000 jobs nationwide (NMFS, 2007). Florida is the most popular saltwater fishing state, with over 6.5 million anglers. As stated above, nearly 50,000 recreational saltwater fishing licenses were sold in Manatee and Sarasota County during the 2009 fiscal year (Hughes, 2011). Most Gulf coast fishing takes place from boats, with roughly 5-10% comprised of charter boats (NMFS, 2007). Longboat Key has numerous charter boats that take clients fishing in the nearshore waters of Longboat Key for catches of tarpon, spotted seatrout, snook, sheepshead, red drum, cobia, king and Spanish mackerel, Spanish sardine, grouper and snapper.

Commercial fisheries include any species that are harvested and sold for human consumption, for medical use, in aquarium or souvenir trades, or for any other for-profit purpose. NMFS collects data on domestic commercial fishery landings, which include those fish and shellfish that are landed and sold in the 50 states by U.S. fishermen and do not include landings made in U.S. territories or by foreign fishermen. The State of Florida collects data from commercial harvesters and dealers to generate statistics on the types of species and quantities landed as well as the size, weight, and age distribution of harvested species.

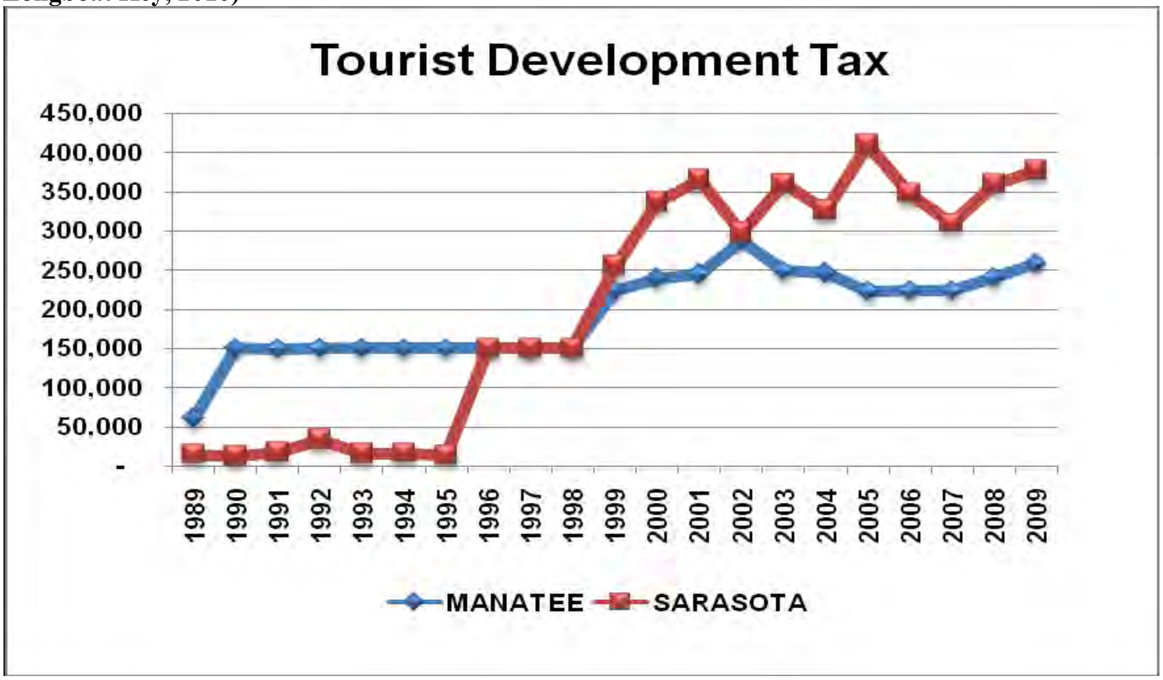
In 2008, the commercial fishery landings for the Gulf coast of Florida totaled 60,013,369 lbs (27,222 metric tons), and were worth $122,484,551 (NMFS, 2010). In 2008, Sarasota County‟s commercial fishery landings totaled 115,163 pounds, and Manatee County landed 5,046,612 pounds, including finfish, shellfish and other invertebrates (FWRI, 2010). In Sarasota County, Florida stone crab (claws), red grouper, blue crab and striped mullet accounted for the majority of the 2008 commercial catch. The majority of the commercial catch in Manatee County in 2008 was comprised of bait fish, striped mullet, Atlantic thread herring and red grouper. Table 15 lists the most abundant commercial fishery landings on Florida‟s Gulf coast, in Sarasota County and in Manatee County in 2008 (NMFS, 2010). Commercial harvesters use cast, beach or haul seine nets, longlines, hook-and-line, and crab traps to harvest their catch in the Gulf of Mexico.

Both Manatee and Sarasota Counties levy a tourist development tax which in part provides revenue to Longboat Key. Starting in 1996, Sarasota County committed $150,000 per year to Longboat Key. Manatee County has been providing $150,000 annually since 1991. However, following an agreement drafted in 1999, the revenues from both Manatee and Sarasota Counties combined rose from $300,000 per year in FY 1998 to $480,100 in the first year following the agreement. It has risen steadily except for certain "down" years. In FY 2009 it reached its highest level at $635,662 (Figure 11). This tax is dependent on tourists renting, eating and shopping on Longboat Key. In fact, each of the Town‟s sales tax based revenues depend on Longboat Key‟s generation of sales.

Table 15. Most abundant commercial fishery landings (pounds) on Florida's Gulf coast, in Sarasota County and in Manatee County in 2008 (NMFS, 2010; FWRI, 2010)

COMMON NAME	FLORIDA - GULF	SARASOTA COUNTY	MANATEE COUNTY
Striped mullet	6,907,263	12,370	1,078,494
Pink shrimp	6,688,662	0	0
Florida stone crab (claws)	6,099,709	46,949	59,622
Red grouper	5,578,037	26,125	683,098
Caribbean spiny lobster	2,975,154	37	0
Bait fish	2,618,706	46	1,718,971
Blue crab	2,617,539	15,371	22,361
Eastern oyster	2,501,475	0	0
Spanish sardine	2,167,195	0	0
Vermillion snapper	1,609,880	0	515
Gag grouper	1,470,149	1,670	32,112
King and cero mackerel	1,449,205	982	1,616
Yellowtail snapper	1,258,875	4	57
Brown shrimp	1,149,776	0	0
Atlantic thread herring	1,094,613	48	784,219
Amberjacks	588,143	976	3,674
Pompano	273,027	619	20,702
Mojarra	261,637	526	12,057
Grunts	224,579	907	86
Gray Snapper	187,349	2,141	6,553
Pinfish	44,357	2,643	1,136
Hogfish	32,480	1,283	48

Figure 11. Tourist development tax revenue provided by Manatee and Sarasota Counties (Town of Longboat Key, 2010)



CHAPTER 4 – WHAT ARE THE IMPACTS ASSOCIATED WITH EACH ALTERNATIVE?

This chapter identifies potential and anticipated impacts from each alternative: the *No Action* alternative and the *Proposed Action* (use of the OCS borrow area).

4.1 What are the Impacts Associated with the No Action Alternative?

4.1.1 Direct Impacts

The Longboat Key beach nourishment project site has been eroding at a significant rate since 2004. Most recently, in 2005/06, the beach was nourished with 1,789,332 cy of fill. Since that time, much of the beach fill has eroded. The No Action alternative entails no augmentation of State sand sources for either the interim nourishment or future nourishments. Consequently, the portion of BA-F2 falling within the Port Dolphin LNG Pipeline route will become inaccessible. Additionally, if authorization to utilize sand resources from BA-F2 is not granted, these resources will not be available for future nourishments; in a beach management climate of dwindling sand sources, enough sand to fill appropriate templates for future nourishments may not be available in State waters alone.

Without access to BA-F2, the immediate management of the Longboat Key beach nourishment program would continue for an interim period with the utilization of the nearshore Borrow areas B3, IX (previously permitted) and the newly designed BA-X. In addition to offshore sand sources, sand placed between R47 and R50 (Reach 2) will be trucked in from either E.R. Jahna‟s Green Cay mine or Surface Prep Supply mine in Davenport as part of the island-wide project. The trucking operation will occur twice within the duration of the permit in order to limit the volume of sand on those profiles and avoid impacts to nearshore hardbottoms. Although the volume of material from within these borrow areas will suffice for a duration, future beach nourishment projects would be directly impacted due to the exclusion of the material found within BA-F2.

4.1.2 Indirect Impacts

The developed upland property found along the Longboat Key Renourishment Project area is primarily designated as residential along with several commercial resort/hotel developments and a few retail businesses. The beach located along Longboat Key has been suffering from severe erosion, specifically along the north end, which may ultimately threaten the integrity of many of these homes and structures. Furthermore, the eroding shoreline has led to the closure of public beach access in some areas and therefore has reduced the number of recreational opportunities along the shoreline. Without the beneficial use of the OCS sand source contained in BA-F2, the Town of Longboat Key may be indirectly impacted by loss of property and loss of revenue generated by property taxes and tourism spending due to further loss of beach front from erosion.

4.1.3 Cumulative Impacts

The project area is prone to hurricanes, which bring strong, damaging winds, torrential rains, and tidal storm surges that flood low-lying areas. Between 1871 and 2009, 32 hurricanes came within 60 mi of the Sarasota area, equivalent to a recurrence interval of approximately 4.3 years. Seven of these storms made a direct hit, equivalent to a recurrence interval of approximately 20 years (Hurricane City, 2009). The highest and longest waves under average conditions occur during the winter months and during the peak of hurricane season, when distant storms can increase the wave height. The highest estimated wave recorded since 1980 was 20 ft, generated by Hurricane Opal on October 4, 1995. During the winter months, storm waves range from 10-16 ft, with wave periods ranging from 9-12 sec. Without the use of the material within BA-F2 to ensure enough material to fill appropriate nourishment templates for the long term protection of Longboat Key from storm damage, indirect cumulative impacts over several storm seasons may be incurred.

Erosion that is not addressed through beach nourishment or other means will result in a decreased beach width, which may further result in several impacts over time. These impacts may include a reduction in recreational usage and decrease in tourism, ultimately leading to a decrease in revenue for the Town, reduction or elimination of sea turtle nesting habitat, and loss or alteration of shorebird nesting and foraging habitat. Steepening of the beach profile through erosion can cause escarpment formation which can impair or prevent access to nesting sites by sea turtles. Sea turtles may elect not to nest on critically eroded beaches and abandon sections of beach if they determine that the nest location will not be suitable. In this instance, nesting sea turtles may return to the ocean to find another, more suitable, location or even evacuate their eggs if none are found. Failure to provide enough sand to fill appropriate nourishment templates can also lead to alteration of shorebird habitat. While narrowed beaches can actually lead to overwash, which is considered important habitat for shorebirds such as piping plovers, this is unlikely in the project area due to the extensive development of the shoreline. A more likely scenario would be narrowed beaches, increased run-up from waves, ultimately reducing or eliminating shorebird foraging and nesting habitat.

4.2 What are the Impacts Associated with the Proposed Action: Use of OCS Borrow Area?

For the purposes of analysis of impacts within this document, direct impacts are defined as those caused by dredging of the OCS borrow area F2 and all related actions such as vessel travel. Indirect impacts are those produced by placement of material from BA-F2 along the shore of Longboat Key within the proposed beach nourishment templates and related actions including dredging of offshore borrow area B3, nearshore borrow areas IX and X, rehandling of material from those borrow areas, and placement of that material in combination with dredged material from BA-F2. Table 16 provides a summary of impacts from the proposed action.

4.2.1 Direct Impacts

Impacts from Turbidity and Sedimentation caused by Dredging

Dredging activity temporarily increases turbidity and sedimentation, which can result in a decrease in biological productivity, clogging of fish gills, low oxygen events leading to fish kills, and mortality of organisms in the bottom community, including hardbottom resources. Dredging within the offshore borrow areas will likely utilize a trailing suction hopper dredge (TSHD), causing temporary increased turbidity around the dredge during project operations. For TSHDs, increases in turbidity from dredging can be generated from the draghead on the seafloor and from the discharge of hopper overflow (Baird & Associates Ltd., 2004). Sediments are suspended at the draghead during the process of removing sediments from the seafloor.

Suspended sediments from dredging operations are usually confined to the immediate vicinity of the draghead and do not reach the surface (LaSalle *et al.*, 1991). Dredging of BA-F2 using a hopper dredge will impact the marine water column and marine non-vegetated bottoms within and around the borrow areas, although in the sandy substrates typical of borrow sites, the extent of suspended sediments is likely to be very restricted (Baird & Associates Ltd., 2004). The State of Florida water quality standards state that turbidity outside the designated mixing zone shall not exceed 29.0 NTU above background at the dredge site. During the Town of Longboat Key 2005/06 Beach Renourishment Project, turbidity measurements were taken every six hours or once per load (whichever was more frequent) at the borrow site and never exceeded the permitted tolerance of 29 NTU‟s above associated background levels.

As mentioned above, dredging activities can lead to increased sedimentation at the borrow site and therefore could result in the burial or smothering of corals and hardbottom resources adjacent to the borrow areas (Wilber and Clarke, 2001; Wilber *et al.*, 2005). Sediment deposition can clog filter-feeding organisms such as sponges, cause corals to expend energy producing mucous to clear sediment from their surfaces, and reduce hard surface area available for recruitment (Baird & Associates Ltd., 2004). Turbid conditions can decrease light penetration and deprive corals of light necessary for photosynthesis (Rogers, 1990; Dompe *et al.*, 1991; Greene, 2002; SFCRI, 2006). Increased turbidity and sedimentation may also reduce growth and increase calcification rates in coral reefs (Aller and Dodge, 1974; Dodge and Vaisnys, 1977). These effects can lead to changes in primary and secondary production, which may cause substantial changes at higher levels of the food web (Nelson, 1989). Gilliam *et al.* (2006) conducted five years of pre-nourishment monitoring to collect sediment data on reefs in proximity to borrow area sites in Broward County. Sampling continued throughout construction revealing that sedimentation levels near the borrow area were elevated during construction but generally remained within the range identified during pre-construction sampling.

Table 16. Summary of potential and anticipated impacts to aquatic habitats from the proposed action.

ACTIVITY	ESTUARINE WATER COLUMN	ESTUARINE SUBSTRATE	SUBMERGED AQUATIC VEGETATION	MARINE WATER COLUMN	MARINE NON-VEGETATED BOTTOM	MARINE LIVE BOTTOM
Dredging of Borrow Area F2				• Potential entrainment • Temporary noise disturbance • Temporary elevated turbidity • Potential accidental pollutant discharge	• Removal of benthic fauna/infauna • Physical impacts to sediment • Temporary elevated turbidity and sedimentation	• Potential temporary elevated turbidity
Placement of F2 Material for Beach Fill	• Sedimentation and temporary elevated turbidity (at the north end) • Temporary noise disturbance • Potential accidental pollutant discharge	• Potential sedimentation (at the north end)	• Potential temporary elevated turbidity and sedimentation over SAV (at the north end)	• Temporary elevated turbidity • Temporary noise disturbance • Potential accidental pollutant discharge	• Burial of benthic fauna/infauna • Temporary elevated turbidity and sedimentation	• Temporary elevated turbidity and sedimentation outside ETOF • Burial and sedimentation from fill equilibration inside ETOF • Potential physical damage from construction equipment

Offshore hardbottom formations have been identified through sidescan sonar surveys conducted by CPE of the area surrounding Borrow areas BA-F2 (CPE, 2010a; Figure 10a). A 400-ft buffer is included in the borrow area design, with the exception of the hardbottom within the Port Dolphin pipeline corridor; these areas were designed with a 200-ft buffer since the hardbottom in this vicinity will be impacted by pipeline placement and have already been mitigated for by Port Dolphin Energy, LLC. These buffers are designed to minimize potential direct impacts caused by increased turbidity and sedimentation during dredging of BA-F2. A monitoring study was conducted during the 2006/2007 South Siesta Key Renourishment Project, located just south of Longboat Key, which examined potential impacts to hardbottom resources located near four offshore borrow areas. Each borrow area was designed to include a buffer area of at least 400 ft between dredging boundaries and hardbottom resources. Results of this study found that sedimentation from dredging activities did not have a significant effect on hardbottom resources and benthic communities located near the offshore borrow areas (CPE, 2007). Because any increase in turbidity typically diminishes rapidly following dredging activity and due to the inclusion of buffers around the borrow areas, no direct impacts to the offshore hardbottom resources found within proximity to BA-F2 due to turbidity and sedimentation are anticipated.

In addition to impacting benthic resources, dredge-related sediment plumes can divert pelagic fishes from normal migratory routes, feeding grounds, or spawning areas. The turbidity surrounding the dredge may reduce visibility, temporarily impact the ability of reef fish, coastal migratory pelagics, and highly migratory species to locate prey in the area, but most fish species can move outside the areas of elevated turbidity for the duration of dredging and can return to forage in the area following conclusion of dredging. Suspended sediments can have other impacts, including abrasion of the body and clogging of the gills (LFR, 2004). Studies have shown that suspended sediments can cause changes in respiration rate, choking, coughing, abrasion, and puncturing of structures (*e.g.*, gills/epidermis) reduced water filtration rates, and reduced response to physical stimulus (Anchor Environmental, 2003). In another study, turbidity was believed to cause excessive mucus secretion, excretory interference, and respiratory interference, adaptations that either prevent or permit survival (Wallen, 1951; LFR, 2004). Elevated turbidity is typically limited to the period of dredging activity. Once dredging is finished, though, water quality is usually restored (Greene, 2002). Motile adult fish that utilize the water column will be able to temporarily avoid areas of dredging, and can return to these areas following construction. However, slower-moving invertebrates such as bivalves and jellyfish may be susceptible to sedimentation and turbidity caused by dredging. Larvae and fish eggs would also not be able to avoid areas of dredging. Anderson *et al.* (2004) found that increased suspended sediments had a negative relationship with bivalves, since, as filter-feeders, suspended sediments and organic matter can prevent them from feeding. Conversely, certain burrowing crabs and polychaetes were more abundant after sediment disturbance (Anderson *et al.*, 2004). Shin (1989) similarly found that polychaete worms thrived in conditions of increased turbidity.

Removal of Benthic Fauna/Infauna through Dredging

Infaunal and epibenthic communities are directly impacted through removal during dredging. Sediment is completely removed during this process, which leaves very few organisms and little organic matter intact (Culter and Mahadevan, 1982; Oliver *et al.*, 1977) and results in direct mortality to the benthic infauna. It has been documented that abundance and diversity drop precipitously and colonization by opportunistic organisms occurs following dredging activities (Oliver *et al.,* 1977; Rhoads and Young, 1979). Benthic organisms are an important food source for finfish, shrimp and other invertebrates, so removal of the non-vegetated bottom sediment will impact fish species which prey on benthic resources (GMFMC, 2004). Some highly motile benthic species such as crabs and lobsters have some ability to avoid disturbance by construction activities; however, slower moving invertebrates such as echinoderms and bivalves would be impacted by removal. A reduction of infaunal biomass resulting from sediment removal could have an indirect effect on the distribution of certain demersal fishes and other epibenthic predators by interrupting established energy pathways to the higher trophic levels represented by these foraging taxa. The benthic community is critical to the health of higher trophic levels and serves as an important indicator of the effects of dredging (Gulland, 1970).

Recovery of infaunal communities after dredging has been shown to occur through larval transport, along with juvenile and adult settlement, but can vary based on several factors including seasonality, habitat type, size of disturbance, and species‟ life history characteristics (*e.g.,* larval development mode, sediment depth distribution) (Shull, 1997; Thrush *et al.,* 1996; Zajac and Whitlatch, 1991). Although studies have shown that though recovery rates are variable (Brooks *et al.,* 2006), the abundance and diversity of benthic fauna within the borrow areas frequently returns to pre-nourishment levels relatively quickly, often within one year post-dredging recovery periods (NRC, 1995; Greene, 2002; Blake *et al.*, 1996). Most studies indicate that dredging had only temporary effects on the infaunal community, and in some studies, differences in infaunal communities were attributed to seasonal variability or to hurricanes rather than to dredging (Posey and Alphin, 2000).

Entrainment during Dredging Operations

Hopper dredges, such as those that are likely to be used for the interim and the island-wide projects can directly kill turtles if caught in drag heads (Dickerson *et al.,*2004). Hopper dredging occasionally results in sea turtle entrainment and death, even with seasonal dredging windows, turtle deflector drag heads in place, and concurrent relocation trawling (NMFS, 2003). Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction drag heads (Clausner *et al.,*2004, Dickerson *et al.*, 2004). Thus far, no incidental takes of sea turtles have been reported from clamshell, pipeline cutterhead, or other types of dredges operating along southeastern coasts (Dickerson *et al.*, 2004). The sea turtle species primarily affected by dredging are loggerhead, green, and Kemp‟s ridley, although, hawksbill and leatherback are also potentially vulnerable (NRC, 1990). Leatherback sea turtles are generally found in deep, pelagic, offshore waters though they occasionally may come into shallow waters to feed on aggregations of jellyfish. The nearshore and inshore waters of the northern and eastern Gulf of Mexico may be used by these species as post-hatchling developmental habitat or foraging habitat (NMFS, 2003). Loggerhead and green sea turtles were the most abundant swimming turtle species relocated using turtle trawlers during the 2005/06 beach renourishment on Longboat Key. Because these species are the most abundant in the project area, it is anticipated that impacts from the project may affect, and are likely to adversely affect these species. Hawksbill and Kemp‟s ridley sea turtles were also captured during turtle relocation efforts during dredging activities near the borrow areas for the 2005/06 renourishment project on Longboat Key but to a lesser extent. No leatherbacks were captured in the turtle trawling efforts for the 2005/06 project. As such, the impacts from this project may affect, but are not likely to adversely affect these three species. For more details on impacts to sea turtle species from the proposed action, see Appendix 2 of the Biological Assessment prepared for the project.

Along with sea turtles, motile fish and invertebrate species may be impacted by entrainment. Greene (2002) reviewed studies on impacts to shrimp by dredge entrainment, and found that the number of postlarval shrimp entrained by dredging was inconsequential when compared to overall penaeid shrimp production. Physical injury through entrainment of adult fishes by hydraulic dredging has been reported (Larson and Moehl, 1988; McGraw and Armstrong, 1990; Reine *et al.*, 1998). Most entrained fishes were demersal species such as flatfishes, sand lance, and sculpin; however, three pelagic species (anchovy, herring, and smelt) were recorded. Entrainment rates for the pelagic species were very low, ranging from 1 to 18 fishes/1,000 cy (McGraw and Armstrong, 1990). Comparisons between relative numbers of entrained fishes with numbers captured by trawling showed that some pelagic species were avoiding the dredge. Few of the coastal pelagic fishes occurring offshore of Florida should become entrained because the dredge‟s suction field exists near the bottom and many pelagic species have sufficient mobility to avoid the suction field.

Physical Impacts to Sediment from Dredging

Dredging may also potentially cause physical impacts to the marine non-vegetated bottoms, such as lower sand content, poorer sorting, and a higher organic content. However, these physical effects have also been observed to be temporary, with borrow area sediments resembling undisturbed areas after a period of only one year (Blake *et al.*, 1996). The impacts on sediments at the dredging site may also include increased post-dredging sedimentation in the newly deepened areas for new work projects and possible slumping of materials from the sides of the dredging areas (LFR, 2004). Impacts to the marine non-vegetated bottom from dredging BA-F2 will be temporary, with the physical characteristics of the borrow area sediments likely returning to pre-dredging conditions in as soon as one year.

Potential Strike Impacts from Dredge and Support Vessels

Dredges, scows, and work vessels traveling between BA-F2 and the seaward end of the pipeline corridor, and back and forth to port will present the potential for additional direct impacts to biological resources including collisions with watercraft. Some whale species may be susceptible to vessel strikes, primarily right whales as they have been observed near the project area and have a higher chance of occurring near the offshore borrow area F2. In the Gulf of Mexico Regional Biological Opinion on Hopper Dredging of Navigation Channels and Borrow Areas in the U.S. Gulf of Mexico, NMFS ascertained that blue, fin, or sei whales will not be adversely affected by hopper dredging operations; the possibility of dredge collisions with these species is remote since these are deepwater species unlikely to be found near hopper dredging sites. There has never been a report of a whale taken by a hopper dredge (NMFS, 2003).

The most significant threat to the Florida manatee is death or serious injury from watercraft strikes. In Florida, 83 manatee deaths were attributed to watercraft in 2010, comprising 11% of total manatee mortality state-wide (FWC, 2011). Manatees are most likely to be impacted by vessel strike while support boats move through channels from dock areas to the dredge vessels (CORPS, 1996). For this project, the support boats will access the dock through Longboat Pass. It is possible, but unlikely, that manatees could come into proximity to dredge activities at the

OCS borrow area. However, manatees are not common in the offshore waters of the Outer Continental Shelf. Additionally, high activity and noise of activities associated with beach fill placement are likely to deter manatees from entering the project area during construction. *Standard Manatee Construction Conditions for In-Water Work* (USFWC, 2009b) will be implemented as protection measures during construction of the Longboat Key Beach Nourishment Project to minimize the potential for significant impacts to manatees by project-related activities. These measures will ensure that all vessels will maintain idle speed within the construction area and no wake speed when the draft of the vessel provides less than 4 ft of clearance from the bottom.

Potential Impacts from Accidental Pollutant Discharge

During the dredging process accidental leaks and spills of fuel, lubricants, and other contaminants from dredges, scows, and work vessels could occur. The proposed project would dredge sediments that have been approved for disposal on the beach, partly on the assumption of very low pollutant concentrations and negligible toxicity. Accordingly, the proposed project is not expected to have significant impacts on water resources related to chemical pollutants. The construction equipment would be governed by Coast Guard regulations, including the recently-promulgated Vessel General Permit, that address the use and control of potential pollutants on vessels and specify the response to accidental releases. Ships can discharge oily wastes in U.S. territorial water only when the vessel is underway more than 12 nautical mi from land and only after processing the oily waste through an oil-water separator, resulting in an effluent that does not exceed 15 parts per million and does not cause a visible sheen. Ships can retain bilge water onboard when in port or deposit untreated bilge water into a pipeline, slop barge, or tank truck which carries the wastewater to a licensed wastewater treatment plant capable of treating oily wastewater (CORPS 2006). Nevertheless, accidental releases of chemical pollutants from construction equipment may occur. Accidental discharges have typically been small volumes (CORPS 2006), and it is reasonable to assume that the increased potential for accidental discharges would have a minimal impact to surface water quality or benthic resources.

Impacts from Noise Disturbance

It has been hypothesized that the noise associated with dredging activities can trigger an avoidance reaction in marine mammals and may interrupt fish migrations (Clarke *et al.,* 2004; Southall *et al*., 2007; Thomsen *et al*., 2009). Noise is generated from vessel travel between sites as well as the dredge process itself. In a review by Southall *et al.* (2007) several studies showed altered behavior or avoidance by dolphins to increased sound related to increased boat traffic. Clarke *et al.* (2004) found that cutterhead dredging operations are relatively quiet compared to other sounds in aquatic environments, whereas hopper dredges produce somewhat more intense sounds. Thomsen *et al.* (2009) conducted a field study to better understand if and how dredge-related noise is likely to disturb marine fauna. This study found that the low-frequency dredge noise would potentially affect low- and mid-frequency cetaceans, such as bottlenose dolphins. Noise in the marine environment has also been responsible for displacement from critical feeding and breeding grounds in several other marine mammal species (Weilgart, 2007). Richardson *et al.* (1990) studied bowhead whale reactions to dredge noise and found a decrease in call rates, cessation of feeding and changes in surfacing and respiration cycling in some (but not all) individuals. Manatees are passive listeners meaning they do not use sonar to navigate and detect objects in the environment; they merely listen to the noises around them (Gerstein, 2002).

Manatees have trouble distinguishing low-frequency noises (Gerstein, 2002), and prefer habitats with less low-frequency noise (Miksis-Olds *et al.,* 2007). This suggests that manatees may avoid areas where dredging activities are taking place and thus reduce the chance of dredge-manatee interactions. Noise has also been documented to influence fish behavior (Thomsen *et al*., 2009). Fish detect and respond to sound utilizing cues to hunt for prey, avoid predators, and for social interaction (LFR, 2004). Some reef fish larvae have been shown to respond to sound stimuli as a sensory queue to settlement sites (Stobutzki and Bellwood, 1998; Tolimieri *et al*., 2000). Alterations of background noise may impair the ability of newly settled fishes to locate preferred substrate. Changes in noise levels also may affect feeding or reproductive activities of reef fishes that depend on sound for these activities (Myrberg and Fuiman, 2002). High intensity sounds can also permanently damage fish hearing (Nightingale and Simenstad, 2001). Fish with swim bladders appear to be more affected than those without (Thomsen *et al.,* 2009) and so far, studies indicate that invertebrate hearing is poor compared to other marine life (Thomsen *et al.,* 2009); however, little is known about invertebrate hearing capabilities at all.

Birds, including listed species and migratory species, may temporarily alter flight paths to avoid dredging activity. If dredging activities cause local fauna to abandon an area for long periods of time (months-long dredging projects), measurable impacts may occur.

Impacts to Air Quality and Contribution to Green House Gas Emissions

There will be a temporary and localized decrease in air quality from construction-equipment emissions. Offshore construction activity will generate air pollutants from the operation of the dredge pumps, pump-out equipment, tug boats, and transport boats. Air emissions from upland sand transport operations will occur from significant truck transportation operations. In addition, air emissions will result from heavy equipment used for beach grading, moving pipe and other construction related activities. Construction of the interim phase of the project is estimated to take 31 days to complete; the island-wide nourishment is estimated to take 216 days using a combination of a hopper dredge and upland truck hauling.

Construction activity equipment emissions were estimated by combining approximate fuel consumption, by equipment type, and the emission factors developed by the EPA. The emission calculation details are provided in Appendix 8. The construction method with the maximum emissions was used in calculating fuel consumption. This method involves the use of a hydraulic dredge and scows to transport the sand to the beach. A maximum daily fuel usage was assumed during construction.

Since the project is located in an attainment area (placement area) and unclassified attainment area (Borrow area F2) for all criteria pollutants, Clean Air Act conformity requirements do not apply to the proposed project. However, for the purpose of determining NEPA significance, the estimated maximum project emissions are compared to Sarasota County"s 2002 emission inventory in Table 17.

Table 17. Estimated project (2011/2012 Interim phase, 2013/2014 Island-wide Phase assuming rehandling) emissions compared to Sarasota County 2002 inventory (EPA, 2010b).

AIR POLLUTANT	SARASOTA COUNTY - 2002 EMISSIONS (Tons/Year)	ESTIMATED PROJECT EMISSIONS 2011/2012 (Tons/Year)	ESTIMATED PROJECT EMISSIONS 2013/2014 (Tons/Year)
Carbon Monoxide (CO)	116,840	10.5	89.6
Nitrogen Oxides (NO_x)	12,990	46.5	411.0
Sulfur Dioxide (SO_2)	2,066	0.8	5.6
Suspended Particulate Matter (PM10)	6,486	1.2	25.2
Suspended Particulate Matter (PM2.5)	2,327	1.2	25.2
Volatile Organic Compounds (VOC)	22,245	1.6	26.9

Project emissions would come from short-term construction activities, as opposed to long-term operational activities. In comparing project emissions with Sarasota County emissions, project emissions would be less than 4% of the countywide emissions. Therefore, pollutant concentration impacts are not expected to be great enough to contribute to any exceedances of the ambient air quality standards. Emissions will occur as a result of the upland truck haul component of the project. It is estimated that approximately half of the project emissions for NO_x and CO are associated with the upland sand transport. These emissions will be distributed roughly linearly over a 112-mi route from the upland sand quarry to the project site. Of the remainder of the emissions, between 78% and 84% of the total NO_x and CO emitted would be from the offshore hopper dredge operation between the borrow area and offshore pumpout location. Pumpout will occur approximately 1 mile offshore. Borrow areas IX and X, B3, and F2 are 14, 17, and 20 miles, respectively from the project and offshore, so dredge emissions will sufficiently mix and be diluted before reaching the region. Operation of the dredge and activities around the beach would result in localized concentrations of nitrogen dioxide (NO_2), sulfur dioxide (SO_2), carbon monoxide (CO) and particulate matter (PM_{10} and $PM_{2.5}$). It is expected that these concentrations would be within the national ambient air quality standards (NAAQS). For these reasons, the project will not result in a significant adverse impact on air quality.

Impacts to Archeological Resources

Although magnetic anomalies were identified in BA-F2 during archeological remote sensing surveys conducted in the area, none were found to be shipwreck remains or other significant cultural resources. Based on results of the surveys, dredging material from BA-F2 will not impact any potentially significant submerged cultural resources. In the event that shipwreck remains or other cultural material is encountered during dredging operations, BOEM will be notified and on-site activity will be shifted until an assessment of the archeological significance of the disturbed material can be assessed.

Impacts to Recreational Resources

Dredging of BA-F2 will not directly impact recreational resources in the project area. The borrow area site is not located in any particular valuable fishing or diving spot, so vessels may avoid the dredge area during construction. However, transport of the material from BA-F2 to shore may temporarily disrupt recreational boating activities in the area.

Impacts to Economic Resources

Dredging of BA-F2 will cause minor, short-term disruption to navigation in the immediate area surrounding the dredge. Commercial and recreational fisheries will not be significantly impacted by the dredging of this site, as fishing activity can avoid the dredging area and relocate to other spots. Stone crab season runs from mid-October through mid-May; therefore, there is a potential short-term impact involving the potential loss of trapping equipment to contractor vessels operating in the travel corridors of the project area.

4.2.2 Indirect Impacts

Impacts from Turbidity and Sedimentation caused by Fill Placement and Potential Rehandling

Approximately 14 acres of nearshore hardbottom have been identified in the proposed project area, which have the potential to be impacted by project activities and project-induced turbidity. While the dredging of BA-F2 as well as the State borrow area B3 are not expected to impact these nearshore hardbottom resources due to their distance from shore, other borrow areas proposed to be used in conjunction with BA-F2 are located in the nearshore and are closer to the identified hardbottom. Additionally, rehandling activity may occur at these borrow areas which may produce higher-than-typical turbidity during island-wide phase dredging operations. Sand excavation options include use of a cutterhead dredge or a small hopper dredge capable of working in shallow water. With either type of dredge, the sand may then be transferred to a scow for direct transport to the pipeline, or the small hopper may serve to transport the sand itself to the pipeline. Another option is the use of two nearby, deeper-water rehandling areas. Rehandling area 1 (RA-1) is located in deeper water within BA-IX and RA-2 is located just west of BA-IX. The sand would be deposited here, to be re-dredged and transported to the pipeline by a deeper-draft, larger-volume hopper dredge. These activities may produce increased turbidity above that of typical dredging operations or sustain typical turbidity levels for a longer duration. However, borrow areas IX and X are located a minimum of 1,000 ft from the nearshore hardbottom resources; the rehandling areas are located a minimum of 700 ft from the hardbottom. Therefore, while rehandling activities may produce higher-than-normal or longer-period turbidity, these areas are far enough from hardbottom resources that operations are not expected to result in turbidity-associated impacts to hardbottom communities.

Since hardbottom communities are not likely to be impacted by rehandling activities, other indirect impacts, such as those to sea turtle foraging habitat, are not anticipated. However, epibenthic and infauna will be impacted by primary dredging and rehandling of borrow areas IX and X. If rehandling is conducted, fauna living in and on the sediment within these borrow areas will not only be removed, but also relocated and removed a second time. Burial and subsequent removal of epibenthic and infauna at the rehandling site would also occur. Impacts to these communities would occur as described under Direct Impacts above. Although studies show that epibenthic and infaunal communities can recolonize, sometimes rapidly after dredging, it is not likely that there will be a long-enough duration between depositing and redredging the material for fauna to recolonize between these activities. Recovery of the borrow areas would not occur until after all activities are completed.

Placement of dredged material from BA-F2, as well as other proposed borrow areas, along Longboat Key will cause localized and short-lived increases in turbidity, which can adversely affect benthic habitat as described in Section 4.2.1 above. Beach nourishment permits granted by the Florida Department of Environmental Protection and the U.S. Army Corps of Engineers typically require the contractor to limit increases in turbidity to 15 or 29 NTUs above background levels. During the 1996-1997 project on Longboat Key, the turbidity exceeded 15 NTUs above background only 23% of the time at the beach fill area, and never exceeded 15 NTUs above background at the borrow area. During 2001 project, the turbidity exceeded 15 NTUs only 9% of the time at the borrow area and never exceeded 15 NTUs above background at the beach fill area. Neither of these projects generated turbidity in excess of 29 NTUs above background levels.

The likelihood of turbidity remaining above background levels after a renourishment project is low. The 1993 beach nourishment project on Longboat Key used fine sand with a mean grain size on the order of 0.20 mm (Table 5 of CPE, 1995). Turbidity was sampled extensively by Hanes and Stubbs (1994) for a 1-year period following the project‟s completion. Differences between the turbidity along the project area and the turbidity at Siesta Key and St. Petersburg Beach were insignificant (Hanes and Stubbs, 1994).

In addition to turbidity, sedimentation from placement of dredged materials can also impact benthic resources as described in the previous section. During project placement activities utilizing sand from BA-F2 as well as other proposed borrow areas, sedimentation is expected to impact 1.4 ac of hardbottom habitat as a result of the beach fill process and equilibration. The hardbottom resources that fall within the Equilibrium Toe of Fill (ETOF) have been mitigated for in the previous beach project (2005/06); therefore, no mitigation measures for impacts to benthic resources are proposed for this project. A biological monitoring plan has been drafted and will be implemented to assess the nearshore hardbottom resources prior to and following construction as part of permit compliance. This plan will include hardbottom resource mapping to determine the acreage of direct hardbottom impacts and transect monitoring to quantitatively identify indirect impacts from sedimentation to the benthic and fish communities.

Burial from Beach Placement and Other Impacts from Mechanical Factors

Project construction during sea turtle nesting season will involve greater potential for the mechanical destruction, burial of nests, and greater likelihood for encounters with construction equipment/pipes on the beach during nesting activities. The presence of heavy machinery on the beach left overnight can create barriers to nesting females as they emerge from the surf and attempt to crawl up the beach, resulting in a higher occurrence of false crawls and needless energy expenditure. The operation of motor vehicles on the beach at night may result in collision with nesting females, disorientation of emergent hatchlings by headlights, and interference by vehicles or vehicle tracks in the sand as hatchlings crawl to the ocean. Studies have shown that hatchlings become diverted not because they are unable to maneuver out of the track (Hughes and Caine, 1994), but because the sides of the rut cast a shadow that causes the hatchlings to lose sight of the ocean horizon (Mann, 1977). Driving directly over incubating egg clutches or on the beach may destroy nests or cause sand compaction which can adversely impact nest site selection, digging behavior, clutch viability and hatchling emergence, thus decreasing nest success and killing pre-emergent hatchlings (Mann, 1977; Nelson and Dickerson, 1989).

Nest relocation as a protection measure for sea turtle nests in the project area may result in potential indirect impacts. Relocation could damage eggs, particularly if relocation of the eggs does not occur within 12 hours of nest deposition (Limpus *et al.*, 1979). Other potential negative effects of nest relocation include impacts to incubation temperature (leading to sex ratio alteration) (Yntema and Mrosovsky, 1982; Godfrey and Mrosovsky, 1999), gas exchange parameters, nest moisture content, or reduction of hatching success and hatchling emergence relative to natural nests (Limpus *et al.*, 1979; Mortimer, 1999). More recently, Mrosovsky (2006) suggested that nest relocation over the long-term may distort gene pools. Relocation efforts can also concentrate nests in one location, making them more vulnerable to predation and wash-out from storms.

Piping plovers have occasionally been observed on Longboat Key. The placement of material on the beach will potentially impact various species of migratory birds, including the threatened or endangered piping plover. The construction window (*i.e.*, disposal of sand) will extend through approximately one piping plover migration and winter season. Heavy machinery and equipment (*e.g.*, trucks and bulldozers operating on project area beaches, the placement of the dredge pipeline along the beach, and sand disposal) may adversely affect any migrating and wintering piping plovers and other migratory birds in the project area by disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere.

Burial and suffocation of invertebrate species will occur during each nourishment and renourishment cycle. Research by Peterson *et al.* (2006) suggests that impacts to foraging habitat for shorebird species may be short-term due to the temporary depletion of the intertidal food base. Timeframes projected for benthic recruitment and re-establishment following beach nourishment are between six months and two years (Greene, 2002; Burlas *et al.*, 2002). Beach wrack has also been recognized as important to shorebirds, including piping plovers, for camouflage and foraging (FWC, 2010). Since piping plovers spend the majority of their overwintering time in Florida foraging along the shoreline, the wrack line provides an important foraging resource for this species (USFWS, 2003). Destruction of wrack, through beach nourishment or wrack-removal programs, eliminates this habitat. Protection of wrack can help to offset the indirect impacts associated with beach nourishment and ensuing human disturbance.

Migratory birds such as red knots are also known to forage on horseshoe crab spawn. In Florida, horseshoe crab breeding activity occurs between March and November with peak spawning occurring as early as April (Brockmann, 1990) and continuing through August (Rudloe, 1980). Adults prefer sandy beach areas within bays and coves that are protected from the rough action of the surf. This habitat is present on the northern tip of Longboat Key in an area known as Greer Island. Despite its name, it is actually not an island, but a landform created by water currents and is referred to as a "hooked spit" creating ideal horseshoe crab spawning habitat. Horseshoe crab eggs are also eaten by migratory shorebirds, including many of the species found along Longboat Key such as the semipalmated plover (*Charadrius semipalmatus*), black-bellied plover (*Pluvialis squatarola*), red knot (*Calidris canutus*), dowitcher (*Limnodromus* spp.), sanderling (*Calidris alba*), and ruddy turnstone (*Arenaria interpres*). The willet (*Catoptrophorus semipalmatus*) is a predator of both horseshoe crab eggs and larvae (Rudloe, 1979).

Positive impacts to migratory birds include benefits incurred from the stabilization of existing beach habitat and the increase in available roosting habitat from this project.

Pipelines placed offshore for pumping sand from the barge/dredge to the fill placement area have the potential to impact nearshore benthic resources. A total of 12 pipeline routes are possible for use during project activities; all routes have been previously cleared and methods implemented during the 2005/06 project will be employed to avoid impacts to hardbottom communities. However, accidental impacts may occur due to unanticipated incidents such as pipeline leakage or breakage, or misplacement of the pipeline. Other unanticipated impacts that may occur from mechanical equipment include vessel grounding and dragging of equipment such as anchors, dredge spuds, ropes, cables or anchors. However, these incidents are highly unlikely unless an unanticipated accident should occur.

Impacts from Artificial Lighting

Artificial lighting may impact sea turtle nesting and hatchling behavior. Artificial lighting on beaches tends to deter sea turtles from emerging from the sea to nest (Witherington and Martin, 1996). Project lighting can also result in the hatchling disorientation. Hatchlings, which use visual cues to locate the sea once they emerge from the nest, can be misdirected by artificial lighting (Dickerson and Nelson, 1989; Nelson *et al.*, 2000; Lorne and Salmon, 2007). Following beach nourishment projects, the wider and flatter beach berm may expose turtles and their nests to artificial lighting that was less visible, or not visible at all, from nesting areas before the project leading to greater hatchling disorientation and possible mortality (Trindell *et al*., 2005). If operations continue into the night, lighting on the dredges, barges and beach equipment will be the minimum necessary to meet OSHA standards or for safe navigation. Artificial lighting on offshore dredges and beach equipment may impact nesting females who may be deterred from nesting by the lights in the nearshore waters. Hatchlings emerging from their nests could be attracted away from the shortest path to the water and instead crawl or swim toward the bright lights of a nearshore dredge or anchored pumpout barge (instead of crawling or swimming seaward toward the open horizon), thus increasing their exposure time to predation (NMFS, 2003). All lighting will be turned off during shutdowns.

Changes to Native Beach Environment

Beach nourishment projects can have indirect effects on sea turtle nesting in the project area, by changing the physical beach environment and causing escarpment formation. If the nourishment sand is dissimilar from the native sand, results can include changes in sand compaction, beach moisture content, sand color, sand grain size and shape, and sand grain mineral content, all of which may alter sea turtle nesting behavior (Grain *et al.*, 1995). Incompatibility of nourishment material with the nesting habitat can potentially affect female sea turtles" ability to nest and reproduce (Lutcavage *et al.*, 1997). Nest site selection and digging behavior of the female can be altered or deterred, if she finds the beach unsuitable. Beach compaction can lead to reductions in nesting success (*i.e.*, increased false crawls), which may result in increased physiological stress to the nesting females (Nelson and Dickerson, 1989). Clutch viability and hatchling emergence may also be impaired if the beach state is altered (Nelson and Dickerson, 1989; Grain *et al.*, 1995). Steep escarpments may form along nourished beaches as they adjust from an unnatural construction profile to a more natural beach profile (Grain *et al.*, 1995). These escarpments can impair or prevent access to nesting sites, in some cases leading to females selecting marginal or unsuitable nesting sites. Studies suggest that within the first year post-nourishment, turtle nesting decreases. Montague (1993) states that beach profiles of a newly restored beach are not conducive to nesting and hatchling success. Profiles may contain irregular or steep scarps and may be unstable. Eventually, with local wave, tide, and wind energy, the profiles equilibrate and the beach stabilizes to resemble a natural profile of the area. Additionally, permit conditions often stipulate that nourished beaches be monitored for escarpment formations which are then leveled upon discovery.

It has been previously stated that beach nourishment may lead to more development in greater density within shorefront communities that are then left with the possible need for additional future replenishment or even coastal armoring in a negative feedback loop (Pilkey and Dixon, 1996). Increased development immediately adjacent to nesting beaches has often led to more coastal construction, sometimes with larger and larger structures being built to accommodate resultant increase in tourism. Aside from encroachment on sea turtle nesting habitat and exposure to artificial lighting, seaside development may attract and support populations of nest predators such as raccoons and foxes, which might not have occurred there naturally or in as large numbers (NRC, 1990).

Sea turtles may also benefit from the Longboat Key Beach Nourishment Project by gaining accessibility to a greater area of beach on which to nest. Sea turtles may elect not to nest on critically eroded beaches and abandon sections of beach if they determine that the nest location will not be suitable. In this instance, nesting sea turtles may return to the ocean to find another more suitable location. This project will repair eroded sections of beach and will widen the dry beach to provide additional nesting habitat as well as additional protection from storms. A nourished beach that is designed and built to mimic the natural beach system will likely benefit nesting sea turtles more than the eroded beach it replaces. Similarly, piping plovers may benefit from the stabilization of existing beach habitat and the increase in available roosting habitat from this project.

Indirect effects of the beach nourishment projects also involve concern for the reduction in potential for formation of overwash habitats utilized by foraging shorebirds within the project area. During storm events, overwash across barrier islands is common, depositing sediments on the bayside, clearing vegetation and increasing the amount of open, sandflat habitat ideal for shoreline-dependent shorebirds. However, the Longboat Key project area is almost fully developed with hotels, condominiums, residential housing, restaurants, and commercial buildings, which precludes overwash and limits creation of open sand flats preferred by piping plovers. The only area that experiences any overwash is located at the undeveloped northern end of the island, between R42 and R43, outside the project area.

There is no federally designated piping plover critical habitat within or near the project area. The closest designated critical habitat for wintering piping plover to the project area is Unit FL-21, located on Egmont Key at the entrance to Tampa Bay, approximately ten mi north of Longboat Key (USFWS, 2010). Therefore, there will be no effects to piping plover critical habitat as a result of this project.

Like sea turtles, piping plovers may benefit from the stabilization of existing beach habitat and the increase in available roosting habitat from this project.

Impacts to Archeological Resources

Cultural resource surveys were also conducted in the State borrow areas and rehandling areas to be used in the Town of Longboat Key Beach Renourishment Project. Multiple magnetic anomalies were observed that exhibited signatures characteristic of modern debris such as fish and crab traps, pipes, small-diameter rods, cable, wire rope, chains, or small boat anchors. No significant cultural or other material was identified with the exception of two concentrations of material in Rehandling Area 2. The concentrations of material are suggestive of more cultural remains, specifically shipwrecks, and could represent significant submerged cultural resources. These areas have therefore been buffered for avoidance during dredging. As such, dredging material from State-water borrow areas and placement into rehandling areas should not impact any potentially significant submerged cultural resources. In the event that shipwreck remains or other cultural material is encountered during dredging operations, activity will be shifted until an assessment of the archeological significance of the disturbed material can be assessed.

Impacts to Recreational Resources

The proposed project will have an indirect temporary short-term impact on recreational use of the beaches and nearshore marine environment. All public beach access points will remain open during construction except during the time of direct fill placement, when those access points will be closed to protect the public. Closure of any access will likely be limited to less than one week. No public facilities will be affected. Gulf of Mexico Drive may be closed down periodically while the project is under construction. Placement of sediment from BA-F2 and other proposed borrow areas will involve the presence of equipment on the beach and in the nearshore zone. This disturbance will be temporary, and people can relocate their activities until the construction is complete in each area. Rehandling activities may impose more activity for a longer duration than project construction without rehandling. This additional activity may impede recreational boat traffic. However, boaters have the ability to skirt around the activity, and no hardbottom resources for diving or fishing will be impeded. Once the nourishment project is complete, the overall impact to recreational resources will be beneficial, in that the beach will be wider and better protected from erosion.

Impacts to Economic Resources

Economic resources on Longboat Key will benefit indirectly from dredging Borrow area F2. The placement of fill on Longboat Key beaches will impact property values, government tax bases and local sales and employment. Beach nourishment projects enhance property values by providing storm protection to the properties, and property owners are saved the cost of alternative property protection measures (*i.e.*, seawalls). Property values will also reflect the enhanced recreation value of the restored beaches. Increases in property values will be reflected in higher revenues of those taxing authorities that levy ad valorem property taxes, such as municipalities, school districts, special taxing districts and county government.

Restored beaches will enhance recreational use of the beaches, which will lead to increased spending by beachfront residents and by visitors to Longboat Key. This, in turn, will lead to increased sales and the creation of jobs on Longboat Key.

4.2.3 Cumulative Impacts

Cumulative impacts are those impacts on the environment that result from the incremental impacts of the action when added to other past, present, and reasonably foreseeable future actions, regardless of what agency (federal or non-federal) or person undertakes such other actions. This section analyzes the proposed action as well as any connected, cumulative, and similar existing and potential actions occurring in the area surrounding the site.

Coastal Engineering Projects

Along with past beach nourishment projects constructed on Longboat Key (see Section 1.3.1 above), several coastal engineering projects located in proximity to the proposed interim and island-wide Beach Management Project for Longboat Key have been conducted or will be conducted in the near future. Details of each project are discussed below:

Port Dolphin Liquid Natural Gas Transmission Line. Port Dolphin Energy, LLC has proposed to install a 28.4-mi, 36-in natural gas transmission line within Florida State waters and onshore areas within Manatee County which will transport liquid natural gas from a deepwater port, to be constructed in offshore federal waters of the Gulf of Mexico. Borrow areas F2 and B3 are located within the footprint of the proposed Port Dolphin Liquid Natural Gas Transmission Line corridor. The proposed activity includes an application for a 100-ft-wide, 25 submerged land public easement containing 190.6 ac for a proposed subaqueous natural gas transmission pipeline across approximately 15.9 statute mi of submerged lands. It also proposes to use a 3,000-ft-wide temporary construction corridor containing approximately 5,528.2 ac and two potential mitigation sites. One mitigation site is situated within the temporary corridor containing 97.4 acres and the other is situated outside the temporary corridor containing 44.5 ac. Refer to section 1.3.2 for more information regarding the Port Dolphin Liquid Natural Gas Transmission Line project.

The project will result in the dredging and backfilling of approximately 179.5 ac of benthic habitat, including 20.6 ac of hardbottom habitat. As a result of anchoring and cable sweeping, temporary impacts will include disturbance to approximately 1,972.4 ac of benthic habitat including up to 256.3 ac of hardbottom habitat.

Anna Maria Island Nourishments. Anna Maria Island is located directly to the north of Longboat Key on the north side of Longboat Pass. The City of Anna Maria was nourished in 2002 between R7 and R10 and the central portion of Anna Maria Island was nourished between R12 and R36 in 1992/93, 2002, and 2005/2006. The next renourishment of R12 to R36 is anticipated to occur in 2014. The Coquina Beach, Beach Nourishment Project (R35+790 to R41+365) was constructed in April 2011. This project placed beach compatible material from an offshore borrow area onto approximately 1.0 mi of Coquina Beach at the southern end of the island. A 0.6-mi portion of beach in the City of Anna Maria at the northern end of the island was also nourished (CPE, 2009b). The purpose of the Coquina Beach and City of Anna Maria projects was to create and improve existing habitat, improve recreation areas and provide greater levels of storm protection for the island. As mitigation for anticipated impacts from the Coquina Beach, Beach Nourishment Project, an artificial reef is being constructed in the nearshore marine environment; biological monitoring will take place on both the artificial reef and on natural nearshore hardbottom located in the vicinity of Coquina Beach. A Beneficial Sediment Use Project is also currently in the permitting phase and is slated for 2012, prior to sea turtle nesting season. Similar to the situation in Longboat Key, the proposed Port Dolphin LNG pipeline route will pass through a large deposit of sand similar in nature to the sediment found on the beaches of Anna Maria Island. In recognition that offshore sediment sources which contain sediment very similar to the existing beach sediment are in short supply, Manatee County desires to extract this sediment prior to the placement of the Port Dolphin pipeline. The current template provides up to 500,000 cy of sediment to be placed between R2 and R7 with the potential to fill between R7 and R10.

Longboat Pass Maintenance Dredging. Periodic maintenance dredging of Longboat Pass, located between Longboat Key and Anna Maria Island, also occurs. The pass is a federally maintained waterway between the Sarasota Bay system and the Gulf of Mexico. It is periodically surveyed and, when shoaling occurs to a point where actual depths are less than the designed project depths, dredging by the U.S. Army Corps of Engineers in cooperation with the West Coast Inland Navigation District (WCIND) occurs. Dredging of this pass aides in navigation and provides sand to nearby beaches where erosional effects are greatest. A comprehensive Inlet Management Plan is currently being formulated for the pass.

Cumulative effects from these projects may result in stress to nearshore hardbottom communities over time due to periodic, repetitive turbidity and sedimentation. However, the temporal spacing of projects should allow for recovery of these communities. Additionally, portions of nearshore hardbottom, especially those that are low-relief in nature, experience natural periodic sand cover alternating with exposure. The species that are found in this environment are well adapted to natural stress from extreme temperature swings as well as sedimentation. Many species are also considered "pioneering" or "fouling" because they are often the first species or group of species to colonize a habitat that has been recently been "reset" (McPherson, 1984; Mook, 1984). Cumulative impacts to nearby SAV within Sarasota Bay may also occur from long-term, repetitive turbidity and sedimentation. Seagrasses need sunlight for photosynthesis to survive; loss of SAV can occur from an increase in sedimentation that can reduce photosynthetic rates.

It has also been suggested that beach nourishment can lead to increased coastal development and tourism (NRC, 1990); this in turn may lead to higher boat traffic which increases the chance of injury to SAV beds. The project area, especially Longboat Pass at the north end of Longboat Key, is highly used by recreational boaters. In addition to potentially impacting SAV, an increased volume in boat traffic could potentially put manatees at a higher risk of collision in this area.

All previous and future projects on Longboat Key and nearby beaches represent actions that cumulatively impact sea turtle nesting habitat. These impacts include compaction of sand over time which may deter female turtles from nesting on a particular beach, alteration of the natural beach profile (Ernest and Martin, 1999), and other chemical and physiological changes in natural beach sand qualities such as color and moisture content as described above (Nelson and Dickerson, 1989; Grain *et al.*, 1995). Alteration of the natural color of beach sand can affect heat transfer through the nest, which in turn can alter the sex ratio of unborn sea turtles in the nest (Yntema and Mrovsky, 1982; Godfrey and Mrovsky, 1999). Alteration of the natural profile of the beach can cause sea turtles to nest closer to the water for the first year or two after nourishment (Trindell *et al.*, 2005). Nesting closer to the water elevates the risk of nests being washed away due to erosion or storms. The number of lost nests due to these factors may be small after a single nourishment, but if multiple nourishments occur over several years in an area, as has occurred in the Longboat Key project area and is planned to continue, the number of nests lost from theses causes may become significant if the profile is drastically altered. The effects of the multiple beach nourishments which have occurred in and around the proposed project area, on the other hand, may ultimately lead to an increase in sea turtle nesting and hatching success rates due to expansion of suitable nesting beaches as long as fill material is compatible with native sands and the fill profile mimics the natural one. The regular addition of suitable beach material to the shorelines provides additional nesting habitat and protects existing nesting beaches from future storm-induced erosion, given that the grain size and color, and placement profile remain similar to the native beach.

Cyclical beach renourishments, continual routine maintenance dredging of inlets, emergency sand placement projects, and coastal armoring and structures may all have cumulative impacts on shorebirds, including piping plovers, over time. Piping plovers overwinter along Florida‟s coastline and forage along the sandy beaches of the project area and adjacent shorelines. Although infauna recovery has been documented after beach renourishments, the repetitive burial of beach infauna may eventually change the abundance and composition of infaunal communities, which can in turn affect food sources for the piping plover. Additionally, large-scale removal of beach wrack associated with coastal construction projects and beach grooming programs (beach cleaning and raking) removes habitat used by piping plovers for foraging and camouflage. The Longboat Key coastline is already extensively developed; however, it is reasonable to expect that human occupancy and recreational use along the Gulf coast of Florida will increase in the future. It is unknown how much influence beach renourishment contributes to the development and recreational use of the shoreline. As the proposed project reduces optimal foraging and roosting habitat through wrack-removal, burial and/or disturbance, it may enhance the aesthetic and recreational value of these beaches, thus increasing recreational pressure within the project area. Recreational activities that may adversely affect piping plovers include disturbance by pets, increased pedestrian use (walking, sunbathing) and reduction of foraging habitat from wrack-removal programs permitted by FDEP.

Deepwater Horizon Oil Spill

Although impacts from the Deepwater Horizon MC 252 oil spill have not been realized in the project area, this does not mean they may not occur in the future. Dispersed and dissolved oil (comprised of polycyclic aromatic hydrocarbons, (PAHs)) in the water can result in exposure of aquatic resources to the toxicological effects of PAHs. This contact in the water column may be exacerbated by use of surfactants, weather conditions and other dispersal methods which increase mixing (NOAA, 2010c).

PAHs can cause direct toxicity (mortality) to marine mammals, fish, and aquatic invertebrates through smothering and other physical and chemical mechanisms. Besides direct mortality, PAHs can also cause sublethal effects such as: DNA damage, liver disease, cancer, and reproductive, developmental, and immune system impairment in fish and other organisms (NOAA, 2010c). PAHs can accumulate in invertebrates, which may be unable to efficiently metabolize the compounds. PAHs can then be passed to higher trophic levels, such as birds, fish and marine mammals, when they consume prey. The presence of discharged oil in the environment may cause decreased habitat use in the area, altered migration patterns, altered food availability, and disrupted life cycles (NOAA, 2010c). During past oil spills in the Gulf of Mexico, NOAA has documented direct toxic impacts to commercially important aquatic fauna, including blue crabs, squid, shrimp and different finfish species (NOAA, 2010c).

When sea turtle hatchlings join the rest of the population out at sea, they may face direct oil exposure, contaminated prey and oil impacts on their habitat. It is difficult to estimate how long it will take for these types of impacts to show up in the population. If adult females are killed, nesting numbers could start to decline almost immediately. Kemp‟s ridley sea turtles do not reach sexual maturity until they are 7-15 years old so the impacts of large numbers of hatchlings being lost to the oil spill could take a decade or more to begin to influence nesting numbers. For loggerhead and green sea turtles, which don't reach maturity until around 20 years of age, it could take even longer to see impacts. Between April 30 and June 26, 2010, a total of 567 sea turtles were found within the designated spill area from the Texas/Louisiana border to Apalachicola, Florida. Of the 567 turtles verified from April 30 to June 26, a total of 425 stranded turtles were found dead, 44 stranded alive. Four of those subsequently died (NOAA, 2010d). The final breadth of the oil spill and the effectiveness of the clean-up efforts remain unknown.

The NOAA ship Pisces reported a dead 25-foot sperm whale on June 15, 2010, that was located 150 mi due south of Pascagoula, Mississippi and approximately 77 mi due south of the spill site. The whale was decomposed and heavily scavenged. The whale had no evidence of external oil, so samples of skin and blubber were collected to be analyzed. There are no records of stranded whales in the Gulf of Mexico for the month of June for the period 2003-2007 (NOAA, 2010d). As of January 2011, this was the only dead sperm whale reported in the Gulf of Mexico. Acoustic survey equipment located 9 mi from the spill site and at 1000-m water depth showed a drop in sperm whale numbers since the spill. This site has nine years of acoustic data that showed a fairly steady rate of five sperm whales in the area. After the spill, the number dropped to two; however, at a site located 15.5 mi away, the numbers did not change. Based on the decrease in numbers near the spill versus no change farther away, experts believe that the whales vacated due to the presence of oil and possibly the noise of the disaster (emergency drilling, increased ship volume) (O‟Hanlon, 2010).

Since the Deepwater Horizon oil spill, Sarasota and Manatee Counties have declared that their beaches are safe, clean and oil-free. Sarasota County remains proactive by testing water, sediment and shellfish, specifically looking for measurements of petroleum-related products.

These efforts are ongoing and results will be reported when the testing has been completed (Sarasota County, 2011).

Climate Change

According to the Intergovernmental Panel on Climate Change (2007), changes in the natural ecosystem caused by potentially rapid climate change pose significant challenges to wildlife. Sea Level Rise (SLR) caused by climate change has the potential to adversely affect nesting sea turtles. In an era of eroding shorelines, SLR may exacerbate erosional conditions, leading to further loss of sea turtle nesting habitat. Climate change may also lead to increased hurricane activity, which can further impact the limited remaining sea turtle nesting habitat. The degree and intensity of climate change and SLR are difficult to estimate with any degree of precision; however, based on measured rates of erosion and changes in water levels in the project area, sea level rise accounts for only 5% of the total shoreline change (CPE, 2009a). Hence, although worldwide SLR may adversely affect sea turtle nesting as a whole, nesting within the project area may be at less of a risk than areas with higher rates of SLR. The magnitude of impacts to sea turtles as well as other wildlife will be better estimated in coming years as more information becomes available.

To evaluate the project‟s contribution to global climate change through Green House Gas (GHG) emissions, total CO_2 emissions were estimated. GHG emissions resulting from the 2011/2012 interim phase were estimated at less than 2,200 metric tons; GHG emissions resulting from the 2013/2014 island-wide phase were estimated at less than 16,200 metric tons. Since the dredging activities proposed in BA-F2 and interrelated project activities are short-term and are estimated to produce < 25,000 metric tons of CO_2, no significant contribution to climate change from GHG emissions are anticipated.

CHAPTER 5 – WHAT MITIGATION MEASURES ARE BEING PROPOSED?

Although nearshore hardbottom habitat will be impacted within the fill templates of the proposed project activities through direct burial, these impacts are repetitive of those which occurred during the 2005/06 beach nourishment project and which were mitigated for through the construction of a compensatory artificial reef. Therefore, no mitigation for impacts to hardbottom resources are proposed, although a nearshore hardbottom monitoring program will be implemented to monitor for impacts beyond those previously mitigated for. Several other measures will be implemented to protect listed species and are described below.

5.1 Construction Measures

In general, the conservation measures that will be taken to protect federally listed species and their habitat will follow construction guidelines as set forth by state and federal agencies, or as recommended in the NMFS Gulf of Mexico Regional Biological Opinion and Biological Opinions prepared by the USFWS and NMFS for various portions of this project (see Section 1.6 for authorizations for proposed actions). The permittee shall comply with the *Sea Turtle and Smalltooth Sawfish Construction Conditions* developed by the NMFS. These conditions stipulate that if a sawfish is observed within 100 yd of construction operations, all appropriate precautions shall be implemented to ensure its protection, including cessation of operation if the animal moves within 50 ft of any moving equipment. For swimming sea turtles, this includes avoiding collision with swimming sea turtles, monitoring of siltation barriers for entanglement, operation at "no wake/idle" speeds in the construction area, taking precautions when sea turtles are observed within 100 yd of the active construction operations, cessation of operation of any moving equipment when within 50 ft of a sea turtle, and reporting of any collision with and/or injury to a sea turtle to NMFS Protected Resources Division and the local authorized sea turtle stranding/rescue organization (Mote Marine Lab).

Construction equipment and material shall be stored in a manner that will minimize impacts to nesting and hatchling sea turtles to the maximum extent practicable. During sea turtle nesting season, all construction pipeline will be placed parallel to shore and as far landward as possible without impacting the dune. All temporary storage of pipeline and equipment will be placed off the beach whenever possible, or as far landward as possible without impacting the dune.

During borrow area selection for this project, a sand compatibility analysis compared the composite characteristics for both beaches and the borrow area including mean grain size, sorting, silt content, shell content, carbonate content, and Munsell color. The results of this analysis show that the material contained within the borrow area is very similar to the existing sand on Longboat Key beaches. Beach quality sand was chosen not only for stability and aesthetics, but also for suitability for sea turtle nesting, successful incubation, and hatchling emergence. Following construction, any escarpments that might form will be leveled to maintain sea turtle access to the nesting beach.

Construction activities will also incorporate the FWC 2009 *Standard Manatee Construction Conditions for In-Water Work*. These conditions include protection measures that will minimize the potential for significant impacts to manatees by project related activities. This includes operation of vessels at „idle speed/no wake" at all times while in the immediate area and when the draft of the vessels provides less than four feet of clearance from the bottom, immediate shutdown of all in-water operations if a manatee comes within 50 ft of construction activities, posting of temporary signs concerning manatees prior to and during all in-water activities, use of turbidity barriers that manatees cannot become entangled in, and reporting any collisions or injury to a manatee to FWC and USFWS.

5.2 Dredging Measures

Rigid sea turtle deflectors will be installed on the dragheads before dredge activity commences and all points of inflow will be screened. Cages will be attached directly to the ends of the discharge pipes and will be inspected by endangered species observers (approved by the NMFS) to monitor every load dredged and document any evidence of sea turtle take. Load sheets will be completed to detail everything found in the screening or dragheads, as well as the condition of the screens and the turtle deflectors. Any sea turtle takes, or samples thereof, will be photographed, measured, and described on data collection sheets and disposed of.

Protected species observers will be onboard the dredge to search for and document whales and sea turtles in proximity to the dredge. All observations of turtles and marine mammals will include information regarding date, time, location, species, number of animals, distance and bearing from dredge, direction of travel and any other relevant information. If a whale is sighted near the dredge, NMFS and CORPS will be notified and all in-water operations will be shut down immediately. The captain of the dredge will also be instructed to avoid whales encountered while traveling between the dredge site and the pipeline and to contact NMFS and CORPS if a whale is observed in the vicinity.

In order to protect cultural and archeological resources, buffers will be implemented around any potentially significant anomalies identified during the cultural resource investigations. Additionally, in the event that shipwreck remains or other cultural material is encountered during dredging, BOEM will be notified and on-site activity will be shifted until an assessment if the archaeological significance of the disturbed material can be assessed.

5.3 Sea Turtle Trawling

Sea turtle relocation trawling will be conducted as a means to reduce the likelihood of turtle mortality associated with dredging activity during the proposed project (Clausner *et al.,* 2004, Dickerson *et al.,* 2004). Shrimp trawlers have been successfully used to capture sea turtles for relocation and research for since the early 1980s (Bargo *et al.*, 2005). For research, turtles are generally captured for tagging purposes; however, relocation is implemented during periods when hopper dredging is imminent or ongoing (NMFS NE Biological Opinion F/NER/2003/00302). Trawling will target the active dredging site within the borrow area. It has been documented that the proportion of sea turtles caught in nets that are dead or comatose increases with an increase in tow time from 0% during the first 50 minutes to about 70% after 90 minutes (CLS, 1990); therefore, the temporal length of each tow will be strictly limited to less than 50 minutes (total time). Positions at the beginning and end of each tow will be determined using GPS and tow speed will be recorded at the approximate midpoint of each tow. Tide and weather conditions will also be recorded during each tow including air temperature, wind velocity and direction, sea state, wave height, and precipitation. Captured turtles will be photographed, measured, biopsied for genetics, epibionts present recorded, and tagged. Turtles will then be relocated at least 3 nt mi from the dredge site in a direction that provides for the least likelihood of recapture. During dredging for the 2005/2006 renourishment of Longboat Key, the turtle relocation trawler captured and removed 129 turtles from the dredging areas using the methods described above. This included 74 loggerheads (*Caretta caretta*), 41 Kemps ridley (*Lepidochelys kempii*), 12 greens (*Chelonia mydas*), and 2 hawksbills (*Eretmochelys imbricate*). Two loggerheads were sent to Mote Marine Lab for rehabilitation unrelated to dredge activity (propeller cuts and emaciation). Two turtles were recaptured during the project and two dredge takes were documented.

5.4 Project Lighting

Direct lighting of the beach and nearshore waters will be limited to the immediate construction area during the sea turtle nesting season and shall comply with safety requirements. Lighting on offshore or onshore equipment shall be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the water's surface and nesting beach while meeting all Coast Guard, EM 385-1-1, and OSHA requirements. Light intensity of lighting equipment shall be reduced to the minimum standard required by OSHA for General Construction areas, in order not to misdirect sea turtles. Shields shall be affixed to the light housing and be large enough to block light from all lamps from being transmitted outside the construction area.

5.5 Surveys, Monitoring and Education

Compaction monitoring, tilling, and escarpment remediation measures will be performed in accordance with the Terms and Conditions of the USFWS Biological Opinion. Sea turtle monitoring, nest evaluation and protection measures shall be conducted by Mote Marine Lab (MML) Sea Turtle Conservation and Research Program personnel beginning April 15 and continuing through October 31. As was implemented during the 2005/06 nourishment project, in order to reduce negative impacts to nests, those nests laid in areas that would interfere with construction activities will be relocated to a safe area determined by MML personnel. Relocation methods will follow those specified by the USFWS and FWC.

During the permitting process for this project, coordination with USFWS has resulted in several recommended conservation measures that will be incorporated into the Terms and

Conditions of the USFWS Biological Opinion. These include shorebird monitoring, education signs at public beach access areas, following FWC‟s best management practices for operating vehicles on the beach, and public outreach. Shorebird surveys will be conducted during project activities and for three years after the project to monitor impacts to shorebirds and their habitat. Monitoring reports will be submitted monthly to the Town. The Town has also committed to posting educational signs at public access areas to the beach regarding piping plovers and the importance of wrack habitat, as well as links to piping plover information on the Town website. The Longboat Key Police Department, Public Works Department and Code Enforcement are the only entities authorized to drive on the beach for official purpose only. Agents of the Town such as Mote Marine Lab (sea turtle surveys) and CPE (beach topographic surveys) occasionally drive on the beach as well as in ATV‟s. All follow FWC‟s guidelines for beach driving which include avoidance of wrack. The Town has also committed to hold a town meeting with shoreline property owners to educate them on the importance of wrack for shorebird habitat.

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REFERENCES

Aller, R. C. and R.E. Dodge. 1974. Animal-sediment relations in a tropical lagoon, Discovery Bay Jamaica. *Journal of Marine Research* 32: 209-231.

Anchor Environmental LLC. 2003. Literature review of effects of resuspended sediments due to dredging operations. iii+87 p. + App. A-C. June. Prepared for Los Angeles Contaminated Sediments Task Force.

Anderson, M.J., R.B. Ford, D.A. Feary, and C. Honeywill. 2004. Quantitative measures of sedimentation in an estuarine system and its relationship with intertidal soft-sediment infauna. *Marine Ecology Progress Series* 272: 33-48

Applied Technology & Management (ATM). 1992. Longboat Pass Inlet Management Plan, Applied Technology & Management, West Palm Beach, Florida.

Baird & Associates Ltd. 2004. Review of existing and emerging environmentally friendly offshore dredging technologies. Prepared for Minerals Management Service, U.S. Department of Interior, Herndon, Virginia, July, 2004. *OCS Study MMS 2004-076*: 441 p.

Bargo, T., J. Glass, T. Fitzpatrick, and D. Oullette. 2005. Sea turtle relocation trawling: is it effective? *Florida Shore and Beach Preservation Association Proceedings.*

Blake, N.J., L.J. Doyle, and J.J. Culter. 1996. Impacts and direct effects of sand dredging for beach renourishment on the benthic organisms and geology of the west Florida shelf. Final report prepared by the Florida Institute of Oceanography for the U.S. Department of the Interior, Minerals Management Service. 109 p. + appendices.

Bland, M.J. 1985. Holocene Geologic History of Little Sarasota Bay, Florida. Tampa, Florida: University of South Florida, Master's Thesis, 101 p.

Boat Info World. 2011. Boat Info World.Com: Sarasota County FL List of Boat, Yacht, & Ship Owners. http://www.boatinfoworld.com/boat/registrations/sarasota-county-fl-florida.asp Last accessed April 4, 2011.

Brockman, H. J. 1990. Mating behavior of Horseshoe Crabs *Limulus polyphemus*. *Behaviour* 114: 206–220.

Brooks, R. A., C. N. Purdy, S. S. Bell, and K. J. Sulak. 2006. The benthic community of the eastern US continental shelf: A literature synopsis of benthic faunal resources. *Continental Shelf Research* 26: 804-818.

Burlas, M., D.G. Clarke, G.L. Ray, and D.H. Wilber. 2002. Biological monitoring of beach nourishment operations in northern New Jersey, USA: Linkages between benthic infauna and higher trophic levels. Dredging '02, May 5-8, 2002, Orlando, Florida. American Society of Civil Engineers.

Carlson, J.K., J. Osborne, and T.W. Schmidt. 2007. Monitoring the recovery of smalltooth sawfish, *Pristis pectinata*, using standardized relative indices of abundance. *Biological Conservation* 136(2): 195-202.

Clarke, D., C. Dickerson, and K. Reine. 2004. Characterization of underwater sounds produced by dredges. Dredging "02: Key Technologies for Global Prosperity. *Proceedings of 3rd Specialty Conference on Dredging and Dredged Material.*

Clausner, J., D. Dickerson, A. Dasilva, and G. Banks. 2004. Equipment and operational modifications for hopper dredges to reduce impacts on sea turtles in the Southeastern USA. U.S. Army Corps of Engineers. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Coastal Planning & Engineering, Inc. (CPE). 1995. Town of Longboat Key Comprehensive Beach Management Plan, Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE). 2007. Manatee County, Anna Maria Island, Shore Protection Feasibility Study, Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE). 2009a. Longboat Pass, Manatee County, Florida, Numerical Calibration of Wave Propagation, Currents, and Morphology Changes, Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE). 2009b. City of Anna Maria and Coquina Beach Nourishment Project Biological Assessment. Coastal Planning & Engineering, Inc., Boca Raton, Florida, 64 p.

Coastal Planning & Engineering, Inc. (CPE). 2010a. Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida. Coastal Planning & Engineering, Inc., Boca Raton, Florida, 117 p.

Coastal Planning & Engineering, Inc. (CPE). 2010b. Town of Longboat Key, 2005/06 Beach Renourishment Project Fourth Post-Construction Hardbottom Monitoring and Mitigation Report. Boca Raton, Florida, 44 p.

Commission on Life Sciences (CLS). 1990. Conservation Measures, *In*: N. Grossblatt (ed.), Decline of the sea turtles: causes and prevention. National Academy Press, Washington D.C.

Culter, J.K. and S. Mahadevan. 1982. Long-term effects of beach nourishment on the benthic fauna of Panama City, Florida. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Miscellaneous Report No. 82-2.

Davis, R.A. 1997. Geology of the Florida Coast. *In*: Randazzo, A.F. and Jones, D.S. (eds.), *The Geology of Florida*. Miami, Florida: University Press of Florida, pp. 155-168.

Davis, R.W., W.E. Evans, and B. Würsig (eds.). 2000. Cetaceans, sea turtles, and seabirds in the northern Gulf of Mexico: Distribution, abundance, and habitat associations. Volume II: Technical report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division USGS/BRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, La. OCS Study MMS 2000-003, 346 p.

Department of Defense (DOD). 2011. Partners in Flight. Conserving Birds and their Habitats on Department of Defense Lands. http://www.dodpif.org/plans/migratory/about.php Last accessed July 5, 2011

Dickerson, D.D. and D.A. Nelson. 1989. Recent results on hatchling orientation response to light wavelengths and intensities. *In:* S.A. Eckert, K.L. Eckert, and T.H. Richardson (compilers), Proceedings of the 9th Annual Workshop on Sea Turtle Conservation and Biology, pp. 41-43. NOAA Technical Memorandum NMFS-SEFC-232.

Dickerson, D., D. Nelson, and G. Banks. 1990. Alternative dredging equipment and operational methods to minimize sea turtle mortalities. Environmental Effects of Dredging Technical Notes. U.S. Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Dickerson, D., M. Wolters, C. Theriot, and D. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Submitted for proceedings of the World Dredging Congress, Hamburg, Germany, September 27 – Oct 1, 2004.

Dodge, R.E. and J.R. Vaisnys. 1977. Coral populations and growth patterns: responses to sedimentation and turbidity associated with dredging. *Journal of Marine Research* 35: 715-730.

Dompe, P. E., D. M. Hanes, T. Khangaonkar, and J. Anton. 1991. "Fluctuations in Turbidity and Waves at Hollywood, Florida", in Preserving and Enhancing Our Beach Environment, Proceedings of the 1991 National Conference on Beach Preservation Technology, Published by FSBPA, Tallahassee, Florida, 384-399.

Doyle, L.J. and T. Sparks. 1980. Sediments of the Mississippi, Alabama, and Florida (MAFLA) continental shelf. *Journal of Sedimentary Petrology* 50: 905-915

Duever, L.C. 1983. Natural communities of Florida‟s coastal dunes. *The Palmetto, Quarterly magazine of the Florida Native Plant Society* 3(4), November issue.

Dugan, J.E., D.M. Hubbard, M.D. McCrary, and M.O. Pierson. 2003. The response of macrofauna communities and shorebirds to macrophyte wrack subsidies on exposed sandy beaches of southern California. *Estuarine, Coastal and Shelf Science* 58S: 25-40.

Ernest, R.G. and R.E. Martin. 1999. Martin County beach nourishment project: sea turtle monitoring and studies. 1997 annual report and final assessment. Prepared for the Florida Department of Environmental Protection.

Evans, M.W., A.C. Hine, D.F. Belknap, and R.A. Davis. 1985. Bedrock controls on barrier island development: West-central Florida coast. *Marine Geology* 63(1-4): 263-283.

Fazioli, K.L., S. Hofmann and R.S. Wells. 2006. Use of Gulf of Mexico coastal waters by distinct assemblages of bottlenose dolphins (*Tursiops truncates*). *Aquatic Mammals* 32(2): 212-222.

Finkl, C.W., L. Benedet, J.L. Andrews, B. Suthard, and S.D. Locker. 2007. Sediment ridges on the West Florida Inner Continental Shelf: sand resources for beach nourishment. *Journal of Coastal Research* 23(1): 143-159.

Finkl, C.W., B.M. Forrest, M. Larenas, J.L. Andrews, and B.C. Suthard. 2009. 2008 Reconnaissance Geotechnical and Geophysical Investigations for the Town of Longboat Key Renourishment Project, Manatee and Sarasota Counties, Florida. Coastal Planning & Engineering, Inc., Boca Raton, Florida, 48 p.

Florida Department of Environmental Protection (FDEP). 2006. 2006 Florida Air Monitoring Report, FDEP Division of Air Resource Management, Tallahassee, Florida.

Florida Department of Health (FDOH). 2004. Florida Healthy Beaches Program. http://esetappsdoh.doh.state.fl.us/irm00beachwater/beachresults.aspx?county=Manatee Last accessed September 30, 2010.

Florida Fish and Wildlife Conservation Commission (FWC). 2009. FWC Manatee Construction Conditions Standard Manatee Conditions for In-Water Work. 2009. Last updated June 12, 2009.

Florida Fish and Wildlife Conservation Commission (FWC). 2010. Beach-nesting birds reference guide. http://myfwc.com/docs/Conservation/FBCI_BNB_SeaTurtleMonitors.pdf Last accessed April 15, 2010.

Florida Fish and Wildlife Conservation Commission (FWC). 2011. Florida manatee mortality database. http://research.myfwc.com/manatees/ Last accessed March 25, 2011.

Florida Fish and Wildlife Research Institute (FWRI). 2010. Commercial Fisheries Landings in Florida, FWC Marine Fisheries Information System, 2008 Annual Landings Summary. http://research.myfwc.com/features/view_article.asp?id=19224 Last accessed June 17, 2010.

Fish and Wildlife Research Institute (FWRI). 2010b. FWC-FWRI Marine Resources Geographic Information System (MRGIS) Internet Map Server (IMS). Manatee Mortality Data (updated 2009) and Seagrass Resource Data (updated 2007). http://ocean.floridamarine.org/mrgis_ims/Description_Layers_Marine.htm Last accessed May 21, 2010.

Florida Fish and Wildlife Research Institute (FWRI) and Sarasota County Natural Resources (SCNR). 2004. Boating and angling guide to Sarasota County.

Fritts, T.H., W. Hoffman, and M.A. McGehee. 1983. The distribution and abundance of marine turtles in the Gulf of Mexico and nearby Atlantic waters. *Journal of Herpetology* 17(4): 327-344.

Gambell, R. 1985. Fin whale *Balaenoptera physalus*. *In:* S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Volume 3: the Sirenians and Baleen Whales, pp. 155-170. Academic Press Inc., London, 362 p.

Gerstein, E. 2002. Manatees, Bioacoustics and Boats: Hearing tests, environmental measurements and acoustic phenomena may together explain why boats and animals collide. *American Scientist:* http://www.americanscientist.org/issues/num2/2002/2/manatees-bioacoustics-and-boats/3

Gibeaut, J.A., and R.A. Davis. 1988. Morphodynamic classification of tidal inlets. *Proceedings of the National Conference on Beach Preservation Technology* (Tallahassee, Florida), 221-230.

Gilliam, D.S., R.E. Dodge, R.E. Spieler, L.K.B. Jordan, and J.C. Walczak. 2006. Marine Biological Monitoring in Broward County, Florida: Year 6 Annual Report. Prepared by Nova Southeastern University Oceanographic Center for Broward County. Dania Beach, Florida.

Godfrey, M. and N. Mrosovsky. 1999. Estimating hatchling sex ratios. *In*: K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/MTSG Publication No. 4, pp. 136-138.

Grain, D.A., A.B. Bolten, and K.A. Bjorndal. 1995. Effects of Beach Nourishment on Sea Turtles: Review and Research Initiatives. *Restoration Ecolo*gy 3(2): 95-104.

Greene, K. 2002. Beach Nourishment: A Review of the Biological and Physical Impacts. *Atlantic States Marine Fisheries Commission (ASMFC) Habitat Management Series #7, November 2002*, 174 p.

Gulf of Mexico Fishery Management Council (GMFMC). 1998. *Generic Amendment for Addressing Essential Fish Habitat Requirements in the following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, United States Waters,* *Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico, Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic, Stone Crab Fishery of the Gulf of Mexico, Spiny Lobster in the Gulf of Mexico and the South Atlantic, Coral and Coral Reefs of the Gulf of Mexico*. Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration.

Gulf of Mexico Fishery Management Council (GMFMC). 2004. *Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to the following fishery management plans of the Gulf of Mexico (GOM): Shrimp Fishery of the Gulf of Mexico; Red Drum Fishery of the Gulf of Mexico; Reef Fish Fishery of the Gulf of Mexico; Stone Crab Fishery of the Gulf of Mexico; Coral and Coral Reef Fishery of the Gulf of Mexico; Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic; Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic.* Gulf of Mexico Fishery Management Council. Tampa, Florida. March 2004.

Gulf of Mexico Fishery Management Council (GMFMC). 2005. *Final Generic Amendment Number 3 For Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing in the following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, United States Waters; Red Drum Fishery of the Gulf of Mexico; Reef Fish Fishery of the Gulf of Mexico; Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic; Stone Crab Fishery of the Gulf of Mexico; Spiny Lobster in the Gulf of Mexico and South Atlantic; Coral and Coral Reefs of the Gulf of Mexico.* Gulf of Mexico Fishery Management Council. Tampa, Florida. March 2005.

Gulland, J.A.. 1970. Food chain studies and some problems in world fisheries. *In*: J.H. Steels (ed.), Marine food chains. Oliver and Boyd, Edinburgh, England, pp. 296-515.

Haig, S.M. and L.W. Oring. 1985. Distribution and status of the piping plover throughout the annual cycle. *Journal of Field Ornithology* 55(4): 334-345.

Haig, S.M. 1992. Piping Plover. No. 2. The Birds of North America. *In:* A. Pools, P. Stettenheim, and F. Gill (eds.), Philadelphia: The Academy of Natural Sciences. The American Ornithologists' Union, Washington, D.C.

Hanes, D.M. and D. Stubbs. 1994. Sedimentation, Turbidity, and Wave Monitoring: Longboat Key, Florida, pp. 18-26. University of Florida.

Hemminga, M.A. and J. Nieuwenhuize. 1990. Seagrass wrack-induced dune formation on a tropical coast (Banc d‟Arguin, Mauritania). *Estuarine, Coastal and Shelf Science* 31(4): 499-502.

Hine, A.C., D.L. Mearns, R.A. Davis, and M. Bland. 1986. Impact of Florida's Gulf Coast Inlets on the Coastal Sand Budget. Tampa, Florida: University of South Florida, 128 p.

Hine, A.C., G.R. Brooks, R.A. Davis, D.S. Duncan, S.D. Locker, D.C. Twichell, and G. Gelfenbaum. 2003. The west-central Florida inner shelf and coastal system: a geologic conceptual overview and introduction to the special issue. *Marine Geology* 200(1-4): 1-17.

Hubbard, D.M. and J.E. Dugan. 2003. Shorebird use of an exposed sandy beach in southern California. *Estuarine, Coastal and Shelf Science* 58S: 41-54.

Hughes, A.L. and E.A. Caine. 1994. The effect of beach features on hatchling loggerhead sea turtles. *Proceedings of the 14th Annual Symposium on Sea Turtle Biology and Conservation.* Hilton Head, South Carolina, p. 237.

Hughes, C.H. 2011. Government Operations Consultant. Florida Fish and Wildlife Conservation Commission. Personal communication regarding recreational saltwater fishing permits issued in Manatee and Sarasota Counties.

Humphrey, S.R. 1992. Florida manatee, *Trichechus manatus latirostris*. *In:* Rare and Endangered Biota of Florida, Volume I: Mammals, pp. 190-198.

Hurricane City. 2009. Sarasota, Florida's History with Tropical Systems. http://www.hurricanecity.com/city/sarasota.htm. Last accessed March 20, 2010.

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Intergovernmental Panel on Climate Change. Fourth Assessment Report.

Irlandi, E. and B. Arnold. 2008. Assessment of Nourishment Impacts to Beach Habitat Indicator Species. Final Report to the Florida Fish and Wildlife Conservation Commission (Grant Agreement No: 05042), August 2008.

Jackson, N.L., K.F. Nordstrom, and D.R. Smith. 2002. Geomorphic-biotic interactions on beach foreshores in estuaries. *Journal of Coastal Research* SI36: 414-424.

Johnson, A.F. and M.G. Barbour. 1990. Dunes and Maritime Forest. *In:* R.L Myers and J.J. Ewel (eds.), Ecosystems of Florida**.** University of Central Florida Press, Orlando, Florida, 765 p.

Josselyn, M.N. and A.C. Mathieson. 1980. Seasonal influx and decomposition of autochthonous macrophyte litter in a north temperature estuary. *Hydrobiologia* 71: 197-208.

Kleypas, J.A., Buddemeier, R.W., Archer, D., Gattuso, J.P., Langdon, C. and Opdyke, B.N. 1999. Geochemical consequences of increased atmospheric carbon dioxide on coral reefs. *Science* 284: 118-120.

Larson, K.W. and C.E. Moehl. 1988. Entrainment of Anadromous Fish by Hopper Dredge at the Mouth of the Columbia River. *In*: C.A. Simenstad (ed.), *Effects of Dredging on*

Anadromous Pacific Coast Fishes, Workshop Proceedings, University of Washington Sea Grant, pp. 102-112.

LaSalle, M.W., D.G. Clarke, J. Homziak, J.D. Lunz, and T.J. Fredette. 1991. A Framework for Assessing the Need for Seasonal Restrictions on Dredging and Disposal Operations. U.S. Army Corps of Engineers Technical Report D-01-1. July 1991. Final Report, 74 p.

LFR Levine-Fricke (LFR). 2004. Framework for Assessment of Potential Effects of Dredging on Sensitive Fish Species in San Francisco Bay - Final Report. Prepared for U.S. Army Corps of Engineers, San Francisco District, San Francisco, California. August 5, 2004.

Limpus, C.J, V. Baker, and J.D. Miller. 1979. Movement induced mortality of loggerhead eggs. *Herpetologica* 35: 335-338.

Locker, S.D., A.C. Hine, and G.R. Brooks. 2003. Regional stratigraphic framework linking continental shelf and coastal sedimentary deposits of west-central Florida. *Marine Geology* 200(1-4): 351-378.

Lorne, J.K. and M. Salmon. 2007. Effects of exposure to artificial lighting on orientation of hatchling sea turtles on the beach and in the ocean. *Endangered Species Research* 3:23-30.

Longboat Key Chamber of Commerce. 2010. Information on Longboat Key community and recreation. http://longboatkeychamber.com/ Last accessed June 17, 2010.

Lutcavage, M., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtles. *In*: P.L. Lutz and J.A Musick (eds.), The Biology of Sea Turtles, CRC Press, New York.

Mann, T.M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. Unpublished M.S. Thesis. Florida Atlantic University, Boca Raton, Florida.

McGraw, K.A. and D.A. Armstrong. 1990. Fish Entrainment by Dredges in Grays Harbor, Washington. *In*: C.A. Simenstad (ed.), *Effects of Dredging on Anadromous Pacific Coast Fishes,* Workshop Proceedings, University of Washington Sea Grant, Seattle, pp. 113-131.

McPherson, B.F., W.H. Sonntag, and M. Sabanskas. 1984. Fouling community of the Loxahatchee River estuary, Florida, 1980-1981. *Estuaries* 7(2): 149-157.

Mead, J.G. 1977. Records of sei and Bryde‟s whales from the Atlantic coast of the United States, the Gulf of Mexico, and the Caribbean. *Report of the International Whaling Commission* SI 1: 113–116.

Miksis-Olds, J.L., P.L. Donaghay, J.H. Miller, P.L. Tyack, and J.A. Nysteun. 2007. Noise level correlates with manatee use of foraging habitat. *Journal of the Accoustical Society of America* 121(5): 3011-3020

Montague, C.L. 1993. Ecological engineering of inlets in Southeastern Florida: design criteria for sea turtle nesting beaches. *Journal of Coastal Research* SI 18: 267-276.

Mook, D.H. 1984. Effects of disturbance and initial settlement on fouling community structure. *Ecology* 62(3): 522-526.

Mortimer, J.A. 1999. Reducing threats to eggs and hatchlings: Hatcheries. *In*: K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois, and M. Donnelly (eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/MTSG Publication No. 4, pp. 175-178.

Mrosovsky, N. 2006. Distorting gene pools by conservation: assessing the case of doomed turtle eggs. *Environmental Management* 38: 523-531.

Myers, R.L. and J.J. Ewel. 1990. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida.

Myrberg, A.A., Jr. and L.A. Fuiman. 2002. The Sensory World of Coral Reef Fishes, pp. 123-148. *In*: P.F. Sale (ed.), Coral Reef Fishes: Dynamics and Diversity in a Complex Ecosystem. Academic Press, San Diego, California.

National Marine Fisheries Service (NMFS). 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS). 1998a. Recovery plan for the blue whale (*Balaenoptera musculus*). Prepared by R.R. Reeves, P.J. Clapham, R.L. Brownell, Jr., and G.K. Silber for the National Marine Fisheries Service, Silver Spring, Maryland, 42 p.

National Marine Fisheries Service (NMFS). 1998b. Recovery plan for the fin whale (*Balaenoptera physalus*) and the sei whale (*Balaenoptera borealis*). Prepared by R.R. Reeves, G.K. Silber, and P.M. Payne for the National Marine Fisheries Service, Silver Spring, Maryland, 66 p.

National Marine Fisheries Service (NMFS). 2003. Gulf of Mexico Regional Biological Opinion (GOM RBO) on Hopper Dredging of Navigation Channels and Borrow Areas in the U.S. Gulf of Mexico. NOAA Fisheries, Southeast Regional Office, St. Petersburg, Florida. Issued November 19, 2003. 121 p.

National Marine Fisheries Service (NMFS). 2006. Recovery plan for smalltooth sawfish (*Pristis pectinata*). Prepared by the Smalltooth Sawfish Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS). 2007. Fisheries of the United States. 2006. Current Fisheries Statistics No. 2006. NMFS Office of Science and Technology, Silver Spring, Maryland. July 2007.

National Marine Fisheries Service (NMFS). 2008. *Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, South Atlantic Region.* National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Revised August 2008

National Marine Fisheries Service (NMFS). 2008a. An overview of protected species commonly found in the Gulf of Mexico. NOAA Fisheries Service, Southeast Regional Office, Protected Resources Division. Last visited 6/23/10, last revised February 2008. http://sero.nmfs.noaa.gov/pr/pdf/Protected%20Species%20In%20GOM-web%20version%202-7-08.pdf

National Marine Fisheries Service (NMFS). 2010. NMFS Fisheries Statistics Division, Annual Commercial and Recreational Fishery Landing Data for Gulf Coast of Florida in 2008. http://www.st.nmfs.noaa.gov/st1/index.html Last accessed June 9, 2010.

National Oceanographic and Atmospheric Administration (NOAA). 2008b. Mean Sea Level Trend 8726520 St. Petersburg, Florida. http://tidesandcurrents.noaa.gov/sltrends/sltrends_station.shtml?stnid=8726520

National Oceanographic and Atmospheric Administration (NOAA). 2009. WAVEWATCH III Model Data Access. http://polar.ncep.noaa.gov/waves/download.shtml

National Oceanographic and Atmospheric Administration (NOAA). 2010. Station SAPF1 - 8726520 - St. Petersburg, Florida. http://www.ndbc.noaa.gov/station_page.php?station=sapf1

National Oceanographic and Atmospheric Administration (NOAA). 2010a. NOAA Harmful Algal Bloom Operational Forecast System Bulletin Archive. http://tidesandcurrents.noaa.gov/hab/bulletins.html Last accessed May 5, 2010.

National Oceanographic and Atmospheric Administration (NOAA). 2010b. Elkhorn coral (*Acropora palmata*). http://www.nmfs.noaa.gov/pr/species/invertebrates/elkhorncoral.htm Last accessed April 22, 2010.

National Oceanographic and Atmospheric Administration (NOAA). 2010c. Shorelines and Coastal Habitats in the Gulf of Mexico Fact Sheet. http://gulfseagrant.tamu.edu/oilspill/pdfs/Shorelines_coastal_habitats_FACT_SHEET.pdf Last accessed January 31, 2010.

National Oceanic and Atmospheric Administration (NOAA). 2010d. Emergency response: Deep Horizon Incident, Gulf of Mexico.

http://www.response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY(entry_subtopic_topic)=entry_id,subtopic_id,topic_id&entry_id(entry_subtopic_topic)=809&subtopic_id(entry_subtopic_topic)=2&topic_id(entry_subtopic_topic)=1 Last accessed June 28, 2010.

National Research Council (NRC). 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press, Washington, D.C.

National Research Council (NRC) 1995. Committee on Beach Nourishment and Protection, 1995. Beach Nourishment and Protection. National Academy Press, Washington, D.C., 334 p.

Nelson, D.A. and D.D. Dickerson. 1989. Effects of beach nourishment on sea turtles. *Proceedings of the 9th Annual Workshop on Sea Turtle Conservation and Biology*. Jekyll Island, Georgia.

Nelson, K.A., R. Trindell, B. Morford, B. Witherington, D. Arnold, and K. Moody. 2000. An analysis of reported disorientation events in the state of Florida. *Proceedings from the 20th Annual Sea Turtle Symposium*. Orlando, Florida, pp. 323-324.

Nicholls, J.L. and G.A. Baldassarre. 1990. Winter distribution of piping plovers along the Atlantic and Gulf coasts of the United States. *Wilson Bulletin* 102(3): 400-412.

Nightingale, B. and C.A. Simenstad. 2001. Dredging Activities: Marine Issues. Seattle, Washington: University of Washington, *Research Project T1803, Task 35 Overwater Whitepaper,* July 2001.

Niles, L.J. A.D. Dey, N.J. Douglas, J.A. Clark, A.S. Gates, B.A. Harrington, M.K. Peck, and H.P. Sitters. 2006. Red Knots wintering in Florida: 2005/6 expeditions. *Wader Study Group Bulletin* 111: 86-99.

Niles L.J., H.P. Sitters, A.D. Dey, P.W. Atkinson, A.J. Baker, K.A. Bennett, R. Carmona, K.E. Clark, N.A. Clark, C. Espoz, P.M. González, B.A. Harrington, D.E. Hernández, K.S. Kalasz, R.G. Lathrop, R.N. Matus, C.D.T. Minton, R.I.G. Morrison, M.K. Peck, M.K. Peck, W. Pitts, R.A. Robinson, and I.L. Serrano. 2008. Status of the Red Knot, *Calidris canutus rufa,* in the Western Hemisphere. Studies in Avian Biology No. 36. A publication of the Cooper Ornithological Society.

O'Hanlon, L. 2010. Sperm whales cleared out after Gulf oil spill. Discovery News. http://news.discovery.com/animals/sperm-whales-gulf-oil-spill.html Last accessed January 4, 2011.

Oliver, J., P. Slattery, L. Hulberg, and J. Nybakken. 1977. Patterns of Succession in Benthic Infaunal Communities Following Dredging and Dredged Material Disposal in Monterey Bay. Technical Report D-77-27, October 1977. U.S. Army Corps of Engineers Waterways Experiment Station.

Perry, C.T. and P. Larcombe. 2003. Marginal and non-reef-building coral environments. *Coral Reefs* 22: 427–432.

Pennings, S.C., T.H. Carefoot, M. Zimmer, J.P. Danko, and A. Ziegler. 2000. Feeding preferences of supralittoral isopods and amphipods. *Canadian Journal of Zoology* 78(11): 1918-1929.

Peterson, C.H., M.J. Bishop, G.A. Johnson, L.M. D‟Anna, and L.M. Manning. 2006. Exploiting beach filling as an unaffordable experiment: benthic intertidal impacts propagating upwards to shorebirds. *Journal of Experimental Marine Biology and Ecology* 338: 205-221.

Pilkey, O.H. and K.L. Dixon. 1996. The Corps and the Shore. Island Press, Washington, D.C., 272 p.

Posey, M. and T. Alphin. 2002. Resilience and Stability in an Offshore Benthic Community: Responses to Sediment Borrow Activities and Hurricane Disturbance. *Journal of Coastal Research* 18(4): 685-697.

Reine, K.J., D.D. Dickerson, and D.G. Clarke. 1998. Environmental Windows Associated with Dredging Operations. U.S. Army Corps of Engineers Research and Development Center, Vicksburg, MS. Dredging Operations and Environmental Research Technical Notes Collection (TN DOER-E2), 14 p.

Rhoads, D.C. and D.K. Young. 1979. The Influence of Deposit-Feeding Organisms on Sediment Stability and Community Trophic Structure. *Journal of Marine Research* 28: 150-178.

Rice, D.W. 1998. Sperm Whale *Physeter macrocephalus* Linnaeus, 1758. *In*: S. H. Ridgway and R. Harrison (eds.), Handbook of Marine Mammals, Volume 4: River Dolphins and the Larger Toothed Whales, pp. 177-234. Academic Press Inc., London.

Richardson, W.J., B. Würsig, and C.R. Greene, Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus,* to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research* 29(2): 135-160.

Rogers. 1990. Responses of coral reefs and reef organisms to sedimentation. *Marine Ecology Progress Series* 62: 185-202.

Rogers, S. and D. Nash. 2003. The Dune Book. North Carolina Sea Grant, Raleigh, North Carolina, 28 p.

Rudloe, A. 1979. Locomotor and light responses of larvae of the horseshoe crab (*Limulus polyphemus* (L.)). *Biological Bulletin* 157: 494-505.

Rudloe, A. 1980. The breeding behavior and patterns of movement of horseshoe crab, *Limulus polyphemus*, in the vicinity of breeding beaches in Apalachee Bay, Florida. *Estuaries* 3: 177-183.

Sarasota County. 2010. Sarasota County Water Atlas, Seagrass Habitat Map. http://maps.wateratlas.usf.edu/sarasota/index.asp Last accessed March 25, 2010.

Sarasota County. 2011. Emergency Response Information Center: Deepwater Horizon oil spill. http://www.scgov.net/oilspill.asp Last accessed February 1, 2010.

Schmidt, W. and M.W. Clark. 1980. *Geology of Bay County*. Florida Department of Natural Resources, Tallahassee, 96 p.

Shin, P.K.S. 1989. Natural disturbance of benthic infauna in the offshore waters of Hong Kong. *Asian Marine Biology* 6: 193-207.

Shull, D. H. 1997. Mechanisms of infaunal polychaete dispersal and colonization in an intertidal sandflat. *Journal of Experimental Marine Biology and Ecology* 55: 153-179.

Sidman, C., R. Swett, T. Fik, S. Fann, and B. Sargent. 2007. A Recreational Boating Characterization of Sarasota County, a publication of the Florida Sea Grant College Program. Original publication date: January 2006. Revised January 2007.

South Florida Coral Reef Initiative Maritime Industry and Coastal Construction Impacts Team (SFCRI MICCI). 2006. Identify and Evaluate Existing and emerging innovative technologies for coastal construction. South Florida Coral Reef Initiative Maritime Industry and Coastal Construction Impacts Workshop, Dania Beach, Florida, 51 p.

Southall, B.L., A., Bowles., W.T. Ellison, J.J. Finneran, R.L. Gentry, C.R. Greene Jr., D. Kastak, D.R. Ketten, J.H. Miller, P.E. Nachtigall, W.J. Richardson, J.A. Thomas, and P.L. Tyack. 2007. Marine mammal noise exposure criteria: initial scientific recommendations. *Aquatic Mammals* 33(4): 411-526

Stapor, F.W., T.D. Mathews, and F.E. Lindfors-Kearns. 1991. Barrier-island progradation and Holocene sea-level history in southwest Florida. *Journal of Coastal Research* 7(3): 815-838.

Staats, E. 2006. Two right whales continue to surprise scientists. Naples News, March 8, 2006. http://www.naplesnews.com/news/2006/mar/08/two_right_whales_continue_surprise_scientists/?local_news Last accessed December 16, 2010.

Stobutzki, I.C. and D.R. Bellwood. 1998. Nocturnal orientation to reefs by late pelagic stage coral reef fishes. *Coral Reefs* 17: 103-110.

Thomsen, F., S. McCully, D. Wood, F. Pace, and P. White. 2009. A generic investigation into noise profiles of marine dredging in relation to the acoustic sensitivity of the marine fauna in UK waters with particular emphasis on aggregate dredging: PHASE 1 Scoping and review of key issues. Marine Aggregate Levy Sustainable Fund. MEPF Ref No. MEPF/08/P21.

Thrush, S.F., R.B. Whitlatch, R.D. Pridmore, J.E. Hewitt, V.J. Cummings, and M.R. Wilkenson. 1996. Scale-dependent recolonization: The role of sediment stability in a dynamic sandflat habitat. *Ecology* 77: 2472-2487.

Tolimieri, N., A. Jeffs, and J. Montgomery. 2000. Ambient sound as a cue for navigation by the pelagic larvae of reef fishes. *Marine Ecology Progress Series* 207: 219-224.

Town of Longboat Key. 2010. Town of Longboat Key Adopted Budget Fiscal Year 2009-2010, 152 p.

Trindell, R., M. Conti, D. Gallagher, and B. Witherington. 2005. Sea turtles and lights on Florida‟s nesting beaches. *Proceedings of the 25th Annual Symposium on Sea Turtle Biology and Conservation,* pp. 152-153. Savannah, Georgia.

U.S. Army Corps of Engineers (CORPS). 1996. Coast of Florida Erosion and Storm Effects Study, Region III, Feasibility Report with Final Environmental Impact Statement.

U.S. Army Corps of Engineers (CORPS).2003. Coastal & Hydraulics Laboratory Wave Information Studies. http://frf.Corps.army.mil/cgi-bin/wis/atl/atl_main.html

U.S. Army Corps of Engineers (CORPS). 2006. Draft General Reevaluation Report and Draft Environmental Impact Statement, West Onslow Beach and New River Inlet (Topsail Beach), North Carolina. Prepared by the U.S. Army Corps of Engineers, Wilmington District.

U.S. Environmental Protection Agency (EPA). 2010a. National Ambient Air Quality Standards (NAAQS). http://www.epa.gov/air/criteria.html Last accessed June 2, 2010.

U.S. Environmental Protection Agency (EPA). 2010b. EPA AirData, Criteria Air Pollutant Emissions, 2002. http://www.epa.gov/oar/data/repsst.html?st~FL~Florida Last accessed June 21, 2010.

U.S. Fish and Wildlife Service (USFWS). 2002. Migratory bird mortality. Many human-caused threats afflict our bird populations. Division of Migratory Bird Management, USFWS. http://www.fws.gov/birds/mortality-fact-sheet.pdf Last accessed July 5, 2011.

U.S. Fish and Wildlife Service (USFWS). 2003. Recovery plan for the Great Lakes piping plover (*Charadrius melodus*). Ft. Snelling, Mn. viii + 141 pp.

U.S. Fish and Wildlife Service (USFWS). 2004. A Blueprint for the Future of Migratory Birds: Migratory Bird Program Strategic Plan 2004-2014.

http://www.fws.gov/migratorybirds/AboutUS/mbstratplan/MBStratPlanTOC.html Last accessed July 5, 2011.

U.S. Fish & Wildlife Service (USFWS). 2010. Critical Habitat for Piping Plover (*Charadrius melodus*), Florida Units 20 and 21. http://www.fws.gov/plover/finalchmaps/Plover_FL_20_to_21.jpg Last accessed June 23, 2010.

Wallen, I.E. 1951. The direct effect of turbidity on fishes. *Bulletin of Oklahoma Agricultural and Mechanical College* 48(2): 1-27.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern U.S.A. shelf. *Fish Oceanography* 2(2): 101-105.

Waring G.T., E. Josephson, K. Maze-Foley, P.E. Rosel (eds.). 2010. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2011. NOAA Tech Memo NMFS NE 219, Woods Hole, Massachusetts, 598 p.

Weilgart, L.S. 2007. A brief review of known effects of noise on marine mammals. *International Journal of Comparative Psychology* 20: 159-168.

Westerink, J.J., R.A. Luettich, and N. Scheffner. 1993. ADCIRC: An advanced three-dimensional circulation model for shelves, coasts, and estuaries, Report 3: Development of a tidal constituent database for the western North Atlantic and the Gulf of Mexico. Tech. Rep. DRP-92-6, Dept. of the Army. National Technical Information Service, Springfield, Virginia, 154 p.

Wilber, D.H. and D.G. Clarke. 2001. Biological effects of suspended sediments: a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. *North American Journal of Fisheries Management* l21: 855-875.

Wilber D., W. Brostoff, D. Clarke, and G. Ray. 2005. Sedimentation: potential biological effects of dredging operations in estuarine and marine environments. DOER Technical Notes Collection: 188 ERDC TN-DOER-E20. U.S. Army Engineer Research and Development Center, Vicksburg, Mississippi, 14 p. http://el.erdc.Corps.army.mil/dots/doer/pdf/doere20.pdf. Last accessed July 22, 2008.

Witherington, B.E. and R.E. Martin. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. Florida Marine Research Institute Technical Report TR-2, 73 p.

Yntema, C.L. and N. Mrosovsky. 1982. Critical periods and pivotal temperatures for sexual differentiation in loggerhead sea turtles. *Canadian Journal of Zoology* 60: 1012-1016.

Yochem, P.K., and S. Leatherwood. 1985. Blue whale *Balaenoptera musculus* (Linnaeus, 1758). *In*: S.H. Ridgway and R. Harrison (eds.), Handbook of Marine Mammals, Vol. 3, Academic Press, London, pp. 193-240.

Zajac, R.N. and R.B. Whitlatch. 1991. Demographic aspects of marine, soft sediment patch dynamics. *American Zoologist* 31: 105-128.

Zieman, R.C. and R.T. Zieman. 1989. The Ecology of the seagrass meadows of the west coast of Florida: A community profile. U.S. Fish and Wildlife Service Biological Report 85 (7.25).

APPENDIX 1

HARDBOTTOM MONITORING & MITIGATION PLAN

TOWN OF LONGBOAT KEY, FLORIDA
BEACH RENOURISHMENT PROJECT
HARDBOTTOM MONITORING & MITIGATION PLAN
FDEP PERMIT NO. 0296464-001-JC

Prepared for:

Town of Longboat Key

Prepared by:

Coastal Planning & Engineering, Inc.
Marine Science & Biological Research Department
2481 N.W. Boca Raton Blvd.
Boca Raton, FL 33431

March 28, 2011

1.0 INTRODUCTION

This Hardbottom Resource Monitoring Plan has been prepared in response to the Town of Longboat Key's interest in constructing a shore protection project between Florida Department of Environmental Protection survey control monuments R-44 (Manatee County) and R-29.5 (Sarasota County), along approximately 10 miles of the Town's coastline (Figure 1). In October 2002, Coastal Planning & Engineering, Inc. (CPE) conducted a side scan sonar survey of the nearshore region of the study area for the Town of Longboat Key, which documented the presence of nearshore hardbottom habitat between R-49.5 and R-51.5 (Manatee County). Subsequently, a hardbottom monitoring and mitigation plan was developed to include biological monitoring and mapping of natural nearshore habitat, placement of 1.5 acres of artificial reef, and biological monitoring of the artificial reef for 5 years post-deployment.

Three hardbottom formations in the project area between DEP monuments R-49.5 and R-51.5 comprise an area of approximately 14 acres. Approximately 1.5 acres of the 14 acres were predicted to be affected by equilibration of the 2005-2006 beach fill (Figure 2). As of August 2009 (3 years post-construction), there were 0.5 acres less hardbottom than during the 2003 baseline survey, and sediment coverage never reached the predicted cover of 1.5 acres (Table 1).

Table 1. Hardbottom edge mapping results presented in acres. Hardbottom change calculation used 2003 acreage as baseline.

Mapping Event	Hardbottom (acres)	Hardbottom Change (acres)
2003	1.204	-----
2006	0.572	-0.632
2007	0.615	-0.589
2008	1.050	-0.154
2009	0.660	-0.544

The goal of proposed island-wide renourishment, planned for winter 2013-2014, is to restore the beach to the fill template designed for the 2005/06 beach nourishment project. The proposed project may utilize fine white sand from both State and Federal sand resources, and coarse white sand from inland sources. The coarse white sand will be placed between R-47 and R-51 to minimize hardbottom impacts at the time of construction and after the construction beach cross section adjusts to equilibrium. There is no mitigation plan in place since the hardbottom that will be impacted was mitigated for during the 2005/06 project by construction of a 1.5 ac artificial reef (see Figure 2) and no further impacts are anticipated.

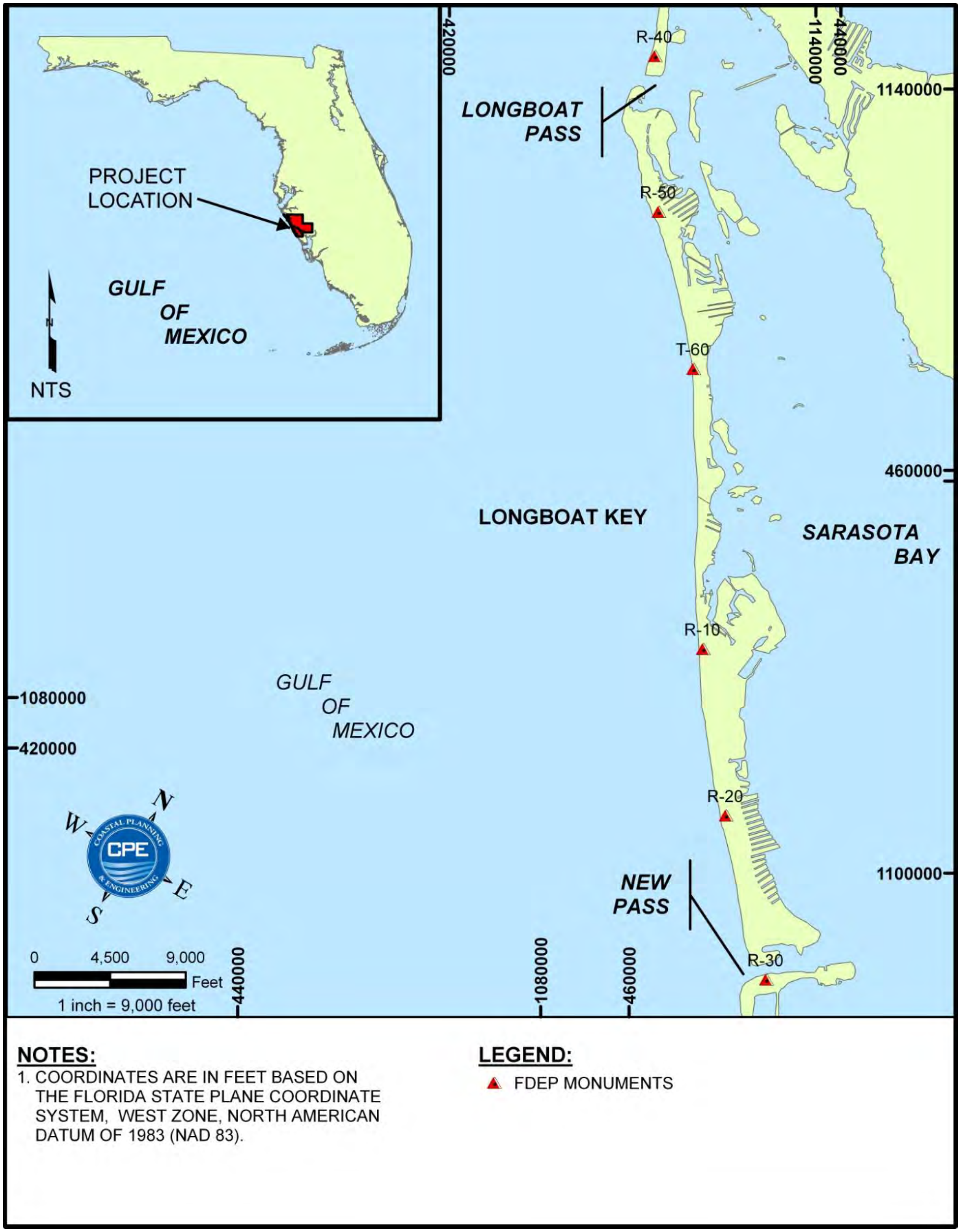


Figure 1. Location map of Longboat Key in Sarasota and Manatee Counties.

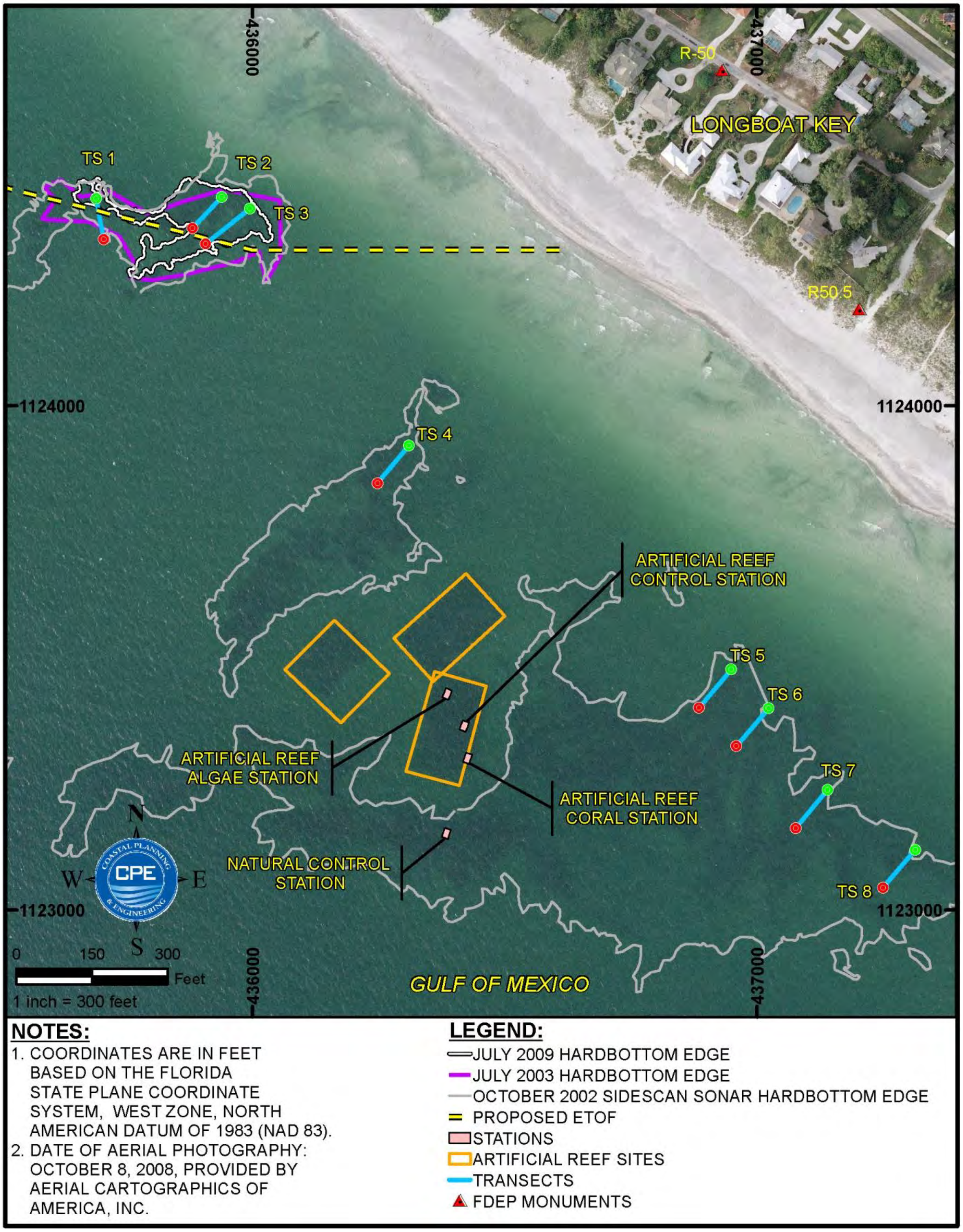


Figure 2. Nearshore natural hardbottom monitoring transects and mitigative artificial reef located between R49.5 and R51.5 on Longboat Key. Hardbottom edge delineations presented from 2002 sidescan sonar and 2003 and 2009 *in situ* diver verification.

2.0 PROJECT HISTORY

2005/2006 Renourishment Project (FDEP Permit No. 0202209-001-JC) Biological Monitoring

Natural Hardbottom

Permanent biological monitoring transects were established on the natural hardbottom in order to determine if secondary impacts to the nearshore natural hardbottom were occurring from the Longboat Key 2005/2006 Renourishment Project equilibration. This included six monitoring transects (TS1 – TS6) and two control transects (TS7 and TS8). Transects monitored for impacts, TS1, TS2 and TS3, were established on the hardbottom formation located offshore of R49.5; TS4 was located on the hardbottom offshore of R50; and, TS5 and TS6 were established on the hardbottom formation offshore of the R50.5 to R51. Control transects TS7 and TS8 were located at the southernmost hardbottom formation (R51 to R51.5). These monitoring transects were evaluated during the pre-construction characterization studies in 2002 and 2003 and during post-construction monitoring between 2006 and 2009; therefore, substantial data exists on this habitat and continued monitoring would beneficially add to the dataset for the next renourishment.

Artificial Reef

The 1.5-acre artificial reef (AR) was installed as mitigation for the 2005/2006 renourishment of Longboat Key, and will be monitored through August 2011 as per permit conditions. Three 24-m^2 rectangular monitoring stations were installed on the artificial reef (named: AR Coral, AR Macroalgae and AR Control stations) and one station was installed on the adjacent natural hardbottom (Natural Control station) (see Figure 2). The active management methodologies applied on the artificial reef included macroalgae, octocoral, and stony coral transplants in designated subsections of each station. Each quarter of the station was treated (T) with transplants or left untreated (U); AT and BT quarters represent the percent cover of transplants in each subsection, where AT = 20% and BT = 5% (Figure 3). The twenty-four 1-m^2 quadrats that made up each station were monitored using BEAMR (see Section 3.1.1).

Turbidity

Turbidity testing was conducted during beach fill construction activities to monitor water quality near the borrow areas and the beach fill area in compliance with DEP and USACE permits; no water quality violations occurred (CPE, 2006).

3.0 MONITORING PLAN

3.1 Nearshore Natural Hardbottom Monitoring Transects

3.1.1 *Benthic Monitoring*

During each survey, qualified biologists/divers utilizing SCUBA equipment will visually inspect and video document the hardbottom areas along the transect lines. Monitoring at each compliance site will include an extensive ecological assessment using the Benthic Ecological Assessment of Marginal Reefs (BEAMR) methodology (Lybolt and Baron, 2006).

The BEAMR method is an *in situ* sampling technique to evaluate the benthic cover of macroalgal dominated marginal reefs and hardbottom formations. This method allows researchers to incorporate macroalgal and other benthic species into their analyses of benthic marine communities. It is a quadrat-based methodology that samples three characteristics of the benthos: physical structure, planar percent cover of sessile benthos, and coral density. Physical characteristics recorded from quadrats include the maximum topographic relief (cm) and the maximum sediment depth (cm). Estimates of the planar percent cover of all sessile benthos are pooled to 19 major functional groups that include: sediment, macroalgae, turf algae, encrusting red algae, sponge, hydroid, octocoral, stony coral, tunicate, bare hard substrate, anemone, barnacle, bryozoan, bivalve, *Millepora* spp., seagrass, sessile annelid, worm rock, and zoanthid.

Datasheets for BEAMR sampling have a standardized layout that prompts biologists to enter data in all fields (Figure 3). The maximum diameter (cm) and species of each stony coral (Scleractinia), and the maximum height and genus of each soft coral (Octocorallia), is recorded. The minimum area cover estimate in BEAMR methodology is 1%, based on presence; therefore, the area cover of organisms representing less than 1% is necessarily overestimated. Furthermore, macroalgae percent cover data are augmented by a breakdown of all genera exhibiting at least 1% cover, and sediment descriptors are collected describing the general texture (*e.g.* sand, shell-hash, or mud). As with all non-consumptive surveys, BEAMR is necessarily constrained to visually conspicuous organisms with well-defined, discriminating characteristics for identification.

The eight, 30-m transects that were permanently installed for the 2005/2006 beach renourishment will be monitored for the proposed nourishment. Monitoring will include 10, 0.5-m^2 quadrats sampled for benthos along each transect.

Quad Label: **Sample Name or #**		List indiv coral sp. size (cm), Macroalgae Genus %, Clionaid spg sp. % + Cyano %	% cover or max size (cm)
Max Relief (cm)			
Max Sediment Depth (cm)			
Sessile Benthos…	**% Cover**		
Sediment- (circle all: sand shell mud)			
Macroalgae- Fleshy+Calcareous			
Turf-algae+cyanobacteria			
Encrusting Red Algae			
Sponge			
Hydroid			
Octocoral			
Stony Coral			
Tunicate			
Bare Hard Substrate			
Clionaid sponge present?	Y or N		
other-…			

Figure 3. A quarter of a BEAMR datasheet. Each sheet provides space for eight quadrat assessments, four on each side.

3.1.2 *Line-Intercept for Sediment*

The line-intercept method has been shown to be an efficient method for collection of ecologically significant data on coral reefs (Loya, 1978). Line-intercept for sediment will be used to document sediment versus non-sediment cover and the location of physical transitions. These data provide greater spatial resolution than any other method and are readily employed along transects. A biologist will document the location of hardbottom boundaries interrupted by sand patches larger than 0.5 m in length to determine increased sand cover and/or movement along each transect.

3.1.2 *Video Documentation*

Video surveys will be conducted by a biologist using a digital video camera in a waterproof housing. Video of the seafloor along each transect will progress no faster than 5.0 m per minute along each 30-m transect line. Video will be recorded perpendicular to the seafloor at a precise height in order to obtain a visible width of imagery of 40 cm. A laser guidance (Figure 4) or equivalent system will be implemented to ensure divers maintain the appropriate height above the substrate to obtain the required imagery area.

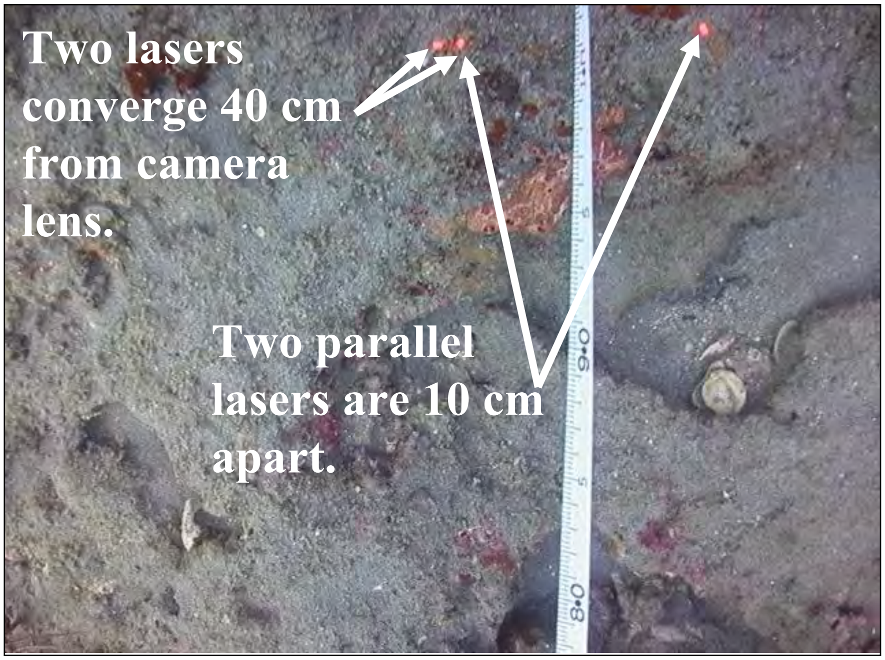


Figure 4. Laser guidance system used to maintain camera height during video documentation.

3.2 Fish Observations

Considering the limited underwater visibility characteristic of the nearshore zone of Longboat Key, formalized fish censuses are not proposed to be conducted during these investigations. A widely accepted method of fish census, the transect method, requires that the diver count all fish along an established transect line using timed and stationary counts. These methods are useful in areas where underwater visibility exceeds 3 m. With underwater visibility likely to be less than 3 m, CPE proposes to document fish species using a roving diver method. Observation and documentation of fish species in this manner does not provide the qualitative or quantitative data required to evaluate populations, but does provide an indication of reef fish assemblages associated with the natural and artificial habitats offshore of Longboat Key. A list of observed species and general size classes and numbers will be included in the final report prepared as a result of these investigations.

3.3 Hardbottom Edge Monitoring

Hardbottom margins that fall within the ETOF will be mapped by recording the position of a diver swimming along the most prominent hardbottom-sand interface, *e.g.* ignoring isolated mobile rubble in the midst of sand. The diver will tow a buoy with a DGPS antenna mounted on it, attached by cable to a positioning system, interfaced to the HYPACK Hydrographic Data Collection and Processing Program with correction from a U.S. Coast Guard Navigational Beacon. The buoy will be on the shortest possible tether, such that it is directly over the diver's head.

Hardbottom edge mapping will be conducted on the hardbottom formation where monitoring transects TS1 – TS3 are located (see Figure 2) since this area is anticipated to be impacted by nourishment fill. The hardbottom edge delineation will be presented in a GIS product deliverable on the most up-to-date aerial photographs and will be included in each monitoring report. A narrative description of notable trends and observations will be included as well.

4.0 Monitoring Schedule

The artificial reef and natural hardbottom have previously been monitored in May/June and August/September. Subsequent monitoring of the natural hardbottom should continue at one of these two timeframes in order to reduce the effects of seasonality to the existing dataset. Monitoring is recommended at the following timeframes: baseline, pre-construction, immediate post-construction, annually for the following three years, and two years after the last event for a total of seven monitoring events. The following table gives a hypothetical monitoring schedule if construction were to end in May 2014. The Monitoring Event names are subject to change based on construction and monitoring timing.

Monitoring Event	Timeframe
Baseline	May/June 2011
Pre-Construction	May/June 2013
Immediate Post-Construction	May/June 2014
12-Month Post-Construction	May/June 2015
24-Month Post-Construction	May/June 2016
36-Month Post-Construction	May/June 2017
60-Month Post-Construction	May/June 2019

5.0 Product Development and Submittal

Within 120 days of completion of each monitoring event, a report will be prepared that presents a biological assessment of the natural hardbottom community. The natural hardbottom transects will be compared over time to determine if project effects exist. Parametric and non-parametric statistical analyses will be used to determine if and where significant differences exist over time and space.

The report deliverable will include the methods utilized for data collection, the results of the data analysis and discussion of the results. A GIS product will be included to present transect and station locations along with hardbottom resource mapping results and project/estimated toe of fill limits.

Literature Cited

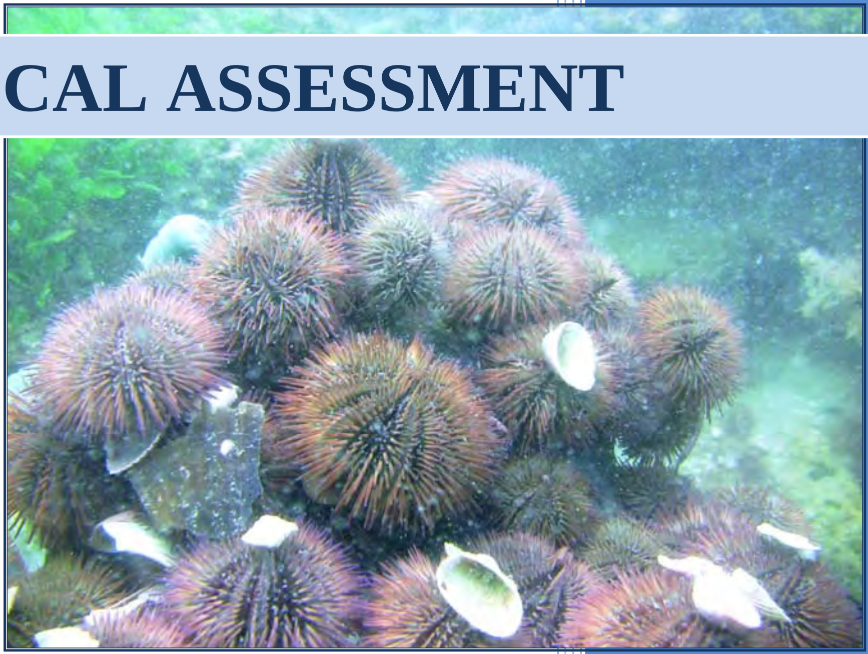
Coastal Planning & Engineering, 2006. Town of Longboat Key 2005-2006 Beach Nourishment Project - Project Completion Report. Boca Raton, Florida. 15 pp.

Lybolt, M. and R. Baron, 2006. BEAMR (Benthic Ecological Assessment for Marginal Reefs): a preferred replacement for AGRRA and similar benthic assessment methods tailored for marginal reefs. Proceedings from the 2006 ISRS European Meeting. Bremen, Germany.

APPENDIX 2

BIOLOGICAL ASSESSMENT

February 2011
Revised



BIOLOGICAL ASSESSMENT

Prepared for the Bureau of Ocean Energy Management, Regulation and Enforcement,
Department of the Interior
and
U.S. Army Corps of Engineers – Jacksonville District,
Department of Defense
In Support of Section 7 (ESA) Consultation for the
Town of Longboat Key Beach Renourishment Project
Town of Longboat Key, Florida

Prepared by
Coastal Planning & Engineering, Inc.
Boca Raton, Florida

BIOLOGICAL ASSESSMENT
LONGBOAT KEY BEACH NOURISHMENT PROJECT

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LONGBOAT KEY BEACH NOURISHMENT PROJECT

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1.0 PROPOSED ACTION

This Biological Assessment follows the presentation as recommended by NOAA's National Marine Fisheries (NMFS) Southeast Regional Office (SERO) and is organized to provide a clear understanding of the project and potential effects to federally listed (threatened and endangered) species and critical habitat that occur in the action area. A request was made by the U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) to integrate three chapters that NMFS normally separates into one chapter. Therefore, effects of the proposed action, conservation/mitigation measures, and effects determination are all presented in Section 7.0. Sections 8.0 and 9.0 present summaries of the conservation measures to be applied and the determination of effects, respectively.

Longboat Key (LBK) is located on the central west coast of Florida and includes portions within both Manatee and Sarasota Counties (Figure 1). The shoreline of LBK extends for approximately 10 miles and is mainly occupied by private residences and resort communities. There are public beach access areas along the Key. In accordance with its Comprehensive Beach Management Plan (CPE, 1995, 2008) to protect this beach infrastructure, the Town is seeking a 10-year permit for continued multiple nourishments of Longboat Key's shoreline from R44 in Manatee County to R29 in Sarasota County. An interim nourishment is proposed for Fiscal Year (FY) 2011/2012 that will utilize sand from borrow areas (F2 and B3) located in both State and federal waters. Borrow area F2 is located in federal waters and borrow area B3 is located in State waters. The interim phase will place sand in hot spots from R44 to R46a and R47.5 to R50.5 in Manatee County, and from R12 to R17 in Sarasota County. The interim nourishment will require approximately 310,000 cy of sand. The Town also intends to nourish the entire island of Longboat Key in FY2013/2014, or later, using sand from borrow areas IX (previously permitted), X (new), and remaining portions of F2 not falling within the Port Dolphin pipeline corridor. As presently conceived, fill will be placed from: R44+220-R45.5, R47-R50, and R67 in Manatee County to T1 in Sarasota County, R13-R17 and R21-R29 in Sarasota County. Sand placed between R47 and R50.5 in Manatee County will be trucked in from an inland sand mine to limit environmental impacts to nearshore hardbottoms. Trucked in sand may be placed twice within the 10-year period. The total estimated volume for the island-wide phase is 865,000 cy. In the event of changes in beach conditions prior to FY 2013/2014, sand may need to be placed in other reaches of the Longboat Key shoreline.

The BOEMRE and the U.S. Army Corps of Engineers (USACE), have regulatory authority over different aspects of the proposed project. The project will be permitted but not funded by the USACE. The proposed project requires authorization from the BOEMRE for the use of Outer Continental Shelf (OCS) sand resources under the Outer Continental Shelf Lands Act, as well as a permit from USACE under Section 404 of the Clean Water Act and Section 10 of the Rivers and Harbors Act for dredging of any state borrow area, conveyance, and placement of sand resources. The USACE does not have Section 10 jurisdiction over the proposed OCS borrow area since it is located further than nine (9) nautical miles offshore.

Although the various sand sources will be used toward the same goal of nourishing Longboat Key's beaches, there are federal actions which result from the BOEMRE's and USACE' distinct federal authorities. The purpose of the coupled federal actions is to authorize the project proponents to dredge the sand resources and then construct a beach nourishment template that will reduce shoreline erosion, enhance beach habitat, and protect valuable infrastructure along Longboat Key. The most efficient vehicle for the required Endangered Species Act (ESA) Section 7 consultation would be the designation of one lead agency for the entire project which would evaluate all interrelated and interdependent actions (50 CFR 402.07). However, this preferred approach is not possible here since, under the National Marine Fisheries Service's Gulf of Mexico Regional Biological Opinion for Hopper Dredging (GRBO; NMFS 2003, rev. 2005, rev. 2007), BOEMRE authorization of dredging activities on the OCS is specifically excluded. The BOEMRE has previously coordinated an approach with NMFS where the BOEMRE will serve as lead agency for the portion of the project associated with dredging operations on the OCS. The permitting action of the USACE for borrow areas within State waters will be covered under the NMFS GRBO. Any incidental take of species under NMFS purview will be assigned accordingly to the respective Biological Opinions. The USACE will serve as lead agency for the Section 7 consultation with U.S. Fish and Wildlife Service (USFWS) for this project.

The purpose of this Biological Assessment is to review the proposed actions in sufficient detail to determine to what extent these actions may affect any threatened, endangered or proposed species and designated or proposed critical habitats. This information is provided to comply with statutory requirements to use the best scientific and commercial information available when assessing risks posed to listed and/or proposed species and designated and/or proposed critical habitat by proposed federal actions. This report is prepared in accordance with legal requirements set forth under regulations implementing Section 7 of the Endangered Species Act (50 CFR 402: 16 U.S.C. 1536 (c)).

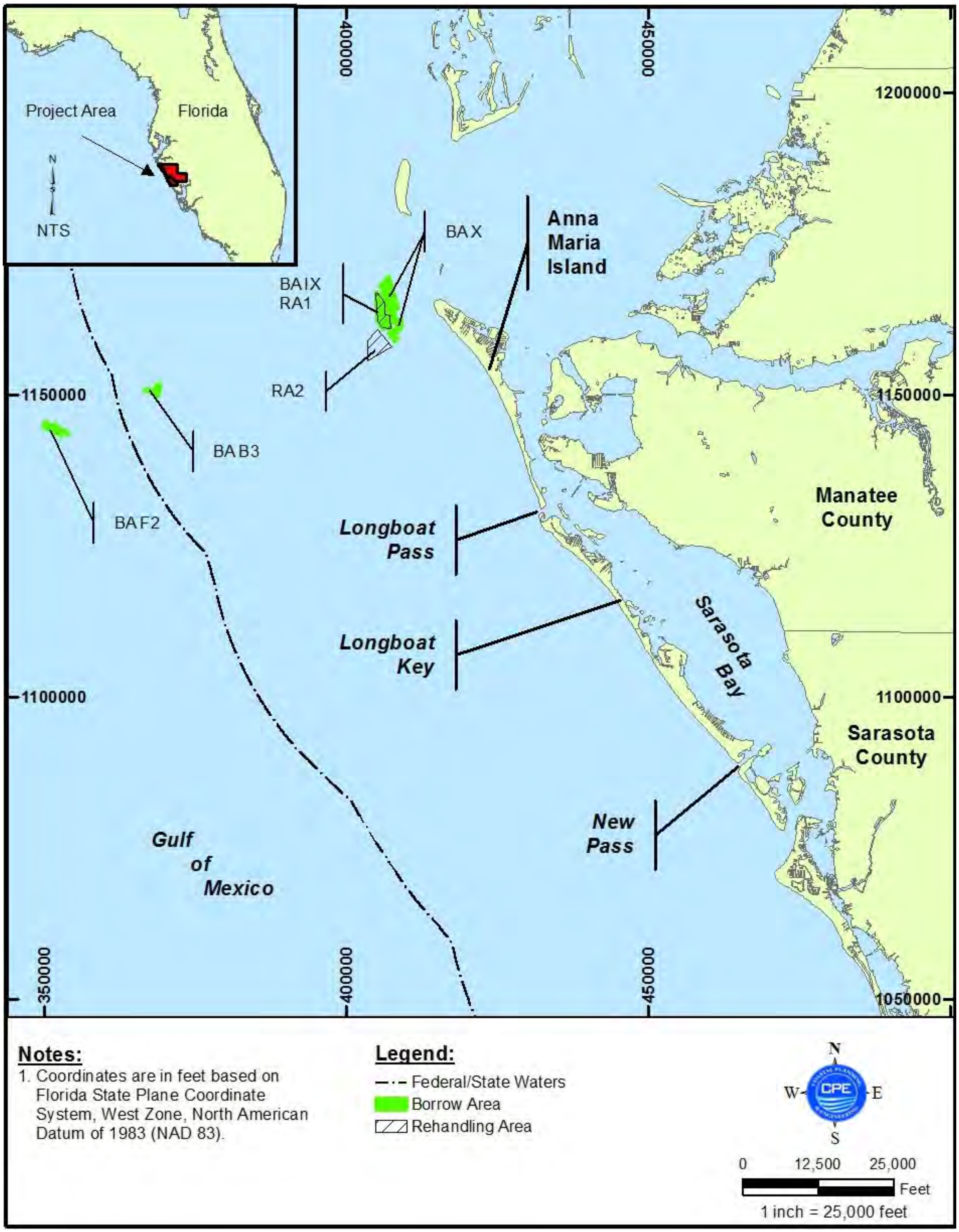

Figure 1. Project location map for the Longboat Key Beach Nourishment Project depicting proposed offshore and inshore borrow areas (BA) and rehandling areas.

2.0 PROJECT DESCRIPTION

The Town of Longboat Key is seeking a 10-year permit for continued multiple nourishments of Longboat Key's shoreline from R44 in Manatee County to R29 in Sarasota County. The proposed project includes island-wide placement of approximately 865,000 cy of sand along Longboat Key in FY2013/2014 (or later) with an interim nourishment phase planned for FY2011/2012 that will place 310,000 cy of sand along three discrete stretches of shoreline from R44 to R46a and R47.5 to R50 in Manatee County and from R12 to R17 in Sarasota County. The interim phase will utilize sand from offshore borrow areas located in State and federal waters and which fall within the path of the Port Dolphin LNG Pipeline route (FDEP File No. 41-0286121-005), construction of which is projected to commence in July 2012; therefore, sand resources must be extracted prior to pipeline construction when the sand resources will become inaccessible. The details of the project actions are described below.

2.1 Dredging Operations

2.1.1 Pipeline Corridors

Eight pipeline corridors within State waters were cleared as no-impact corridors during the 2005/06 island-wide beach renourishment project that may be utilized for the proposed project actions. The pipeline corridors extend from the shoreline out to the 30-ft depth contour and range in width from 400 ft to 2,500 ft. Although the corridors are primarily softbottom, sidescan sonar surveys revealed several patches of hardbottom within the corridors; however, the contractor will be instructed to avoid these resources in a manner that was successfully implemented in 2005/06. The pipeline will be laid and removed as project progress is made along the shoreline. There is the potential for two pipelines to be deployed at one time if the contractor has the resources to do so.

2.1.2 Borrow Areas

Four borrow areas are proposed for the planned nourishments. Two of the borrow areas are located offshore: BA-F2 is located in federal waters approximately 12 miles offshore of Anna Maria Island (AMI) in Manatee County, Florida and BA-B3 is on State of Florida sovereign submerged lands approximately 9 miles offshore of AMI. One previously permitted borrow area, BA-IX, and newly designed BA-X, are also proposed as sand resources. Both borrow areas are on State of Florida sovereign submerged lands less than 2 miles northwest of AMI (Figure 1).

Borrow areas F2 and B3 are located within the proposed Port Dolphin pipeline corridor and will be dredged first in order to remove the sand prior to the planned pipeline construction in July, 2012 (see Section 3.2). A medium-sized hopper dredge will excavate and transport the sand to the seaward end of the submerged pipeline for placement in the fill areas. It is anticipated that the dredge will move approximately 10,000 cy of sand per day, resulting in up to four round-trips from the borrow area to the pipeline per day. Table 1 presents the volume of sand that will be dredged from each borrow area and total duration of dredging activity that will occur for the interim nourishment.

Table 1. Borrow area volumes and dredging duration for the interim nourishment phase. BA-F2 is in the federal waters of the OCS and BA-B3 is in state waters.

BORROW AREA	Total Volume per Borrow Area	Minimum Volume to be Dredged from Port Dolphin Corridor	Duration of Dredging†
F2	668,200 cy	196,300 cy	31 days
B3	141,100 cy	76,400 cy	

†Assuming 10,000 cy of sand are excavated per dredge day. Weather, equipment failure, etc. may prolong this timeframe.

Borrow area IX abuts BA-X, which lies directly east of BA-IX. Borrow area IX was used during the 2005/06 beach nourishment project. No changes in the design of the borrow area have been made. The remaining volume in BA-IX has been calculated as 2,120,000 cy. Approximately 133,000 cy will be dredged from this borrow area during a separately permitted emergency nourishment at the north end of Longboat Key scheduled for March 2011 (see Section 3.1). Borrow area X contains approximately 3,753,000 cy (Table 2). Because of the fine white sand located in to BA-F2, the remainder of this borrow area (up to ~400,000 cy) will likely be dredged first, followed by dredging from BA-IX. Any remaining volume required to fill the template will be obtained from BA-X.

Dredging BA-X and the shallow portions of BA-IX by medium sized hopper dredges may be precluded by the shallow nature of these borrow areas. Dredging of these areas by small hopper dredges is feasible, but the transport of the sand to Longboat Key is usually not cost effective. Because of the shallow borrow areas, two rehandling areas have been proposed. The sand will be excavated by a shallow-draft hopper dredge or cutterhead dredge from BA-X and the shallow portions of BA-IX and deposited by bottom dumping using a hopper, or discharging from a vertically oriented cutterhead discharge pipe into either of the rehandling areas. Rehandling Area 1 (RA1) is the excavated portion of BA-IX and Rehandling Area 2 (RA2) is a section of the Gulf of Mexico approximately 1 mile southwest of BA-IX and BA-X. The sand would be deposited in these areas, to be re-dredged and transported to the beach pipeline by a deeper-draft, medium or large hopper dredge.

Similar to dredging operations during the interim nourishment phase, approximately 10,000 cy of sand may be transported from the rehandling areas to the beach pipeline each day of dredging, taking approximately 87 days to complete. However, speed of transport from the shallow portions of the borrow areas to the rehandling areas will depend on the type of dredge used. A small hopper dredge may accomplish 20 cycles per day to transport 20,000 cy of sand, whereas a cutterhead may move as much as 40,000 cy per day. These smaller dredges may work ahead of or concurrently with the larger hopper dredge moving sand to the beach.

In addition to offshore sand sources, approximately 200,000 cy of sand will be trucked in from either E.R. Jahna’s Green Cay mine or Surface Prep Supply mine in Davenport as part of the island-wide nourishment. The trucking operation will occur twice within the duration of the permit in order to limit the volume of sand on those profiles and avoid impacts to nearshore hardbottoms.

Table 2. Borrow area volumes available for the island-wide nourishment phase.

BORROW AREA	AVAILABLE VOLUME PER BORROW AREA
Upland source (trucked)	~ 200,000 cy
F2*	471,900 cy
IX	2,120,000 cy
X	3,753,000 cy

*Accessible volume remaining after placement of Port Dolphin natural gas pipeline.

2.2 Impact Factors

2.2.1 Sedimentation and Turbidity

During construction, elevated turbidity and sedimentation levels will occur at the dredge, rehandling, and the fill sites, but are not anticipated to extend beyond the duration of construction activities. Sedimentation can smother corals on adjacent reefs or hardbottom resources and reduced water clarity deprives corals of light necessary for photosynthesis (Rogers, 1990). Turbidity monitoring will be conducted at the dredge and fill sites to ensure turbidity levels outside the designated mixing zone do not exceed State water quality standards (29.0 NTU above background). During the 2005/06 project, turbidity levels never exceeded 29.0 NTU above background at the dredge nor the fill site. Similarly, Gilliam *et al.* (2006) conducted five years of pre-nourishment monitoring to collect sediment data on reefs in proximity to borrow area sites in Broward County. Sampling continued throughout construction revealing that sedimentation levels near the borrow area were elevated during construction but generally remained within the range identified during pre-construction sampling. In addition, buffer zones around hardbottom resources can reduce the potential for negative impacts due to increased turbidity and sedimentation.

2.2.2 Burial

Loss of nearshore hardbottom resources can occur from construction of beach nourishment projects, either through direct burial during placement or subsequent equilibration of fill. Mitigative artificial reefs were placed to compensate for a predicted loss of 1.5 acres of nearshore hardbottom resources due to impacts from the 2005/06 nourishment of Longboat Key. Post-construction monitoring of these nearshore hardbottom communities demonstrated that the 1.5 ac was not exceeded. Fill volumes for the interim and island-wide nourishment phases will not exceed those of the 2005/06 project; therefore, any burial of nearshore hardbottom from the project is repetitive of the 2005/06 project and has already been mitigated for. No additional impacts are anticipated.

2.2.3 Entrainment

Sea turtle entrainment is a potential impact of hopper dredging operations; therefore, the use of turtle trawlers are proposed to reduce sea turtle mortality. Shrimp trawlers have been successfully used to capture sea turtles for relocation and research since the early 1980s (Bargo *et al.*, 2005). For research, turtles are generally captured for tagging purposes; however, relocation is implemented during periods when hopper dredging is imminent or ongoing (NMFS NE Biological Opinion F/NER/2003/00302). During dredging for the 2005/2006 renourishment of Longboat Key, the turtle relocation trawler captured and removed 129 turtles from the dredging areas using the methods described above. This included 74 loggerheads (*Caretta*

caretta), 41 Kemp's ridley (*Lepidochelys kempii*), 12 greens (*Chelonia mydas*), and 2 hawksbills (*Eretmochelys imbricata*).

Other fauna that may be impacted by dredge entrainment include fish, invertebrates, and manatees. Dredging operations are shutdown when manatees are observed within 50 ft of the dredge to reduce injury or mortality.

2.2.4 Strike

The most significant threat to the Florida manatee is death or serious injury from watercraft strikes. In Florida, 38 manatee deaths were attributed to watercraft in 2008, comprising 24% of total manatee mortality state-wide (FWC, 2009). During construction, vessels will travel between the rehandling areas, borrow areas, and the seaward end of the pipeline corridor, as well as back and forth to port. Standard manatee protection measures will be implemented to minimize potential impacts to manatees during construction which include all vessels maintaining idle speed within the construction area and no wake speed when the draft of the vessel provides less than four feet of clearance from the bottom (Appendix 2). All sightings of manatees shall be documented and submitted to Florida Fish and Wildlife Conservation Commission Bureau of Protected Species and to the USFWS. Other marine mammals such as whales are not likely to occur within the project area, although northern right whales have recently been observed transiting the project area.

2.2.5 Noise

It has been hypothesized that the noise associated with dredging activities can trigger an avoidance reaction in marine mammals and may interrupt fish migrations (Clarke *et al.*, 2004; Thomsen *et al.*, 2009). Noise is generated from vessel travel between sites and the dredge process. Clarke *et al.* (2004) found that cutterhead dredging operations are relatively quiet compared to other sounds in aquatic environments, whereas hopper dredges produce somewhat more intense sounds. If dredging activities cause local fauna to abandon an area for long periods of time (months-long dredging projects), measurable impacts may occur such as reduction sin local populations. Thomsen *et al.* (2009) conducted a field study to better understand if and how dredge-related noise is likely to disturb marine fauna. This study found that the low-frequency dredge noise would potentially affect low- and mid-frequency cetaceans, such as bottlenose dolphins. Manatees have trouble distinguishing low frequency noises (Gerstein, 2002), and prefer habitats with less low frequency noise (Miksis-Olds *et al.*, 2007). This suggests that manatees may avoid areas where dredging activities are taking place and thus reduce the chance of dredge-manatee interactions. Fish with swim bladders appear to be more affected than those without and so far, studies indicated that invertebrate hearing is poor compared to other marine life; however, little is known about invertebrate hearing capabilities at all.

3.0 PREVIOUS COORDINATION

3.1 History of Beach Nourishment on Longboat Key

On March 22, 1991, the USACE published Public Notice number 199100296 (IP-MN) for the initial nourishment of a 9.3-mile section of Longboat Key shoreline between Florida Department of Environmental Protection (FDEP) monuments between R47 in Manatee County to R29 in

Sarasota County. The initial Longboat Key Beach Restoration Project was constructed from February through August 1993, with a total volume placed of 3,336,000 cubic yards (cy) of white sand fill dredged from the ebb shoals of Longboat Pass and New Pass; however, the material subsequently eroded during the active hurricane season of 1995. The project also removed 5,751 tons of derelict groins and coastal structures and created one artificial reef.
In the Public Notice dated March 28, 1996, the USACE stated that the applicant proposed to renourish the shoreline of Longboat Key between FDEP monuments R14 and R65 during the sea turtle nesting season. On October 16, 1996, the USFWS provided the USACE with a Biological Opinion (BO) (Log Number 4-1-96-F-396).

The Mid-Key interim beach nourishment project was constructed between October 1996 and February 1997, and extended from R62a in Manatee County to R14 in Sarasota County. Approximately 891,000 cy of coarse grey sand was dredged from an offshore borrow area (BA), labeled BA-Va, for placement along the 3.1 miles of shoreline.

In February 1997, the second island-wide renourishment of Longboat Key was constructed. The project renourished Longboat Key within the original project footprint, but the applicant requested to increase the amount of fill material by 100,000 cy in the southern portion of the project.

Longboat Pass and New Pass were dredged for maintenance in July and August-September 1997, respectively. Approximately 109,000 cy of fill from Longboat Pass was placed from R44+48' to R46a and R48+722' to R51 (1.0 mile) in Manatee County. Approximately 171,200 cy was dredged from New Pass and placed along 0.8 miles from R22+584' to R27+415' in Sarasota County.

In early 1998, 2,000 cy of sand was dredged from Greer Island channel and placed on the north side of North Shore Drive, near R45 in Manatee County.

On April 3, 2001, FWS provided a letter to amend their 1996 BO to reflect the modification of the project description. The 2001 Beach Nourishment Project was construction between April 24 and May 2, 2001 with 105,300 cy of coarse grey sand placed from R10.5 to R14 in Sarasota County. The sand was dredged from offshore BA-Va and was constructed to mitigate sand losses caused by Hurricane Gordon.

New Pass was dredged for maintenance in 2003 as part of the USACE maintenance dredging program. Approximately 99,800 cy of sand was placed on the south end of Longboat key from T22 to R28 in Sarasota County.

The 2005/06 renourishment placed 1,789,332 million cy of sand on 10 miles of shoreline from FDEP monument R44.5 in Manatee County to R29.5 in Sarasota County. The project began in April 2005 and was completed in July 2006. The fill design for this nourishment included sections of the island to be filled with a dual layer of both coarse and white sand while other sections were filled with white sand only. In the dual layer sections, white sand was placed on top of coarse sand from elevation +3 to +6 ft NAVD. Of the total volume placed, 737,683 cy was course grey sand dredged from BA-VIa and 1,051,649 cy was fine white sand dredged from BA-

IX. The dual layered fill was placed in three sections, extending from the northern tip of Greer Island (170 ft north of R44) to R50.5, T1 to R7, and R9 to T15. White sand fill only was placed in the gaps between the dual layer fill sections for the extent of the fill template (R44-170' to R29.5). The purpose of the coarse sand was to slow the rate of erosion at the hotspot erosion areas of the island.

In 2010, there were three permit applications under review for projects on Longboat Key: application for an island-wide beach renourishment, the north end emergency nourishment, and breakwaters at the north end of the island. The application for an emergency nourishment at the north end of the island was submitted on March 24, 2010. On May 10, 2010, the USACE submitted a letter to USFWS requesting formal consultation. The applicant proposed to place 133,000 cy of white sand from BA-IX along a 4,015-ft (1,224-m) length of eroding beach on the north end of Longboat Key. The project's main objective is to restore the beach from R43 to R47.5. On May 27, 2010, FWS submitted a draft BO for the USACE to review. On May 28, 2010, the applicant provided comments on the draft BO. The final BO for nourishment of the north end of Longboat Key (R43 to R47.5) was provided to USACE June 11, 2010. The FDEP permit was issued September 13, 2010; the USACE permit was issued November 16, 2010. Notice to Proceed was issued by the FDEP January 12, 2011. This project is scheduled to begin in February, 2011 and be completed by April 30, 2011.

An application to construct segmented breakwaters at the north end of Longboat Key was submitted on May 21, 2009. Responses were generated to satisfy State and federal agencies' requests for additional information. On January 17, 2011, a request was submitted to FDEP and USACE to put the breakwater project application on hold while the Town evaluates the coastal processes of the north end through an inlet management study.

The subject beach renourishment application was originally submitted as an island-wide-only renourishment project on May 6, 2009; however, a modification was submitted on January 27, 2011 based on the Town of Longboat Key's desire to immediately address hotspot erosion utilizing sand from the Port Dolphin Pipeline route, and pursue the island-wide nourishment in FY 2013/2014 or later. This Biological Assessment is being prepared in support of this application.

3.2 History of Port Dolphin LNG Pipeline and Relevance to Project

On March 29, 2007, Port Dolphin Energy LLC (Port Dolphin) submitted to the U.S. Coast Guard (USCG) and Maritime Administration (MARAD) an application under the Deepwater Port Act of 1974 (DWPA) for all federal authorizations required for license to own, construct, and operate a deepwater port off the coast of Florida. On June 15, 2007, USCG notified Port Dolphin that the application contained sufficient information to continue processing, and on June 25, 2007, the USCG and Maritime Administration issued a Notice of Application in the Federal Register summarizing the application (Public Docket: USCG-2007-28532).

The Town of Longboat Key became aware of the Port Dolphin project in May 2008 when the Draft Environmental Impact Statement was released. Town concerns were expressed regarding the position of the proposed pipeline corridor over permitted sand resources and sand resources identified for future use, including those planned for use in this project. Further discussion resulted in the submittal of the Port Dolphin LLC Deepwater Port License Application, Addendum II on December 18, 2008. Addendum II provided an additional pipeline re-route to avoid already permitted sand resources as requested by Manatee County and the Town of Longboat Key.

The Town of Longboat Key is currently working to obtain a permit to utilize sand resources in federal waters that will become inaccessible once construction of the Port Dolphin LLC Deepwater Port begins. Borrow area F2 lies approximately 12 miles directly west of Anna Maria Island. Once a lease for mining rights to BA-F2 is obtained from BOEMRE, material from this borrow area, along with sand from borrow area BA-B3, will be used first in the proposed interim nourishment phase in 2011/2012. Additional sand from portions of BA-F2 that do not fall within the Port Dolphin Pipeline corridor and will therefore remain accessible will be used in the subsequent island-wide nourishment phase and may be used in future placement projects.

4.0 DESCRIPTION OF AFFECTED ENVIRONMENT

The following is a description of the existing environmental resources located within the project area, with emphasis on those natural resources that are capable of supporting listed threatened and endangered species which may occur within the action area.

Longboat Key is one of the many barrier islands, or linear islands of sand, that parallel much of the coastline of Florida. Typically, the waterward profile of these islands is composed of a sandy beach backed by vegetated dunes. Barrier islands along the southwest coast of Florida naturally migrate landward, and experience growth of spits from headlands, overwash, and breaching. (Johnson and Barbour, 1990). However, due to encroachment of condominiums and hotels, and interruptions in the shoreline caused by seawalls, artificially maintained inlets, and other coastal armoring, these natural processes can be stunted. Dune formation is often limited and erosion of beaches occurs in many places, as seen in Longboat Key.

4.1 Dune Environment

Barrier islands are dynamic environments, with topographic and vegetation profiles dictated by the interaction of plant growth and physical processes such as wind-driven sand movement and salt spray, and wave-driven erosion and accretion (Johnson and Barbour, 1990). High temperatures, strong winds, and varying wet and dry conditions typical of a dune environment along south Florida’s barrier island system provide unique conditions for plant species with specific adaptations. These specific adaptations include extensive root systems, allowing for

Photograph 1. Limited dune vegetation typical of the developed portions of shoreline along Longboat Key.

prolific growth in unconsolidated beach sand. Sand dunes and vegetation that comprise the dune system are important recreational and wildlife habitat areas and provide coastline protection from storm surge. Dunes are important reservoirs for sand, replacing beach material lost through erosion. Dunes also provide important protection to the island from storms and hurricanes. However, the extent of dune habitat is limited in the project area due to the developed nature of Longboat Key's shoreline (Photograph 1). Currently, narrow low dunes are present throughout the length of the island, interrupted in some places by seawalls. Although the proposed project does not include any fill placement on the existing dunes, widening the beach area fronting the dunes will offer additional protection and stabilization to the dune system.

4.2 Beach Environment

Eroded material from the dune system contributes to the dry beach located between the toe of dune, or scarp, and the mean high water (MHW) line. The dry beach area does not support much vegetation and is susceptible to wind and storm surge. However, this habitat type provides recreational areas for humans and nesting grounds for sea turtles and shorebirds. The intertidal zone, or wet beach, of oceanfront barrier island beaches is the area periodically exposed and submerged by waves, varying with frequency and with lunar tide cycles. These areas are comprised mainly of sandy bottoms and are influenced by tidal changes. This high energy area is habitat to many benthic and infaunal organisms and offers foraging grounds for birds and finfish.

The action area of this project includes approximately 9.8 miles of shoreline and adjacent, non-project sections of the beach within Manatee and Sarasota Counties. Beach habitat has been highly eroded in some places along Longboat Key (Photograph 2), and the project proposes widening and increasing the elevation of the existing low and narrow beach along the entire stretch of Longboat Key. By widening the existing beach and stabilizing the eroded shoreline this project will create and improve existing beach habitat, thereby improving recreation and wildlife areas such as sea turtle nesting habitat, and providing greater levels of storm protection for the island.

Photograph 2. Illustration of erosion typical along Longboat Key.

4.3 Subtidal Habitats

4.3.1 Softbottom Communities

Subtidal habitat within the project area includes sandy, unvegetated softbottom marine habitat. Submerged aquatic vegetation occurs near the project area, within adjacent passes and Sarasota Bay and can occasionally be found in small patches offshore; however, no seagrass resources have been observed within the project area based on previous surveys (see Figures 2a-d). Softbottom, subtidal habitats consisting of various percentages of sand, sand-gravel and shell comprise the dominant benthic habitat along both Florida coasts. The unvegetated, softbottom subtidal areas are important habitats for benthic organisms living on (epibenthos) or within (infauna) the sediment, providing for high species diversity. Spatial and temporal gradients (*i.e.* salinity, temperature, water quality and sediment type) affect both community composition and diversity. The fauna is typically dominated by polychaete worms, crustaceans, mollusks and insect larvae (Myers and Ewel, 1990). The benthos is an important element in the food web, providing food for wading birds, shorebirds and fish.

Epibenthic softbottom communities have previously been sampled and described at four sites in the vicinity of the project area, which included three previously permitted borrow sites (Longboat Key, the ship channel off Egmont Key, and Manasota Key site) and an undredged site (Sarasota) (Blake *et al.*, 1996). A total of 41 different taxa were observed during the study, indicating the low species richness and constancy of the dynamic sandy habitat in this area. Approximately 120 hours of underwater video was recorded over the study sites during which observations of flora and fauna were rare.

Benthic infaunal communities were also sampled and described as part of the Blake *et al.* (1996) study, which revealed much higher taxonomic richness and abundances compared to the epibenthic community: 620 infaunal taxa were found compared to 41 epibenthic taxa. Annelids, mollusks, and arthropods contributed 44%, 22%, and 27% of the taxa, respectively. These three taxonomic groups represented 93% of the taxa and 89% of all fauna. Results indicated that three of the borrow sites studied supported a healthy, diverse infaunal community.

4.3.2 Hardbottom Habitat

Nearshore. The term “hardbottom” refers to areas of rock or consolidated sediments in temperate, subtropical, and tropical regions, generally located in the ocean rather than in the estuarine system. Hardbottom habitats provide food, shelter, spawning and nursery areas to a wide variety of fish, invertebrate and algal species.

In 2002, CPE conducted a side-scan sonar survey of the nearshore region between Florida Department of Environmental Protection (FDEP) survey control monuments R42 (Longboat Pass in Manatee County) and R29.5 (New Pass in Sarasota County), along approximately 10 miles of shoreline. The survey documented three hardbottom formations located in the nearshore between R49 and R51.5 representing approximately 14 acres (see Figures 2a-d). The hardbottom formations are generally low relief (<2 ft) and some portions are ephemeral in nature.

These 14 acres of nearshore hardbottom habitat were documented and characterized within the 2005/06 beach renourishment project area; four years of bi-annual monitoring surveys were conducted on the artificial reef and nearshore natural hardbottom habitats between 2005 and 2009. Monitoring revealed a community dominated by turf and macroalgae species (Photograph 3). The macroalgae community primarily consisted of *Hypnea, Gracilaria, Codium*, and *Sargassum* species. *Dictyota, Caulerpa,* and *Padina* were also frequently observed. A total of 21 macroalgae genera were identified on the nearshore natural hardbottom throughout monitoring.

Tunicates and sponges dominated the invertebrate community. The sponge community was found to mainly consist of the bioeroding sponges *Cliona celata* and *Pione lampa*. Coral cover in the nearshore benthic community was generally less than 1%. *Leptogorgia virgulata* and *Leptogorgia hebes* were the primary octocoral species encountered; the stony coral community included *Solenastrea* spp., *Siderastrea siderea, Phyllangia americana, Oculina robusta,* and *Cladocora arbuscula*. The average size of stony coral colonies in the nearshore habitat is small (<3cm).

Photograph 3. Macroalgae community on the nearshore natural hardbottom of Longboat Key.

The Town of Longboat Key constructed 1.5 ac of artificial reef as required mitigation for anticipated impacts to 1.5 ac of the nearshore natural hardbottom described above. These installations were monitored simultaneously with the nearshore hardbottom in conjunction with the 2005/06 renourishment. By four years post-deployment, the artificial reefs appeared to have a benthic community that was functionally similar to the natural hardbottom.

Offshore. Hardbottom formations have been identified through sidescan sonar surveys conducted by CPE of the area surrounding BA-F2 and BA-B3 (Forrest-Vandera *et al.*, 2011) (Figure 3). Hardbottom resources in the vicinity of BA-F2 and BA-B3 within the Port Dolphin pipeline route were assessed by Continental Shelf Associates, Inc. (CSA) between August and December 2006 using towed video and *in situ* diver verification. The benthic resources in proximity to the offshore borrow areas were characterized as having between 20% to 100% epibenthic cover (habitat A), 5% and 20% epibenthic cover (habitat B), and less than 5% epibenthic cover (habitat C) (CSA, 2007). The towed video and diver photo-documentation revealed the hardbottom resources to be dominated by macroalgae and supporting stony corals, including *Solenastrea hyades.* Macroalgae genera observed included *Caulerpa, Gracilaria, Codium, Halimeda* and *Hypnea. Caulerpa* was the most abundant macroalgae observed in the photo-documentation.

CPE has conducted benthic assessments of offshore hardbottom communities near borrow areas associated with other projects along the central gulf coast. Offshore of Siesta Key in Sarasota County, south of the project area, CPE biologists characterized and monitored multiple hardbottom formations adjacent to borrow areas used for the nourishment of South Siesta Key. These formations were low-relief (<1 ft) and supported macroalgae-dominated benthic communities. Scleractinian corals were present at all formations, but octocorals were rare to absent, depending on the site. The most abundant stony coral species included *Solenastrea hyades*, *Oculina robusta,* and *Siderastrea* spp. All areas showed strong seasonality in benthic composition, primarily in macroalgae phyla abundance. Green (Chlorophyta) algae of the genus *Caulerpa* dominated during the warmer months, and then died back when cold water temperatures set in, leaving various red algae (Rhodophyta) dominant.

FIGURE 2a.

Figure 2b.

Figure 2c.

Figure 2d.

Figure 3.

5.0 DESCRIPTION OF SPECIES BIOLOGY

Table 3 lists all federally listed threatened and endangered species that have the potential to occur within the region based on each species' distribution and habitat preference, as determined by NMFS Southeast Regional Office and USFWS. There is no critical habitat designated for any of the listed species that may be present in the project area.

Table 3. Federally endangered and threatened species in the Gulf of Mexico.

COMMON NAME	SCIENTIFIC NAME	USFWS/NMFS	Project Area Within Known Species Range?
SEA TURTLES			
Loggerhead	*Caretta caretta*	T	Y
Green	*Chelonia mydas*	E[1]	Y
Leatherback	*Dermochelys coriacea*	E	Y
Hawksbill	*Eretmochelys imbricata*	E	Y
Kemp's ridley	*Lepidochelys kempii*	E	Y
FISH			
Smalltooth sawfish	*Pristis pectinata*	E	Y
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	N
MAMMALS			
Sei Whale	*Balaenoptera borealis*	E	Y
Fin Whale	*Balaenoptera physalus*	E	Y
North Atlantic Right Whale	*Eubalaena glacialis*	E	Y
Humpback Whale	*Megaptera novaeangliae*	E	Y
Sperm Whale	*Physeter macrocephalus*	E	Y
Blue Whale	*Balaenoptera musculus*	E	Y
Florida manatee	*Trichechus manatus latirostris*	E	Y
BIRDS			
Piping plover	*Charadrius melodus*	T	Y
CORALS			
Staghorn coral	*Acropora cervicornis*	T	N
Elkhorn coral	*Acropora palmata*	T	N

Notes: E=Endangered; T=Threatened
USFWS = U.S. Fish and Wildlife Service; NMFS=National Marine Fisheries Service
[1]Green turtles are listed as threatened, except for breeding populations of green turtles in Florida and on the Pacific Coast of Mexico, which are listed as endangered.

5.1 Species Eliminated from Further Consideration

While many of these species are anticipated to be present within the project area, several species are not expected within the project area due to their known limited historic range and are eliminated from further evaluation in this document beyond this section. These species include gulf sturgeon, staghorn coral, and elkhorn coral.

The gulf sturgeon was listed as a threatened species under the Endangered Species Act on September 30, 1991 (56 FR 49653). A recovery/management plan was published for the Gulf sturgeon in 1995. In addition, all U.S. fisheries for the Gulf sturgeon have been closed. Gulf sturgeon are anadromous fish, inhabiting coastal rivers from Louisiana to Florida during the warmer months, and the Gulf of Mexico and its estuaries and bays in the cooler months. Gulf sturgeon initiate movement up to the rivers between February and April and migrate back out to the Gulf of Mexico between September and November. Sturgeon are primitive fish characterized by bony plates, or "scutes," and a hard, extended snout. Adults range from 1.0-2.5 m (4-8 ft) in length. The average life span is usually 20-25 years, but they can live for about 60 years. Gulf sturgeon are bottom feeders, and eat primarily macroinvertebrates. All foraging occurs in brackish or marine waters of the Gulf of Mexico and its estuaries. Gulf sturgeon migrate into rivers to spawn in the spring; spawning occurs in areas of clean substrate comprised of rock and rubble (NMFS, 2010). In 2003, NMFS and USFWS jointly designated Gulf sturgeon critical habitat; 14 geographic areas from Florida and Louisiana were included encompassing spawning rivers and adjacent estuarine areas (68 FR 13370). The Florida designated habitat is restricted to the Florida Panhandle; there is no critical habitat located as far south as the project area or its vicinity. Historically, Gulf sturgeon occurred from the Mississippi River east to Tampa Bay. Sporadic occurrences were recorded as far west as the Rio Grande River in Texas and Mexico, and as far east and south as Florida Bay; however, their present range extends from Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi respectively, east to the Suwannee River in Florida (USFWS and NMFS, 2009a). Gulf sturgeon are not likely to occur south of Tampa Bay, and are thus not expected to be impacted by project-related activities. A determination of No Impact to the Gulf sturgeon is recommended.

Staghorn coral is a branching coral with cylindrical branches ranging from a few centimeters to over 2 m (6.5 ft) in length. Elkhorn coral is a large, branching coral with thick and sturdy antler-like branches. The dominant mode of reproduction for these corals is asexual fragmentation, with new colonies forming when branches break off a colony and reattach to the substrate. Sexual reproduction occurs via broadcast spawning of gametes into the water column once each year in August or September. Individual colonies are both male and female (simultaneous hermaphrodites) and will release millions of "gametes". Staghorn coral exhibits the fastest growth of all known western Atlantic corals, with branches increasing in length by 10-20 cm (4-8 in) per year (NMFS, 2010) while elkhorn branches grow at a rate of 5-10 cm (2-4 in) per year. Staghorn and elkhorn coral have been important Caribbean corals in terms of their contribution to reef growth and fish habitat. These corals typically occur in back reef and fore reef environments from 0 to 30 m (0-98 ft) deep. The upper limit is defined by wave forces, and the lower limit is controlled by suspended sediments and light availability. Fore reef zones at intermediate depths of 5-25 m (16-82 ft) were formerly dominated by extensive single species stands of staghorn coral until the mid 1980s. Both elkhorn and staghorn coral are found throughout the Florida Keys, the Bahamas, the Caribbean islands, and Venezuela (NMFS, 2010). NMFS designated critical habitat for staghorn and elkhorn corals in areas of Florida, Puerto Rico, St. John, St. Thomas, and St. Croix (73 FR 72210). Critical habitat in Florida extends from Palm Beach County to Key West which also includes the Dry Tortugas; this critical habitat does not include the Gulf coast of Florida. Staghorn coral and elkhorn coral have never been observed during surveys of Longboat Key's nearshore hardbottom habitat; therefore these coral species are not expected to be impacted by the proposed project. A determination of No Effect to these species is recommended.

5.2 Sea Turtles

Table 2 lists five federally listed sea turtle species that may be found in the coastal waters of the Florida gulf coast: the loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*), and Kemp's ridley (*Lepidochelys kempii*) turtles.

5.2.1 Loggerhead Sea Turtle

Loggerhead sea turtles are protected under the U.S. Endangered Species Act of 1973, the Marine Turtle Protection Act Chapter 370.12 (Florida Administration Code), Sarasota County Sea Turtle Protection Ordinance (No. 97-082), and the Town of Longboat Key Ordinance (No. 87-16). These sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. Loggerhead sea turtles nest on coasts within the continental U.S. from Louisiana to Virginia. Adults and sub-adults have a large, reddish-brown carapace. Scales on the top and sides of the head and on top of the flippers are also reddish-brown, but have yellow borders. The neck, shoulders, and limb bases are dull brown on top and medium yellow on the sides and bottom. The plastron is also medium yellow. Adult average size is 91 cm (36 in) straight carapace length; average weight is 115 kg (253 lbs). The relative size of a loggerhead's head, when compared to the rest of its body, is substantially larger than other sea turtle species (NMFS and USFWS, 1991a; NMFS, 2010).

The loggerhead is the most abundant sea turtle occurring in U.S. waters. Along the Gulf coast, the turtle's range extends from southern Florida to southern Texas. Aerial survey data has estimated that only 12% of all western North Atlantic loggerheads reside in the eastern Gulf of Mexico, with the majority of this population occurring off the coast of western Florida. Major nesting concentrations in the U.S. are found on the coastal islands of North Carolina, South Carolina, and Georgia, and on the Atlantic and Gulf coasts of Florida. Loggerhead incubation ranges from about 45 to 95 days (NMFS and USFWS, 1991a; NMFS, 2010).

Critical habitat has not been designated for the loggerhead sea turtle.

5.2.2 Green Sea Turtle

The green sea turtle was federally listed as a protected species on July 28, 1978 (43 FR 32800). Breeding populations of the green turtle in Florida and along the Pacific Coast of Mexico are listed as endangered; all other populations are listed as threatened. Adults commonly reach a carapace length of 101 cm (40 in) and 150 kg (330 lbs) in mass. Colorization of the adult carapace ranges from solid black to gray, yellow, green, and brown in various patterns; the plastron is a lighter yellow to white. Hatchlings are distinctively black on the dorsal carapace and white on the ventral plastron. The green turtle has a worldwide distribution in tropical and subtropical waters. Major green turtle nesting colonies in the Atlantic occur on Ascension Island, Aves Island, Costa Rica, and Surinam. Within the U.S., green turtles nest in small numbers in the

U.S. Virgin Islands and Puerto Rico, and in larger numbers along the east coast of Florida, particularly in Brevard, Indian River, St. Lucie, Martin, Palm Beach, and Broward Counties. Nesting has also been documented along the Gulf Coast of Florida on Santa Rosa Island (Okaloosa and Escambia Counties) and from Pinellas County through Collier County (FWRI, 2010). Green sea turtle incubation ranges from about 45 to 75 days.

Critical habitat for the green sea turtle was designated in 1998 for the waters surrounding Culebra Island, Puerto Rico, and its outlying keys (63 FR 46693). There is no critical habitat for the green sea turtle within the project area.

5.2.3 Leatherback Sea Turtle

The leatherback sea turtle was listed as an endangered species on June 2, 1970 (35 FR 8491) and nests on shores of the Atlantic, Pacific, and Indian Oceans. The carapace is distinguished by a rubber-like texture, about 4 cm (1.6 in) thick, and made primarily of tough, oil-saturated connective tissue. No sharp angle is formed between the carapace and the plastron, resulting in the animal being somewhat barrel-shaped. The average curved carapace length for adult turtles is 155 cm (61 in) and weight ranges from 200 kg to 699 kg (440 to 1,543 lbs). Non-breeding animals have been recorded as far north as the British Isles and the Maritime Provinces of Canada and as far south as Argentina and the Cape of Good Hope (Pritchard, 1997). Nesting grounds are distributed worldwide, with the Pacific Coast of Mexico supporting the world's largest known concentration of nesting leatherbacks. The largest nesting colony in the wider Caribbean region is found in French Guiana, but nesting occurs frequently, although in lesser numbers, from Costa Rica to Columbia and in Guyana, Surinam, and Trinidad.

The leatherback regularly nests in the U.S. in Puerto Rico, the U.S. Virgin Islands, and along the Atlantic coast of Florida as far north as Georgia. Leatherback turtles have been known to nest in Georgia, South Carolina, and North Carolina, but only on rare occasions. Leatherback nesting also has been reported on the northwest coast of Florida (FWRI, 2010a). The incubation period for leatherback sea turtles ranges from about 55 to 75 days.

Critical habitat for the leatherback sea turtle has been designated as waters adjacent to Sandy Point on Saint Croix, U.S. Virgin Islands (44 FR 17710). There is no critical habitat for the leatherback sea turtle within the project area.

5.2.4 Hawksbill Sea Turtle

The hawksbill sea turtle was listed as an endangered species on June 2, 1970 (35 FR 8491). One of the smallest sea turtles of the Gulf of Mexico, weighing only 43 to 75 kg (95 to 165 lbs) as an adult and ranging in size from approximately 63.5 to 94 cm (25 to 37 in) straight carapace length, hawksbills have a hawk-like beak, posteriorly overlapping carapace scutes, and two pairs of claws on their flippers (NMFS and USFWS, 1993). The hawksbill is found in tropical and subtropical seas of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean.

In contrast to all other sea turtle species, hawksbills nest in low densities on scattered small beaches. The most important hawksbill nesting beaches in the Caribbean occur along the Yucatán Peninsula of Mexico. Several Yucatán beaches account for 25 to 30 percent of all hawksbill nesting in the Caribbean. The Gulf and Caribbean coasts of the Yucatán Peninsula, Mexico, where hawksbills nest on long expanses of beach in densities of 20 to 30 nests/km, are exceptions (USFWS, 2010a). Within the continental U.S., hawksbill sea turtle nesting is rare and is restricted to the southeastern coast of Florida (Volusia through Miami-Dade Counties) and to the Florida Keys in Monroe County, Florida. In the U.S. Caribbean, hawksbill nesting occurs on beaches throughout Puerto Rico and the U.S. Virgin Islands (NMFS and USFWS, 1993). Incubation for hawksbill sea turtles lasts for about 60 days.

Critical habitat for the hawksbill sea turtle has been designated for selected beaches and/or waters of Mona and Monito Islands, Puerto Rico (63 FR 46693).

5.2.5 Kemp's Ridley Sea Turtle

The Kemp's ridley sea turtle was listed as endangered on December 2, 1970, and internationally, the Kemp's ridley is considered the most endangered sea turtle (NMFS and USFWS, 1992a; TEWG, 2000). The smallest living sea turtle, the Kemp's ridley has a straight carapace length around 65 cm (25.6 in), with the adult's shell almost as wide as it is long. The dorsal carapace is round to heart-shaped and distinctly light gray. The range of the Kemp's ridley includes the Gulf coasts of Mexico and the U.S., and the Atlantic coast of North America as far north as Nova Scotia and Newfoundland. As juveniles, Kemp's ridley turtles feed primarily on crabs, clams, mussels and shrimp and are most commonly found in productive coastal and estuarine areas. Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the U.S. (NMFS and USFWS, 1992a).

Most Kemp's ridleys nest on the coastal beaches of the Mexican states of Tamaulipas and Veracruz, although a very small number of Kemp's ridleys nest consistently at Padre Island National Seashore, Texas (USFWS, 2010a). In 1966, conservation efforts for the Kemp's ridley were initiated on the beach near Rancho Nuevo in Tamaulipas, Mexico. This locale is the only place in the world where large nesting aggregations of this sea turtle are known to occur (USFWS, 2010a). The incubation period for the Kemp's ridley sea turtle ranges from 45 to 70 days. Hatchlings, after leaving the nesting beach, are believed to become entrained in eddies within the Gulf of Mexico, where they are dispersed within the Gulf and Atlantic by oceanic surface currents until they reach about 20 cm (8 in) in length, at which size they enter coastal shallow water habitats.

Critical habitat has not been designated for the Kemp's ridley sea turtle.

5.3 Smalltooth Sawfish

The smalltooth sawfish (*Pristis pectinata*) belongs to a group of fish called elasmobranchs, whose skeletons are made of cartilage and are actually modified rays with a shark-like body and gill slits on their ventral side. As the name implies, they have saw-like snouts edged with pairs of teeth used to locate, stun and kill prey. The rostrom is about one quarter the total length of an adult specimen. They commonly reach 5.5 m (18 ft) in length and may grow up to 7.6 m (25 ft) (NMFS, 2009a; NOAA, 2010b).

Smalltooth sawfish are tropical marine and estuarine fish with a circumtropical distribution. The northwestern terminus of their Atlantic range is in the waters of the eastern U.S. They were once widespread throughout Florida and commonly encountered from Texas to North Carolina but currently, they can only be found with any regularity in south Florida between the Caloosahatchee River and the Florida Keys. In the U.S., smalltooth sawfish distribution is centered in the Ten Thousand Islands and Florida Bay region of Everglades National Park (Carlson *et al.*, 2007).

Based on the contraction in range and anecdotal data, it is likely that the population is currently at a level less than 5% of its size at the time of European settlement (NMFS, 2009a). This decline has been attributed to commercial and recreational fishing, loss of habitat and a vulnerable life history (Simpfendorfer, 2002). The literature indicates that sawfish less than 10 ft in length are most common in shallow coastal waters with a depth less than 10 m (32 ft). Very small juveniles (< 1 m) are generally found in sand and mud banks (< 0.3 m water depth), whereas small juveniles (1-2 m) utilize similar habitat but are common in slightly deeper water (mostly less than 1 m). Larger sawfish (greater than 3 m) regularly occur at depths greater than 10 m (32 ft) and have been found as deep as 122 m (400 ft) (Poulakis and Seitz, 2004; Simpfendorfer and Wiley, 2005). Red mangrove root systems and shallow (< 1 m) euryhaline habitat appear to be especially important for juvenile sawfish and are potentially important in helping them avoid predation (Simpfendorfer, 2003).

Smalltooth sawfish were once caught as bycatch in commercial and recreational fisheries throughout their historic range but this is now rare due to population declines and population extirpations. Between 1990 and 1999, there were four documented takes of smalltooth sawfish in shrimp trawls in Florida (Simpendorfer, 2000). The U.S. Distinct Population Segment of smalltooth sawfish was listed as endangered under the ESA on April 1, 2003 (68 FR 15680) becoming the first elasmobranch on the Endangered Species List.

In September 2009, NMFS designated critical habitat for the U.S. distinct population segment (DPS) of smalltooth sawfish (74FR 45353). The critical habitat consists of two units: the Charlotte Harbor Estuary Unit and the Ten Thousand Islands/Everglades Unit for a total of 840,472 ac. The two units are located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. Because the center of distribution and the designated critical habitat are located nearly 40 miles south of the project area, this species is not expected to be impacted by project-related activities, and a determination of No Impact is recommended.

5.4 Marine Mammals

Table 2 lists six federally listed whale species that may be found in the coastal waters of the Florida Gulf coast. The sei whale (*Balaenoptera borealis*), fin whale (*Balaenoptera physalus*), North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), sperm whale (*Physeter macrocephalus*), and blue whale (*Balaenoptera musculus*) were listed as endangered under the Endangered Species Conservation Act, the precursor to the ESA, in June 1970. These species were subsequently listed as endangered under the ESA in 1973, and are also protected under the Marine Mammal Protection Act (MMPA) of 1972 which prohibits the "taking" (harassing, hunting, capturing, or killing) of marine mammals. Although not listed by

NMFS Southeast Regional Office as likely to occur in the Gulf of Mexico, right whales have occasionally been sighted offshore of the Town of Longboat Key Beach Renourishment Project area near Bradenton Beach (Staats, 2006), and have the potential to occur in the proposed action area.

The Florida manatee (*Trichechus manatus latirostris*) is also a federally listed endangered marine mammal. Manatees were first listed as endangered under the Federal Endangered Species Preservation Act of 1966, later superseded by the 1969 Endangered Species Conservation Act. In 1973, manatees were listed under the ESA. They are also protected under the MMPA of 1972.

5.4.1 Sei Whale

Sei whales are members of the baleen whale family and considered one of the "great whales" or rorquals. They are very similar in external appearance to fin and Bryde's whales, both of which also have a prominent falcate dorsal fin. All three have typical rorqual body shapes. In both sei and Bryde's whales, the dorsal fin rises at a steep angle from the back. Sei whales have only a single prominent longitudinal ridge on the rostrum and a slightly arched rostrum with a downturned tip. Bryde's and sei whales prove difficult to distinguish at sea unless the head can be seen at close range. Adults grow up to 18 m (59 ft) in length, although 15 m (49 ft) is an average adult length. Large adults can weigh up to 30 tons (27, 215 kg; 60,000 lbs). At birth, sei whales are 4.5-4.8 m (14.7-15.7 ft) long. Sei whales have the most diverse diet of any baleen whale, eating up to 1 ton (907 kg) of food per day, including small fish, krill, and copepods. The life span of a sei whale is likely greater than 50 years (NMFS, 2010).

The sei whale is one of the least well-studied of the "great whales". Hence little is known about the distribution or current population status for most stocks. They are believed to undertake seasonal north/south migrations, spending the summer on feeding grounds in the higher latitudes and winter in lower latitudes where they most likely breed or calve. During the summer, it is thought that a large segment of the western North Atlantic population is centered in northern waters, such as the Scotian Shelf (Mitchell and Chapman, 1977). Though they are not commonly found in the waters of the U.S. Atlantic, their southern range during the spring and summer includes the northern areas of the U.S. Atlantic Exclusive Economic Zone (EEZ) (i.e., Gulf of Maine and Georges Bank). Documented strandings along the northern Gulf of Mexico and in the Greater Antilles indicate those areas to be the southernmost range for this population (Mead, 1977). Sei whales may be found in one area for a while and then not return for years or decades. This behavior is unusual for rorquals, which generally have a predictable distribution. Sei whales usually live and travel by themselves or in small groups of only two to three whales. If there is abundant food in a particular area, larger groups will come together to feed. Up to 100 sei whales have been observed together, but this is an uncommon event (NMFS, 2010).

Critical habitat has not been designated for the sei whale.

5.4.2 Fin Whale

Fin whales (also called “Finback” whales), the second-largest whale species, have been under the full protection of the International Whaling Commission (IWC) since 1966 and have been classified as endangered under precursors to the ESA since 1970. The fin whale is long, sleek, and streamlined, with a V-shaped head that is flat on top. A single ridge extends from the blowhole to the tip of the rostrum (upper jaw). There is a series of 50-100 pleats or grooves on the underside of the body extending from under the lower jaw to the navel (Jefferson *et al.*, 1993). The basic body color of the fin whale is dark gray dorsally and white ventrally with a complex pigmentation pattern. The lower jaw is gray or black on the left side and creamy white on the right side. Fin whales show slight sexual dimorphism, with females measuring longer than males by 5-10%. The largest fin whale caught in the Northern Hemisphere was a 24.7 m (81 ft) female and a 22.9 m (75 ft) male during 1919-1926 (Clapham *et al.*, 1997).

Fin whales reach sexual maturity at about 6-10 years of age (ACS, 2004; NMFS, 2006a). Gestation is 12 months, and calves are born at intervals of three to four years. Length at birth ranges from 5.5-6.5 m (14-20 ft) and weight is approximately 2 tons (1,814 kg). Calves nurse for 6-8 months and are weaned when they reach 10-12 m (30-40 ft) in length.

Fin whale aggregation areas in the Northern Hemisphere include the eastern North Pacific Ocean (from the Chukchi Sea, around the coast of Alaska, south to Baja California), the western North Pacific Ocean (from the Philippine Sea, East China Sea, Yellow Sea, Sea of Japan, Bering Sea and Sea of Okhotsk), the western North Atlantic Ocean (from Cape Hatteras, Canada, Newfoundland and Cape Cod, in the north, to the Gulf of Mexico, Florida and the Greater Antilles, in the south) and the eastern North Atlantic Ocean (Norway, Iceland, Jan Mayen and the Spitsbergen Archipelago, in the north, to the Straits of Gibraltar in the south) (Gambell, 1985). During the Northern Hemisphere summer (June - August), fin whales are concentrated between the shore and the 1800 m bathymetric contour from 41° N to 57° N (Gambell, 1985). There is no stock information regarding fin whale occurrence or abundance within the Gulf of Mexico.

Critical habitat has not been designated for the fin whale.

5.4.3 North Atlantic Right Whale

North Atlantic right whales (also referred to as “northern right whales” or “right whales”) are large, rotund, black whales with large heads, long rostrums, and no dorsal fins. They can grow up to 16.2 m (53 ft) long. They are baleen whales, eating mostly small crustaceans including copepods and euphausiids (Caldwell and Caldwell, 1983). Right whales reach sexual maturity around eight years old. Gestation lasts approximately 13 months and calves are born every three to five years. Calves have the ability to swim when born. A mother and her calf form a very close bond, with the calf spending most of its time swimming close to its mother, being carried in the mother's "slip stream" or wake. There are estimated to be about 300-400 remaining individuals in the western North Atlantic Ocean and due to the slow reproduction rates, the population is biologically incapable of rapid increase (NMFS, 2010). Every mortality is therefore detrimental to the species’ survival.

The right whale primarily occurs in coastal or shelf waters. Individuals in the western North Atlantic population range from winter-calving and nursery areas in coastal waters off the southeastern U.S. to summer feeding grounds in New England waters and north to the Bay of Fundy and Scotian Shelf (NMFS, 2005). Migrations south to the calving grounds occur by pregnant females during mid-November. In the late winter and early spring, right whales leave the southeast waters and travel north to a feeding and nursery area in Cape Cod Bay, Massachusetts.

Critical habitat for the North Atlantic right whale was designated in 1994, and includes portions of Cape Cod Bay and Stellwagen Bank, the Great South Channel (each off the coast of Massachusetts), and waters adjacent to the coasts of Georgia and the east coast of Florida (59 FR 28805). Designated critical habitat in Southeastern U.S. is located between 31°15N (approximately the mouth of the Altamaha River, Georgia) and 30°15N (approximately Jacksonville, Florida) from the coast out to 15 nautical miles (nm) offshore, and within coastal waters out to 5 nm between 30°15N and 28°00N (approximately Sebastian Inlet, Florida). NMFS designated these areas as essential for the reproduction, rest and refuge, health, continued survival, conservation and recovery of the northern right whale population. There is no critical habitat located in the vicinity of the project area although there have been documented observations near LBK.

Photograph 4. Mother and calf North Atlantic right whales spotted off Bradenton Beach in 2006.

As recently as February 2006, two right whales (mother and calf) were sighted off Bradenton Beach, which is located on Anna Maria Island and just north of Longboat Pass (Photograph 4). The same individuals were spotted off Texas in January 2006, identified by a boomerang marking on the mother's tail fluke (Staats, 2006). Prior to the 2006 observations, a pair of right whales was seen about a mile and a half off of Panama City (MSNBC, 2004), a dead calf stranded in Texas in winter in the 1970s, and one individual was observed off of LBK in 1963 (Jefferson and Schiro, 1997). NMFS maintains that the few published records from GOM waters represent either distributional anomalies, normal wanderings, or a more extensive range beyond the sole known calving and wintering ground in the southeastern U.S. and that there is no resident stock in the GOM (NMFS, 2009b).

5.4.4 Humpback Whale

The humpback whale has been federally listed as endangered throughout its range under the precursor to the ESA since June 2, 1970. One of the larger rorqual species, adult humpbacks range in length from 12–16 m (40–50 ft) and weigh approximately 36,000 kg (40 tons). The humpback has a distinctive body shape, with unusually long pectoral fins (up to 5 m or about 1/3 total body length) and a knobby head. The maximum size of a humpback whale recorded is 18 m (59 ft). Calves are born in tropic and subtropical waters and nurse for about 5 months (Winn and Reichley, 1985). At birth, they are between 4 and 5 m long and weigh between 1,300 and 1,400 kg. Humpbacks are acrobatic animals, often breaching and slapping the water. Males produce a complex whale song, which lasts for up to 30 minutes and is repeated for hours at a time during courtship (NMFS, 1991).

Found in oceans and seas around the world, though less common in arctic waters, humpback whales typically migrate up to 25,000 km (15,500 miles) each year. Humpbacks feed only in summer, in polar waters, and migrate to tropical or sub-tropical waters to breed and give birth in the winter when they fast and live off fat reserves. Many summer habitats are apparently traditional feeding grounds, with long records of returns by identified individuals. The species' diet consists mostly of krill and small fish. They utilize diverse feeding methods, including the unique bubble net fishing technique. While on their wintering grounds, humpback whales can be found over shallow bars and shelf waters. Principal wintering grounds are located in the West Indies. In particular, protected breeding grounds for the humpback whale include portions of the Virgin Islands and Puerto Rico (NMFS, 1991).

Critical habitat has not been designated for the humpback whale.

5.4.5 Sperm Whale

Sperm whales have been classified as endangered in their entire range since 1970. Sperm whales are the largest toothed whale species with adult males measuring as much as 18 m (59 ft) in length. The skin is dark brown to dark grey in color and appears to be wrinkly or scarred posterior of the head. The head, well known for its distinct shape, is over a third of the total body length of the animal. Although the triangular tail fluke is broad and powerful, the flippers appear to be short and stubby, and the dorsal fin is a low, rounded hump with a series of bumps on the dorsal ridge of the tailstock (Jefferson *et al.*, 1993; NMFS, 2006b). The core units of sperm whales are made up of up to a dozen related and unrelated females, accompanied by their female and young male offspring. Males start leaving these family groups at about six years of age to live in ‘bachelor schools’. During breeding prime and old age, male sperm whales are essentially solitary (NMFS, 2006b).

Sperm whales are found in all of the world's oceans, except for the Arctic region. In U.S. waters, they may be found from California and Hawaii north to the Bering Sea, and from Maine to the Gulf of Mexico. The North Atlantic Population is divided into two management units: a western North Atlantic stock and a northern Gulf of Mexico stock. In the northern Gulf of Mexico, the sperm whale is the most common large cetacean. NMFS (2006b) reported an estimate of 1,349 individuals in the northern Gulf of Mexico based on vessel surveys conducted between 1996 and 2001.

Sperm whales tend to prefer deep waters and occur in the greatest density along the edge of continental shelves in water depths of 914 m (3,000 ft) to 1,829 m (6,000 ft) or further out to sea. They are especially common near the Mississippi Canyon where they reside year-round (NMFS, 2006b). When in open waters, they may dive for periods of more than one hour at depths of up to 2,438 m (8,000 ft) (Waring *et al.*, 1993; Rice, 1998). No published observations of sperm whales were identified near Longboat Key.

Critical habitat has not been designated for the sperm whale.

5.4.6 Blue Whale

The blue whale is the largest species of baleen whale: adults in the Antarctic have reached a maximum body length of about 33 m (108 ft) and can weigh more than 150,000 kg (165 tons). Blue whales are long-bodied and slender. They have a mottled gray color pattern which appears light blue when seen through the water. The background color can be dark gray, interrupted by irregular light gray markings, with dark gray splotches (NMFS, 1998a). Sexual maturity is achieved between 5 and 15 years of age, and some individuals live longer than 50 years (Yochem and Leatherwood, 1985). Gestation lasts 10-12 months and calves are nursed for 6-7 months. Calves are born approximately every two to three years. Mother and calf form a very close bond, with the calf often swimming close to its mother.

Blue whale distribution is largely governed by food requirements; thus populations are seasonally migratory. Poleward movements in spring allow these whales to take advantage of high zooplankton production in summer. Movement toward the subtropics in the fall allows blue whales to reduce their energy expenditure while fasting, avoid ice entrapment in some areas, and engage in mating activities in warmer waters of lower latitudes (NMFS, 1998a).

There are three geographical populations of blue whales: the Antarctic stock (endangered), the North Pacific stock (low risk, conservation dependent), and the North Atlantic stock (vulnerable). The range of the North Atlantic stock extends from the subtropics north to Baffin Bay and the Greenland Sea (NMFS, 1998a). There have been occasional sightings off Cape Cod, Massachusetts; this area may represent the southern limit of the blue whales' feeding range. Their distribution in southern waters remains largely unknown (Yochem and Leatherwood, 1985).

Although the species may be found in coastal waters, blue whales are thought to occur generally more offshore than northern right whales and humpback whales (NMFS, 2010). The two documented records (pre-1970) of blue whale strandings in the Gulf of Mexico suggest that this species may occasionally stray into the area, but they are less common in these waters (NMFS, 1998a; 2010). One blue whale stranded near Sabine Pass, Louisiana in 1924 and one stranded on the Texas coast in 1940 (Bradley, 1997). There have been no recorded observations of blue whales in the Gulf of Mexico since 1970.

Critical habitat has not been designated for the blue whale.

5.4.7 Florida Manatee

The Florida manatee (*Trichechus manatus latirostris*) is a subspecies of the West Indian manatee (*Trichechus manatus*) and is listed as a federally endangered marine mammal. Manatees were first listed as endangered in 1967 under the Federal Endangered Species Preservation Act of 1966, later superseded by the 1969 Endangered Species Conservation Act. In 1973 manatees were listed under the ESA. They are also protected under the Marine Mammal Protection Act.

The average size of an adult manatee is 3 m (10 ft), weighing approximately 998 kg (2,200 lbs). They are commonly referred to as "sea cows." The coloring of the manatee is grayish brown which contributes to the difficulty in detecting manatees in silt-laden waters. This mammal can be found in shallow waters (1.5-6.1 m/ 5-20 ft) of varying salinity levels including coastal bays, lagoons, estuaries and inland river systems. Manatees primarily feed on aquatic vegetation, but can be found feeding on fish, consuming four to nine percent of their body weight in a single day (Schwartz, 1995; USFWS, 2001). Sheltered areas such as bays, sounds, coves and canals are important for resting, feeding and reproductive activities (Humphrey, 1992).

The Florida manatee can be found occupying the coastal, estuarine and some riverine habitats throughout the southeastern U.S. During the winter months, the entire U.S. population typically moves to the waters surrounding Florida (Humphrey, 1992) and are generally restricted to the inland and coastal waters of peninsular Florida during the winter (USFWS, 2009b). Although there are four USFWS manatee management areas in Florida, the Florida population is considered part of the same stock; the project area is within the Southwest management unit.

Critical habitat for the West Indian manatee was designated on September 24, 1976 (41 FR41914). The designation of critical habitat in Florida includes waterways throughout one-half of the state with two types of manatee protection areas: manatee sanctuaries and refuges. Manatee sanctuaries (federally sanctioned) are specific zones where all waterborne activities are regulated and are in Citrus, Hillsborough, and Pinellas Counties. Manatee refuges are areas where certain waterborne activities are regulated. The refugees are located in Brevard, Charlotte, DeSoto, Hillsborough, Lee, and Sarasota Counties (USFWS, 2001, 2002a, 2002b). North east of the project area, there is manatee critical habitat located in the Manatee River downstream from the Lake Manatee Dam (Manatee County). This comes within eight miles of the project area. To the south of the project area, the closest manatee critical habitat is in the Myakka River downstream from Myakka River State Park (Sarasota County) located about 40 miles from the project area at the mouth of the estuary (42 FR 47840). There are no manatee sanctuaries, refuges, or critical habitat in the project area.

The project area is within the known range of the manatee and therefore, it is possible that manatees may be present in or near the borrow areas, the fill area, and the pipeline corridors during construction. It is very unlikely that a manatee would be observed near the offshore borrow areas F2 and B3 due to their distance from shore. Florida Fish and Wildlife Conservation Commission (FWC) standard manatee conditions for in-water work are implemented during project activities in order to eliminate any impacts to manatees. These conditions include idle speed/no wake of all project vessels and immediate shut down of all in-water activities when a manatee is within 50 ft of project activities.

5.5 Birds

Although several state-listed shore and waterfowl are present along the Gulf Coast of Florida and can be found within the project area, the only federally listed bird species that occurs within the project area is the piping plover (*Charadrius melodus*).

5.5.1 Piping Plover

Piping plovers are small, migratory shorebirds that breed in only three geographic regions of North America: on sandy beaches along the Atlantic Ocean, on sandy shorelines throughout the Great Lakes region, and on the river-bank systems and prairie wetlands of the Northern Great Plains (Haig, 1992). The Great Lakes population is listed as endangered under the ESA, whereas the Atlantic Coast and Great Plains populations are listed as threatened (December 11, 1985). Although this species does not breed in Florida, individuals from all three breeding populations winter in Florida. Wintering habitat has been proven a key factor in survival for piping plovers since they may spend 7-8 months per year away from breeding areas (Nicholls and Baldassarre, 1990; USFWS, 2009a).

Critical habitat for the wintering grounds of the piping plover was designated under Federal Register (66 FR 36038). On July 10, 2001, 142 areas along the coasts of North Carolina, South Carolina, Georgia, Florida, Alabama, Mississippi, Louisiana, and Texas encompassing approximately 1,793 miles of mapped shoreline were designated as critical habitat for the wintering piping plover; the rule erroneously states 137 areas (USFWS, 2009a). Although historical wintering sites are not well described, piping plovers have been generally seen along Gulf of Mexico beaches, southern U.S. Atlantic beaches from North Carolina to Florida, in eastern Mexico, and numerous islands scattered throughout the Caribbean (Nicholls and Baldassarre, 1990). The complete winter distribution of the piping plover remains to be determined, although specific Gulf and Atlantic coastal sites are becoming better recognized for their importance to wintering birds (Haig and Oring, 1985, 1987; Nicholls and Baldassarre, 1990; Sprandel *et al.*, 1997; USFWS, 2009a).

There is no federally designated piping plover critical habitat within the project area. The closest designated critical habitat for wintering piping plover to the project area is Unit FL-21, located on Egmont Key at the entrance to Tampa Bay, approximately ten miles north of Longboat Key (USFWS, 2010b).

6.0 DESCRIPTION OF CURRENT CONDITIONS FOR EACH SPECIES

This section describes the current status of those species listed in Table 2, including threats to their populations. The current condition of each species is described, with data presented for any listed species known to occur in the vicinity of the project area.

6.1 Sea Turtles

The distribution of sea turtle nesting activity on Florida's Gulf Coast (Manatee, Sarasota, Charlotte, Lee, and Collier Counties) makes up a small percentage of the overall nesting activity within the State when compared to the east coast epicenter of sea turtle nesting located between Brevard and Palm Beach Counties. According to the FWC statewide nesting database, 9% of the total 2009 nesting activity on Florida's coastline occurred on the Gulf Coast. During the 2009 nesting season, Sarasota County and Manatee County combined accounted for approximately 4% of the overall sea turtle nesting in the State of Florida (FWRI, 2010a). Although the green, Kemp's ridley, hawksbill and leatherback sea turtles have been documented as nesting on Florida's Gulf coast beaches, the loggerhead sea turtle is the dominant nesting species.

Sea turtle monitoring for Longboat Key is conducted by Mote Marine Lab (MML) Sea Turtle Conservation and Research Program (STCRP) personnel, interns, and volunteers authorized under FWC Marine Turtle Permits #054 and #027 issued to Ms. Paula Clark.

6.1.1 Loggerhead Sea Turtle

Threats to loggerhead sea turtles include: incidental take from channel dredging and commercial trawling, longline, and gill net fisheries; loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and disease. There is particular concern about the extensive incidental take of juvenile loggerheads in the eastern Atlantic by long-line fishing vessels from several countries (NMFS and USFWS, 1991a).

Results from a study conducted as part of the Florida Fish and Wildlife Conservation Commission's (FWC) Index Nesting Beach Survey indicate loggerhead sea turtle nest numbers in 2009 represented the fourth lowest count since the Index Nesting Beach Survey began in 1989. An updated analysis of Florida's long-term loggerhead sea turtle nesting data reveals that nest counts have declined 24% from 1989 to 2009, and 38% from 1998 to 2009. The steep decline in loggerhead nest numbers followed a modest (25%) increase that occurred between 1989 and 1998 (FWRI, 2010a).

Loggerhead turtles account for the majority of nests observed on Longboat Key. Table 4 presents Longboat Key loggerhead sea turtle nesting data collected by Mote Marine Lab (MML) between 2002 and 2009 (Tucker *et al.,* 2009), including the total number of loggerhead nests and the percentage of the total nesting activity on Longboat Key that were loggerhead nests; green sea turtles are the only other documented species to nest on Longboat Key during this timeframe.

Table 4. Loggerhead sea turtle nests observed on Longboat Key from 2002-2009.

YEAR	NO. NESTS	Percent of Total Nesting Activity by Loggerheads
2002	213	100%
2003	293	99.7%
2004	161	99.4%
2005	151	100%
2006	160	100%
2007	143	98.6%
2008	252	99.6%
2009	216	100%

6.1.2 Green Sea Turtle

Two major factors contributing to the green turtle's decline worldwide is commercial harvest for eggs and meat, and fibropapillomatosis. Fibropapillomatosis in sea turtles is characterized by the development of multiple tumors on the skin and internal organs and has no cure. This disease has seriously impacted green turtle populations in Florida, Hawaii, and other parts of the world. Although fibropapillomatosis is primarily found on green sea turtles, it has now been found on all species of sea turtles (The Turtle Hospital, 2010). The tumors interfere with swimming, eating, breathing, vision, and reproduction, and turtles with heavy tumor burdens generally die. Other threats to green sea turtles include: loss or degradation of nesting habitat from coastal development and beach armoring; disorientation of hatchlings by beachfront lighting; excessive nest predation by native and non-native predators; degradation of foraging habitat; marine pollution and debris; watercraft strikes; and incidental take from channel dredging and commercial fishing operations (NMFS and USFWS, 1991b).

Total global population estimates for the green turtle are unavailable, and trends based on nesting data are difficult to assess because of large annual fluctuations in numbers of nesting females. In Florida, where the majority of green turtle nesting in the southeastern U.S. occurs, the annual number of green turtle nests at core index beaches ranged from 267 to 9091 between 1989 and 2009 (FWRI, 2010a). Although there were fewer green sea turtle nests recorded in 2009 than in 2008 on Florida index beaches, this did not change the long-term increasing trend observed by the Index Nesting Beach Survey. In 2007, the number of green turtle nests on index beaches was the highest since the trend-monitoring program began in 1989. Overall, the green turtle nesting trend differs dramatically from the loggerhead nesting trend, with green turtle nests increasing by a factor of ten over the 21-year study period (FWRI, 2010a).

Since 1994, 101 green sea turtle nests have been deposited in Sarasota County; 11 were deposited in 2009 and 7 in 2008. Mote Marine Lab reported a total of four green sea turtle nests observed on Longboat Key since 2001; one in 2003, one in 2004, two in 2007, and one in 2008 (Tucker *et al.*, 2009).

6.1.3 Leatherback Sea Turtle

The global leatherback population has been estimated between 26,000 and 43,000, which is a dramatic decline from the estimated population of 115,000 in 1980 (Spotila *et al.*, 1996). This is primarily due to the exponential decline in leatherback nesting over the last two decades along the Pacific coasts of Mexico and Costa Rica. Leatherbacks are rare in the Indian Ocean and now exist in very low numbers in the western Pacific Ocean. These populations cannot withstand even moderate levels of adult mortality and even the largest population, which now exists in the western Atlantic, is being exploited at a rate that cannot be sustained (Spotila *et al.*, 1996). Leatherbacks are heading towards extinction and further population declines can be expected unless action is taken to reduce adult mortality and increase survival of eggs and hatchlings.

The crash of the Pacific leatherback population is believed primarily to be the result of exploitation by humans for the eggs and meat, as well as incidental take in numerous commercial fisheries of the Pacific. Factors threatening leatherbacks in Florida include loss or degradation of nesting habitat from coastal development, disorientation of hatchlings by beachfront lighting, excessive nest predation by native and non-native predators, marine pollution and debris, watercraft strikes, and incidental takes from commercial fishing operations.

Results from the FWC Index Nesting Beach Survey show a long-term increasing trend in the number of leatherback nests, ranging from 27 to 498 between 1989 and 2008 at the core set of Florida index beaches. In 2009, the number of leatherback nests on index beaches was the highest since the trend-monitoring program began in 1989 (FWRI, 2010a).

With the exception of a few nests on the west coast, leatherback nesting occurs primarily on the east coast of Florida – almost 50% of all nests in Florida occur in Palm Beach County (FWRI, 2010a). The first leatherback nesting event documented along the central west coast shoreline of Florida was deposited on May 31, 2001 on Longboat Key in Sarasota County (Tucker, *pers comm*, 2010); one nest was also deposited on Sanibel Island in Lee County in 2009 (Tucker *et al.*, 2009).

6.1.4 Hawksbill Sea Turtle

About 15,000 females are estimated to nest each year throughout the world; the Caribbean accounts for 20 to 30 percent of the world’s hawksbill population. The decline of the hawksbill species is primarily due to human exploitation for tortoiseshell. While the legal hawksbill shell trade ended when Japan agreed to stop importing shell in 1993, a significant illegal trade continues. In addition, there are serious attempts by Cuba, with support from other countries, to down-list hawksbills in Cuba to Appendix 2 of the Convention on International Trade in

Endangered Species (CITES) of Wild Fauna and Flora in order to make it possible to reopen trade with Japan and possibly other countries (USFWS, 2009c).

Threats in Florida include loss or degradation of nesting habitat from coastal development and beach armoring, disorientation of hatchlings by beachfront lighting, excessive nest predation by native and non-native predators, degradation of foraging habitat, marine pollution and debris, watercraft strikes, and incidental take from commercial fishing (NMFS and USFWS, 1993).

One hawksbill sea turtle nest was documented on Longboat Key by FWC staff in 1979. This nest was verified at the time by phone descriptions; however, no specimens were taken for further verification. Because hawksbills are typically tropical nesters, MML questions the validation of this single hawksbill nest (Tucker, *pers comm*, 2010). Within the continental U.S., hawksbill nesting is restricted to and rare in the southeast coast of Florida and the Florida Keys (NMFS, 2010). Florida is not considered one of the nesting concentrations for hawksbill sea turtles (NMFS and USFWS, 2007a).

6.1.5 Kemp's Ridley Sea Turtle

The Kemp's ridley is the most endangered of the sea turtles. Its numbers have precipitously declined since 1947, when over 40,000 nesting females were estimated in a single arribada (mass nesting event) in Rancho Nuevo, Mexico. Between the late 1940s and the mid-1980s, the Kemp's ridley experienced a sharp decline that produced only 720 nests in 1985 in Rancho Nuevo, where tens of thousands once nested. However, since the mid-1980's, the number of nests laid in a season has been increasing primarily due to nest protection efforts and implementation of regulations requiring the use of turtle excluder devices in commercial fishing trawls. In 2006, approximately 7,866 nests were laid in Rancho Nuevo and an additional 100 nests were laid on U.S. beach, mostly Texas (USFWS and NMFS, 2007b). The decline of this species is directly related to human activities, including the harvest of adults and eggs and incidental capture in commercial fishing operations. Today, under strict protection, the population appears to be in the early stages of recovery (NMFS and USFWS, 1992a; NMFS and USFWS, 2007b).

Occasional nesting has been documented in North Carolina, South Carolina, and the Gulf and Atlantic coasts of the U.S., including Florida (NMFS, 2010). In 2009, two nests were observed on Casey Key and one on Venice in Sarasota County and one nest was documented on Sanibel Island in Lee County. In Sarasota County, these were the first recordings of a Kemp's ridley nest since 1999. According to data collected by MML, no Kemp's ridley sea turtle nests have ever been observed on Longboat Key beaches (Tucker, *pers comm*, 2010). As for swimming sea turtles, Davis *et al.* (2000) reported three Kemp's ridleys in open waters along the continental shelf in the northern Gulf of Mexico based on aerial and boat surveys. The observations noted here are not near the borrow areas or the fill areas of the proposed project on Longboat Key.

6.1.6 Climate Change

According to the Intergovernmental Panel on Climate Change (2007), changes in the natural ecosystem caused by potentially rapid climate change pose significant challenges to wildlife. Sea Level Rise (SLR) caused by climate change has the potential to adversely affect nesting sea turtles. In an era of eroding shorelines, SLR may exacerbate erosional conditions, leading to further loss of sea turtle nesting habitat. Climate change may also lead to increased hurricane activity, which can further impact the limited remaining sea turtle nesting habitat. The degree and intensity of climate change and SLR are difficult to estimate with any degree of precision; however, based on measured rates of erosion and changes in water levels in the project area, sea level rise accounts for only 5% of the total shoreline change (CPE, 2009a). Hence, although worldwide SLR may adversely affect sea turtle nesting as a whole, nesting within the project area may be at less of a risk than areas with higher rates of SLR. The magnitude of impacts to sea turtles as well as other wildlife will be better estimated in coming years as more information becomes available.

6.2 Marine Mammals

Of the six endangered whale species listed in Table 2, only sperm whales are considered to commonly occur in the Gulf of Mexico. Typically, no threatened or endangered species of whales occur in the nearshore waters (0-200m) over the continental shelf of the Gulf of Mexico. Occasionally, North Atlantic right whales and humpback whales may be found in nearshore waters of the Gulf of Mexico, usually during the winter season. However, sightings of these species are relatively uncommon and the individuals observed were likely inexperienced juveniles straying from the normal range of their stocks (NMFS, 2003; NMFS, 2008a). According to Keith D. Mullin, PhD., Fishery Biologist with NOAA, no whales are expected to be present in the coastal waters off of Longboat Key, as the only marine mammal species that routinely occur in Florida Gulf Coast waters within 1-2 miles of the coast are bottlenose dolphins, Atlantic spotted dolphins and Florida manatees. Rarely, in winter, humpback whales are observed in these waters (Mullin, *pers comm*, 2009).

6.2.1 Sei Whale

No recovery plan currently exists for the sei whale. A draft recovery plan for both fin and sei whales was prepared in 1998; however, it was decided that plans for each species should be drafted separately and thus far, only a draft for the fin whale has been completed.

Sei whales were hunted by modern whalers primarily after the preferred larger, and more easily taken, baleen whale species had been seriously depleted, including the right, humpback, gray, blue, and fin whales. Most stocks of sei whales were reduced, some of them drastically, by whaling in the 1950's through the early 1970's. International protection began in the 1970's for this species but exploitation continued in the North Atlantic by Iceland through 1986. Of the commercially-exploited “great whales,” the sei whale is one of the least well-studied, and the current status of most sei whale stocks is poorly known (NMFS, 1998b).

The estimated population size between Cape Hatteras, North Carolina, and Nova Scotia, Canada was 253 between 1978 and 1982. There are few if any data on fishery interactions or human impacts. There was no reported fishery-related mortality or serious injury to sei whales in fisheries observed by NMFS during 1994-1998. There are no reports of mortality, entanglement, or injury in the Northeast Regional Office databases. However, there have been at least five reports of ship strikes and one report of entanglement with fishing gear leading to death between 1994 and 2007 on the U.S. Atlantic coast from Boston, MA to Norfolk, VA (NMFS, 2008b). There was also a reported entanglement of a sei whale with commercial fishing gear in September 1996 on Jeffreys Ledge off New England (NMFS, 2008b).

Sei whales are a deepwater species and are not expected to occur in the project vicinity (NMFS, 2003).

6.2.2 Fin Whale

Fin whales (also called finback whales) are widely distributed around the world. Although most populations were depleted by modern whaling in the mid-twentieth century, there are still tens of thousands of fin whales worldwide. The most recent stock assessment of the western North Atlantic stock estimates the population at 2,269 individuals (NMFS, 2009c). Commercial whaling for this species ended in the North Atlantic in 1987. Fin whales are still hunted in Greenland and subject to catch limits under the International Whaling Commission (IWC) "aboriginal subsistence whaling" scheme. Populations in the North Atlantic, North Pacific, and Southern Hemisphere have been legally protected from commercial whaling for the last twenty or more years, and this protection continues. Japan has started killing fin whales in its scientific whaling program, and the numbers of whales killed in this program are steadily increasing (NMFS, 1998b; NMFS, 2006a). According to NOAA's large whale ship strike database, fin whales are the most often reported species hit – 75 records of strike between 1975 and 2002 worldwide (Jensen and Silber, 2003).

Although the main direct threat to fin whales was addressed by the ICW whaling moratorium, several potential threats remain, including collisions with vessels, entanglement in fishing gear, reduced prey abundance due to overfishing, habitat degradation, disturbance from low-frequency noise and the possibility that illegal whaling or resumed legal whaling will cause removals at biologically unsustainable rates. Schooling fish constitute a large proportion of the fin whale's diet in many areas of the North Atlantic. Thus, trends in fish populations, whether driven by fishery operations, human-caused environmental deterioration, or natural processes, may strongly affect the size and distribution of fin whale populations (NMFS, 1998b; NMFS, 2006a).

Fin whales are a deepwater species and not expected to occur in the project vicinity (NMFS, 2003).

6.2.3 North Atlantic Right Whale

Ship collisions and entanglement in fishing gear are the most common recent human causes of serious injury and mortality of western North Atlantic right whales. Additional threats may include habitat degradation, contaminants, climate and ecosystem change, and predators such as large sharks and killer whales. Disturbance from such activities as whale watching and noise from industrial activities may affect the population. To reduce disturbance from boats, NMFS published regulations in 1997 that prohibit vessels from approaching within 500 yards of right whales (NMFS, 2005). North Atlantic right whales are the third most often reported species struck by ships – 38 records between 1975 and 2002 worldwide (Jensen and Silber, 2003).

While past population estimates were based on more limited information and may have been less accurate, the best population estimate for the North Atlantic right whale in 1991 was 350 animals. The population is currently believed to contain only about 300 individuals and it remains unclear whether its abundance is static, undergoing modest growth or, as recent modeling exercises suggest, currently in decline. However, there has been no apparent sign of recovery in the last 15 years and the species may be rarer and more endangered than previously thought. A recent model predicts that under current conditions, the population will be extinct in less than 200 years (NMFS, 2005; NMFS, 2010).

Occasionally, North Atlantic right whales may be found in nearshore waters of the Gulf of Mexico, usually during the winter season. The most recent sighting of right whales in Florida waters was a mother and calf right whale spotted off of Bradenton Beach, Florida, in February 2006 (Staats, 2006). Despite this sighting, these occurrences are considered rare; as such, this species is not expected to occur in the project vicinity.

6.2.4 Humpback Whale

As a species, humpback whales are probably the fourth most numerically depleted whale worldwide, after the northern right whale, blue whale, and bowhead whale. Prior to commercial whaling, the worldwide population of humpback whales was thought to be more than 125,000. American whalers alone killed between 14,000 and 18,000 humpbacks in the nineteenth century, and the total North Pacific kill was estimated at about 28,000. Today the estimated population is between 10,000 and 12,000, or roughly 10% of the estimated pre-whaling numbers (NMFS, 1991).

Although whaling is no longer a threat, humpback whales that occur adjacent to human population centers are affected by human activities throughout their range. Both habitat and prey are affected by human-induced factors that could impede recovery. Such factors include subsistence hunting, incidental entrapment or entanglement in fishing gear, collision with ships, and disturbance or displacement caused by noise and other factors associated with shipping, recreational boating, whale watching or air traffic. Humpback whales are the second most often reported species struck by ships – 44 records between 1975 and 2002 worldwide (Jensen and Silber, 2003). Humpback whales may also be impacted by introduction and/or persistence of pollutants and pathogens from waste disposal, disturbance and/or pollution from oil, gas or other mineral exploration and production, habitat degradation or loss associated with coastal development, and competition with fisheries for prey species. These factors could affect individual reproductive success, alter survival, and/or limit availability of needed habitat (NMFS, 1991).

Occasionally, humpback whales may be found in nearshore waters of the Gulf of Mexico, usually during the winter season. However, sightings are relatively uncommon and the individuals observed were likely inexperienced juveniles straying from the normal range of their stocks (NMFS, 2003; NMFS, 2008a). Humpback whales are not expected to occur in the project vicinity.

6.2.5 Sperm Whale

Sperm whales were subject to commercial whaling for more than two and a half centuries in all parts the world. Commercial whaling for this species ended in 1988, with the implementation of a moratorium against whaling by the International Whaling Commission (IWC). Currently, there is no good estimate for the population of sperm whales worldwide. The best estimate is that there are between 200,000 and 1,500,000 sperm whales, based on extrapolations from only a few areas that have useful estimates. The status of populations throughout the world's oceans, stated in terms of present population size relative to "initial" (pre-whaling or carrying capacity) level, is close to 18th and 19th century concentrations. However, a large area in the South Pacific appears to have a low density of sperm whales (NMFS, 2006b).

Sperm whales are still being targeted in some areas: there is a small catch by primitive methods in Indonesia, and Japan takes sperm whales for "scientific research". There is also some evidence to suggest that sperm whales are being hunted illegally in some parts of the world, but the impact of this take is unknown. Canada withdrew its membership in the IWC in 1982. Norway and Iceland have formally objected to the IWC ban on commercial whaling and are therefore free to resume whaling of sperm whales under IWC rules, but neither country has expressed an interest in taking sperm whales (NMFS, 2006b).

In addition to commercial whaling threats, sperm whales are susceptible to entanglement in fishing gear and collisions with ships. Their demonstrated responsiveness to loud, unfamiliar underwater sounds makes it likely that they are adversely affected, at least transiently, by anthropogenic noise in the marine environment. Also, levels of some contaminants in sperm whale tissue, such as heavy metals and organochlorine compounds, are high enough to raise concerns about toxicity and reproductive impairment. Site selection for whale migration, feeding, and breeding for sperm whales is linked to ocean currents and water temperature, which may be negatively impacted by climate change (NMFS, 2006b).

Of the six endangered whale species (Table 2), only sperm whales are considered to commonly occur in the Gulf of Mexico. There is a resident population of female sperm whales in the northern Gulf near the Mississippi Canyon, and whales with calves are spotted frequently, but sperm whales are rare in inshore waters (NMFS, 2003; NMFS, 2008a). It is therefore unlikely that this species will occur in the project area.

6.2.6 Blue Whale

Stocks of the blue whale have been depleted by modern whaling, and the number of blue whales in the world's oceans is now only a fraction of what it was early in the twentieth century. Blue whales were only occasionally hunted by the sailing-vessel whalers of the nineteenth century. The introduction of steam power in the second half of that century made it possible for boats to overtake the large, fast-swimming blue whales, but killing on an industrial scale did not occur until the development of the deck-mounted harpoon cannon. Most of the technology for modern whaling was available by the early 1870s, and factory ships were added in the early twentieth century. Thus, from the turn of the century until the mid-1960s, blue whales from various stocks were intensively hunted in all the world's oceans (NMFS, 1998a).

Since gaining complete legal protection from commercial whaling in 1966, some populations have shown signs of recovery, while others have not been adequately monitored to determine their status. Collisions with vessels, entanglement in fishing gear, reduced zooplankton production due to habitat degradation, and disturbance from low-frequency noise are the most obvious potential indirect threats (NMFS, 1998a).

Blue whales are a deepwater species, and have not been observed in the Gulf of Mexico since 1970; therefore, they are not expected to occur in the vicinity of the project area (NMFS, 2003; 2010).

6.2.7 Florida Manatee

The manatee population is difficult to assess. The best available count of Florida manatees is 3,802 animals, based on a single synoptic survey of warm-water refuges in January 2009 (USFWS, 2009b). Ground and aerial synoptic surveys are done one to three times every year; however, these surveys do not include individuals that are located away from wintering sites on the day of the count and therefore, do not represent an accurate representation of the population. Weather conditions, water clarity, manatee behavior, and other environmental factors add to the variability. As a result, scientists are reluctant to base their evaluations of the manatee population on these surveys. With these caveats in mind, the results from these synoptic surveys reported 22 manatee sightings within Manatee and Sarasota Counties in proximity to the project area between 1991 and 2001 (Table 5) (FWRI, 2010b). To evaluate the population, statistics are monitored such as adult survival rates, reproduction, and population growth rate. The Florida manatee population is considered one stock but is divided into four management units, formerly referred to as subpopulations: the Upper St. Johns River unit (4% of the population); the Atlantic Coast unit (46%); the Southwest unit (38%); and the Northwest unit (12%). Recent demographic analyses indicate that, with the exception of the Southwest management unit, manatee populations are increasing or stable throughout much of Florida (USFWS, 2009b). There is little information on the status of the Southwest Florida sub-population, though research is underway (USFWS, 2001, 2009b).

The most significant threat to the Florida manatee is death or serious injury from watercraft strikes. In Florida, 38 manatee deaths were attributed to watercraft in 2008, comprising 24% of total manatee mortality state-wide (FWC, 2009). Another important threat is loss of reliable warm water habitats that allow manatees to survive the cold in winter. Natural springs are threatened by increased demands for water supply and aging power plants may need to be replaced. Deregulation of the power industry may also result in less reliable man-made sources of warm water. Consequences of an increasing human population and intensive coastal development are long-term threats to the Florida manatee. Seagrass and other aquatic foods that manatees depend on are affected by water pollution and sometimes direct destruction (USFWS, 2001). Seagrass is not located directly within the project area; however, extensive seagrass beds are found within adjacent Sarasota Bay (FWRI, 2010b). Since 1974, FWC has reported 53 manatee deaths within proximity of Longboat Key, including natural deaths and those caused by watercraft strikes. The majority of these mortalities were located within Sarasota Bay and the estuarine waters behind Longboat Key. No seagrass has been observed in the nearshore Gulf of Mexico waters off Longboat Key; however, manatees may use this area as a travel corridor and are frequently seen in the nearshore. During construction, there is a potential for manatee strike in the nearshore as project vessels travel between borrow areas, rehandling areas, and the seaward end of the pipeline corridor. Manatee protection measures will be implemented to minimize such events.

Table 5. Manatee sightings within Sarasota and Manatee Counties during synoptic surveys from 1991-2001

Date	Adults	Calves	Total	County
2/18/1991	1	0	1	Manatee
1/10/1996	1	0	1	Sarasota
2/19/1996	1	0	1	Manatee
1/20/1997	1	0	1	Sarasota
1/6/1999	2	0	2	Sarasota
1/6/1999	3	0	3	Manatee
1/6/1999	1	0	1	Sarasota
1/6/1999	1	0	1	Manatee
2/23/1999	1	0	1	Sarasota
2/23/1999	1	0	1	Manatee
2/23/1999	1	1	2	Sarasota
2/23/1999	1	0	1	Manatee
2/23/1999	1	0	1	Sarasota
2/23/1999	1	0	1	Sarasota
3/6/1999	1	1	2	Sarasota
1/27/2000	1	0	1	Sarasota
1/6/2001	1	0	1	Sarasota

6.3 Birds

6.3.1 Piping Plover

In recent decades, piping plover populations have declined drastically, especially in the Great Lakes area. In the early 1900s, uncontrolled hunting drove them nearly to extinction. Destruction and degradation of winter habitat in Florida, shoreline erosion, human disturbance, and predators, including domestic animals, all contribute to low reproductive success and decline in numbers over much of the piping plover's range. Although Florida's conservation lands provide considerable suitable habitat, increasing recreational demands result in increased harassment of foraging and roosting birds (FNAI, 2010).

The 2001 International Piping Plover Census (IPPC) documented one piping plover on Longboat Key (Lott, 2009). Shorebird surveys have been conducted within recent years along Longboat Key's shoreline by Steven Sauers Environmental Management and Eckerd College. Steven Sauers Environmental Management conducted shorebird monitoring surveys as part of the 2005/06 renourishment compliance monitoring and reported a total of four piping plovers from daily and/or weekly surveys conducted between February and September, 2005 to 2007 (Sauers, *pers comm*, 2009). Data collected by the Eckerd College beach nesting birds survey program between April and August 2007-2009 included observations of seven piping plovers, all of which were observed in 2009 (Sauers, *pers comm*, 2009).

7.0 EFFECTS OF PROPOSED ACTION, CONSERVATION MEASURES AND EFFECTS DETERMINATIONS

This section describes how the proposed actions will affect threatened and endangered species or any critical habitats that occur in the project area. The Endangered Species Act requires that all effects be considered when determining if an action may affect listed species. Direct effects, indirect effects, interrelated or interdependent actions, and cumulative effects are all considered. Direct effects are defined as those caused by the action and occur at the same time and place as the action. Indirect effects are caused by the action at a later time, but are reasonably certain to occur. Interrelated actions are those that are part of the primary action and depend on the primary action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration. Cumulative effects are those effects of future actions which are reasonably certain to occur within the action area subject to consultation. Cumulative impacts can result from individually minor, but collectively significant, impacts taking place over a period of time.

Past and future beach nourishment projects on Longboat Key and nearby beaches contribute to species effects and are referred to throughout the following species sections. In order to reduce redundancy, projects are referenced only by name; past project details can be found in Section 3.1 - History of Beach Nourishment on Longboat Key, and brief details of projects on Anna Maria Island (located north of Longboat Key) are as follows. The City of Anna Maria was nourished in 2002 between R7 and R10 and the central portion of Anna Maria Island was nourished between R12 and R36 in 1992/93, 2002, and 2005/2006. The Coquina Beach renourishment (R35+790 to R41+365) on Anna Maria Island has been permitted and is scheduled to be constructed over the winter of 2010/2011 and will take place outside of sea turtle nesting season. Periodic maintenance dredging of Longboat Pass, located between Longboat Key and Anna Maria Island, also occurs. It is a federally maintained waterway between the Sarasota Bay system and the Gulf of Mexico. It is periodically surveyed and, when shoaling occurs to a point where actual depths are less than the designed project depths, dredging by the U.S. Army Corps of Engineers (USACE) in cooperation with the West Coast Inland Navigation District (WCIND) occurs. Dredging of this pass aides in navigation and provides sand to nearby beaches where erosional effects are greatest.

Conservations measures are described for each species and indicate the specific actions and measures that will be incorporated into the design of the project to avoid or significantly reduce adverse effects or the incidental take of listed species. Effects determinations are also provided based on the existing information available for each species and associated habitat, and the conservation measures proposed. *Acropora* spp. and gulf sturgeon are not discussed as they have been eliminated from further consideration.

7.1 Smalltooth Sawfish

Direct and/or Indirect Effects

In the nearshore habitat, fill is projected to directly impact approximately 1.5 acres of hardbottom resources. Increased turbidity during construction and anticipated burial of hardbottom resources are unlikely to impact sawfish as a minimal amount of sawfish encounters occur over rock and reef formations (4% each) compared to observations over mud (61%) (Poulakis and Seitz, 2004). If any risk of impacts to smalltooth sawfish exist, it would be greater near the borrow area as this habitat is similar to the sawfish preferred habitat of sand and mud substrate (Poulakis and Seitz, 2004). However, the actions proposed at borrow area and within the fill area are not anticipated to adversely affect, directly or indirectly, the smalltooth sawfish due to the low likelihood of occurrence of this species within the project area as there have been few documented observations of sawfish north of Charlotte Harbor (about 40 miles south of the project area).

Effects of Interdependent or Interrelated Actions

Of all the actions in or near the project area, the dredging of Longboat Pass has the highest likelihood of impacting smalltooth sawfish as the few recent occurrences of this species have been reported in the passes adjacent to Longboat Key. Mud-bottom mangrove habitat preferred by this species also occurs in and around the pass. However, the likelihood of occurrence of this species is low, and activity associated with dredging operations may deter any sawfish in the area from approaching.

Cumulative Effects

Destruction of mangrove and estuarine habitat preferred by smalltooth sawfish, along with historic fishing pressure have contributed to the drastic reduction in numbers of smalltooth sawfish. As the proposed project is not impacting preferred habitat of this species, it is not expected to add to cumulative impacts to smalltooth sawfish.

Impacts from the Deepwater Horizon MC 252 oil spill on April 20, 2010 have not been reported on the central west coast shoreline of Florida. Slurried (thickened) oil arrived on Northwest Florida beaches the week of June 14, 2010, but to date, no oil has been reported in Manatee or Sarasota Counties. Conflicting reports have emerged regarding oil impacts to the sea floor ecosystem; however, research continues to determine the extent and duration of impacts from the oil spill.

Conservation Measures

The permittee shall comply with the *Sea Turtle and Smalltooth Sawfish Construction Conditions* developed by the NMFS (Appendix 1). These conditions stipulate that if a sawfish is observed within 100 yards of construction operations, all appropriate precautions shall be implemented to ensure its protection, including cessation of operation if the animal moves within 50 ft of any moving equipment.

Effects Determination

NMFS has determined that there has never been a reported take of a smalltooth sawfish by a hopper dredge and impact to the species during dredging activities is unlikely due its affinity for shallow estuarine habitats. Based on the low probability that smalltooth sawfish will occur in the project area, along with compliance with the *Sea Turtle and Smalltooth Sawfish Construction Conditions,* an effects determination of May Affect, Not Likely to Adversely Affect is assigned to the smalltooth sawfish.

7.2 Sea Turtles

7.2.1 Nesting Sea Turtles and Hatchlings

According to nesting data collected by Mote Marine Laboratory, loggerhead (*Caretta caretta*), green (*Chelonia mydas*), and leatherback (*Dermochelys coriacea*) sea turtles have been documented nesting on Longboat Key (Tucker, *pers comm*, 2010). Loggerheads are the dominant nesting turtle (usually between 95%-100% of the nests are loggerheads), greens have only nested four times since 2001, and there has only been one documented leatherback nest on Longboat Key (2001). The proposed project has the potential to adversely affect nesting females, nests, and hatchlings within the project area. The timing of construction activities will commence prior to sea turtle nesting season on the Gulf coast of Florida (May through October); however, it is very likely that construction will continue into nesting season. Several conservation methods will be implemented in order to reduce impacts to nesting sea turtles, nests and hatchlings. Beach compatible material is being utilized to limit and/or prevent any unnecessary impacts to nesting sea turtles. These measures have the potential to greatly reduce disturbance of nesting sea turtles, nests, and hatchlings.

<u>Direct and/or Indirect Effects</u>

There are several potential direct and indirect effects from the proposed project to nesting sea turtles. Direct impacts may result from use of construction equipment on the beach, artificial lighting, and nest relocation. Project construction during sea turtle nesting season will involve greater potential for the direct mechanical destruction and burial of nests, and greater likelihood for encounters with construction equipment/pipes on the beach during nesting activities. The presence of heavy machinery on the beach left overnight can create barriers to nesting females as they emerge from the surf and attempt to crawl up the beach, resulting in a higher occurrence of false crawls and needless energy expenditure. The operation of motor vehicles on the beach at night may result in collision with nesting females, disorientation of emergent hatchlings by headlights, and interference by vehicles or vehicle tracks in the sand as hatchlings crawl to the ocean. Studies have shown that hatchlings become diverted not because they are unable to maneuver out of the track (Hughes and Caine, 1994), but because the sides of the rut cast a shadow that causes the hatchlings to lose sight of the ocean horizon (Mann, 1977). Driving directly over incubating egg clutches or on the beach may destroy nests or cause sand compaction which can adversely impact nest site selection, digging behavior, clutch viability and hatchling emergence, thus decreasing nest success and killing pre-emergent hatchlings (Mann, 1977; Nelson and Dickerson, 1989).

While the interim nourishment phase is scheduled to occur outside of sea turtle nesting season, the duration of the island-wide nourishment phase necessitates construction into nesting season. Therefore, nest relocations may be necessary during this phase of the project. Nest relocation as a protection measure for sea turtle nests in the project area may result in potential direct impacts. Relocation could damage eggs, particularly if relocation of the eggs does not occur within 12 hours of nest deposition (Limpus *et al.*, 1979). Other potential negative effects of nest relocation include impacts to incubation temperature (leading to sex ratio alteration) (Yntema and Mrosovsky, 1982; Godfrey and Mrosovsky, 1999), gas exchange parameters, nest moisture content, or reduction of hatching success and hatchling emergence relative to natural nests (Limpus *et al.*, 1979; Mortimer, 1999). More recently, Mrosovsky (2006) suggested that nest relocation over the long-term may distort gene pools. Relocation efforts can also concentrate nests in one location, making them more vulnerable to predation and wash-out from storms.

Artificial lighting may also impact sea turtle nesting and hatchling behavior. Artificial lighting on beaches tends to deter sea turtles from emerging from the sea to nest (Witherington and Martin, 1996). Project lighting can also result in the hatchling disorientation. Hatchlings, which use visual cues to locate the sea once they emerge from the nest, can be misdirected by artificial lighting (Dickerson and Nelson, 1989; Nelson *et al.*, 2000; Lorne and Salmon, 2007). Following beach nourishment projects, the wider and flatter beach berm may expose turtles and their nests to artificial lighting that was less visible, or not visible at all, from nesting areas before the project leading to greater hatchling disorientation and possible mortality (Trindell *et al.*, 2005). Artificial lighting on offshore dredges may also impact nesting females who may be deterred from nesting by the lights in the nearshore waters. Hatchlings emerging from their nests could be attracted away from the shortest path to the water and instead crawl or swim toward the bright lights of a nearshore dredge or anchored pumpout barge (instead of crawling or swimming seaward toward the open horizon), thus increasing their exposure time to predation (NMFS, 2003).

Beach renourishment projects can have indirect effects on sea turtle nesting in the project area, such as changes to the physical beach environment and escarpment formation. If the nourishment sand is dissimilar from the native sand, results can include changes in sand compaction, beach moisture content, sand color, sand grain size and shape, and sand grain mineral content, all of which may alter sea turtle nesting behavior (Grain *et al.*, 1995). Incompatibility of nourishment material with the nesting habitat can potentially affect female sea turtles' ability to nest and reproduce (Lutcavage *et al.*, 1997). Nest site selection and digging behavior of the female can be altered or deterred, if she finds the beach unsuitable. Beach compaction can lead to reductions in nesting success (*i.e.*, increased false crawls), which may result in increased physiological stress to the nesting females (Nelson and Dickerson, 1989). Clutch viability and hatchling emergence may also be impaired if the beach state is altered (Nelson and Dickerson, 1989; Grain *et al.*, 1995). Steep escarpments may form along nourished beaches as they adjust from an unnatural construction profile to a more natural beach profile (Grain *et al.*, 1995). These escarpments can impair or prevent access to nesting sites, in some cases leading to females selecting marginal or unsuitable nesting sites. Studies suggest that within the first year post-nourishment, turtle nesting decreases. Montague (1993) states that beach profiles of a newly restored beach are not conducive to nesting and hatchling success. Profiles may contain irregular or steep scarps and may be unstable. Eventually, with local wave, tide, and wind energy, the profiles equilibrate and the beach stabilizes to resemble a natural profile of the area.

It has been previously stated that beach nourishment may lead to more development in greater density within shorefront communities that are then left with the possible need for additional future replenishment or even coastal armoring in a negative feedback loop (Pilkey and Dixon, 1996). Increased development immediately adjacent to nesting beaches has often led to more coastal construction, sometimes with larger and larger structures being built to accommodate resultant increase in tourism. Aside from encroachment on sea turtle nesting habitat and exposure to artificial lighting, seaside development may attract and support populations of nest predators such as raccoons and foxes, which might not have occurred there naturally or in as large numbers (NRC, 1990).

Sea turtles may also benefit from the Longboat Key Beach Nourishment Project by gaining accessibility to a greater area of beach on which to nest. Sea turtles may elect not to nest on critically eroded beaches and abandon sections of beach if they determine that the nest location will not be suitable. In this instance, nesting sea turtles may return to the ocean to find another more suitable, location. This project will repair eroded sections of beach and will widen the dry beach to provide additional nesting habitat as well as additional protection from storms. A nourished beach that is designed and built to mimic the natural beach system will likely benefit nesting sea turtles more than the eroded beach it replaces.

Effects of Interdependent or Interrelated Actions

As mentioned above, a small emergency nourishment is planned for the highly eroded north end "hotspot" of Longboat Key. For long-term protection of this stretch of island, various shore protection alternatives have been evaluated, including the placement of offshore emergent breakwaters. According to a modeling study conducted by CPE for evaluation of breakwater performance, a combination of four breakwater structures combined with backfilling and periodic renourishment is recommended as the most effective means of stabilizing the north end of the island (CPE, 2010).

Various regulatory agencies have expressed a growing concern over the increase in the number of coastal armoring and nearshore control structures in recent years as potential obstacles to sea turtle hatchlings; unfortunately, studies on the impacts of offshore breakwaters on sea turtles is limited. What we do know is that, during the first 24-36 hours after leaving the nest, hatchlings engage in a continuous swimming "frenzy" to reach less risky offshore waters (Whelan and Wyneken, 2007). Surface wave refraction is an initial cue critical to the process of normal offshore orientation of sea turtle hatchlings (Glenn, 1996). Shore-parallel offshore breakwaters imitate the wave-attenuating effect of a natural shore-parallel nearshore island, reef, or sand bar, and refraction waves should approach the shore in a parallel manner (Pope, 1986). Hatchling sea turtles may temporarily be impeded in their swim frenzy offshore, but may evade the structures through lateral swimming; enough space exists between breakwaters to allow access to the open ocean by the hatchlings. The resulting circulation of water behind a segmented breakwater should force hatchlings away from the structures and toward the gaps.

Sharks and fin-fishes including snappers (Lutjanidae) are significant sources of mortality for hatchling sea turtles entering the ocean from nesting beaches and during the swim-frenzy period as they migrate offshore (Vose and Shank, 2003). Although emergent offshore breakwaters may only temporarily impede offshore progress of newly hatched sea turtles, unnecessary time spent in predator-rich shallow nearshore waters may be detrimental to hatchling survival. Whelan and Wyneken (2007) found that most predation occurred between 38 m and 220 m from shore. During hatchling predation studies in Broward County, Florida, it was documented that predatory fish species, such as tarpon (*Megalops atlanticus*) and snappers (*Lutjanus* spp.), targeted sea turtle hatchlings and "learned" where to concentrate foraging efforts (Wyneken *et al.*, 1998). Therefore, a delay in the offshore migration may increase predation of sea turtle hatchlings (Glenn, 1998; Gyuris, 1994; Witherington and Salmon, 1992). While fish predators are likely to congregate around bottom structures, Glenn (1996) found that hatchling predation was higher over natural hardbottom than over sand or breakwater structures; whereas, Stewart and Wyneken (2004) found that different bottom types did not affect predation rates at all. However, the permit application for the north end breakwaters has been placed on hold. Breakwater construction is not planned for the immediate future.

Cumulative Effects

All previous and future projects on Longboat Key and nearby beaches represent actions that cumulatively impact sea turtle nesting habitat. Impacts include compaction of sand which may deter female turtles from nesting on a particular beach, alteration of the natural beach profile (Ernest and Martin, 1999), and other chemical and physiological changes in natural beach sand qualities such as color and moisture content as described above (Nelson and Dickerson, 1989; Grain *et al.*, 1995).

Alteration of the natural profile of the beach can cause sea turtles to nest closer to the water for the first year or two after nourishment (Trindell *et al.*, 2005). Nesting closer to the water elevates the risk of nests being washed away due to erosion or storms. The number of lost nests due to these factors may be small after a single nourishment, but if multiple nourishments occur over several years in an area, as has occurred in the Longboat Key project area and is planned to continue, the number of nests lost from theses causes may become significant if the profile is drastically altered.

Beach nourishment can also alter the natural color of the sand. The color of sand plays a role in heat transfer and retention of the sand. Altered temperature characteristics of a nesting beach may affect the nest incubation environment, which can in turn alter the sex ratio of unborn sea turtles in the nest, as temperature plays a direct role in determining the sex of the hatchling (Yntema and Mrosovsky, 1982; Godfrey and Mrosovsky, 1999). Again, the effects of a single nourishment on the sex ratio of a sea turtle population may be insignificant, but the cumulative effects over several years and several nourishment events may be detrimental to a local population of a species if sex ratios are continually altered.

The effects of the multiple beach nourishments which have occurred in and around the proposed project area, on the other hand, may ultimately lead to an increase in sea turtle nesting and hatching success rates due to expansion of suitable nesting beaches as long as fill material is compatible with native sands and the fill profile mimics the natural one. The regular addition of suitable beach material to the shorelines provides additional nesting habitat and protects existing nesting beaches from future storm-induced erosion, given that the grain size and color, and placement profile remain similar to the native beach.

The Longboat Key coastline is already extensively developed; however, it is reasonable to expect that human occupancy and recreational use along the Gulf Coast of Florida will continue to increase in the future. It is unknown how much influence beach renourishment contributes to the development and recreational use of the shoreline, but it has been suggested that beach nourishment may lead to more development in greater density within shorefront communities (Pilkey and Dixon, 1996). Increased development immediately adjacent to nesting beaches may lead to more frequent and larger scale coastal construction projects in order to accommodate increases in tourism.

According to the Intergovernmental Panel on Climate Change (2007), changes in the natural ecosystem caused by potentially rapid climate change pose significant threats to wildlife and climatic changes in Florida could amplify existing land and water management challenges. Sea Level Rise (SLR) caused by climate change has the potential to adversely affect nesting sea turtles. In an era of eroding shorelines, SLR may exacerbate erosional conditions, leading to further loss of sea turtle nesting habitat. Climate change may also lead to increased hurricane activity, which can further impact the limited remaining sea turtle nesting habitat. The degree and intensity of climate change and SLR are difficult to estimate with any degree of precision; however, based on measured rates of erosion and changes in water levels in the project area, sea level rise accounts for only 5% of the total shoreline change (CPE, 2009a). Hence, although worldwide SLR may adversely affect sea turtle nesting as a whole, nesting within the project area may be at less of a risk than areas with higher rates of SLR. The magnitude of impacts to sea turtles as well as other wildlife will be better estimated in coming years as more comprehensive information becomes available.

Impacts from the Deep Horizon MC 252 oil spill on April 20, 2010 have not been reported on the central west coast shoreline of Florida, which includes the project area. If oil were to permeate the shoreline at the project area, the sandy beaches would be rendered useless for all species, including sea turtles. Potential impacts could include: 1) reduced nesting due to injuries to mature females or nesting beaches being covered in oil; and 2) reduced hatching success rates if oil washes up on the beach after the nests are already laid. Such impacts to hatching success would become apparent through nest monitoring programs once the nests start to hatch (Wilson, 2010).

Conservation Measures

The following provides various conservation measures for nesting sea turtles that will be implemented with the project.

Construction Methods. Construction equipment and material shall be stored in a manner that will minimize impacts to nesting and hatchling sea turtles to the maximum extent practicable. During sea turtle nesting season, all construction pipeline will be placed parallel to shore and as far landward as possible without impacting the dune. All temporary storage of pipeline and equipment will be placed off the beach whenever possible, or as far landward as possible without impacting the dune.

Compatibility of Dredge Material with Native Beach Material. During borrow area selection for this project, a sand compatibility analysis compared the composite characteristics for both beaches and the borrow areas including mean grain size, sorting, silt content, shell content, carbonate content, and Munsell color. The results of this analysis show that the material contained within the borrow area is very similar to the existing sand on Longboat Key beaches. Beach quality sand was chosen not only for stability and aesthetics, but also for suitability for sea turtle nesting, successful incubation, and hatchling emergence. Following construction, any escarpments that might form will be leveled to maintain sea turtle access to the nesting beach. These

Monitoring and Nest Relocation. Compaction monitoring, tilling, and escarpment remediation measures will be performed in accordance with the Terms and Conditions of the USFWS Biological Opinion. Sea turtle monitoring, nest evaluation and protection measures shall be conducted by Mote Marine Lab (MML) Sea Turtle Conservation and Research Program personnel beginning April 15 and continuing through October 31. As was implemented during the 2005/06 nourishment project, in order to reduce negative impacts to nests, those laid in areas that would be threatened by construction activities will be relocated to a safe area determined by MML personnel. Relocation methods will follow those specified by the USFWS and FWC.

Project Lighting. Direct lighting of the beach and nearshore waters will be limited to the immediate construction area during the sea turtle nesting season and shall comply with safety requirements. Lighting on offshore or onshore equipment shall be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the water's surface and nesting beach while meeting all Coast Guard, EM 385-1-1, and OSHA requirements. Intensity of lighting equipment shall be reduced to the minimum standard required by OSHA for General Construction areas, in order to minimize sea turtle disorientation. Shields shall be affixed to the light housing and be large enough to block light from being transmitted outside the construction area.

7.2.2 Swimming Sea Turtles

Although not all five species nest in the project area, loggerhead (*Caretta caretta*), green (*Chelonia mydas*), leatherback (*Dermochelys coriacea*), hawksbill (*Eretmochelys imbricata*) and Kemp's ridley (*Lepidochelys kempi*) sea turtles all have the potential to occur in the nearshore or offshore marine habitat of Longboat Key, and may be directly or indirectly impacted by project activities.

Direct and/or Indirect Effects

Many factors pose a threat to sea turtles including coastal development, land-based pollution, habitat encroachment, and harvesting. Potential impacts associated with beach restoration projects include degradation or even elimination of foraging grounds through burial or sedimentation of nearshore hardbottom resources, or injury from dredging equipment such as pipelines. These activities pose a threat to in-water sea turtles, especially loggerheads. Hopper dredges, such as those that are likely to be used for the Longboat Key Beach Nourishment Project activities, can directly kill turtles if caught in drag heads. Hopper dredging occasionally results in sea turtle entrainment and death, even with seasonal dredging windows, turtle deflector drag heads in place, and concurrent relocation trawling (NMFS, 2003). Incidental takes of sea turtles have only been documented from hopper dredge operations that use trailing suction drag heads. Thus far, no incidental takes of sea turtles have been reported from clamshell, pipeline cutterhead, or other types of dredges operating along southeastern coasts (Dickerson *et al.*, 2004). The sea turtle species primarily affected by dredging are loggerhead, green, and Kemp's ridley, although, hawksbill and leatherback are also potentially vulnerable (NRC, 1990). Leatherback sea turtles are generally found in deep, pelagic, offshore waters though they occasionally may come into shallow waters to feed on aggregations of jellyfish. The nearshore and inshore waters of the northern and eastern Gulf of Mexico may be used by these species as post-hatchling developmental habitat or foraging habitat (NMFS, 2003).

Beach restoration projects can indirectly affect sea turtles by impacting nearshore foraging habitat. Hopper dredging entails placement of submerged pipelines leading to the beach placement area and to which the barge connects for sand pumpout. Up to eight previously cleared pipeline routes will be used for this project. Most of the pipeline corridors are softbottom; however, sidescan sonar surveys of the corridors revealed some suspected hardbottom resources. The contractor will be instructed to avoid these resources in a manner successfully implemented in 2005/06. Therefore, no impacts to sea turtle foraging habitat are anticipated from pipeline placement. Some foraging habitat will, however, be affected by sand placement. Within the fill templates of the proposed project activities, 1.5 ac of nearshore hardbottom resources will be impacted through direct burial; however, these impacts are repetitive of those which occurred during the 2005/06 beach nourishment project which were mitigated through the construction of a compensatory artificial reef. The mitigated natural hardbottom was found to support 26 genera of macroalgae including *Acanthophora*, *Bryothamnion*, *Dictyota*, *Gracilaria*, *Hypnea* and *Jania*, which are preferred food resources for juvenile green turtles (Makowski *et al.* 2006; Wershoven and Wershoven 1988, 1992). Four years after construction, the benthic community on the artificial reef, particularly the macroalgae assemblage preferred by juvenile green sea turtles, has successfully replaced that of the nearshore natural hardbottom (CPE, 2009b). The nearshore artificial reef will not be impacted by the proposed project; therefore, it will continue to provide foraging habitat for sea turtles which replaces that impacted by the project.

Effects of Interdependent or Interrelated Actions

Several coastal construction projects in and near the project area are scheduled to occur in the same timeframe, all with the ultimate goal of shoreline stabilization. These include the emergency nourishment at the north end of Longboat Key and the nourishment on Coquina Beach north of the project area on Anna Maria Island. These actions impact both the water column used by swimming sea turtles and nearshore benthic habitat used for foraging as described above.

Cumulative Effects

Longboat Key and nearby beaches on Anna Maria Island have been nourished on multiple occasions, which may lead to cumulative impacts within the project area, such as additional sand movement and deposition within the habitats of the project area. Littoral transport of materials from adjacent shorelines contributes to sedimentation stress on nearshore hardbottom habitats. Dredging of offshore borrow areas can lead to sedimentation of offshore hardbottom resources and degrade water-column quality. Inlets and dredging of navigation channels also add influential stress to the adjacent nearshore hardbottom as the flow of freshwater from neighboring bays and waterways channel storm water runoff, and land-based sediments may be deposited in the ebb tidal zone. All of these factors may degrade sea turtle swimming and foraging habitat over time.

Although impacts from the Deepwater Horizon MC 252 oil spill have not been realized in the project area, this does not mean they may not occur in the future. When sea turtle hatchlings join the rest of the population out at sea, they may face direct oil exposure, contaminated prey and oil impacts on their habitat. It is difficult to estimate how long it will take for these types of impacts to show up in the population, if at all. If adult females are killed, nesting numbers could start to decline almost immediately. Kemp's ridley sea turtles do not reach sexual maturity until they are

7-15 years old so the impacts of large numbers of hatchlings being lost to the oil spill could take a decade or more to begin to influence nesting numbers. For loggerhead and green sea turtles, which don't reach maturity to around 20 years of age, it could take even longer to see impacts. Between April 30 and June 26, 2010, a total of 567 sea turtles were found within the designated spill area from the Texas/Louisiana border to Apalachicola, Florida. Of the 567 turtles verified from April 30 to June 26, a total of 425 stranded turtles were found dead, 44 stranded alive. Four of those subsequently died (NOAA, 2010a). The final breadth of the oil spill and the effectiveness of the clean-up efforts remain unknown.

Conservation Measures

The following provides various conservation measures for swimming sea turtles that will be implemented with the project.

Relocation Trawling. Shrimp trawlers have been successfully used to capture sea turtles for relocation and research for since the early 1980s (Bargo *et al.*, 2005). For research, turtles are generally captured for tagging purposes; however, relocation is implemented during periods when hopper dredging is imminent or ongoing (NMFS NE Biological Opinion F/NER/2003/00302).

Sea turtle relocation trawling will be conducted as a means to reduce the likelihood of turtle mortality associated with dredging activity during the proposed project. Trawling will target the active dredging site within the borrow area. It has been documented that the proportion of sea turtles caught in nets that are dead or comatose increases with an increase in tow time from 0% during the first 50 minutes to about 70% after 90 minutes (CLS, 1990); therefore, the temporal length of each tow will be strictly limited to less than 50 minutes (total time). Positions at the beginning and end of each tow will be determined using GPS and tow speed will be recorded at the approximate midpoint of each tow. Tide and weather conditions will also be recorded during each tow including air temperature, wind velocity and direction, sea state, wave height, and precipitation. Captured turtles will be photographed, measured, biopsied for genetics, epibionts present recorded, and tagged. Turtles will then be relocated at least 3 nt mi from the dredge site in a direction that provides for the least likelihood of recapture.

During dredging for the 2005/2006 renourishment of Longboat Key, the turtle relocation trawler captured and removed 129 turtles from the dredging areas using the methods described above. This included 74 loggerheads (*Caretta caretta*), 41 Kemps ridley (*Lepidochelys kempii*), 12 greens (*Chelonia mydas*), and 2 hawksbills (*Eretmochelys imbricate*). Two loggerheads were sent to Mote Marine Lab for rehabilitation unrelated to dredge activity (propeller cuts and emaciation). Two turtles were recaptured during the project and two dredge takes were documented.

Construction Methods. The permittee shall comply with the *Sea Turtle and Smalltooth Sawfish Construction Conditions* developed by NMFS (Appendix 1). For swimming sea turtles, this includes avoiding collision with swimming sea turtles, monitoring of siltation barriers for entanglement, operation at “no wake/idle” speeds in the construction area, taking precautions when sea turtles are observed within 100 yards of the active construction operations, cessation of operation of any moving equipment when within 50 ft of a sea turtle, and reporting of any collision with and/or injury to a sea turtle to NMFS Protected Resources Division and the local authorized sea turtle stranding/rescue organization (Mote Marine Lab).

Project Lighting. Direct lighting of the beach and nearshore waters will be limited to the immediate construction area during the sea turtle nesting season and shall comply with safety requirements. Lighting on offshore or onshore equipment shall be minimized through reduction, shielding, lowering, and appropriate placement to avoid excessive illumination of the water's surface and nesting beach while meeting all Coast Guard, EM 385-1-1, and OSHA requirements. Light intensity of lighting equipment shall be reduced to the minimum standard required by OSHA for General Construction areas, in order not to misdirect sea turtles. Shields shall be affixed to the light housing and be large enough to block light from all lamps from being transmitted outside the construction area.

7.2.3 Sea Turtle Effects Determination

Loggerhead sea turtles are the most abundant nesting turtles on Longboat Key and also represent the most abundant swimming turtle species relocated using turtle trawlers during the 2005/06 beach renourishment on Longboat Key. Green sea turtles are the only other species that regularly nest on Longboat Key, although not near the abundance of loggerheads. Greens were also captured during turtle trawling near the borrow areas. Because these species are the most abundant in the project area, they have been assigned an effects determination of May Affect, Likely to Adversely Affect.

Hawksbill and Kemp’s ridley sea turtles were also captured during turtle relocation efforts during dredging activities near the borrow areas for the 2005/06 renourishment project on Longboat Key; however, there is no documented nesting of these species in the project area. There was one leatherback nest reported on Longboat Key in 2001 and no leatherbacks were captured in the turtle trawling efforts for the 2005/06 project. As such, these three species are assigned an effects determination of May Affect, Not Likely to Adversely Affect.

7.3 Marine Mammals

7.3.1 Whales

<u>Direct and/or Indirect Effects</u>

Of the six endangered whale species (Table 2), only sperm whales are considered to commonly occur in the Gulf of Mexico, and no whales are expected to be present in the coastal waters off of Longboat Key, as the only marine mammal species that routinely occur in Florida Gulf Coast waters within 1-2 miles of the coast are bottlenose dolphins, Atlantic spotted dolphins and Florida manatees. In the Gulf of Mexico Regional Biological Opinion on Hopper Dredging of Navigation Channels and Borrow Areas in the U.S. Gulf of Mexico, NMFS ascertained that blue, fin, or sei whales will not be adversely affected by hopper dredging operations; the possibility of dredge collisions is remote since these are deepwater species unlikely to be found near hopper dredging sites. There has never been a report of a whale taken by a hopper dredge (NMFS, 2003).

Noise in the marine environment has been responsible for displacement from critical feeding and breeding grounds in several marine mammal species (Weilgart, 2007). Richardson *et al.* (1990) studied bowhead whale reactions to dredge noise and found a decrease in call rates, cessation of feeding and changes in surfacing and respiration cycling in some (but not all) individuals. Since whales are not common in the project area and no critical feeding or breeding grounds are located in the area, it is not likely that any whale species will be affected by the noise of the dredging operations. Should any whale species be traveling near the coastline at the time project activities are underway, particularly right whales which have been observed offshore of Longboat Key in the recent past, they may be deterred from approaching the project area and remain offshore.

Vessel strike is also a concern with marine mammals during marine construction operations. Vessel travel between the offshore borrow areas (F2 and B3) and the beach may pose a strike hazard to some whale species, primarily right whales as they have been observed near the project area and have a higher chance of occurring near the offshore borrow area than the nearshore borrow areas. Precautions will be taken to observe and avoid marine mammals during dredging operations. Although rehandling of sand in the nearshore borrow areas will increase vessel activity, the likelihood of whales entering the nearshore environment is unlikely; as such, whales are not likely to be impacted by vessel strike in this area.

Effects of Interdependent or Interrelated Actions

Near the same timeframe as the proposed action, other coastal construction activities in and near the project area may occur. These actions include the emergency nourishment at the north end of Longboat Key and the nourishment on Coquina Beach, north of the project area. These activities are not anticipated to adversely affect the whale species addressed in this biological assessment as they do not utilize the nearshore region within the project area. Although two of the proposed borrow areas (F2 and B3) are located between 8 and 12 miles offshore, the likelihood of whales occurring near dredge activities is low; thus, adverse impacts to whale species are not anticipated.

Cumulative Effects

Manatee and Sarasota Counties nourish the beaches along Longboat Key and Anna Maria Island periodically to repair damage done by storms and to widen beaches as protection against storm damage and erosion. While some spreading of the beach fill into the nearshore waters following beach nourishment occurs, this is limited to the shallow coastal marine environment and does not impact offshore areas where whales might be present. The impacts of dredging offshore borrow areas is typically temporary degradation of water quality (primarily turbidity) surrounding the borrow areas. When considering the proposed project along with previous and future projects and their impacts to whales, it is not anticipated that these species will be affected by cumulative impacts due to their low likelihood of occurrence within the project area and the temporary nature of the water quality impacts.

Impacts from the Deepwater Horizon MC 252 oil spill have not been reported in the waters along the central west coast of Florida, including the project area; however, this does not mean they may not occur in the future. The NOAA ship Pisces reported a dead 25-ft sperm whale on June 15, 2010, that was located 150 miles due south of Pascagoula, Mississippi and approximately 77 miles due south of the spill site. The whale was decomposed and heavily scavenged. The whale had no evidence of external oil, so samples of skin and blubber were collected to be analyzed. There are no records of stranded whales in the Gulf of Mexico for the month of June for the period 2003-2007 (NOAA, 2010a). As of January 2011, this was the only dead sperm whale reported in the Gulf of Mexico. Acoustic survey equipment located nine miles from the spill site and at 1,000-m water depth showed a drop in sperm whale numbers since the spill. This site has nine years of acoustic data that showed a fairly steady rate of five sperm whales in the area. After the spill, the number dropped to two; however, at a site located 15.5 miles away, the numbers did not change. Based on the decrease in numbers near the spill versus no change farther away, experts believe that the whales vacated the area due to the presence of oil and possibly the noise of the disaster (emergency drilling, increased ship volume) (O'Hanlon, 2010).

Conservation Measures

Protected species observers will be on board the dredge to search for and document whales and sea turtles in proximity to the dredge. If a whale is sighted near the dredge, NMFS and USACE will be notified and all in-water operations will be shut down immediately. The captain of the dredge will also be instructed to avoid whales encountered while traveling between the dredge site and the pipeline and to contact NMFS and USACE if a whale is observed in the vicinity.

Effects Determination

Based on the unlikelihood of their presence, feeding habits, and very low likelihood of hopper dredge interaction, an effects determination of May Affect, Not Likely to Adversely Affect is designated to whales for this project.

7.3.2 Florida Manatee

Direct and/or Indirect Effects

Florida manatees occur in subtropical and tropical waters from the western North Atlantic to the southeastern U.S. Their preferred habitat is warm freshwater, estuarine, and nearshore coastal waters. Feeding areas are located in coastal and riverine systems, where shallow seagrass communities are found. Manatees often seek refuge in secluded brackish canals and coastal sloughs for resting, mating, and calving (USFWS, 2001). Manatees are most likely to be impacted by vessel strike while support boats move through channels from dock areas to the dredge vessels. In this project, the support boats will access the dock through Longboat Pass.

It is possible, but unlikely, that manatees could come into close proximity to dredge activities at the offshore borrow areas due to their distance from shore. However, they may be encountered during vessel travel from the offshore borrow areas to the beach pump-out sites. It is more likely that manatees would be present near the borrow areas located closer to shore (BA-IX, and BA-X). Transport of sand from shallow portions of the borrow areas into rehandling areas will increase vessel activity compared to standard dredging operations, thereby increasing the chance of encounter with manatees. However, this high activity and noise associated with beach fill placement are likely to deter manatees from entering the project area during construction. Additionally, *Standard Manatee Construction Conditions for In-Water Work* (Appendix 2) will be implemented as protection measures during construction of the Longboat Key Beach Nourishment Project to minimize the potential for significant impacts to manatees by project-related activities.

In addition to potential impacts by collision with watercraft, manatees may be indirectly affected by project activities through impacts to foraging habitat. However, manatees forage mostly in Sarasota Bay where seagrass beds (*i.e.*, submerged aquatic vegetation or SAV) may be locally abundant. No seagrass has been observed growing in the nearshore habitat of the project area.

Critical habitat for the Florida manatee is located in the Manatee River downstream from the Lake Manatee Dam (Manatee County) and in the Myakka River downstream from Myakka River State Park (Sarasota County) (42 FR 47840). There is no critical habitat in the project vicinity. It is not anticipated that this project will affect foraging habitat or designated critical habitat for the Florida manatee.

Effects of Interdependent or Interrelated Actions

The other coastal construction projects currently permitted near and within the project area may impact the nearshore and offshore benthic habitats of the proposed project area. However, the absence of SAV habitat in the project area eliminates impacts to manatee foraging habitat. Again, the impact to manatees from these interrelated activities is due the increased risk of vessel strike.

Cumulative Effects

The Florida manatee primarily feeds on SAV. Therefore, negative cumulative effects to manatees could occur if there is an overall loss of SAV. A loss of SAV can occur from an increase in sedimentation and change in salinity levels and tidal flow. Although the beaches within Sarasota and Manatee County have been nourished on multiple occasions, and other coastal construction projects have occurred over the years which may lead to some cumulative impacts to benthic habitat within the project area, there are no known SAV communities utilized as foraging habitat for manatees within the project limits. Cumulative impacts resulting from changes in manatee foraging habitat due to past and future projects are not anticipated.

It has been suggested that beach nourishment can lead to increased coastal development and tourism (NRC, 1990). The project area, especially Longboat Pass at the north end of Longboat Key, is highly used by recreational boaters. As such, as tourism increases, recreational boating may in turn increase. An increased volume in boat traffic could potentially put manatees at a higher risk of collision.

Dredging activities create temporary increased noise to the underwater environment (Clarke *et al.*, 2004). Different types of dredges cause various increases to ambient underwater noise (Clarke *et al.*, 2004) but are generally considered to be low frequency noises (Thomsen, 2009). Manatees are passive listeners meaning they do not use sonar to navigate and detect objects in the environment; they merely listen to the noises around them (Gerstein, 2002). Manatees have trouble distinguishing low frequency noises (Gerstein, 2002), and prefer habitats with less low frequency noise (Miksis-Olds *et al.*, 2007). This suggests that manatees may avoid areas where dredging activities are taking place and thus reduce the chance of dredge-manatee interactions.

Manatees appear to have avoided direct major impacts from the Deepwater Horizon MC 252 oil spill; however, it is still unknown what long-lasting damage may occur to manatee habitat, including food resources such as seagrass beds.

Conservation Measures

Construction activities will incorporate the *Standard Manatee Construction Conditions for In-Water Work* (Appendix 2). These conditions include protection measures that will minimize the potential for significant impacts to manatees by project-related activities. This includes operation of vessels at 'idle speed/no wake' at all times while in the immediate area and when the draft of the vessels provides less than four feet of clearance from the bottom, immediate shutdown of all in-water operations if a manatee comes within 50 ft of construction activities, posting of temporary signs concerning manatees prior to and during all in-water activities, use of turbidity barriers that manatees cannot become entangled in, and reporting any collisions or injury to a manatee to FWC and USFWS.

Effects Determination

It is unlikely that manatees will be present near the offshore borrow areas; however, they may be in the vicinity of the nearshore borrow areas and the fill placement area. There will be no impacts to manatee foraging areas because seagrass is not present within the project area. The construction conditions that provide manatee protection measures will also aid in reducing impacts to manatees. Although manatees may be present in the project area, it is unlikely that they will be negatively impacted by project activities and therefore, an effects determination of May Affect, Not Likely to Adversely Affect is designated to manatees for this project.

7.4 Birds

7.4.1 Piping Plover

Direct and/or Indirect Effects

Piping plovers have occasionally been observed on Longboat Key. The construction window (*i.e.,* disposal of sand) for the interim nourishment phase and possibly the island-wide nourishment phase will extend through piping plover migration and overwintering season. Heavy machinery and equipment (*e.g.,* trucks and bulldozers operating on project area beaches, the placement of the dredge pipeline along the beach, and sand disposal) may adversely affect any migrating and overwintering piping plovers in the project area by disturbance and disruption of normal activities such as roosting and feeding, and possibly forcing birds to expend valuable energy reserves to seek available habitat elsewhere. Burial and suffocation of invertebrate species will occur during each nourishment and renourishment cycle. Impacts from project activities will affect the entire 9.8 miles along the project fill sites. Research by Peterson *et al.* (2006) suggests that impacts to foraging habitat for shorebird species may be short-term due to the temporary depletion of the intertidal food base. Timeframes projected for benthic recruitment and re-establishment following beach nourishment are between six months and two years (Greene, 2002; Burlas *et al.,* 2002). Beach wrack has also been recognized as important to shorebirds, including piping plovers, for camouflage and foraging. Since piping plovers spend the majority of their overwintering time in Florida foraging along the shoreline, the wrack line provides an important foraging resource for this species. Destruction of wrack, through beach nourishment or wrack-removal programs, eliminates this habitat. Protection of wrack can help to offset the direct and indirect impacts associated with beach nourishment and ensuing human disturbance.

Indirect effects of beach nourishment projects involve concern for the reduction in potential for formation of overwash habitats in the project area. During storm events, overwash across barrier islands is common, depositing sediments on the bayside, clearing vegetation and increasing the amount of open, sandflat habitat ideal for shoreline-dependent shorebirds. However, the Longboat Key project area is almost fully developed with hotels, condominiums, residential housing, restaurants, and commercial buildings, which precludes overwash and limits creation of open sand flats preferred by piping plovers. The only area that experiences any overwash is located at the undeveloped northern end of the island, between R42 and R43, outside the project area.

There is no federally designated piping plover critical habitat within or near the project area. The closest designated critical habitat for wintering piping plover to the project area is Unit FL-21, located on Egmont Key at the entrance to Tampa Bay, approximately ten miles north of Longboat Key (USFWS, 2010b). Therefore, there will be no effects to piping plover critical habitat as a result of this project.

Piping plovers may benefit from the stabilization of existing beach habitat and the increase in available roosting habitat from this project.

Effects of Interdependent or Interrelated Actions

The other coastal construction projects currently permitted near and within the project area will involve the use of construction machinery and equipment on the beach and within potential piping plover roosting and foraging habitat. These projects may have impacts on the beaches within the project area including depletion of intertidal and beach infauna, beach wrack, and temporary disruption of roosting and foraging by piping plovers. Apart from these temporary disturbances, no long-term negative effects to piping plovers are anticipated. The Coquina Beach Renourishment Project is required to avoid wrack disturbance or removal at the southernmost portion of Anna Maria Island. The Biological Opinion for the North End Emergency Nourishment of Longboat Key included conditions for wrack avoidance as well as piping plover surveys during construction. This species may benefit from the stabilization of existing beach habitat and the increase in available beach habitat from this project.

Cumulative Effects

Cyclical beach renourishments, continual routine maintenance dredging of inlets, emergency sand placement projects, and coastal armoring may all have cumulative impacts on piping plovers over time. This species overwinters along Florida's coastline and forages along the sandy beaches of the project area and adjacent shorelines. Although infauna recovery has been documented after beach renourishments, the repetitive burial of beach infauna may eventually change the abundance and composition of infaunal communities, which can in turn affect food sources for the piping plover. Additionally, large-scale removal of beach wrack associated with coastal construction projects and beach grooming programs (beach cleaning and raking) removes habitat used by piping plovers for foraging and camouflage.

The Longboat Key coastline is already extensively developed; however, it is reasonable to expect that human occupancy and recreational use along the Gulf coast of Florida will increase in the future. It is unknown how much influence beach renourishment contributes to the development and recreational use of the shoreline. As the proposed project reduces optimal foraging and roosting habitat through wrack-removal, burial and/or disturbance, it may enhance the aesthetic and recreational value of these beaches, thus increasing recreational pressure within the project area. Recreational activities that may adversely affect piping plovers include disturbance by pets, increased pedestrian use (walking, sunbathing) and reduction of foraging habitat from wrack-removal programs permitted by FDEP.

The potential for rapid climate change and its effects on SLR could adversely impact the habitat of listed species such as piping plovers. As climate changes, we can reasonably expect the abundance and distribution of wildlife to change as well. Although estimating future climate change and its effects is difficult, we can speculate that SLR caused by global warming may adversely affect already eroded shorelines, reducing the amount coastal and beach habitat available to wildlife including piping plovers. However, based on measured rates of erosion and changes in water levels in the project area, sea level rise accounts for only 5% of the total shoreline change (CPE, 2009a). Thus, the affects of climate change and SLR on piping plovers in the project area is likely minimal. The magnitude of impacts to piping plovers as well as other shorebirds will be better estimated in the future as more information becomes available.

Impacts from the Deepwater Horizon MC 252 oil spill have not been realized onshore within the project area; however, the final breadth of the oil spill and the effectiveness of the clean-up efforts remain unknown.

Conservation Measures

During the permitting process for this project, coordination with USFWS has resulted in several recommended conservation measures that will incorporated into the Terms and Conditions of the USFWS Biological Opinion. These include shorebird monitoring, education signs at public beach access areas, following FWC's best management practices for operating vehicles on the beach, and public outreach. Shorebird surveys will be conducted during project activities and for three years after the project to monitor impacts to shorebirds and their habitat. Monitoring reports will be submitted monthly to the Town. The Town has also committed to posting educational signs at public access areas to the beach regarding piping plovers and the importance of wrack habitat, as well as links to piping plover information on the Town website. The Longboat Key Police Department, Public Works Department and Code Enforcement are the only entities authorized to drive on the beach for official purpose only. Agents of the Town such as Mote Marine Lab (sea turtle surveys) and CPE (beach topographic surveys) occasionally drive on the beach as well as in ATV's. All follow FWC's guidelines for beach driving which include avoidance of wrack. The Town has also committed to hold a town meeting with shoreline property owners to educate them on the importance of wrack for shorebird habitat.

Effects Determination

Based on low abundance of documented piping plover observations on Longboat Key within the last five years and the conservation measures that will be implemented to reduce impacts to piping plovers, an effects determination of May Affect, Not Likely to Adversely Affect is assigned to piping plovers for this project.

8.0 CONSERVATION MEASURES SUMMARY

In general, the conservation measures that will be taken to protect federally listed species and their habitat will follow construction guidelines as set forth by state and federal agencies, or as recommended in the NMFS Gulf of Mexico Regional Biological Opinion. See Appendices 1 and 2 for protected species construction conditions.

9.0 CONCLUSIONS

Table 6 presents the effects determinations for each species based on the existing information available for each species and its occurrence, project design, and conservation measures discussed by species in Section 7.

Table 6. Effects determination for evaluated species.

COMMON NAME	SCIENTIFIC NAME	EFFECTS DETERMINATION
CORAL		
Staghorn coral	*Acropora cervicornis*	No Effect
Elkhorn coral	*Acropora palmata*	No Effect
FISH		
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	No Effect
Smalltooth sawfish	*Pristis pectinata*	May affect, not likely to adversely affect
SEA TURTLES		
Loggerhead	*Caretta caretta*	May affect, likely to adversely affect
Green	*Chelonia mydas*	May affect, likely to adversely affect
Leatherback	*Dermochelys coriacea*	May affect, not likely to adversely affect
Hawksbill	*Eretmochelys imbricata*	May affect, not likely to adversely affect
Kemp's ridley	*Lepidochelys kempii*	May affect, not likely to adversely affect
MAMMALS		
Sei whale	*Balaenoptera borealis*	May affect, not likely to adversely affect
Fin whale	*Balaenoptera physalus*	May affect, not likely to adversely affect
North Atlantic right whale	*Eubalaena glacialis*	May affect, not likely to adversely affect
Humpback whale	*Megaptera novaeangliae*	May affect, not likely to adversely affect
Sperm whale	*Physeter macrocephalus*	May affect, not likely to adversely affect
Blue whale	*Balaenoptera musculus*	May affect, not likely to adversely affect
Florida manatee	*Trichechus manatus latirostris*	May affect, not likely to adversely affect
BIRDS		
Piping plover	*Charadrius melodus*	May affect, not likely to adversely affect

Based upon the findings of this biological assessment, we have determined that the proposed action "May affect, likely to adversely affect" the following species, which commonly nest in the project area:

Loggerhead sea turtle (*Caretta caretta*)
Green sea turtle (*Chelonia mydas*)

Based upon the findings of this biological assessment, we have determined that the proposed action "May affect, not likely to adversely affect" the following species. These species of sea turtles rarely or never nest in the project area, but may occur in nearshore waters. Manatees may occur in nearshore waters. Piping plovers are occasionally observed in the project area. However, incorporation of conservation measures listed in Section 7.0 minimizes the effects to these species:

Leatherback sea turtle (*Dermochelys coriacea*)
Hawksbill sea turtle (*Eretmochelys imbricate*)
Kemp's ridley sea turtle (*Lepidochelys kempii)*
Florida manatee (*Trichechus manatus latirostris)*
Piping Plover (*Charadrius melodus)*
Sei whale (*Balaenoptera borealis)*
Fin whale (*Balaenoptera physalus)*
North Atlantic right whale (*Eubalaena glacialis)*
Humpback whale (*Megaptera novaeangliae)*
Sperm whale (*Physeter macrocephalus)*
Blue Whale (*Balaenoptera musculus)*

Based upon the findings of this biological assessment, we have determined that the proposed action will have "No effect" on the following species because they are known not to occur in or near the project area:

Staghorn coral (*Acropora cervicornis*)
Elkhorn coral (*Acropora palmata*)
Gulf sturgeon (*Acipenser oxyrinchus desotoi*)

The May Affect, Likely to Adversely Affect, May Affect, Not Likely to Adversely Affect, and the No Effect determinations for the listed species and critical habitat were concluded based upon compiled local and regional data and conservation, monitoring and mitigation measures to avoid and minimize impacts to listed species.

10.0 LITERATURE CITED

American Cetacean Society (ACS). 2004. ACS Fact Sheet: Fin Whale. Last visited 6/23/10, last revised March 2004. http://www.acsonline.org/factpack/finWhale/fin-whale.pdf

Bargo, T., J. Glass, T. Fitzpatrick, and D. Oullette. 2005. Sea turtle relocation trawling: is it effective? *Florida Shore and Beach Preservation Association Proceedings.*

Blake, N.J., L.J. Doyle, and J.J. Culter. 1996. Impacts and direct effects of sand dredging for beach renourishment on the benthic organisms and geology of the West Florida Shelf, Final Report. U.S. Department of the Interior, Minerals Management Service, Office of International Activities and Marine Minerals, Herndon, Va. OCS Report MMS 95-005, 109 pp.

Bradley, L. 1997. The Mammals of Texas, Online Edition. Texas Tech University. Last visited 12/21/2010. http://www.depts.ttu.edu/nsrl/tmot1/Default.htm.

Burlas, M., D.G. Clarke, G.L. Ray, and D.H. Wilber. 2002. Biological monitoring of beach nourishment operations in northern New Jersey, USA: Linkages between benthic infauna and higher trophic levels. Dredging '02, May 5-8, 2002, Orlando, FL. American Society of Civil Engineers.

Caldwell, D.K. and M.C. Caldwell. 1983. Whales and Dolphins. *In:* Alfred A. Knopf (ed.). The Audubon Society Field Guide to North American Fishes, Whales and Dolphins. Alfred A. Knopf, Inc., New York, NY, pp. 767-812.

Carlson, J.K., J. Osborne, and T.W. Schmidt. 2007. Monitoring the recovery of smalltooth sawfish, *Pristis pectinata*, using standardized relative indices of abundance. *Biological Conservation* 136(2):195-202.

Clarke, D., C. Dickerson, and K. Reine. 2004. Characterization of underwater sounds produced by dredges. Dredging ’02: Key Technologies for Global Prosperity. *Proceedings of 3rd Specialty Conference on Dredging and Dredged Material.*

Clapham, P.J., S. Leatherwood, I. Szczepaniak, and R.L. Brownell, Jr. 1997. Catches of humpback and other whales from shore stations at Moss Landing and Trinidad, California, 1919-1926. *Marine Mammal Science* 13:368-394

Coastal Planning & Engineering, Inc. (CPE). 1985. Town of Longboat Key Comprehensive Beach Management Plan, Prepared for the Town of Longboat Key, Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE). 1985. Town of Longboat Key Comprehensive Beach Management Plan, Prepared for the Town of Longboat Key, Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE). 2009a. Longboat Pass, Manatee County, FL, Numerical Calibration of Wave Propagation, Currents, and Morphology Changes, Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE). 2009b. Town of Longboat Key, 2005/06 Beach Renourishment Project Fourth Post-Construction Hardbottom Monitoring and Mitigation Report. Coastal Planning & Engineering, Inc., Boca Raton, Florida, 44 pp. (Prepared for the Florida Department of Environmental Protection).

Coastal Planning & Engineering, Inc. (CPE). 2010. Longboat Key North End Breakwaters: Numerical modeling of breakwater and beach fill performance. Coastal Planning & Engineering, Inc., Boca Raton, FL, 104 pp. (Prepared for the Town of Longboat Key).

Commission on Life Sciences (CLS). 1990. Conservation Measures, *In*: N. Grossblatt (eds.), Decline of the sea turtles: causes and prevention. National Academy Press, Washingon D.C.

Continental Shelf Associates (CSA). 2007. Terra Ceia re-route survey of marine benthic habitats within the proposed Port dolphin pipeline corridor within Tampa Bay, Florida. Addendum to the Deepwater Port License Application. Prepared for Port Dolphin LLC.

Davis, R.W., W.E. Evans, and B. Würsig (eds.). 2000. Cetaceans, Sea turtles and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. Prepared by Texas A&M University at Galveston and the National Marine Fisheries Service. U.S. Department of the Interior, Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-0006 and Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2000-003. 346 p.

Dickerson, D.D. and D.A. Nelson. 1989. Recent results on hatchling orientation response to light wavelengths and intensities. *In:* S.A. Eckert, K.L. Eckert, and T.H. Richardson (compilers), Proceedings of the 9th Annual Workshop on Sea Turtle Conservation and Biology, pp. 41-43. NOAA Technical Memorandum NMFS-SEFC-232.

Dickerson, D., M. Wolters, C. Theriot, and D. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Submitted for proceedings of the World Dredging Congress, Hamburg, Germany, September 27 – October 1, 2004.

Ernest, R.G. and R.E. Martin. 1999. Martin County beach nourishment project: sea turtle monitoring and studies. 1997 annual report and final assessment. Prepared for the Florida Department of Environmental Protection.

Fish and Wildlife Research Institute (FWRI). 2010a. FWC and FWRI Sea turtle nesting activity in Florida. http://research.myfwc.com/features/category_sub.asp?id=2309. Last visited June 23, 2010.

Fish and Wildlife Research Institute (FWRI). 2010b. FWC-FWRI Marine Resources Geographic Information System (MRGIS) Internet Map Server (IMS). Manatee Mortality Data (updated 2009) and Seagrass Resource Data (updated 2007). Last visited May 21, 2010. http://ocean.floridamarine.org/mrgis_ims/Description_Layers_Marine.htm.

Florida Fish and Wildlife Conservation Commission (FWC). 2009. FWC Marine Mammal Pathobiology Laboratory, Preliminary Manatee Mortality Report. Last updated June 12, 2009.

Florida Natural Areas Inventory (FNAI). 2010. Field Guide to Rare Animals of Florida. Last visited 6/24/10. http://www.fnai.org

Forrest-Vandera, B.M., M. Larenas, B.S. Suthard, and J.L. Andrews. 2011. Longboat Key Sand Search Investigation. Boca Raton, Florida: Coastal Planning & Engineering, Inc. (Prepared for the Town of Longboat Key, Florida).

Gambell, R. 1985. Fin whale *Balaenoptera physalus*. *In:* S.H. Ridgway and R. Harrison (eds.), Handbook of marine mammals, Volume 3: the Sirenians and Baleen Whales, pp. 155-170. Academic Press Inc., London. 362 p.

Gerstein, E. 2002. Manatees, Bioacoustics and Boats: Hearing tests, environmental measurements and acoustic phenomena may together explain why boats and animals collide. *American Scientist:* http://www.americanscientist.org/issues/num2/2002/2/manatees-bioacoustics-and-boats/3

Gilliam, D.S., R.E. Dodge, R.E. Spieler, L.K.B. Jordan and J.C. Walczak. 2006. Marine Biological Monitoring in Broward County, Florida: Year 6 Annual Report. Prepared by Nova Southeastern University Oceanographic Center for Broward County. Dania Beach, Florida.

Glenn, L. 1996. The orientation and survival of loggerhead sea turtle hatchlings (*Caretta caretta*) in the near shore environment. Unpublished Master's thesis. Florida Atlantic University, Boca Raton, Florida.

Glenn, L. 1998. The consequences of human manipulation of the coastal environment on hatchling loggerhead sea turtles (*Caretta caretta* L.), pp 58-59 *In:* R. Byles and Y. Fernandez (compilers), *Proceedings of the 16th Annual Symposium on Sea Turtle Biology and Conservation*. NOAA Technical Memorandum NMFS-SEFSC-412.

Godfrey, M. and N. Mrosovsky. 1999. Estimating hatchling sex ratios. *In*: K.L. Eckert, K.A. Bjorndal, F.A. Abreu-Grobois and M. Donnelly (eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/MTSG Publication No. 4. pp 136-138.

Grain, D.A., A.B. Bolten, and K.A. Bjorndal. 1995. Effects of Beach Nourishment on Sea Turtles: Review and Research Initiatives. *Restoration Ecology* 3(2):95-104.

Greene, K. 2002. Beach Nourishment: A Review of the Biological and Physical Impacts. *Atlantic States Marine Fisheries Commission (ASMFC) Habitat Management Series #7, November 2002*, 174 p.

Gyuris, E. 1994. The rate of predation by fishes on hatchlings of the green turtle (*Chelonia mydas*). *Coral Reefs* 13:137-144.

Haig, S.M. 1992. Piping Plover. No. 2. The Birds of North America. *In:* A. Pools, P. Stettenheim, and F. Gill (eds.), Philadelphia: The Academy of Natural Sciences. The American Ornithologists' Union, Washington, D.C.

Haig, S.M. and L.W. Oring. 1985. The distribution and status of the piping plover throughout the annual cycle. *Journal of Field Ornithology* 56:334-345.

Haig, S.M., and L.W. Oring. 1987. The piping plover. *The Audubon Society*, 1987 Audubon Wildlife Report. Washington, D.C.

Hughes, A.L. and E.A. Caine. 1994. The effect of beach features on hatchling loggerhead sea turtles. *Proceedings of the 14th Annual Symposium on Sea Turtle Biology and Conservation.* Hilton Head, South Carolina, p. 237.

Humphrey, S.R. 1992. Florida manatee, *Trichechus manatus latirostris*. *In:* Rare and Endangered Biota of Florida, Volume I: Mammals, pp. 190-198.

Intergovernmental Panel on Climate Change. 2007. Climate Change 2007: Climate Change Impacts, Adaptation and Vulnerability. Working Group II Contribution to the Intergovernmental Panel on Climate Change. Fourth Assessment Report.

Jefferson, T.A., S. Leatherwood, and M.A. Webber. 1993. FAO species identification guide: marine mammals of the world. United Nations Environment Programme, Food and Agriculture Organization of the United Nations, Rome. 320 p.

Jefferson T.A. and A.J. Schiro. 1997. Distribution of cetaceans in the offshore Gulf of Mexico. *Mammal Review* 27:27-50.

Jenson, A.S. and G.K. Silber. 2004. Large whale ship strike database. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-OPR-25. 37 p.

Johnson, A.F. and M.G. Barbour. 1990. Dunes and Maritime Forest. *In:* R.L Myers and J.J. Ewel (eds.), Ecosystems of Florida**.** University of Central Florida Press, Orlando, Florida. 765 p.

Limpus, C.J, V. Baker, and J.D. Miller. 1979. Movement induced mortality of loggerhead eggs. *Herpetologica* 35:335-338.

Lorne, J.K. and M. Salmon. 2007. Effects of exposure to artificial lighting on orientation of hatchling sea turtles on the beach and in the ocean. *Endangered Species Research* 3:23-30.

Lott, C.A. 2009. Distribution and abundance of Piping Plovers (*Charadrius melodus*) and Snowy Plovers (*Charadrius alexandrinus*) on the west coast of Florida before and after the 2004/2005 hurricane seasons. Prepared for the U.S. Army USACE of Engineers, Washington, D.C. Dredging Operations and Environmental Research Program, Final Report, ERDC/EL TR-09-13, September 2009. 47 p.

Lutcavage, M., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtles. *In*: P.L. Lutz and J.A Musick (eds.), The Biology of Sea Turtles, CRC Press, New York.

Makowski, C., J.A. Seminoff, and M. Salmon. 2006. Home range and habitat use of juvenile Atlantic green turtles (*Chelonia mydas* L.) on shallow reef habitats in Palm Beach, Florida, USA. *Marine Biology* 148:1167-1179.

Mann, T.M. 1977. Impact of developed coastline on nesting and hatchling sea turtles in southeastern Florida. Unpublished M.S. Thesis. Florida Atlantic University, Boca Raton, Florida.

Mead, J.G. 1977. Records of sei and Bryde's whales from the Atlantic coast of the United States, the Gulf of Mexico, and the Caribbean. *Report of the International Whaling Commission* SI 1:113–116.

Miksis-Olds, J.L., P.L. Donaghay, J.H. Miller, P.L. Tyack, and J.A. Nysteun. 2007. Noise level correlates with manatee use of foraging habitat. *Journal of the Accoustical Society of America* 121(5):3011-3020

Mitchell, E. and D. G. Chapman. 1977. Preliminary assessment of stocks of northwest Atlantic sei whales (*Balaenoptera borealis*). *Report of the International Whaling Commission* SI 1:117–120.

Montague, C.L. 1993. Ecological engineering of inlets in Southeastern Florida: design criteria for sea turtle nesting beaches. *Journal of Coastal Research* SI 18:267-276.

Mortimer, J.A. 1999. Reducing threats to eggs and hatchlings: Hatcheries. *In*: K.L. Eckert, K.A. Bjorndal, F.A Abreu-Grobois, and M. Donnelly (eds.), Research and Management Techniques for the Conservation of Sea Turtles. IUCN/MTSG Publication No. 4. pp. 175-178.

Mrosovsky, N. 2006. Distorting gene pools by conservation: assessing the case of doomed turtle eggs. *Environmental Management* 38:523-531.

MSNBC. 2004. Rare whales seen for first time in decades. 'Right' species among world's most endangered. Posted April 14, 2004. http://www.msnbc.msn.com/id/4750744/. Last visited 12/20/2010.

Myers and Ewel. 1990. Ecosystems of Florida. University of Central Florida Press, Orlando, Florida.

National Marine Fisheries Service (NMFS). 1991. Recovery plan for the humpback whale (*Megaptera novaeangliae*). Prepared by the Humpback Whale Recovery Team for the National Marine Fisheries Service, Silver Spring Maryland.

National Marine Fisheries Service (NMFS). 1998a. Recovery plan for the blue whale (*Balaenoptera musculus*). Prepared by R.R. Reeves, P.J. Clapham, R.L. Brownell, Jr., and G.K. Silber for the National Marine Fisheries Service, Silver Spring, Maryland. 42 p.

National Marine Fisheries Service (NMFS). 1998b. Draft recovery plan for the fin whale (*Balaenoptera physalus*) and sei whale (*Balaenoptera borealis*). Prepared by Randall Reeves, R., G.K. Silber, and P.M. Payne for the National Marine Fisheries Service, Silver Spring, Maryland. 65 p.

National Marine Fisheries Service (NMFS). 2003. Gulf of Mexico Regional Biological Opinion (GOM RBO) on Hopper Dredging of Navigation Channels and Borrow Areas in the U.S. Gulf of Mexico. NOAA Fisheries, Southeast Regional Office, St. Petersburg, Florida. Issued November 19, 2003. 121 p.

National Marine Fisheries Service (NMFS). 2005. Recovery plan for the North Atlantic right whale (*Eubalaena glacialis*). National Marine Fisheries Service. Silver Spring, Maryland.

National Marine Fisheries Service (NMFS). 2006a. Draft recovery plan for the fin whale (*Balaenoptera physalus*). National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS). 2006b. Draft recovery plan for the sperm whale (*Physeter Macrocephalus*). National Marine Fisheries Service, Silver Spring, Maryland.

National Marine Fisheries Service (NMFS). 2008a. An overview of protected species commonly found in the Gulf of Mexico. NOAA Fisheries Service, Southeast Regional Office, Protected Resources Division. Last visited 6/23/10, last revised February 2008. http://sero.nmfs.noaa.gov/pr/pdf/Protected%20Species%20In%20GOM-web%20version%202-7-08.pdf

National Marine Fisheries Service (NMFS). 2008b. Sei whale (*Balaenoptera borealis*): Nova Scotia Stock.

National Marine Fisheries Service (NMFS). 2009a. Recovery plan for smalltooth sawfish (*Pristis pectinata*). Prepared by the Smalltooth Sawfish Recovery Team for the National Marine Fisheries Service, Silver Spring, Maryland. January 2009.

National Marine Fisheries Service (NMFS). 2009b. North Atlantic Right Whale (*Eubalaena glacialis*): Western Atlantic Stock. December 2009.

National Marine Fisheries Service (NMFS). 2009c. Fin Whale (*Balaenoptera physalus*): Western North Atlantic Stock. December 2009.

National Marine Fisheries Service (NMFS). 2010. NOAA Fisheries Office of Protected Resources, Species Information. Last visited 1/4/11. http://www.nmfs.noaa.gov/pr/species/

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1991a. Recovery plan for U.S. population of loggerhead turtle (*Caretta caretta*). National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1991b. Recovery plan for U.S. population of Atlantic green turtle. National Marine Fisheries Service, Washington, D.C.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1992a. Recovery plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). National Marine Fisheries Service, St. Petersburg, Florida.

National Marine Fisheries Service (NMFS) and U.S. Fish and Wildlife Service (USFWS). 1993. Recovery plan for hawksbill turtle (*Eretmochelys imbricata*) in the U.S. Caribbean, Atlantic, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Florida.

National Marine Fisheries Service (NMFS) and U.S. Fish & Wildlife Service (USFWS). 2007a. Hawksbill sea turtle (*Eretmochelys imbricata*) 5-Year Review: Summary and Evaluation. August 2007. Jacksonville, Florida. 90 p.

National Marine Fisheries Service (NMFS) and U.S. Fish & Wildlife Service (USFWS). 2007b. Kemp's Ridley sea turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation. August 2007. Albuquerque, New Mexico. 50 p.

National Oceanic and Atmospheric Administration (NOAA). 2010a. Emergency response: Deep Horizon Incident, Gulf of Mexico. Last visited 6/28/10. http://www.response.restoration.noaa.gov/topic_subtopic_entry.php?RECORD_KEY(entry_subtopic_topic)=entry_id,subtopic_id,topic_id&entry_id(entry_subtopic_topic)=809&subtopic_id(entry_subtopic_topic)=2&topic_id(entry_subtopic_topic)=1.

National Oceanic and Atmospheric Administration (NOAA). 2010b. Smalltooth sawfish (*Pristis pectinata*). Last visited 8/19/10. http://www.nmfs.noaa.gov/pr/species/fish/smalltoothsawfish.htm

National Research Council (NRC). 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press, Washington, D.C.

Nelson, D.A. and D.D. Dickerson. 1989. Effects of beach nourishment on sea turtles.

Proceedings of the 9th Annual Workshop on Sea Turtle Conservation and Biology. Jekyll Island, Georgia.

Nicholls, J.L. and G.A. Baldassarre. 1990. Winter distribution of piping plovers along the Atlantic and Gulf Coasts of the United States. *Wilson Bulletin* 102(3):400-412.

O'Hanlon, L. 2010. Sperm whales cleared out after Gulf oil spill. Discovery News. Last viewed 1/4/2011. http://news.discovery.com/animals/sperm-whales-gulf-oil-spill.html.

Peterson, C.H., M.J. Bishop, G.A. Johnson, L.M. D'Anna, and L.M. Manning. 2006. Exploiting beach filling as an unaffordable experiment: benthic intertidal impacts propagating upwards to shorebirds. *Journal of Experimental Marine Biology and Ecology* 338:205-221.

Pilkey, O.H. and K.L. Dixon. 1996. The USACE and the Shore. Island Press, Washington, D.C. 272 p.

Pope, J. 1986. Segmented offshore breakwaters: An alternative for beach erosion control. *Shore and Beach* 54(4):3-6.

Poulakis, G.R. and J.C. Seitz. 2004. Recent occurrence of the smalltooth sawfish, *Pristis pectinata* (Elasmobranchiomorphi: Pristidae), in Florida Bay and the Florida Keys, with comments on sawfish ecology. *Florida Scientist* 67:27–35.

Pritchard, P.C.H. 1997. Evolution, Phylogeny, and Current Status. *In*: P.L Lutz and J.A. Musick (eds.), The Biology of Sea Turtles, CRC Press, New York.

Rice, D.W. 1998. Sperm Whale *Physeter macrocephalus* Linnaeus, 1758. *In*: S. H. Ridgway and R. Harrison (eds.), Handbook of Marine Mammals, Volume 4: River Dolphins and the Larger Toothed Whales, pp. 177-234. Academic Press Inc., London.

Richardson, W.J., B. Wrsig, and C.R. Greene, Jr. 1990. Reactions of bowhead whales, *Balaena mysticetus,* to drilling and dredging noise in the Canadian Beaufort Sea. *Marine Environmental Research* 29(2):135-160.

Rogers, 1990. Responses of coral reefs and reef organisms to sedimentation. *Marine Ecology Progress Series* 62:185-202.

Schwartz, F.J. 1995. Florida manatees, *Trichechus manatus* (Sirenia Trichechidae), in North Carolina 1919-1994. *Brimleyana* 22:53-60.

Sipfendorfer, C.A. 2000. Predicting population recovery rates for endangered western Atlantic sawfishes using demographic analyses. *Environmental Biology of Fishes* 58:371-377.

Sipfendorfer, C.A. 2002. Smalltooth sawfish: the USA's first endangered elasmobranch? *Endangered Species Update* 19:45-49.

Simpfendorfer, C.A. 2003. Abundance, movement and habitat use of the smalltooth sawfish. Final Report to the National Marine Fisheries Service, Grant number WC133F-02-SE-0247. Mote Marine Laboratory Technical Report (929).

Simpfendorfer, C.A. and T.R. Wiley. 2005. Determination of the distribution of Florida's remnant sawfish population and identification of areas critical to their conservation. Final Report. Florida Fish and Wildlife Conservation Commission, Tallahassee, Florida.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: Are leatherbacks going extinct? *Chelonian Conservation and Biology* 2:209-222.

Sprandel, G.L., J.A. Gore, and D.T. Cobb. 1997. Winter shorebird survey. Final performance report. Florida Game and Fresh Water Fish Commission, Tallahassee, Florida.

Staats, E. 2006. Two right whales continue to surprise scientists. Naples News, March 8, 2006. Last visited 12/16/2010. http://www.naplesnews.com/news/2006/mar/08/two_right_whales_continue_surprise_scientists/?local_news

Stewart, K.R. and J. Wyneken. 2004. Predation risk to loggerhead hatchlings at a high-density nesting beach in southeast Florida. *Bulletin of Marine Science* 74:325-335.

Trindell, R., M. Conti, D. Gallagher, and B. Witherington. 2005. Sea turtles and lights on Florida's nesting beaches. *Proceedings of the 25th Annual Symposium on Sea Turtle Biology and Conservation*, pp. 152-153. Savannah, Georgia.

Thomsen, F., S. McCully, D. Wood, F. Pace, and P. White. 2009. A generic investigation into noise profiles of marine dredging in relation to the acoustic sensitivity of the marine fauna in UK waters with particular emphasis on aggregate dredging: PHASE 1 Scoping and review of key issues. Marine Aggregate Levy Sustainable Fund. MEPF Ref No. MEPF/08/P21.

Tucker, A., R. Welsh, K. Mazzarella, K. Garrett, S. Hirsch, and P. Clark. 2009. Sea turtle monitoring, nest evaluation, and protection measures for Longboat Key 2009. Submitted to Town of Longboat Key. Sea Turtle Conservation and Research Program, Mote Marine Laboratory, Sarasota, Florida.

Turtle Expert Working Group (TEWG). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the western North Atlantic. NOAA Technical Memorandum NMFS-SEFSC-444.

The Turtle Hospital. 2010. Hidden Harbor Marine Environmental Project, Inc. Marathon, Florida. Last visited 12/27/10. http://www.turtlehospital.org/fibropapilloma.htm

U.S. Fish and Wildlife Service (USFWS). 2001. Florida manatee recovery plan, (*Trichechus manatus latirostris*). Third Revision. U.S. Fish and Wildlife Service. Atlanta, Georgia, 144 p. with Appendices.

U.S. Fish and Wildlife Service (USFWS). 2002a. Endangered and threatened wildlife and plants: manatee protection areas in Florida. *Federal Register* 67(4):680-696.

U.S. Fish and Wildlife Service (USFWS). 2002b. Endangered and threatened wildlife and plants: final rule to establish thirteen additional manatee protection areas in Florida. Final rule and proposed rule. *Federal Register* 67(217):68449-68489.

U.S. Fish and Wildlife Service (USFWS). 2009a. Piping plover (*Charadrius melodus*) 5-Year Review: Summary and Evaluation. September 2009.

U.S. Fish and Wildlife Service (USFWS). 2009b. West Indian Manatee *(Trichechus manatus)* Florida Stock (Florida subspecies, *Trichechus manatus latirostris*), U.S. Fish and Wildlife Service, Jacksonville, Florida. Last visited 12/29/10. Revised 12/30/09. http://www.fws.gov/northflorida/Manatee/SARS/20091230_rpt_Final_Florida_Manatee_SAR.pdf.

U.S. Fish and Wildlife Service (USFWS). 2009c. Hawksbill sea turtle (*Eretmochelys imbricata*). Last updated 1/16/09. http://www.fws.gov/northflorida/SeaTurtles/Turtle%20Factsheets/hawksbill-sea-turtle.htm

U.S. Fish & Wildlife Service (USFWS). 2010a. USFWS North Florida Ecological Services Office, Sea Turtle Information. Last visited 1/23/10. http://www.fws.gov/northflorida/SeaTurtles/seaturtle-info.htm

U.S. Fish & Wildlife Service (USFWS). 2010b. Critical Habitat for Piping Plover (*Charadrius melodus*), Florida Units 20 and 21. Last visited 6/23/10. http://www.fws.gov/plover/finalchmaps/Plover_FL_20_to_21.jpg

U.S. Fish & Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). 2009. Gulf sturgeon (*Acipenser oxyrinchus desotoi*) 5-Year Review: Summary and Evaluation. September 2009. Panama City, Florida. 49 p.

Vose, F.E. and B.V. Shank, 2003. Predation on loggerhead and leatherback post-hatchlings by gray snapper. *Marine Turtle Newsletter* 99:11-14.

Waring, G.T., C.P. Fairfield, C.M. Ruhsam, and M. Sano. 1993. Sperm whales associated with Gulf Stream features off the northeastern U.S.A. shelf. *Fish Oceanography* 2(2):101-105.

Weilgart, L.S. 2007. A brief review of known effects of noise on marine mammals. *International Journal of Comparative Psychology* 20:159-168.

Wershoven, R.W. and J.L. Wershoven. 1988. A survey of juvenile green turtles and their resting and foraging habitats off Broward County, Florida. Unpublished report to the Florida Department of Natural Resources, Division of Marine Resources, Broward County, pp. 1–35.

Wershoven, J.L. and R.W. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: a five year review. *In*: M. Salmon and J. Wyneken (compilers), *Proceedings of the 11th Annual Workshop on Sea Turtles Biology and Conservation*, NOAA Technical Memorandum NMFS-SEFC-302, pp. 121-123.

Whelan, C.L. and J. Wyneken. 2007. Estimating predation levels and site-specific survival of hatchling loggerhead sea turtles (*Carretta caretta*) from South Florida Beaches. *Copeia* 3:745-754.

Winn, H.E. and N.E. Reichley. 1985. Humpback whale *Megaptera novaeangliae* (Borowski, 1781). *In:* S.H. Ridgway and R.J. Harrison (eds.), Handbook of Marine Mammals, Volume 3: the Sirenians and Baleen Whales, pp. 241-273. Academic Press Inc., London. 362 p.

Witherington, B.E. and R.E. Martin. 1996. Understanding, assessing, and resolving light-pollution problems on sea turtle nesting beaches. Florida Marine Research Institute Technical Report TR-2. 73 p.

Witherington, B.E. and M. Salmon. 1992. Predation on loggerhead turtle hatchlings after entering the sea. *Journal of Herpetology* 26(2):226-228.

Wilson, E.G. 2010. Oceana: Potential impacts of Deepwater Horizon Oil Spill on Sea Turtles. http://na.oceana.org/sites/default/files/Potential_Impacts_of_Deepwater_Horizon_Oil_Spill_on_Sea_Turtles_FINAL_0.pdf. June 2010

Wyneken, J., L. DeCarlo, L. Glenn, S. Weege, and L. Fisher. 1998. On the consequences of timing, location and fish to hatchling sea turtle survival. *In:* R. Byles and C. Coogan (compilers), NOAA Technical Memorandum, NMFS-SEFSC. *Proceedings of the 16th Annual Symposium on Sea Turtle Biology and Conservation* 412:155-156.

Yntema, C.L. and N. Mrosovsky. 1982. Critical periods and pivotal temperatures for sexual differentiation in loggerhead sea turtles. *Canadian Journal of Zoology* 60:1012-1016.

Yochem, P.K. and S. Leatherwood. 1985. Blue whale *Balaenoptera musculus* (Linnaeus, 1758). *In*: Ridgway, S.H. and R.J. Harrison (eds.), Handbook of Marine Mammals, Volume 3: The Sirenians and Baleen Whales, pp.193-240. Academic Press Inc., London. 362 p.

APPENDIX 1

NMFS SEA TURTLE AND SMALLTOOTH SAWFISH CONSTURCTION CONDITIONS

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701

SEA TURTLE AND SMALLTOOTH SAWFISH CONSTRUCTION CONDITIONS

The permittee shall comply with the following protected species construction conditions:

a. The permittee shall instruct all personnel associated with the project of the potential presence of these species and the need to avoid collisions with sea turtles and smalltooth sawfish. All construction personnel are responsible for observing water-related activities for the presence of these species.

b. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing sea turtles or smalltooth sawfish, which are protected under the Endangered Species Act of 1973.

c. Siltation barriers shall be made of material in which a sea turtle or smalltooth sawfish cannot become entangled, be properly secured, and be regularly monitored to avoid protected species entrapment. Barriers may not block sea turtle or smalltooth sawfish entry to or exit from designated critical habitat without prior agreement from the National Marine Fisheries Service's Protected Resources Division, St. Petersburg, Florida.

d. All vessels associated with the construction project shall operate at "no wake/idle" speeds at all times while in the construction area and while in water depths where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will preferentially follow deep-water routes (e.g., marked channels) whenever possible.

e. If a sea turtle or smalltooth sawfish is seen within 100 yards of the active daily construction/dredging operation or vessel movement, all appropriate precautions shall be implemented to ensure its protection. These precautions shall include cessation of operation of any moving equipment closer than 50 feet of a sea turtle or smalltooth sawfish. Operation of any mechanical construction equipment shall cease immediately if a sea turtle or smalltooth sawfish is seen within a 50-ft radius of the equipment. Activities may not resume until the protected species has departed the project area of its own volition.

f. Any collision with and/or injury to a sea turtle or smalltooth sawfish shall be reported immediately to the National Marine Fisheries Service's Protected Resources Division (727-824-5312) and the local authorized sea turtle stranding/rescue organization.

g. Any special construction conditions, required of your specific project, outside these general conditions, if applicable, will be addressed in the primary consultation.

Revised: March 23, 2006
O:\forms\Sea Turtle and Smalltooth Sawfish Construction Conditions.doc

APPENDIX 2

FWC STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

Standard Manatee Conditions For In-water Work

July 2009

STANDARD MANATEE CONDITIONS FOR IN-WATER WORK

2009

The permittee shall comply with the following conditions intended to protect manatees from direct project effects:

a. All personnel associated with the project shall be instructed about the presence of manatees and manatee speed zones, and the need to avoid collisions with and injury to manatees. The permittee shall advise all construction personnel that there are civil and criminal penalties for harming, harassing, or killing manatees which are protected under the Marine Mammal Protection Act, the Endangered Species Act, and the Florida Manatee Sanctuary Act.

b. All vessels associated with the construction project shall operate at "Idle Speed/No Wake" at all times while in the immediate area and while in water where the draft of the vessel provides less than a four-foot clearance from the bottom. All vessels will follow routes of deep water whenever possible.

c. Siltation or turbidity barriers shall be made of material in which manatees cannot become entangled, shall be properly secured, and shall be regularly monitored to avoid manatee entanglement or entrapment. Barriers must not impede manatee movement.

d. All on-site project personnel are responsible for observing water-related activities for the presence of manatee(s). All in-water operations, including vessels, must be shutdown if a manatee(s) comes within 50 feet of the operation. Activities will not resume until the manatee(s) has moved beyond the 50-foot radius of the project operation, or until 30 minutes elapses if the manatee(s) has not reappeared within 50 feet of the operation. Animals must not be herded away or harassed into leaving.

e. Any collision with or injury to a manatee shall be reported immediately to the FWC Hotline at 1-888-404-FWCC. Collision and/or injury should also be reported to the U.S. Fish and Wildlife Service in Jacksonville (1-904-731-3336) for north Florida or Vero Beach (1-772-562-3909) for south Florida.

f. Temporary signs concerning manatees shall be posted prior to and during all in-water project activities. All signs are to be removed by the permittee upon completion of the project. Awareness signs that have already been approved for this use by the Florida Fish and Wildlife Conservation Commission (FWC) must be used (see MyFWC.com). One sign which reads *Caution: Boaters* must be posted. A second sign measuring at least 81/2" by 11" explaining the requirements for “Idle Speed/No Wake” and the shut down of in-water operations must be posted in a location prominently visible to all personnel engaged in water-related activities.

CAUTION: MANATEE HABITAT

All project vessels

IDLE SPEED / NO WAKE

When a manatee is within 50 feet of work
all in-water activities must

SHUT DOWN

Report any collision with or injury to a manatee:

Wildlife Alert:

1-888-404-FWCC(3922)

cell *FWC or #FWC

APPENDIX 3

PORT DOLPHIN AGREEMENT
ADDENDUM 1

PortDolphin

Port Dolphin Energy LLC
400 North Tampa Street, Suite 1050
Tampa, FL 33602, USA

Telephone: 813 514 398
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www.portdolphin.com

December 7, 2007

By Overnight Delivery

Mr. Raymond W. Martin
Deepwater Ports Project Officer
Deepwater Ports Standards Division (CG-3PSO-5)
U.S. Coast Guard Headquarters, Room 1508
2100 Second Street, S.W.
Washington, D.C. 20593-0001

Regarding: Port Dolphin Energy LLC Liquefied Natural Gas Deepwater Port License Application, Public Docket USCG-2007-28532. 72 Fed. Reg. 34,741 (Jun. 25, 2007). **Deepwater Port Application Addendum - Project Design Changes and Corresponding Impacts - December 2007**

Dear Mr. Martin:

Enclosed for filing is Port Dolphin Energy LLC's Deepwater Port Application Addendum – Project Design Changes and Corresponding Impacts. The addendum amends the March 29, 2007, license application in the above-designated docket. The application was considered complete on June 15, 2007. Processing was suspended on August 10, 2007, however, based on route changes for the pipeline.

This addendum proposes nearshore and onshore pipeline route changes, as well as an optimized buoy anchoring arrangement. It is submitted for analysis prior to a re-determination that the Port Dolphin Project application is once again complete. Nearshore route changes provide a routing around the Terra Ceia Aquatic Preserve, while onshore route changes reflect routing based on comments filed by HRK Holdings LLC and Florida Power & Light Company in the FERC docket CP07-191 proceeding for this Project. The buoy anchoring optimization reflects a reduced footprint if compared to the original buoy arrangement design.

The principal sections and attachments enclosed in this addendum are:

1. Alternative Analysis of Nearshore Pipeline Routes
2. Alternative Analysis of Onshore Pipeline Routes
3. Project Design Changes
4. Construction Plan
5. Water Quality
6. Marine Resources
7. Cultural Resources
8. Geology
9. Terrestrial Resources

A Public Attachments
B Confidential Attachments

Parts of this addendum, as well as other parts of this application, are labeled confidential. *E.g.,* Confidential Attachments titles, B.1 to B.5. Port Dolphin Energy LLC continues to request confidential treatment and withholding from public disclosure for such data from all recipients because the data are proprietary, and public disclosure could harm its competitive position. Also, such data include privileged archaeological survey and cultural resources materials.

On November 29, 2007, a participating Project engineering firm's name changed. The new company name is "Pipeline Engineering Solutions, Inc." (PESI), replacing Pipeline Engineering & Technology Corp. (PETC). 33 C.F.R. § 148.105(c). There are no other changes to PESI's data (business address, citizenship, telephone) listed in the March 29, 2007, license application, Vol. I, page 19, Table 4.1.

Due to Project-related commercial considerations, including both planning requirements in the Florida off-taker markets to receive the Project's regasified liquefied natural gas, and the need for conclusive arrangements to construct the Project's shuttle and regasification vessels (SRVs), Port Dolphin Energy LLC respectfully requests that the application be deemed complete, with processing resumed, at the earliest possible date. If there are questions, or if we can be of further service to support and advance the analysis to confirm completeness for this important application, we trust you will inform us.

Port Dolphin Energy LLC appreciates USCG's and MARAD's efforts in working to complete a technically sound Environmental Impact Statement.

Very truly yours,

German J. Castro
Project Development Manager
Port Dolphin Energy LLC

cc.: U.S. Department of Transportation, Maritime Administration, Office of Deepwater Ports and Offshore Activities, c/o Ms. Yvette Fields

Port Dolphin Energy LLC

Deepwater Port License Application Addendum

Project Design Changes and Corresponding Impacts

Port Dolphin Project, Tampa Bay, Florida

December 2007

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Acronyms and Abbreviations

ABS	American Bureau of Shipping
API	American Petroleum Institute
APL	Advanced Production Loading AS
AWOIS	Automated Wreck and Obstruction Information System
BML	below mud line
BMPs	Best Management Practices
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
EFH	Essential Fish Habitat
ERP	Environmental Resource Permit
F.A.C.	Florida Administrative Code
FAS	Floridian aquifer system
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FLUCCS	Florida Land Use, Cover and Forms Classification System
FPL	Florida Power & Light Company
GIS	geographic information system
HDD	horizontal directional drill
IAS	intermediate aquifer system
MARPOL	International Convention for the Prevention of Pollution from Ships
MLLW	mean low low water
MLW	mean low water
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
NGVD	National Geodetic Vertical Datum
NHPA	National Historic Preservation Act
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTU	Nephelometric Turbidity Unit
NWI	National Wetlands Inventory
NEPA	National Environmental Policy Act
OFW	Outstanding Florida Waters
PLC	Program Logic Controller
PSIG	pounds per square inch gauge
ROW	right-of-way
SAS	surficial aquifer system
SHPO	State Historic Preservation Office
SRV	shuttle and regasification vessel
STL	submerged turret loading
TMDL	total maximum daily load
USACE	U.S. Army Corps of Engineers
USCG	U.S. Coast Guard
USGS	U.S. Geological Survey
USEPA	U.S. Environmental Protection Agency

INTRODUCTION

On August 10, 2007, the U.S. Coast Guard notified Port Dolphin Energy LLC (Port Dolphin) of the suspension of its application processing for the *Port Dolphin* Deepwater Port Project until additional information (including description of a nearshore pipeline route modification and its construction methods, results of environmental surveys of new areas to be impacted as a result of the route modification, as well as descriptions of applicable impacts) is received, analyzed, and determined to be complete. The need to modify the nearshore pipeline route resulted from consultation with the Florida Department Environmental Protection regarding their view of a potential crossing of the Terra Ceia Aquatic Preserve and, subsequently, the agency position on the subject.

Accordingly, Port Dolphin proceeded to modify its proposed nearshore pipeline route to avoid the Terra Ceia Aquatic Preserve. In addition, based on interventions filed in the Federal Energy Regulatory Commission docket for this project, Port Dolphin decided to also modify its proposed onshore pipeline route, primarily to avoid HRK Holdings' property (east of US 41) and Florida Power & Light Company's right-of-way (which runs parallel to Buckeye Road and east of US 41). Furthermore, Port Dolphin identified the opportunity for optimizing the unloading buoy anchoring arrangement and reducing the overall deepwater port terminal footprint (**Figure I-1**, presented at the end of this **Introduction**). All of these modifications have required additional engineering and environmental work, including:

- Engineering design including geophysical and land surveys, utility location surveys, coordination with property owners to address technical issues of common interest, and consideration of applicable technical and operational criteria,
- Environmental surveys including benthic, seagrass, archaeological, and wetland surveys, to fully describe baseline conditions of new areas to be impacted, and
- Supplemental impact analyses.

Therefore, this **Addendum**, Project Design Changes and Corresponding Impacts, has been designed to provide the information listed above, and amends the March 29, 2007, Deepwater Port license application in Public Docket No. USCG-2007-28532. The principal sections and attachments contained in this **Addendum** are as follows:

1. Alternative Analysis of Nearshore Pipeline Routes: Includes an analysis of three nearshore pipeline route variations, compares them to the original nearshore route, and selects a preferred nearshore route for avoiding the Terra Ceia Aquatic Preserve.

2. Alternative Analysis of Onshore Pipeline Routes: Presents the new location for Port Dolphin's proposed interconnection station to existing Gulfstream Natural Gas System LLC and Tampa Electric Company gas distribution systems, including an analysis of alternative onshore routes from Port Manatee to the proposed interconnection station location, as well as within Port Manatee; and selects a Revised Preferred Onshore Route between Port Manatee's bulkhead and the proposed interconnection station.

3. Project Design Changes: Describes the revised nearshore and onshore pipeline routes, the new interconnection station location and its conceptual engineering design, the optimized terminal buoy arrangement, and subsequent changes in location of the pipeline end manifolds and flowlines alignment.

4. Construction Plan: Describes applicable construction methods and sequence of construction activities, and identifies construction methods for all fixed offshore/onshore components or segments.

5. Water Quality: Describes the existing conditions along the revised nearshore pipeline corridor (based on available literature included in the original **Deepwater Port Application**), analyzes potential impacts applicable to construction/operation of the revised nearshore pipeline and optimized buoy arrangement, and summarizes overall project impacts resulting from implementation of the offshore design modifications.

6. Marine Resources: Describes the existing conditions along the revised nearshore pipeline corridor (based on results of a supplemental benthic/seagrass survey report), analyzes potential impacts applicable to construction/operation of the revised nearshore pipeline and optimized buoy arrangement, and summarizes overall project impacts resulting from implementation of the offshore design modifications.

7. Cultural Resources: Describes the existing conditions along the revised nearshore pipeline corridor (based on results of a supplemental geophysical investigation and review of remote sensing results), analyzes potential impacts applicable to construction/operation of the revised nearshore pipeline and optimized buoy arrangement, and summarizes overall project impacts resulting from implementation of the offshore design modifications.

8. Geology: Describes the existing conditions along the revised nearshore pipeline corridor (based on results of a supplemental geophysical investigation), analyzes potential impacts applicable to construction/operation of the revised nearshore pipeline and optimized buoy arrangement, and summarizes overall project impacts resulting from implementation of the offshore design modifications.

9. Terrestrial Resources: Describes the existing conditions along the revised onshore pipeline corridor (based on results of land and archaeological surveys, wetlands delineation, and existing literature included in the original **Deepwater Port Application**), analyzes potential impacts applicable to construction/operation of the revised onshore pipeline and proposed interconnection station, and summarizes overall project impacts resulting from implementation of the onshore design modifications.

Attachments:

A Public Attachments: Includes the supplemental Benthic/Seagrass Survey Report; Wetland Delineation U.S. Army Corps of Engineers Sheets and Photographs; and Engineering Drawings.

B Confidential Attachments: Includes the supplemental Hazard/Archaeological (Geophysical) Survey Report; Terrestrial Cultural Resources Survey Report Summary; Project Design Basis; Pipeline Hydraulics Report; Mooring System Optimization Report; and Construction Costs, Schedule, and revised financial model outputs.

Figure I-1
Revised *Port Dolphin* Buoy Arrangement and Pipeline Route

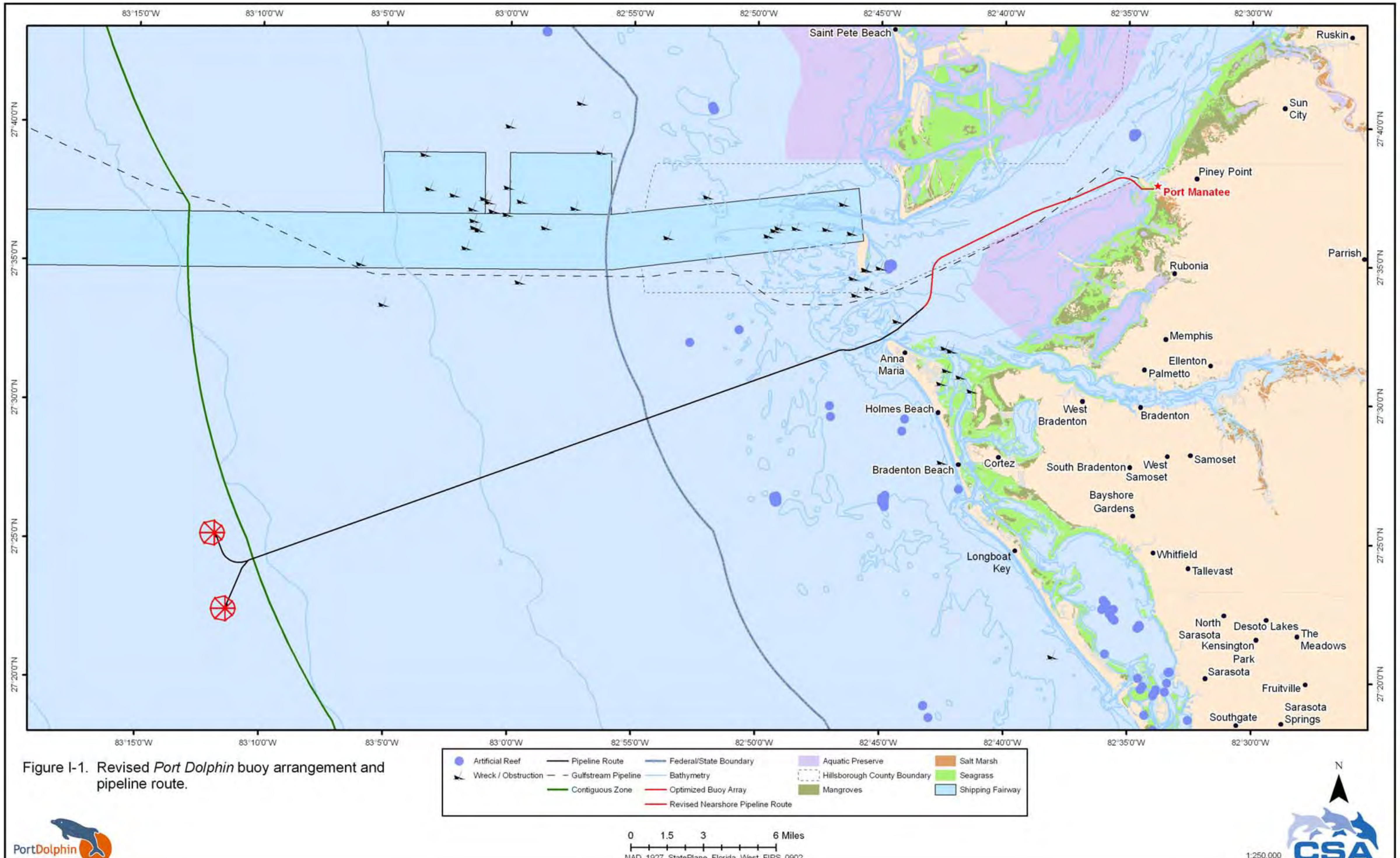


Figure I-1. Revised *Port Dolphin* buoy arrangement and pipeline route.

1. ALTERNATIVE ANALYSIS OF NEARSHORE PIPELINE ROUTES

Port Dolphin's gas transmission pipeline (hereafter referred to as “the pipeline”) would include an offshore pipeline section to transport natural gas from the deepwater port to Port Manatee. The **Deepwater Port Application, Volume II** identified three alternative routes (Northern, Southern, and Preferred) (**Figure 1-1**). All three alternative routes correspond to alternative terminal locations that were selected to meet the minimum requirements for deepwater port siting. The Preferred and Southern Routes were studied in greatest detail, including archaeological, engineering, and geohazards surveys and benthic environmental mapping. Subsequent discussions with the U.S. Coast Guard (USCG) and the State of Florida led to further evaluation of nearshore alternative pipeline routes. Within Tampa Bay, three new nearshore alternative routes (A, B, and C) were developed, analyzed, and also compared to the nearshore portion of the Original Preferred Route.

1.1 Nearshore Alternative Routes

As presented in the **Deepwater Port Application**, the three offshore pipeline route alternatives (Northern, Southern, and Preferred) converged within Tampa Bay at 82°41’45”W longitude, 27°31’44”N latitude, northeast of Anna Maria Island and just outside the Terra Ceia Aquatic Preserve (**Figure 1-2**). The routes then followed a common corridor passing through the outer edge of the Terra Ceia Aquatic Preserve before turning southeast to the pipeline landfall at Port Manatee.

Based on subsequent discussions with the State of Florida, new nearshore alternative routes were developed within Tampa Bay to avoid passing through the Terra Ceia Aquatic Preserve. All nearshore alternative routes involve different technical and environmental challenges, as discussed below.

Original Preferred Route

As originally proposed in the **Deepwater Port Application**, the Preferred Route would enter Terra Ceia Aquatic Preserve from the northwest and pass through the preserve for a distance of 3.0 miles (4.8 kilometers). The pipeline would then exit the preserve and traverse another 3.6 miles (5.8 kilometers) along the northern boundary before re-entering the preserve at the northeast corner for 0.6 miles (1.0 kilometers) (**Deepwater Port Application, Volume II, Figure 4-2**).

As originally proposed, the Preferred Route would run south of and roughly parallel to the existing Gulfstream Natural Gas System LLC (Gulfstream) pipeline. The route would require no crossings of the Gulfstream pipeline and no crossings of shipping fairways.

Figure 1-1
Original Preferred and Alternative Pipeline Routes

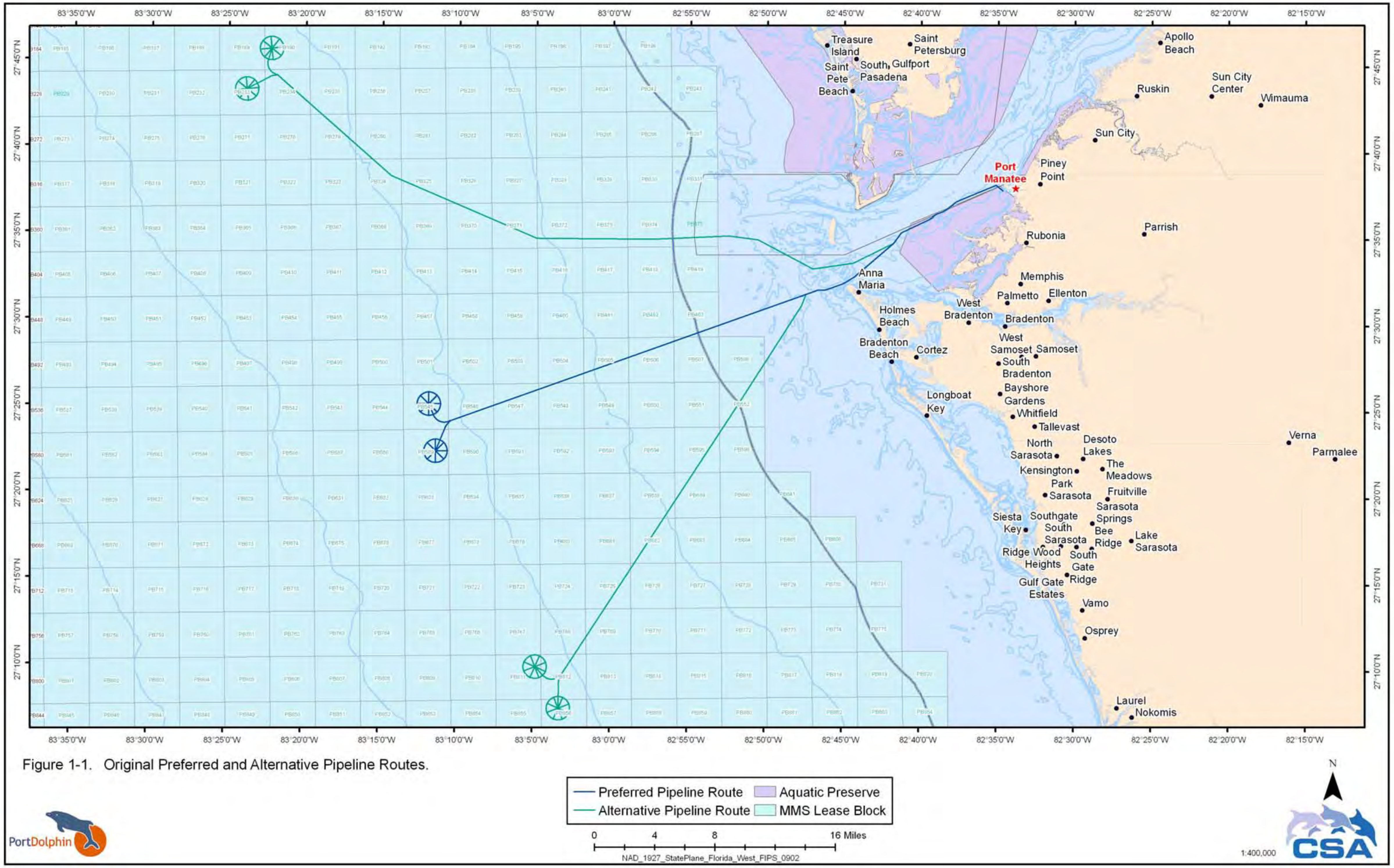


Figure 1-1. Original Preferred and Alternative Pipeline Routes.

Figure 1-2
Convergence of Original Preferred Pipeline Route and Alternative Pipeline Routes

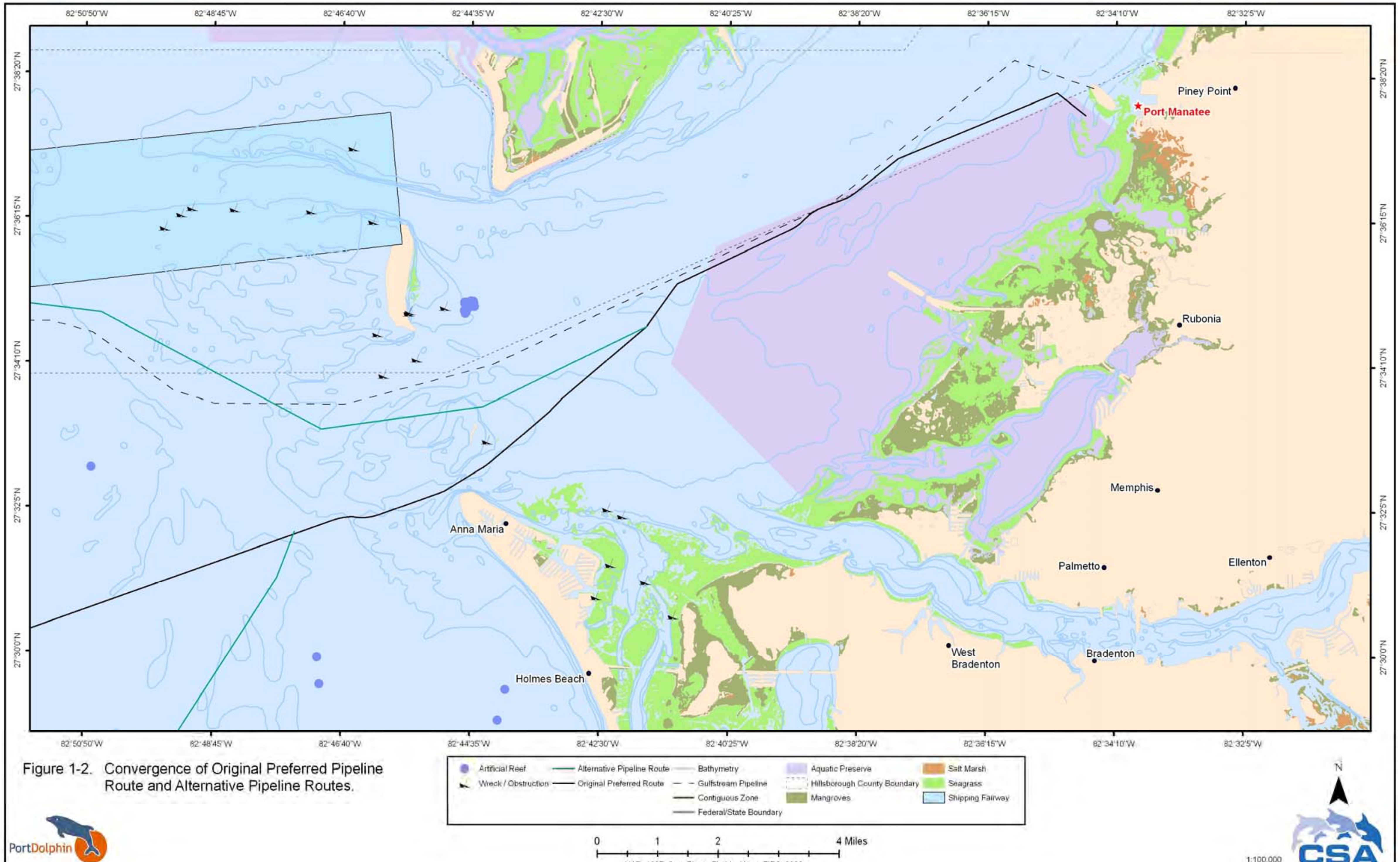


Figure 1-2. Convergence of Original Preferred Pipeline Route and Alternative Pipeline Routes.

Alternative A

From the starting point at 27°33'32.15" N, 82°43'16.31" W, Alternative A would turn northward and cross the Gulfstream pipeline, requiring a horizontal directional drill (HDD) of 1,335 feet (407 meters). The route would then turn to the northeast, running roughly parallel to Gulfstream and the main shipping fairway, passing through three dredge spoil areas. The route would cross the Gulfstream pipeline again, requiring an HDD of 3,300 feet (1,006 meters) before turning southeast toward the HDD landfall just south of Manbirdtee Key. The landfall site would be located at 27°37'49.81" N, 82°34'28.16" W (**Figure 1-3**).

Alternative B

From the starting point at 27°33'32.15" N, 82°43'16.31" W, Alternative B would turn northward and cross the Gulfstream pipeline, requiring a HDD of 2,300 feet (701 meters). The route would then turn to the northeast, running roughly parallel to the Gulfstream pipeline and the main shipping fairway, passing mostly to the south of dredge spoil areas adjacent to the main channel. This route would continue past the tip of Manbirdtee Key before turning southeast toward a landfall between the Gulfstream pipeline and the Port Manatee shipping channel. Alternative B would involve a shore approach from the north side of Manbirdtee Key. This landfall site would be located at 27°38'13.33" N, 82°34'17.17" W (**Figure 1-3**).

Alternative C

From the starting point at 27°33'32.15" N, 82°43'16.31" W, Alternative C would turn northward and cross the Gulfstream pipeline, requiring a HDD of 2,600 feet (792 meters). The route would then turn to the northeast, running roughly parallel to the Gulfstream pipeline and the main shipping fairway, passing through approximately 4.0 miles (6.4 kilometers) of dredge spoil areas adjacent to the main channel. This route would continue past the tip of Manbirdtee Key and cross the Manatee shipping channel (requiring an HDD of 2,400 feet [732 meters]) before turning southeast toward a landfall. The landfall site would be located at 27°38'53.41" N, 82°33'50.93" W (**Figure 1-3**).

1.2 Evaluation Criteria

Key criteria for evaluating the nearshore alternative routes include:

- Length of pipeline route;
- Avoidance of the Terra Ceia Aquatic Preserve; and
- Landfall location.

Figure 1-3
Original Preferred Route with Nearshore Alternatives (A, B, C)

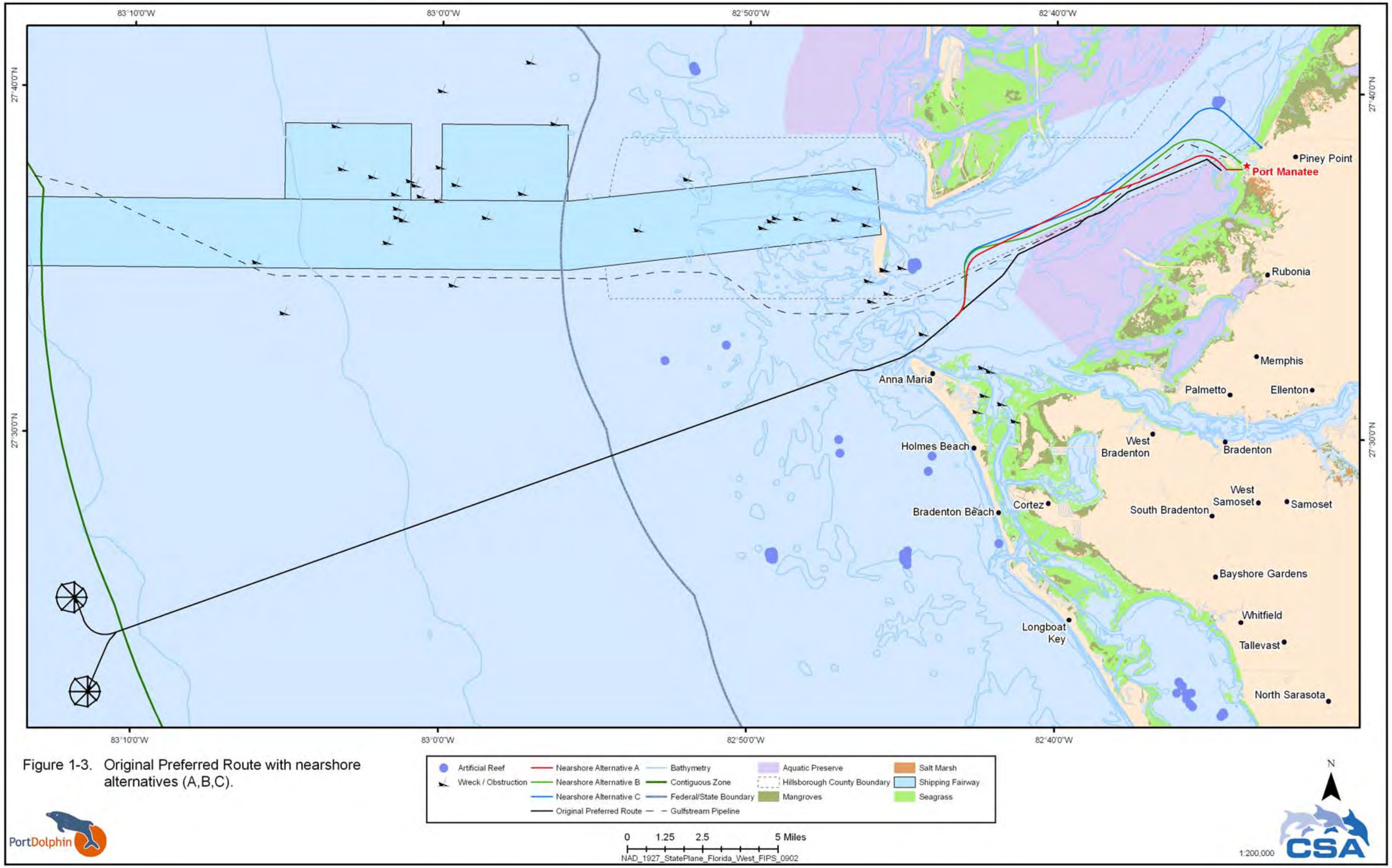


Figure 1-3. Original Preferred Route with nearshore alternatives (A,B,C).

1.3 Analysis of Alternatives

This section presents the Port Dolphin Energy LLC (Port Dolphin) analysis of nearshore alternative pipeline routes.

1. **Length of pipeline route**. The length of the pipeline has both economic and environmental consequences. In general, the longer the pipeline, the greater the cost. A longer pipeline would also likely cause more impacts to the marine environment during installation and would increase other environmental impacts that depend on the duration of construction operations (e.g., air pollutant emissions from construction vessels). *Scoring: Length of route in miles (shorter is preferable).*

    - **Analysis –** The nearshore portion of the Original Preferred Route is shortest at 10.6 miles (17.1 kilometers), followed by Alternative A (11.4 miles [18.3 kilometers]), Alternative B (12.9 miles [20.8 kilometers]), and Alternative C (13.9 miles [22.4 kilometers]). These differences are small relative to the total pipeline length.

2. **Avoidance of Terra Ceia Aquatic Preserve**. As a result of meetings with the Florida Department of Environmental Protection (FDEP), it was strongly recommended that Port Dolphin select a route that avoided the Terra Ceia Aquatic Preserve. All Florida Aquatic Preserves are classified as Outstanding Florida Waters (OFW), and any increase in turbidity (e.g., due to sediment resuspension during pipeline installation) would be a violation of OFW standards. Although turbidity generated by pipeline construction activities could still travel into the Terra Ceia Aquatic Preserve, the corresponding turbidity levels would likely be buffered by distance and, therefore, lower than if construction activities were to occur within the Aquatic Preserve. *Scoring: Meets/does not meet.*

    - **Analysis** – The Original Preferred Route passes through the Aquatic Preserve for a distance of 3.7 miles (6.0 kilometers). The three new alternatives would not enter the Aquatic Preserve.

3. **Landfall location**. A prospective landfall location (i.e., the entry point for the HDD) must be acceptable to Port Manatee because it would commit land for this particular use and may preclude existing or future development plans for other Port facilities. *Scoring: Areas with no future development plans are preferable.*

    - **Analysis –** Both the Original Preferred Route and Alternative A landfall locations have been coordinated with Port Manatee officials. The landfall for both the Original Preferred Route and Alternative A is just east of the Gulfstream valve station located at Port Manatee. The entry point for the Alternative B HDD would be in the same location as a future Port Manatee warehouse and therefore is not technically feasible. Alternative C is in an area that is currently unused but is also considered unacceptable by the Port because it would limit the area for future land use.

1.4 Discussion

The nearshore portion of the **Original Preferred Route** is the shortest and offers the advantage of no crossings of the Gulfstream pipeline or the Port Manatee shipping fairway. However, the route passes through the Terra Ceia Aquatic Preserve for 3.7 miles (6.0 kilometers). FDEP staff would not recommend issuance of a permit for the *Port Dolphin* pipeline to cross the Aquatic Preserve.

Alternative A is the second shortest route and avoids the Terra Ceia Aquatic Preserve. This route has a landfall that is acceptable to Port Manatee.

Alternative B, which involves a shore approach from the north side of Manbirdtee Key, has several significant technical challenges and high risk issues. The transition HDD would have to traverse under the existing Gulfstream pipeline at a point where the Gulfstream pipeline is 40 feet below the bottom of the existing Port Manatee ship slip. The resulting depth of the *Port Dolphin* pipeline (40 feet below the Gulfstream pipeline) would result in significant stresses on the pipe and could damage its coating, as well as increasing the force needed to pull the carrier pipe into the reamed hole. Due to this increased depth, the HDD entry point would have to be located in the same location as a future Port Manatee warehouse. In addition, the transition HDD exit would be close to the ship channel and could cause significant hazards to navigation due to the size and amount of equipment needed to facilitate the HDD operation.

Alternative C poses one significant disadvantage. The prospective landfall location is considered unacceptable by Port Manatee since it would create a new no-build zone in an area that is slated for future Port development plans.

On the basis of this evaluation, which is summarized in **Table 1-1, Alternative A** is selected as the nearshore route that best meets the technical and environmental requirements for the *Port Dolphin* project.

Table 1-1
Summary of Criteria Evaluation for Original Preferred and Alternative Nearshore Routes

Evaluation Criteria	Original Preferred Route	Alternative A	Alternative B	Alternative C
Length of pipeline route[a]	10.6 miles	11.4 miles	12.9 miles	13.8 miles
Avoidance of Terra Ceia Aquatic Preserve (AP)	Passes through AP for a distance of 3.7 miles	Avoids AP	Avoids AP	Avoids AP
Landfall location	Just east of Gulfstream valve station at Port Manatee	Just east of Gulfstream valve station at Port Manatee	Future warehouse location on Port Manatee property	Currently unused portion of Port Manatee property

[a] The demarcation point for the start of the nearshore alternative routes is 27°33'32.15" N latitude, 82°43'16.31" W longitude.

1.5 Conclusions

Based on the analysis discussed above, a reconfigured alternative route was defined: the Revised Preferred Route (i.e., offshore Preferred Route plus nearshore Alternative A). **Figure 1-4** shows the Revised Preferred Route. Subsequent environmental analysis in this **Addendum** focuses on the Revised Preferred Route.

Detailed archaeological, engineering, geohazards, and benthic biological surveys were previously conducted for the Original Preferred Route as described in **Volume II** of the **Deepwater Port Application**, and additional archaeological, engineering, geohazards and benthic biological surveys were performed for Alternative A as described in **Attachments A.1, Benthic Survey Report** and **B.2, Hazard/Archaeological Survey** of this **Addendum**.

Figure 1-4
Revised Preferred Route with Optimized Buoy Array

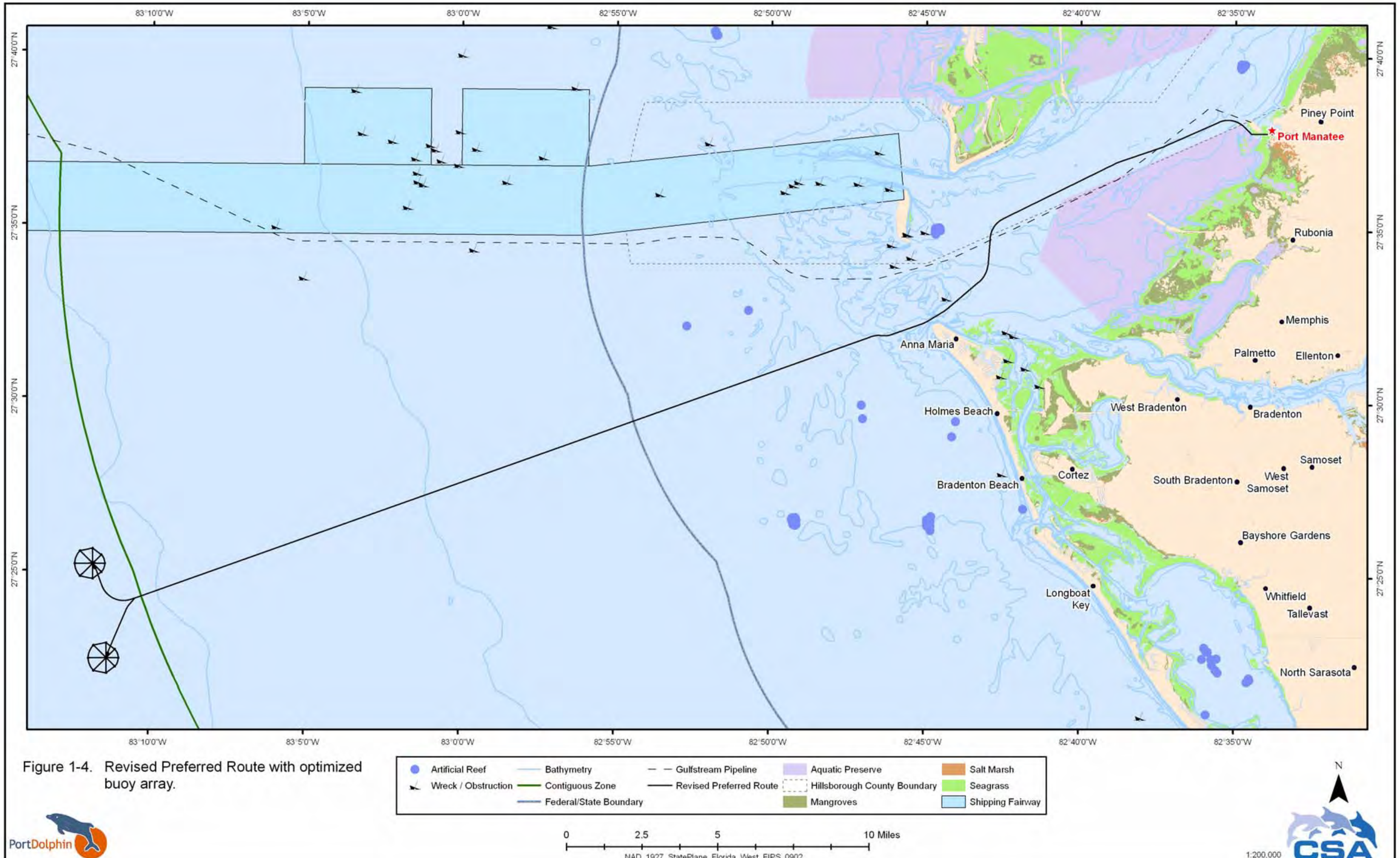


Figure 1-4. Revised Preferred Route with optimized buoy array.

2. ALTERNATIVE ANALYSIS OF ONSHORE PIPELINE ROUTES

Port Dolphin's gas transmission pipeline (hereafter referred to as "the pipeline") would include an onshore pipeline section to transport natural gas from Port Manatee to interconnection facilities with the Gulfstream and Tampa Electric Company (TECO) systems to be located east of Port Manatee. The **Deepwater Port Application, Volume II**, identified a Preferred Onshore Route (**Figure 2-1**). This route was selected and studied in detail, which included archaeological, engineering, wetland, land use, and other environmental mapping. Subsequent discussions with Port Manatee, land owners along the Original Preferred Onshore Route, and the Federal Energy Regulatory Commission (FERC), as well as interventions filed to the Port Dolphin FERC filing, led to further evaluation of alternative pipeline routes and selection of a Revised Preferred Onshore Route.

2.1 Rationale and Methodology

As discussed in **Section 1**, re-route alternatives for a portion of the offshore pipeline route were necessary to avoid traversing the Terra Ceia Aquatic Preserve. During evaluation of the offshore routes, several alternatives were examined for onshore routes from each pipeline landing location (i.e., Port Manatee's north and south areas). Ultimately, offshore Alternative A was selected; therefore, only onshore routes from its landing location (Port Manatee's south area) were evaluated.

After Port Dolphin submitted its USCG **Deepwater Port Application** and FERC **Application for Certificate of Public Convenience and Necessity and Related Authorizations**, several entities filed interventions to the onshore pipeline routing proposed, including the following:

- HRK Holdings LLC – The Original Preferred Onshore Route would traverse areas (former Piney Point) that would present groundwater contamination issues;
- Florida Power & Light Company (FPL) – The Original Preferred Onshore Route would utilize areas within FPL's existing right-of-way (ROW) that are slated for future expansion of FPL's power distribution capabilities, and construction activities within such an ROW would face technical limitations and challenges; and
- Taylor Woodrow – The Original Preferred Onshore Route would impact a large wetland located on property owned by Taylor Woodrow.

Port Dolphin's goal was to identify alternatives and select a revised pipeline route that would address all issues raised in the above-mentioned interventions and meet its own technical and environmental criteria, as well as consider more detailed criteria identified in discussions with property owners (including Port Manatee, FPL, JJC-Port Manatee LLC, Buckeye Industrial Limited, and the Mock family).

Figure 2-1
Onshore Original Preferred Route

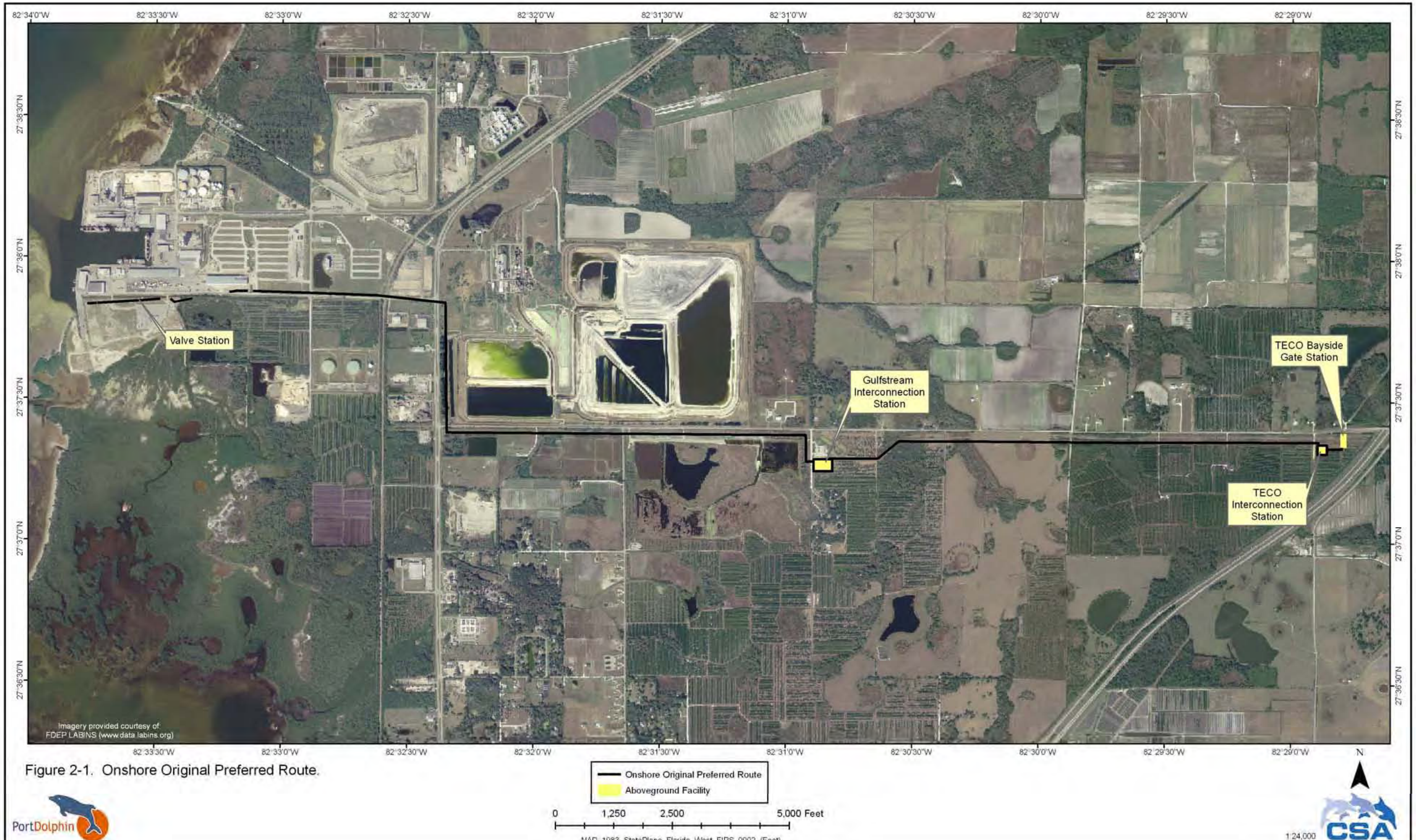


Figure 2-1. Onshore Original Preferred Route.

During the development of alternatives, analysis of desktop data was performed and included review of aerial photographs, mapping of NWI wetlands, and identification of existing utilities. Port Dolphin used a three-step approach for evaluating onshore pipeline route alternatives. The selection of the location of the interconnection station to connect with both Gulfstream's pipeline and TECO's Bayside pipeline was the initial step in the process. Next, alternative routes from Port Manatee were identified and evaluated. Finally, routing alternatives through Port Manatee were developed in consultation with Port Manatee managers. Once the alternatives were developed, numerous desktop analyses and field work were conducted, and discussions with property owners were held to evaluate the alternatives and develop the final route. This work included performing walkdown of the alternative routes with representatives from engineering, environmental, and surveying disciplines.

2.2 Potential Alternatives

The *Port Dolphin* gas transmission line would transport natural gas to onshore facilities for interconnection with the Gulfstream and TECO systems in Manatee County, Florida. From there, the natural gas would be available to serve residential, commercial, industrial, and electrical generation customers primarily in Florida and the southeastern United States. In order to connect with the Gulfsteam and TECO systems, interconnection facilities are required. Previously, two interconnection facilities, one for Gulfstream and one for TECO, were located approximately 3.6 miles (5.7 kilometers) (Gulfstream) and 5.8 miles (9.2 kilometers) (TECO) inland from the bulkhead at Port Manatee. Subsequent to the original filing of the *Port Dolphin* application for a deepwater port license in May and June 2007, several issues arose that caused the locations of the *Port Dolphin* interconnections to the Gulfstream pipeline and TECO to be changed.

Interconnection with Gulfstream's Pipeline – During detail negotiations with the landowner of the property (Gene's Citrus Ranch) where Port Dolphin had first selected to place the Gulfstream pipeline interconnection station, it was determined that the landowner had several family-related issues and future land use options that would complicate the placement of the facilities on their property. Port Dolphin immediately began the search for alternative parcels of land in the immediate vicinity of the original site and has successfully negotiated an option agreement to place the Gulfstream interconnection station facilities on a parcel of land located within several hundred feet north of the original site. The new location is positioned in an industrial area of Manatee County and immediately to the east of Gulfstream's pressure reduction station on Buckeye Road. The location has excellent access to a major county road and existing utilities.

Interconnection with TECO's Proposed Bayside Pipeline – The original rationale for placement of the TECO interconnection station was that it should be located adjacent to a planned (future) TECO facility that would be the beginning of their Bayside pipeline system (which would be initially fed by the Gulfstream pipeline). After Port Dolphin had filed the original application with the USCG and FERC, Port Dolphin learned that TECO relocated their planned facilities further west to a site located south of Buckeye Road and west of Oneil Road, in the vicinity of Gulfstream's pressure reduction station. Due to this change and the subsequent re-route of TECO's Bayside pipeline, Port Dolphin now proposes to locate the Gulfstream and TECO interconnection station facilities on the same parcel of land described above for the Gulfstream interconnection station. Port Dolphin has successfully negotiated an option agreement for this parcel of land to be large enough to safely and effectively accommodate both interconnections. The new location is positioned in an industrial area of Manatee County and immediately to the east of Gulfstream's pressure reduction station on Buckeye Road. The location has excellent access to a major county road and existing utilities.

The relocation of both interconnection stations does not affect the ability of *Port Dolphin* to deliver the planned quantity and quality of natural gas at the pressures required by both the Gulfstream pipeline and TECO's proposed Bayside pipeline.

The following subsections present the onshore route alternatives evaluated for selecting the Revised Onshore Pipeline Route between Port Manatee and the new proposed locations for interconnecting with the Gulfstream and TECO Bayside pipelines.

2.2.1 Route Alternatives from Port Manatee's Southeast Area to Interconnection Station

Several onshore alternatives (I – V) were developed for pipeline routing from Port Manatee's southeast area to the proposed location for interconnections (**Figure 2-2**).

Alternative I **–** This alternative would shift the N-S segment of the pipeline route along US 41 west from the Original Preferred Onshore Route to lie closer to the edge of US 41 and out of the way of ongoing activities on the HRK Holdings LLC property. This alternative would then go under Buckeye Road and connect with Alternative V to head east to the proposed interconnection station (**Figure 2-2**).

Alternative II **–** This alternative would move the N-S segment of the pipeline route to the west side of US 41 along the utility corridor. This alternative would then cross under US 41 and connect with Alternative V to head east to the proposed interconnection station (**Figure 2-2**).

Alternative III **–** This alternative would provide a N-S segment that would turn south between the railroad tracks and US 41 along the eastern boundary of the C&D Fruit and Vegetable property, and would continue south until turning east to connect with Alternative V and head east to the proposed interconnection station (**Figure 2-2**).

Alternative IV-1 **–** This alternative would provide a N-S segment that would traverse the east side of the railroad tracks as it heads south from South Dock Street, and would then turn east to connect with Alternative V and head east to the proposed interconnection station (**Figure 2-2**).

Alternative IV-2 **–** This alternative would provide a N-S segment that would traverse the west side of the railroad tracks as it heads south from South Dock Street, and would then turn east to connect with Alternative V and head east to the proposed interconnection station (**Figure 2-2**).

Alternative V **–** Due to concerns raised by FPL, this alternative would move the E-W segment along Buckeye Road south from the Original Preferred Onshore Route out of the FPL ROW (**Figure 2-2**).

Figure 2-2
Onshore Original Preferred and Alternative Routes in Relation to Parcel Owner Information

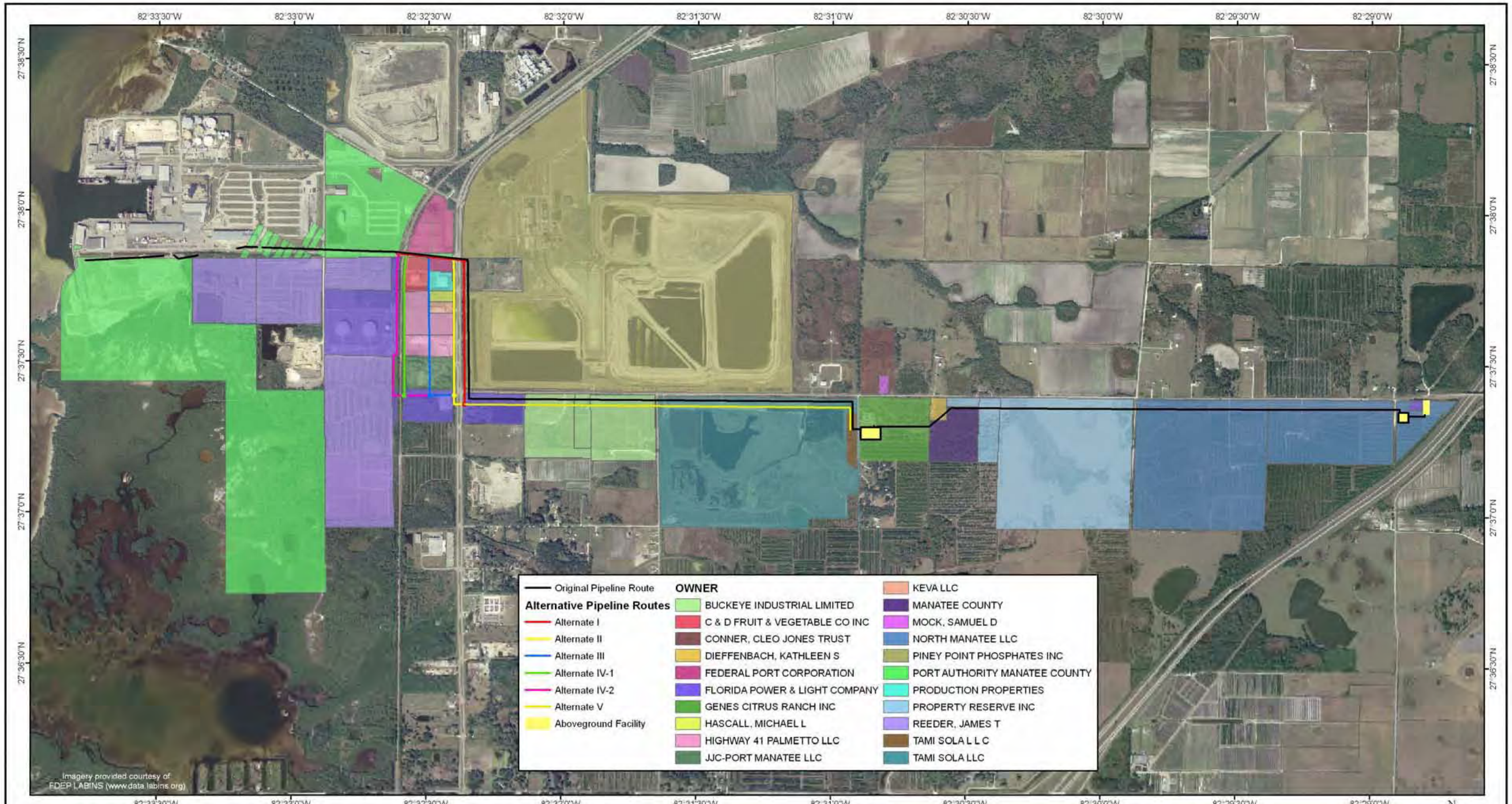


Figure 2-2. Onshore Original Preferred and Alternative Routes in relation to parcel owner information.

2.2.2 Route Alternatives Through Port Manatee

Based on discussions with the Port Manatee managers who expressed their interest to minimize potential obstructions to future Port development plans, the Port requested that Port Dolphin adjust its routing through Port Manatee by placing the pipeline in the south conveyance ditch located on the south side of South Dock Street. Based on those discussions, two route alternatives, a Northern Route and a Southern Route, were developed for consideration for traversing the Port Manatee property (**Figures 2-3** and **2-4**).

Northern Route **–** This alternative route would start at the HDD 1 entrance, just east of the Gulfstream valve station, and run east a short distance before turning north to become centered on a conveyance ditch located on the south side of South Dock Street. The routing would then follow the conveyance ditch eastward until just west of Reeder Road, where the routing would turn north across South Dock Street and then turn east to continue along the north side of South Dock Street. This route would stay on the north side of South Dock Street until it turned south just west of the railroad tracks (**Figure 2-3**).

Southern Route **–** This alternative route would start at the HDD 1 entrance, just east of the Gulfstream valve station, and run east a short distance before turning north to become centered on a conveyance ditch located on the south side of South Dock Street. The routing would then follow the conveyance ditch eastward until it turned south just west of the railroad tracks (**Figure 2-4**).

2.3 Key Criteria

2.3.1 Alternatives from Port Manatee's Southeast Area to the Interconnection Station

Key criteria utilized in this step of the alternative analysis for the route from Port Manatee's southeast area to the interconnection station are listed below.

Initial Screening Criteria:
- Engineering/construction feasibility; and
- Avoid potential groundwater/soil contaminated areas.

Evaluation Criteria:
- Minimize the number of property owners;
- Maintain required safe distances from existing utilities in area;
- Minimize impacts to existing land use and operations of facilities on properties crossed; and
- Minimize impacts to wetlands.

Figure 2-3a
Port Manatee Northern Route (Sheet 1 of 3)

Figure 2-3b
Port Manatee Northern Route (Sheet 2 of 3)

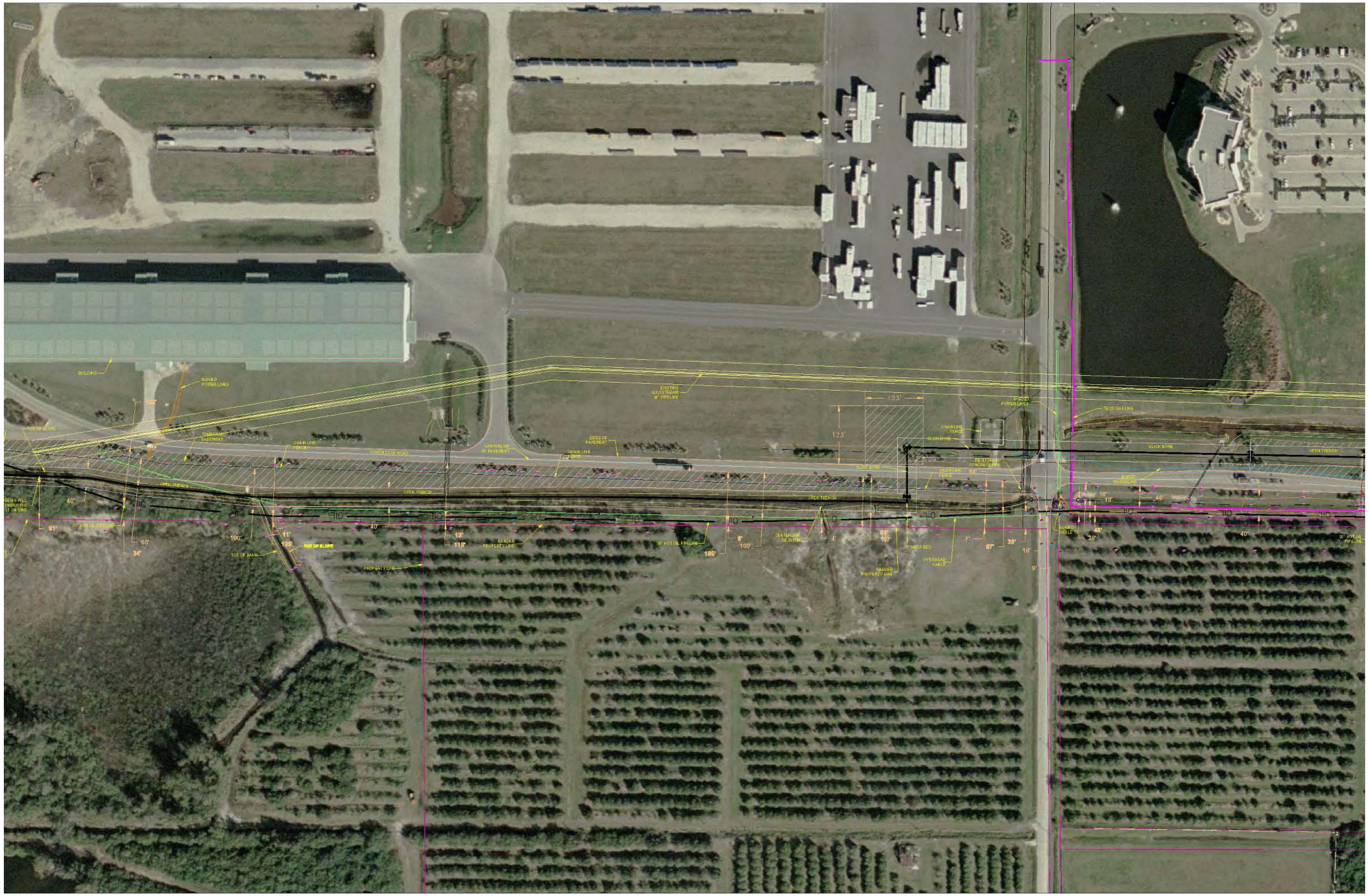


Figure 2-3c
Port Manatee Northern Route (Sheet 3 of 3)

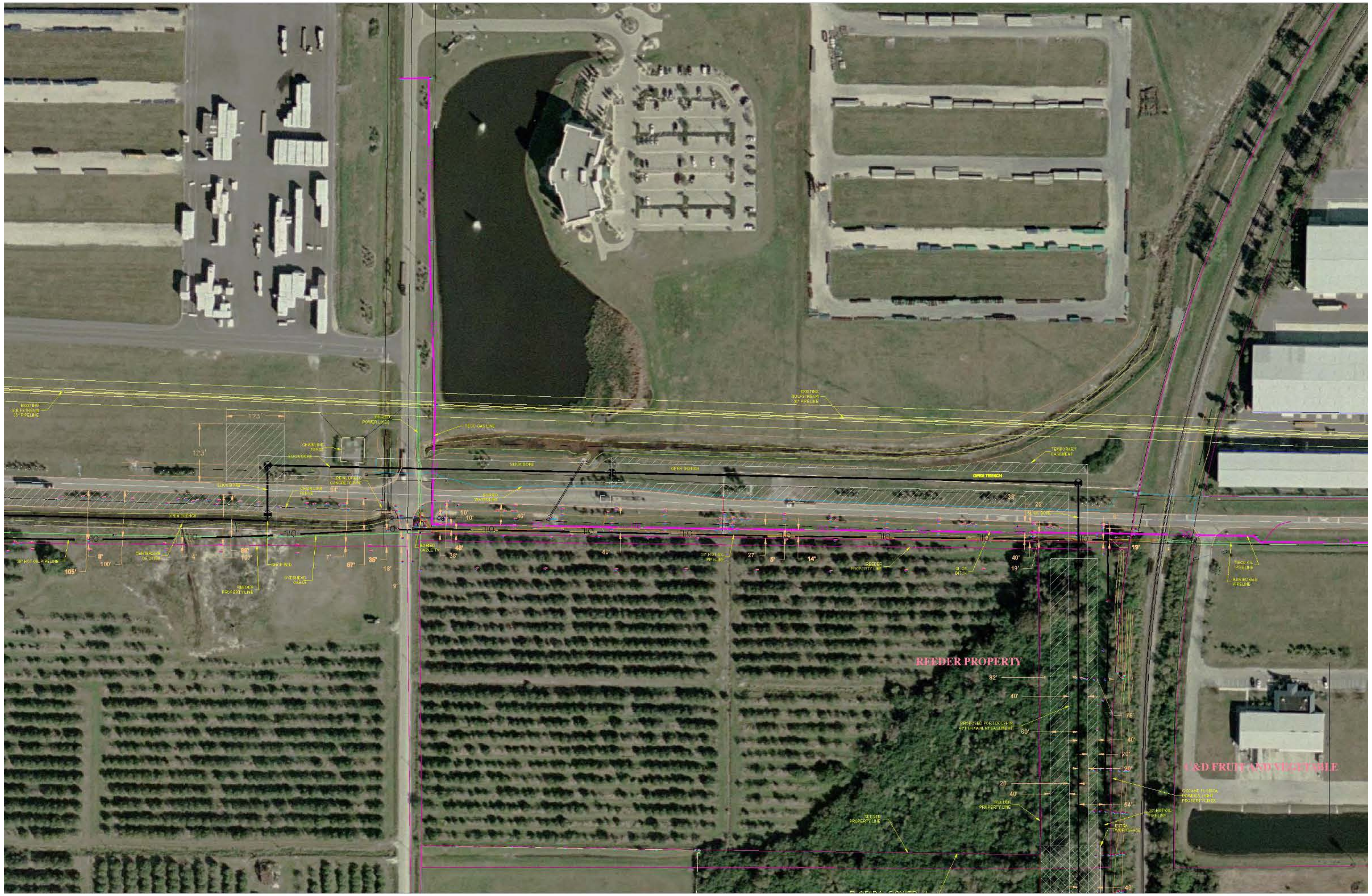


Figure 2-4a
Port Manatee Southern Route (Sheet 1 of 3)

Figure 2-4b
Port Manatee Southern Route (Sheet 2 of 3)

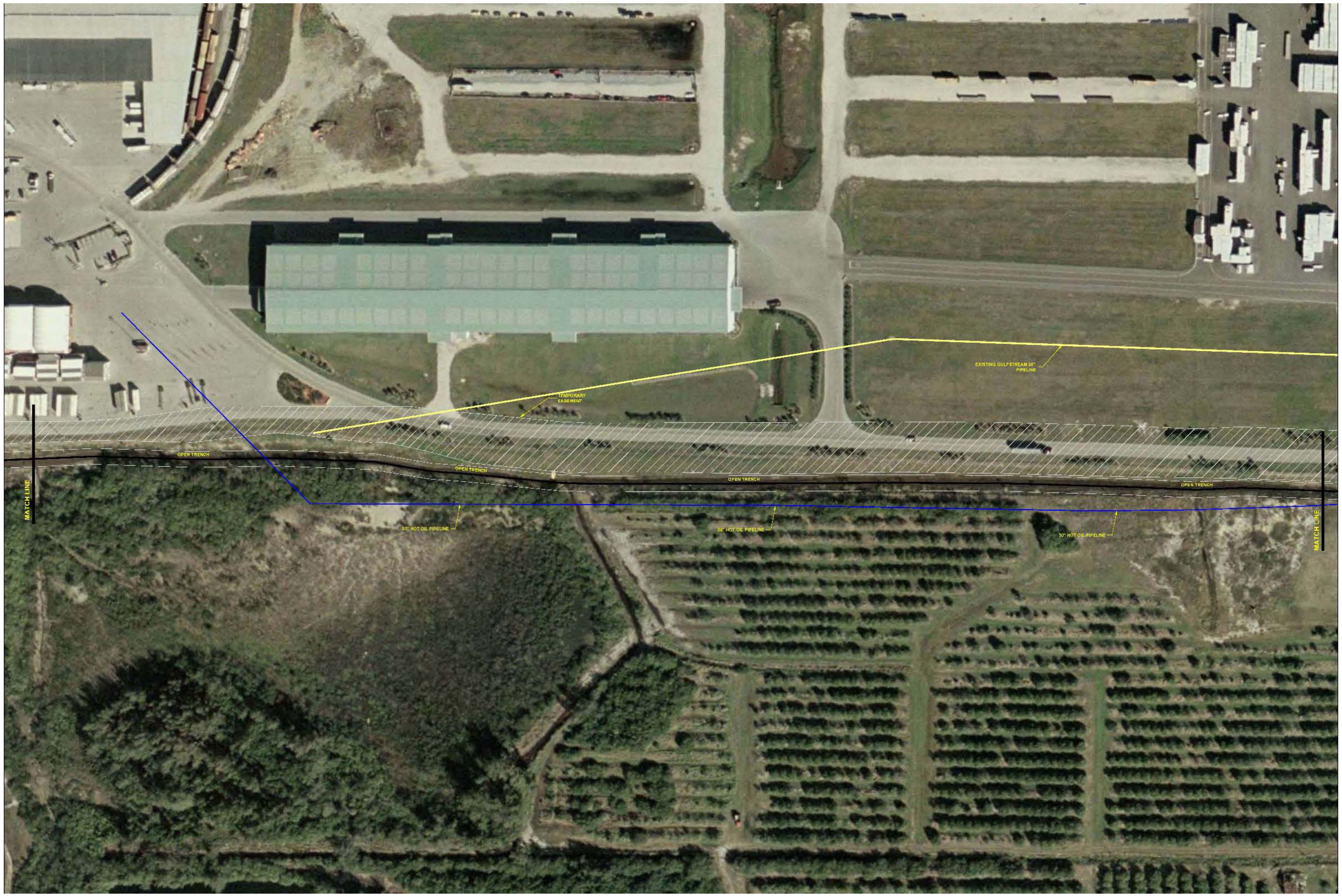


Figure 2-4c
Port Manatee Southern Route (Sheet 3 of 3)

2.3.2 Alternatives Through Port Manatee

Key criteria utilized in this step of the alternative analysis for the route through Port Manatee are listed below.

- Minimize impacts to Port Manatee existing operations;
- Minimize impacts to lands that are identified for future Port expansion; and
- Maintain required safe distances from existing utilities in the area.

2.4 Analysis of Alternatives

This section presents Port Dolphin's analysis of onshore pipeline route alternatives.

2.4.1 Evaluation of Route Alternatives from Port Manatee's Southeast Area to the Interconnection Station

The six route alternatives were first evaluated against the screening criteria. Only alternatives that passed the initial screening criteria were further evaluated.

2.4.1.1 Initial Screening

1. **Engineering/construction feasibility** – Site walkdowns of the route alternatives were performed to determine if the routes selected during desktop work could be engineered/constructed, based on field observations and constraints. *Scoring: Constructable or not constructable.*

Analysis – Alternative II would not be constructable because the distance from buildings along US 41 to the edge of pavement would be less than the required 100-foot construction easement. A new building was being constructed over a portion of the Alternative III route. All other route alternatives were considered constructable.

2. **Avoid potential groundwater/soil contaminated areas** – Based on the intervention filed by HRK Holdings LLC, the former Piney Point property has undergone extensive remediation of contamination created by previous phosphate mining activities at the site. According to HRK Holdings LLC, construction activities at this site could result in potential disturbance of existing contamination, costly clean-up efforts, and storm water control issues. *Scoring: Avoids HRK Holdings LLC property or does not.*

Analysis – Alternative I would not avoid the HRK Holdings LLC property; and therefore, would likely impact areas with groundwater and/or soil contamination. All other alternatives would avoid the HRK Holdings LLC property. Alternative V is located south of existing contaminated groundwater that accidentally migrated south from the former Piney Point facility in 2005.

2.4.1.2 Initial Screening Results

Alternatives I, II, and III did not pass the initial screening criteria and therefore were removed from further evaluation. **Table 2-1** provides a summary of the screening results.

2.4.1.3 Evaluation

3. **Minimize the number of property owners** – Although the pipeline can be constructed through a variety of parcels, preference must be given to alternatives that minimize the number of property owners to be dealt with for obtaining land access and negotiating ROW agreements. *Scoring: Fewer landowners is preferable.*

Analysis – Alternative IV-1 would traverse five property parcels and involve four property owners (C&D Fruit and Vegetable, Highway 41 Palmetto LLC, JJC Port Manatee LLC, and FPL). Alternative IV-2 would traverse four property parcels and involve two property owners, FPL and JJC Port Manatee LLC. Alternative V would traverse three property parcels and involve three property owners (FPL, Buckeye Industrial Limited, and Tami Sola LLC) (**Figure 2-2**).

4. **Minimize impacts to existing land use and operations of facilities on properties crossed** – Although the pipeline can be installed in a variety of ways (i.e., HDD, open trench), there will be impacts to the land parcels traversed by the pipeline, including a construction ROW required during installation and a permanent easement that precludes construction of buildings. Project activities potentially could impact the existing properties and ongoing facility operations. *Scoring: Using lands without existing facilities minimizes operational impacts, and traversing parcels as near to property boundaries as possible is preferred over traversing the center of parcels.*

Analysis – Alternative IV-1 would traverse the entrance of the C&D Fruit and Vegetable business, which would be disruptive to the ongoing activities of the business. In addition, it would traverse the west side of the Highway 41 Palmetto LLC and JJC Port Manatee LLC properties, both of which contain ongoing business operations that would be impacted by the required 100-foot construction ROW. Even if an HDD were to be used to traverse some of the properties, the HDD pullback string would present an additional set of impacts to traffic on South Dock Street, which would not be allowed by Port Manatee. This alternative would also traverse an FPL facility but would use an existing oil pipeline ROW, therefore minimizing operational impacts. Alternative IV-2 would traverse the edge of an FPL tank farm and use an existing utility corridor that contains electrical lines and an FPL oil pipeline. This alternative would also traverse an FPL facility but would use an existing oil pipeline ROW, therefore minimizing operational impacts. Alternative V would traverse predominantly open lands for its entire distance. A portion of the Alternative V route would traverse the northern edge of farming fields located on Buckeye Industrial Limited property (**Figure 2-2**).

Table 2-1
Summary of Criteria Evaluation from Port Manatee to the Interconnection Station

	Alternative I	Alternative II	Alternative III	Alternative IV-1	Alternative IV-2	Alternative V
INITIAL SCREENING CRITERIA						
Engineering/construction feasibility	Constructable	Not constructable	Not constructable	Constructable	Constructable	Constructable
Avoid potential groundwater/soil contaminated areas	Does not avoid	Avoids	Avoids	Avoids	Avoids	Avoids
CARRIED FORWARD FOR EVALUATION?	No	No	No	Yes	Yes	Yes
EVALUATION CRITERIA						
Minimize the number of property owners	Not evaluated	Not evaluated	Not evaluated	4 Owners	2 Owners	3 Owners
Minimize impacts to existing land use and operations of facilities on properties crossed	Not evaluated	Not evaluated	Not evaluated	No	Yes	Yes
Minimize impacts to National Wetlands Inventory-mapped wetlands	Not evaluated	Not evaluated	Not evaluated	2 Wetlands	2 Wetlands	2 Wetlands

5. **Minimize Impacts to Wetlands** – Based on mapping of National Wetland Inventory (NWI) data, wetlands were evaluated along the route alternatives. *Scoring: Less wetlands are preferable, and potential impacts to herbaceous wetlands are preferred over potential impacts to forested wetlands (if any).*

Analysis – Alternative IV-1 would traverse one freshwater emergent wetland and one freshwater forested/shrub wetland. Alternative IV-2 would traverse two freshwater forested/shrub wetlands. Alternative V would traverse one freshwater pond and one freshwater emergent wetland (**Figure 2-5**).

2.4.1.4 Evaluation Results

Based on this evaluation, which is summarized in **Table 2-1**, **Alternative IV-2** for the N-S segment and **Alternative V** for the E-W segment best meet the technical and environmental requirements for *Port Dolphin* and therefore were selected as the preferred routing of the pipeline from Port Manatee's Southeast Area to the proposed interconnection station.

2.4.2 Evaluation of Route Alternatives Through Port Manatee

The two route alternatives were directly evaluated against the applicable evaluation criteria.

2.4.2.1 Evaluation

1. **Minimize impacts to Port Manatee existing operations** – South Dock Street is a main access road to Port Manatee operations, and traffic access cannot be disrupted by *Port Dolphin* construction activities. In addition, existing facilities and operations (i.e., warehouse access and existing utilities) cannot be impacted by *Port Dolphin* construction activities. *Scoring: Routing that minimizes current operations at the Port is favorable.*

Analysis – The Northern Route would not impact South Dock Street or existing facilities or operations. The Southern Route could potentially impact South Dock Street with the work space requirements, however, since the Port has plans to widen South Dock Street to the north, this route is considered acceptable. In addition, the Southern Route does not impact existing facilities or operations.

2. **Minimize impacts to lands that are identified for future Port expansion** – The Port has significant future development plans for expansion of existing facilities and new facilities. The pipeline cannot impact the future development plans of the Port. *Scoring: Routing that minimizes impacts to lands identified for future Port expansion is favorable.*

Figure 2-5
Onshore Alternative Pipeline Routes and National Wetlands Inventory (NWI) Data

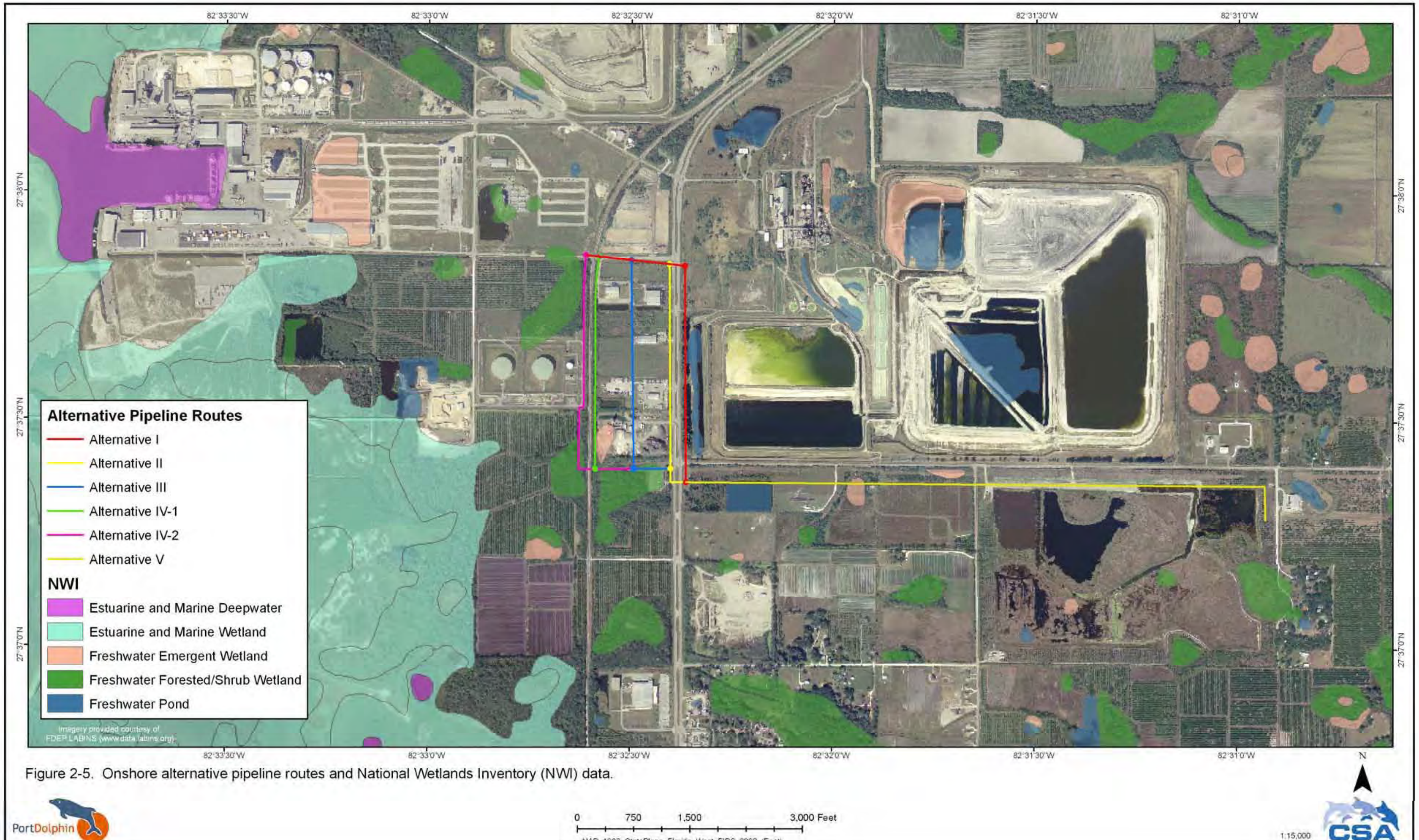


Figure 2-5. Onshore alternative pipeline routes and National Wetlands Inventory (NWI) data.

Analysis – The Northern Route through Port Manatee would create several conflicts for future Port development plans. The pipeline would create a 30-foot permanent easement or no-build zone through lands that the Port intends to develop in the future. Port Manatee has plans to construct a dredge spoils slurry pipeline from the bulkhead to the former Piney Point property along the north side of South Dock Street. The Port also has plans to widen South Dock Street to the north, and the Northern Route could affect the road widening project. Furthermore, the Southern Route would be located predominantly in the southern conveyance ditch, which is not slated for future development.

3. **Maintain required safe distances from existing utilities in area –** There are many existing utilities that are located throughout the Port. The pipeline must be routed to ensure that existing utility easements are respected and that the pipeline can be installed safely with respect to existing utilities. *Scoring: Routing that maintains a safe distance from existing utilities is favorable.*

2.4.2.2 Evaluation Results

Based on this evaluation, which is summarized in **Table 2-2**, the Southern Alternative best meets the technical requirements for *Port Dolphin* and, therefore, was selected as the preferred routing of the pipeline through Port Manatee.

Table 2-2
Summary of Criteria Evaluation from Port Manatee to the Interconnection Station

Evaluation Criteria	Northern Route	Southern Route
Minimize impacts to Port Manatee existing operations	No impact	Limited impact
Minimize impacts to lands that are identified for future Port expansion	Multiple impacts	No impact
Maintain required safe distances from existing utilities in the area	Safe distances maintained	Safe distances maintained

2.5 Discussion

2.5.1 Route Alternatives from Port Manatee's Southeast Area to the Interconnection Station

Alternative I did not pass one of the screening criteria (i.e., Avoid potential groundwater/soil contaminated areas) because it traverses the HRK Holdings LLC property, which is the former Piney Point facility; therefore, this alternative was not further evaluated.

Alternative II did not pass one of the screening criteria (i.e., Engineering/construction feasibility) because there is not sufficient space between the existing buildings along the west side of US 41 and the road for the required 100-foot construction ROW; therefore, this alternative was not further evaluated.

Alternative III did not pass one of the screening criteria (i.e., Engineering/construction feasibility) because a new building is being constructed on the Federal Port Corporation Property that prohibits the pipeline from being constructed along this route; therefore, this alternative was not further evaluated.

Alternative IV-1 provides a N-S segment and involves traversing the east side of the railroad tracks. This alternative is constructable and avoids potential contaminated groundwater and soils. However, it would involve obtaining land access and ROW agreements from four property owners and would create impacts to existing businesses along the route during the construction activities. In addition, the route would cross two NWI-mapped wetlands.

Alternative IV-2 would traverse the west side of the railroad tracks to provide a N-S segment. This alternative is constructable and also avoids potential contaminated groundwater and soil. This route would involve acquiring access and ROW agreements from two property owners and would not impact any ongoing businesses along the route. This route would cross two NWI-mapped wetlands.

Alternative V provides the E-W segment of the pipeline and moves the route south from the Original Preferred Onshore Route. This route would involve obtaining access and ROW agreements from three property owners and would not impact any ongoing facility operations along the route. This route would cross two NWI-mapped wetlands.

Alternative V is located just south of existing contaminated groundwater that migrated south from the former Piney Point facility in 2005. An inspection by FDEP revealed that some gypsum from a stack located south in Piney Point was inadvertently deposited in a seepage collection ditch. The water level along a portion of the ditch rose and temporarily reversed the hydraulic gradient away from the ditch, causing a groundwater plume to migrate south towards Buckeye Road (Ardaman & Associates, Inc. 2007). This area of contamination is being monitored, and since the groundwater flow direction is towards the former Piney Point facility (away from the *Port Dolphin* pipeline route), it is anticipated that groundwater quality will improve over time as a result of dispersion and flushing of the contaminant back towards the former Piney Point facility. Port Dolphin's current construction plan (see **Section 4**) includes a methodology for installing the pipeline in this area while maintaining existing groundwater quality. Port Dolphin will investigate the groundwater issue in this area and adjust installation methods (if necessary). Therefore, this alternative was carried through the evaluation.

Based on this evaluation, which was summarized in **Table 2-1**, **Alternative IV-2** for the N-S segment and **Alternative V** for the E-W segment were selected as the preferred routing of the pipeline from Port Manatee to the interconnection station that best meets the technical and environmental requirements for *Port Dolphin*.

2.5.2 Route Alternatives Through Port Manatee

The **Northern Route** splits from the Southern Route just west of Reeder Road, where it moves to the north side of South Dock Street into areas that the Port has slated for future development. These areas would be impacted by the 30-foot permanent easement centered on the pipeline, which would preclude construction of buildings and have to be maintained clear of facilities. Although the Northern Route does not impact existing operations, the Port is planning to widen South Dock Street to the north and this route could impact that future widening plan. In addition, the routing to the north side of South Dock Street would create space conflicts with a new dredge spoils slurry pipeline to be constructed from the bulkhead to the former Piney Point property along the north side of South Dock Street. The Northern Route maintains safe distance from existing utilities and respects existing easements.

The **Southern Route** places the pipeline in the south conveyance ditch all the way to where it turns south off of Port property. This area is not slated for future development. However, this conveyance ditch is both tidally-influenced and creates a hydraulic connection for the mangroves located along a portion of the south side of the conveyance ditch with tidal waters of Tampa Bay, as well as providing water management for rain water from portions of the Port and water management from the Port's Dredged Materials Disposal Site. The water management functions of this south conveyance ditch must be maintained during the construction activities. This alternative could impact South Dock Street with the work space requirements. However, since the Port has plans to widen South Dock Street to the north, this route is considered acceptable. The Southern Route maintains safe distance from existing utilities and respects existing easements.

Based on this evaluation, the **Southern Route** was selected as the preferred routing of the pipeline through Port Manatee that best meets the technical and operational requirements as well as future Port development plans. The potential impact to South Dock Street from this alternative can be mitigated during the construction activities (i.e., through traffic management measures such as temporary by-passes), and the minimization of impacts to future Port development plans was the key criteria. In addition, Port Dolphin is committed to providing the functions of the south conveyance ditch during the project construction activities (see **Section 4, Construction Plan**).

2.6 Conclusions

Once the preferred routing was determined by the above evaluation process, detailed discussions were initiated with various property owners along the route (i.e., Port Manatee and FPL). Based on these discussions, several minor modifications were made to the selected route and/or its construction plan. Key requirements for the N-S and E-W Segments identified during these discussions are listed below:

N-S Segment:

- FPL required that the *Port Dolphin* pipeline maintain a minimum distance of 50 feet from their existing oil pipeline that runs N-S along the west side of the railroad tracks;
- FPL required that the *Port Dolphin* pipeline HDD under the tank farm; and
- FPL required that the *Port Dolphin* pipeline traverse to the south of the substation along the southern boundary of the property on the west side of US 41.

E-W Segment:

- FPL required that the *Port Dolphin* pipeline traverse the southern boundary of the property on the east side of US 41, on the south side of the pond, and along the east side of the pond to minimize impacts to land development potential.

Based on these additional requirements, the final routing was adjusted and is illustrated in **Figure 2-6**. Land access agreements were negotiated and are in place with all property owners along the Revised Preferred Onshore Route, with the exception of the Tami Sola LLC property. Once access agreements were obtained, cultural resources, wetland, land, and utility surveys were performed along the final route.

Figure 2-6
Onshore Revised Preferred Route

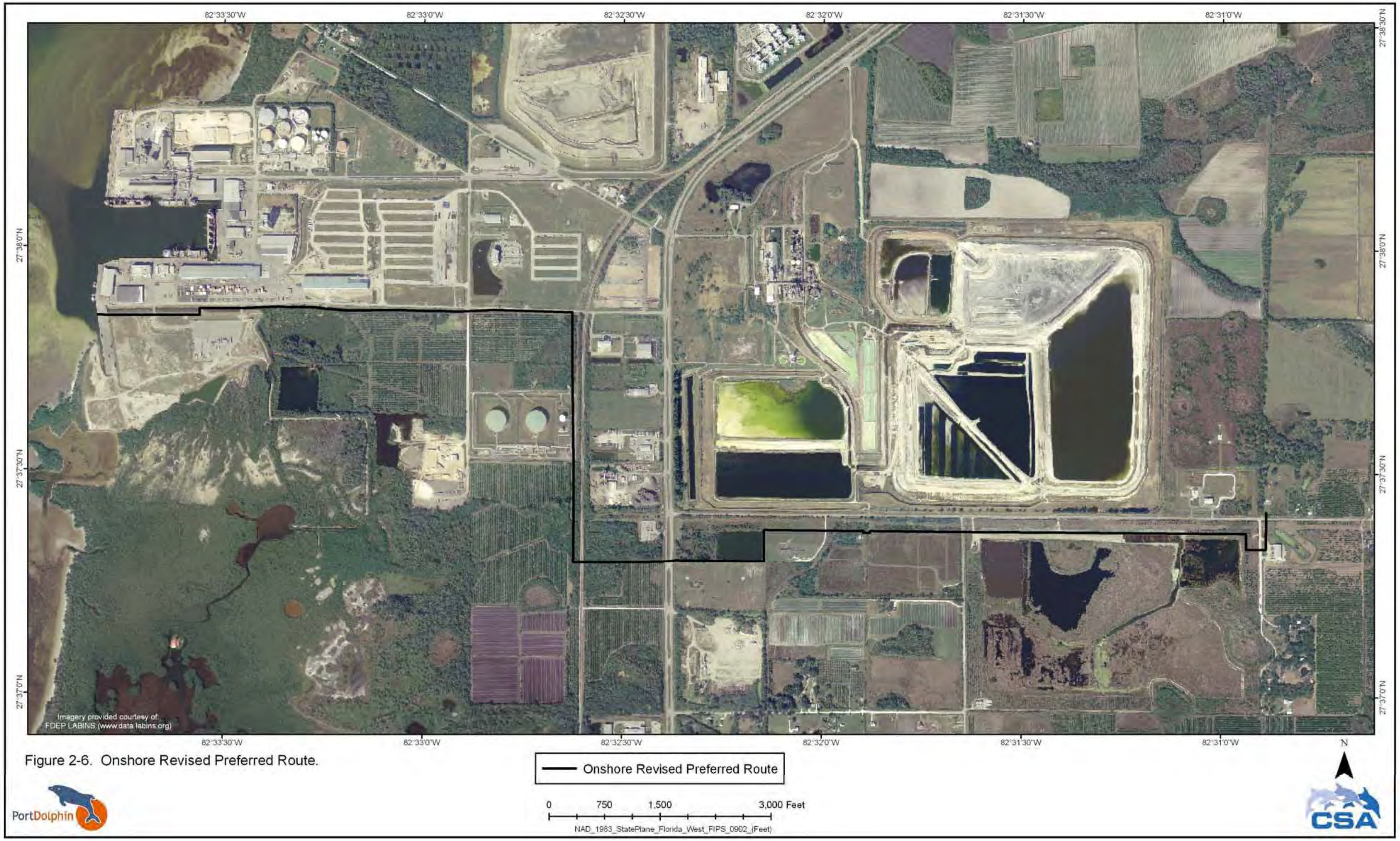


Figure 2-6. Onshore Revised Preferred Route.

3. PROJECT DESIGN CHANGES

This section describes the proposed project design changes to *Port Dolphin* that are being implemented to further minimize potential environmental impacts associated with installation/construction of the project's fixed components. **Table 3-1** lists each proposed design change and describes the corresponding objective/purpose, and **Figure 3-1** illustrates the design changes.

Table 3-1
Design Changes Purpose/Objectives

Design Change	Purpose/Objective
Nearshore Pipeline Route Modification	• Avoid direct impacts to Terra Ceia Aquatic Preserve habitats.
Onshore Pipeline Route Modification	• Avoid or minimize impacts to Port Manatee's existing facilities, operations, and future expansion plans. • Avoid potential disturbance of Piney Point's existing groundwater contamination. • Avoid occupation of FPL's existing ROW along Buckeye Road (including technical challenges to complete construction) and interference with FPL's planned power distribution expansion plans. • Reduce pipeline length and avoid impacts to Taylor Woodrow's property resources along Buckeye Road.
Buoy Anchoring Optimization	• Optimize the area to be physically occupied by the proposed terminal buoys. • Reduce potential impacts to seabed resources.
Adjustment of Pipeline End Manifolds (PLEMs) Location and Flowlines	• Modify the PLEMs location and adjust flowlines design for connecting the optimized buoy arrays with the piggable Y.

3.1 Nearshore Pipeline Route

3.1.1 Selection Process and Criteria

Methods utilized for identifying nearshore alternatives, evaluation, and selection of a preferred alternative is explained in detail in **Section 1**. *Port Dolphin*'s design basis has not changed with respect to the natural gas transmission pipeline (see *Confidential* **Attachment B.3**). The nearshore portion of the Revised Preferred Route proposed by Port Dolphin includes the same design parameters, routing strategies, and constructability and safety considerations previously applied in the original **Deepwater Port Application** submitted by Port Dolphin, including:

Figure 3-1
***Port Dolphin* General Site Location Overview with Optimized Buoy Arrangement and Revised Preferred Pipeline Route**

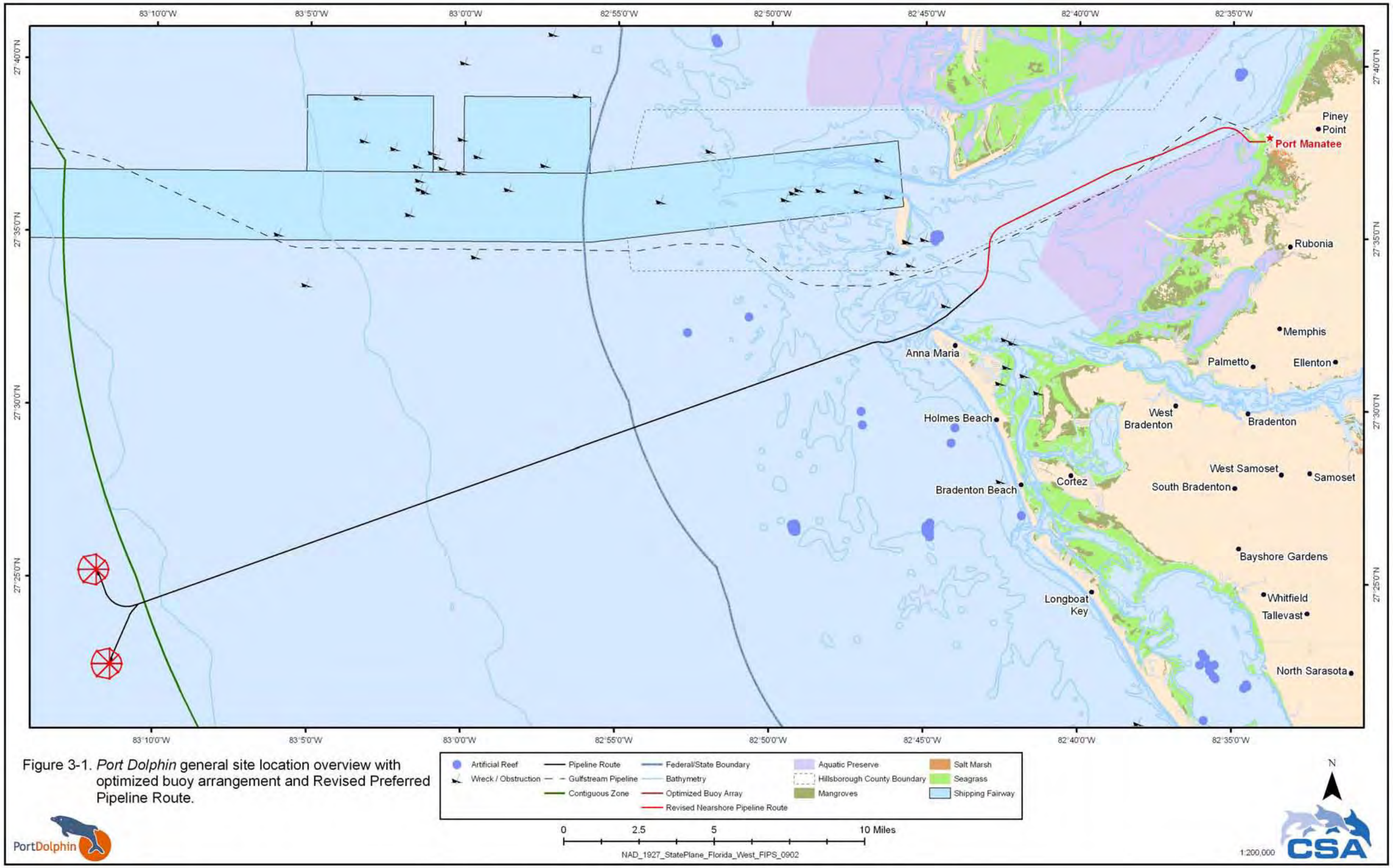


Figure 3-1. *Port Dolphin* general site location overview with optimized buoy arrangement and Revised Preferred Pipeline Route.

- Minimum pipeline bend radius of 4,000 feet (1,219 meters) to facilitate a safe and efficient lay operation;
- To the extent possible, routing around high value hard bottoms, habitats and artificial reefs while attempting to stay in areas that would allow a reasonable and effective pipeline burial using a plow; and
- Consideration of archaeological avoidance areas.

3.1.2 Revised Nearshore Preferred Route

In response to discussions held with the USCG and FDEP regarding the Original Preferred Route through the Terra Ceia Aquatic Preserve, Port Dolphin designed a nearshore alternative route around the north side of this preserve (**Figure 3-2**). The new route added some additional design and construction activities including two subsea crossings of the Gulfstream pipeline. Port Dolphin has designed these two crossings so that the new route of the *Port Dolphin* pipeline would be installed under the existing Gulfstream pipeline using the "water to water" HDD design and construction method. This re-route added 0.65 miles (1.0 kilometers) to the total length of the water segment of the *Port Dolphin* pipeline system. The adjusted length of the offshore gas transmission pipeline (from piggable Y to the bulkhead at Port Manatee) is 42.04 miles (221,957 feet). **Table 3-2** presents route positions for the complete offshore gas transmission pipeline.

The nearshore portion of the Revised Preferred Route begins at pipeline station No. 1583+74 and immediately turns in a northerly direction using a 4,000-foot (1,219-meter) bend radius. The first significant engineering design feature of this nearshore route is the crossing of the existing Gulfstream pipeline (west), which occurs at pipeline station No. 1657+46. The conventional method used to cross foreign lines in the Gulf of Mexico is to install the new pipeline on top of the existing one. However, this method would reduce the water depth at this crossing location (from approximately 22 feet [6.7 meters] to approximately 14 feet [4.3 meters]) after covering and protecting the two lines, which could create a potential hazard to navigation. For this reason, Port Dolphin has decided to utilize the HDD method to cross under the Gulfstream pipeline, and has designed this crossing so that the *Port Dolphin* pipeline would have a separation of approximately 24 feet (7.3 meters) when measured from the bottom of the Gulfstream pipeline to the top of the *Port Dolphin* pipeline. The length of this first HDD crossing would be approximately 1,335 feet (407 meters) (see **Drawing 26017-D-2308** in **Attachment A.3**).

Immediately following this first HDD, the nearshore portion of the Revised Preferred Route would use a 4,000-foot (1,219-meter) radius to turn in a northeasterly direction and continue towards the Sunshine Skyway Bridge, ranging between 5,892 and 2,254 feet (1,796 and 687 meters) south of the Tampa Bay ship fairway. Prior to reaching the Sunshine Skyway Bridge, the revised route would cross two designated spoil areas that are used by the U.S. Army Corps of Engineers (USACE) for depositing spoil material from dredging of the Tampa Bay shipping fairway. This spoil disposal area would have a positive impact on the pipeline, as the burial depth in these areas would be enhanced each time dredging is conducted by the USACE.

Figure 3-2
***Port Dolphin* Revised Preferred Route and Original Route in the Vicinity of Terra Ceia Aquatic Preserve**

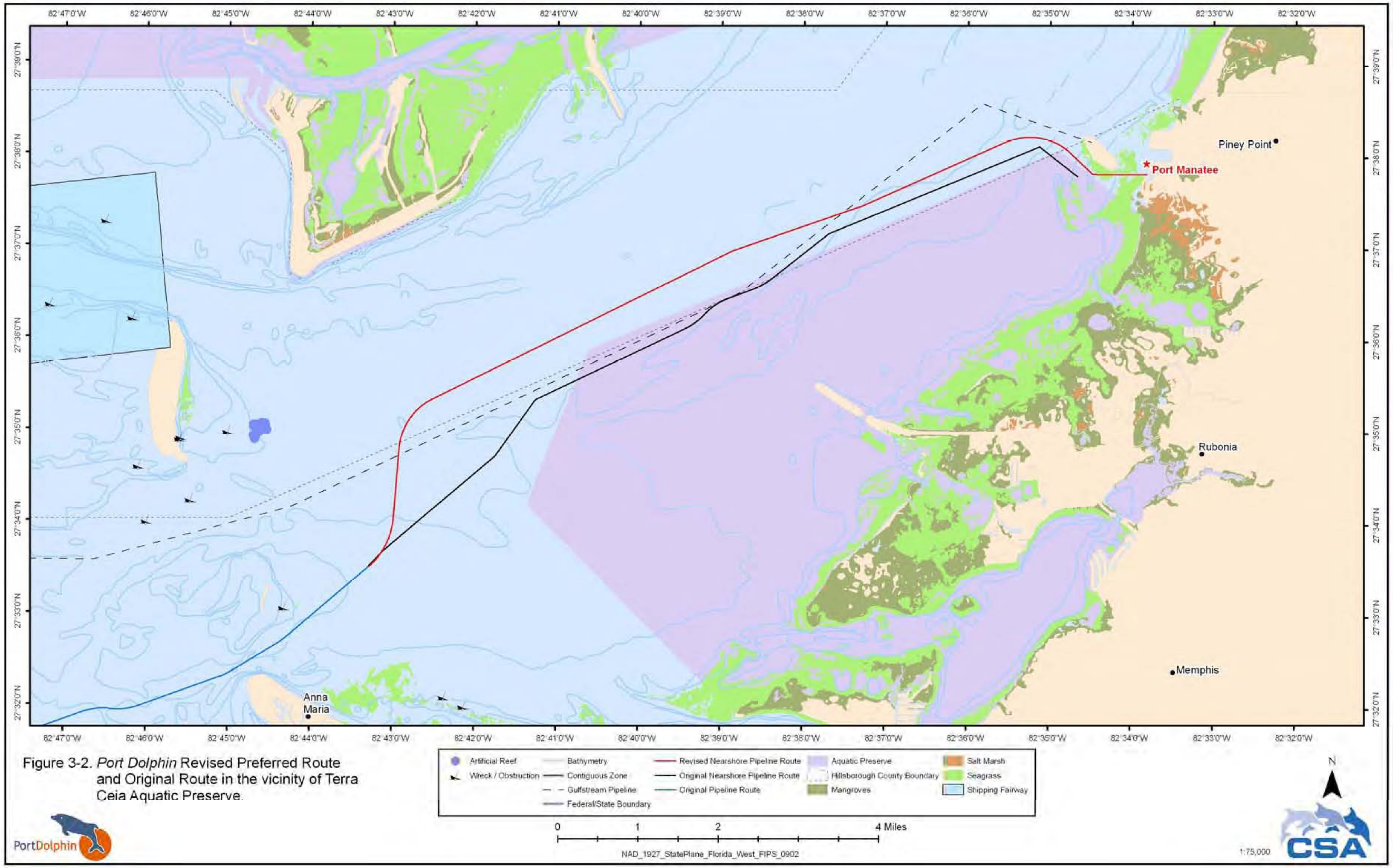


Table 3-2
Offshore Gas Transmission Pipeline Route Positions

Notable Point ID	Description	Latitude	Longitude
P1	Piggable Y	27°24’12.846”	83°10’27.711”
P2	Federal/State Waters	27°29’26.302”	82°54’24.858”
P3	PC – begin curve #1	27°31’54.622”	82°46’46.754”
P4	PC- end curve #1 begin #2	27°31’57.208”	82°46’28.633”
P5	PC – end curve #2	27°31’58.874”	82°46’05.128”
P6	PC – begin curve #3	27°32’18.102”	82°45’05.632”
P7	PC – end curve #3	27°32’21.606”	82°44’57.489”
P8	PC – begin curve #4	27°32’40.249”	82°44’23.496”
P9	PC – end curve #4	27°32’43.920”	82°44’17.850”
P10	PC – begin curve #5	27°33’32.871”	82°43’13.818”
P11	Revised nearshore route begins	27°33’32.879”	82°43’13.807”
P12	PC – end curve #5	27°34’00.611”	82°42’59.283”
P13	Gulfstream east cross.	27°34’42.345”	82°42’55.597”
P14	PC – begin curve #6	27°34’47.924”	82°42’55.104”
P15	PC – end curve #6	27°35’20.237”	82°42’30.680”
P16	PC – begin curve #7	27°36’56.720”	82°38’54.101”
P17	PC – end curve #7	27°36’58.644”	82°38’49.010”
P18	Gulfstream east cross.	27°37’23.470”	82°37’29.941”
P19	PC – begin curve #8	27°37’27.053”	82°37’18.526”
P20	PC – end curve #8	27°37’28.295”	82°37’15.044”
P21	PC – begin curve #9	27°38’09.223”	82°35’32.974”
P22	PC – end curve #9	27°38’04.128”	82°34’47.070”
P23	PI – HDD exit (shore app.)	27°37’48.673”	82°34’28.820”
P24	Bulkhead	27°37’48.652”	82°33’49.102”

Once past the Sunshine Skyway Bridge, the nearshore portion of the Revised Preferred Route would continue in a northeasterly direction, parallel to and south of the shipping fairway still located inside a dredge spoil area. The second crossing of the existing Gulfstream pipeline (east), which occurs at pipeline station No. 2002+50, is now outside of any dredge spoil areas. Port Dolphin has also decided to utilize the HDD method to cross under the Gulfstream pipeline, for the same reasons previously described. Port Dolphin has also designed this crossing so that the *Port Dolphin* pipeline will have a separation of approximately 20 feet (6.1 meters) when measured from the bottom of the Gulfstream pipeline to the top of the *Port Dolphin* pipeline. The length of this second HDD crossing is approximately 2,950 feet (899 meters) (see **Drawing 26017-D-2307** in **Attachment A.3**).

Approximately 11,494 feet past the second HDD crossing, the revised nearshore route would turn in a southeasterly direction (using a 4,000-foot [1,219-meter] radius) as it continues towards Port Manatee. The pipeline would pass south of Manbirdtee Key by approximately 876 feet (267 meters) before connecting to the exit end of the Port Manatee shore approach HDD.

The shore approach HDD into Port Manatee has been designed to exceed the depth and length requirements requested by the Port. The total length of the shore approach HDD would be approximately 4,900 feet (1,494 meters). The depth of the crossing would be at -120 feet (-36.6 meters) mean low water (MLW) and extend well past the future widening proposed for ship slip No. 12 at the Port (see **Drawing 26017-D-2306** in **Attachment A.3**). A remotely actuated mainline block valve will be installed near the bulkhead on Port property to facilitate isolation of the pipeline in case of emergencies (see **Drawing 26017-D-4104** in **Attachment A.3**).

Alignment sheets showing the route and applicable modifications to the offshore gas transmission pipeline are included in **Attachment A.3** (**Drawings 26017-D-2003** through **26017-D-2021**). The Design Basis Manual, which describes the specific pipeline design criteria and routing parameters, is included in *Confidential* **Attachment B.3**.

Subsea Valve Removal

In the original filing to the USCG Port Dolphin had proposed to install a subsea block valve just west of Skyway Bridge. Port Dolphin has decided to remove this valve from the scope of the Port Dolphin pipeline system due to the following reasons:

1) As indicated in the Design Basis Manual (*Confidential* **Attachment B.3**), the Port Dolphin pipeline will be designed, fabricated, constructed and inspected to meet the requirements of the Code of Federal Regulations, 49 CFR Part 192. This regulation does not require a valve on a gas transmission pipeline to be located in a location such as west of Skyway Bridge.

2) FDOT’s Utility Accommodation Manual requires gas pipelines to conform with 49 CFR Part 192.

3) Port Dolphin's emergency shutdown (ESD) system would be redundantly controlled and operated onboard the SRVs and its onshore operation center. Port Dolphin's system design includes remotely operated shutoff valves at the following locations: (1) SRV's, (2) PLEM's, (3) Port Manatee, and (4) Interconnection Station. This design allows for a safe and effective means of isolating the pipeline from several strategic locations.

4) A subsea valve that must be remotely actuated will require an umbilical cable system to transmit the power and the communication signal to the valve actuator. This umbilical cable would have to be routed across the Terra Ceia Aquatic Preserve to a communication building on the south fishing pier. Based on discussions with FDEP, Port Dolphin believes that the impact to the Terra Ceia Aquatic Preserve is not justified in this application.

3.2 Onshore Pipeline Route

3.2.1 Selection Process and Criteria

The key criteria and methodology used for modifying the onshore pipeline route are explained in detail in **Section 2**. *Port Dolphin's* design basis has not changed with respect to the natural gas transmission pipeline (*Confidential* **Attachment B.3**). The Revised Preferred Onshore Route proposed by Port Dolphin includes the same design parameters, routing strategies, and constructability and safety considerations previously applied in the original **Deepwater Port Application** submitted by Port Dolphin. Special attention has been directed to avoid environmentally sensitive areas (i.e., wetlands) and existing landowner facilities (where practicable).

Port Dolphin has conducted numerous meetings and discussions with key stakeholders (i.e., Port Manatee, FPL, Buckeye Industrial) to ensure they are fully aware of project details related to crossing of their properties. Port Dolphin has concluded that the centerline and constructability of the onshore pipeline can be installed effectively and safely, as described in this **Addendum**.

3.2.2 Revised Onshore Preferred Route

In response to interventions filed with FERC, Port Dolphin designed a Revised Preferred Onshore Route to avoid/minimize issues and concerns raised by potentially affected parties (including HRK Holdings, FPL, and Taylor Woodrow). In addition, in completing this design, Port Dolphin also considered constructability issues raised by Port Manatee.

The Revised Preferred Onshore Route proposed by Port Dolphin has been thoroughly assessed by numerous site visits, landowner contacts, desktop research, and land/environmental surveys. This new onshore route eliminates approximately 2.0 miles (3.2 kilometers) of the total length of the original onshore segment of the *Port Dolphin* pipeline system. The adjusted length of the onshore gas transmission pipeline (from the bulkhead at Port Manatee to the proposed interconnection station) is 3.9 miles (20,486 feet). **Table 3-3** presents route positions for the onshore gas transmission pipeline.

Table 3-3
Onshore Gas Transmission Pipeline Route Positions

Notable Point ID	Description	Latitude	Longitude
P1	Bulkhead	27-37-48.65	82-33-49.10
P2	Middle valve station	27-37-50.72	82-33-34.34
P3	PI - turn south to ditch	27-37-50.73	82-33-33.64
P4	PI- cl ditch turn east	27-37-51.64	82-33-33.64
P5	CL east bridge	27-37-51.67	82-33-37.39
P6	Gulfstream crossing	27-37-51.85	82-33-19.34
P7	FPL oil line crossing	27-37-51.86	83-33-18.23
P8	PI – cl ditch	27-37-51.82	82-33-15.97
P9	PI – cl ditch	27-37-51.65	82-33-14.77
P10	Slick bore Reeder Road (west)	27-37-51.31	82-32-54.85
P11	CL Reeder Road	27-37-51.39	82-32-53.42
P12	TECO gas line crossing	27-37-51.41	82-32-52.82
P13	Slick bore Reeder Road (east)	27-37-51.58	82-32-49.41
P14	PI – turn south FPL row	27-37-51.29	82-32-37.63
P15	TECO gas line crossing	27-37-51.19	82-32-37.63
P16	FPL oil line crossing	27-37-51.06	82-32-37.63
P17	HDD north FPL tank farm	27-37-42.71	82-32-37.59
P18	HDD south FPL tank farm	27-37-30.05	82-32-37.33
P19	PI – east (west of CSX railroad)	27-37-17.74	82-32-37.38
P20	Bore CSX railroad (west)	27-37-17.74	82-32-36.94
P21	CL CSX railroad	27-37-17.77	82-32-36.22
P22	Bore CSX railroad (east)	27-37-17.76	82-32-35-49
P23	Slick bore US 41 (west)	27-37-17.86	82-32-24.21
P24	CL US 41	27-37-17.94	82-32-23.09
P25	Slick bore US. 41 (east)	27-37-18.03	82-32-21.99
P26	PI – turn north (FPL property)	27-37-17.94	82-32-8.70
P27	PI – turn east @ Buckeye Ind.	27-37-22.20	82-32-8.73
P28	CL Bud Rhoden Road	27-37-22.03	82-31-39.01
P29	PI – turn south @ TECO station	27-37-21.87	82-30-56.30
P30	PI – slick bore Oneil Road (west)	27-37-19.75	82-30-56.26
P31	CL – Oneil Road	27-37-19.75	82-30-54.23

3.2.2.1 Revised Route Through Port Manatee

The Revised Preferred Onshore Route would begin at the block valve that would be installed at Port Manatee. The location of this block valve is the same as the original location depicted in the original **Deepwater Port Application** submitted by Port Dolphin. Starting at the aforementioned block valve, the pipeline would quickly turn north into the existing tidally-influenced conveyance ditch (south conveyance ditch) and then east along this ditch. The pipeline would be installed below the bottom of this ditch for approximately 3,600 feet (1,097 meters) until it reaches Reeder Road. Once past Reeder Road, the pipeline would continue east for approximately 2,900 feet (884 meters) until reaching a point just west of CSX Railroad where it would turn due south before leaving Port Manatee property (**Figures 3-3** through **3-5**). The revised route across Port Manatee would involve installing the pipeline south of South Dock Street, whereas the original route was north of South Dock Street.

3.2.2.2 Revised Route from Port Manatee to the Interconnection Station

Port Dolphin's proposed onshore route from Port Manatee to its proposed interconnection station would include a N-S segment between Port Manatee and an FPL property and an E-W segment between the same FPL property and a proposed interconnection station that will be located next to Gulfstream's pressure reduction station along Buckeye Road (**Figures 3-5** through **3-10**).

Route Along the West Side of CSX Railroad
The pipeline would turn south leaving Port Manatee property and enter FPL property. It would continue south approximately 280 feet (85 meters) west of and parallel to CSX Railroad. The pipeline would use an HDD to cross under the existing FPL tank farm, continue south past the FPL tank farm for approximately 1,300 feet (396 meters), and then turn east, where it would cross CSX Railroad. Port Dolphin proposes to use the dry jack and bore method to install an uncased crossing under CSX Railroad.

Route Across FPL's Substation 41 Property
Once the pipeline crossed CSX Railroad, it would continue east across an FPL property (named "Substation 41" parcel by FPL) and cross US 41. On the east side of US 41, it would continue east back onto an FPL property, along the south and east sides of an existing borrow pit. Once the pipeline reached the northeast corner of the FPL property, it would turn east onto Buckeye Industrial property.

Figure 3-3
Revised Preferred Onshore Route (Sheet 1 of 8)

Figure 3-4
Revised Preferred Onshore Route (Sheet 2 of 8)

Figure 3-5
Revised Preferred Onshore Route (Sheet 3 of 8)

Figure 3-6
Revised Preferred Onshore Route (Sheet 4 of 8)

Figure 3-7
Revised Preferred Onshore Route (Sheet 5 of 8)

Figure 3-8
Revised Preferred Onshore Route (Sheet 6 of 8)

Figure 3-9
Revised Preferred Onshore Route (Sheet 7 of 8)

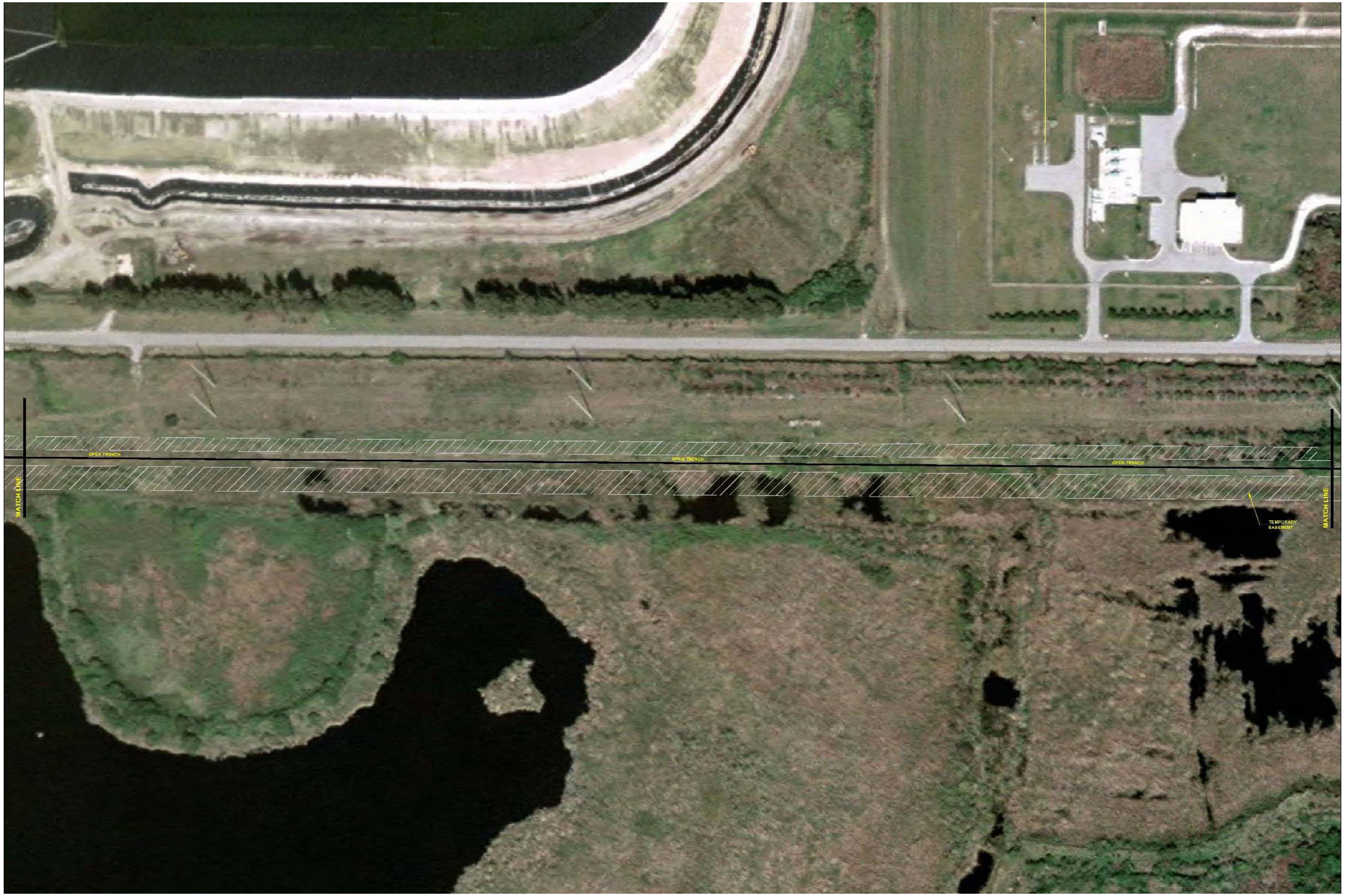
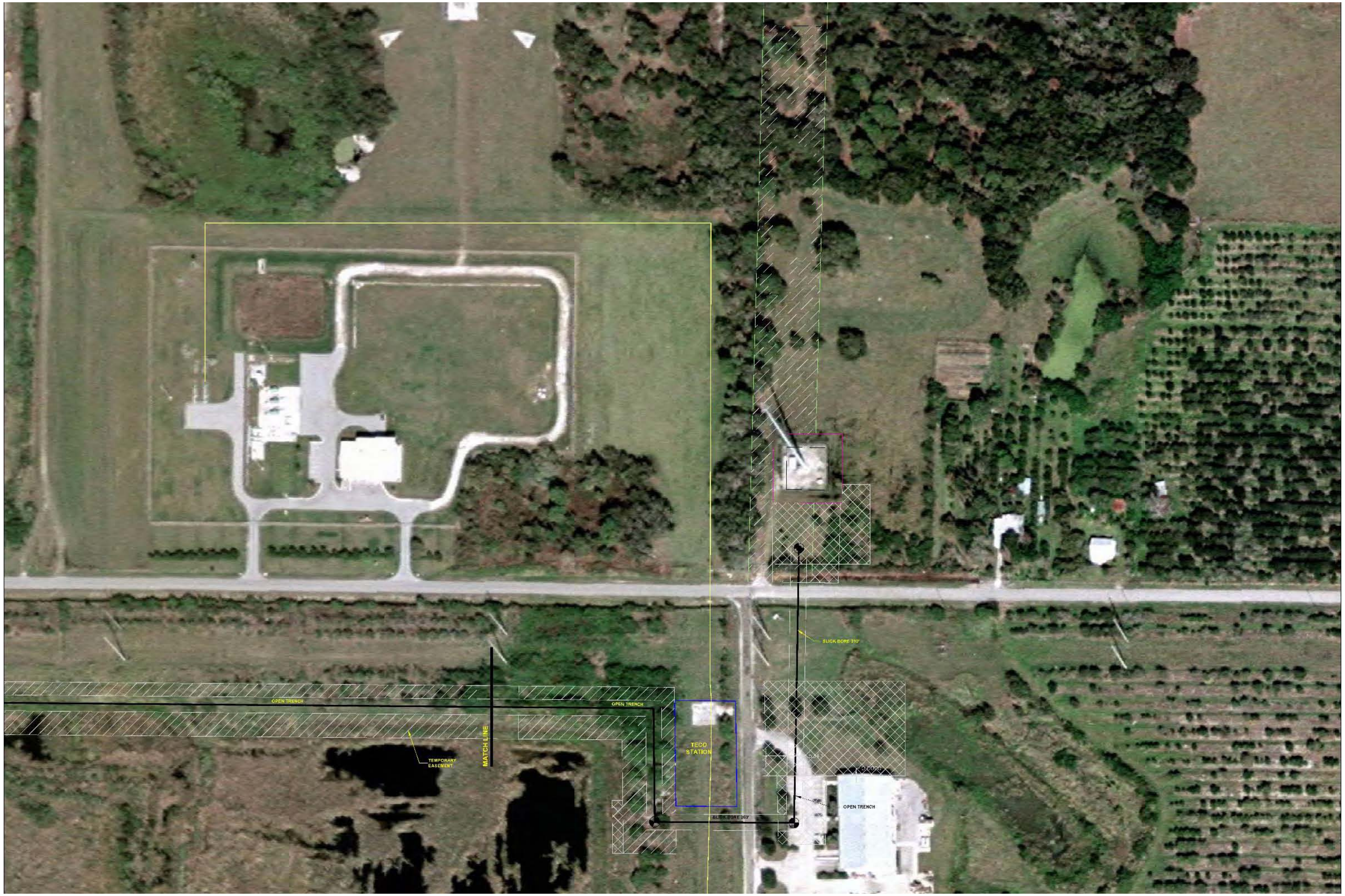


Figure 3-10
Revised Preferred Onshore Route (Sheet 8 of 8)



Route Across Buckeye Industrial and Tami Sola Properties
Once the pipeline crossed onto Buckeye Industrial property, it would continue east approximately 3,350 feet (1,021 meters) until reaching Bud Rhoden Road. Bud Rhoden Road is a field gravel road; therefore, Port Dolphin proposes to open trench across this road. Once across this gravel road, the pipeline would continue east onto Tami Sola property for approximately 3,700 feet (1,128 meters) along the north side of an existing borrow pit until reaching Oneil Road. Oneil Road is a paved road, so Port Dolphin proposes to slick bore under this road. Once the pipeline crossed Oneil Road, it would enter Gene Citrus property.

Route North Across Buckeye Road
Once the pipeline crossed onto Gene Citrus property, it would turn immediately north across the Gene Citrus facility entrance road and continue north approximately 230 feet (70 meters), where it would cross both the FPL existing ROW and Buckeye Road, with a single slick bore. Once across Buckeye Road, the pipeline would enter the Port Dolphin property, where the pipeline would be terminated at a pig receiver.

3.2.3 Interconnection Station

Subsequent to the original filing of the **Deepwater Port Application** in March 2007, several issues arose that required the locations of the interconnection station to the Gulfstream pipeline and TECO's Bayside pipeline to be changed.

3.2.3.1 Interconnection with Gulfstream's Pipeline

Port Dolphin was unable to reach agreement with the landowner of the property where it had initially planned to locate the Gulfstream pipeline interconnection station. Port Dolphin has successfully negotiated an option agreement to place the Gulfstream interconnection station facilities on a parcel of land that is within several hundred feet and north of the original site. This new location is located next to Gulfstream's pressure reduction station along Buckeye Road, has excellent access to a major county road and utilities, and is positioned in an industrial area of Manatee County. This parcel of land is roughly 3.14 acres (1.27 hectares) in size.

3.2.3.2 Interconnection with TECO's Bayside Pipeline

The original rationale for placement of the TECO interconnection station was that it should be located adjacent to a planned (future) TECO facility that would be the beginning of their Bayside pipeline system (which would be initially fed by the Gulfstream pipeline). After Port Dolphin had filed the original application with the USCG and FERC, Port Dolphin learned that TECO relocated their planned facilities further west to a site located south of Buckeye Road and west of Oneil Road, in the vicinity of Gulfstream's pressure reduction station. Due to this change and the subsequent re-route of TECO's Bayside pipeline, Port Dolphin now proposes to locate both the Gulfstream and TECO interconnection stations on the same parcel of land described above for the Gulfstream interconnection station. Port Dolphin has successfully negotiated an option agreement for this parcel of land to be large enough to safely and effectively accommodate both interconnection facilities. The new location is positioned in an industrial area of Manatee County and immediately to the east of Gulfstream's pressure reduction station on Buckeye Road. The location has excellent access to a major county road and existing utilities.

The relocation of both interconnections does not affect the ability of *Port Dolphin* to deliver the planned quantity and quality of natural gas at the pressures required by both the Gulfstream pipeline and TECO's proposed Bayside pipeline (see *Confidential* **Attachment B.4**).

3.2.3.3 Conceptual Engineering Design

Port Dolphin has decided to combine both the interconnections with Gulfstream and TECO on the same site (see **Drawing No. 26017-D-4105** in **Attachment A.3**). A summary of the changes in the revised design of interconnection facilities is shown in **Table 3-4**. A process flow diagram for the proposed combined interconnection facilities is presented in **Drawing No. 26017-B-4004** in **Attachment A.3**.

Table 3-4
Comparison of Interconnection Equipment/Component Needs

Original Design	Revised Design
Interconnection with Gulfstream	
• Pressure Reduction Equipment	√
• Filter/Coalescer Equipment	√
• Measurement Equipment	√
• Liquid Storage Tank	√
• Buildings	√
• API Separator	√
• Sump	√
• Retention Pond	√
• Utility Equipment	√
Interconnection with TECO	
• Pressure Reduction Equipment	√
• Filter/Coalescer Equipment	X
• Measurement Equipment	√
• Liquid Storage Tank	X
• Building	√ (smaller size)
• Sump	X
• Retention Pond	X
• Utility Equipment	X

The change in the location of the proposed interconnection with the Gulfstream system resulted in a change to the 36-inch pipeline length of approximately 500 feet (152 meters). As mentioned before, this change in length had a minimal effect on the pipeline hydraulics and the receiving pressures (see *Confidential* **Attachment B.4**). Since the selection of equipment and components by Port Dolphin engineers for the original design included a wide range of capabilities, no modifications were necessary for the incoming pressure reduction/control, filter/coalescer or metering equipment for the Gulfstream interconnection facilities.

3.3 Buoy Anchoring Arrangement

The proposed *Port Dolphin* will include a combined mooring and offloading system based on the submerged turret loading (STL) buoy concept that will be interconnected to an offshore/onshore gas transmission pipeline via flexible risers.

The **Deepwater Port Application** (March 2007) included a very basic buoy arrangement represented by a symmetrical configuration of mooring locations and equidistant mooring line lengths that resulted in a very conservative terminal footprint size. In order to minimize the size of the footprint, Port Dolphin requested its buoy technology provider (Advanced Production Loading AS [APL]) to complete a mooring system optimization analysis (*Confidential* **Attachment B.5**).

This section summarizes APL's new mooring analysis, which is mainly based on directionality of wave, wind, and currents obtained from Port Dolphin's Metocean Study (**Deepwater Port Application, Volume III, Section 11**), as well as consideration of site-specific geologic information included in Port Dolphin's Geophysical Investigation Report (**Deepwater Port Application, Volume III, Section 2**).

3.3.1 Optimization Process and Criteria

3.3.1.1 Rules and Regulations

The design optimization of the mooring system has been made according to relevant American Bureau of Shipping (ABS) and American Petroleum Institute (API) rules/recommendations, including:

- ABS – Guide for Building and Classing Floating Production Installations, and Rules for Building and Classing Single Point Moorings; and
- API – RP for Planning, Designing, and Constructing Floating Production Systems, and Recommended Practice for Design and Analysis of Station Keeping System for Floating Structures.

3.3.1.2 Design Requirements

The mooring optimization was completed according to the following main requirements:

- Service life of 40 years (25 years minimum);
- Shuttle and regasification vessel (SRV) to be passive and naturally weather-vaning;
- SRV to stay connected in the 100-year non-hurricane conditions; and
- Idle system must survive the 100-year hurricane condition.

3.3.1.3 Methodology of Analysis

The design of a mooring system is based upon calibrations with applicable model test results followed by specific station keeping analysis. In this case, the station keeping analysis was performed to assess the behavior of the mooring system when connected to the SRV in extreme conditions and, therefore, optimize the system configuration and predict the extreme loads and motions that the system must withstand during its lifetime.

As part of the design process, several computer programs are used for (1) mooring system analysis (MIMOSA), (2) analysis of interaction of surface waters with offshore structures (WAMIT), (3) simulation of motions and station keeping behavior of systems of floating vessels and suspended loads (SIMO), (4) time domain analysis for static and dynamic analysis of slender marine structures (RIFLEX), and (5) analysis of data for structural response, environmental loads, and their generating processes (STARTIMES). The station keeping analysis procedure is generally divided into three steps:

1) Calibration of the SIMO model with respect to model tests.
2) Quasi-dynamic station keeping analysis by means of SIMO.
3) Dynamic analysis of specific mooring lines by means of RIFLEX (if necessary).

The parameters considered for meeting design requirements and station keeping conditions include (1) extreme conditions, (2) wind vs. wave direction, (3) current vs. wave direction, (4) marine growth, (5) sea elevation, (6) low frequency damping, and (7) current force on mooring lines and riser. A safety ratio (≥1.25 for the line failure and ≥1.67 for the intact condition) and average/extreme corrosion and wear allowances were also applied to the analysis.

3.3.1.4 Sequence of Evaluation and Design Verification

The analysis included sequential evaluation of four scenarios, as follows:

1) 145,000 m^3 SRV on the original "base case" mooring system.
2) Optimization of the original "base case" mooring system for the 145,000 m^3 SRV (by reducing the line lengths in different directions according to weather rose).
3) 217,000 m^3 SRV on the original "base case" mooring system.
4) 217,000 m^3 SRV on the optimized mooring system.

A screening study of all possible loads cases with nominal wave spectrum was performed as a first step in the design verification process. The most critical load cases from this study were then investigated in more detail, where the sensitivity to the wave spectrum and the seed number for wave and wind time series generation were considered. Based on the screening study and sensitivity analysis results, the original "base case" mooring configuration was optimized. Site-specific geologic conditions were considered for selecting appropriate locations to locate buoy mooring anchors.

Finally, the consequences of accommodating the large 217,000 m^3 SRV at *Port Dolphin* were investigated with respect to mooring system capacity. Given that in the future Port Dolphin is planning to use 217,000 m^3 SRVs for serving this terminal, the following section presents a proposed mooring arrangement that would allow both sizes of SRVs to stay connected during similar extreme weather conditions.

3.3.2 Optimized Buoy Arrangement

Table 3-5 presents the coordinates of both proposed buoy turrets. These proposed buoy turret locations have not been changed and remain the same as in the original "base case" mooring arrangement.

Table 3-5
North and South Buoy Center Coordinates

Buoy	Coordinates (NAD 27)	
	Latitude	Longitude
North	27°25'12.12	83°11'50.12
South	27°22'28.73	83°11'22.49

(Source: Mooring System Optimization Report [*Confidential* **Attachment B.5**])

Table 3-6 presents the new coordinates for each proposed anchoring location and horizontal projection lengths for corresponding mooring lines (between anchoring points and buoy center), as well as original horizontal projection for same lines under the original "base case" mooring scenario and the corresponding percentage of reduction achieved through this design optimization analysis.

It is important to note that while the percentage of reduction achieved for horizontal projection of both buoy mooring lines ranges between 24% and 48%, the total seafloor area to be occupied by each buoy has been reduced to 39.9% of the original "base case" mooring arrangement (see **Drawings 26017-B-2701** and **26017-B-4206** in **Attachment A.3**). Similarly, the footprint or area of direct impact (defined by the anchor lines sweeping area) has been reduced to approximately 90,000 m^2 or 74% of the original "base case" mooring arrangement.

Table 3-6
Optimized Anchoring Locations and Line Lengths

Mooring Anchors	Coordinates (NAD 27)		Distance from Turret Center to Mooring Anchor (meters)		Net Reduction (%)
	Latitude	Longitude	Optimized Design	Original Design	
North Buoy					
N1	27°25'38.70"	83°11'50.40"	800	1,250	36
N2	27°25'27.17"	83°11'33.58"	650	1,250	48
N3	27°25'12.32"	83°11'26.50"	650	1,250	48
N4	27°24'57.36"	83°11'33.26"	650	1,250	48
N5	27°24'46.16"	83°11'49.84"	800	1,250	36
N6	27°24'50.11"	83°12'14.31"	950	1,250	24
N7	27°25'11.82"	83°12'24.66"	950	1,250	24
N8	27°25'33.71"	83°12'14.78"	950	1,250	24
South Buoy					
S1	27°22'54.66"	83°11'22.78"	800	1,250	36
S2	27°22'43.76"	83°11'5.96"	650	1,250	48
S3	27°22'28.91"	83°10'58.88"	650	1,250	48
S4	27°22'13.94"	83°11'5.64"	650	1,250	48
S5	27°22'2.75"	83°11'22.22"	800	1,250	36
S6	27°22'6.74"	83°11'46.68"	950	1,250	24
S7	27°22'8.42"	83°11'57.03"	950	1,250	24
S8	27°22'50.30"	83°11'47.15"	950	1,250	24

(Source: Mooring System Optimization Report [*Confidential* **Attachment B.5**])

3.3.3 Subsequent Flowlines Route Modification

During the optimization of the buoy mooring systems, the lengths of the anchor lines, the configuration of the flexible risers, and placement/design of the pipeline end manifolds (PLEMs) were modified. These changes subsequently resulted in the flowlines being re-aligned. Although the starting point of each flowline was adjusted slightly, Port Dolphin has re-designed the flowlines so that they both terminate at the same location as in the original design, thus avoiding a change in the location of the piggable Y. This approach allowed the offshore gas transmission pipeline to remain unchanged until the point where the nearshore portion of the Revised Preferred Route around the Terra Ceia Aquatic Preserve was initiated.

The north and south flowlines both traverse the same general alignments as the previous north and south flowlines depicted in the original **Deepwater Port Application**. The north PLEM was moved approximately 440 feet (134 meters) to the southeast of its original location, and the south PLEM was moved 440 feet (134 meters) northwest of its original location.

During the analysis of the flowline routing, Port Dolphin maintained a minimum pipeline bend radius of 4,000 feet (1,219 meters) to facilitate a safe and efficient lay operation. Both flowlines were routed around high value hard bottoms while attempting to stay in areas that would allow a reasonable and effective pipeline burial. There are no archaeological avoidance areas that were identified that impacted the revised flowline routing. The adjusted lengths of the flowlines caused by these adjustments are as follows:

- North Flowline = 1.98 miles (10,462 feet)
- South Flowline = 2.08 miles (10,985 feet)

Table 3-7 presents route positions for both flowlines.

Table 3-7
North/South Flowline Route Positions

Notable Point ID	Description	Latitude	Longitude
North Flowline			
P1	North PLEM	27°25’06.358”	83°11’45.746”
P2	PC- begin 4000’ radius	27°24’33.608”	83°11’31.834”
P3	PC- mid point curve	27°24’11.629”	83°11’08.799”
P4	PC- end 4000’ radius	27°24’10.445”	83°10’35.106”
P5	Piggable Y	27°24’13.272”	83°10’27.928”
South Flowline			
P1	South PLEM	27°22’35.546”	83°11’21.032”
P2	PC- begin 4000’ radius	27°23’51.600”	83°10’45.094”
P3	PC- mid point curve	27°23’56.823”	83°10’42.098”
P4	PC- end 4000’ radius	27°24’01.592”	83°10’38.269”
P5	Piggable Y	27°24’12.699”	83°10’27.862”

Alignment sheets showing the route and applicable modifications to the offshore gas transmission pipeline are included in **Attachment A.3** (**Drawings 26017-D-2001** and **26017-D-2002**). The Design Basis Manual, which describes the specific pipeline design criteria and routing parameters, is included in *Confidential* **Attachment B.3**.

4. CONSTRUCTION PLAN

Based on comments provided by the USCG after completing review of the original **Deepwater Port Application**, Port Dolphin is providing in this section a comprehensive project construction plan that (1) describes applicable construction assets and methods, (2) identifies specific construction methods to be utilized for each project component and/or component segments (if applicable), (3) establishes the sequence of activities to be followed for completing construction, and (4) defines a construction schedule for fixed project components.

4.1 Offshore Pipeline Construction Plan

This section describes the proposed offshore construction assets and plan for *Port Dolphin's* gas transmission pipeline, pigabble Y, flowlines, and PLEMs.

4.1.1 Description of Offshore Pipeline Construction Assets

4.1.1.1 Typical Pipelay, Plowing, and Backfill Spread

The main pipeline installation vessel would be a dedicated inshore pipelay barge in the maximum size range, approximately 400-feet long by 100-feet wide (**Figure 4-1**). The barge would be fully equipped with pipeline welding stations, pipeline tensioners, and a heavy duty winch for abandonment and recovery of the pipeline. Cranes on the barge would facilitate loading of the pipeline sections onto the barge following transportation from the onshore supply/fabrication base. The barge would be equipped with a complete anchoring/positioning system. For a barge in the 400-foot long by 100-foot wide size range, as is planned for the *Port Dolphin* pipeline installation (i.e., the *Sea Horizon*) there would likely be 10 anchors weighing about 20,000 pounds each. To deploy and recover these anchors, two anchor handling support vessels with a power rating of 3,000 to 5,000 horsepower (HP) each would be used.

Figure 4-1
Typical Pipelay, Plowing, and Backfill Spread
(courtesy of Horizon Offshore)

During operations, there would be a total crew of approximately 190 persons present on the barge and anchor handling support vessels. Using dedicated tugs and barges, pipe segments would be shuttled from the onshore staging area to the pipeline installation barge offshore. It is anticipated that all construction operations would operate 24 hours per day, 7 days per week.

4.1.1.2 Shallow Water Lay Barge

The extreme inshore section of the route, currently estimated to be from the HDD exit to a water depth of 15 feet (a distance of approximately 4,384 feet), would be installed with the use of a shallow water lay spread. Additionally, the section of pipe to be installed under the Sunshine Skyway Bridge would be installed with the assistance of the same shallow water lay spread.

A typical shallow water spread would be assembled by joining two barges of typically 140-foot length and 40-foot beam, end-to-end, fitted with spuds for positioning in the constricted area of the HDD shore approach (between Manbirdtee Key and Terra Ceia Aquatic Preserve). The spread will also be equipped with automated welding equipment to allow for the assembly of pipe sections on board and an 8-point anchor spread.

4.1.1.3 Spud Barge and Clamshell Dredge (Sunshine Skyway Bridge Section)

Certain sections of the pipeline route would be buried using non-plowing techniques (i.e., the section of the route that passes beneath the Sunshine Skyway Bridge). An inshore dredge barge would be accurately located along the proposed pipeline corridor using the satellite-deployed differential global positioning system (DGPS) and moored in position using either temporary spudded legs or anchors (**Figure 4-2**). A clamshell dredge grab would be deployed to seabed from a crane on the barge, and an acoustic sonar system would be used to accurately monitor the depth of ditch dredged.

Figure 4-2
Conventional Spudded Leg Clamshell Dredge (courtesy of U.S. Army Corps of Engineers)

4.1.1.4 Jack-up Barge (HDD Shore Approach)

The HDD shore approach would be assisted by one jack-up barge in the 200-class range. These barges typically are self-propelled, with spuds 60 meters long, 288 square meters of deck space, and up to 181 tonnes of deck loading capacity.

4.1.1.5 Horizontal Directional Drilling Spread (HDD Crossings)

The spread to be utilized for water-to-water HDDs would include:

- Four jack-up barges in the 200-class range (described above in **Section 4.1.1.4**).
- Three hopper barges moored to one jack-up barge at each crossing location to collect slurry and cuttings, along with water barges to provide fresh water for slurry make-up.
- Two tugs (1,200 HP each) for barge towing, and crew boats for personnel transport and logistics.

4.1.1.6 Diving Support Vessel

Four barges in the 140-foot length by 40-foot beam size range, equipped with a four-point mooring system would be utilized for diving support. These barges would be used to support the tie-in and mattressing operations.

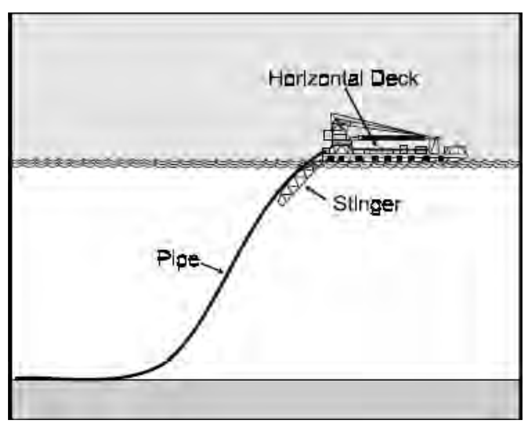
4.1.2 Offshore Pipeline Construction Methods

4.1.2.1 Base Case Methods

Pipelay (Deep Water)

The pipeline would be installed onto the seabed using the "S-Lay" method. The "S-Lay" method is the traditional and most extensively proven technique for installing pipe in the relatively shallow water Gulf of Mexico conditions that are a characteristic of the *Port Dolphin* location. The technique is known as "S-Lay" because the shape taken by the pipe as it moves from the welding and inspection stations on the deck of the pipelay barge, across the stern of the pipelay barge and on to the ocean floor forms an elongated "S" (**Figure 4-3**). As the pipeline moves across the stern of the lay barge and before it reaches the ocean floor, the pipe is supported by a truss-like structure equipped with rollers, known as a stinger. The purpose of a stinger is to minimize curvature, and therefore the bending stress, of the pipe as it leaves the vessel.

Figure 4-3
Diagram Showing
"S-Lay" Technique



Pipelay (Shallow Water)
The shallow water pipelay spread would be used to install the section of pipe between the Port Manatee HDD exit and a water depth of 15 feet (a distance of approximately 4,384 feet). This section of pipe would be installed in a manner similar to the deepwater construction method described above, but would not use a stinger to guide the pipe to the seabed. For the inshore tie-in operation, during which the barge would be positioned in close quarters to Manbirdtee Key and the Terra Ceia Aquatic Preserve, it is expected that the barge would hold station on spuds, moving away from the tie-in location on bow anchors only. Additional anchors could be used as the barge moves forward and additional space is available. No anchors would be deployed within the Terra Ceia Aquatic Preserve. No burial would be conducted within the inshore section of the route.

Pipeline Plowing and Burial
In the plowing technique the pipeline is lowered below seabed level by shearing a "V" shaped ditch in the soil underneath the pipeline. The plow is towed along the pipeline directly behind the burial barge. As the ditch is cut, spoil is removed and passively pushed to the side by specially-shaped moldboards that are fitted to the main plowshare.

It is planned to use a "conventionally moored" barge, which means that the position of the pipeline installation will be maintained through anchors, associated anchor chains, and/or cables. The anchor re-set distance for each mile of offshore pipeline burial route will be a function of the size of the lay/bury barge, weather conditions, water depth, seabed type, and the amount of anchor line that can be stored, deployed, and retrieved by the barge. Based on previous experience and accepted practice in similar conditions, and also following discussions with an experienced pipelay/bury contractor, it is currently assumed that each anchor will be re-set approximately every 2,000 feet along the pipeline route.

The barge will first position directly over the burial initiation point on the pipeline (**Figure 4-4**). The plow is then launched with its share in the open position and lowered towards the burial initiation point (**Figure 4-5**). The plow will be fitted with cameras, sonar, and sensor instruments, which will assist with final positioning. Divers or robotic submersibles will also be deployed as necessary to monitor the plow as it is located and placed astride the pipeline.

Figure 4-4
A Typical Pipeline Burial Plow
(courtesy of Horizon Offshore)

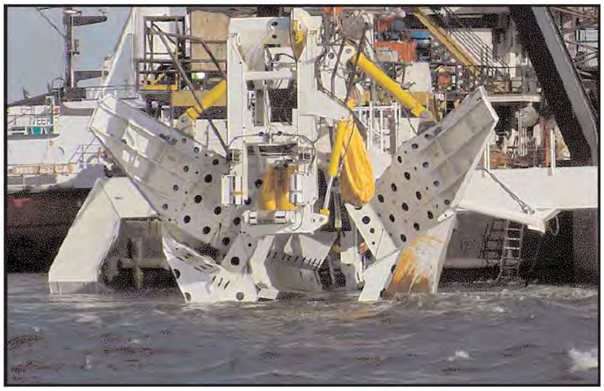


Figure 4-5
Lowering Plow with Share Open

When it is confirmed that the plow safely straddles the pipeline and all in-water system checks have indicated that it is safe to proceed, the plow's pipeline lifters are activated. The pipeline is raised into the plowshare, which is then closed around it (**Figure 4-6**). At this point the barge would recover the plow's main lifting line and advance forward along the pipeline route in order to establish a proper tow catenary. Barge advancement is achieved by winching-in/paying-out anchor cable while "walking" and relocating the anchor array as required.

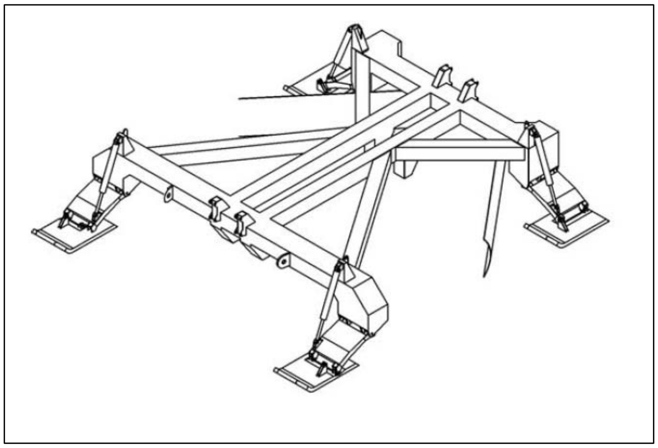
Once a proper tow catenary is established, the plow is pulled forward under tension while operators monitor and adjust the depth of the ditch being cut. The latest generation of burial plow is fitted with sophisticated computer control systems and instrumentation, enabling the operators to select and continuously monitor the depth of the ditch as it is formed in real time (**Figure 4-7**). The process continues as the barge simultaneously advances along the pipeline route and lowers the pipeline into the ditch cut by the plow.

Figure 4-6
Pipeline is Raised into Plowshare

Figure 4-7
Monitoring and Adjustment of
Ditch Being Cut

Once the end of the pipeline route is reached, the procedure above is reversed in order to lift and recover the plow back onto the deck of the barge. The pipeline route is then surveyed either by the barge itself, or by a separate survey vessel, to determine where full pipeline lowering has been achieved.

Figure 4-8
Backfill Plow Configuration
(courtesy of Horizon Offshore)



Finally, one further pass will be made along the pipeline route to backfill the pipeline lying in the ditch. For this purpose, the plow blades are reversed for scraping the spoils back into the ditch (**Figure 4-8**). As the backfill plow is advanced, the spoil is simultaneously pushed back into the ditch and on top of the pipeline. Upon completion, a final survey is run to confirm and document the conclusion of all burial operations.

Trench and Burial (Sunshine Skyway Bridge Section)
The section of the route that passes beneath the Sunshine Skyway Bridge is anticipated to be buried by means of bucket dredging. In this section, dredging of the pipeline ditch would be carried out "pre-lay" prior to passage of the pipelay barge. An inshore dredge barge would be accurately located at all times along the proposed pipeline corridor using a satellite-deployed DGPS operated and supervised by suitably qualified professional surveyors. The barge will be moored in position using either temporary spudded legs or anchors.

Depending on any access restrictions for the anchor handling support vessels in the shallowest water zones, it may be temporarily required to operate the barge with a reduced number of anchors. In such a case it may be necessary to use the anchor handling support vessels as tugs to aid barge positioning.

A clamshell dredge grab would be deployed to seabed from a crane on the barge, and an acoustic sonar system would be used to accurately monitor the depth of the ditch dredged. Excavated spoil will be carefully placed adjacent to the ditch formed, and its location will be recorded. Following passage of the pipelay barge, the spoil will be relocated back into the ditch in order to backfill the laid pipeline.

Pipeline Installation (Sunshine Skyway Bridge Section)
The primary lay barge would approach the bridge from the east side, bearing west. At a pre-determined station, the barge would blind flange the pipe and lay it on the seafloor. The barge would then reposition 180 degrees, heading due east.

A second, smaller, pull-in barge would be positioned on the west side of the bridge. It is currently anticipated that the shallow water lay barge would be used in this capacity. A pulling wire is passed from the pull-in barge to the primary lay barge, and the wire attached to a pulling head on the section of pipe to be pulled under the bridge. The primary lay barge then begins welding and stalking pipe, which is pulled under the bridge into the pre-cut trench.

Once the pull is complete, the pull-in barge blind flanges the western end of the line and lays the end to the seabed. The pull-in barge is then demobilized. The primary lay barge then repositions on the west side of the bridge, retrieves the pipe, and begins lay away to the offshore location. On the east side of the bridge, a closing spool will be installed through subsea diving operations.

Pipeline Installation Through Passage Key Inlet

The offshore pipeline route is planned through Passage Key Inlet, a natural channel located between Anna Maria Island to the south and Passage Key to the north.

The lay barge would construct the pipeline in a westward direction, meaning that the approach through the inlet would be on a southwesterly bearing. The inlet itself offers more than adequate water depth for the draft of the lay barge and support tugs. However, the inlet is very narrow and quickly shoals to the north and south to a water depth of 2 feet. The lay barge requires a minimum of 8 anchors to operate and usually deploys 10 (2 bow, 2 stern, 4 to 6 port and starboard). These anchors weigh up to 10 tons each, and the tugs required to position them cannot navigate in a water depth of 2 feet. Additionally, if the anchor(s) are placed in shallow water, the anchor wires will not have a catenary in the anchor wire scope and, therefore, lose a high percentage of their bollard pull.

Accordingly, Port Dolphin proposes to utilize a “live boat” method to install the pipeline through the 3,000-foot section of the route between stations 1,450+00 and 1,480+00. On approaching this section, the barge would deploy only the two stern anchors and two bow anchors. This anchor deployment would require two anchor handling tugs, one on the bow and one on the stern. Two additional tugs would be secured or “hipped” to the barge to control the port-starboard lateral displacement. A fifth tug would be on site to assist in any unforeseen movement of the barge. Due to the constraints described above, plowing is not foreseen to be feasible through this section.

External Pipeline Protection – Concrete Mattresses

In order to provide equivalent protection and stabilization in areas where burial is not achieved, it is planned to use concrete mattress placement.

The final burial survey will identify any zones where full burial has not been achieved. In such zones, an alternative protection technology would be installed. The primary technique planned is the placement of flexible concrete mattresses. These concrete mattresses will be selected to conform to applicable regulatory requirements and designed to provide an equivalent level of stabilization and protection of the pipeline.

Figure 4-9
Concrete Mattress on Deployment Frame

The concrete mattresses would be installed from a specialist diving support or construction barge that will be moored in position with an anchoring system similar to that of the burial barge. The mattresses will be lifted and located on top of the pipeline using the barge crane and a special deployment frame (**Figure 4-9**). Divers or a robotic submersible vehicle would assist with the final positioning and attachment of the mattresses to the pipeline.

A typical example of a proprietary concrete mattress product widely used for protection of large-diameter pipelines in the Gulf of Mexico is 20 feet wide, 8 feet long, and 9 inches thick. It weighs 10,500 pounds in air (6,000 pounds submerged). Such mattresses are normally laid together to provide continuous protective cover over the pipeline.

Port Manatee HDD Shore Approach

The HDD operation on the *Port Dolphin* shore approach would involve drilling from onshore to offshore, ultimately pulling the carrier pipe into the drill bore from the offshore exit site. Employing HDD for the bay to shore transition at Port Manatee offers three distinct advantages over an "open trench" approach, such as:

1) It is not environmentally intrusive, as the entry and exit construction sites are temporary in nature and will be restored to pre-construction condition;
2) It offers excellent protection for the pipeline from mechanical and/or storm damage; and
3) It avoids active industrial areas present on the shore approach.

A drill rig would be positioned at the entry site station 2219+56.82, which would be located inside the Port Manatee industrial complex. The exit point would be 3,573 feet away, bearing northwest into Tampa Bay at station 2183+84.35, located in a water depth of 7 feet mean low low water (MLLW). The apex of the drill bore curve would be 120 feet below MLLW.

The drilling operation consists of progressively larger drill strings to be inserted into the hole, ultimately producing a drill bore 48-inches in diameter. As the drilling operation is underway, a jack-up barge would be positioned offshore at the exit station to excavate an "exit" hole. This excavation would be accomplished by either the use of a long-boom backhoe or bucket dredging (refer to description of trenching method to be utilized under the Sunshine Skyway Bridge).

Simultaneously, or even in advance of onshore drilling at Port Manatee, the 36-inch carrier pipe would be constructed onshore in close proximity to the entry point. The carrier pipe would be constructed in several long sections to be welded together once the pull is started.

Once the exit pit is constructed, a jack-up barge would be positioned near the pit for the pulling operation. The drilling commences at shore and proceeds until the drill string is punched through at the exit pit. The exit angle would be between 3 and 10 degrees. The definitive exit angle would be determined during detailed design engineering.

A shallow water diving operation would connect the drill string to the pulling winch on the jack-up barge. The pull wire is retrieved to the entry point, the sections of pipe are positioned in alignment with the entry hole, and the pipeline is pulled offshore to the exit point. At this point, the HDD operation is complete.

East and West HDD Crossings of the Gulfstream Pipeline

In order to avoid construction activity in the Aquatic Preserve, the *Port Dolphin* pipeline route would now follow a northerly direction after passing through Passage Key. This new route would require crossing the existing Gulfstream pipeline in two locations.

The first crossing would be east of the causeway in a water depth of 21 feet. This crossing would be 2,950 feet in length. The second crossing would be west of the causeway, also in a water depth of 21 feet. This crossing would be 1,335 feet in length. Other than the difference in total length (due to a difference in crossing angles), the crossing construction requirements are the same for each crossing.

The results of an acoustic bathymetric survey conducted in October 2007 by Port Dolphin, confirm that the Gulfstream pipeline, as located in the Tampa Bay complex, is below or at minimum flush with the natural bottom. For all practical purposes, the water-to-water HDD crossings would be identical to the water-to-land HDD, as would be conducted for the final approach into Port Manatee, with two basic exceptions:

- The crossing would require two jack-up barges in the 200-class range; and
- The depth of the drill below the Gulfstream pipeline would be approximately 20 feet.

For construction continuity and economy, the two crossings can be drilled while other segments of the pipeline are under construction. To achieve this, the two pull-in strings (or carrier pipes) are constructed by the lay barge and wet-stored on the seafloor. Both strings would be wet-stored on the north side of the pipeline route, as the pull-in would be from the south side. The strings would not be concrete-coated, but would be flooded with filtered and treated seawater. Flooding is required in order to provide stability on the seafloor. The south end of the west string will be wet-stored approximately 650 feet north of the Gulfstream pipeline within the surveyed corridor. The south end of the east string will be wet-stored approximately 1,500 feet east of the Gulfstream pipeline within the surveyed corridor. Each string would be hydrostatically-tested after installation on the seafloor, prior to tie-in.

The two jack-up barges work in unison during the drilling operation. A teardrop-shaped exit pit would be excavated on both ends of each crossing, using either the backhoe or bucket dredge methods described previously. The spoil from the pit(s) would be side-cast and reused later for backfill after the HDD string is tied in to the pipeline. The exit pits are constructed as an elevation transition to facilitate the pull-in of the string and the final tie-in to the pipeline. The fluids and muds (i.e., water and Super Gel-X® or equivalent) utilized are environmentally benign and pose no danger to the environment if lost and not recovered. The exit pits are not constructed or intended for containment and recovery of drilling fluids or muds. All drilling fluids and muds would be collected and recycled during the HDD operation.

Upon completion of the drilling operation, the carrier pipe stored on the seafloor is dewatered by a pigging operation. The water, which has been treated with an environmentally benign corrosion inhibitor (i.e., HydroHib P or equivalent), would be discharged subsea into the bay.

The dewatered carrier pipe is pulled in the drill shaft utilizing the drill string pipe. Upon completion of the pull-in, the ends of the carrier would be raised to the surface by each of the jack-up barges. On one end, the pulling head would be removed and the end fitted with a temporary pig launcher. The other end would be prepped and fitted with a pig receiver. Both ends would be prepped with swivel flanges mated to the pig launcher and pig receiver assemblies. The string would again be flooded with filtered and treated seawater while awaiting tie-in to the main pipeline.

Piggable Y Installation

The piggable Y is a pre-fabricated construction spool that would connect the two buoy flowlines to the gas transmission pipeline running to Port Manatee.

Upon arrival at the target box, the pipeline would be laid down on the seabed with a welded flange and lay-down head/pig launcher. The pig launcher is required, as the line must be flooded prior to connecting the Y to the gas transmission pipeline.

At this point the lay barge installs a "dead man" pile (suction or driven) or anchor for each of the north and south flowlines and lays away from each dead man to construct the two flowline segments off the respective Y tangent. Concrete mattress placement would be used to protect the piggable Y.

Tie-Ins

A tie-in basically is a section of pipe that has been constructed to "tie" the pipeline together. Tieing in the pipeline is a mechanical operation accomplished with specially designed connectors. It is a manned diving operation and does not require underwater welding. Depending on the construction progress, there may be two or more diving tie-in operations going on at the same time. Subsea tie-in operations are commonly practiced in the pipeline industry.

There are 11 locations where tie-in operations would be required:

1) Port Manatee HDD exit;
2) East HDD crossing (East);
3) East HDD crossing (West);

4) Sunshine Skyway Bridge (East);
5) West HDD crossing (North);
6) West HDD crossing (South);
7) Piggable Y (East);
8) Piggable Y (North);
9) Piggable Y (South);
10) North PLEM; and
11) South PLEM.

Under tie-in scenarios, pipeline protection adjacent to the HDD exits will consist of external protection using either the exit pit spoil to backfill, or concrete mattress placement.

Pipeline Hydrostatic Testing
Hydrostatic testing is conducted after the entire pipeline has been constructed and either buried or mechanically protected. The two PLEMs would not yet be connected, and the north and south flowlines would be connected to pig receivers. At this point, the pipeline would be flooded with filtered, treated seawater totaling approximately 12 million gallons.

From the beach side, a gauging pig train is launched to prove that the pipeline does not have any mechanical damage (buckles). This pig run will discharge the 12 million gallons of seawater from within the pipeline. The water, which has been filtered and treated with an environmentally benign corrosion inhibitor (i.e., HydroHib P or equivalent), would be discharged subsea offshore.

The gauging pig train is pushed with 12 million gallons of filtered (untreated) seawater, so the pipeline is again in a flooded condition. This seawater is supplied via a seawater intake located in Port Manatee. The pig receivers are removed, and the two flowlines are fitted with high-pressure blind flanges. On the beach side, high-pressure compressors are connected to the pipeline. The pipeline is pressurized to 2,200 psi and held for 24 hours. Once the hydrostatic test is complete, the blind flanges are removed from the flowlines and the PLEMs connected to the flowlines. The PLEMs are connected with temporary pig launchers.

At this point, successive dewatering and drying (using dry air) pig trains would be run from onshore to offshore. The water received offshore would not be treated with any chemicals and would be discharged subsea at the PLEM locations. Upon reaching a dew point of -40 degrees, the pipeline would be tested, certified, commissioned, and ready for service.

Subject to successful gauging and hydrotest runs, the pipeline will have been filled and flushed a total of two times, with an approximate total of 24 million gallons of filtered seawater (half of which is also treated with corrosion inhibitor).

PLEMs Installation
After each flowline is laid, the lay barge will deploy each PLEM overboard to a predetermined target box for connection/tie-in by subsea diving operations after the flowline is hydrotested.

The PLEMs will be constructed with "mud mats" to ensure horizontal alignment with the flowlines and maximum stability on the seafloor.

Out-of-Service Cable Crossings
For any out-of-service cable crossings encountered, the cable is located, excavated and cut subsea by divers. Each end is then pulled perpendicular to the route, clear of the pipeline construction corridor.

4.1.2.2 Optional Methods

Below are descriptions of optional construction methods that are not part of Port Dolphin's base case construction plan, but could still be considered during future discussions with permitting agencies (i.e., FDEP, USACE, etc.).

Pipeline Lowering – Jetting
In the jetting approach, the pipeline is lowered by the passage of a towed sled fitted with rows of high-pressure water jets. The jets impinge on the seabed below the pipeline and a "U"-shaped ditch is created by a combination of soil shearing and fluidization. Spoil from the ditch is simultaneously removed and dispersed by a short section of suction dredge pipe, which is mounted to the sled.

Pipeline Installation through Passage Key Inlet – HDD
Another option for installation through the Passage Key inlet is to install a 6,000-foot horizontal directionally-drilled duct through the inlet. As opposed to the Port Manatee approach, this would be a subsea-to-subsea drilling operation. The use of HDD protection along this section requires that external protection in the form of mattresses or rock armoring be applied at both subsea HDD entrance points and continue along the route to a point where burial may continue.

External Pipeline Protection – Rock Armoring
Rock armoring is a common and proven methodology to externally protect pipelines that cannot be buried and backfilled due to extreme soil substrates. A conventional anchor barge is mobilized with hoppers, shakers, and a Tremmie chute, and a natural material, procured locally, is sized to withstand existing ambient current conditions with consideration for storm surge. This material is placed over and around the pipeline through the Tremmie chute from the barge. The operation is monitored by subsurface sonar mounted on the chute. Once the operation is complete, an as-built survey is conducted with side-scan or multi-beam sonar to ensure the engineered cover has been achieved.

4.1.3 Construction Sequence

In general, the *Port Dolphin* pipeline would be constructed in an onshore to offshore direction through a number of construction phases and critical path activities. The construction phases may be conducted concurrently, or in several cases, in parallel. Once mobilized, the construction activity would be 24 hours per day, 7 days per week, including nationally recognized holidays.

The pipeline would be laid in a dry condition. During all tie-in operations (11), the pipeline would be in a flooded condition. Whenever the pipeline or a section of it is to be flooded, it would be flooded with filtered seawater and treated with an environmentally benign water treatment (with the exception of the hydrotest, for which the water would be filtered but not treated).

The major phases and activities that would occur are listed below:

- Mobilization – The majority of the construction assets and support vessels would be mobilized from bases in Louisiana or Texas. The mobilization would be staggered, as the travel times to Tampa Bay location would be different for each asset;
- Port Manatee HDD – As this is an onshore to offshore drill, with an onshore to offshore pull, this phase requires only the support of one 200-class jack-up barge;
- HDD Carrier Pipe – The carrier pipe for both the east and west crossings would be constructed by the primary lay barge and wet-stored in a flooded condition;
- Sunshine Skyway Bridge Dredging – The trench under the causeway would be dredged using the clamshell or bucket-dredge barge;
- Port Manatee HDD Tie-In – Upon completion of the Port Manatee HDD, the shallow water lay barge would initiate pipelay from a “dead man” anchor, laying out to a water depth of approximately 15 feet;
- East and West HDD Crossings – Both crossings would be drilled simultaneously with the support of two jack-up barges per HDD location;
- Sunshine Skyway Bridge Pipe String – Once the causeway dredging is complete, the causeway pipe string is constructed and pulled through the causeway section (into the pre-dredged trench) using the primary lay barge and the shallow water lay barge (pull-in);
- Pipeline Segments – Upon completion of the east and west HDD drilling, the pipelay segments are sequentially installed with the shallow water and primary lay barges from the Port Manatee tie-in to the west crossing. At this point, the four drilling support jack-up barges are demobilized;
- Pipe Lay – Following installation of the sections between the crossings, the primary lay barge picks up the pipeline south of the west crossing and commences lay through Passage Key and towards the piggable Y;
- Diving Operations – During the deepwater pipelay operation, diving operations commence to complete the tie-ins at the three HDD sites and the Sunshine Skyway Bridge, and the shallow water barge is demobilized;
- Pipe Lay – Pipe installation proceeds to the lay down at the piggable Y location, and continues to lay the north and south flowlines on the seafloor;
- Y tie-in – At this point, divers tie-in the two flowlines and the main line to the piggable Y, and three of the four diving spreads are demobilized;
- Burial Operations – Upon completion of all tie-in operations, burial and backfill operations would commence, including plowing or placement of concrete mattresses for the sections to be externally armored (where necessary). The primary lay barge is reconfigured to support

burial operations, and the remaining diver support barge is employed in the mattressing operations. Following completion of the burial operations, the primary lay barge is demobilized;

- Gauging and Testing – Upon completion of the burial operations, the physical integrity of the pipeline is proven with a gauging pig train. Upon completion of the gauging pig run, the line is hydrostatically tested. Gauging and testing are done prior to installation of the PLEMs;
- North and South PLEMs – Upon completion of the hydrostatic test, the two PLEMs are installed and equipped with pig receivers;
- Drying – Dry the pipeline to -40 degree dew point with air. The drying pig runs would be from onshore to offshore;
- As Built – As the final testing and commissioning is ongoing, the final as-built survey would be conducted; and
- Demobilization – All remaining assets are demobilized.

4.1.4 Identification of Construction Methods by Segments

It should be noted that under any installation scenario contemplated, the installation of the *Port Dolphin* pipeline and associated infrastructure would be conducted in compliance with all local, state and federal regulations, including those governing safety, environmental, and socioeconomic considerations.

The offshore section of *Port Dolphin's* gas transmission pipeline would be fully protected and stabilized throughout its entire length in accordance with all applicable regulatory requirements. Where possible, the burial technique would be used. The pipeline would be lowered into a ditch with its top at a target depth of 3 feet below seabed level and then backfilled.

In certain areas of the offshore pipeline route, full burial would likely not be achievable because the geophysical survey data have indicated localized occurrences of hard bottom conditions that could be impenetrable with a plow. In order to provide equivalent protection and stabilization in areas where burial is not achieved, it is planned to use proven external protection techniques such as concrete mattress placement.

Table 4.1 presents a detailed identification of construction methods applicable to segments of *Port Dolphin's* offshore gas transmission pipeline. In addition, the offshore pipeline alignment sheets presented in **Drawings 26017-D-2001** through **26017-D-2021** (**Attachment A.3**) include a graphic representation of these construction methods by segments.

Table 4-1
Identification of Base Case Construction Methods by Offshore Pipeline Segments(1)

Foot Post		Station Number		Construction Method	Buried (feet)	External Protection (2) (feet)
From	To	Start	End			
N PLEM	10462	N PLEM	104 +62	Pipelay	0	10,462
S PLEM	4000	S PLEM	40 +00	Pipelay	0	4,000
4000	9500	40 +00	95 +00	Plow Burial	5,500	0
9500	10985	95 +00	109 +85(3)	Pipelay	0	1,485
0	1000	0 +00	10 +00	Pipelay	0	1,000
1000	9000	10 +00	90 +00	Plow Burial	8,000	0
9000	13000	90 +00	130 +00	Pipelay	0	4,000
13000	15000	130 +00	150 +00	Plow Burial	2,000	0
15000	28500	150 +00	285 +00	Pipelay	0	13,500
28500	31000	285 +00	310 +00	Plow Burial	2,500	0
31000	33000	310 +00	330 +00	Pipelay	0	2,000
33000	36000	330 +00	360 +00	Plow Burial	3,000	
36000	41000	360 +00	410 +00	Pipelay	0	5,000
41000	42500	410 +00	425 +00	Plow Burial	1,500	0
42500	58500	425 +00	585 +00	Pipelay	0	16,000
58500	60500	585 +00	605 +00	Plow Burial	2,000	0
60500	71250	605 +00	712 +50	Pipelay	0	10,750
71250	73750	712 +50	737 +50	Plow Burial	2,500	0
73750	109250	737 +50	1092 +50	Pipelay	0	35,500
109250	111000	1092 +50	1110 +00	Plow Burial	1,750	0
111000	111250	1110 +00	1112 +50	Pipelay	0	250
111250	113750	1112 +50	1137 +50	Plow Burial	2,500	0
113750	116500	1137 +50	1165 +00	Pipelay	0	2,750
116500	145000	1165 +00	1450 +00	Plow Burial	28,500	0
145000	148000	1450 +00	1480 +00	Pipelay	0	3,000(4)
148000	152500	1480 +00	1525 +00	Plow Burial	4,500	0
152500	153500	1525 +00	1535 +00	Pipelay	0	1,000
153500	158374	1535 +00	1583 +74(5)	Plow Burial	4,874	0
158374	163886	1583+74(5)	1638+86	Plow Burial	5,512	0
163886	164886	1638 +86	1648 +86	Pipelay	0	1,000
164886	166221	1648 +86	1662 +21	West HDD Crossing	1,335	0
166221	167221	1662 +21	1672 +21	Pipelay	0	1,000
167221	190062	1672 +21	1900 +62	Plow Burial	22,841	0
190062	191062	1900 +62	1910 +62	Trench, Pipelay & Burial(6)	0	1,000
191062	197098	1910 +62	1970 +98	Plow Burial	6,036	0
197098	198098	1970 +98	1980 +98	Pipelay	0	1,000
198098	201045	1980 +98	2010 +45	East HDD Crossing	2,947	0
201045	202045	2010 +45	2020 +45	Pipelay	0	1,000
202045	214000	2020 +45	2140 +00	Plow Burial	11,955	0
214000	218384	2140 +00	2183 +84	Shallow Pipelay(7)	0	4,384
218384	221957	2183 +84	2219 +57	HDD Shore Approach	3,573	0
				Total (feet)	123,383	120,081
				Total (percentage)	50.68%	49.32%

(1) Base case construction methods have been selected based on best available data (geophysical surveys data) and are subject to adjustment pending on results of the geotechnical survey and detailed engineering.
(2) Concrete mattresses is the base case method for external protection.
(3) Station No. 109+85 corresponds to the piggable Y location.
(4) Protection of the pipeline through the high-current section of Passage Key will be accomplished by external protection (concrete mattresses).
(5) Station No. 1583+74 corresponds to the beginning of the nearshore pipeline route modification.
(6) Sunshine Skyway Bridge section.
(7) Pipelay to be performed by shallow water lay barge.

Port Dolphin is currently finalizing a geotechnical survey workplan, based on results of the geophysical investigation completed for the nearshore portion of the Revised Preferred Route. This geotechnical workplan will be utilized to prepare an Environmental Resource Permit (ERP) application, which Port Dolphin anticipates it will file with FDEP in January 2008. Based on conversations with FDEP, Port Dolphin anticipates receiving the ERP to begin the geotechnical survey field work in March 2008. Port Dolphin expects to have a final geotechnical survey report available by July-August 2008.

The Deepwater Port Act and its regulations state that a deepwater port license for a proposed project requires the approval of the adjacent coastal State's governor, 33 U.S.C. § 1508(b)(1), and that an applicant must prepare and submit applications to State agencies requiring permits. 33 C.F.R § 148.700(b). In order to facilitate the State review of this project, Port Dolphin is planning to file a project-wide ERP application with FDEP after the National Environmental Policy Act (NEPA) Draft Environmental Impact Statement (DEIS) has been issued. Once complete, the geotechnical survey report would be filed with the USCG, FDEP, and USACE. The information contained in the geotechnical survey report would allow FDEP to complete an administrative review of Port Dolphin's project-wide ERP application concurrently with the Coastal Zone Management consistency review of the NEPA Final Environmental Impact Statement (FEIS) being prepared for this project. Port Dolphin expects these reviews would provide FDEP with all elements necessary for providing a recommendation to the Florida Governor.

Port Dolphin would review the results of the geotechnical survey and incorporate any necessary construction plan adjustments in consultation with FDEP and the USACE during the ERP and Section 10/404 permit proceedings.

4.2 STL Buoy Installation

This section describes the proposed offshore construction assets and plan for *Port Dolphin's* STL unloading buoys.

4.2.1 Description of Buoy Installation Assets

The STL buoy would be installed using vessels and equipment (i.e., tugboat and barge) similar to those used for the pipeline. In addition to this equipment, the STL buoy installation would require a vessel capable of driving the anchor piles into the seafloor, as well as a crane vessel.

4.2.2 Buoy Installation Methods

4.2.2.1 Anchor Pile Installation

A pile guide frame will be required to keep the pile stable after the self-penetration. The frame would be equipped with a conductor, allowing the follower to drive the top of the pile all the way to the seabed. A steel ring would be welded to the pile. When the pile is driven far enough to reach a stable depth, this ring engages a latching mechanism on the conductor such that the conductor opens and is forced apart by gravity, allowing the padeye and chain to pass the open frame.

No hydraulics are necessary. The only equipment on the frame would include transponders for positioning and orientation purposes. A guiding system between the pile and the guide frame conductor would automatically ensure that the pile has correct orientation within the frame.

When the pile is driven to the correct depth, the frame is lifted to the next pile location. The lifting force itself would close the conductor, and the frame would be ready to receive a new pile without having to be brought to the surface.

Once the pile is driven to the correct depth, the chain segment and lower wire segment would be attached and laid out in a predefined corridor. These lines would then be temporarily abandoned for later retrieval and connection to the STL buoy and upper wire segments.

4.2.2.2 STL Buoy Installation

The STL buoy would be staged onshore with all upper wire segments connected. A tug(s) would be mobilized to tow the STL buoy mounted on a barge. If necessary, the pre-installed upper wire segments may be hung off on separate barges. A crane vessel would be mobilized in the field for hook-up of the STL buoy to the pre-installed mooring lines. The crane vessel would be equipped with a connection frame on the vessel side and a subsea connection frame. Such a frame comprises wire routing arrangement and socket lock off devices with hydraulic position adjustments.

The first four mooring lines would be attached to the STL buoy prior to lowering to the seafloor (landing pad). This attachment consists of connecting the upper wire segment to the lower wire segment. Next, the STL buoy is lowered to the seafloor using the crane. The last four mooring lines are then connected.

4.2.2.3 Riser and Umbilical Installation

When all mooring lines are connected and the STL buoy is standing on the seafloor in idle position, the riser and umbilical installation takes place. The riser and umbilical would be installed from the installation vessel (i.e., barge with roller or chute).

The riser end would be lowered to the seabed by a winch wire routed over the roller or chute on the installation vessel. The riser end is located close to the STL buoy, and the final pull-in and connection to the connection pipe is done with diver assistance.

When the riser has been connected to the turret, the laying operation of the riser begins. The buoyancy elements would be attached at the deck of the installation vessel during the laying operation. The riser end is lowered to the seabed by a winch wire routed over the roller or chute. The riser end is located close to the PLEM and the final pull-in and connection to the PLEM subsea connector is done with remotely operated vehicle (ROV) assistance.

The umbilical would be installed with the same procedure. The riser and umbilical would now be connected permanently to the PLEM and the STL buoy. A permanent locking of the riser and umbilical at the buoy end would then take place with assistance from divers. It is intended that the riser would be locked-off with a watertight hang-off mechanism.

4.2.3 Construction Sequence

The offshore pipeline construction sequence would be as follows:

1) The anchor piles would be driven into the seafloor and the chain segment and lower wire segment connected.
2) The STL landing pad and buoy system (with the upper wire sections attached) would be lowered to the seafloor. Once properly located, the upper and lower wire segments would be connected.
3) The riser and umbilical would be installed after the mooring line installation is complete. The riser would first be connected to the buoy and then to the PLEM. The umbilical would be installed using a similar procedure.

(Note: The PLEMs are installed as part of the pipeline installation and are assumed to be in place prior to the installation of the buoys.)

4.3 Onshore Construction Plan

This section describes the proposed onshore construction assets and plan for *Port Dolphin's* gas transmission pipeline and interconnection station.

4.3.1 Identification of Onshore Construction Equipment

4.3.1.1 Standard Construction Equipment

The construction of the onshore segment of the *Port Dolphin* pipeline will utilize standard construction equipment such as backhoes, dump trucks, cranes, and bulldozers. The number and size of this equipment will be based on the detailed construction plan.

4.3.1.2 Special Construction Equipment

A side-boom tractor is a specialized tractor used to lower line pipe into the pipe trench. It is a tracked vehicle with lifting booms and counterweight. Multiple side-boom tractors can be used together to lower segments of pipe into the installation trench.

Drill rigs are specialized machines used to drive and control the drill strings utilized in HDDs. Drill rigs are used to drill the pilot hole and ream it to the desired diameter, and may have to be quite large to accommodate the forces required for large-diameter pipeline projects.

4.3.2 Description of Construction Methods

Installation of the onshore pipeline involves the following construction methods:

1) Open trench;
2) Joint-by-joint stalking (across Port Manatee);
3) HDDs;
4) Slick bore;
5) Dry jack and bore; and
6) Hydrostatic testing.

Each of these construction methods involves different logistical considerations, specific construction equipment, work space requirements, and special operations in order to install the pipeline. All of these methods have been used in the pipeline industry for decades and are considered to be the most effective and safe ways to construct an onshore pipeline.

4.3.2.1 Open Trench

Open trench construction first involves clearing the workspace and opening a ditch with a hydraulic excavator. The trench is shored up according to local requirements. Next, a string of line pipe is laid out and the segments are welded together at each joint. Any coatings that are required would be applied at the newly welded joints, and the string of pipe would then be lowered into the open ditch with a side-boom tractor. Once the pipe is properly placed in the ditch, it would be welded to the installed line pipe and covered again with dirt that was excavated while opening the ditch using a track-hoe or a bulldozer.

4.3.2.2 Joint-by-Joint Stalking

Joint-by-joint stalking is essentially the same as open trenching, but the length of the pipe string is reduced due to special construction considerations. For example, a confined area may limit the amount of heavy equipment with access to the ditch and require short strings of pipe to be lowered, connected, and covered.

4.3.2.3 Onshore HDDs

The onshore HDD method is essentially the same as that described in the offshore construction methods. In this case, both ends of the drill would be located onshore. The drill rig and pull-in equipment would be located on either HDD ends. Lubrication such as bentonite muds would be used to facilitate pipe installation.

4.3.2.4 Slick Bore

The slick bore method of construction is used for road and other short distance crossings. This method can require excavation of pits at either end of the proposed slick bore. Once excavated, a length of bore pipe is installed by boring a horizontal hole under a highway or railroad track and pushing the bore pipe into the bored hole one joint at a time. The product pipe is welded to the bore pipe, and the bore pipe is pulled through the hole. As the bore pipe is pulled through the hole, the carrier pipe is pulled into place. Lubrication such as bentonite muds can be used to facilitate pipe installation.

4.3.2.5 Dry Jack and Bore

Boring and jacking, or pipe jacking, is a method that utilizes a horizontal jack to install pipe in a single pass. A hydraulic jack pushes the pipe segment by segment through the soil from a jacking pit to a receiving pit. Soil is excavated mechanically or manually at the pipe's leading edge. Pipe jacking is normally used for relatively short tunneling installations because friction resistance increases with length and only very gentle curves can be negotiated. It is preferred in areas where there are concerns about formation of voids around the installed pipe.

4.3.2.6 Onshore Hydrostatic Testing and Commissioning

Onshore pipeline commissioning would occur in two distinct phases. First, the onshore segment located on Port Manatee property would be filled, gauged, and hydrostatically tested. Next, this segment would be tied into the remainder of the onshore pipeline, which would then be filled, gauged, and hydrostatically tested. The hydrostatic test water used for the Port Manatee segment would be retained and used in subsequent test phases. Once testing is complete, the entire segment would be drained and the pipeline would be dried.

Hydrostatic Testing within Port Manatee

The segment of pipeline that crosses Port Manatee would be separately gauged and hydrostatically tested prior to performing these functions on the entire onshore segment. This would occur prior to tie-in of this segment with the remainder of the onshore pipe. This segment of pipeline has been designed to meet Class III location requirements and, as such, the test pressure of this segment would be 2,625 per square inch gauge (psig). Overall onshore gauging operations are described below. For the pipeline segment within Port Manatee, this operation would require that the pig receiver be located at the end of this segment rather than at the interconnection station. Once these operations are complete, the receiver would be relocated for further testing.

Filling and Gauging

The onshore pipeline would be fitted with a pig launcher at the point where the onshore tie-in to the shore landing HDD is located in Port Manatee. The pig receiver would be located at the interconnection station. The appropriate monitoring and control equipment would be installed on the pipeline to allow for safe operation during this phase of construction. The filling and gauging operation will use fresh water from Port Manatee's fresh water supply.

The gauging pig would be launched from Port Manatee and propelled through the pipeline to the receiver at the interconnection station. Fresh water would be used to propel the pig through the pipe. The pipeline would be pressurized to 500 psig for this operation. After completing the gauging run, the pig would be inspected for damage. If damage exists, subsequent gauging runs would be performed until all debris has been removed.

Hydrostatic Testing
Once the gauging operation is complete, the pig launcher and receiver would be removed and appropriate test flanges and associated monitoring and control equipment would be installed. The pipeline would be pressurized incrementally in order to ensure integrity at each pressure level. At each pressure level, it would be held for a period of time (e.g., 30 minutes) to ensure that no leaks exist. At the maximum test pressure of 2,200, psig the pressure would be held for 8 hours.

Dewatering
After completion of the hydrostatic test, the test flange at the Port Manatee location would be removed and replaced with a pig launcher. The test flange at the receiving station would be removed and replaced with a pig receiver. A dewatering pig would be run through the pipeline, forcing the water out of the pipeline. This water would be filtered through appropriate media (e.g., hay bale) to remove any suspended solids that may be flushed from the pipeline. The water discharge would comply with all permit requirements.

Once the dewatering pig has been received, the pig receiver would be removed and a flange would be installed with a needle valve to be used in the purging operations. The pipeline would be purged and dried to a dew point of -40 °F.

4.3.3 Construction Sequence

The general construction sequence envisioned by Port Dolphin for the onshore pipeline is as follows:

1) Clearing, grubbing, and grading of entire pipeline route;
2) Installation of all HDDs, slick bores, and dry bores;
3) Unloading and stringing of line pipe;
4) Ditching;
5) Laying/welding pipeline;
6) Lowering welded pipe in ditch;
7) Making tie-ins;
8) Installing cathodic protection test sites;
9) Backfilling ditch;
10) Filling, hydrostatic testing, and dewatering of pipeline;

11) Cleaning and drying of pipeline;
12) Installation of pipeline markers and signs; and
13) Cleanup and restoration of work areas.

Port Dolphin plans to install the HDD, slick bores, and dry jack bore prior to initiating installation via open trench methods. The HDD would be installed first followed by the dry jack and bore across the CSX Railroad. The slick bore installations would be performed next in the following order: US 41, Oneil Road, Buckeye Road, and Reeder Road. The installation of the remainder of the pipe would be initiated in parallel, starting at (1) the HDD shore approach and (2) the corner where the pipeline turns south to run parallel to the CSX Railroad at the eastern limit of Port Manatee property.

4.3.3.1 Water Handling during Pipeline Construction within Port Manatee (Conceptual Plan)

Installation of the *Port Dolphin* pipeline across Port Manatee requires placement of the pipeline in the existing southern conveyance ditch located to the south of South Dock Street (see **Section 4.3.4.1**). This ditch is tidally influenced from Tampa Bay and has a hydraulic connection to the adjacent mangroves, and also is used to transport stormwater runoff from Port Manatee. There can be no long-term impacts to water flow to the mangroves, and Port Dolphin is committed to providing a practical alternative for maintaining the ditch's stormwater transport function during pipeline construction, as well as to conducting an extensive hydrological study prior to construction for detailing this conceptual water management/handling plan.

The open trench construction along the south conveyance ditch would be approximately 3,600 feet long, beginning about 1,400 feet east of Tampa Bay open water. The pipeline would be placed 7 feet beneath the invert of the ditch. A mangrove area is connected to this ditch within this 3,600-foot reach. The west and east edge of the wetland are approximately 900 feet and 1,950 feet east of the beginning of the open trench segment, respectively. The existing connection between the ditch and mangroves is a swale system at the west and east ends of the mangroves. This connection would not be maintained throughout the 2- to 4-week construction period, and once construction is complete in this area the tidal connection would be restored. The construction work would be conducted during the non-rainy season, i.e., between November and May.

The construction work within the Port property would be performed in three segments:

1) South conveyance ditch between open water bay and the west edge of the mangroves;
2) South conveyance ditch between the west edge of the mangroves and Reeder Road; and
3) Open trench construction east of Reeder Road.

Work on South Conveyance Ditch to West Edge of Mangroves
Pipeline construction work would generally proceed as follows as pertains to managing water along this open trench segment of the pipeline:

1) Shut off flap gate to stop tidal flow;
2) Construct diversion channel to the south along west edge of mangroves and block off existing ditch at east edge of the east bridge. Stormwater runoff from the watershed during this construction period would be diverted south along the west edge of the mangrove area;
3) Dewater the working section of ditch;
4) Excavate for installing pipeline;
5) Install pipeline;
6) Backfill section to proposed ditch bottom elevation and prepare design ditch flow section;
7) Sod banks; and
8) Open flap gate and remove block in ditch at the east bridge.

As currently envisioned, the existing box culverts at the east bridge would be removed and a new open water span bridge would be constructed in its place after the pipeline was installed. Port Dolphin acticipates that the ditch would not supply tidal waters to the mangroves during the 2- to 4-week construction period for this pipeline segment.

Work on Conveyance Ditch from East Bridge (West Edge of Mangroves) to Reeder Road
Construction work would generally proceed as follows as pertains to managing water along this open trench segment of the pipeline:

1) Set up pump and pipeline along north side of South Dock Street;
2) Block off tidal ditch from the east bridge to Reeder Road;
3) Pump runoff to tidal ditch downstream of the east bridge. If necessary, intermittently backup runoff to swales and stormwater pond along north side of Reeder Road, including the stormwater pond northeast of the intersection, before pump system can lower the water levels in these areas;
4) Dewater tidal ditch;
5) Excavate for installing pipeline;
6) Install pipeline;
7) Backfill section to proposed ditch bottom elevation and prepare design ditch flow section;
8) Sod banks of ditch flow section; and
9) Remove ditch block and block diversion channel.

Work on Ditch East of Reeder Road
Construction work would generally proceed as follows as pertains to managing water along this open trench segment of the pipeline:

1) Set up pump and pipeline along north side of South Dock Street;
2) Block off ditch from Reeder Road to railroad track;

3) Pump runoff to ditch downstream of Reeder Road. Backup runoff to swales and stormwater pond along north side of South Dock Street into stormwater pond northeast of the Reeder Road/South Dock Street intersection as necessary;
4) Dewater ditch;
5) Excavate for installing pipeline;
6) Install pipeline;
7) Backfill section to proposed ditch bottom elevation and prepare design ditch flow section;
8) Sod banks of ditch flow section; and
9) Remove ditch blocks.

Perform Possible Future Maintenance Work on Pipeline

Any future maintenance work that requires excavation to the pipeline will generally proceed as follows as pertains to managing water:

1) Set up pump and pipeline for diverting stormwater runoff around the excavation section;
2) Block off section of pipe for maintenance;
3) Pump runoff around blocked off pipe section as necessary;
4) Dewater ditch section;
5) Perform maintenance;
6) Restore site to original conditions; and
7) Remove ditch blocks.

4.3.4 Description of Construction Methods by Segment

This section covers the onshore portion of the *Port Dolphin* pipeline, located in Manatee County, Florida. The onshore portion of the *Port Dolphin* pipeline has been reduced from 5.57 miles to 3.88 miles, a reduction of approximately 30.3%. **Table 4-2** identifies the construction methods that Port Dolphin proposes to use along all onshore pipeline route segments.

Table 4-2
Onshore Pipeline Construction Methods by Segment

Location	Construction Method
Revised Route through Port Manatee	
Conveyance Ditch in Port Manatee	Open Trench & Joint-by-Joint Stalking
Reeder Road Crossing	Slick Bore (Uncased)
Revised Route from Port Manatee to Interconnection Station	
South Across FPL Property	Open Trench
Across FPL Tank Farm	HDD
South Across JJC-Port Manatee and FPL Properties	Open Trench
CSX Railroad Crossing	Uncased Dry Jack & Bore
East Across FPL Property (West of US 41)	Open Trench
US 41 Crossing	Slick Bore (Uncased)
East Across FPL Property (East of US 41)	Open Trench
North Across FPL Property (East of US 41)	Open Trench
East Across Buckeye Industrial Property	Open Trench
Bud Rhoden Road Crossing	Open Trench

Location	Construction Method
East Across Tami Sola Property	Open Trench
Oneil Road Crossing	Slick Bore (Uncased)
North Across Gene Citrus Property	Open Trench
Buckeye Road Crossing	Slick Bore (Uncased)

Figures 3-3 to **3-10** present the onshore pipeline route along with the corresponding construction corridor and extra work spaces.

Port Dolphin will conduct a comprehensive site survey of this proposed route prior to detailed design and construction. In addition, Port Dolphin will continue coordinating with property and facility owners during development of the detailed engineering design.

4.3.4.1 Revised Route Through Port Manatee

This onshore pipeline route segment has been developed in consultation with Port Manatee managers. The segment of the onshore portion of the project across Port Manatee requires unique technical solutions due to installation in the south conveyance ditch and ongoing Port operations in the area in which the work is to be executed. Port Dolphin remains committed to continue working closely with Port Manatee for coordinating development of detailed pipeline engineering and executing construction in compliance with Port Manatee's applicable security, safety, and environmental policies, procedures, and rules.

South Conveyance Ditch to West Edge of Mangroves
The first special construction consideration concerns the area near the HDD entry point on Port property. The area where the HDD would tie-in to the onshore pipeline is sufficient for construction of the pipeline, however, the preparation phase prior to pipeline construction would require some special consideration due to a large communication range tower located in the construction area. Port Dolphin proposes to protect the integrity of this tower by installing interlocking sheet piling driven into the ground to ensure that the tower's foundation is not disturbed during excavation around it. Once the pipeline has been installed and backfilled in this area and the ditch banks have been compacted and stabilized, the sheet piling would be removed.

Three 345-type Caterpillar track-hoes and three 345-type Caterpillar long stick hoes would be used to perform the excavations from the range tower location east approximately 1,100 feet to a point north of the west edge of the mangrove wetland. The actual work area along the south conveyance ditch is not large enough to handle the amount of excavated spoils that needs to be stockpiled while still allowing for the pipe to be strung and welded and for movement of the construction equipment. Therefore, six large T-Rex style dump trucks must be used to remove the excavated dirt so that it can be relocated and stored in a designated location near the construction site during excavation. Once the pipe is installed, the dirt would be returned to the site by the same trucks and used as backfill. One front end loader would be used to load the trucks from the temporary storage site. A D-7 bulldozer and one 345 Caterpillar long stick hoe would be used to backfill the trench. Due to the probability of groundwater entering the pipeline trench, it is planned that there would be no more than 600 feet of ditch opened up on any given day to allow enough time each day to fully complete 600 feet of newly laid pipeline and completely back fill the ditch.

Port Dolphin proposes to install the pipeline under existing power and communication cables located in this area by either temporarily diverting them or carefully securing them in their existing locations while the pipeline is being installed.

The south conveyance ditch spans approximately 60 feet (bank to bank), with the actual pipeline centerline located in the center of the ditch itself (i.e., 30 feet from each bank). The distance from the bank to the center of the ditch, combined with the weight of the pipe joints, may require the use of specialized equipment. Port Dolphin has identified two options to install the pipeline in this area: (1) 10 to 12 Caterpillar 594 side-booms (30-feet boom size, or (2) seven 100-ton Mantises style cranes.

In this segment, the pipeline would be installed in three-joint sections. Following the complete welding of each section, including x-rays and coatings, they would be lowered into the ditch using these side-booms and cranes. Limiting the number of pipe sections to three joints at a time is due to the combined weight of the pipe and concrete coating. A dragline would be used for excavation of the ditch under the east bridge. This process would be used in the first segment for about 1,100 feet. Once the diversion channel has been constructed to effectively divert the runoff between the west edge of the mangroves and Reeder Road, construction of the next segment can begin.

Conveyance Ditch from East Bridge (West Edge of Mangroves) to Reeder Road

The next segment of the project entails double matting the work area with wooden mats on the north side of the ditch to allow for the stringing and welding activities. In anticipation of wet weather occurring during construction, the entire area along the ditch on the north side would have to be matted to hold the weight of the equipment and the pipe. The total number of mats required to ensure a productive and safe work environment is estimated to be 2,200. Once construction of the pipeline has been completed, these mats would be removed.

The existing Gulfstream pipeline as well as an existing FPL 30-inch hot oil pipeline cross the conveyance ditch in this segment of the route. The Gulfstream pipeline was installed using the HDD method, so it is much deeper in this area where *Port Dolphin* crosses it; therefore, the *Port Dolphin* pipeline would not have to expose or disturb the Gulfstream pipeline in any way and would be installed above it with an expected separation of approximately 20 feet. The FPL hot oil pipeline is installed under the conveyance ditch with approximately 3 feet of cover. Open trench construction methods would be used to install *Port Dolphin's* pipeline under the FPL pipeline. The FPL pipeline would be exposed, supported, and secured in place while the *Port Dolphin* pipeline is installed under it.

When the pipeline reaches the west side of Reeder Road, Port Dolphin proposes to use an uncased slick bore to cross under the road as well as under existing utilities, stormwater concrete pipes, and an existing TECO 4-inch gas pipeline. This uncased slick bore is designed to begin approximately 250 west of Reeder Road and would be approximately 25 feet deep and approximately 500 feet long. Based on discussions with Port Manatee, Port Dolphin was made aware that the Port would also have constructed a dredge discharge pipe across Reeder Road (but north of South Dock Street) by the time the *Port Dolphin* pipeline is to be constructed. Port Dolphin will continue working closely with Port Manatee and other utility companies to ensure this discharge pipe and other utilities in this area would be crossed safely without interruption of these services.

Once the civil work necessary to divert the stormwater runoff between Reeder Road and the CSX railroad has been completed, construction can begin on the next segment of pipeline.

Conveyance Ditch from East Bridge (West Edge of Mangroves) to Reeder Road
There are no other known utilities or pipelines crossing the conveyance ditch following Reeder Road to the east. Therefore, the pipeline would be constructed using open trenching across this segment of Port Manatee.

The open trench installation process described above would be repeated as the pipeline continues east along the remainder of the route across Port Manatee. Along this segment, the FPL 30-inch hot oil pipeline and the TECO 4-inch gas pipeline are located on the south side of South Dock Street. As planned, the *Port Dolphin* pipeline would be installed parallel to and north of these two pipelines. Port Dolphin will continue working closely with FPL and TECO to ensure their pipelines are not moved or disturbed during the construction period. Timber piles or another appropriate method will be used to stabilize and secure these two pipelines prior to crossing underneath and entering the FPL property.

When the *Port Dolphin* pipeline reaches a point approximately 380 feet west of CSX Railroad, it would turn south onto FPL property.

4.3.4.2 Revised Route from Port Manatee to Interconnection Station

This onshore pipeline route segment has been developed in consultation with key property owners (i.e., FPL, Buckeye Industrial, and the Mock family). The design of this onshore pipeline route segment requires consideration of existing facilities and property development plans. Port Dolphin remains committed to continue working closely with property owners for coordinating development of the detailed pipeline engineering design.

South Across FPL Property
The *Port Dolphin* pipeline would be constructed using the open trench method for approximately 850 feet to a point where the HDD entry point for crossing under the FPL tank farm would be located.

South Across FPL Tank Farm
Port Dolphin proposes to use the HDD method to drill under the FPL tank farm to a depth of 40 feet for a distance of approximately 1,250 feet. The HDD would exit on the south side of the tank farm in JJC-Port Manatee property.

South Across JJC-Port Manatee and FPL Properties
Once past the HDD exit, the *Port Dolphin* pipeline would continue south and be constructed using the open trench method for approximately 1,300 feet before it would turn east and cross the CSX Railroad. Along this approximately 700-foot segment, the *Port Dolphin* pipeline would be installed east of and parallel to an existing FPL 16-inch hot oil pipeline. Special care would be taken to protect the hot oil pipeline, such as using additional fill material and wood mats when working around and over this line.

Crossing of CSX Railroad
Port Dolphin proposes to use the dry jack and bore method to install an uncased crossing under CSX Railroad. This method is an accepted method for crossing railroads. This uncased dry bore is designed to begin approximately 80 feet west of the railroad and would be approximately 15 feet deep and 150 feet long. Once the pipeline cross the railroad, it would continue east onto FPL property.

East Across FPL Property (West of US 41)
After crossing the CSX Railroad, the pipeline would continue east across the FPL property (named "substation 41" parcel by FPL). Port Dolphin proposes to use a conventional open trench method to cross this property until it reaches a point approximately 75 feet west of US 41. In this segment, all of the available 100 feet of work space is located on the north side of FPL's south property line. Due to this restriction, Port Dolphin proposes to modify the conventional method of handling the excavated material by storing it on the northern edge of the temporary work area. This would allow sufficient construction space to safely string, weld, X-ray, coat, and lower the pipeline into the trench. Once the line is placed in the trench, the excavated material would be used to backfill the trench.

US 41 Crossing
The *Port Dolphin* pipeline would cross US 41 at a 90-degree angle. Port Dolphin proposes to use the slick bore method to install an uncased crossing under US 41. This method is an accepted method for crossing roads without a casing. This uncased slick bore is designed to begin approximately 75 feet west of the highway and would be approximately 15 feet deep over a length of 220 feet. After crossing US 41, the pipeline would continue east back onto FPL property.

East Across FPL Property (East of US 41)
The pipeline would continue east onto the FPL property for a distance of approximately 550 feet, where it would reach the south side of an existing borrow pit. In this segment, all of the available 100 feet of work space is also located on the north side of FPL's south property line, and approximately 60% of the temporary work space would encroach into the borrow pit. Due

to this restriction, Port Dolphin proposes to modify the conventional method of handling the excavated material by storing it on the northern edge of the temporary work area.

Port Dolphin proposes to construct a permanent levee approximately 60 feet on the north side of the pipeline, inside the borrow pit and along its entire length (about 600 feet). This would require Port Dolphin to acquire a permit to reduce this borrow pit by approximately 15%, which would allow sufficient construction space to safely string, weld, X-ray, coat, and lower the pipeline into the trench using the southern portion of the work area. Once the line is placed in the trench, the excavated material would be used to backfill the trench.

North Across FPL Property (East of US 41)
After reaching the southeast corner of this existing borrow pit, the pipeline would turn north along the east side of the borrow pit until it reaches the northeast corner of the FPL property. Port Dolphin would also have to construct a levy on the east side of the borrow pit. The reduction of the borrow pit in this area would be limited to only 7%. From the northeast corner of the FPL property, the pipeline turns east onto Buckeye Industrial property.

East Across Buckeye Industrial Property
This 3,350-foot segment of the *Port Dolphin* pipeline would generally follow the same route as that originally filed with the USCG except it is approximately 70 feet further south. Port Dolphin proposes to use an open trench method for construction of the pipeline across the entire length of the Buckeye Industrial property. In order to avoid the migration of the contamination plume currently in this area, Port Dolphin proposes to use a bell hole pump to pump any water that migrates into the pipeline ditch to create a dry environment for pipe lay operations. The water removed will be either pumped into the drainage ditch along the south side of Buckeye Road or pumped into frac tanks for treatment and disposal, as appropriate, in accordance with requirements based on the existing water quality at the time of construction. The available work space for construction of the pipeline across all of Buckeye Industrial property allows for use of adequate work space on both sides of the pipeline centerline.

Bud Rhoden Road Crossing
Once the pipeline reaches Bud Rhoden Road (field gravel), Port Dolphin proposes to open trench across and backfill it with compacted road base material and a final cover of gravel. After crossing Bud Rhoden Road, the pipeline would enter Tami Sola property.

East Across Tami Sola Property
The pipeline would continue east for approximately 4,850 feet across Tami Sola property. Port Dolphin proposes to use an open trench method for construction of the pipeline across the entire length of the Tami Sola property. Some wetland areas on this property would be matted with wooden mats to ensure the construction equipment has a firm and safe working platform. The available work space for construction of the pipeline across all of Tami Sola property allows for use of adequate work space on both sides of the pipeline centerline. Along this segment of the route, the pipeline is routed approximately 130 feet from and parallel to the northern boundary of the existing borrow pit, until it reaches a point approximately 175 feet from Oneil Road. At this

point, the pipeline is routed south approximately 225 feet to travel around a proposed TECO meter station before reaching Oneil Road.

Oneil Road Crossing

The *Port Dolphin* pipeline would cross Oneil Road at approximately a 90-degree angle. Port Dolphin proposes to use the slick bore method to install an uncased crossing under Oneil Road. This method is an accepted method for crossing roads without a casing. This uncased slick bore is designed to begin approximately 160 west of the road and would be approximately15 feet deep and approximately 280 feet long. The existing Gulfstream pipeline is routed southward and is west of Oneil Road in this area. The *Port Dolphin* pipeline would cross Gulfstream at this point with the proposed slick bore. Port Dolphin proposes to install its pipeline with a separation of approximately 10 feet under the Gulfstream pipeline. Once the pipeline has crossed Oneil Road, it would enter Gene Citrus property.

North Across Gene Citrus Property

The pipeline enters Gene Citrus property, turns immediately north across the Gene Citrus facility entrance road, and continues north approximately 230 feet, where it would traverse an FPL power line ROW. Port Dolphin proposes to use the open trench method for construction of the pipeline across the Gene Citrus property. The available work space for construction of the pipeline across the Gene Citrus property allows for use of adequate work space on both sides of the pipeline centerline. Once the pipeline reaches the southern edge of the FPL powerline ROW, Port Dolphin proposes to install another slick bore to cross under the existing FPL power lines and Buckeye Road.

North Across FPL Powerlines and Buckeye Road

The FPL powerline ROW is 170 feet wide. In order to avoid any contact with the existing FPL overhead powerlines, Port Dolphin proposes to cross both the FPL easement and Buckeye Road with a single uncased slick bore crossing. This uncased slick bore is designed to begin approximately 200 feet south of Buckeye Road, and will be approximately 15 feet deep and 300 feet long. Once across Buckeye Road, the pipeline enters the Mock family property (which Port Dolphin holds an option for a portion of) where it would be terminated at a pig receiver.

4.3.4.3 Construction of Interconnection Station

This section describes the construction of the interconnection station with the Gulfstream and TECO pipeline systems. The Port Dolphin interconnection station would be located on a 3.04 acre (1.23 hectare) site located on the northeast corner of the intersection of Buckeye Road and Oneil Road, in Manatee County, Florida. The proposed equipment selection and configuration for this interconnection station (see **Drawing No. 26017-D-4105** in **Attachment A.3**) is based on the hydraulic optimization design data. The construction of the station would generally proceed as follows:

1) Construction would start with preparation of the property by clearing and excavating (side slopes, trenching, drainage, and erosion control as required) any embankments and fills.

This would be done with tracked equipment including a dozer, backhoe, grader, and debris hauling trucks;

2) A temporary security fence would be installed around the perimeter of this facility;
3) Excavate, form, install reinforcing steel, and pour concrete for all foundations and slabs. Foundations and curbed slabs would be used for the pig receiver, gas filter/coalescers, pressure reduction stations piping, meter skids, and buildings. These would be constructed using a backhoe and a front-end loader;
4) The 350-barrel storage tank (to be fabricated offsite at a local fabrication yard) would be delivered and set on a compacted gravel ring foundation. It would also include a retaining ring, a liner, and a containment levee to avoid hydrocarbon liquids from entering the ground or groundwater;
5) All pipe, flanges, weld fittings and bulk materials would be delivered to the site and the piping spools would be fabricated onsite or at a local fabrication yard. Rig welders and a backhoe would be used for this construction task. All station piping would be 100% x-rayed, wrapped/coated, and tested prior to being backfilled. All aboveground pipe would be painted. Piping would be filled with clean fresh water and tested in accordance with specifications. The test water would be filtered and discharged in accordance with the discharge permits requirements;
6) The filter/coalescers and meter runs would be supplied by certified fabrication vendors. The construction contractor would install them and connect them to the piping using a backhoe and rig welders;
7) The pressure reduction station would be fabricated onsite or at a local fabrication yard. Rig welders and a backhoe would be used for this construction task;
8) The buildings would be supplied by certified fabrication vendors. The construction contractor would use a cherry picker crane and certified electricians to set and connect them to the utilities;
9) All end devices such as transmitters, gauge panels, Program Logic Controllers (PLCs), and electrical equipment would be installed and connected to the main power and communication systems by certified electricians;
10) The roads and parking lots would be asphalt-finished by a local contractor; and
11) The retention pond would be constructed with local dirt materials and include a compacted clay liner. All final grading of the site would allow stormwater runoff to be routed and collected in this retention pond. A backhoe and dozer would be used to construct this retention pond.

4.4 Construction Schedule

On-site construction activities in Tampa Bay would be initiated in August 2010 and completed by early June 2011. A more detailed schedule encompassing offshore and onshore construction activities is included in *Confidential* **Attachment B.6**. The following paragraphs provide a brief introduction of the construction duration for each fixed project component.

4.4.1 Offshore Pipeline Construction

The scope of the offshore pipeline construction begins at the PLEMs and includes all offshore pipeline segments up to the point where it crosses the bulkhead at Port Manatee. The installation of the shore approach at Port Manatee is also part of the offshore pipeline system. The construction of the offshore pipeline is expected to take approximately 9 to 10 months.

4.4.2 STL Subsea System Installation

The main components of the STL subsea system include the mooring system, the STL buoy, the riser system, the umbilical system. Each of these components would be installed using a crane vessel/barge, pile driving equipment and diving support vessels. The entire STL subsea system is expected to take approximately 3 to 4 months to install.

4.4.3 Onshore Pipeline Construction

The scope of the onshore pipeline construction begins at the block valve at Port Manatee and includes all 3.88 miles of the onshore 36” pipeline segments up to the point where it enters the Port Dolphin property north of Buckeye Road. The construction of the onshore pipeline is expected to take approximately 4 to 5 months to install.

4.4.4 Interconnection Station

The scope of the interconnection station construction includes all interconnection equipment necessary to control the pipeline pressures and scrub and measure the gas being delivered to the Gulfstream and TECO pipelines. The construction of the interconnection station is expected to take approximately 2 to 3 months.

5. WATER QUALITY

This section addresses water quality impacts associated with the nearshore portion of the Revised Preferred Route within Tampa Bay and the optimization of the buoy anchoring arrangement. A Revised Preferred Route was developed to avoid passing through the Terra Ceia Aquatic Preserve. Water quality impacts related to installation and operation of the nearshore portion of the Revised Preferred Route and optimization of the buoy anchoring arrangement are presented.

5.1 Existing Conditions

Water quality at the offshore terminal site and along the pipeline route have been described in **Volume II, Section 3.2** of the **Deepwater Port Application**. The only new information presented here is for water quality along the nearshore portion of the Revised Preferred Route (Alternative A).

Nearshore Alternative A shifts the pipeline route north of the Terra Ceia Aquatic Preserve, and therefore, 65% less of the pipeline route would traverse Outstanding Florida Waters (OFW). No portion of the proposed Alternative A route passes through areas designated as Aquatic Preserve. The Original Preferred Route passed through OFW for 10.45 miles (16.8 kilometers), whereas the Revised Preferred Route passes through 3.69 miles (5.94 kilometers) of OFW (**Figure 5-1**).

To the north of the Terra Ceia Aquatic Preserve are located a series of permitted spoil areas. The nearshore portion of the Revised Preferred Route (Alternative A) would traverse through these areas (**Figure 5-1**), which are used primarily for dredged material from dredging of the Port Manatee turning basin and docking areas and composed predominantly of fine to medium sand. This was documented during the photodocumentation survey of the Alternative A pipeline corridor completed in October 2007. These permitted areas contained spoil materials in different configurations; some appeared fully utilized, while others had excess capacity. In addition, the corridor along and adjacent to the old demolished Sunshine Skyway Bridge includes numerous areas of disturbed seafloor and debris, and it is considered likely that this area is littered with concrete and ferrous debris from the bridge demolition.

5.2 Analysis of Potential Consequences

The following new or revised activities (project design changes) are included in this impact analysis:

- **Optimization of Buoy Anchoring Arrangement** – The mooring pattern around the STL buoys has been optimized, resulting in a different seafloor footprint (see **Section 3.3**).

- **Offshore Pipeline Route** – The nearshore portion of the pipeline route (i.e., within Tampa Bay) has been revised to avoid passing through the Terra Ceia Aquatic Preserve (see **Section 3.1**).

Figure 5-1
Portions of Preferred Routes Passing Through Outstanding Florida Waters

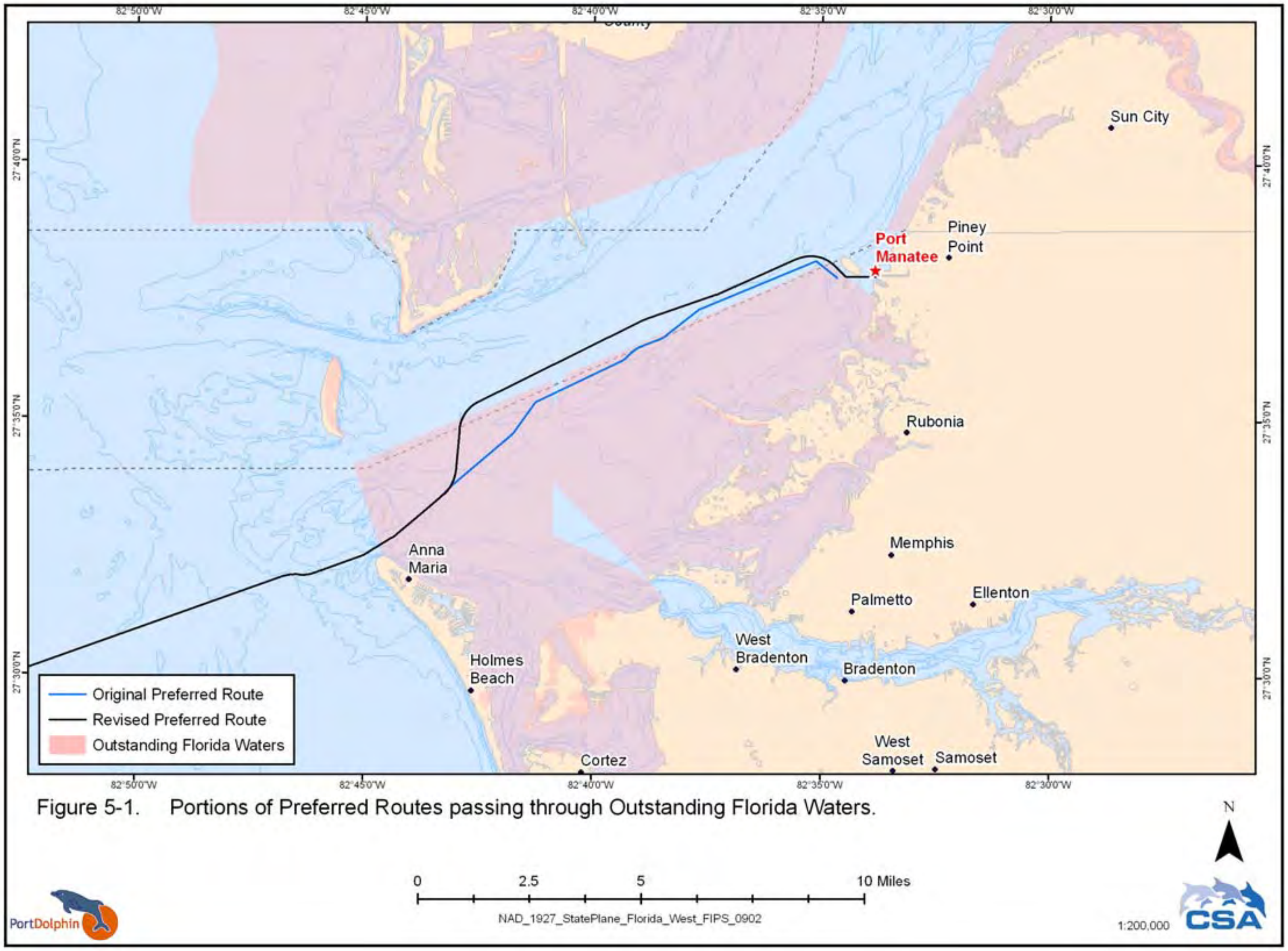


Figure 5-1. Portions of Preferred Routes passing through Outstanding Florida Waters.

In addition to these changes, impacts of pipeline installation along the entire Original Preferred Route have been re-evaluated based on the Revised Preferred Route.

The following impact-producing factors are relevant to the project design changes:

- **Turbidity Due to Sediment Resuspension –** The extent and location of seafloor disturbance and turbidity within Tampa Bay during pipeline installation has changed due to re-routing of the pipeline around the Aquatic Preserve. Also, the areal extent of turbidity impacts at the offshore terminal location has changed because the mooring pattern around the STL buoys has been optimized.

- **Hydrostatic Test Discharges** – The volume of hydrostatic test water will be roughly twice the original estimate due to a slight increase in pipeline length and the fact that the pipeline will be filled twice (i.e., there was an error in the original calculation). The hydrotest discharge location has also been changed to an offshore location rather than at Port Manatee, and the revised plan includes an "environmentally benign" treatment chemical that is not expected to require any treatment prior to discharge. In addition, there will be two subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe used for the two HDD crossings of the Gulfstream pipeline. There are no other changes to the anticipated discharges during construction, operations, or decommissioning.

- **Turbidity Due to Excavation of HDD Entrance and Exit Pits and Bridge Crossing** – There will be a total of three HDDs, one at the land-to-water transition point and two water-to-water HDDs under the existing Gulfstream pipeline. At the two water-to-water HDDs, there will be an exit and entrance pit excavated with a bucket dredge at each location, and the land-to-water HDD will have only an exit pit in the water (**Section 4.1.2**). A bucket dredge will be used to excavate the pipeline trench underneath the Sunshine Skyway Bridge.

- **HDD Drilling Fluids** – There will be a total of three HDDs, one at the land-to-water transition point and two water-to-water HDDs under the existing Gulfstream pipeline. All three HDDs will require drilling fluids for the installation process (**Section 4.1.2**)

- **Turbidity Caused by STL Buoy Anchor Installation** – The mooring pattern around the STL buoys has been optimized, resulting in a different seafloor footprint and the use of shorter anchor chains (**Section 3.3**). The number of anchors, size of the SLT landing pad, and placement of PLEMS and barge anchoring remain unchanged.

- **Turbidity from STL Buoy Anchor Sweep –** The mooring pattern around the STL buoys has been optimized, resulting in a different seafloor footprint and the use of shorter anchor chains (**Section 3.3**).

The following impact-producing factors are not analyzed in detail in this **Addendum**, either because they are irrelevant to the project design changes or they would not differ in any meaningful way from those previously discussed in the **Deepwater Port Application**:

- **Discharges from Construction Vessels** – None of the project design changes would alter the discharges from construction vessels, since the vessels used would be the same or similar and would have the same operating mitigation measures required.

- **Operational Seawater Intakes** – None of the project design changes would alter the operational seawater intake and discharge process described in the **Deepwater Port Application**.

- **Hydrocarbon Spill or Natural Gas Release** – None of the project design changes would significantly alter the potential for an accidental hydrocarbon spill or natural gas release.

- **Sediment Quality** – None of the project design changes would alter the existing sediment quality in the project area.

5.2.1 Water Quality

Water quality in Tampa Bay is described in **Volume II**, **Section 3.2.2.9** of the **Deepwater Port Application**. Impacts discussed here are those resulting from direct physical disturbance to the seafloor during plowing of the seafloor, placement of concrete mattresses, and anchoring of barges during construction activities.

5.2.1.1 Construction

Turbidity From Seafloor Disturbance – Pipeline Installation. The areal extent of seafloor disturbance during pipeline installation has increased due to re-routing of the pipeline around the Aquatic Preserve. Also, the specific location of some impacts within Tampa Bay has changed due to the re-routing.

Plowing and Mattress Placement – Pipeline installation will be the largest source of turbidity. Plowing is the preferred methodology for pipeline burial, and the baseline installation methods presented include 47.4% (115,469 feet) of the pipeline to be laid on the seafloor by a pipelaying barge, and then buried. Although plowing is the preferred methodology for pipeline burial, other techniques, such as dredging and HDD, will be used in certain areas. External protection with concrete mattresses or other armoring will be used where full burial is not achieved and is anticipated to occur over 49.3% (120,081 feet). Dredging is the selected installation method for the crossing under the Sunshine Skyway Bridge. This distance is 1,000 feet and will have external protection of concrete mattresses placed on top. There are two water-to-water HDDs planned for crossing the Gulfstream pipeline: the western HDD crossing will be 1,335 feet and the eastern HDD crossing will be 2,947 feet. In addition, there is a 3,573-foot transition HDD to connect the offshore pipeline to the onshore pipeline (**Figure 5-2**). The burial *per se*, as well as placement of the pipeline and mattresses, HDD of the shore approach, and water-to-water HDDs are sources of turbidity.

Figure 5-2
Pipeline Installation Methods Along Revised Preferred Route

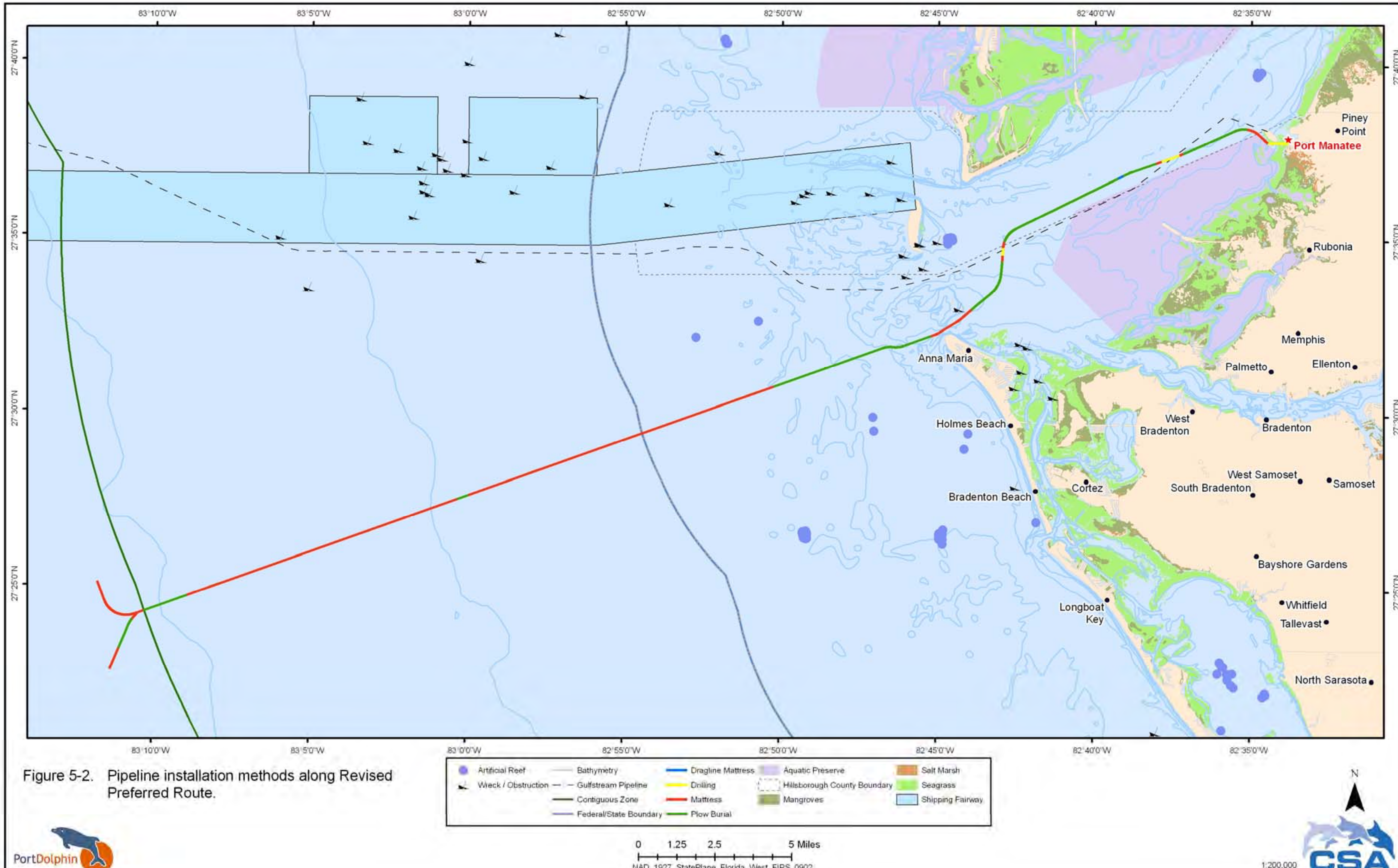


Figure 5-2. Pipeline installation methods along Revised Preferred Route.

An impact on water quality is considered significant if it is likely to result in violation of discharge regulations or ambient water quality standards. The relevant discharge regulations for operational discharges from the SRVs while in port, as well as hydrostatic test discharges, will be specified in the National Pollutant Discharge Elimination System (NPDES) permit from the U.S. Environmental Protection Agency (USEPA). For construction and support vessels, USCG discharge regulations apply, which also ensures compliance with international guidelines (e.g., the International Convention for the Prevention of Pollution from Ships [MARPOL]). Relevant ambient water quality standards include the USEPA (1986) standards for Federal waters, and State of Florida standards (Florida Administrative Code [F.A.C.] Chapter 62-302) for those portions of the pipeline route in State waters. Much of the pipeline route passes through Class III marine waters; portions of lower Tampa Bay, however, are classified as Outstanding Florida Waters, which have more stringent standards. The most important difference is that Class III standards allow turbidity <29 nephlometric turbidity units (NTUs) above natural background conditions, whereas OFW standards prohibit discharges that would lower ambient water quality, although there is a provision for obtaining a temporary variance to temporarily lower water quality during construction activities (with special restrictions).

For the portions of the pipeline that are trenched using the plowing technique, it is expected that turbidity levels would not exceed the Florida Class III Marine water quality criterion of 29 NTU above natural background. If it is determined that the criterion would be exceeded, then either additional mitigation will be implemented or a temporary variance will be applied for to ensure that there is no violation.

Although jetting is not anticipated to be used, it has been discussed here in the event it ultimately is needed during installation. For conventional pipeline jetting, it has been estimated that about 6,540 cubic yards (5,000 cubic meters) of sediment is re-suspended for each kilometer of pipeline jetted (Minerals Management Service [MMS] 2001). The plowing method is expected to produce much less turbidity, but the amount of re-suspension has not been quantified.

Anchoring – During the pipeline installation, the installation vessels will require anchor placement, which is a source of turbidity. Nearshore Alternative A is approximately 0.9 miles (1.4 kilometers) longer than the Original Preferred Route through the Aquatic Preserve. However, 0.6 miles (1.0 kilometers) of this difference will be installed by water-to-water HDD and would only have anchor placement impacts at the entrance and exit points of the HDDs. Therefore, the additional distance that the pipeline is either installed using a plow or by mattress placement would be 0.3 miles (0.5 kilometers) and would require additional anchor re-sets along the route. In addition, there would be a slight increase in vessel traffic due to the addition of the two water-to-water HDD operations.

Each barge anchor cable may also contact (sweep) the seafloor. During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard bottom. Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep.

Even though the Revised Preferred Route avoids the Terra Ceia Aquatic Preserve, a portion of the revised route still passes through OFW (**Figure 5-1**). OFW standards prohibit discharges that would lower ambient water quality, although there is a provision for temporary lowering of water quality during construction activities (with special restrictions). Turbidity curtains and/or other mitigation measures may be used as practicable to ensure that the installation complies with OFW standards. A temporary variance will be applied for to ensure that there is no violation.

Hydrostatic Test Water Intake and Discharge. During the construction phase, seawater will be used for hydrostatic testing of the offshore pipeline and flowlines. The analysis in **Volume II, Section 4.3.1** of the **Deepwater Port Application** concluded that hydrostatic test water intake and discharge would be in compliance with the NPDES permit, and the impacts were considered negligible.

The following project design changes are relevant:

- The estimated volume of water has increased from 12.3 to 23.9 million gallons due to the increased length of the nearshore portion of the Revised Preferred Route and the fact that the pipeline would be filled twice (i.e., there was an error in the original calculation).
- The discharge will occur offshore from a marine vessel at one of the STL buoy locations rather than at Port Manatee within Tampa Bay.
- Originally, the hydrotest water was expected to contain biocides, oxygen scavenger, and a fluorescent dye. The water was to be treated with industrial grade hydrogen peroxide to render the effluent non-toxic prior to discharge. The revised plan includes an "environmentally benign" treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharge would comply with NPDES permit requirements and is expected to be non-toxic upon discharge.

The project design changes would not affect the conclusion of the impact analysis. Although the discharge volume is greater, it is expected to disperse more rapidly offshore than in Tampa Bay because of stronger ocean currents and the larger volume of receiving waters. The discharge is expected to be non-toxic, and any impacts on fish would be negligible.

Dewatering Discharge from Carrier Pipe. During installation of the two HDD crossings of the Gulfstream pipeline, there would be two subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe. The volumes are estimated to be approximately 81,000 gallons and 179,000 gallons. The water would include an "environmentally benign" treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharges would comply with NPDES permit requirements and are expected to be non-toxic. Therefore, the discharges would have little or no impact to water quality, and impacts are considered negligible.

Turbidity Due to Excavation of HDD Entrance and Exit Pits and Bridge Crossing. During the installation of the two HDD crossings of the Gulfstream pipeline, there will be a small exit and entrance pit excavated at each location. The land-to-water HDD will have only an exit pit in the water. A teardrop-shaped exit pit will be excavated on both sides of the two water-to-water crossings and at the exit pit of the land-to-water transistion HDD. The spoil from the pit(s) will be side-cast and reused later for back fill after the HDD string is tied into the pipeline. The exit pits are constructed as an elevation transition to facilitate the pull-in of the string and the final tie-in into the pipeline. The exit pits are not constructed or intended for containment and recovery of drilling fluids or muds. Excavation with the bucket dredge will be a source of turbidity, but the amount of resuspension has not been quantified. Turbidity curtains will be used as practicable during these dredging activities to minimize the impacts to water quality; therefore, turbidity impacts would have localized short-term impacts to water quality, and impacts are considered minor.

HDD Drilling Fluids. There will be a total of three HDDs, one at the land-to-water transition point and two water-to-water HDDs under the existing Gulfstream pipeline. All three HDDs will require drilling fluids for the installation process (**Section 4.1.2**). All drilling fluids and muds will be collected and recycled during the HDD operation. The fluids and muds utilized are environmentally benign and pose no danger to the environment if lost and not recovered. The drilling fluids are heavier than water and will remain on the seafloor; therefore, they would have little to no impact to water quality, and impacts are considered negligible.

Turbidity From Seafloor Disturbance – STL Subsea System Installation. Another construction activity that will disturb the seafloor is installation of the STL subsea system, which consists of the STL buoy and PLEM, as well as associated moorings, risers, and umbilicals. Installation will disturb sediments due to placement of components on and in the seabed, as well as anchoring of construction vessels. Although specific mooring locations around the STL buoys have been changed due to optimization of the mooring configuration (see **Section 3.3**), the number of moorings is unchanged. Therefore, the total area of seafloor impacts during construction is the same as in the original analysis in **Volume II, Section 4.3.2** of the **Deepwater Port Application**, which was 0.59 acres (0.23 hectares) of seafloor.

5.2.1.2 Operations

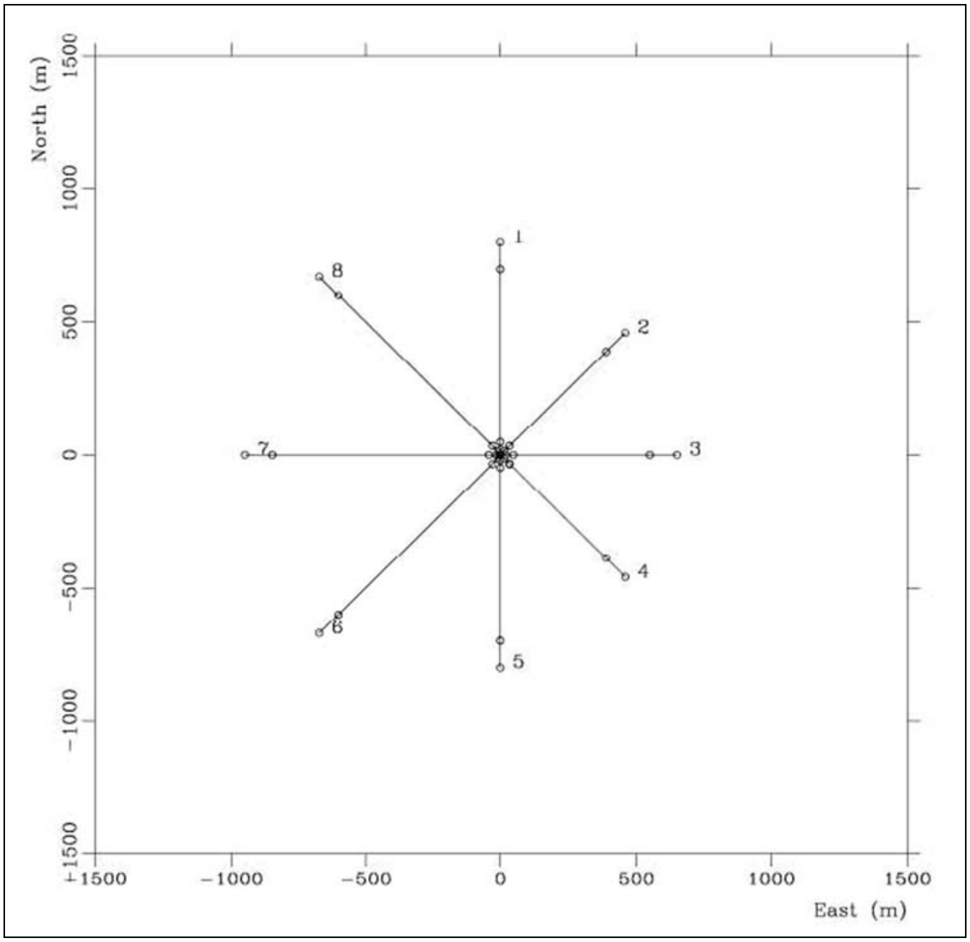
Turbidity from STL Buoy Anchor Sweep. During operations, the anchor chains/cables from the STL buoys will chafe bottom sediments. The two unloading buoys each will have eight mooring lines consisting of wire rope and chain, connecting to anchors or driven piles on the seabed. When not connected to an SRV, the unloading buoy would be submerged below the sea surface. When an SRV arrives, the unloading buoy would be retrieved from its submerged position by means of a winch and recovery line. As the STL buoy moves up and down, some lateral movement of the mooring lines will occur, contacting the seabed. Anchor sweep will temporarily re-suspend bottom sediments and create turbidity near the seabed.

One of the project design changes in this **Addendum** is the optimization of the mooring pattern around the STL buoys (see **Section 3.3**). The mooring system footprint has been recalculated based on the maximum observed vessel offset for the optimized mooring system. An SRV size of 217,000 meters^3 was used because it would have the largest footprint.

Figure 5-3 shows a horizontal projection of the optimized mooring system. The mooring lines can be divided into three groups based on their length:

- Lines 2, 3, and 4: length = 649 meters (2,129 feet);
- Lines 1 and 5: length = 799 meters (2,622 feet); and
- Lines 6, 7, and 8: length = 949 meters (3,114 feet).

Figure 5-3
Horizontal Projection of Optimized Mooring System



A lateral offset of ±7 meters was estimated at a distance of 100 meters from the buoy center (**Figure 5-4**). The area affected by "cable sweep" was calculated for each line group and summarized to find the total impact area (**Table 5-1**).

Figure 5-4
Diagram of Seafloor Impact Area for Mooring Lines 6, 7, and 8.
The diagram would be similar for the other two line groups, except for the shorter line length

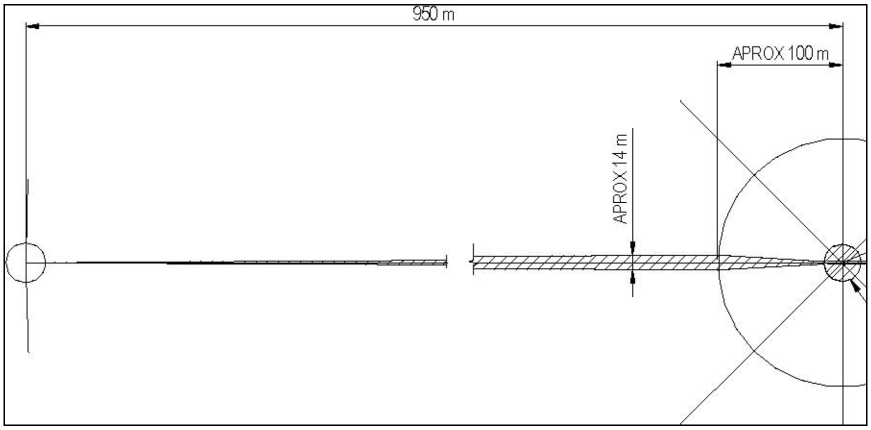


Table 5-1
Seafloor Area Affected by Mooring System Cables at Each Buoy Area

Mooring Line No.	Vessel Offset (meters)	Distance from Center (meters)	Area Affected (per buoy area)	
			Hectares	Acres
2, 3, 4	± 7	649	1.36	3.37
1, 5	± 7	799	1.12	2.76
6, 7, 8	± 7	949	1.99	4.92
		Total:	4.47	11.05

Based on these calculations, the total area affected by cable sweep would be 11.05 acres (4.47 hectares) per loading buoy, or a total of approximately 22.10 acres (8.94 hectares).

In **Volume II, Section 4.3.2** of the **Deepwater Port Application**, the total seafloor area affected by anchor sweep at both the North and South buoys combined was estimated to be about 30 acres (12.14 hectares). The revised estimate is approximately 22.10 acres (8.94 hectares). The area of seafloor disturbance is about 26% less than the original estimate. The resulting impacts on water quality would be reduced.

5.2.1.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on water quality as discussed in **Volume II, Section 3.3.1** of the **Deepwater Port Application**.

5.2.1.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on water quality as discussed in **Volume II, Section 3.3.1** of the **Deepwater Port Application**.

5.3 Summary of Potential Impacts and Mitigation

Table 5-2 summarizes the impact characteristics for water and sediment quality. Potential impacts are rated as significant, minor, or negligible using the following criteria:

- **Significant** – An impact is significant if it is likely to result in violation of discharge regulations or ambient water quality standards, or elevated concentrations of metals, hydrocarbons, or other sediment contaminants.
- **Minor** – changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible** – changes that are unlikely to be noticed or measurable against background conditions.

The table also summarizes the effect of project design changes and categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible.

Water quality and sediment impacts related to the Revised Preferred Route will not be very different from the Original Preferred Route impacts. The main impact to water quality would be turbidity and water clarity due to sediment re-suspension caused by disturbance of the bottom. Water quality degradation would be most prevalent during pipeline installation and only in the general vicinity where a pipe was being laid. Use of a plow to bury 52.1% of the pipeline and surface lay with mattresses for 47.9% of the pipeline will minimize turbidity compared to jetting or dredging methods.

Although the proposed re-route bypasses the Terra Ceia Aquatic Preserve, utmost care will be taken when laying the pipeline in this vicinity of this OFW to ensure impact is minimized. Any increase in turbidity in this area would be a violation of OFW standards. Turbidity curtains and/or other mitigation measures may be used to comply with OFW standards. A temporary variance will be applied for to ensure that there is no violation. With careful mitigation and monitoring, no violation of water quality standards is expected and water quality impacts would be considered negligible to minor. While laying the pipeline, anchoring and pipeline systems would temporarily disrupt seafloor habitat. Upset would be localized and temporary. No mitigation would be required, as sediment would soon re-settle.

Table 5-2
Summary of Impacts to Water and Sediment Quality

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Water Quality					
Construction *Pipeline Installation*	Seafloor disturbance would cause turbidity/reduced water clarity due to suspended sediments during pipeline installation (plowing and trenching of seafloor, anchoring of barges, placement of pipeline and mattresses, HDD at shore approach and Gulfstream crossings)	Areal extent of turbidity increased due to increased pipeline length Addition of two water-to-water HDD crossings of the Gulfstream pipeline will cause turbidity in the immediate vicinity of construction but decreased turbidity in the Terra Ceia Aquatic Preserve	• Localized • Certain • Direct • Reversible	Minor for turbidity	• Use of a plow (where feasible) to bury the pipeline will produce much less turbidity than conventional jetting or dredging because it does not fluidize bottom sediments • The use of turbidity curtains and other related measures will be used when installing near the Terra Ceia Aquatic Preserve • Where the pipeline route passes through Outstanding Florida Waters, turbidity curtains or other mitigation measures will be used as practicable to avoid water quality impact • Monitoring will be done during pipeline trenching to ensure compliance with water quality standards • A temporary water quality variance from OFW will be applied to ensure no violations

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Test Water Intake and Discharge	Hydrostatic test water intake and discharge	Discharge will now occur offshore rather than in Tampa Bay; volume about twice the original estimate Addition of two water-to-water HDD crossings of the Gulfstream pipeline will cause turbidity in the immediate vicinity of construction but decreased turbidity in the Terra Ceia Aquatic Preserve	• Localized • Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic) • Offshore discharge will enhance rapid dispersion
	Dewatering discharge water from carrier pipe	New discharge due to two HDD crossings of Gulfstream pipeline	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic)
Dredging of HDD Exit Pits and Bridge Crossing	Additional excavation by dredging	Additional excavation due to two HDD crossings of Gulfstream pipeline and under the bridge	• Localized • Certain • Direct • Reversible	Minor	• Use of turbidity screens as practicable
HDD Drilling Fluids	Potential small release of drilling fluids into the exit pit for each HDD	Addition of two water-to-water HDD crossings of the Gulfstream pipeline	• Localized • Likely • Direct • Reversible	Negligible	• All drilling fluids and muds will be collected and recycled during the HDD operations • The fluids and muds utilized are environmentally benign and pose no danger to the environment if lost and not recovered

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
					• The drilling fluids are heavier than water and will remain on the seafloor
STL Mooring Buoys	Turbidity/reduced water clarity due to sediment disturbance during STL subsea system installation (placement of components on seafloor, anchoring of barges, and movement of anchor lines)	Areal extent of turbidity and seafloor impacts decreased by revised mooring pattern around buoy locations	• Localized • Certain • Direct • Reversible	Minor	• STL buoy mooring are adjusted to minimize contact with hard/live bottom habitats as best as possible • Additional midline buoys will minimize impacts on anchor chain sweep of bottom
Vessels	Routine discharges from construction vessels (deck drainage, etc.) Anchor lines will disturb sediment when anchor is raised and lowered	Slight increase in vessel traffic to install two HDDs at Gulfstream pipeline No change in vessel size or type	• Localized • Certain • Direct • Reversible	Negligible	• Discharges will comply with USCG regulations and NPDES permit conditions • Construction vessel sizes and number will be minimized when possible to reduce potential of anchor damage
Routine Operations	Physical disturbance of sediments from STL buoy anchor sweep	Areal extent decreased due to optimization of mooring pattern around buoys	• Certain • Direct • Reversible	Minor	• Hard/live bottom habitats within the STL buoy areas have been mapped and the STL mooring pattern has been adjusted to minimize contact with these areas
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Sediment Quality					
Construction	*No change*	*No change*	*No change*	*No change*	*No change*
Routine Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

HDD = horizontal directional drill; NPDES = National Pollutant Discharge Elimination System; STL = submerged turret loading; USCG = U.S. Coast Guard.

6. MARINE RESOURCES

6.1 Existing Conditions

Marine resources at the offshore terminal site and along the Original Preferred Route have been described in **Volume II, Section 4.2** of the **Deepwater Port Application**. The only new information presented here is for benthic communities along the nearshore portion of the Revised Preferred Route (Alternative A).

A photodocumentation survey of the Alternative A pipeline corridor was completed in October 2007 using a towed underwater camera system (**Appendix A.1**). Qualitative video and still photographs of the seafloor were collected along the centerline of the pipeline corridor and along three parallel transects to each side of the centerline (**Figure 6-1**). The spacing between transect lines was 656 feet (200 meters). Parts of the southern transect lines overlapped the original corridor and were not re-surveyed. Plan-view photographs were collected every 656 feet (200 meters) to meet Federal and State requirements for photodocumentation.

After the towed camera surveys, divers collected quantitative still photographs at two locations within areas of Type A habitat (**Figure 6-1**). Randomly-positioned quantitative still photographs and several minutes of high-quality video were collected at each dive site to pair with the nearshore data for a minimum of 100 photographs per discrete habitat type. Several other dive locations were attempted, but the habitat was too sporadic to locate areas large enough for quantitative photographic data gathering. As part of the diver surveys, divers also visited the HDD exit point for the Port Manatee shore crossing and used a tape measure to identify the distance and bearing to the closest seagrass areas.

The total survey area was 5,422 acres (2,194 hectares). **Figure 6-2** shows the distribution of benthic habitats with the area. Benthic habitats were categorized based on the FDEP "Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida," as follows:

- **Type A** – 331.6 acres (134.2 hectares) or 6.1% of the survey area. Defined as 20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 feet (0.25 meters) in relief, inclusive of sand components integral to these habitats.
- **Type B** – 76.5 acres (31.0 hectares) or 1.4% of the survey area. Defined as 5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 feet (0.25 meters) in relief, inclusive of sand components integral to these habitats.
- **Type D** – 442.7 acres (179.2 hectares) or 8.2% of the survey area. Defined as sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage.
- **Soft substrate/sand** – 4,572 acres (1,850 hectares) or 84.3% of the survey area. Defined as soft substrate/sedimentary habitats not associated with hard bottom ecotones.

Figure 6-1
Video/Photographic Transects and Dive Sites
Along the Nearshore Portion of the Revised Pipeline Corridor (Alternative A)

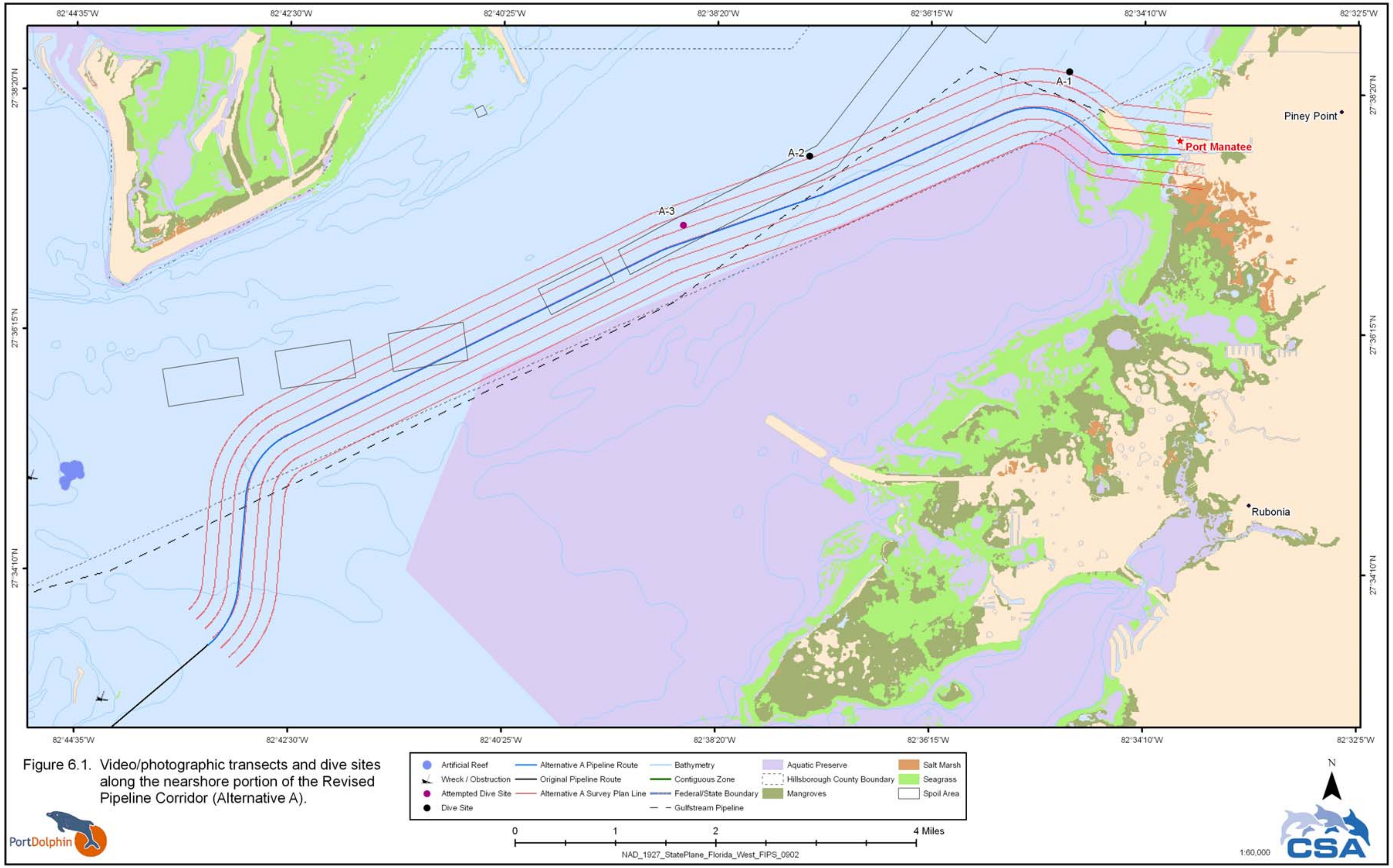


Figure 6.1. Video/photographic transects and dive sites along the nearshore portion of the Revised Pipeline Corridor (Alternative A).

Figure 6-2
Benthic Habitat Types Mapped Along the
Nearshore Portion of the Revised Pipeline Corridor (Alternative A)
See Text for Definitions of Type A, B, and D Habitats

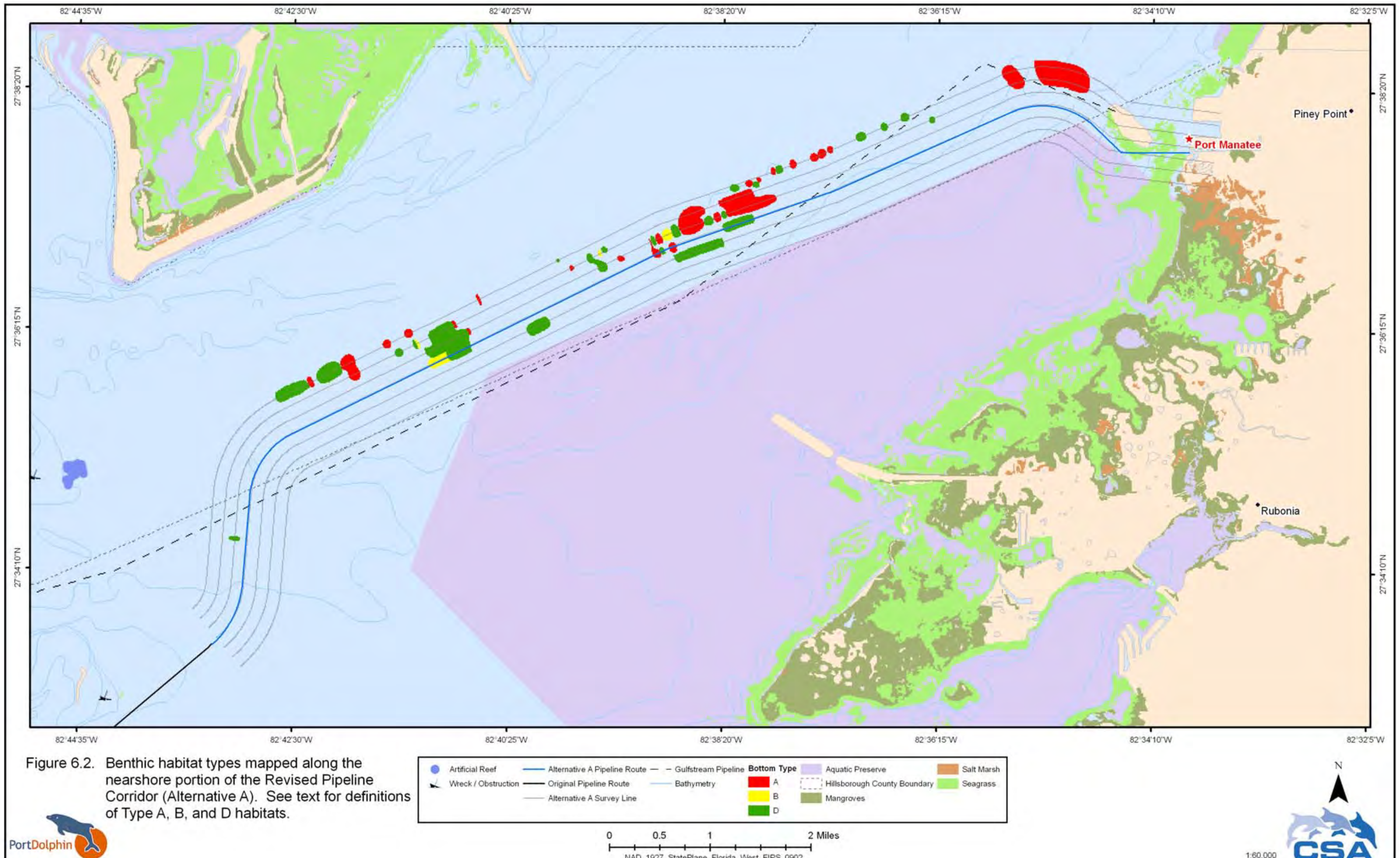


Figure 6.2. Benthic habitat types mapped along the nearshore portion of the Revised Pipeline Corridor (Alternative A). See text for definitions of Type A, B, and D habitats.

Most of the survey area was soft substrate/sand habitat (84.3%), with small and patchy clusters of Type A, Type B, and Type D habitats (combined total of 15.7%). Most Type A habitats were identified east of the Sunshine Skyway Bridge. Parts of the corridor overlap with spoil areas (**Figure 6-1**), including areas littered with concrete and ferrous debris from the demolition of the old Sunshine Skyway Bridge.

Both of the dive sites were in areas classified as Type A habitat based on the video survey. Analysis of quantitative photographs confirmed the habitat classifications, as biotic cover was estimated to be 25.2% at Site A-1 and 24.3% at Site A-2. Faunal components included sponges, hydroids, octocorals (including *Carijoa riisei*), encrusting bryozoans, urchins (*Arbacia punctulata*), and colonial tunicates (*Clavilina gigantica*). Hydroids accounted for most of the faunal cover at Site A-1 with 18.0%. Sponges had the greatest percent cover at Site A-2 with 14.0%. Macroalgae were a relatively minor component, contributing less than 3% cover at both sites.

The distribution of benthic habitats in the revised pipeline corridor within Tampa Bay is generally similar to that of the original corridor (**Table 6-1**). Both corridors are predominantly soft/sand bottom (84.3% in the revised corridor, 91.6% in the original) with patchy areas of hard/live bottom. The revised corridor has about twice the percentage of total hard/live bottom habitat (15.7% vs. 8.4%) and about nine times the percentage of Type A habitat (6.1% vs. 0.7%). A portion of the re-route goes through areas of spoils and debris that meet the vertical relief criterion for Type A habitat; these features are colonized with sponges and tunicates. The observations of patchy hard/live bottom are consistent with other previous observations in Tampa Bay (Lewis and Estevez 1988; Savercool and Lewis 1994).

Table 6-1
Comparison of Benthic Habitats in Original and Revised Pipeline Corridors
(From Re-route Point to HDD Exit Near Port Manatee)

Benthic Habitat Type	Original Corridor			Revised Corridor		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Type A Habitat	27.36	11.07	0.71	312.01	126.27	7.50
Type B Habitat	70.10	28.37	1.82	68.44	27.70	1.65
Type D Habitat	227.10	91.90	5.88	383.15	155.05	9.22
Total Hard/Live Bottom (A+B+D)	324.56	131.34	8.40	763.60	309.02	18.37
Soft Substrate/Sand Habitat	3,536.98	1,431.37	91.60	3,394.12	1,373.55	81.63

The dive at the HDD exit point showed that seagrasses are not present there; the nearest seagrasses were 75 feet (23 meters) to the southwest and greater than 194 feet (59 meters) to the northeast. Because seagrass beds are dynamic habitats, a seagrass survey will be performed prior to construction to determine the status and location of seagrass near the HDD exit point.

Table 6-2 lists the percentages of hard bottom along the entire Revised Preferred Route as compared with the values listed in **Volume II**, **Table 4-6** of the **Deepwater Port Application** for the Original Preferred Route. The revised data for the entire corridor were used for impact calculations later in this section.

Table 6-2
Comparison of Benthic Habitats in Original and Revised Preferred Corridors
(Entire Surveyed Route Including Buoy Areas)

Benthic Habitat Type	Original Corridor			Revised Corridor		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Type A Habitat	1,608	651	6.1	1,887	764	7.1
Type B Habitat	4,883	1,976	18.5	4,806	1,945	18.0
Type D Habitat	2,851	1,154	10.1	2,917	1,180	10.9
Total Hard /Live Bottom (A+B+D)	9,342	3,780	35.4	9,609	3,889	35.9
Soft Substrate/Sand Habitat	16,228	6,567	61.5	19,409	7,855	64.1

6.2 Analysis of Potential Consequences

The following new or revised activities (project design changes) are included in this impact analysis:

- **Optimization of buoy anchoring arrangement** – The mooring pattern around the STL buoys has been optimized, resulting in a different seafloor footprint (see **Section 3.3).**
- **Offshore pipeline route** – The nearshore portion of the pipeline route (i.e., within Tampa Bay) has been revised to avoid passing through the Terra Ceia Aquatic Preserve (see **Section 3.1**).

In addition to these changes, impacts of pipeline installation along the entire Original Preferred Route have been recalculated based on the Revised Preferred Route. The analysis included corrections to the original spreadsheet for "plowability" of various pipeline segments and the use of a geographic information system (GIS) to calculate more accurately the extent of impacts.

The following impact-producing factors are relevant to the project design changes:

- **Seafloor disturbance and turbidity** – The areal extent and location of seafloor disturbance and turbidity within Tampa Bay during pipeline installation has changed due to re-routing of the pipeline around the Aquatic Preserve. Also, the areal extent of seafloor impacts at the offshore terminal location has changed because the mooring pattern around the STL buoys has been optimized.
- **Vessel traffic** – The nearshore portion of the Revised Preferred Route will require additional vessels for the two HDD crossings of the Gulfstream pipeline. These include two jack-up barges, a bucket dredge barge, a spud lay barge, crewboats, and tugs**.** For the rest of the

pipeline construction, the types of vessels and their frequency of travel will be unchanged. There are no changes to the expected vessel traffic during operations or decommissioning.

- **Discharges** – The volume of hydrostatic test water will be about twice the original estimate due to a slight increase in pipeline length and the fact that the pipeline will be filled twice (i.e., there was an error in the original calculation). The hydrotest discharge location has also been changed to an offshore location rather than at Port Manatee, and the revised plan includes an "environmentally benign" treatment chemical that is not expected to require any treatment prior to discharge. In addition, there will be two subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe used for the two HDD crossings of the Gulfstream pipeline. There are no other changes to the anticipated discharges during construction, operations, or decommissioning.

The following impact-producing factors are not analyzed in detail in this **Addendum**, either because they are irrelevant to the project design changes or they would not differ in any meaningful way from those previously discussed in the **Deepwater Port Application**:

- **Operational seawater intake (entrainment/impingement)** – None of the project design changes would alter the operational seawater intake and discharge process described in the **Deepwater Port Application**.
- **Underwater noise** – None of the project design changes would significantly alter the underwater noise generated during construction, operations, or decommissioning. Although additional vessels will be required for the two Gulfstream HDD crossings, they will be the same types (e.g., barges, tugs, crew boats) previously identified in **Volume II, Table 4-25** of the **Deepwater Port Application**, and they will be operating in the same general area within the same general time frame.
- **Lights** – None of the project design changes would significantly alter the offshore light sources described in **Volume II, Table 4-27** of the **Deepwater Port Application**.
- **Debris (entanglement/ingestion)** – None of the project design changes would significantly alter the potential for accidental loss of debris into the marine environment during the project.
- **Hydrocarbon spill or LNG release** – None of the project design changes would significantly alter the potential for an accidental hydrocarbon spill or LNG release.

6.2.1 Marine Fish Resources and Essential Fish Habitat

Marine fish resources occurring in the project area include broadly defined assemblages of soft bottom, hard bottom, and pelagic fishes as described in **Volume II, Section 4.2.1** of the **Deepwater Port Application**. This discussion focuses on juvenile or adult fishes that have passed through the planktonic larval stage and either settled to the seafloor (soft bottom or hard bottom species) or taken up residence in the water column (pelagic species). Ichthyoplankton are considered separately in **Section 6.2.3**.

Impacts to fish resources and essential fish habitat (EFH) are discussed in **Volume II, Section 4.3.1** of the **Deepwater Port Application**. Additional information and impact analysis for EFH and managed species (including invertebrates) from soft bottom, hard bottom, and pelagic assemblages are presented in **Volume II, Appendix D** of the **Deepwater Port Application**.

Impact factors relevant to the project design changes include seafloor disturbance and turbidity during pipeline installation; hydrostatic test water intake and discharge; and discharge of treated water from carrier pipe. Other impact factors such as operational seawater intake and discharge, underwater noise, offshore lighting, and accidental spills or LNG release either are not relevant to the revised activities or would not differ in any meaningful way from those discussed in the **Deepwater Port Application**.

6.2.1.1 Construction

Seafloor Disturbance and Turbidity. The areal extent of seafloor disturbance and turbidity during pipeline installation within Tampa Bay has increased due to re-routing of the pipeline around the Aquatic Preserve. For the pipeline route as a whole, however, the re-routing would result in a relatively small increase in the areal extent of seafloor impacts.

Sources of seafloor disturbance and turbidity during pipeline installation include plowing, mattress placement, and anchoring. The areal extent of these impacts is discussed in **Section 6.2.2** (Benthic Communities). The affected area is estimated to be about 9% larger than originally estimated in **Volume II**, **Section 4.3.2** of the **Deepwater Port Application**.

Another construction activity that will disturb the seafloor is installation of the STL subsea system. Although specific mooring locations around the STL buoys have been changed due to optimization of the mooring configuration (see **Section 3.3**), the number of moorings is unchanged. Therefore, the total area of seafloor impacts during construction is the same as in the original analysis. However, the relative impact areas for benthic habitat types has changed due to the change in configuration. The impact areas are slightly less for soft bottom and slightly greater for Type B habitat (see **Section 6.2.2**).

The analysis in **Volume II, Section 4.3.1** of the **Deepwater Port Application** concluded that turbidity and seafloor disturbance impacts on fish during construction would be minor. The relatively small increase in the areal extent of seafloor impacts would not change this conclusion.

Hydrostatic Test Water Intake and Discharge. During the construction phase, seawater will be used for hydrostatic testing of the offshore pipeline and flowlines. The analysis in **Volume II, Section 4.3.1** of the **Deepwater Port Application** concluded that hydrostatic test water intake and discharge would have little or no impact on fish, and the impacts were considered negligible. The following project design changes are relevant:

- The estimated volume of water has increased from 12.3 million gallons to 23.9 million gallons due to the increased length of the nearshore portion of the Revised Preferred Route and the fact that the pipeline would be filled twice (i.e., there was an error in the original calculation).

- The discharge will occur offshore from a marine vessel at one of the STL buoy locations rather than at Port Manatee within Tampa Bay.
- Originally, the hydrotest water was expected to contain biocides, oxygen scavenger, and a fluorescent dye. The water was to be treated with industrial grade hydrogen peroxide to render the effluent non-toxic prior to discharge. The revised plan includes an "environmentally benign" treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharge would comply with NPDES permit requirements and is expected to be non-toxic upon discharge.

The project design changes would not affect the conclusion of the impact analysis. Although the discharge volume is greater, it is expected to disperse more rapidly offshore than in Tampa Bay because of stronger ocean currents and the larger volume of receiving waters. The discharge is expected to be non-toxic, and any impacts on fish would be negligible.

Dewatering Discharge from Carrier Pipe. During the installation of the two HDD crossings of the Gulfstream pipeline, there will be two subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe. The volumes are estimated to be approximately 81,000 gallons and 179,000 gallons. The water would include an "environmentally benign" treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharges would comply with NPDES permit requirements and are expected to be non-toxic. Therefore, the discharges would have little or no impact on fish, and impacts are considered negligible.

6.2.1.2 Operations

Turbidity from Anchor Sweep. During operations, the anchor chains/cables from the STL buoys will chafe bottom sediments. The two unloading buoys each will have eight mooring lines consisting of wire rope and chain, connecting to anchors or driven piles on the seabed. When not connected to an SRV, the unloading buoy would be submerged below the sea surface. When an SRV arrives, the unloading buoy would be retrieved from its submerged position by means of a winch and recovery line. As the STL buoy moves up and down, some lateral movement of the mooring lines will occur, contacting the seabed. Anchor sweep will temporarily resuspend bottom sediments and create turbidity near the seabed.

In **Volume II**, **Section 4.3.2** of the **Deepwater Port Application**, the total seafloor area affected by anchor sweep at both North and South buoys combined was estimated to be about 30 acres (12.14 hectares). The revised estimate is approximately 22.1 acres (8.94 hectares); the revised calculation is explained in **Section 6.2.2**. The area of seafloor disturbance is about 25% less than the original estimate and represents less than 1% of the seafloor within each buoy area. The resulting impacts on fish and EFH would be negligible.

6.2.1.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on fish or EFH as discussed in **Volume II, Section 4.3.1** of the **Deepwater Port Application**.

6.2.1.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on fish or EFH as discussed in **Volume II, Section 4.3.1** of the **Deepwater Port Application**.

6.2.2 Benthic Communities

Impacts to benthic communities are discussed in **Volume II, Section 4.3.2** of the **Deepwater Port Application**. Impacts discussed here are those resulting from direct physical disturbance to the seafloor during plowing of the seafloor, placement of concrete mattresses, and anchoring of barges during construction activities.

6.2.2.1 Construction

Seafloor Disturbance – Pipeline Installation. The areal extent of seafloor disturbance during pipeline installation has increased due to re-routing of the pipeline around the Aquatic Preserve. Also, the specific location of some impacts within Tampa Bay has changed due to the re-routing.

Plowing and Mattress Placement – **Table 6-3** summarizes the area affected by plowing, mattress placement, and anchoring for the original and revised corridors. (Further details of the anchoring calculations are provided later in this section.) The original corridor values are from **Volume II**, **Section 4.3.2** of the **Deepwater Port Application**. The revised numbers reflect (1) the re-routing of the pipeline around the Terra Ceia Aquatic Preserve; (2) corrections to the original spreadsheet for "plowability" of various pipeline segments; and (3) the use of GIS to calculate more accurately the extent of impacts.[1]

For plowing impacts, a width of 67 feet (20.4 meters) was used. Mattress placement was assumed to affect a width of 13 feet (4.0 meters). Diagrams illustrating the impact width are included in the **Deepwater Port Application**. In one location in Tampa Bay where a combination of dragline burial and concrete mattresses is planned, an effect width of 60 feet (18.3 meters) was assumed. This impact is related to the Sunshine Skyway Bridge crossings and was not included in the original analysis.

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[1] In the original analysis, the pipeline route was divided into about 90 segments that were rated as plowable or not plowable, and the habitat within each segment was rated as A, B, D, or soft bottom. In the revised analysis, the same approach was used for plowability, but the linear extent of plowing and mattressing impacts were measured directly using the GIS on mapped habitats.

Table 6-3
Areal Extent of Seafloor Impacts from Pipeline Installation in Original and Revised Preferred Corridors (Entire Route)

Activity	Area Affected Acres (Hectares)							
	Original Preferred Corridor[a]				Revised Preferred Corridor			
	Soft Bottom	Type A	Type B	Type D	Soft Bottom	Type A	Type B	Type D
Plowing	128.05 (51.82)	0	0	25.38 (10.27)	146.66 (59.35)	4.19 (1.70)	3.63 (1.47)	21.62 (8.75)
Mattress Placement	17.36 (7.03)	5.67 (2.29)	12.77 (5.17)	5.07 (2.05)	16.32 (6.60)	2.48 (1.00)	9.64 (3.90)	7.30 (2.96)
Dragline /mattress	--	--	--	--	1.38 (0.56)	0	0	0
Anchoring	12.17 (4.93)	1.22 (0.49)	3.67 (1.49)	2.13 (0.86)	13.55 (5.49)	1.32 (0.53)	3.36 (1.36)	2.04 (0.82)
Total	157.58 (63.78)	6.89 (2.78)	16.44 (6.66)	32.58 (13.18)	177.91 (72.00)	7.99 3.23	16.63 (6.73)	30.96 (12.53)

[a] As estimated in **Volume II, Section 4.3.2** of the **Deepwater Port Application**.

The revised analysis predicts that a total of 176.10 acres (71.27 hectares) would be affected by plowing. About 83% of this area would be soft bottom habitat, but small areas of Types A, B, and D habitat would also be affected. The original analysis did not indicate any Type A or B habitat affected by plowing, but the revised analysis using the GIS showed that some of these areas would be affected.

The revised analysis also predicts that 35.74 acres (14.46 hectares) would be affected by concrete mattresses. About 54% would be hard/live bottom habitats, and the remaining 46% would be soft bottom.

A small area of 1.38 acres (0.56 hectares) would be affected by dragline burial and concrete mattresses at one location in Tampa Bay. All of the area would be soft bottom.

Overall, the areal extent of seafloor impacts during pipeline installation is estimated to be about 9% larger than originally estimated in **Volume II, Section 4.3.2** of the **Deepwater Port Application**.

Anchoring – **Table 6-4** summarizes impacts of anchoring for the entire Revised Preferred Route. The following assumptions were made to calculate the extent of anchoring impacts:

- The barge will make four passes along the route, for pipelaying, plowing, backfilling, and mattress placement.
- During the first three passes, the barge will use 10 anchors, which will be reset every 2,000 feet (610 meters). Each anchor contact with the seafloor will directly affect an area of 360 square feet (33.4 meters^2).

- The fourth pass (mattress placement) will be done by a smaller barge with four smaller anchors, which will be reset every 1,000 feet (305 meters). The anchors would affect a smaller area of 90 square feet (8.4 meters^2).
- Hard/live bottom areas will be affected in direct proportion to the percentage of these habitats along the pipeline route.

Table 6-4
Areal Extent of Impacts from Anchoring During Pipeline Installation
(Entire Revised Preferred Route)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	No. of Anchor Impacts	Direct Impact Area[b]			
					Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)
1st	Pipelaying	235,549	117	1,170	6.20 (2.51)	0.68 (0.27)	1.74 (0.70)	1.06 (0.43)
2nd	Plowing	115,468	58	580	3.07 (1.24)	0.34 (0.14)	0.86 (0.35)	0.52 (0.21)
3rd	Backfilling	115,468	58	580	3.07 (1.24)	0.34 (0.14)	0.86 (0.35)	0.52 (0.21)
4th	Mattress placement	120,081	121	484	0.64 (0.26)	0.07 (0.03)	0.18 (0.07)	0.11 (0.04)
				Total	12.90 (5.26)	1.43 (0.58)	3.63 (1.47)	2.21 (0.89)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each would affect an area of 360 square feet (33.4 meters^2). For the fourth pass, assumed four smaller anchors would be reset every 1,000 feet (305 meters) and each would affect an area of 90 square feet (8.4 meters^2).
[b] Assumed anchors would contact habitats in proportion to their occurrence during the video surveys (9.36% Type A, 13.04% Type B, 13.14 Type D, and 64.47% soft bottom).

The actual sequence of events involved in pipelaying is more complicated than indicated by these assumptions, particularly in Tampa Bay where three HDD operations will be conducted. However, the assumptions are considered a reasonable basis for estimating the number and extent of anchor impacts.

The revised analysis predicts that 20.27 acres (8.20 hectares) would be affected by anchoring. Based on the assumption that habitats would be affected in proportion to their occurrence in the survey area, about 64.1% of the total impacts would be in soft bottom habitats and 35.9% would be in hard/live bottom habitats.

In addition to the direct impacts, each anchor cable will also contact (sweep) the seafloor. The areal extent of anchor sweep impacts has not been estimated. During detailed design, an anchoring plan will be developed that will provide specific procedures to minimize anchor sweep impacts on hard/live bottom habitat.

Seafloor Disturbance – STL Subsea System Installation. Another construction activity that will disturb the seafloor is installation of the STL subsea system, which consists of the STL buoy and pipeline end manifold (PLEM), as well as associated moorings, risers, and umbilicals. Installation will disturb sediments due to placement of components on the seabed, as well as anchoring of construction vessels. Although specific mooring locations around the STL buoys have been changed due to optimization of the mooring configuration (see **Section 3.3**), the number of moorings is unchanged. Therefore, the total area of seafloor impacts during construction is the same as in the original analysis in **Volume II**, **Section 4.3.2** of the **Deepwater Port Application**, which was 0.59 acres (0.23 hectares). However, the relative impact areas for benthic habitat types has changed due to the change in configuration.

Figure 6-3 shows the optimized mooring configuration in relation to hard/live bottom habitat types. At the North Buoy area, none of the moorings would be within a hard/live bottom area. At the South Buoy area, 5 of 8 moorings would be within Type B habitat. **Table 6-5** summarizes impact calculations.

Table 6-5
Area of Benthic Habitats Affected by Installation of the STL Subsea System

Impact Source	North Buoy				South Buoy				Total			
	Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)	Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)	Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)
Placement of STL landing pad	0.13 (0.05)	0	0	0	0.13 (0.05)	0	0	0	0.26 (0.10)	0	0	0
Placement of PLEM	0.02 (0.01)	0	0	0	0.02 (0.01)	0	0	0	0.04 (0.02)	0	0	0
Placement of anchors/piles (8 anchors total)[a]	0.066 (0.027)	0	0	0	0.025 (0.010)	0	0.041 (0.017)	0	0.091 (0.037)	0	0.041 (0.017)	0
Barge anchoring (10 anchors total)[b]	0.074 (0.030)	0	0.008 (0.003)	0	0.033 (0.013)	0	0.050 (0.020)	0	0.107 (0.033)	0	0.058 (0.023)	0
Total	0.29 (0.12)	0	0.01 (0.003)	0	0.21 (0.08)	0	0.09 (0.04)	0	0.50 (0.19)	0	0.10 (0.04)	0

[a] Each mooring assumed to affect 360 square feet (33.4 meters^2). For North Buoy area, assumed all 8 moorings would be in soft bottom. For South Buoy area, assumed 3 of 8 moorings would be in soft bottom, the rest in Type B habitat.
[b] Each barge anchor assumed to affect 360 square feet (33.4 meters^2). For North Buoy area, assumed 9 of 10 barge anchors would be in soft bottom and the other in Type B habitat. For South Buoy area, assumed 4 of 10 barge anchors would be in soft bottom, the rest in Type B habitat.

The landing pad and PLEM will be fixed to the seafloor, either by means of a skirted mud mat or with a suction pile. These components will be placed on soft bottom. The area affected would be 0.02 acres (0.01 hectares) for the PLEM and 0.13 acres (0.05 hectares) for the STL landing pad.

The STL subsea system includes eight anchors or suction piles in both the North Buoy and South Buoy areas. Each anchor or suction pile is assumed to affect an area of 360 square feet (33.4 meters^2). Based on the optimized mooring configuration, all of the North Buoy moorings are assumed to be in soft bottom areas, whereas 5 of 8 moorings in the South Buoy area would be in Type B habitat. The total area affected at both buoy areas would be 0.09 acres (0.04 hectares) of soft bottom and 0.04 acres (0.02 hectares) of hard/live bottom (Type B habitat).

Figure 6-3
Benthic Habitat Types Mapped within the Optimized Buoy Array

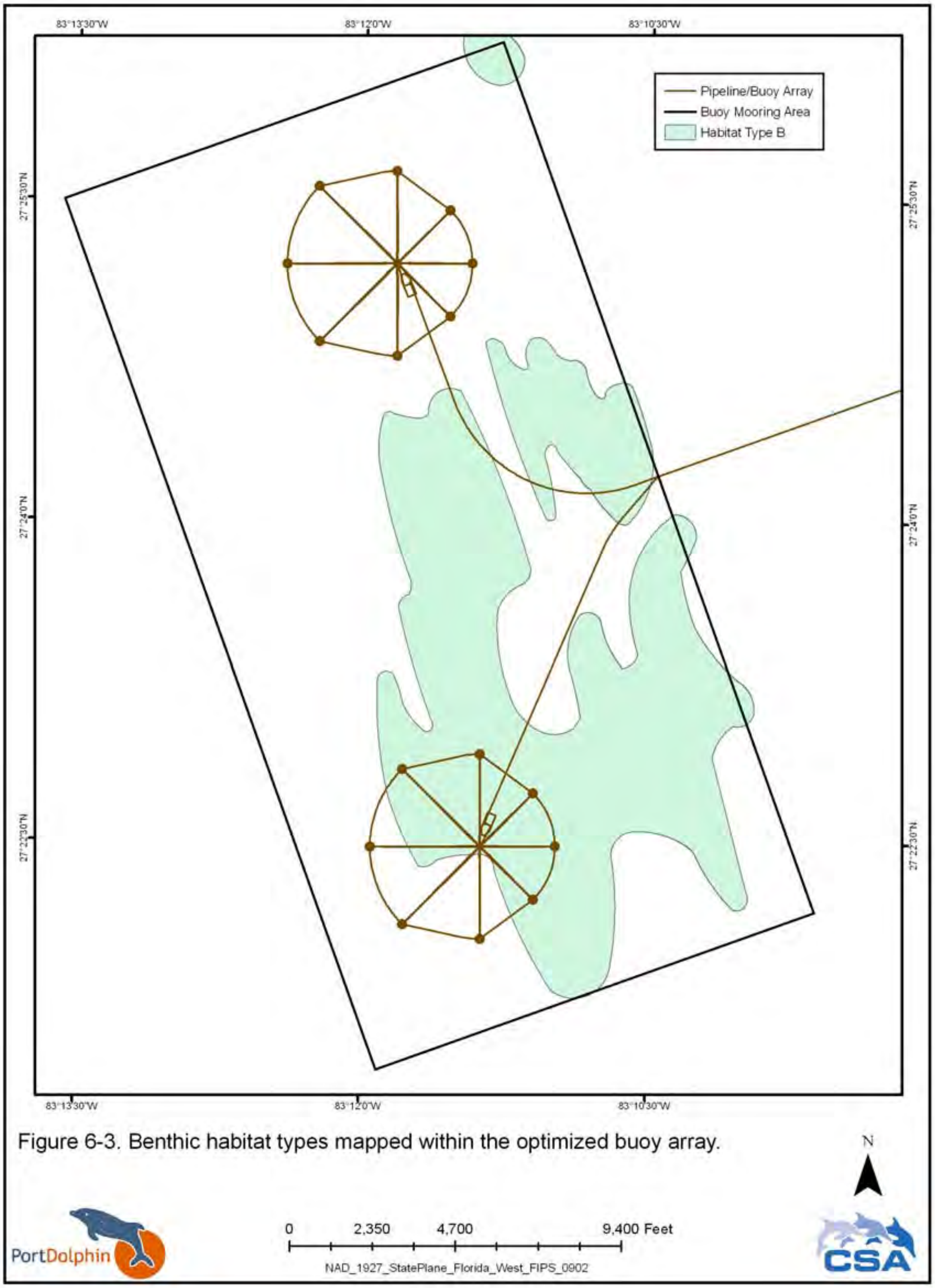


Figure 6-3. Benthic habitat types mapped within the optimized buoy array.

Installation of the STL subsea system is assumed to be conducted by a barge with 10 anchors, each affecting an area of 360 square feet (33.4 $meters^2$). Anchor positions will be adjusted to contact primarily soft bottom, but it is assumed that in the North Buoy area, one of the anchors will be placed on Type B habitat and in the South Buoy area, 6 of 10 anchors will be placed in Type B habitat. The area affected would be 0.11 acres (0.03 hectares) of soft bottom and 0.06 acres (0.02 hectares) of Type B habitat.

The total impact area for STL subsea system installation is estimated to be 0.50 acres (0.19 hectares) of soft bottom and 0.10 acres (0.04 hectares) of Type B habitat.

6.2.2.2 Operations

During operations, the anchor chains/cables from the STL buoys will chafe bottom sediments. The two unloading buoys will each have eight mooring lines consisting of wire rope and chain connecting to anchors or driven piles on the seabed. When not connected to an SRV, the unloading buoy would be submerged below the sea surface. When an SRV arrives, the unloading buoy would be retrieved from its submerged position by means of a winch and recovery line. As the STL buoy moves up and down, some lateral movement of the mooring lines will occur, contacting the seabed.

As noted previously, one of the project design changes in this **Addendum** is the optimization of the mooring pattern around the STL buoys (see **Section 3.3**). The aeral extent of anchor cable sweep has been recalculated based on the maximum observed vessel offset for the optimized mooring system. An SRV size of 217,000 $meters^3$ was used because it would have the largest footprint.

Figure 6-4 shows a horizontal projection of the optimized mooring system. The mooring lines can be divided into three groups based on their length:

- Lines 2, 3, and 4: length = 649 meters (2,129 feet);
- Lines 1 and 5: length = 799 meters (2,622 feet); and
- Lines 6, 7, and 8: length = 949 meters (3,114 feet).

A lateral offset of ±7 meters was estimated at a distance of 100 meters (328 feet) from the buoy center (**Figure 6-5**). The area affected by “cable sweep” was calculated for each line group and summarized to find the total impact area (**Table 6-6**).

Figure 6-4
Horizontal Projection of Optimized Mooring System

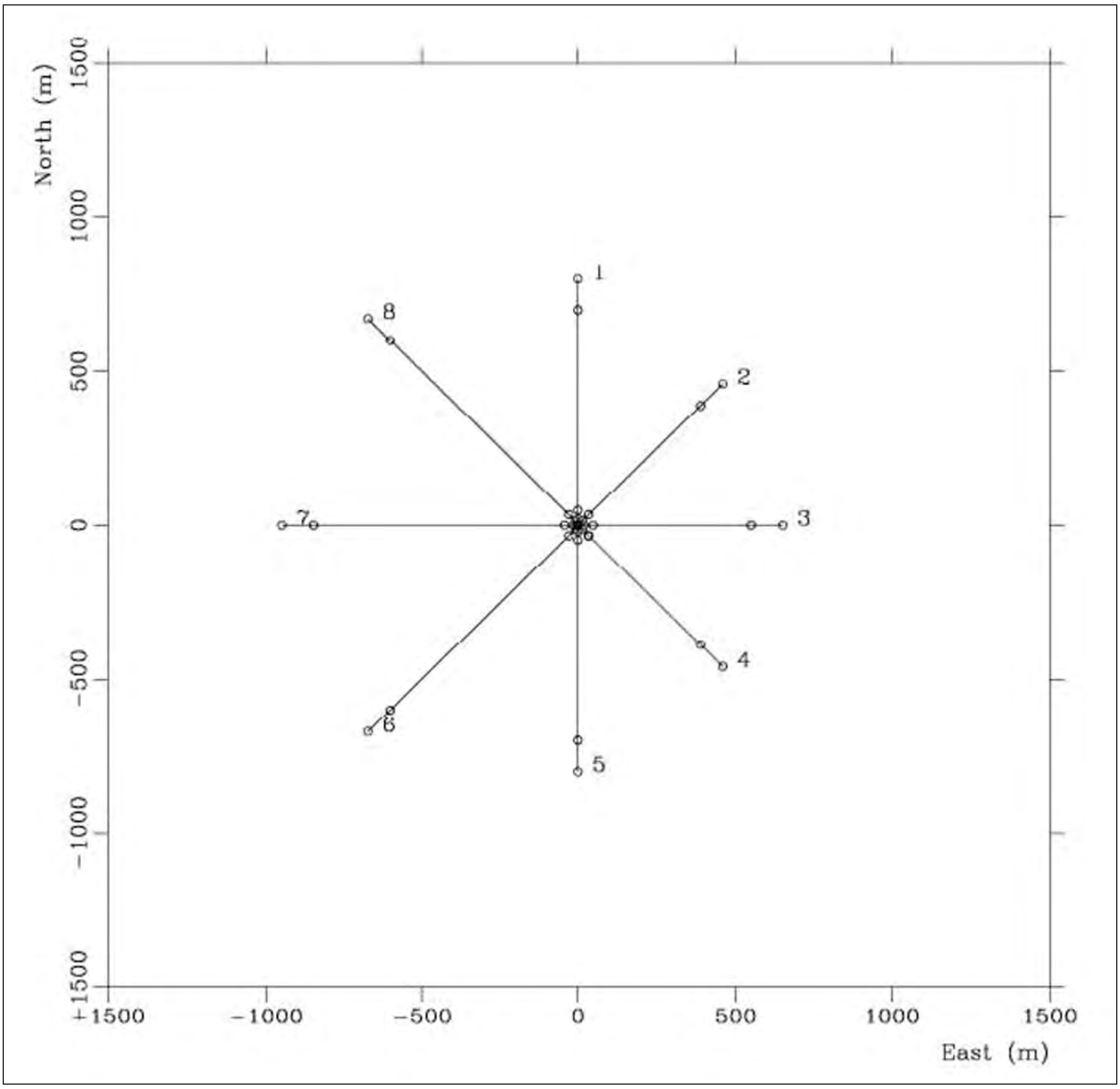


Figure 6-5
Diagram of Seafloor Impact Area for Mooring Lines 6, 7, and 8
The Diagram Would be Similar for the Other Two Line Groups,
Except for the Shorter Line Length

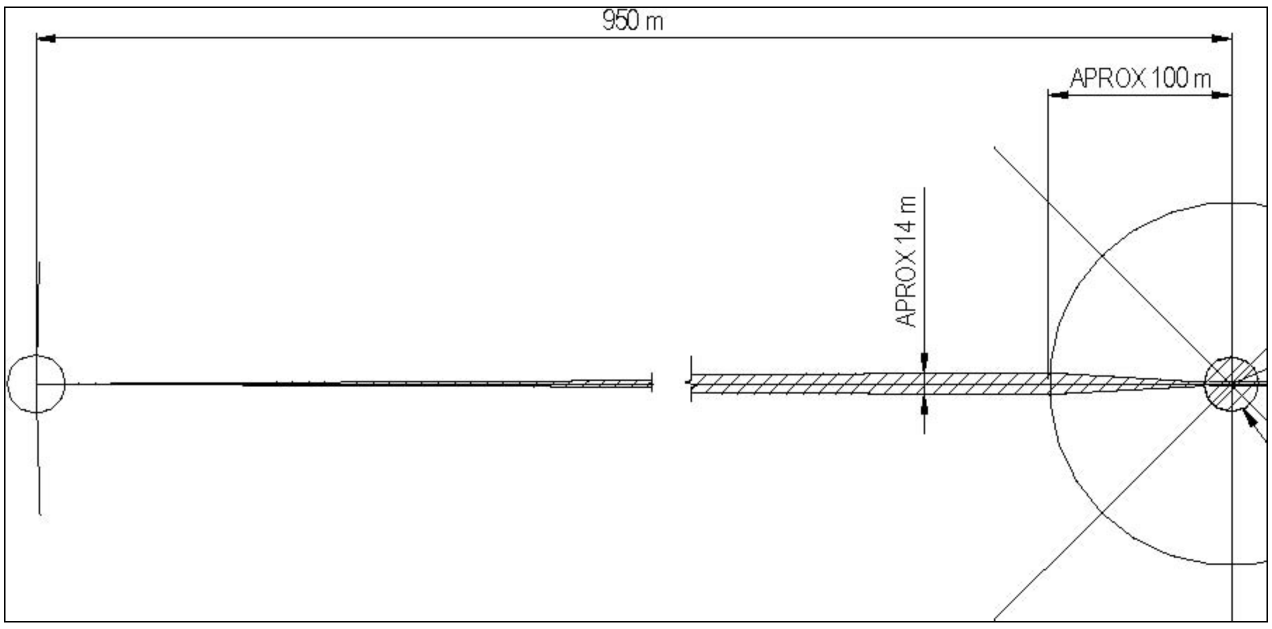


Table 6-6
Seafloor Area Affected by Mooring System Cables at Each Buoy Area

Mooring Line No.	Vessel Offset (meters)	Distance from Center (meters)	Area Affected (per buoy area)	
			Hectares	Acres
2, 3, 4	± 7	649	1.36	3.37
1, 5	± 7	799	1.12	2.76
6, 7, 8	± 7	949	1.99	4.92
		Total	4.47	11.05

Based on these calculations, the total area affected by cable sweep would be 11.05 acres (4.47 hectares) per loading buoy, or a total of approximately 22.1 acres (8.94 hectares).

As shown previously, the seafloor around the North and South Buoy locations includes both soft bottom and hard bottom areas (**Figure 6-3**). At the North Buoy area, none of the moorings would be within a hard/live bottom area. At the South Buoy area, mooring numbers 1, 2, 3, 4, and 8 would be within Type B habitat and mooring numbers 5, 6, and 7 would be in soft bottom areas. **Table 6-7** summarizes the estimated habitat areas that would be contacted by anchor sweep.

Table 6-7
Area of Benthic Habitat Estimated to be Affected by Anchor Sweep During Routine Operations[a]

Impact Source	North Buoy		South Buoy		Total	
	Soft Bottom acres (hectares)	Type B acres (hectares)	Soft Bottom acres (hectares)	Type B acres (hectares)	Soft Bottom acres (hectares)	Type B acres (hectares)
Anchor sweep (STL buoy)	11.05 (4.47)	0	4.66 (1.89)	6.39 (2.58)	15.71 (6.36)	6.39 (2.58)

[a] In North buoy area, assumed all 8 moorings would sweep soft bottom areas; in South Buoy area, assumed mooring lines 5, 6, and 7 would sweep soft bottom and the rest would sweep Type B habitat. Used areal estimates for anchor sweep of each mooring line from **Table 6-6**.

In **Volume II, Section 4.3.2** of the **Deepwater Port Application**, the total seafloor area affected by anchor sweep at both North and South buoys combined was estimated to be about 30 acres (12.14 hectares). The revised estimate is approximately 22.1 acres (8.94 hectares). The area of seafloor disturbance is about 25% less than the original estimate and represents less than 1% of the seafloor within each buoy area. The resulting impacts on benthic communities would be minor for soft bottom and significant for hard/live bottom habitat. During detailed design, the STL mooring pattern will be adjusted to minimize contact with hard/live bottom areas to the extent practicable, and the extent of hard/live bottom impacts may be less than estimated here.

6.2.2.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on benthic communities as discussed in **Volume II, Section 4.3.2** of the **Deepwater Port Application**.

6.2.2.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on benthic communities as discussed in **Volume II**, **Section 4.3.2** of the **Deepwater Port Application**.

6.2.3 Plankton

Plankton assemblages are discussed in **Volume II, Section 4.2.3** of the **Deepwater Port Application**. The relevant impact factors for project design changes are turbidity due to sediment resuspension, hydrostatic test water discharges, and dewatering discharges. Other impact factors discussed in **Volume II, Section 4.3.3** of the **Deepwater Port Application** are irrelevant to the project design changes or they would not differ in any meaningful way from those previously discussed in the **Deepwater Port Application**.

6.2.3.1 Construction

Turbidity from Pipeline Installation. Pipeline installation will be the largest source of turbidity. Both the trenching *per se* and anchoring of the lay barge are sources of turbidity. For conventional pipeline jetting, it has been estimated that about 5,000 $meters^3$ of sediment is resuspended for each kilometer of pipeline jetted (MMS, 2001). The plowing method is expected to produce much less turbidity, but the amount of resuspension has not been quantified.

The areal extent of seafloor disturbance during pipeline installation within Tampa Bay has increased due to re-routing of the pipeline around the Aquatic Preserve. However, the total length of the pipeline (excluding portions drilled under the seafloor using HDD) has decreased by about 0.5%. The analysis in **Volume II**, **Section 4.3.3** of the **Deepwater Port Application** concluded that turbidity impacts on plankton during construction would be minor. The slight increase in turbidity due to the increased pipeline length would not change the conclusion of the impact analysis.

Hydrostatic Test Water Intake and Discharge. During the construction phase, seawater will be used for hydrostatic testing of the offshore pipeline and flowlines. The analysis in **Volume II**, **Section 4.3.3** of the **Deepwater Port Application** concluded that hydrostatic test water intake and discharge would have little or no impact on plankton, and the impacts were considered negligible.

The following Project Design changes are relevant:

- The estimated volume of water has increased from 12.3 million gallons to 23.9 million gallons due to the increased length of the nearshore portion of the Revised Preferred Route and the fact that the pipeline would be filled twice (i.e., there was an error in the original calculation).

- The discharge will occur offshore from a marine vessel at one of the STL buoy locations rather than at Port Manatee within Tampa Bay.
- Originally, the hydrotest water was expected to contain biocides, oxygen scavenger, and a fluorescent dye. The water was to be treated with industrial grade hydrogen peroxide to render the effluent non-toxic prior to discharge. The revised plan includes an "environmentally benign" treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharge would comply with NPDES permit requirements and is expected to be non-toxic upon discharge.

The project design changes would not affect the conclusion of the impact analysis. Although the volume is greater, the discharge is expected to disperse more rapidly offshore than in Tampa Bay because of stronger ocean currents and the larger volume of receiving waters. The discharge is expected to be non-toxic, and any impacts on plankton would be negligible.

Dewatering Discharge from Carrier Pipe. During the installation of the two HDD crossings of the Gulfstream pipeline, there will be two subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe. The volumes are estimated to be approximately 81,000 gallons and 179,000 gallons. The water would include an "environmentally benign" treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharges would comply with NPDES permit requirements and are expected to be non-toxic. Therefore, the discharge would have little or no impact on plankton, and impacts are considered negligible.

6.2.3.2 Operations

None of the project design changes would significantly alter the potential impacts of routine Port operations on plankton as discussed in **Volume II**, **Section 4.3.3** of the **Deepwater Port Application**.

6.2.3.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on plankton as discussed in **Volume II**, **Section 4.3.3** of the **Deepwater Port Application**.

6.2.3.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on plankton as discussed in **Volume II**, **Section 4.3.3** of the **Deepwater Port Application**.

6.2.4 Marine Mammals

Three marine mammals are most likely to occur in the project area (see **Volume II**, **Section 4.2.4** of the **Deepwater Port Application**). Bottlenose dolphins and Atlantic spotted dolphins are likely to be present in continental shelf and coastal waters, including the STL buoy locations and along the pipeline route. The Florida manatee occurs primarily in coastal waters within Tampa Bay and would not be expected to occur at the STL buoy locations or along open-water, offshore portions of the pipeline route.

As discussed in **Volume II**, **Section 4.3.4** of the **Deepwater Port Application**, factors potentially affecting marine mammals include vessel traffic, turbidity and discharges, underwater noise, debris (entanglement/ingestion), and accidental spills. Project design changes will result in a slight increase in construction vessel traffic, turbidity, and noise during construction. Impacts during routine Port operations and decommissioning would be essentially unchanged. The risk of debris-related impacts and accidental spills would also be unchanged.

6.2.4.1 Construction

The main potential impact during construction is the risk of a vessel striking a marine mammal such as a manatee within coastal waters. Project design changes would result in a slight increase in vessel traffic due to the two additional HDD crossings within Tampa Bay. However, the construction vessels would be of the same size and type previously identified, and they would be moving slowly. Neither the Original Preferred Route nor the Revised Preferred Route around the Terra Ceia Aquatic Preserve would pass through any manatee protection zones. The **Deepwater Port Application** included extensive mitigation measures to avoid vessel strikes. In addition, further detailed measures have been developed in “Revised Appendix F: Mitigation Measures” submitted to the USCG in response to completeness comments.

The analysis in **Volume II**, **Section 4.3.4** of the **Deepwater Port Application** concluded that impacts of vessel traffic on marine mammals would be minor. Taking into account the proposed mitigation measures, the slight increase in construction vessel traffic would not change this conclusion.

Project design changes would also result in slight increases in turbidity (due to the pipeline re-route) and underwater noise (due to the addition of a few more construction vessels for the HDD crossings). These changes would not significantly alter the impacts on marine mammals, which are considered negligible to minor in the original analysis.

6.2.4.2 Operations

None of the project design changes would significantly alter the potential impacts of routine operations on marine mammals as discussed in **Volume II**, **Section 4.3.4** of the **Deepwater Port Application**.

6.2.4.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on marine mammals as discussed in **Volume II**, **Section 4.3.4** of the **Deepwater Port Application**.

6.2.4.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on marine mammals as discussed in **Volume II**, **Section 4.3.4** of the **Deepwater Port Application**.

6.2.5 Sea Turtles

Five species of sea turtles, the green, hawksbill, Kemp's ridley, leatherback, and loggerhead, are known to inhabit the eastern Gulf of Mexico (see **Volume II**, **Section 4.2.5** of the **Deepwater Port Application**). Within Tampa Bay, four species are likely to be present, with the following apparent order of abundance: loggerhead, Kemp's ridley, green, and hawksbill. Tampa Bay serves as habitat for several life history stages of marine turtles, including foraging adults, foraging juveniles and subadults, and nesting adult females. Gulf waters adjacent to Tampa Bay can be expected to be visited by both reproductive males and females during the summer mating and nesting season. Nearly all ocean-facing (Gulf) sandy beaches in the Tampa Bay area are used as nesting habitat by sea turtles, primarily loggerheads. Occasional green turtle nesting has also been recorded. Other sea turtles are not expected to nest in the area.

As discussed in **Volume II**, **Section 4.3.5** of the **Deepwater Port Application**, factors potentially affecting sea turtles include vessel traffic, turbidity and discharges, entrainment/impingement during seawater intake, underwater noise, lighting, debris (entanglement/ingestion), and accidental spills. Project design changes will result in a slight increase in construction vessel traffic during construction. Impacts during routine Port operations and decommissioning would be essentially unchanged. There is no change in seawater intake and therefore the risk of entrainment/impingement would not differ. The risk of debris-related impacts and accidental spills would also be unchanged.

6.2.5.1 Construction

The main potential impact during construction is the risk of a vessel striking a sea turtle. Project design changes would result in a slight increase in vessel traffic due to the two additional HDD crossings within Tampa Bay. However, the construction vessels would be of the same size and type previously identified, and they would be moving slowly. The **Deepwater Port Application** included extensive mitigation measures to avoid vessel strikes. In addition, further detailed measures have been developed in "**Revised Appendix F: Mitigation Measures**" submitted to the USCG in response to completeness comments.

The analysis in **Volume II**, **Section 4.3.5** of the **Deepwater Port Application** concluded that impacts of vessel traffic on sea turtles would be minor. Taking into account the proposed mitigation measures, the slight increase in construction vessel traffic would not change this conclusion.

Project design changes would also result in slight increase in turbidity (due to the pipeline re-route) and underwater noise (due to the addition of a few more construction vessels for the HDD crossings). These changes would not significantly alter the impacts on sea turtles, which are considered negligible to minor in the original analysis.

6.2.5.2 Operations

None of the project design changes would significantly alter the potential impacts of routine operations on sea turtles as discussed in **Volume II**, **Section 4.3.5** of the **Deepwater Port Application**.

6.2.5.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on sea turtles as discussed in **Volume II**, **Section 4.3.5** of the **Deepwater Port Application**.

6.2.5.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on sea turtles as discussed in **Volume II**, **Section 4.3.5** of the **Deepwater Port Application**.

6.2.6 Marine and Coastal Birds

The project area is inhabited by a diverse assemblage of resident and migratory birds including seabirds, shorebirds, wetland birds, and waterfowl (see **Volume II, Section 4.2.6** of the **Deepwater Port Application**). Although five endangered or threatened bird species occur in the area, none are likely to be affected by any project activities.

As discussed in the **Volume II**, **Section 4.3.6** of the **Deepwater Port Application**, sources of potential impacts on other marine and coastal birds include lighting on vessels during construction, operations, and decommissioning; disturbance by nearshore vessel traffic during construction; and debris (entanglement/ingestion). In addition, marine and coastal birds could be affected in the unlikely event of a minor hydrocarbon spill, LNG release, or natural gas release.

Project design changes will result in a slight increase in construction vessel traffic during construction. Impacts during routine Port operations and decommissioning would be essentially unchanged. The risk of debris-related impacts and accidental spills would be unchanged.

6.2.6.1 Construction

The main potential impact during construction is disturbance due to vessel traffic in coastal waters. Project design changes would result in a slight increase in vessel traffic due to the two additional HDD crossings within Tampa Bay. However, the construction vessels would be of the same size and type previously identified, and they would be moving slowly. Several mitigation measures were proposed in **Volume II**, **Section 4.3.6** of the **Deepwater Port Application** to minimize disturbance. The original analysis concluded that impacts of vessel traffic on marine and coastal birds would be minor. In addition, the two water-to-water HDDs are located more than 2.5 miles from Manbirdtee Key. Taking into account the proposed mitigation measures, the slight increase in construction vessel traffic would not change this conclusion.

6.2.6.2 Operations

None of the project design changes would significantly alter the potential impacts of routine operations on marine and coastal birds as discussed in **Volume II**, **Section 4.3.6** of the **Deepwater Port Application**.

6.2.6.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on marine and coastal birds as discussed in **Volume II**, **Section 4.3.6** of the **Deepwater Port Application**.

6.2.6.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on marine and coastal birds as discussed in **Volume II, Section 4.3.6** of the **Deepwater Port Application**.

6.2.7 Threatened and Endangered Species

Threatened and endangered species that may occur in and near the area include the Florida manatee, five sea turtle species, and five bird species, as discussed in **Volume II**, **Section 4.2.7** of the **Deepwater Port Application**.

Potential impacts on threatened and endangered marine mammals are discussed in **Volume II**, **Section 4.3.7** of the **Deepwater Port Application**. Impacts of project design changes on marine mammals and sea turtles have been discussed in the preceding sections. None of the project design changes would significantly alter the potential impacts on these animals.

As discussed in **Volume II**, **Section 4.3.7** of the **Deepwater Port Application**, the project is not expected to have any impact on threatened or endangered birds. None of the project design changes would significantly alter this conclusion.

6.2.8 Aquatic Preserves and Protected Areas

Within the Tampa Bay estuary, there are four Aquatic Preserves (Boca Ciega Bay, Cockroach Bay, Pinellas County, and Terra Ceia). As discussed in **Volume II**, **Section 4.3.8** of the **Deepwater Port Application**, the project is not near or expected to have any impact on Boca Ciega Bay, Cockroach Bay, or Pinellas Count Aquatic Preserves.

As originally proposed, the three alternative pipeline routes would converge within Tampa Bay and pass through the Terra Ceia Aquatic Preserve before reaching the landfall at Port Manatee. The combined pipeline route would enter Terra Ceia Aquatic Preserve from the northwest and traverse primarily soft bottom and some hard/live bottom communities for 3.03 miles. The pipeline would exit the preserve and traverse another 3.63 miles along the northern boundary before re-entering the preserve at the northeast corner for 0.63 miles.

As discussed in **Section 3.1**, the revised nearshore route (Alternative A) avoids entering the Terra Ceia Aquatic Preserve. **Figure 6-6** shows the Revised Preferred Route. The pipeline route would be about 530 meters (1,740 feet) from the northern edge of the Aquatic Preserve. Near the approach to Port Manatee along the northeastern edge of the Aquatic Preserve, the minimum distance would be 37 meters (121 feet).

Impacts on the Terra Ceia Aquatic Preserve would occur only during construction. There will be no activities in Terra Ceia during routine operations or decommissioning.

6.2.8.1 Construction

Potential sources of impact to the Terra Ceia Aquatic Preserve relevant to the project design changes include physical disturbance to the seafloor, turbidity caused by sediment resuspension, and discharges of hydrostatic test water and treated water from carrier pipes. Discharges from construction vessels are not expected to have any impact on the Aquatic Preserve.

Seafloor Disturbance. The Original Preferred Route passed through the Terra Ceia Aquatic Preserve for 3.66 miles (5.89 kilometers). Both the pipeline installation *per se* (plowing) and the anchoring of pipelaying barges would have disturbed the seafloor within the Aquatic Preserve.

The Revised Preferred Route would avoid disturbing sediments within the Aquatic Preserve. No plowing, dredging, or anchoring will occur within the Aquatic Preserve. In the shore approach area near Port Manatee where the pipeline is closest to the Aquatic Preserve, a jack-up barge will be used that has legs that rest directly on the seafloor, so there will no anchors extending into the Aquatic Preserve. Therefore, seafloor disturbance impacts are negligible.

Figure 6-6
Revised Pipeline Route in Relation to Terra Ceia Aquatic Preserve

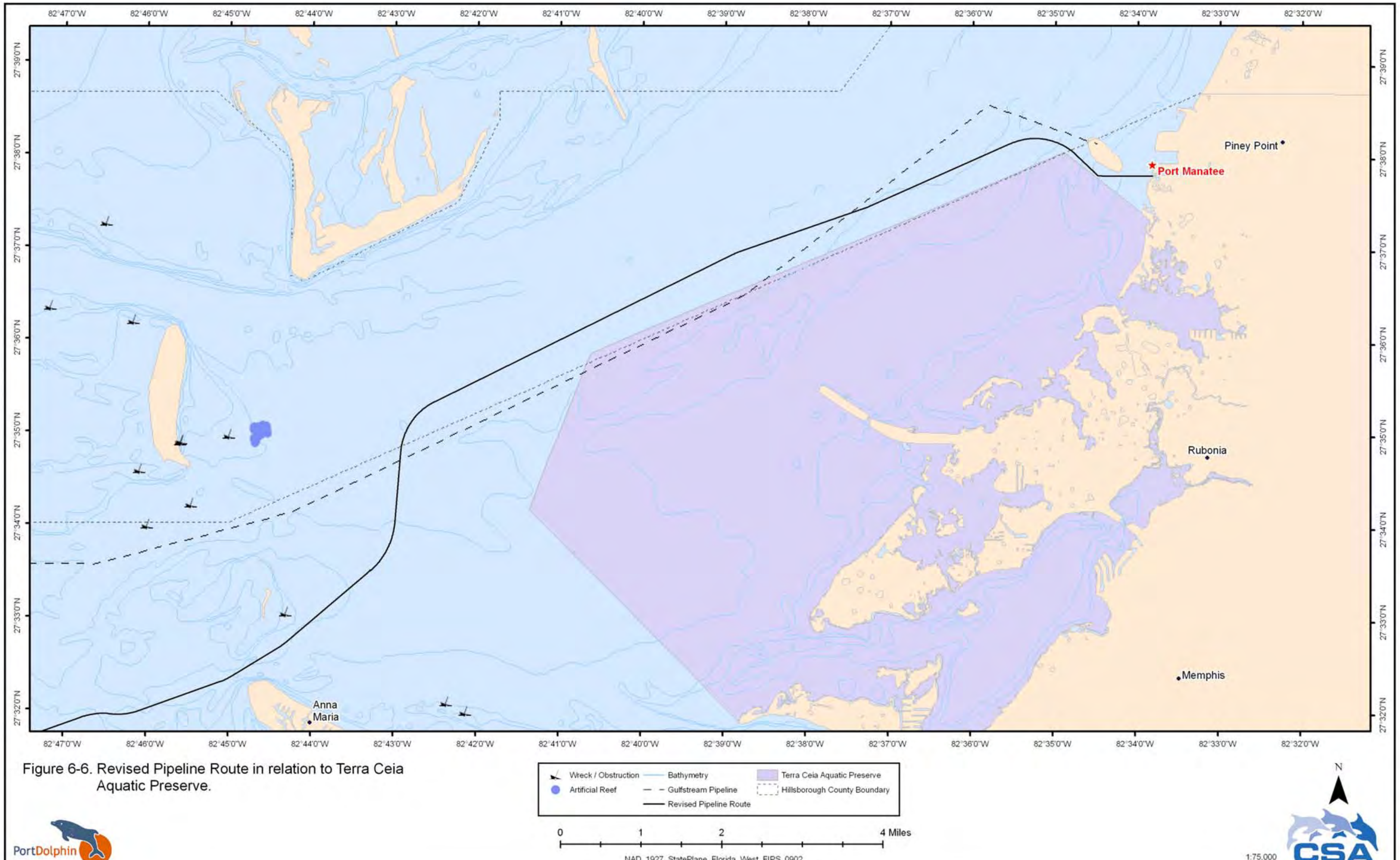


Figure 6-6. Revised Pipeline Route in relation to Terra Ceia Aquatic Preserve.

Turbidity. For most of its length the pipeline will be buried using a plowing technique. Both the trenching *per se* and anchoring of the lay barge are sources of turbidity. For conventional pipeline jetting, it has been estimated that about 5,000 meters^3 of sediment is resuspended for each kilometer of pipeline jetted (MMS, 2001). The plowing method is expected to produce much less turbidity, but the amount of resuspension has not been quantified.

The areal extent of seafloor disturbance and turbidity during pipeline installation within Tampa Bay has increased due to re-routing of the pipeline around the Aquatic Preserve. However, considering the pipeline route as a whole, the total length of the pipeline (excluding portions drilled under the seafloor using HDD) has decreased by about 0.5%. However, in the nearshore area from the re-route point to the HDD exit near Port Manatee, the distance expected to be buried by plow has increased from 9,337 to 13,935 meters (30,626 to 45,706 feet), or about a 62% increase. The total amount of sediment resuspension is likely to be greater, but most of the turbidity will occur in waters outside of the Aquatic Preserve.

Gulfstream modeled the dispersion of turbidity plumes for a pipeline installation in Tampa Bay (FERC and MMS, 2001). However, only conventional jetting was modeled, which produces much more turbidity than the plowing method. The modeling predicted a plume of suspended solids extending approximately 1,200 meters (3,937 feet) down current of the trenching site. A suspended solids concentration of 30 mg/L was estimated to extend about 400 meters (1,312 feet) from the trenching site. As noted previously, the pipeline route would be about 530 meters (1,740 feet) from the northern edge of the Aquatic Preserve. Near the approach to Port Manatee along the eastern edge of the Aquatic Preserve, the minimum distance would be 37 meters (121 feet).

All Aquatic Preserves are designated as Outstanding Florida Waters (OFWs), which are waters worthy of special protection because of their natural attributes. OFW standards prohibit discharges that would lower ambient water quality, although there is a provision for temporary lowering of water quality during construction activities (with special restrictions). Based on the preceding discussion of turbidity plumes, it will be necessary to use turbidity curtains and/or other mitigation measures to minimize suspended solids. In addition, a temporary variance will be applied for to ensure that there is no violation of OFW standards.

Hydrostatic Test Water Intake and Discharge. During the construction phase, seawater will be used for hydrostatic testing of the offshore pipeline and flowlines. Originally, the hydrostatic test water discharge was to occur at Port Manatee in Tampa Bay. The analysis in **Volume II, Section 4.3.8** of the **Deepwater Port Application** concluded that impacts on the Terra Ceia Aquatic Preserve would be negligible because the discharge would occur outside the Terra Ceia Aquatic Preserve and the water would be non-toxic. Seawater intake *per se* was not expected to have an impact on the aquatic preserve since the water would not be drawn from waters within the Aquatic Preserve.

Due to Project Design changes, the hydrostatic test water discharge is now planned to occur offshore from a marine vessel at one of the STL buoy locations rather than at Port Manatee. The discharge would comply with NPDES permit requirements and is expected to be non-toxic upon discharge. Because the discharge would occur well offshore, potential impacts on the Aquatic Preserve are negligible.

Dewatering Discharge from Carrier Pipe. During the installation of the two HDD crossings of the Gulfstream pipeline, there will be two subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe. The volumes are estimated to be approximately 81,000 gallons and 179,000 gallons. The water would include an “environmentally benign” treatment chemical (HydroHib P) that is not expected to require any treatment prior to discharge. The discharges would comply with NPDES permit requirements and are expected to be non-toxic. Because the discharges will occur outside the Terra Ceia Aquatic Preserve and the water will be non-toxic, impacts on the Terra Ceia Aquatic Preserve or any other Aquatic Preserve are considered negligible.

6.2.8.2 Operations

As discussed in **Volume II, Section 4.3.8** of the **Deepwater Port Application**, routine operations are not expected to have any impact on Aquatic Preserves. None of the project design changes would alter this conclusion.

6.2.8.3 Decommissioning

As discussed in **Volume II, Section 4.3.8** of the **Deepwater Port Application**, decommissioning is not expected to have any impact on Aquatic Preserves. None of the project design changes would alter this conclusion.

6.2.8.4 Accidents and Upsets

As discussed in **Volume II, Section 4.3.8** of the **Deepwater Port Application**, accidents and upsets are not expected to have any impact on Aquatic Preserves. None of the project design changes would alter this conclusion.

6.3 Summary of Impacts

Table 6-8 summarizes potential impacts on marine resources. Impacts are rated as significant, minor, or negligible using the following criteria:

- **Significant –** likely to result in violation of applicable laws, regulations, or standards; death, injury, disruption of critical activities, or adverse modifications to the critical habitat of an endangered or threatened species; mortalities, injuries, or habitat degradation of non-endangered wildlife in sufficient numbers to adversely affect their population; and/or broad-scale, persistent shifts in species composition, ecological relationships, or ecosystem function.

- **Minor** – changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible** – changes that are unlikely to be noticed or measurable against background conditions.

The table also categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible. Reversibility is based on the population-level impact rather than the individual organism (e.g., individuals may be killed, but the population would recover).

The following are the key changes in impacts caused by project design changes:

- **Avoidance of Terra Ceia Aquatic Preserve**. The nearshore portion of the Revised Preferred Route would avoid direct seafloor disturbance within the Terra Ceia Aquatic Preserve, reducing this impact from significant to negligible. However, pipeline installation in nearby areas could result in temporary turbidity within the Aquatic Preserve. Turbidity curtains or other measures will be implemented to minimize these impacts where the pipeline route passes near the Aquatic Preserve. In addition, a temporary variance from OFW standards will be applied for to ensure there is no violation. Taking mitigation into account, the impacts are reduced from significant to minor.

- **Increased seafloor disturbance due to pipeline re-route**. The areal extent of seafloor impacts for the revised pipeline corridor would be about 9% greater than those calculated in the original **Deepwater Port Application**. This change is due partly to the changed pipeline route, but also reflects corrections to the calculations since the original estimates were made. Most of the increased area is soft bottom habitat. The overall impact ratings are unchanged (minor for soft bottom, significant for hard/live bottom habitats).

- **Optimized buoy mooring arrangement**. The mooring pattern around the STL buoys has been optimized, resulting in a smaller seafloor footprint. Installation is expected to affect about the same area of seafloor as originally estimated. However, anchor sweep impacts on the seafloor during operations would be about 25% less under the optimized arrangement, resulting in a corresponding decrease in impacts on benthic habitats and EFH. For both construction impacts and anchor sweep during operations, the relative proportion of benthic habitat types affected would change slightly (less soft bottom and more Type B habitat). The overall impact ratings are unchanged (minor for soft bottom, significant for hard/live bottom).

- **Hydrotest discharge**. The volume of hydrostatic test water will be about twice the original estimate due to a slight increase in pipeline length and the fact that the pipeline will be filled twice (i.e., there was an error in the original calculation). The hydrotest discharge location has also been changed to an offshore location rather than at Port Manatee, and the revised plan includes an "environmentally benign" treatment chemical that is not expected to require any treatment prior to discharge. The overall impact ratings for fish, EFH, and plankton are unchanged (negligible).

- **Dewatering discharges**. There will be two new subsea discharges of filtered, treated seawater from dewatering of short lengths of carrier pipe used for the two HDD crossings of the Gulstream pipeline. The water would include an "environmentally benign" treatment chemical that is not expected to require any treatment prior to discharge. The discharges would comply with NPDES permit requirements and are expected to be non-toxic. The impacts on fish, EFH, and plankton are considered negligible.

- **Increased vessel traffic**. Project design changes would result in a slight increase in vessel traffic due to the two additional HDD crossings within Tampa Bay. However, the construction vessels would be of the same size and type previously identified, and they would be moving slowly. Neither the Original Preferred Route nor the revised route around the Terra Ceia Aquatic Preserve would pass through any manatee protection zones. The **Deepwater Port Application** included extensive mitigation measures to avoid vessel strikes on marine mammals and turtles. In addition, further detailed measures have been developed in "Revised Appendix F: Mitigation Measures" submitted to the USCG in response to completeness comments. The overall impact ratings remain unchanged (minor).

Table 6-8
Summary of Impacts to Marine Resources Due to Project Design Changes

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Fish and Essential Fish Habitat					
Construction	Physical disturbance to benthic fish habitat during pipeline installation	Areal extent of seafloor disturbance increased	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard/live bottom)	• Hard/live bottom habitats within the pipeline corridor and in STL buoy locations have been mapped and avoided to the extent practicable • During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard/live bottom habitat • Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep • Anchoring on areas of significant benthic resources (i.e., Type A habitat) will be avoided to the extent practicable • During installation, vessel sizes will be selected to provide vessels adequate to perform the work, but minimized to reduce the number and type of anchors, where possible
	Reduced water clarity due to sediment resuspension/turbidity during pipeline installation	Areal extent of turbidity increased due to increased seafloor disturbance	• Likely • Direct • Reversible	Negligible to Minor	• Use of a pipeline plow to bury the pipeline will produce much less turbidity than conventional jetting or dredging because it does not fluidize bottom sediments. • Turbidity curtains or other measures will be implemented to minimize turbidity in certain areas (e.g., near Terra Ceia AP)
	Hydrostatic test water intake and discharge	Discharge will now occur offshore rather than in Tampa Bay; volume about twice the original estimate	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic) • Offshore discharge will enhance rapid dispersion
	Dewatering discharge water from carrier pipe	New discharges due to two HDD crossings of Gulfstream pipeline	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic)

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Operations	Physical disturbance to benthic fish habitat due to movement of anchor lines as STL buoy is raised and lowered	Areal extent decreased due to optimization of mooring pattern around buoys	• Likely • Direct • Reversible	Negligible	• During detailed design, the STL mooring pattern will be adjusted to minimize contact with hard/live bottom areas to the extent practicable.
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Benthic Communities					
Construction	Physical disturbance to benthic communities during pipeline installation and STL buoy installation	Areal extent of seafloor impacts along pipeline route increased	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard/live bottom)	• Hard/live bottom habitats within the pipeline corridor and in STL buoy locations have been mapped and avoided to the extent practicable • During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard/live bottom habitat • Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep • Anchoring on areas of significant benthic resources (i.e., Type A habitat) will be avoided to the extent practicable • During installation, vessel sizes will be selected to provide vessels adequate to perform the work, but minimized to reduce the number and type of anchors, where possible
Operations	Physical disturbance to benthic communities due to movement of anchor lines as STL buoy is raised and lowered	Areal extent decreased due to optimization of mooring pattern around buoys	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard/live bottom)	• During detailed design, the STL mooring pattern will be adjusted to minimize contact with hard/live bottom areas to the extent practicable
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Plankton					
Construction	Reduced water clarity due to sediment resuspension/turbidity during pipeline installation	Areal extent of turbidity increased due to increased seafloor disturbance	• Likely • Direct • Reversible	Negligible to Minor	• Use of a pipeline plow to bury the pipeline will produce much less turbidity than conventional jetting or dredging because it does not fluidize bottom sediments • Turbidity curtains or other measures will be implemented to minimize turbidity in certain areas (e.g., near Terra Ceia AP)
	Hydrostatic test water intake and discharge	Discharge will now occur offshore rather than in Tampa Bay; volume about twice the original estimate	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic) • Offshore discharge will enhance rapid dispersion
	Dewatering discharge water from carrier pipe	New discharge due to two HDD crossings of Gulfstream pipeline	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic)
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Marine Mammals					
Construction	Risk of a vessel striking a manatee or dolphin	Slight increase in vessel traffic due to two HDD crossings of Gulfstream pipeline; however, no change in vessel size/type and they would not be operating in manatee protection zones	• Unlikely • Direct • Reversible	Minor	• Extensive mitigation program as detailed in the **Deepwater Port Application** and “Revised Appendix F: Mitigation Measures” submitted in response to completeness comment
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Sea Turtles					
Construction	Risk of a vessel striking a sea turtle	Slight increase in vessel traffic due to two HDD crossings of Gulfstream pipeline; however, no change in vessel size/type	• Unlikely • Direct • Reversible	Minor	• Extensive mitigation program as detailed in the **Deepwater Port Application** and "Revised Appendix F: Mitigation Measures" submitted in response to completeness comments
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Marine and Coastal Birds					
Construction	Vessel traffic (disturbance)	Slight increase in vessel traffic due to two HDD crossings of Gulfstream pipeline; however, no change in vessel size/type	• Likely • Direct • Reversible	Minor	• Plan vessel transit routes to avoid sensitive receptors (e.g., bird colonies) to the extent feasible • Limit the number of vessel trips by using full-capacity crew boats as much as possible • To minimize excessive noise, maintain vessel engines and equipment in accordance with manufacturer recommendations; use sound-muffling devices or engine covers where appropriate, and turn off engines and equipment when not in use
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Threatened and Endangered Species					
Construction	Risk of a vessel striking a manatee, dolphin, or sea turtle	Slight increase in vessel traffic due to two HDD crossings of Gulfstream pipeline; however, no change in vessel size/type	• Unlikely • Direct • Reversible	Minor	• Extensive mitigation program as detailed in the **Deepwater Port Application** and "Revised Appendix F: Mitigation Measures" submitted in response to completeness comments
	Disturbance of endangered or threatened coastal birds	Slight increase in vessel traffic due to two HDD crossings of Gulfstream pipeline; however, no change in vessel size/type	• Unlikely • Direct • Reversible	Minor	• See measures for Marine and Coastal Birds, **Volume II**, **Section 4.3.7** of the **Deepwater Port Application**
Operations	*No change*	*No change*	*No change*	*No change*	*No change*

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Aquatic Preserves and Protected Areas					
Construction	Seafloor disturbance due to plowing and anchoring during pipeline installation	Direct seafloor impact avoided due to re-routing of the pipeline around the Terra Ceia Aquatic Preserve	• Unlikely • Direct • Reversible	Negligible	• Use of a pipeline plow to bury the pipeline will produce much less turbidity than conventional jetting or dredging because it does not fluidize bottom sediments • Turbidity curtains or other measures will be implemented to minimize turbidity in certain areas (e.g., near Terra Ceia AP)
	Reduced water clarity due to sediment resuspension/turbidity	Turbidity impacts lessened by re-routing of the pipeline around the Terra Ceia Aquatic Preserve	• Likely • Direct • Reversible	Minor	• Use of a pipeline plow to bury the pipeline will produce much less turbidity than conventional jetting or dredging because it does not fluidize bottom sediments • Turbidity curtains or other measures will be implemented to minimize turbidity where the pipeline route passes near the Terra Ceia AP • A temporary variance from OFW standards will be applied for to ensure there is no violation
	Hydrostatic test water	Discharge will now occur offshore rather than in Tampa Bay; volume about twice the original estimate	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic) • Offshore discharge will enhance rapid dispersion
	Dewatering discharge water from carrier pipe	New discharge due to two HDD crossings of Gulfstream pipeline	• Likely • Direct • Reversible	Negligible	• No treatment necessary (discharges expected to be non-toxic)
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

AP = Aquatic Preserve; HDD = horizontal directional drill; STL = submerged turret loading.

7. CULTURAL RESOURCES

7.1 Existing Conditions

An offshore cultural resources evaluation performed for Port Dolphin was prepared and conducted in compliance with Section 106 of the National Historic Preservation Act (NHPA), Florida State requirements, and MMS requirements. The offshore cultural resources report is included as Appendix A of the Archaeological, Engineering, & Hazard Study Proposed 36-Inch Gas Pipeline Reroute, Tampa Bay, Florida (*Confidential* **Attachment B.1**).

7.1.1 Prehistoric Resources Background

The entire *Port Dolphin* project area is situated on the broad Gulf inner continental shelf off the west coast of Florida and extends into the shallow estuary of Tampa Bay, which comprises a system of interconnected bays and lagoons bordered by coastal barrier islands (Brooks and Doyle 1998). The present day coastal configuration has been determined by pre-Holocene geologic history (Hine 1997; Hine et al. 2001). Tampa Bay occupies a local structural depression that has most probably resulted from the dissolution of underlying limestones within the Florida Platform during the late Paleogene and early Neogene (Hine 1997). Seismic reflections indicate that a major east-west paleofluvial channel extended from beneath modern Tampa Bay, flowing north of Egmont Key, across the inner continental shelf to approximately ~24 miles (40 kilometers) seaward of the present day coastline at Tampa Bay (Willis 1988; Duncan 1992; Hine 1997; Hine et al. 2001). Buried relict channeling in profiles from within the Bay appears extensively truncated with cut and fill structures (Brooks and Doyle 1998). Sediments near the modern coastline are predominantly quartz-sands that have contributed to the formation of the coastal barrier island system. Sediments that occupy the lower end of Tampa Bay are predominantly carbonate-rich, marine-derived sands and gravels derived from Pleistocene terrace deposits and biogenic carbonates that formed in situ or were transported in from the Gulf of Mexico (Doyle and Brooks 1998).

Previous geological and archaeological studies have examined the sea level fluctuations of the late Pleistocene and early Holocene epochs (Curray 1960; Coleman and Smith 1964; Scholl et al. 1967; Colquhoun and Brooks 1986; Coastal Environments, Inc. 1977, 1982, 1986; Garrison 1992). While complexities and differences occur between models based on local studies (Colquhoun et al. 1981; Colquhoun and Brooks 1986), the Holocene marine transgression is generally summarized as a rapid rise from 14,000 years B.P. to 6,000 B.P., with a slower transgression marked by periodic fluctuations from 6,000 B.P. to the present. Dunbar et al. (1991) and Faught and Donoghue (1997) suggest that the approximately 130-foot (40-meter) isobath offshore the western coast of Florida (outside of the survey area) represents a Paleo Indian or “Clovis Shoreline.” By about 3,000 B.P., sea level reached its current stand.

Between 5,000 and 3,000 B.P., in response to the declining rate of sea level rise, the barrier islands across the mouth of Tampa Bay began to take on their present configurations. The regional west coast study reported on by Hine et al. (2001) showed that the barriers essentially exhibit the same basic stratigraphy, that of development by initial upward shoaling on a Holocene bedrock foundation dating to about 4,000 B.P., followed by the aggradation of sediments, and in some areas, by the progradation of sediments.

Predictive models based on correlations between prehistoric archaeological sites and geomorphic landforms, which have been proposed by Coastal Environments, Inc. (1977, 1982, 1986), Colquhoun et al. (1981), Aten (1983), Kraft et al. (1983), Gagliano (1984), Dunbar et al. (1989a,b 1991), Faught (2003, 2004), Stright (1986, 1987, 1990) and others, suggest that submerged Paleo Indian and Archaic period sites in Florida may be associated with natural levees, margins, point bars, and terraces of alluvial streams; margins of bays, lakes and estuaries; sinkholes; and relict beach ridges. Numerous reports on investigations of Paleo Indian, Archaic, and later cultural occupations of now submerged landforms have examined these early land-man relationships off the coasts of Florida (Goggin 1964; Ruppe 1980; Stright 1987; Dunbar 1983, 1991; Dunbar et al. 1989; Murphy 1990; Milanich 1994). The identification of these or related landforms in presently submerged areas would represent high probability areas for the occurrence of prehistoric archaeological sites.

The archaeological culture history of Tampa Bay and offshore Florida has been presented in depth by numerous sources (e.g., Bense 1994; Milanich 1994; and others), with one of the earliest cultural syntheses provided by Willey (1949), and for an introduction to inundated site potential, by Goggin (1947). More recent frameworks of the Paleo Indian and Archaic stages, whose artifact assemblages would be represented off the present west Florida Gulf of Mexico coast, have been described by Ruppe (1980), Stright (1987), Dunbar et al. (1989), and Murphy (1990), among others. Because sea level reached its current stand about 3,000 B.P., archaeological cultural complexes younger than this date are unlikely to be present in the now submerged area of Tampa Bay. However, it is possible that isolated finds of dugout canoes or artifacts used for exploiting marine resources by more recent cultures could be present.

The Paleo Indian stage is dated roughly to the period between about 12,000 and 8,000 B.P. The late Pleistocene period was characterized geographically by greatly lowered sea levels, with the Florida Gulf coastline located some 40 to 85 miles west of its present site (Faught 1996). Arid conditions prevailed with much lower groundwater tables. Many Paleo Indian sites in Florida are situated adjacent to Tertiary Karst and Marginal Karst water sources represented by deep springs and still water retention basins, and a model for this settlement pattern, the Oasis model, has been proposed by James Dunbar and S. David Webb (Dunbar 1983, 1991; Webb et al. 1984; Dunbar et al. 1989), which built upon the earlier premise of Wilfred T. Neill (1964). Resources found at these sinks would have included chert sources and fauna. Clovis, Suwannee, and Simpson lanceolate projectile points are typical diagnostic tools, and are sometimes associated with the remains of Pleistocene megafauna. Evidence of now inundated sites dating from the Paleo Indian and Archaic stages has been found on the continental shelf off of the Big Bend region of Florida (Anuskiewicz 1988; Dunbar et al. 1989). Possible Paleo Indian shell middens in Tampa Bay have been reported by Goodyear with others in 1972, 1980, and 1983. A prominent excavation of a Paleo Indian site in the Tampa Bay area was conducted at Harney Flats (Daniel and Wisenbaker 1987).

The Archaic stage defines the cultures that adapted to the post-Pleistocene environmental changes and economic strategies necessitated by climatic shifts. Three stages have been defined: early Archaic from about 8,000 to 7,000 B.P., the middle Archaic from 7,000 to about 4,500 B.P., and the late Archaic from about 4,500 to about 3,200 B.P. (Bense 1994; Milanich 1994). Climatic conditions became wetter as a result of postglacial warming, and marine transgression inundated the continental shelf, reaching its current position some 3,000 years ago during the late Archaic stage. Pollen analyses reflect variations in local ecologies and the shift in coastal environments. With stabilizing and more easily accessible water sources, an increase in population occupying established base camps is associated with the early Archaic stage. In Florida, as elsewhere, the archaeological convention ends this tradition characterized by hunting and gathering with the development of more complex technologies, including ceramics; however, hunting and gathering strategies persisted along the Florida coast through later prehistoric cultures until European contact.

New technologies introduced during the Archaic Period reflect a more settled population, and include the use of more diverse lithic assemblages used for a multitude of tasks (Milanich 1994). Noted in the Archaic artifact assemblages are milling implements, hearths and baking pits, polished stone artifacts, mortuary rituals with cemeteries, including the earliest mound building, horticulture, textiles for clothing, nets, and baskets, and, at the end of the period during the transition to Late Prehistoric or Woodland period, the introduction of ceramics around 2,100 B.P. (Purdy 1981; Bense 1994; Mistovich 1994). Diagnostic lithic artifacts of the Early Archaic period include Bolen-Kirk, Dalton, and Kirk projectile points, while those of the Middle Archaic include Newnan and Eva points. The ceramic sequence on the upper northwest Florida coast begins about 2,100 B.P. with fiber tempered wares assigned to the Norwood series (Bense 1994; Mistovich 1994).

7.1.2 Historic Cultural Resources

Tampa Bay and its offshore approaches are the primary locations for possible shipwrecks, and many wrecks have been reported and documented in the bay and along the west Florida coast that are representative of vessels dating from the Spanish and British periods of European colonization, the American period of colonization and immigration of the 19th century, through the present day. Colonial and historic period shipping routes commonly traversed this area, typically hugging the coast to provide access to trade and provisioning centers such as those developed in Tampa, Pensacola, Mobile Bay, Biloxi, and Galveston (Coastal Environments, Inc. 1977; Garrison et al. 1989). Overland transport of goods and materials was difficult until the mid and late 19th century when railroad and canal networks were established and the early 1900’s when roads were improved.

Settlers were dependent upon a variety of different vessel types to support their transportation needs. For more than 200 years, many versions of canoes, skiffs, and flatboats were used for lightering goods and people in shoaled waters. Caravels, galleons, and frigates were the principal vessel types of the Spanish and British colonial periods. During the late 18th century and early 19th century, schooners were the principal sailing rigs used for fishing and the transport of passengers and freight and were popular as pleasure craft. By the 1830's, steamboats were becoming increasingly common offshore, as well as on the inland waterways.

Garrison et al. (1989) presented a regional historic framework for the northern Gulf of Mexico outlining historic and technological changes in their synthesis of archaeological, environmental, and geographic data relevant to shipwreck occurrence in the Gulf of Mexico. These periods include the New Spain Period (1500-1699), the Colonial period (1700-1803), the American Period (1803-1865), the Victorian Period (1866-1899), and the 20th Century Period (1900-present). They have been well described in regional literature pertinent to the west coast of Florida (Works Progress Administration 1939; Dovell 1952; Tebeau 1987; Gannon 1996), as well as on a broader scale (Coastal Environments, Inc. 1977; Weddle 1985, 1991, 1995; Hoffman 1980). The Geographic and Cultural Context Section in the Archaeological Assessment submitted to the USCG as part of Data Gap Responses 64 and 81 (31 August 2007) addresses the historic period and incorporates particular references to the Tampa Bay area.

Modern cultural features identified along the route include the Gulfstream 36-inch pipeline (Segment No. 12373) and artificial reef sites established by the Gulfstream Natural Gas System as mitigation for impacts incurred during pipeline installation, the Pinellas County Department of Environmental Protection Artificial Reef Program, and the Florida Fish and Wildlife Conservation Commission. Rubble derived from the old Sunshine Skyway Bridge demolition is a prominent feature within the project area in Tampa Bay.

An archival search was conducted to determine the presence or reported incidence of shipwrecks within or adjacent to the project area. No sites listed on the National Register of Historic Places are in the project area. Reference to lists and charts published by the U.S. Department of Transportation, USCG Local Notices to Mariners, National Ocean Service (NOS) Navigation Charts, the NOS Automated Wreck and Obstruction Information System (AWOIS) database (2007), Berman (1972), Marx (1985), Potter (1988), Singer (1992), and the MMS shipwreck database (Pearson et al. 2003) indicates that there have been numerous vessels reported from the colonial, historic, and modern periods off the coast of Florida, as well as in Tampa Bay, whose wreck sites remain undetermined.

Possible 19^{th} and 20^{th} century wrecks in the project vicinity in Tampa Bay include the following: the *Isis*, burned in 1842; the *Eugene Batty*, sunk through collision in 1906; the *Wave*, burned in 1908; the *Davy Crockett*, stranded in 1909; the *Water Boy*, sunk in 1911; the *City of Sarasota*, foundered in 1919; the *Thomas B. Garland*, stranded in 1921; the *Bon Temps*, sunk in 1921; the *Gwalia*, foundered in 1925; the *Stranger*, burned in 1927; the *Belmont*, sunk in 1940; the *Kim Too*, stranded in 1955; *Barge No. B-29*, foundered in 1955; the *Miss Powerama*, stranded in 1962; the *Buhnday*, sunk in 1966; and the *Ranger III*, sunk in 1966.

Four obstructions are listed in the AWOIS files in the survey area of the Revised Preferred Route in Tampa Bay: Nos. 10318, 9833, 10310, and 10312. These obstructions were confirmed in the geophysical data set. No. 10318 was reported to be a cylindrical tank. No. 9833 was a metal-hulled watercraft identified as similar to an aluminum SeaArk boat. No. 10310 was found to represent several chunks of concrete, and No. 10312 represents a metal tank.

7.1.3 Geophysical Survey of Nearshore Portion of the Revised Preferred Route

Port Dolphin conducted a comprehensive high-resolution geophysical survey of the nearshore portion of the Revised Preferred Route in Tampa Bay in September 2007. The geophysical instrumentation included an echo sounder, a side-scan sonar (100 and 500 kHz frequencies collected simultaneously), a marine magnetometer, and a subbottom profiler. Water column velocity data were gathered and a heave sensor was utilized. Navigation software was integrated with a global positioning system that provided horizontal control at a reported accuracy of ± 3 meters.

The survey grid covering the proposed pipeline realignment corridor was run in four sections and was designed to provide complete geophysical coverage (3,000 feet wide) of the seafloor when supplemented by the survey data collected along the Original Preferred Route.

7.1.4 Summary of Cultural Resource Findings

7.1.4.1 Objectives

The objective of the cultural resource evaluation was to locate and identify cultural resources that exist in the project site area that potentially could be physically disturbed by project activities within the survey area of the nearshore portion of the Revised Preferred Route in Tampa Bay. Any potentially significant submerged cultural resources that might be eligible for listing on the National Register of Historical Places (NRHP) will require avoidance or additional archaeological investigation.

7.1.4.2 Prehistoric Resources

Water depths along the nearshore portion of the Revised Preferred Route range from 29 to 6 feet (~8.8 to 1.8 meters) Mean Lower Low Water. Seafloor slope is variable across the area, but decreases notably to the east in Tampa Bay.

Across much of the area the seafloor exhibits a generally smooth seafloor interrupted by migrating sands and shoals and hard bottom zones. These features were corroborated in the side-scan sonar data. Possible remnant shoals exhibit heights from 2 to 3 feet (0.6 to 1 meters), extending over areas up to 1,000 feet (304 meters). Acoustic penetration of the subbottom profiler below the seafloor ranged from little or no penetration (where hard limestone occurs at or very near the seafloor or where consolidated sandy sediments attenuate the acoustic signal) to very good penetration (about 32 feet below mud line [BML]). Strong seafloor multiples, indicating hard seafloor, occur throughout the data set. No fluvial channels, possible sinkholes, or other geomorphic features that could represent high probability areas for prehistoric archaeological sites were recorded in the data set.

7.1.4.3 Historic Cultural Resources

A total of 920 magnetic anomalies were recorded, of which 788 magnetic anomalies remain unidentified. The majority of these unidentified anomalies occur in the vicinity of the old demolished Sunshine Skyway Bridge, the new Sunshine Skyway Bridge, and known dredge spoil deposits. Most of these anomalies are low amplitude, short duration features representing small ferrous debris that is densely scattered within the surveyed area. In addition, Debris from storm damaged infrastructure and property in communities around the Bay has been commonly swept into the Bay, most recently from Hurricane Wilma in 2005. Of these magnetic anomalies, 31 occur along or within 50 feet (approximately 15 meters) of the nearshore portion of the Revised Preferred Route.

Thirteen unidentified individual sonar contacts and two sonar contact zones were recorded during the survey. Twelve of the sonar contacts corresponded with unidentified magnetic anomalies.

The Phase 1 cultural resources evaluation for the nearshore portion of the Revised Preferred Route identified one feature of potential cultural significance in the side scan-sonar and magnetometer data, comprising one unidentified side-scan sonar contact and three unidentified magnetic anomalies. This feature is situated about 1,100 feet (335 meters) north of the proposed route. An avoidance zone of 500 feet (152 meters) has been designated around this site (**Figure 7-1**).

7.2 Analysis of Potential Consequences

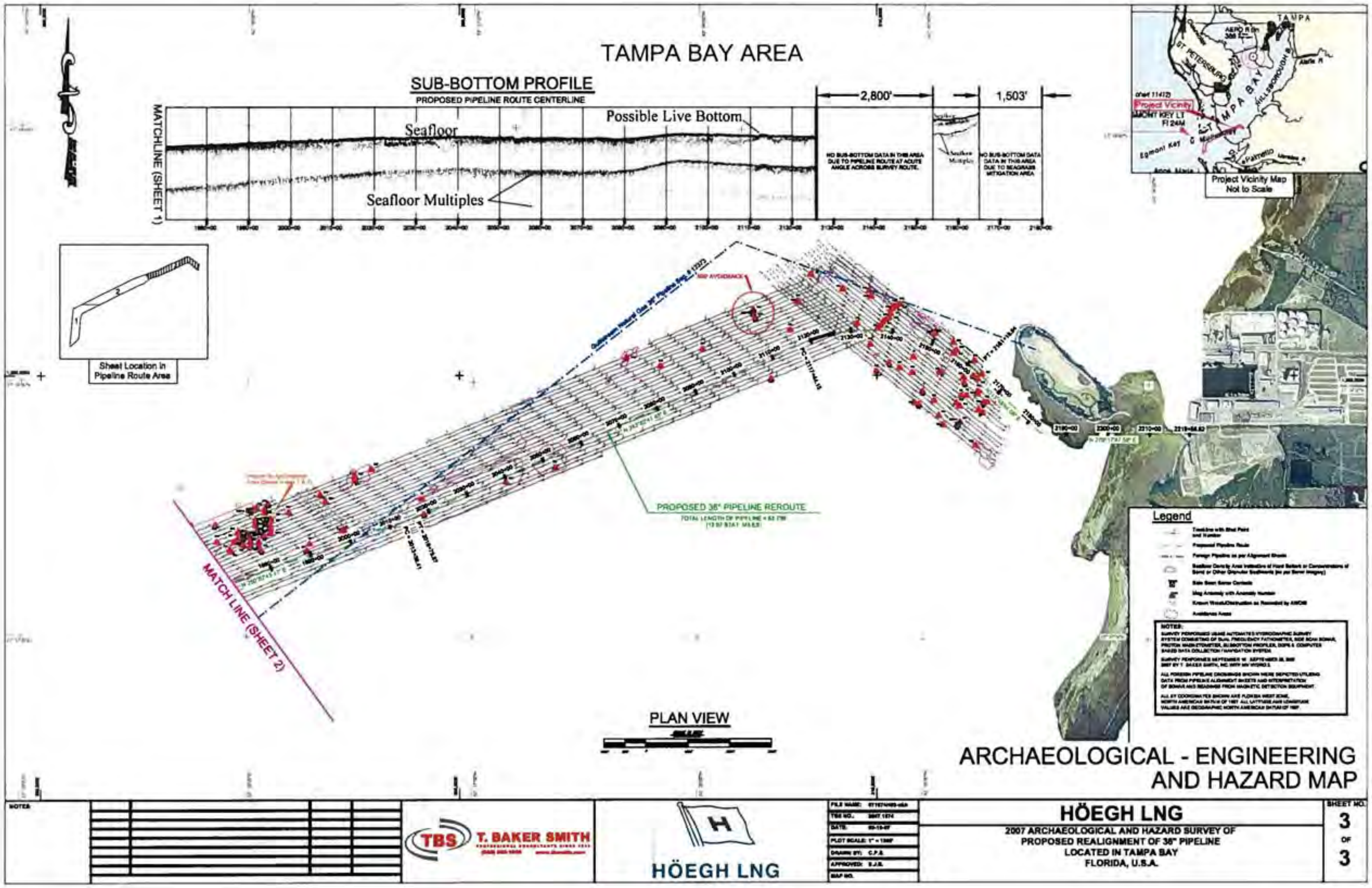
Adverse impacts to cultural resources occur when an activity is likely to damage or disturb a unique feature such as an historic site (shipwreck) or prehistoric site (former human occupation areas). The nature of any impacts to cultural resources as a result of project activities would be direct, in that the consequence of offshore installation/decommissioning activities could have an immediate affect upon the resource. In all cases, the duration of environmental consequences to cultural resources resulting from project activities would be long-term or permanent, as opposed to temporary. In addition, any impacts to cultural resources may be irreversible.

Impacts were evaluated based on consequence-producing factors related to the following phases of the project.

7.2.1 Construction

The primary potential impacts to cultural resources associated with offshore construction activities would be potential impacts to prehistoric and historic sites. Construction of the pipeline would involve derrick/lay barges, anchor handling tug support vessels, and other such vessels. Potential disturbance of historic and prehistoric sites could only occur from anchors used by these vessels if used within the designated avoidance zones.

Figure 7-1
Avoidance Zone Around Unidentified Feature



The Phase 1 geophysical survey along the nearshore portion of the Revised Preferred Route revealed no geomorphic features representing high probability areas for prehistoric archaeological sites.

One unidentified side-scan sonar contact associated with three unidentified magnetic anomalies was identified about 1,100 feet (335 meters) north of the nearshore portion of the Revised Preferred Route. An avoidance zone of 500 feet (152 meters) has been designated around this feature (**Figure 7-1**).

The Phase I geophysical survey completed in January 2007, in and around the proposed DWP terminal location, revealed the presence of buried fluvial channels in St. Petersburg Area Blocks 545 and 589 that retain geomorphic features representing high probability areas for prehistoric archaeological sites. One avoidance area was established with a 250-foot wide buffer zone around one area of relict channels located northwest of the south buoy. Project installation activities, specifically Anchor 8 of the modified south buoy anchoring arrangement, would be located about 5,600 feet (1,707 meters) southeast of this prehistoric resources avoidance area.

In the event that any cultural resources are discovered during construction, the details and procedures for handling these unanticipated discoveries are outlined in an Unanticipated Discoveries Plan, which was submitted with the archaeological assessment.

7.2.2 Operations

Once the offshore pipeline is installed, there should be no further contact with the seafloor. Since no potentially significant prehistoric or historic resources would be located within 1,000 feet (304 meters) of the pipeline, there would be no impacts on cultural resources by routine operations.

7.2.3 Decommissioning

Impacts on historic and prehistoric and prehistoric sites from decommissioning activities are not anticipated because the pipeline would be more than 1,000 feet (304 meters) from any potentially significant targets, and disturbance to the seabottom from decommissioning activities would be minimal.

The pipeline would be decommissioned by filling it with seawater and leaving in place subject to MMS guidelines and the terms of the submerged lands lease to be obtained from the State of Florida. Pipeline decommissioning procedures should have no impact on prehistoric or historic cultural resources.

7.2.4 Accidents and Upsets

It is not anticipated that releases of LNG, natural gas, or other petroleum products from vessels or operations would impact the seafloor. Therefore, cultural resources are not expected to be impacted by upsets or accidents.

7.3 Summary of Impacts and Mitigation Measures

The proposed STL buoy site and Revised Preferred Route have been designed to avoid prehistoric and historic cultural resources. Installation, operation, and decommissioning activities would avoid impact to resources, if found. If avoidance of these areas of potential resources is not possible, then these resources would be retrieved and curated at a state or federally recognized facility in accordance with applicable procedures.

The main objective of the cultural resource evaluation was to locate and identify cultural resources that exist in the project site area that potentially could be physically disturbed by project activities. Any potentially significant submerged cultural resources that might be eligible for listing on the NRHP would require avoidance or additional archaeological investigation.

7.3.1 Prehistoric Resources

In the west-central portion of the mooring area, buried fluvial channels were recorded that do not appear significantly affected by erosion. The upper channel margins are buried by a sediment cover of about 10 feet (3 meters). Axial depths were noted from 16 to 18 feet (4.9 to 5.5 meters) BML, and channel fill sediments are amorphous. The profiles indicate that overbank deposition may remain undisturbed. These features are identified as high probability areas for prehistoric archaeological sites.

No geomorphic features that could represent high probability areas for prehistoric archaeological sites were recorded along the Revised Preferred Route.

7.3.2 Historic Cultural Resources

A total of 2,066 magnetic anomalies was recorded, of which, 1,688 magnetic anomalies remain unidentified. Of these, 105 occur in Federal waters, and the remainder are in Florida waters. Twenty-three unidentified sonar contacts and two sonar contact zones were recorded during the surveys. Three occurred in Federal waters, and the others are in Florida waters.

The Phase 1 geophysical survey magnetometer and side-scan sonar data cultural resources evaluation identified a number of features of potential cultural significance. Four unidentified side-scan sonar contacts, one of which is in Federal waters, and 18 unidentified magnetic anomalies, all but one of which is in Florida waters, were interpreted as possible historic shipwreck remains.

In the event of unanticipated discovery of cultural resources, Port Dolphin would follow an Unanticipated Discoveries Plan, which was submitted to the USCG as part of Data Gap Response 65 (3 August 2007). Under this Plan, all activity in the area of work would be halted immediately, and an avoidance zone of at least 1,000 feet for further work in that area would be established. Within 48 hours of the discovery, the Regional Supervisor, Leasing and Environment, and archaeologists at the MMS office in New Orleans, as well as the USCG and the appropriate Florida State Historic Preservation Officer (SHPO) with the Florida Division of Historical Resources would be notified.

8. GEOLOGY

8.1 Existing Conditions

Existing geological conditions at the offshore terminal site and along the offshore portions of the Original Preferred Route have been described in **Volume II, Section 7** of the **Deepwater Port Application**. The only new information presented here is for geological conditions along the nearshore portion of the Revised Preferred Route (Alternative A).

A geophysical survey of the Alternative A pipeline corridor was completed by T. Baker Smith in September 2007 (*Confidential* **Appendix B.1**). According to the survey report, the seafloor along the revised corridor is generally uneventful, with only minor undulations associated with migrating sand ripples and shoals. In a few areas the seabed character changes into more of an irregular surface interrupted by sandy accumulations and possible hard bottom areas. These outcrops are believed to represent calcareous bioherms that develop in shallow waters.

Figure 8-1 shows the distribution of hard bottom within the revised corridor, and **Table 8-1** compares the hard bottom percentages along the nearshore portion of the original and revised preferred corridors. The total survey area was 4,133 acres (1,673 hectares). Most of the newly surveyed area was soft bottom (81.45%), with small areas classified as hard bottom (18.55%). The distribution of seafloor substrates in the revised preferred corridor is generally similar to that of the original preferred corridor in that both corridors are predominantly soft bottom. However, the revised preferred corridor has about eight times as much hard bottom (18.55% vs. 2.27%).

Table 8-1
Comparison of Hard Bottom in Original and Revised Preferred Corridors
(Nearshore Portion Only from Re-route Point to Landfall HDD)

Seafloor Substrate	Original Preferred Corridor			Revised Preferred Corridor		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Hard Bottom	87.88	35.57	2.27	766.76	310.30	18.55
Soft Bottom	3,773.66	1,527.15	97.72	3,366.16	1,362.24	81.45
Total Area	3,861.54	1,562.71	100	4,132.92	1,672.53	100

The apparently higher incidence of hard bottom along the revised corridor may be due to several factors. Parts of the corridor overlap with spoil areas (**Figure 8-1**), including areas littered with concrete and ferrous debris from the demolition of the old Sunshine Skyway Bridge. These areas are classified as hard bottom in the analysis. Also, some areas classified as hard bottom may represent areas of sandy and granular sediments that show up as high reflectivity areas in the side-scan sonar data. The exact classification of these features could not be entirely made on the basis of the side-scan sonar data alone. However, the overall percentages of hard bottom from the geophysical survey are similar to those from the video survey (**Appendix A.1**).

Figure 8-1
Distribution of Geophysically-defined Hard Bottom Within Revised Nearshore Pipeline Corridor (Alternative A).

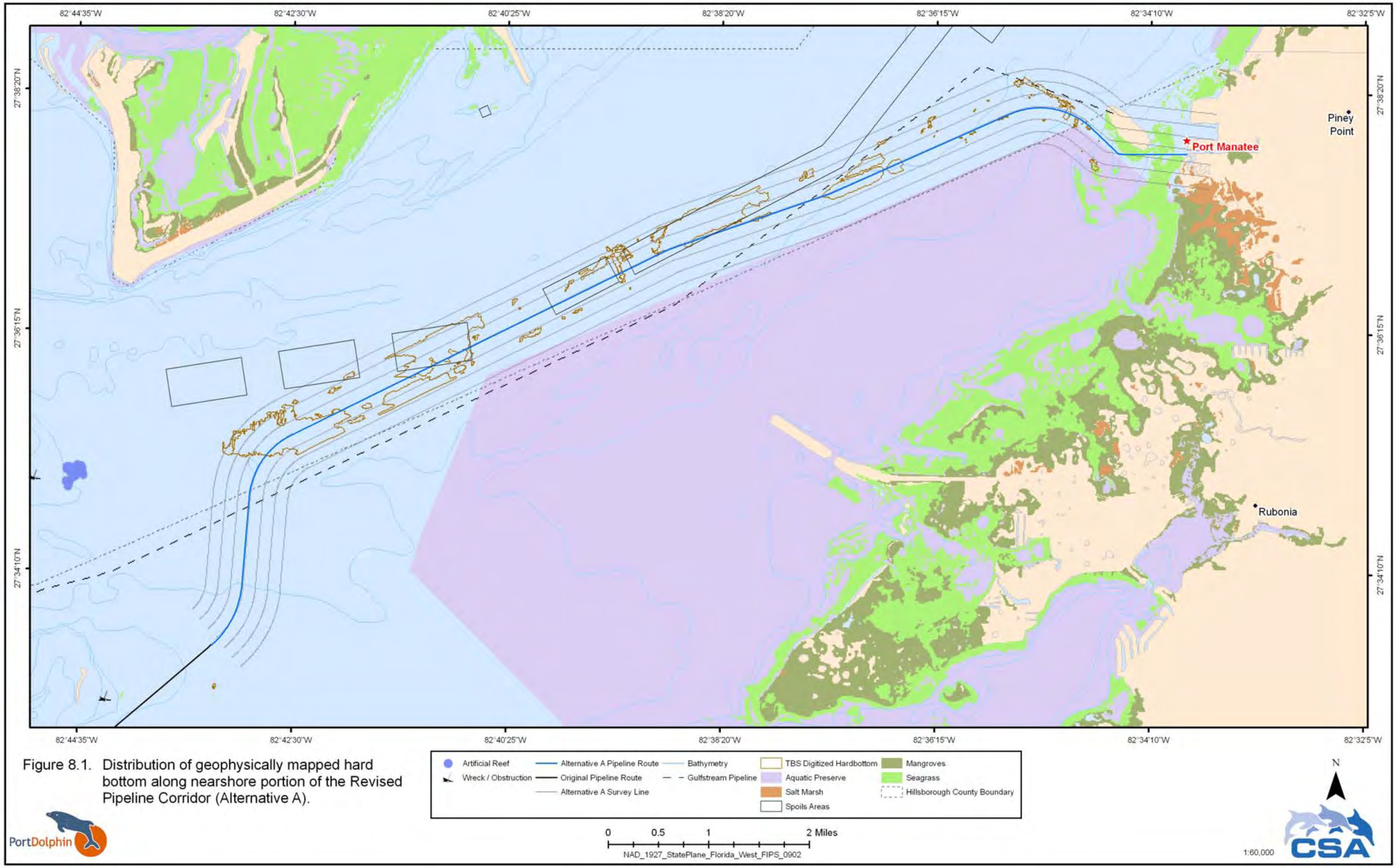


Figure 8.1. Distribution of geophysically mapped hard bottom along nearshore portion of the Revised Pipeline Corridor (Alternative A).

Considering the entire revised pipeline corridor including the buoy area, the total survey area is 26,758 acres (10,828 hectares), of which 12% is categorized as hard bottom. The overall hard bottom percentage is the same as in the original survey, which covered an area of 26,371 acres (10,672 hectares).

8.2 Analysis of Potential Consequences

The following new or revised activities (project design changes) are included in this impact analysis:

- **Optimization of buoy anchoring arrangement** – The mooring pattern around the STL buoys has been optimized, resulting in a different seafloor footprint (see **Section 3.3**).
- **Offshore pipeline route** – The nearshore portion of the Original Preferred Route (i.e., within Tampa Bay) has been revised to avoid passing through the Terra Ceia Aquatic Preserve (see **Section 3.1**).

In addition to these changes, impacts of pipeline installation along the entire Original Preferred Route have been recalculated based on the Revised Preferred Route.

8.2.1 Geology and Sediments

Impacts to geology and sediments are discussed in **Volume II, Section 7.3.1** of the **Deepwater Port Application**. The main impacts will consist of direct physical disturbance to the seafloor during pipeline installation. These impacts will result from plowing of the seafloor, placement of concrete mattresses, and anchoring of barges during pipeline installation. Other impact sources relevant to the project design changes include installation of the STL subsea system and sweeping of the seafloor due to movement of STL mooring lines during routine operations. These impacts are changed slightly due to optimization of the mooring system. There are no project design changes relevant to decommissioning or accidents or upsets, and so potential impacts from these sources are unchanged from the original analysis.

8.2.1.1 Construction

Seafloor Disturbance – Pipeline Installation. The areal extent of seafloor disturbance during pipeline installation has increased due to re-routing of the pipeline around the Aquatic Preserve. Also, the specific location of some impacts within Tampa Bay has changed due to the re-routing.

Plowing and Mattress Placement – **Table 8-2** summarizes the area affected by plowing, mattress placement, and anchoring for the original and revised corridors. (Further details of the anchoring calculations are provided later in this section.) The original corridor values are from **Volume II, Section 7.3.1** of the **Deepwater Port Application**. The revised numbers reflect (1) the re-routing of the pipeline around the Terra Ceia Aquatic Preserve; (2) revisions to the original spreadsheet for "plowability" of various pipeline segments (**Table 4-1**); and (3) the use of GIS to more accurately calculate the extent of impacts.[1]

Table 8-2
Areal Extent of Seafloor Impacts from Pipeline Installation in Original and Revised Preferred Corridors (Entire Route)

Activity	Area Affected Acres (Hectares)			
	Original Preferred Corridor[a]		Revised Preferred Corridor	
	Soft Bottom	Hard Bottom	Soft Bottom	Hard Bottom
Plowing	153.43 (62.08)	0	159.53 (64.56)	16.57 (6.71)
Mattress placement	22.84 (9.24)	18.03 (7.29)	27.15 (10.99)	8.59 (3.48)
Dragline /mattress	--	--	1.38 (0.56)	0
Anchoring	19.83 (8.03)	2.71 (1.10)	17.70 (7.16)	2.56 (1.03)
Total	196.10 (79.35)	20.74 (8.39)	205.76 (83.27)	27.72 (11.22)

[a] As estimated in **Volume II, Table 7-1** of the **Deepwater Port Application**.

For plowing impacts, a width of 67 feet (20.4 meters) was used. Mattress placement was assumed to affect a width of 13 feet (4.0 meters). Diagrams illustrating the impact width are included in the **Deepwater Port Application**. In one location in Tampa Bay where a combination of dragline burial and concrete mattresses is planned, an effect width of 60 feet (18.3 meters) was assumed. This impact is related to the Sunshine Skyway Bridge crossings and was not included in the original analysis.

The revised analysis predicts that a total of 176.10 acres (71.27 hectares) would be affected by plowing. About 91% of this area would be soft bottom, but small areas of hard bottom would also be affected. The original analysis did not indicate any hard bottom affected by plowing, but the revised, more accurate analysis using the GIS showed that some of these areas would be affected.

The revised analysis also predicts that 35.74 acres (14.46 hectares) would be affected by concrete mattresses. About 24% would be hard bottom and 76% would be soft bottom.

A small area of 1.38 acres (0.56 hectares) would be affected by dragline burial and concrete mattresses at one location in Tampa Bay. All of the area would be soft bottom.

Overall, the areal extent of seafloor impacts during pipeline installation is estimated to be about 8% larger than originally estimated in **Volume II, Section 7.3.1** of the **Deepwater Port Application** resulting in minor impacts to soft bottom and significant impacts to hard bottom.

[1] In the original analysis, the pipeline route was divided into about 90 segments that were rated as plowable or not plowable, and the habitat within each segment was rated as hard or soft bottom. In the revised analysis, the same approach was used for plowability, but the linear extent of plowing and mattressing impacts were measured directly using the GIS on mapped hard and soft bottom areas.

Anchoring – **Table 8-3** summarizes impacts of anchoring for the entire Revised Preferred Route. The following assumptions were made to calculate the extent of anchoring impacts:

- The barge would make four passes along the route, for pipelaying, plowing, backfilling, and mattress placement.
- During the first three passes, the barge will use 10 anchors, which would be reset every 2,000 feet (610 meters). Each anchor contact with the seafloor would directly affect an area of 360 square feet (33.4 meters^2).
- The fourth pass (mattress placement) would be done by a smaller barge with four smaller anchors, which would be reset every 1,000 feet (305 meters). The anchors would affect a smaller area of 90 square feet (8.4 meters^2).
- Hard and soft bottom areas would be affected in direct proportion to the percentage of these areas along the pipeline route (12% hard bottom, 88% soft bottom).

Table 8-3
Areal Extent of Impacts from Anchoring During Pipeline Installation
(Entire Revised Preferred Route)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	No. of Anchor Impacts	Direct Impact Area[b]	
					Soft Bottom acres (hectares)	Hard Bottom acres (hectares)
1st	Pipelaying	235,549	117	1,170	8.45 (3.42)	1.22 (0.49)
2nd	Plowing	115,468	58	580	4.19 (1.70)	0.60 (0.24)
3rd	Backfilling	115,468	58	580	4.19 (1.70)	0.60 (0.24)
4th	Mattress placement	120,081	121	484	0.87 (0.35)	0.13 (0.05)
				Total	17.70 (7.10)	2.56 (1.03)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each would affect an area of 360 square feet (33.4 meters^2). For the fourth pass, assumed four smaller anchors would be reset every 1,000 feet (305 meters) and each would affect an area of 90 square feet (8.4 meters^2).
[b] Assumed anchors would contact hard bottom or soft bottom areas in proportion to their occurrence within the revised pipeline corridor including the buoy areas (12% hard bottom, 88% soft bottom).

The actual sequence of events involved in pipelaying is more complicated than indicated by these assumptions, particularly in Tampa Bay where three HDD operations would be conducted. However, the assumptions are considered a reasonable basis for estimating the number and extent of anchor impacts.

The revised analysis predicts that 20.25 acres (8.20 hectares) would be affected by anchoring. Based on the assumption that seafloor types would be affected in proportion to their occurrence in the survey area, about 88% of the impacts would be in soft bottom and 12% of the total would be in hard bottom areas.

In addition to the direct impacts, each anchor cable would also contact (sweep) the seafloor. The areal extent of anchor sweep impacts has not been estimated. During detailed design, an anchoring plan will be developed that will provide specific procedures to minimize anchor sweep impacts on hard bottom areas.

Seafloor Disturbance – STL Subsea System Installation. Another construction activity that will disturb the seafloor is installation of the STL subsea system, which consists of the STL buoy and PLEM, as well as associated moorings, risers, and umbilicals. Installation would disturb sediments due to placement of components on the seabed, as well as anchoring of construction vessels. Although specific mooring locations around the STL buoys have been changed due to optimization of the mooring configuration (see **Section 3.3**), the number of moorings is unchanged. Therefore, the total area of seafloor impacts during construction is the same as in the original analysis in **Volume II, Section 7.3.1** of the **Deepwater Port Application**, which was 0.59 acres (0.23 hectares). However, the relative impact areas for hard bottom and soft bottom areas has changed due to the change in configuration.

Figure 8-2 shows the optimized mooring configuration in relation to seafloor substrates, and **Table 8-4** summarizes revised impact calculations for installation of the STL subsea system.

Table 8-4
Area of Seafloor Affected by Installation of the STL Subsea System Optimized Configuration

Impact Source	North Buoy		South Buoy		Total	
	Soft Bottom acres (hectares)	Hard Bottom acres (hectares)	Soft Bottom acres (hectares)	Hard Bottom acres (hectares)	Soft Bottom acres (hectares)	Hard Bottom acres (hectares)
Placement of STL landing pad	0.13 (0.05)	0	0.13 (0.05)	0	0.26 (0.10)	0
Placement of PLEM	0.02 (0.01)	0	0.02 (0.01)	0	0.04 (0.02)	0
Placement of anchors/piles (8 anchors total)[a]	0.05 (0.02)	0.02 (0.01)	0.02 (0.01)	0.04 (0.02)	0.07 (0.03)	0.06 (0.02)
Barge anchoring (10 anchors total)[b]	0.074 (0.030)	0.008 (0.003)	0.033 (0.013)	0.050 (0.020)	0.107 (0.043)	0.058 (0.023)
Total	0.27 (0.11)	0.03 (0.01)	0.20 (0.08)	0.09 (0.04)	0.47 (0.19)	0.12 (0.05)

[a] Each mooring assumed to affect 360 feet^2 (33.4 meters^2). For North Buoy area, assumed 6 of 8 moorings would be in soft bottom. For South Buoy area, assumed 3 of 8 moorings would be in soft bottom.
[b] Each barge anchor assumed to affect 360 feet^2 (33.4 meters^2). For North Buoy area, assumed 9 of 10 barge anchors would be in soft bottom. For South Buoy area, assumed 4 of 10 barge anchors would be in soft bottom.

The landing pad and PLEM would be fixed to the seafloor, either by means of a skirted mud mat or with a suction pile. These components would be placed on soft bottom. The area affected would be 0.02 acres (0.01 hectares) for the PLEM and 0.13 acres (0.05 hectares) for the STL landing pad.

Figure 8-2
Distribution of Geophysically Identified Hard Bottom in Buoy Placement Areas

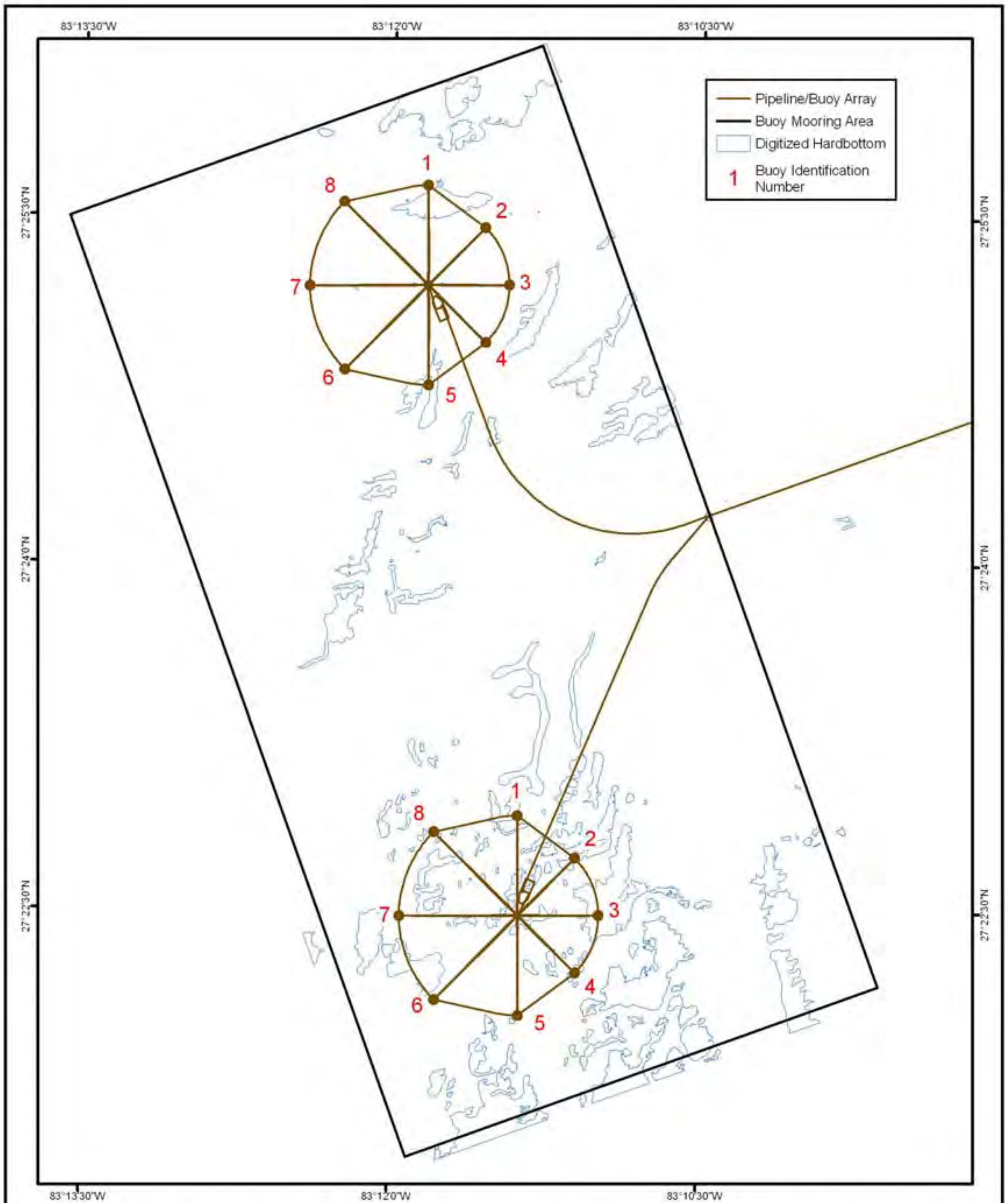


Figure 8-2. Distribution of geophysically mapped hard bottom within optimized buoy array.

The STL subsea system includes eight anchors or suction piles in both the North Buoy and South Buoy areas. Each anchor or suction pile is assumed to affect an area of 360 square feet (33.4 $meters^2$). Based on the optimized mooring configuration (**Figure 8-2**), it is assumed that 6 of 8 moorings would be in soft bottom at the North Buoy area, as would 3 of 8 moorings in the South Buoy area. The total area affected at both buoy locations would be 0.07 acres (0.03 hectares) of soft bottom and 0.06 acres (0.02 hectares) of hard bottom.

Installation of the STL subsea system is assumed to be conducted by a barge with 10 anchors, each affecting an area of 360 square feet (33.4 $meters^2$). Based on the optimized mooring configuration (**Figure 8-2**), it is assumed that 9 of 10 barge anchors would be in soft bottom at the North Buoy area, as would 4 of 10 barge anchors in the South Buoy area. The area affected would be 0.11 acres (0.04 hectares) of soft bottom and 0.06 acres (0.02 hectares) of hard bottom

The total impact area for STL subsea system installation is estimated to be 0.59 acres (0.24 hectares), including 0.47 acres (0.19 hectares) of soft bottom and 0.12 acres (0.05 hectares) of hard bottom. During detailed design, the STL mooring pattern and barge anchor patterns will be adjusted to minimize contact with hard bottom areas to the extent practicable, and the extent of hard bottom impacts may be less than estimated here.

8.2.1.2 Operations

During operations, the anchor chains/cables from the STL buoys will chafe bottom sediments. The two unloading buoys will each have eight mooring lines consisting of wire rope and chain connecting to anchors or driven piles on the seabed. When not connected to an SRV, the unloading buoy would be submerged below the sea surface. When an SRV arrives, the unloading buoy would be retrieved from its submerged position by means of a winch and recovery line. As the STL buoy moves up and down, some lateral movement of the mooring lines will occur, contacting the seabed.

As noted previously, one of the project design changes in this Addendum is the optimization of the mooring pattern around the STL buoys (**Section 3.3**). The mooring system footprint has been recalculated based on the maximum observed vessel offset for the optimized mooring system. The calculations are explained in **Section 6.2.2**. The total area affected by cable sweep is estimated to be 11.05 acres (4.47 hectares) per loading buoy, or a total of approximately 22.1 acres (8.94 hectares).

In **Volume II, Section 7.3.1** of the **Deepwater Port Application**, the total seafloor area affected by anchor sweep at both North and South Buoys combined was estimated to be about 30 acres (12.14 hectares). The revised estimate is about 26% less than the original estimate and represents less than 1% of the seafloor within each buoy area.

Based on the optimized mooring configuration (**Figure 8-2**), it is assumed that six of eight moorings would sweep soft bottom at the North Buoy area, as would three of eight moorings in the South Buoy area. **Table 8-5** summarizes the estimated areas of hard and soft bottom that would be contacted by anchor sweep. The resulting impacts on geological conditions would be minor for soft bottom and significant for hard bottom. During detailed design, the STL mooring pattern will be adjusted to minimize contact with hard bottom areas to the extent practicable, and the extent of hard bottom impacts may be less than estimated here.

Table 8-5
Area of Hard and Soft Bottom Estimated to be Affected by Anchor Sweep During Routine Operations

Impact Source	North Buoy		South Buoy		Total	
	Soft Bottom acres (hectares)	Hard Bottom acres (hectares)	Soft Bottom acres (hectares)	Hard Bottom acres (hectares)	Soft Bottom acres (hectares)	Hard Bottom acres (hectares)
Anchor sweep (STL buoy)	8.29 (3.35)	2.76 (1.12)	4.66 (1.89)	6.39 (2.58)	12.95 (5.24)	9.15 (3.70)

[a] In North Buoy area, assumed moorings 1 and 5 would sweep hard bottom areas and the others soft bottom; in South Buoy area, assumed mooring lines 1, 2, 3, 4, and 8 would sweep hard bottom areas and the others soft bottom. Used areal estimates for anchor sweep of each mooring line from **Section 6.2.2, Table 6-6**.

8.2.1.3 Decommissioning

None of the project design changes would significantly alter the potential impacts of decommissioning on geological conditions as discussed in **Volume II, Section 7.3.1** of the **Deepwater Port Application**.

8.2.1.4 Accidents and Upsets

None of the project design changes would significantly alter the potential impacts of accidents and upsets on geological conditions as discussed in **Volume II, Section 7.3.1** of the **Deepwater Port Application**.

8.2.2 Mineral Resources

Impacts to mineral resources are discussed in **Volume II, Section 7.3.2** of the **Deepwater Port Application**. The analysis concludes that the project is not expected to have any impacts on mineral resources from construction, operations, decommissioning, or accidents and upsets. The only active mineral resource use in the region consists of dredging of nearshore sand deposits for beach nourishment and other coastal engineering projects in Florida. Neither the original nor Revised Preferred Routes pass through any permitted or proposed borrow sites. Therefore, the routes would not conflict with any known existing or planned use of mineral resources. The project design changes do not affect the conclusion of negligible impacts on mineral resources.

8.3 Summary of Impacts

Table 8-6 summarizes the impact characteristics for geological resources. Potential impacts to geological resources are rated as significant, minor, or negligible using the following criteria:

- **Significant** – impacts that would damage or disturb a unique geological feature, modify seafloor stability, or conflict with an active existing or planned use of mineral resources.
- **Minor** – changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible** – changes that are unlikely to be noticed or measurable against background conditions.

The table also categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible.

The following are the key changes in geological impacts caused by project design changes:

- **Increased seafloor disturbance due to pipeline re-route**. The areal extent of seafloor impacts for the revised pipeline corridor would be about 8% greater than those calculated in the original **Deepwater Port Application**. This change is due partly to the changed pipeline route, but also reflects corrections to the calculations since the original estimates were made. Most of the increased area is soft bottom. The overall impact ratings are unchanged (minor for soft bottom, significant for hard bottom).

- **Decreased seafloor disturbance due to optimized buoy mooring arrangement**. The mooring pattern around the STL buoys has been optimized, resulting in a smaller seafloor footprint. Installation is expected to affect about the same area of seafloor as originally estimated. However, anchor sweep impacts on the seafloor during operations would be about 25% less under the optimized arrangement, resulting in a corresponding decrease in impacts on benthic habitats and EFH. For both construction impacts and anchor sweep during operations, the relative proportion of seafloor types affected would change slightly (less soft bottom and more hard bottom). The overall impact ratings are unchanged (minor for soft bottom, significant for hard bottom).

During detailed design, the STL mooring pattern and barge anchor patterns will be adjusted to minimize contact with hard bottom areas to the extent practicable, and the extent of hard bottom impacts may be less than estimated here. In addition, an anchoring plan will be developed that will provide specific procedures to minimize anchor sweep impacts on hard bottom areas.

Table 8-6
Summary of Impacts to Marine Resources Due to Project Design Changes

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Geology and Sediments					
Construction	Physical disturbance to sediments during pipeline installation, including plowing and anchoring	Areal extent of seafloor disturbance increased	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard bottom)	• Hard bottom areas within the pipeline corridor and in STL buoy locations have been mapped and avoided to the extent practicable • During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard bottom • Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep • Anchoring on areas of significant hard bottom will be avoided to the extent practicable • During installation, vessel sizes will be selected to provide vessels adequate to perform the work, but minimized to reduce the number and type of anchors, where possible
Operations	Physical disturbance to sediments due to movement of anchor lines as STL buoy is raised and lowered	Areal extent decreased due to optimization of mooring pattern around buoys	• Likely • Direct • Reversible	Minor (soft bottom) Significant (hard bottom)	• During detailed design, the STL mooring pattern will be adjusted to minimize contact with hard bottom areas to the extent practicable
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Mineral Resources					
Construction	*No change*	*No change*	*No change*	*No change*	*No change*
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

9. TERRESTRIAL RESOURCES

9.1 Existing Conditions

The Revised Preferred Onshore Route has changed significantly from the Original Preferred Onshore Route; and therefore, for clarity, the complete discussion of the existing environment has been included below.

9.1.1 Fish, Wildlife, and Vegetation

9.1.1.1 Fish

Fisheries are defined as water bodies providing habitat for fish species. Significant fisheries resources are typically defined as surface waters that provide important habitat for foraging, rearing, or spawning and are areas of commercial or recreational fishing or support protected species or large populations of commercially or recreationally valuable fish species.

Potential fishery resources in the terrestrial portion of the project include a brackish tidally-influenced canal adjacent to the mangroves, a small creek (Curiosity Creek), drainage ditches, multiple open water reservoirs, and seasonally flooded wetland sites.

The brackish tidally-influenced canal is located in Port Manatee (southern conveyance ditch). The canal is a shallow, man-made canal which connects to Tampa Bay to the west and culverted drainage ditches to the east. In the western section of the canal, little vegetation is present. However, the canal parallels a mangrove swamp and further east contains small mangrove trees along the banks. The eastern section of the canal appears to have a lower salinity, and freshwater wetland species such as cattails (*Typha* sp.) are present along the banks. This canal can support juvenile estuarine fish species such as those in the Snapper-Grouper complex that can tolerate lower salinities. Fish in the Snapper-Grouper complex are known to be important commercial and recreational fish species.

Curiosity Creek is classified as a Class III waterbody by FDEP and is considered a minor surface water based on FERC standards. Curiosity Creek provides no evidence of fisheries resources. There is, however, the potential for the presence of mosquitofish (*Gambusia affinis*). During the field investigation, no hydrology was present in the creek. The creek appears to be connected to the other drainage ditches, creating a matrix of stormwater drainage sites for road and field runoff. Many of the other drainage ditches along the pipeline had standing water at the time of the field investigation; however, no aquatic life was observed. The reservoirs present along the pipeline route are previously excavated sites. Fish were observed during the field investigation. The tidally-influenced canal (south conveyance ditch) contained the largest volume of water. A variety of fish species and invertebrates were observed within the canal. The canal has the potential to sustain fishery resources due to the connectivity to the Gulf of Mexico and close proximity to the mangrove wetlands.

9.1.1.2 Wildlife

The potential for wildlife present along the proposed pipeline corridor is based on land use and habitat within the project area. The majority of the pipeline will be constructed in or near previously disturbed sites. The pipeline corridor traverses Port Manatee, along cropland and pastureland, across industrial land, under railroad and road easements, across recreation land, and across extractive land. These areas will have minimal wildlife utilization due to the lack of shelter, foraging ground, and increased human interaction**.** Wildlife expected to use these areas are raccoons (*Procyon lotor*), striped skunk (*Mephitis mephitis*), wild pigs (*Sus scrofa*), armadillo (*Dasypus novemcinctus*), and various reptiles and birds.

The areas of potentially greater wildlife utilization are the wetland sites. These sites provide a variety of natural resources. The adjacent mangrove wetland provides habitat for wading birds, fish, invertebrates, amphibians, and reptiles. The emergent wetlands provide foraging opportunities for small mammals and wading birds, while the open water areas provide habitat for invertebrates, reptiles, and amphibians. The stormwater ditches and open water sites provide habitat that will most likely be utilized by a variety of aquatic animals and bird species. The forested sites also provide foraging opportunities for larger mammals, birds, and reptiles. Wildlife can also utilize these sites for shelter, roosting, and nesting in the canopy and subcanopy stratums. Overall, a wide range of wildlife is expected to utilize the habitat provided by the different wetland sites.

Threatened and endangered species or Species of Special Concern have been observed in the project area. During the field investigations, a snowy egret (*Egretta thula*) and American alligator (*Alligator mississippiensis)* were observed at the open water (reservoir) site. During the field survey of the tidally influenced canal (south conveyance ditch) and adjacent mangrove site, multiple tricolored herons (*Egretta tricolor*), wood storks (*Mycteria americana*), an American kestrel (*Falco sparverius*), and an American alligator were observed. The kestrel was sighted while perched on a powerline and was observed foraging on the adjacent agricultural property. The area was surveyed for suitable nesting snags; however, no snags were observed. Due to the fact that both the southeastern American kestrel (a State threatened species) and the American kestrel (not listed) are present in Florida in similar habitats in the late fall/winter, a follow-up survey in the spring may be necessary to confidently determine the kestrel species present. It is important to note that the pipeline location, ROW, and work areas are not suitable kestrel habitat. A list of the potential State and Federal threatened and endangered terrestrial species and Species of Special Concern that may occur within the site are provided in **Table 9-1**. The table also gives a brief description of the habitat where the species would most likely be found and their State and Federal status.

Table 9-1
State and Federally Listed Species Potentially Occurring in the Project Area

Species Common Name	Species Scientific Name	Federal Status	State Status	Habitat
Birds				
Audubon's crested caracara	*Caracara cheriway*	T	T	Open lands, pastureland, arid and moist habitats
Florida burrowing owl	*Speotyto cunicularia floridana*		SSC	Open, well-drained areas with herbaceous ground cover
Brown pelican	*Pelecanus occidentalis*		SSC	Mangroves
Wood stork	*Mycteria americana*	E	E	Wetlands and other waterbodies
White ibis	*Eudocimus albus*		SSC	Freshwater, brackish, and saline environments
Snowy egret	*Egretta thula*		SSC	Coastal and inland wetlands, mangroves
Tricolor heron	*Egretta tricolor*		SSC	Mangroves and willow thickets
Peregrine falcon	*Falco peregrinis*		E	Prairies, coastal ponds, marshes, and urban areas
Roseate spoonbill	*Platalea ajaja*		SSC	Mangroves
Little blue heron	*Egretta caerulea*		SSC	Shallow freshwater, brackish, and saltwater environments
American kestrel	*Falco sparverius*		T	Open fields, forest edges, and marshes; require perching apparatus
Reptiles				
Eastern indigo snake	*Dymarchon corais couperi*	T		Dry habitats bordered by water
Gopher tortoise	*Gopherus polyphemus*		SSC	Sandy, open scrub habitats
American alligator	*Alligator mississippiensis*		SSC	Water-retaining habitats
Amphibians				
Florida gopher frog	*Rana capito aesopus*		SSC	Sandy scrub wet areas

Sources: Ashton and Ashton 1981; Rogers et al. 1996; Bartlett and Bartlett 1999; Florida Natural Areas Inventory 2007; U.S. Fish and Wildlife Service 2007.
T = Threatened.
E = Endangered.
SSC = Species of Special Concern.

9.1.1.3 Vegetation

Vegetation in the project area is dominated by disturbed and ruderal sites; however, a variety of habitat types would be traversed. The proposed pipeline route would be located parallel to and cross large sections of existing ROWs, roadways, excavated sites, and drainage canals. Due to previous disturbances, nuisance and exotic species have had the opportunity to spread in these areas. Brazilian pepper (*Schinus terebinthifolius*), specifically, has become the dominant species throughout the majority of the sites, including wetlands, within the proposed pipeline route.

Other non-wetland sites along the proposed pipeline corridor include industrial sites, such as Port Manatee, railroad and transportation ROWs, agricultural fields, maintained grass fields, and previous mining land. Many of these sites have reduced or no vegetation due to the respective land uses and/or maintenance activities.

Small areas of upland forest exist on either side of US 41. The area immediately west of US 41 contains temperate hardwood components including live oak (*Quercus virginiana*), red cedar (*Juniperus virginiana*), hackberry (*Celtis occidentalis*), and cabbage palm (*Sabal palmetto*). The area immediately east of US 41 is composed primarily of Australian pine (*Casuarina equisetifolia*).

The wetlands sites have the greatest abundance of vegetation along the proposed pipeline route. A number of wetland types would be traversed including exotic wetland hardwood, wetland scrub, vegetated non-forested wetlands, and freshwater marsh wetlands. Many of these wetland sites have been subjected to disturbances from adjacent conditions and an influx of nuisance/exotic species.

Exotic wetland hardwoods and mixed wetland forests are present along the pipeline route (Wetlands 2 and 3). However, the interior portions of these habitats contained thick tangles of Brazilian Pepper, while only the outer edges contained a mixture of forested and herbaceous species. Forested species included red maple (*Acer rubrum*), cabbage palms, swamp tupelo (*Nyssa sylvatica*), and live oak. Ground cover and herbaceous species included leather fern (*Acrostichum dangaeifolium*), Virginia chain fern (*Woodwardia virginica*), saw palmetto (*Serena repens*), switch grass (*Panicum virgatum*), elephant grass (*Pennisetum purpureum*), beggar tick (*Bidens alba*), frog fruit (*Phyla nodiflora*), and saltmarsh aster (*Aster subulatus*). Wetlands are discussed in detail in **Section 9.1.4**.

The vegetated non-forested wetlands and freshwater marshes are located on the eastern portion of the pipeline. True forested components are absent in these wetlands. Due to the lack of "perceptible flow" of water during the field investigation, Curiosity Creek (Wetland 5) has been classified as a freshwater marsh in this assessment. FERC defines a waterbody as "any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing…" Since no water was present in this man-made creek, Curiosity Creek is classified as a wetland. At the time of the assessment, the creek contained little vegetation and the vegetation that was present included exotic species such as air potato (*Dioscorea bulbifera*). Wetland 6 is a man-made ditch most likely created for the adjacent agricultural fields. This ditch is dominated by blue maidencane (*Amphicarpum muhlenbergianum*) and leads into a Brazilian pepper forest. The middle section of Wetland 8 contained a freshwater scrub-shrub habitat dominated by exotic species that included primrose willow (*Ludwigia peruviana*). Wetland 9 contains a freshwater component within and adjacent to the extractive land use area. This area was heavily disturbed due to past sand mining activities. This disturbance has caused an influx of cattail (*Typha* sp.) along the reservoir banks. Other species identified in these wetland habitat included primrose willow (*Ludwigia* spp.), flat sedge (*Cyperus* spp.), beggar tick, bushy bluestem (*Andropogon glomeratus*), saltbush (*Baccharis hamilifolia*), Brazilian pepper, Caesar weed (*Urena lobata*), dog fennel (*Eupatorium capillifolium*), foxtail (*Setaria geniculata*), Carolina willow (*Salix caroliniana*), frog fruit, maidencane (*Panicum hemitomon*), soft rush (*Juncus effusus*), rosey camphorweed (*Pluchea rosea*), and Bermuda grass (*Cynodon dactylon*).

A mangrove swamp is located adjacent to the proposed route in Port Manatee, and it is not anticipated that these mangroves would be directly affected. However, mangroves do exist adjacent to the pipeline route, on the southern bank of the tidally influenced canal (south conveyance ditch) within Port Manatee. Red (*Rhizophora mangle*), black (*Avicennia germinans*), and white (*Laguncularia racemosa*) mangroves were all observed within the site. The banks of the canal also contain grass and herbaceous species such as saltgrass (*Distichlis spicata*), samphire (*Blutaparon vermicluane*), golden rod (*Solidago* sp.), cattail, saltbush, and frog-fruit.

9.1.2 Water Use and Quality

This section describes the water use and quality within the area along the 3.9-mile (6.3 km) pipeline route from the pier bulkhead to the proposed interconnecting station. The current groundwater resources in the pipeline area include aquifers, watersheds, and supply wells used by private citizens and agriculture. Surface waters existing in the pipeline area are classified and discussed. Wetland resources are identified and discussed along the proposed pipeline route. Specific construction methods discussed in **Section 4** that would minimize long-term impacts would be used to cross the tidal ditch and wetlands.

9.1.2.1 Groundwater Resources

The groundwater underlying the Revised Preferred Onshore Route occurs within three aquifer systems: the surficial aquifer system (SAS), the intermediate aquifer system (IAS), and the Floridan aquifer system (FAS). The SAS is an unconfined aquifer, while the other two aquifer systems are separate confined systems.

Surficial Aquifer System
The SAS at the site consists of the undifferentiated surficial soils and the Peace River Formation. The water table in this non-artesian aquifer system generally reflects topographic contours and is usually within a few to several feet of the ground surface. The base of the aquifer is the top of the first laterally extensive and vertically persistent bed of much lower permeability, *i.e.*, the

"bedclay complex." Due to the relatively impervious base of the aquifer, groundwater flow is primarily horizontal.

The SAS is recharged by precipitation and drains toward local relief points, such as South Dock Street ditch and creeks. The water table generally follows the contours of the ground surface but will vary across the pipeline route, depending on the ground surface elevation, distance to topographic relief points, and surface water bodies. The depth to ground water exhibits seasonal variations with the lowest water levels occurring at the end of the dry season (November to May). The thickness of the surficial aquifer along the Revised Preferred Onshore Route varies from 10 to 20 feet (3.0 to 6.1 meters) in thickness.

Intermediate Aquifer System
The IAS at the site is composed of pervious and impervious zones within the Arcadia Formation, which includes the Arcadia Formation-Undifferentiated. The aquifer is bounded at the top by impervious deposits within the lower portion of the Peace River Formation and within the upper portion of the Arcadia Formation-Undifferentiated. These beds separate the IAS from the overlying SAS. In addition, interbedded layers of clay act as semi-confining beds at the base of the aquifer system. The aquifer is recharged by downward percolation from the SAS. Discharge from the aquifer occurs through pumpage and downward percolation to the FAS.

Floridan Aquifer System
The FAS is the major water supply source for most public, industrial, and irrigation users in Manatee County and Central Florida. The aquifer consists of more than 1,000 feet (305 meters) of limestone and dolomite within the Tampa Member of the Arcadia Formation (Tampa), and Suwannee, Ocala, and Avon Park limestone formations. According to Brown (1983), at this site, the Tampa is the top of the Floridan aquifer because the Tampa is in direct hydraulic connection with the Suwannee Limestone. The lower part of the Avon Park Formation, containing lenses of anhydrite and gypsum, are believed to form the lower confining bed for the FAS. Movement within the aquifer is primarily horizontal toward zones of discharge via an extensive pattern of cracks, joints, and solution cavities. The Tampa and Suwannee Limestones are not as great as that of underlying formations, but yield a sufficient quantity of water for most domestic, industrial, and irrigation purposes. The Avon Park Formation is the primary potable and industrial water producing unit in Central Florida. Its high permeability is a result of solutioning of the limestone, which has created large cavernous zones that readily transmit water.

The depths to aquifers are summarized in **Table 9-2**. No Sole Source Aquifers are present in the area of the *Port Dolphin* pipeline.

There is no anticipated use of groundwater for the pipeline. Field surveys (literature well inventory and a windshield survey) identified no public water supply wells occurring within 150 feet (46 meters) of the proposed pipeline route. Agricultural use wells in the vicinity of the pipeline are shown on **Figures 9-1** and **9-2**. No private water supply wells were identified in the area of the pipeline route. The agricultural wells obtain water from the intermediate and Floridan aquifers. Construction of the pipeline will have no impact on the water supply wells.

Table 9-2
Stratigraphic Section of the Aquifer System

System	Series	Stratigraphic Unit	Thickness (feet)	Depth (Feet, BLS) From	Depth (Feet, BLS) To	Approximate Elevation (Feet, NGVD) From	Approximate Elevation (Feet, NGVD) To	Lithologic Description	Hydrostratigraphic Unit
Quaternary / Tertiary	Holocene, Pleistocene, Pliocene	Undifferentiated Surficial Soils	10	0	10	25	15	Silty sands, clayey sands, some hardpan and organic soils (overburden soils)	Surficial Aquifer System (Unconfined)
Tertiary	Miocene	Hawthorn Group – Peace River Formation	30	10	40	15	-15	Silty sands, phosphatic clayey sand and sandy clay (matrix)	Surficial Aquifer System (Unconfined)
Tertiary	Miocene	Hawthorn Group – Arcadia Formation – Undifferentiated	230	40	270	-15	-245	Light gray and brown, sandy, phosphatic, calcareous hard clay and claystone (bedclay) overlying light gray and brown, sandy, phosphatic, dolomitic limestone with minor layers of sand, clay and phosphate	Intermediate Aquifer System – Confining Beds and Producing Zone
Tertiary	Miocene	Hawthorn Group – Arcadia Formation – Tampa Member	125	270	395	-245	-370	White, gray and brown, hard, dense, sandy, locally phosphatic, fossiliferous limestone (Tampa Limestone)	Floridan Aquifer System
Tertiary	Oligocene	Suwannee Limestone	200	395	595	-370	-570	White to light brown, soft to hard, non-phosphatic, granular, non-quartz sandy, very fossiliferous, porous limestone with some beds of crystalline dolomite	Floridan Aquifer System
Tertiary	Eocene	Ocala Limestone – Upper Zone	300	595	895	-570	-875	White to light gray, soft, friable, chalky, highly fossiliferous, muddy, granular limestone	Floridan Aquifer System
Tertiary	Eocene	Ocala Limestone – Lower Zone						White to light gray, generally soft, highly fossiliferous, very porous, more granular limestone with beds of brown and light brown, hard, crystalline dolomite	Floridan Aquifer System
Tertiary	Eocene	Avon Park Formation	700+	895	1,595	-875	-1,575	Interbedded limestone and dolomite; limestones range from white brown, soft to hard, fine to granular and fossiliferous; dolomites range from light to dark brown, hard, and microcrystalline to crystalline	Floridan Aquifer System

Figure 9-1
Surface Water Map West

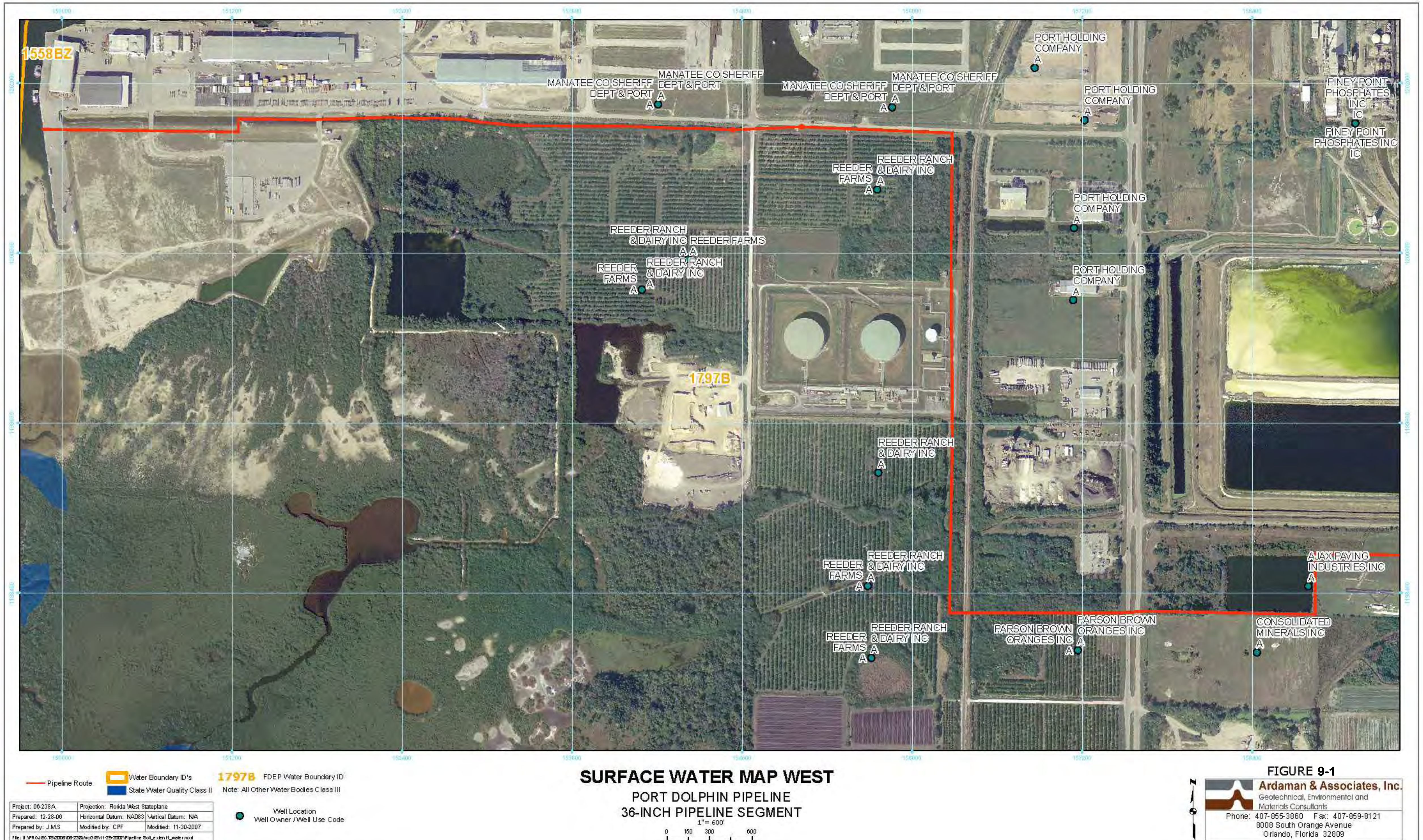
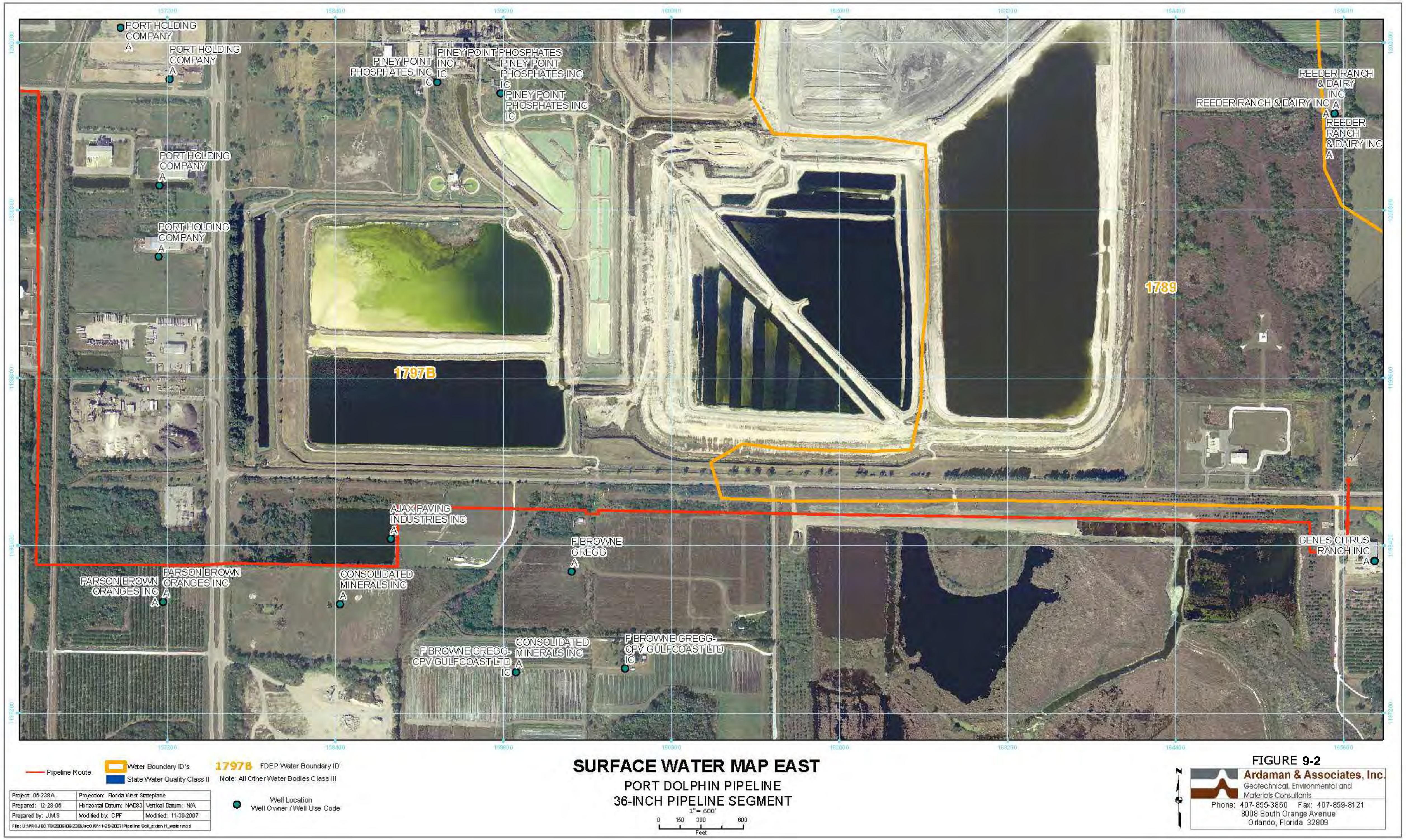


Figure 9-2
Surface Water Map East



9.1.2.2 Surface Water Resources

The *Wetland and Waterbodies Construction and Mitigation Procedures*, issued by the FERC, defines a waterbody as any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies, such as ponds and lakes. The State of Florida defines a surface water or waterbody as any water contained in bounds created naturally or artificially, including the Atlantic Ocean, the Gulf of Mexico, bays, bayous, sounds, estuaries, lagoons, lakes, ponds, impoundments, rivers, streams, springs, creeks, branches, sloughs, tributaries, and other watercourses.

Surface Water Classification and Standards
In Florida, surface waters are assigned to one of five general use categories, pursuant to Chapter 62-302: Rules and Regulations for Surface Water Quality Standards (FDEP). These categories are the following:

Class I – Potable water supplies
Class II – Shellfish propagation or harvesting
Class III – Recreation, propagation, and maintenance of a healthy, well-balanced population of fish and wildlife
Class IV – Agricultural water supplies
Class V – Navigation utility

These use classes are arranged in the order of degree of protection required, with Class I waters having the most stringent water quality criteria and Class V waters generally having the least stringent. Criteria applicable to a classification are designed to maintain the minimum conditions necessary to assure the suitability of water for the designated use. Unless listed in Rule 62-302.400(12) as either a Class I or Class II water, the water is assumed to have a Class III designation. In addition, all secondary and tertiary canals located entirely within agricultural areas are Class IV.

The *Port Dolphin* pipeline would be constructed in two FDEP-designated water quality planning units: Coastal Lower Tampa Bay Tributary (Segment 1797B), and Coastal Middle Tampa Bay Tributary (Segment 1789) Piney Point Creek, as identified on **Figures 9-1** and **9-2**. The streams associated with these two planning units include Piney Point Creek (Segment 1789) and unnamed tributaries in Bishop Harbor (Segment 1797B). Piney Point Creek is classified as Class III waters. The coastal/estuarine areas of Bishop Harbor are classified as Class II waters.

In addition, pursuant to the requirements of Section 303(d) of the Clean Water Act (CWA) and in accordance with the Florida Watershed Restoration Act (Chapter 99-223, Laws of Florida), total maximum daily load (TMDL) is currently being established for all waters that do not meet their designated uses and are thus defined as impaired. Implementation of this statewide watershed management approach is aimed at improving and protecting water quality.

A water quality assessment report for Tampa Bay Tributaries by FDEP (FDEP, 2006) indicated that 60 waterbodies or waterbody segments in the Tampa Bay Tributaries Basin (including contributing watersheds) are impaired and require the development of TMDLs. Portions of the *Port Dolphin* pipeline route would pass through waters that have been designated as impaired.

The pipeline would pass through one water planning unit that has been identified as having waters with identified impairments. Bishop Harbor is noted as having waters with identified impairments associated with elevated coliform bacteria and mercury levels that can adversely affect the areas' designated uses for shellfish propagation or harvesting. The impairments associated with observed mercury levels are in fish and not specifically with observed mercury concentrations in the water column. The Bishop Harbor water segment has been classified as having "low" priority for development of mercury TMDLs, and it is projected that such TMDLs will be developed by 2011.

No data are available for the Piney Point Creek segment.

Waterbodies Crossed

Surface waterbodies within the pipeline project areas were identified through the use of aerial photographs, literature reviews, and on-site surveys. The pipeline route (3,600-foot [1,097-meter] segment) would be within the existing South Dock Street ditch channel beginning between the west and east bridges on Port property on the west and Reeder Road crossing on the east. This ditched surface waterbody is tidally-influenced along most of its 5,000-foot (1,524-meter) reach. The ditch provides tidal water to a mangrove area south of the ditch east of the East Bridge, via shallow swales approximately 2,250 and 3,350 feet (686 and 1,021 meters) east of the bay open waters. In addition, multiple freshwater wetlands containing periodic flooding would be crossed during pipeline construction.

9.1.3 Soils and Geological Resources

Soils and geological resources were analyzed along the proposed pipeline route between the mean high water mark at Port Manatee and its termination at the interconnection station. The combined length of the Revised Preferred Onshore Route is approximately 3.9 miles (6.3 km). Land surface elevations along the proposed pipeline route vary from 7 to 9 feet (2.1 to 2.7 meters) National Geodetic Vertical Datum (NGVD) on the west near the Port to 25 to 30 feet (7.6 to 9.1 meters) NGVD on the east.

The soils in this area have been classified as very poorly drained Wulfert and Kesson type soils. The surficial soils at this site probably have been altered by the development of the Port. Under these altered soils are approximately 10 to 20 feet (3 to 6 meters) of Plio-Pleistocene to Recent Age undifferentiated surficial sands that overlay Miocene- aged Peace River Formation silty sands, phosphatic clayey sand, and sandy clay to a depth of 40 feet (12.2 meters). The Undifferentiated Arcadia Formation underlies the Peace River Formation to approximately 270 feet (82 meters) below land surface.

Figures 9-3 and **9-4** illustrate where the soil types are located along the pipeline corridor. The project area contains 12 different soil types; however, approximately 26.7 acres (10.8 hectares) of the overall 47.2 acres (19.1 hectares) project area (considering 100-foot wide corridor) is composed of Eau Gallie series soils (**Table 9-3**). Eau Gallie soils are poorly drained soils formed in thick beds of sandy and loamy marine sediments (Hyde 1983). These soils are nearly level and found in broad areas of flatwoods and occasionally in slightly depressed areas.

Table 9-3
Soils in the Proposed Pipeline Corridor

Soil Name	Drainage
Bradenton fine sand/Limestone substratum	Poor or somewhat poor
Canova; Anclote and Okeelanta soils	Very poor
Cassia fine sand	Moderately well
Chobe loamy fine sand	Very poor
EauGallie fine sand	Poor or somewhat poor
Floridana-Immokalee-Okeelanta Association	Very poor
Myakka fine sand, tidal	Very poor
Okeelanta muck, tidal	Very poor
Palmetto sand	Poor or somewhat poor
Parkwood Variant complex	Poor or somewhat poor
Wabasso fine sand	Poor or somewhat poor
Wulfert-Kesson Association	Very poor

The soils across the project area are generally poorly drained, ranging from somewhat poor to very poorly drained. A small area contains moderately drained soils, but this soil is not common in the project area. Surface ditches along South Dock Street improve soil drainage in most of the poor to somewhat poorly drained soils.

The surficial geology in the vicinity of the proposed interconnection station, which will have a footprint of approximately 3.14 acres (1.27 hectares), consists of undifferentiated surficial soils classified as Cassia fine sand. Cassia fine sands form in thick deposits of marine sands consisting of somewhat poorly drained to moderately well drained soils and has moderate to moderately rapid permeability. Without drainage improvement, the seasonal high water table is 15 to 40 inches (38 to 102 centimeters) below land surface. These Cassia fine sands grade into the Plio-Pleistocene Peace River Formation, consisting of sand, clay, and clayey sand.

Figure 9-3
U.S. Department of Agriculture Soils Map West

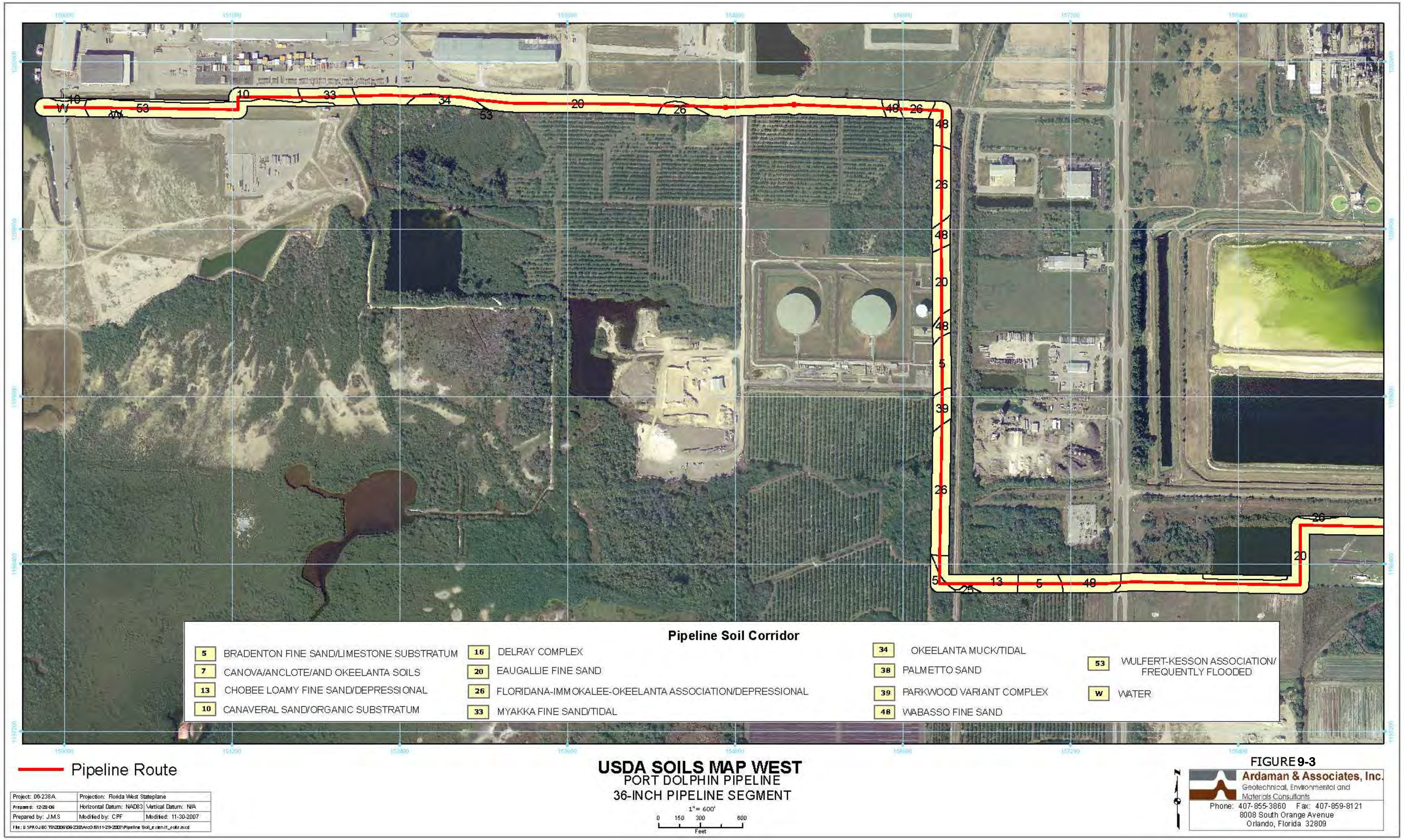


Figure 9-4
U.S. Department of Agriculture Soils Map East

Based upon recent aerial imagery, three inactive mining areas have been identified along the proposed pipeline routings. All three of the inactive mining areas are located along the 36-inch pipeline segment and are classified as inactive sand pits (**Figures 9-5** and **9-6**). The first inactive mining area is located approximately 720 feet (220 meters) from the construction ROW, the second is approximately 1,450 feet (442 meters) from the construction ROW, and the third inactive mining area is located within 40 feet (12.2 meters) of the construction ROW. A review of Manatee County Environmental Management Department records showed active mining permits have been issued for the land south of the proposed pipeline within 40 feet (12.2 meters) south of the construction ROW. Another mining permit has been issued for property on the west side of Grass Farm Road approximately 3,250 feet (991 meters) north of Buckeye Road and the proposed pipeline. Vacant land south of the proposed pipeline may be candidate sites for possible future mining of sandy soils.

Recent analysis has shown that there are no known geological hazards for the Revised Preferred Onshore Route. The U.S. Geological Survey (USGS) Seismic Risk Map of Florida shows the proposed pipeline routings are located in Zone 0, which means there is no expected damage from an earthquake.

Furthermore, there are no active faults within the state of Florida. Earthquakes can cause soil liquefaction of saturated sediments. Because of the low probability of earthquakes occurring in the region of the proposed pipeline, however, the likelihood of earthquake-induced liquefaction is not a concern. Due to the flat nature of the topography along the proposed pipeline routing, no landslides are anticipated. The USGS (Sinclair and Stewart 1985) classifies all of Manatee County as an area where sinkholes are few, but large-diameter and deep sinkholes can occur. Of the four known recent sinkholes in Manatee County, based on the Florida Geological Survey Sinkhole Database, two have been documented within 10 miles (16 kilometers) of the proposed pipeline.

9.1.4 Wetlands

Wetlands are defined by the USACE as areas that are inundated or saturated by surface or ground water at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions, commonly known as hydrophytic vegetation. Section 404 of the Clean Water Act requires a permit for the filling of jurisdictional waters of the United States, which may include certain wetlands. Generally categorized as swamps, marshes, bogs, and similar areas that are often found between open water and dry land, wetlands may improve water quality and reduce flood and storm damage, while providing habitat for many fish and wildlife.

Figure 9-5
Borrow Pit Location Map West

Figure 9-6
Borrow Pit Location Map East

An NWI desktop search was completed identifying the presence of multiple wetlands within the project area (**Figure 9-7**). A preliminary field survey was then completed to delineate federally jurisdictional wetland boundaries along the proposed pipeline route and confirm or refine wetland classifications, as appropriate, based on data gathered from the on-site surveys. The USACE Wetlands Delineation Manual (USACE, 1987) was used to provide the technical guidelines and methods to identify and delineate wetlands for purposes of Section 404 of the Clean Water Act. There are three requirements to define a wetland under this provision: (1) the prevalent vegetation consists of macrophytes that are typically adapted to areas for life in saturated soil conditions; (2) the soils present have been classified as hydric, or they possess characteristics that are associated with reducing; and (3) the area is inundated either permanently or periodically at mean water depths less than or equal to 6.5 feet (2.0 meters) or the soil is saturated to the surface at some time during the growing season.

From the preliminary field survey along the Revised Preferred Onshore Route, 11 wetlands were identified (**Table 9-4, Figures 9-8**, **9-9**, and **9-10**) and classified as the following types:

Table 9-4
Wetlands Located Along the Pipeline Corridor

Wetland	NWI Code	NWI Classification Type	Acres in Corridor
W-1	EOW/SS (3)	Estuarine Open Water/Scrub-Shrub	1.88
W-2	PFO/SS	Freshwater Forested/Scrub-Shrub	0.95
W-3	PSS/FO	Freshwater Scrub-Shrub/Forested	2.75
W-4	POW(h)(x)	Freshwater Open Water (permanently flooded) (Excavated)	1.11
W-5	R4SB(5)	Riverine Intermittent Streambed (mud)	0.06
W-6	PEM/SS	Freshwater Emergent/Scrub-Shrub	0.07
W-7	PSS	Freshwater Scrub-Shrub	0.03
W-8	PSS/EM	Freshwater Scrub-Shrub/Emergent	0.15
W-9	PEM/L1OW(x)	Freshwater Emergent/Lacustrine Limnetic Open Water (Excavated)	5.46
W-10	PEM	Freshwater Emergent	0.37
W-11	POW	Freshwater Open Water	0.24

NWI = National Wetlands Inventory (U.S. Fish and Wildlife Service, 1979).

The wetlands observed on site can be primarily categorized into four vegetative classifications: (1) Open Water, (2) Scrub-Shrub, (3) Emergent, and (4) Forested. These classifications include both palustrine (freshwater) and estuarine (saltwater) sites. Many of the wetland sites could not be identified by a single NWI classification; therefore, a combination of appropriate classifications was applied, with the dominant site characteristics listed first. The remaining classifications listed above are sites with open water, river, or other deep water habitats identified as the primary site characteristic.

Figure 9-7
***Port Dolphin* Pipeline Route Options Relative to National Wetlands Inventory Data (NWI)**

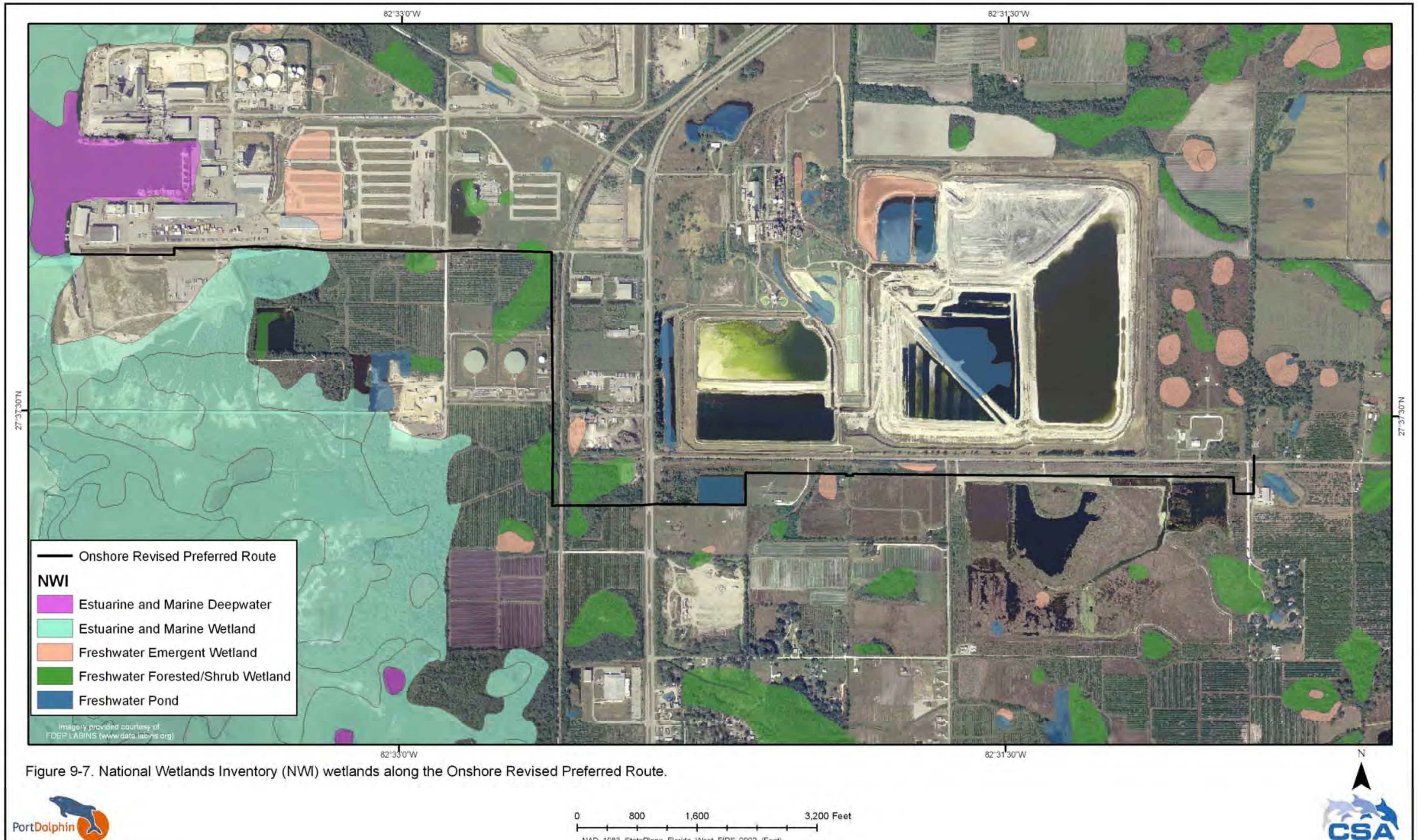


Figure 9-7. National Wetlands Inventory (NWI) wetlands along the Onshore Revised Preferred Route.

Figure 9-8
Wetlands – *Port Dolphin* Pipeline, Manatee County, FL (1 of 3)

Figure 9-9
Wetlands – *Port Dolphin* Pipeline, Manatee County, FL (2 of 3)

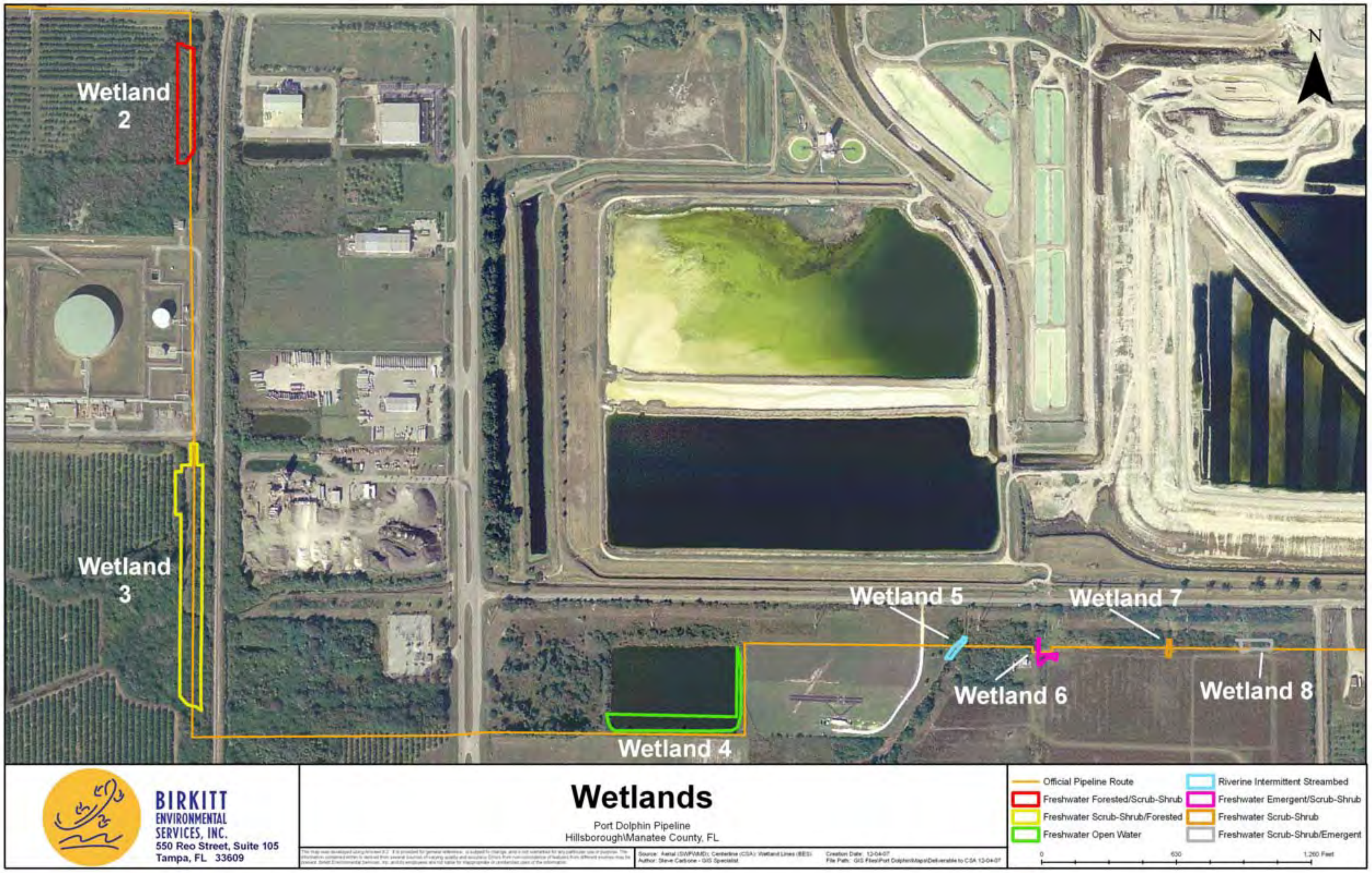


Figure 9-10
Wetlands – *Port Dolphin* Pipeline, Manatee County, FL (3 of 3)

9.1.4.1 Estuarine Open Water/Scrub-Shrub

Estuarine open water classification includes coastal canals that have little vegetation and the water supports estuarine fish and wildlife species. Estuarine Scrub-Shrub wetlands are coastal marshes periodically flooded by tidal waters. The tidal flushing is an important characteristic providing the wetland with mixing of soils, seed banks, and nutrients. The estuarine Open Water habitat includes the tidal canal located in Port Manatee. This canal contains a few small red mangroves along the banks of the tidal canal. Due to the present of two different habitats, this wetland is listed as a combination of both Open Water and Scrub-Shrub classification. A total of 1.88 acres (0.76 hectares) of estuarine Open Water/Scrub-Shrub are found in the project site.

9.1.4.2 Freshwater Forested

Freshwater Forested habitats are characterized by sites containing woody vegetation at least 20 feet (6 meters) tall. All water regimes are included except subtidal. Due to the presence of Brazilian pepper trees throughout the majority of wetland sites, no wetland was classified as only Forested.

9.1.4.3 Freshwater Scrub-Shrub

Scrub-Shrub wetlands are dominated by woody vegetative species. Scrub-Shrub wetlands are similar to Forested wetlands in species composition; however, they have a reduced Forested component or immature Forested species, leading to vegetation less than 20 feet (6 meters) in height. A total of 0.03 acres (0.01 hectares) of freshwater Scrub-Shrub wetlands are located in the proposed pipeline corridor.

9.1.4.4 Freshwater Emergent Wetland

Emergent wetlands are dominated by herbaceous vegetation exhibiting stems that are erect, rooted, and soft. Emergent wetlands may show a diverse variety of non-woody species including grasses, sedges, or other emergent hydrophytes. Periodic non-tidal flooding may occur leaving wetland soils saturated and/or inundated. A total of 0.37 acres (0.15 hectares) of freshwater Emergent wetlands are found in the project area.

The other wetland sites did not have an overwhelming dominance of vegetation type or were dominated by Open Water; therefore, these wetlands were classified as a combination of categories as follows:

- Freshwater Forested/Scrub Shrub (0.95 acres) (0.38 hectares);
- Freshwater Scrub Shrub/Forested (2.75 acres) (1.11 hectares);
- Freshwater Open Water (Excavated) (1.35 acres [0.55 hectares]; Note two wetlands);
- Riverine Intermittent Streambed (0.06 acres) (0.02 hectares);
- Freshwater Emergent/Scrub Shrub (0.07 acres) (0.03 hectares);
- Freshwater Scrub Shrub/Emergent (0.15 acres) (0.06 hectares);

- Freshwater Emergent/Lacustrine Limnetic Open Water (Excavated) (5.46 acres) (2.21 hectares); and
- Freshwater Open Water (0.24 acres) (0.10 hectares).

9.1.5 Land Use, Recreation, and Aesthetics

9.1.5.1 Land Use

The Florida Land Use, Cover and Forms Classification System (FLUCCS) nomenclature system was utilized to identify the dominant habitat and land use features along the onshore portion of the pipeline alignment. The FLUCCS system was developed by the Florida Department of Transportation (FDOT) State Topographic Bureau Thematic Mapping Section (Procedure No. 550-010-001-a, September 1985, Second Edition). This system is widely used in the State of Florida by land planners, environmental consultants, local governments, and the regulatory agencies.

The land types traversed by the proposed project were assigned to land use categories through preliminary site reconnaissance and aerial interpretation of the 2004 FDEP Land Boundary Information System (Labins), Digital Ortho Quarter Quads (DOQQs, scale 1:24,000) with 1-meter resolution, and existing land use data from Manatee County.

Land uses and/or vegetative communities are broadly categorized into the six basic FLUCCS categories: Urban and Built Up, Agriculture, Upland Forests, Water, Wetlands, and Transportation. Within each broad category, additional detailed levels of land use/vegetation cover classifications are assigned.

Table 9-5 presents the FLUCCS categories (codes) and length of pipeline (centerline) in each category that were field-identified as vegetation communities and land use along the proposed *Port Dolphin* Revised Preferred Onshore Route. **Figures 9-11, 9-12,** and **9-13** illustrate FLUCCS codes along the Revised Preferred Onshore Route as designated by FDOT. However, field verification of the land uses revealed the presence of different land uses than those designated by FDOT (Note: Figures have not been altered to show field investigation findings; however, **Table 9-5** has been updated with the field-verified FLUCCS codes).

9.1.5.2 Recreation

The proposed pipeline would traverse a section of land classified as recreational use. The site is currently used as a radio controlled airplane fly zone. The site primarily consists of maintained grasses. Two asphalt runways less than 500 feet (152 meters) long and a covered area for observation also exist within the site.

Table 9-5
Land Use Along Revised Preferred Onshore Route

Land Use (code)	Length (feet)
Urban and Built-Up (100)	
• Commercial and Services (140)	476.3
• Industrial (150)	
o Mineral Processing (153)	1,101
• Recreation (180)	
o Other (189)	1,416
• Openland (190)	454.4
Agriculture (200)	
• Cropland and Pasture (210)	111.8
• Tree Crops (220)	496.4
o Abandon Groves (224)	454.4
Upland Forest (400)	
• Upland Hardwood Forest (420)	
o Brazilian Pepper (422)	2,393.1
o Temperate Hardwood Forest (425)	522.4
o Australian Pine (437)	531
Water (500)	
• Streams and Waterways (510)	3,633.1
Wetlands (600)	
• Wetland Hardwood forests (610)	
o Exotic Wetland Hardwoods (619)	868.1
• Wetland Forested Mixed (630)	826.9
o Wetland Shrub (631)	410
• Vegetated Non-Forested Wetlands (640)	0
o Freshwater Marshes (641)	841.8
o Cattail (6412)	1938
o Maidencane (6414)	11.3
Transportation, Communication and Utilities (800)	
• Transportation (810)	
o Railroads (812)	56.2
o Roads and Highways (814)	1,517.6
o Port Facilities (815)	1,452.9

Figure 9-11
FLUCCS Codes for Land Use Categories Along the *Port Dolphin* Pipeline (1 of 3)

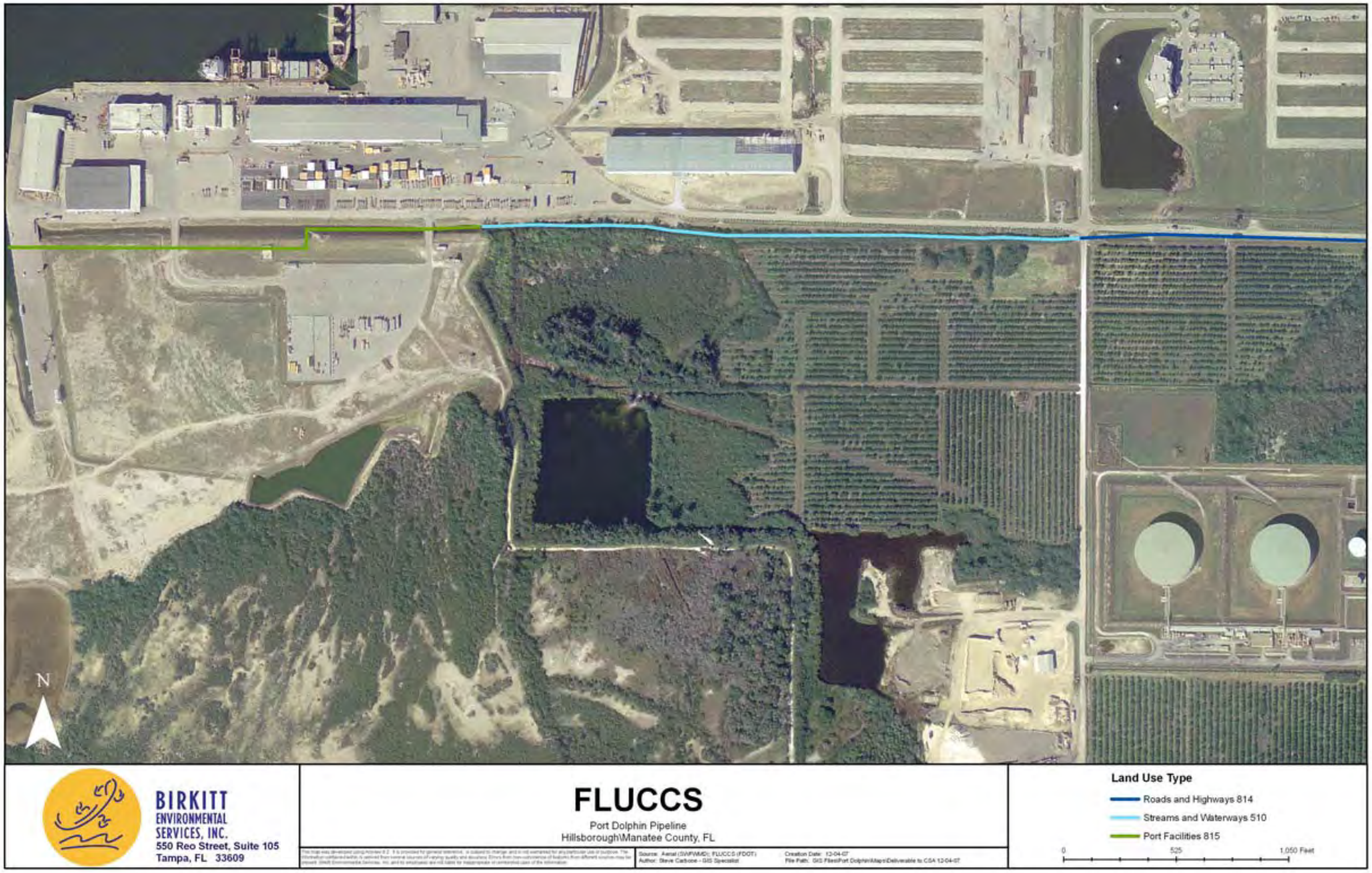


Figure 9-12
FLUCCS Codes for Land Use Categories Along *Port Dolphin* Pipeline (2 of 3)

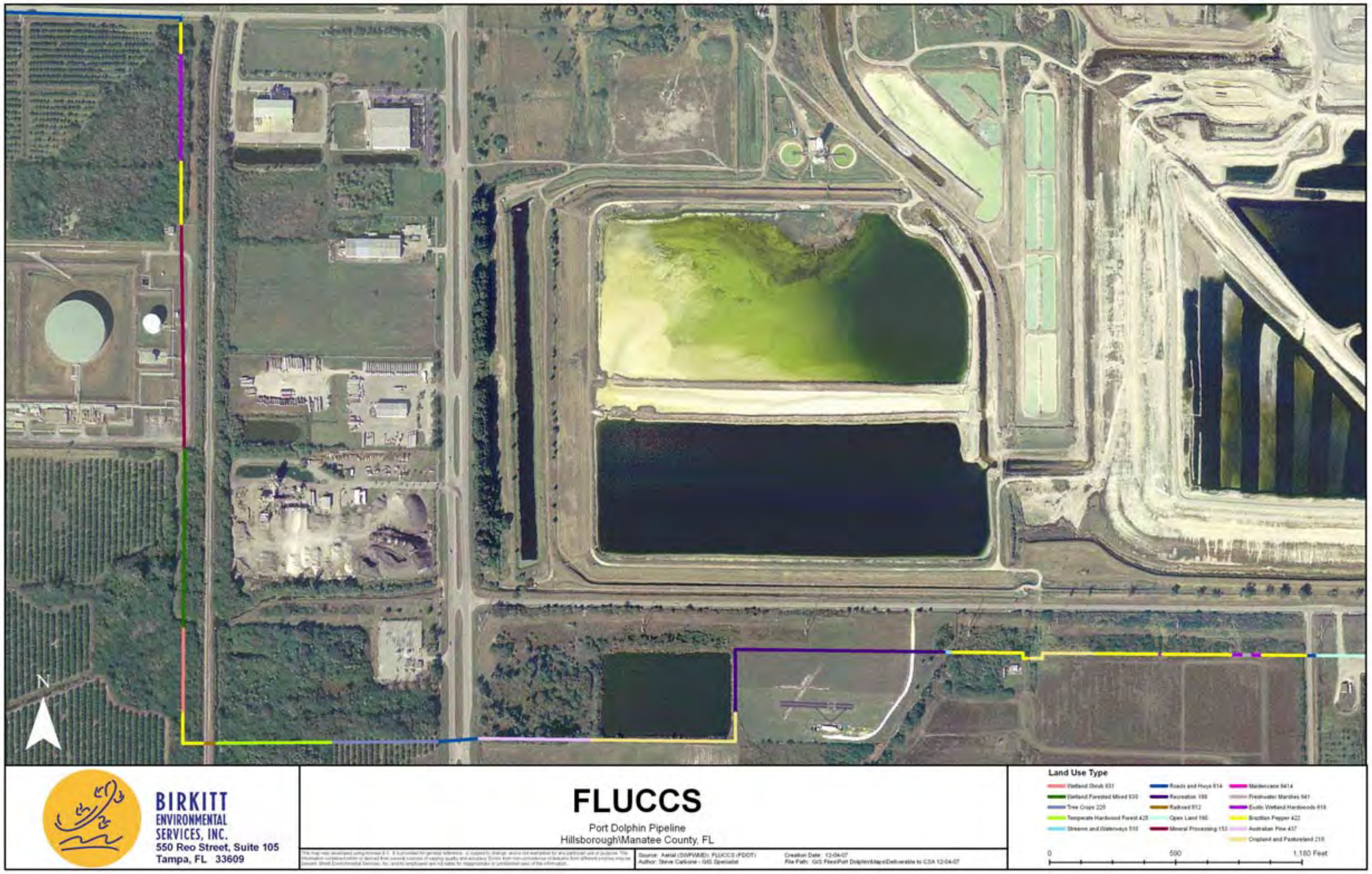
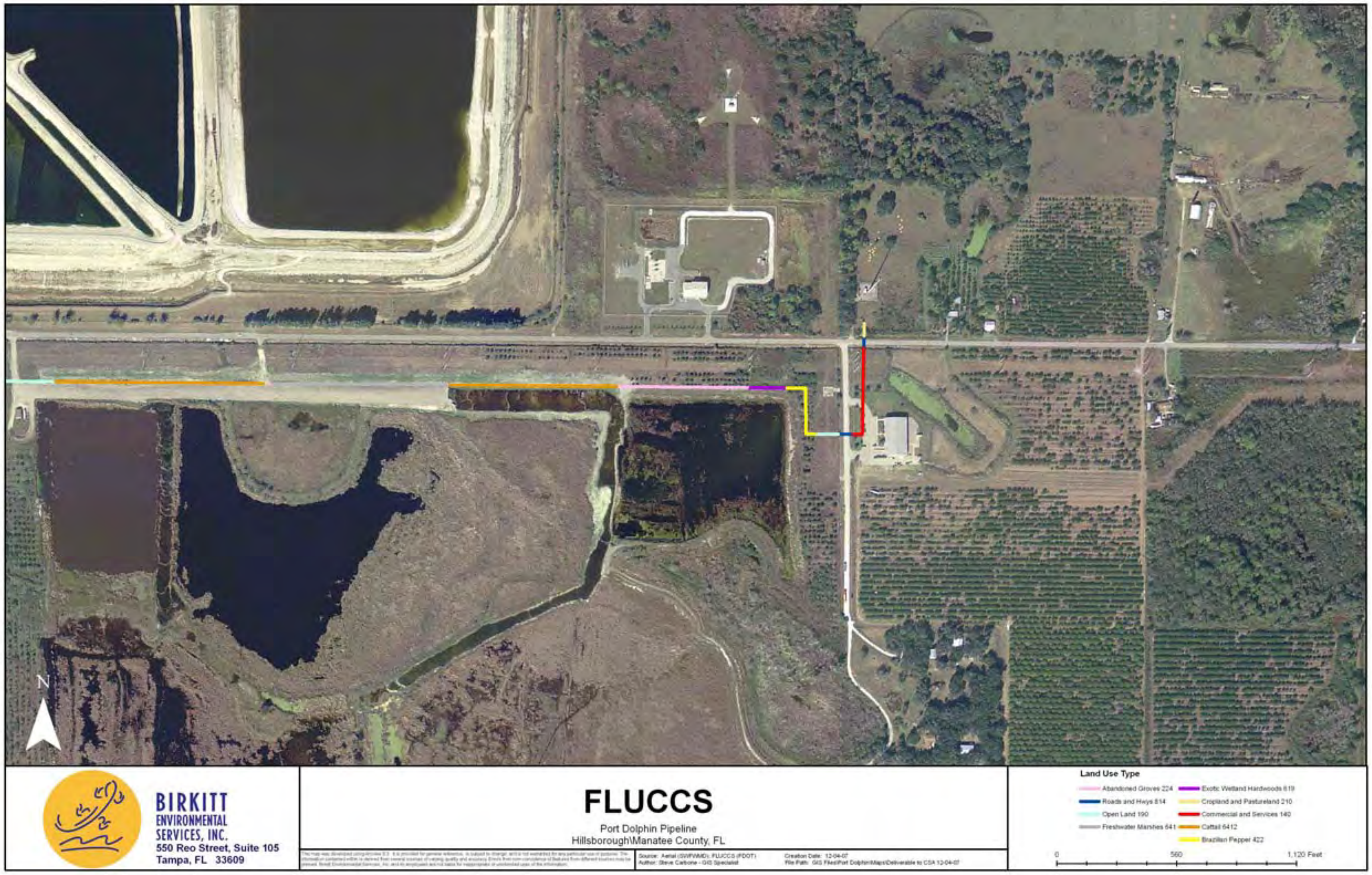


Figure 9-13
FLUCCS Codes for Land Use Categories Along *Port Dolphin* Pipeline (3 of 3)



9.1.5.3 Aesthetics

The proposed *Port Dolphin* Revised Preferred Onshore Route consists of primarily urban, built-up, and ruderal/disturbed sites. The Revised Preferred Onshore Route would traverse Port Manatee, across a railroad easement, along the edges of the former Piney Point property, along an existing linear facility corridor that is currently used for both underground and overhead linear facilities, former grove lands, and pasture lands.

The remaining land use areas consist of freshwater and estuarine wetlands. The proposed pipeline would be installed underground in all areas and not affect aesthetics once construction is complete.

9.2 Analysis of Potential Consequences

The Revised Preferred Onshore Route has changed significantly from the Original Preferred Onshore Route; therefore, for clarity, the complete analysis of potential consequences has been included below.

Potential impacts to terrestrial resources are rated as significant, minor, or negligible using the following criteria:

- **Significant** – An impact is significant if it is likely to result in violation of discharge regulations or ambient water quality standards, or elevated concentrations of metals, hydrocarbons, or other sediment contaminants.
- **Minor** – changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible** – changes that are unlikely to be noticed or measurable against background conditions.

9.2.1 Fish, Wildlife, and Vegetation

All impacts to fish, wildlife, and vegetation will be temporary and short-term while construction operations are underway. No areas of special concern will be impacted, and most of the impacts will be to areas that provide reduced habitat due to prior land use or site disturbances. A mitigation plan will be implemented on a site-specific basis to fully restore the corridor to preconstruction conditions.

9.2.1.1 Construction

All construction methods employed along the proposed pipeline route will comply with the FERC *Wetland and Waterbody Construction and Mitigation Procedures*. Prior to the start of construction activities, a project specific Wetland and Waterbody Construction and Mitigation Procedures document will be developed and implemented during construction activities.

Construction impacts on fish and fish resources will be negligible through the use of appropriate construction methods and site selection. Methods also have been implemented to assure minimal impacts in the event of a drill fluid spill. Non-toxic additives will be used, and a contingency plan for contamination of any frac-outs will be in place to mitigate all unexpected events.

The only possible fish resources impacted would be in the south conveyance ditch at Port Manatee, the reservoirs, drainage canals, and the inundated wetland sites. Minimal fishery resources are potentially present in these areas; however, if present, rapid re-establishment of populations is expected following completion of construction and ROW restoration. As a result, only short-term impacts would occur to the fish resources, and thus, impacts are anticipated to be negligible.

Wildlife and vegetation along the Revised Preferred Onshore Route would be temporarily impacted by construction activities. Open trenching would be the method of construction for the majority of the pipeline route. As stated in the existing conditions, reduced wildlife habitat is present along the majority of the proposed route due to previous and/or current land use. For this reason, it is expected that wildlife would not be largely affected. Once construction is complete, all sites will be restored in accordance with the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan*, allowing wildlife to resume use of the ROW corridor. The vegetation in non-wetland sites currently is composed of minimal upland forests, upland shrubs, grasses, and invasive species.

There is one HDD planned to traverse under the FPL tank farm, measures will be taken to minimize any drilling fluid release (or frac-outs) from the HDD construction methodology. Impacts will be minimized in the event of a frac-out as the drilling entry and exit holes have been located away from the sensitive areas. Additionally, the use of non-toxic additives and development of a contingency plan will further minimize impacts. In the event of a frac-out, containment will occur in an expedited manner, assuring negligible potential for impact to the surrounding area.

The wetland sites will have the most impact since they provide the greatest resource to wildlife. The vegetation would be temporarily impacted while construction is ongoing. However, all sites would be restored through implementation of a mitigation plan upon construction completion. In addition, efforts will be made to minimize impacts to the sites, including using mats under the excavation equipment and flagging wetland areas adjacent to the construction ROW for protection, resulting in minor impacts.

The wetland sites would experience temporary impacts from construction of the pipeline. Many of the wetland sites currently provide limited resources due to poor existing conditions and high composition of nuisance/exotic species, as well as close proximity to disturbed sites. Wildlife, such as wading birds, amphibians, and other mobile wetland species are expected to relocate during the construction operations; but, are also expected to return once the construction is completed. The site will be restored by means of a mitigation plan addressing re-vegetation, control of invasive species, and monitoring the progress of the site's restoration.

Permanent impacts will also occur to the extractive pond Open Water habitats Wetlands 4 and 9. A permanent levee will be constructed to isolate the area where the proposed pipeline will be placed and the water in the proposed ROW will be pumped out. Therefore, the pipeline will be placed underground and the water in the ponds will not be restored. These ponds have little to no vegetation and were formed during mining and other extractive activities. Therefore, impacts to these ponds are expected to be minimal.

However, as discussed above, these areas provide limited resources due to poor existing conditions and high composition of nuisance/exotic species, as well as close proximity to disturbed sites. The aboveground facilities (valve station and interconnection station) are the only other permanent impacts. These facilities would be constructed in areas that currently provide minimal suitable habitat for wildlife due to previous clearing and land use activities. Therefore, impacts to vegetation and wildlife habitat would be negligible.

9.2.1.2 Operations

Operational impacts from the Revised Preferred Onshore Route would be minimal. The area within the ROW corridor will be fully restored to pre-construction conditions with the exception of the aboveground facilities, which are discussed above under the construction impacts section; therefore, no additional impacts would be experienced during the operational phase. The aboveground facilities will be permanent impacts, but the sites chosen were selected based on the minimal resources present at those locations. Therefore, the impacts are negligible. No other operational impacts are expected.

9.2.1.3 Decommissioning

Aboveground decommissioning of the pipeline would consist of all of the equipment and pipes being removed. The underground decommissioning will consist of the removal of any hydrocarbons in the pipe through flushing, filling the pipe with treated freshwater, and capping the ends of the pipe. The impacts from the decommissioning activities would be negligible.

9.2.1.4 Accidents and Upsets

Accidents or upsets during construction could result in a release of natural gas to the atmosphere or a frac-out during the HDD. Any upsets or accidents during construction will be handled by contingency planning and development of a spill response plan to respond to spills of any size. Such impacts tend to be temporary; and therefore, the effect is considered to be negligible. A release of natural gas would result in no impact.

9.2.2 Water Use and Quality

There are no surface waters used as potable water supply intakes within the pipeline corridor. The pipeline would not cross any public water supply watershed areas or surface water protection areas. Therefore, the pipeline would have no impact on water supply wells.

9.2.2.1 Construction

Construction methods were outlined in **Section 4**, and the FERC *Wetland and Waterbody Construction and Mitigation Procedures* will be followed. These will include, but not be limited to, complying with all state and federal permit conditions; the use of sediment barriers for soil piles adjacent to the waterbody. HDD will be used in the Port for 1,400 lineal feet at the west end of the upland pipeline and will be used to cross Reeder Road at the east end of the ditch crossing. In between these two areas, the pipeline will be constructed beneath the conveyance ditch. Typically, slick bores will be used for road crossings along the entire route of the pipeline, and a jack and bore will be used for the railroad crossing.

Long-term surface water impacts are not anticipated along the Revised Preferred Onshore Route. Temporary and short-term impacts will be minimized during construction activities by complying with the FERC *Wetland and Waterbody Construction and Mitigation Procedures* including, but not limited to, complying with all state and federal permit conditions, using sediment barriers for soil piles adjacent any surface water body, and minimizing the time that the pipeline excavation is open. Any steps required to minimize impacts to the surface water sites will be followed, as appropriate, on a site-specific basis. Necessary permits will be obtained from state agencies to comply with state water quality standards. The construction of the pipeline along the tidal South Dock Street ditch will occur during the dry season between November and May. Possible runoff occurring during the pipeline construction in the tidal section will be re-routed to the south along the west edge of the mangrove area. A detailed description of the construction methodology is provided in **Section 4**.

No groundwater contamination sites have been identified in the vicinity of the *Port Dolphin* Revised Preferred Onshore Route with the exception of a plume south from the Piney Point phosphate gypsum stack system. Seepage from the Piney Point phosphate gypsum stack system is currently contained by a seepage interceptor drain now being actively operated and maintained to prevent offsite seepage of process water. The ongoing closure work at this site should eliminate future groundwater impacts. Nevertheless, residual inorganic groundwater contamination may be present along Buckeye Road. During pipeline construction south of the gypsum stack, Port Dolphin will investigate the groundwater issue in this area and adjust installation methods, if necessary, and any dewatering activities required will be completed in accordance with agency regulations and permits to avoid discharge of contaminated waters.

Impacts to water quality and sedimentation typically would be minor and short-term in nature when properly mitigated, as evidenced by extensive industry experience. Therefore, impacts, if any, will be short term, occurring during construction.

Port Dolphin will adopt the FERC's *Upland Erosion Control, Revegetation, and Maintenance Plan* and construct and operate the *Port Dolphin* pipeline without adverse environmental impacts to waterbodies, as explained in **Section 4**. Prior to commencement of construction activities, a site-specific Erosion Control Plan will be developed for implementation. The measures to be implemented will include, but not be limited to, coordinating with appropriate local, state, and federal agencies and complying with all permit conditions; installing silt fencing and other appropriate erosion control measures; providing oversight by an Environmental Inspector; developing a Stormwater Pollution Prevention Plan; demarking the construction ROW; segregating topsoil from trench areas; and revegetation of the disturbed areas.

The pipeline would be hydrostatically tested following construction. The hydrostatic test would be completed through acquisition of approximately 1.1 million gallons of water from a fire hydrant. After testing, it is anticipated that the test water would be discharged at a rate of approximately 415 gallons per minute at the interconnection station. All appropriate permits for water use and discharges will be obtained from State agencies prior to construction.

9.2.2.2 Operations

There is no water use required during operations.

9.2.2.3 Decommissioning

Aboveground decommissioning of the pipeline will consist of all of the equipment and pipe being removed. The underground decommissioning will consist of the removal of any hydrocarbons in the pipe through flushing, filling the pipe with treated freshwater, and capping the ends of the pipe. Temporary short term impacts to surface waters may occur during decommissioning.

9.2.2.4 Accidents and Upsets

Upsets or accidents are not anticipated to affect the surface waters along the *Port Dolphin* Revised Preferred Onshore Route. Any clean-up activities and thus any impacts would be temporary and controlled by the implementation of an Upland Erosion Control, Revegetation, and Maintenance Plan and Spill Contingency Plan; and therefore, the impacts are negligible.

9.2.3 Soils and Geological Resources

9.2.3.1 Construction

No long-term geological related impacts are anticipated from construction of the proposed Revised Preferred Onshore Route. Pipeline construction should not have any impacts on geology along the route. Dewatering may be required during open trench excavations because of high water table conditions. Pipeline construction is expected to have no long-term impacts to soils; however, limited or temporary impacts to soils along pipeline ROWs may occur, and the impacts would be negligible.

9.2.3.2 Operations

No long-term geological related impacts are anticipated from operation of the proposed pipeline along the Revised Preferred Onshore Route. Operation of the pipeline should not have any impacts on geology or soils along the route.

9.2.3.3 Decommissioning

Aboveground decommissioning of the pipeline will consist of all of the equipment and pipe being removed. The underground decommissioning will consist of the removal of any hydrocarbons in the pipe through flushing, filling the pipe with treated freshwater, and capping the ends of the pipe. Soils and geological resources will have negligible impacts during decommissioning.

9.2.3.4 Accidents and Upsets

Upsets or accidents are not anticipated to affect the soils or geology of the *Port Dolphin* pipeline Revised Preferred Onshore Route. Any cleanup activities and thus any impacts would be temporary and controlled by the implementation of an Upland Erosion Control, Revegetation, and Maintenance Plan; and therefore, the impacts are negligible.

9.2.4 Wetlands

9.2.4.1 Construction

The majority of impacts to the wetlands along the Revised Preferred Onshore Route would be temporary and short-term while pipeline construction is taking place. The estimated time for construction of the pipeline is approximately 3 months.

In Port Manatee, the pipeline would be placed underneath the south conveyance ditch utilizing open trenching. Care will be taken to avoid impacts to adjacent mangrove habitat. The water management plan for the installation in the south conveyance ditch is described in **Section 4.3.3.1**.

The open-trench construction method to be employed to cross all wetlands along the pipeline route will comply with the open trenching methods standardized by the FERC Wetland and Waterbody Construction and Mitigation Procedures. Prior to the start of construction activities, a project-specific Wetland and Waterbody Construction and Mitigation Procedures document will be developed and implemented during construction activities.

A total of 13.07 acres (5.29 hectares) of wetlands will be impacted during the construction operations (**Table 9-6**). Approximately 5.13 acres (2.08 hectares) of wetland impacts will be temporary, and mitigation measures will be taken to ensure restoration of the wetlands; therefore, impacts would be minor. Prior to construction activities, the wetland boundaries and buffer areas will be clearly flagged. Other mitigating measures include removal of top soils, use of appropriate stabilizer (rip-rap, terra mats, etc.), use of low ground weight construction equipment, minimal access roads, and removal of vegetation within the ROW only.

It is important to note that there would be some permanent impacts to forested habitats. However, only a small portion of the wetlands are forested and are dominated by exotic species. The majority of the wetlands are herbaceous are expected to be restored once construction is complete. The removal of these exotic species and the restoration of the wetlands to a more natural state will improve the quality of habitat for fish and wildlife. A mitigation and restoration plan will be developed with consultation of the appropriate agencies. The plan will address methods for restoring wetland vegetation, controlling the spread of nuisance/exotic species, planting of appropriate species, and monitoring the success of wetland restoration.

Table 9-6
Wetlands Located Along the Pipeline Corridor

Wetland	NWI Code	NWI Classification Type	Acres of Temporary Impact	Permanent Impacts (Acres)	Length of Crossing (feet)
W-1	EOW/SS (3)	Estuarine Open Water/Scrub-Shrub	1.88	0.0	2,769.4
W-2	PFO/SS	Freshwater Forested/Scrub-Shrub	0.00	0.95	505.2
W-3	PSS/FO	Freshwater Scrub-Shrub/Forested	0.73	2.02	1,224.5
W-4	POW(h)(x)	Freshwater Open Water (permanently flooded) (Excavated)	0.18	0.93	1,059.4
W-5	R4SB(5)	Riverine Intermittent Streambed (mud)	0.06	0.00	32.3
W-6	PEM/SS	Freshwater Emergent/Scrub-Shrub	0.07	0.00	120.6
W-7	PSS	Freshwater Scrub-Shrub	0.03	0.00	22.3
W-8	PSS/EM	Freshwater Scrub-Shrub/Emergent	0.15	0.00	168.7
W-9	PEM/L1OW(x)	Freshwater Emergent/Lacustrine Limnetic Open Water (excavated)	1.42	4.04	3,533.2
W-10	PEM	Freshwater Emergent	0.37	0.00	137.9
W-11	POW	Freshwater Open Water	0.24	0.00	34.0

NWI = National Wetlands Inventory.

Permanent impacts will also occur to the extractive pond Open Water habitats Wetlands 4 and 9. A permanent levee will be constructed to isolate the area where the proposed pipeline will be placed and the water in the proposed ROW will be pumped out. Therefore, the pipeline will be placed underground, and the water in the ponds will not be restored. These ponds have little to no vegetation and were formed during mining and other extractive activities. Therefore, impacts to these ponds are expected to be minimal.

9.2.4.2 Operations

No impacts to wetlands are expected during the operational phase of the project.

9.2.4.3 Decommissioning

No impacts to wetlands are expected during the decommissioning of the project. Aboveground decommissioning of the pipeline will consist of the equipment and pipes being removed. The underground decommissioning will consist of the removal of any hydrocarbons in the pipe through flushing, filling the pipe with treated freshwater, and capping the ends of the pipe.

9.2.4.4 Accidents and Upsets

Any upsets or accidents during construction will be handled by contingency planning and development of a spill response plan to respond to spills of any size. Such impacts tend to be temporary, and therefore, the effect is considered to be minor. With the appropriate methods in place, all impacts from potential upsets will be negligible.

9.2.5 Land Use, Recreation, and Aesthetics

9.2.5.1 Construction

Land Use. The pipeline route would come onshore within the Port Manatee property via an HDD where the proposed valve station would be located. Slick bores would be used to minimize impacts to any existing roadways. An HDD will also be used to traverse property where an existing FPL tank farm is located. The depth of the HDD is anticipated to be 40 feet (12.5 meters) below land surface and the slick bores are anticipated to be approximately 15 to 20 feet (4.6 to 6.1 meters) below land surface, and therefore, the potential for impacts to the FPL tank farm and roadways is negligible. The crossing of the CSX Railroad will be performed by the use of a dry jack and bore that will be approximately 15 feet (4.6 meters) below land surface; therefore, impacts to the CSX Railroad are negligible.

At the location of each of the six onshore HDD/bores, it will be necessary to excavate HDD/bore entry and exit pits. The remaining portions of the *Port Dolphin* pipeline would be installed using the open trench construction method. The impacts to the lands disturbed during construction activities, with the exception of the interconnection facility, would be temporary.

Any temporary impacts to the additional land uses would be minimized utilizing the Best Management Practices (BMPs) that will be developed for the project to help minimize erosion during trenching operations and construction activities. The pipeline will be 3.88 miles (6.24 kilometers) in length. Most construction activities associated with the pipeline will occur within a 100-foot (30.5-meter) construction ROW, centered on the pipeline. However, where HDD/bores are utilized to cross the FPL tank farm, the CXS Railroad, and roads, a total of 2.49 acres (1.01 hectares) of additional work space is required for HDD equipment. The lands included in the additional work space required at Port Manatee would be adjacent to the pipeline and are previously disturbed lands. Any other additional required areas would be located at Port Manatee in existing laydown areas or buildings. Once the pipeline installation is complete, all of these areas impacted would be restored to original grade and revegetated, and therefore the impacts are negligible.

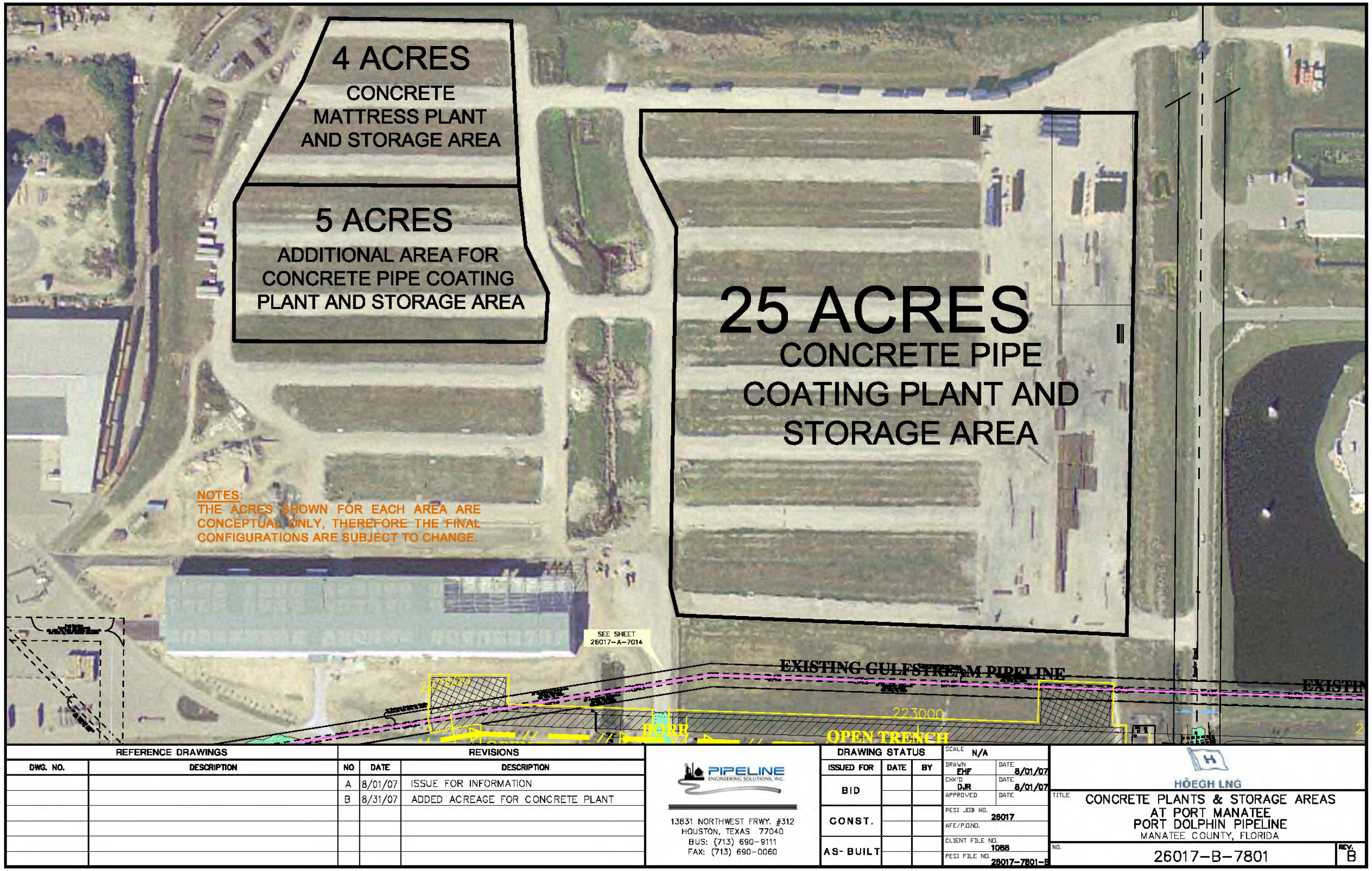
All staging areas, pipe yard, and contractor facilities will be located at Port Manatee in existing staging areas and buildings. Construction for the onshore *Port Dolphin* pipeline is anticipated to last approximately 5 months, and the construction for the *Port Dolphin* deepwater port and pipeline, which will use the pipe yard and contractor facilities, will last approximately 6 months.

These extra work/staging areas will consist of a temporary concrete coating batch plant, a concrete mattress production facility, and pipe lay-down areas located at Port Manatee, totaling 34 acres (13.8 hectares) (**Figure 9-14**). The batch plant, concrete mattress production facility, and pipe and contractor yards will be located at Port Manatee in areas previously used for this purpose. The contractor facilities will be housed in existing office space at the Port. There will be no access roads required outside of existing roads and the 100-foot (30.5-meter) construction ROW.

Two aboveground facilities will be required for the Revised Preferred Onshore Route: the proposed valve station, located at Port Manatee; the proposed interconnection station, located in an area currently zoned as orchard/citrus; and a portion of the parcel that currently contains a cell phone tower. Therefore, the impacts are negligible.

The cleanup and restoration will encompass all disturbed areas. The sites will be finish graded and any remaining trash and debris will be properly disposed of in compliance with federal, state, and local regulations. After construction is completed, the entire ROW will be protected by the implementation of permanent and temporary erosion control measures including site specific contouring, permanent slope breakers, mulch and reseeding or sodding with soil-holding grasses. Contouring will be accomplished using acceptable soil stockpiled during initial grading. The erosion control measures used will be in accordance with the Soil and Erosion Control Plans approved by the local soil conservation districts, appropriate state agencies, FERC's *Upland Erosion Control, Revegetation and Maintenance Plan*, and Port Dolphin BMPs.

Figure 9-14
Extra Work/Staging Areas Locations at Port Manatee



Due to the existing land uses, mitigation measures to be implemented, and restoration activities to take place, impacts from the construction activities are considered minor.

Recreation. There is one parcel along the Revised Preferred Onshore Route that is currently used as a radio controlled airplane fly zone. The pipeline construction ROW does not traverse the runways on the site; and therefore, the impacts to recreational activities would be minor.

Aesthetics. Additional extra work and staging areas outside of the 100-foot (30.5-meter) ROW required for the proposed project will include a temporary concrete coating batch plant, a concrete mattress production facility, and pipe yard set up at Port Manatee, which will require approximately 34 acres (13.8 hectares). The batch plant, mattress facility, and pipe yard will be located in an area of the Port that was previously used for these activities. Since the area is already an industrial area, the visual impacts from this activity will be negligible and short-term. In addition, after dismantling of the temporary batch plant and mattress facility, the site will be returned to existing conditions. The contractor facilities will be housed in existing office space at Port Manatee and will have no visual impacts from the proposed project.

9.2.5.2 Operations

Land Use. There will be a 30-foot (30.5-meter) wide permanent ROW that is centered on the pipeline route. Within this ROW, the placement of buildings and will be prohibited.

Two aboveground facilities will be required for the Revised Preferred Onshore Route: the proposed valve station, located at Port Manatee; the proposed interconnection station, located in an area currently zoned as orchard/citrus; and a portion of the parcel currently contains a cell phone tower. Since these aboveground facilities are located at Port Manatee and on an impacted land parcel and the ROW are in predominantly disturbed areas, the impacts from operations are minor.

Recreation. There is one parcel along the Revised Preferred Onshore Route that is currently used as a radio controlled airplane fly zone. There will be a 30-foot (30.5-meter) wide permanent ROW that is centered on the pipeline route. Within this ROW, only the placement of buildings will be prohibited, therefore, the impacts to recreational activities would be negligible.

Aesthetics. After construction of the *Port Dolphin* pipeline, the aesthetics would be similar to the existing environment and therefore not altered, with the exception of the aboveground facilities and placement of markers along the route.

The valve station will be located at Port Manatee and be installed in an industrial area adjacent to the Gulfstream valve station; therefore, visual impacts would be negligible. The interconnection station will be located on a parcel that currently contains a cell phone tower. There will be permanent visual impact of approximately 3.23 acres (1.31 hectares). Due to the fact that the Gulfstream pressure reduction station is adjacent to the proposed interconnection station and the valve station is located at Port Manatee, impacts would be negligible due to the similar land use of the existing surrounding areas.

9.2.5.3 Decommissioning

Land Use. Decommissioning of aboveground facilities will consist of removal of all of the equipment within the valve station and interconnection station. Underground decommissioning will consist of the removal of any hydrocarbons in the pipe, filling the pipe with treated fresh water, and capping off of the ends. There would be no land use impacts outside of the pipeline ROW.

Recreation. Decommissioning of the pipeline consists of emptying the pipeline of natural gas, filling the pipeline with fresh water, and capping the ends. The impacts from these activities will be negligible.

Aesthetics. The decommissioning of *Port Dolphin* would result in a temporary visual impact in the project area. However, the effects would be similar to those described above under construction and would be negligible and temporary.

9.2.5.4 Accidents and Upsets

Land Use. Any accidents or upsets will be handled by contingency planning and development of a spill response plan to respond to spills of any size. Such impacts tend to be temporary; therefore, the effect is considered to be negligible. In addition, measures will be taken to minimize any drilling fluid release (or frac-outs) from the HDD construction methodology.

Recreation. Any accidents or upsets will be handled by contingency planning and development of a spill response plan to respond to spills of any size. Such impacts tend to be temporary; therefore, the effect is considered to be negligible.

Aesthetics. Any upsets or accidents during construction will be handled by contingency planning and development of a spill response plan to respond to spills of any size. Such impacts tend to be temporary; therefore, the effect is considered to be negligible. In addition, measures will be taken to minimize any drilling fluid release (or frac-outs) from the HDD construction methodology.

9.3 Cumulative Impacts

Cumulative impacts to the project area are expected to be minimal and short-term. Actions requiring cumulative impacts analysis include past, present, and reasonably foreseeable future actions. Past impacts include the development of Port Manatee, which is still in operation today. Piney Point Phosphate Plant is no longer in operation but was at one time considered a contaminated site. The plant is now privately owned and may be permitted as a commercial or industrial site. Agricultural sites once used as citrus groves occur in the area but are now utilized as work stations.

No mangrove impacts are expected to occur. No long-term impacts to freshwater wetlands and the south conveyance ditch are anticipated to occur. There will be temporary impacts to freshwater wetlands while construction is ongoing; however, steps have been taken to minimize impacts. HDD methodology will be implemented to avoid the FPL tank farm area in order to minimize impacts. Existing ROWs will be used where possible to minimize the impact on the wetland system. FERC procedures and the project-specific restoration plan also will be followed to ensure the wetlands are restored once the pipeline is completed. Freshwater wetlands and the south conveyance ditch impacted due to open trench construction will be restored following construction. Appropriate mitigation will compensate for temporary impacts.

There will be permanent impacts to forested wetlands. However, it is important to note that only a small portion of the impacted wetlands is forested, and the dominant species is Brazilian pepper. The majority of the wetlands are herbaceous and are expected to be restored once construction is complete. Furthermore, the wetland habitats are dominated by exotic species. The removal of these exotic species and the restoration of the wetlands to a more natural state will improve the quality of habitat for fish and wildlife.

Permanent impacts will also occur to the extractive pond open water habitats. A permanent levee will be constructed to isolate the area where the proposed pipeline will be placed and the water in the proposed ROW will be pumped out. Therefore, the pipeline will be placed under hard ground, and the water in the ponds will not be restored in these areas. The ponds currently have little to no vegetation and were formed during mining and other extractive activities. Therefore, impacts to these ponds are expected to be minimal.

A mitigation and restoration plan will be developed with consultation of the appropriate agencies. The plan will address methods for restoring wetland vegetation, controlling the spread of nuisance/exotic species, planting of appropriate vegetation, and monitoring the success of wetland restoration. Therefore, cumulative impacts, if any, would be minimal.

9.4 Summary of Potential Impacts and Mitigation

In addition to the mitigation measures set forth below, Port Dolphin Energy LLC; its affiliated parent company, Höegh LNG AS (Höegh); and other affiliated companies have a deep and broad commitment to environmental stewardship, sustainability, and social responsibility. Höegh's objective is to continuously seek to reduce the impact of its activities on the environment. Höegh not only strives to comply with all applicable environmental conventions, laws, and regulations, but seeks to go beyond these requirements. Through its environmental policy, Höegh is taking active measures to seek new technology and methods to go beyond these requirements. As examples, Höegh and affiliated companies have made it their goal to reduce the risk of spreading invasive or harmful organisms through ballast water; to reduce emissions of exhaust gases to the atmosphere by reducing consumption of lubricating oil; and to reduce the consumption of and impacts from chemical cleaners. In addition, Höegh's affiliated company, Höegh Fleet Services, has instituted a compliance program that includes upgrading and improving bilge water systems on board, improving routines and procedures for waste stream handling, introducing an extensive MARPOL inspection and training scheme on board, and developing a training course in "bilge water/waste oil operation," and reporting to the USCG. It is Höegh's policy to be open and transparent, and this policy includes the publication of an annual environmental and sustainability report that details the company's efforts in these arenas.

The *Port Dolphin* project is anticipated to have minimal impacts on the terrestrial environment within the project area with regards to fish, wildlife, and vegetation; soils and geological resources; wetlands; and land use, recreation, and aesthetics during the construction and long-term operations.

Table 9-7 summarizes the potential impacts on terrestrial resources and associated mitigation measures for the Revised Preferred Onshore Route for the *Port Dolphin* project. Potential impacts to the terrestrial resources are rated as significant, minor, or negligible using the criteria presented above in **Section 9.2**.

The table also categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible.

Minimal impacts would occur to terrestrial resources as a result of this project. Overall, potential impacts to the project site would be minimal. There would be temporary impacts during the construction activities due to open trenching methods. Vegetation within the ROW will be cleared, and associated wildlife will have to relocate. This impact would be most evident in the wetland sites. Permanent impacts from the aboveground facilities would occur; however, the location of the facilities is such that no significant vegetation or substantial wildlife habitat would be affected. There is the potential for fluid spills during the HDD operation. Appropriate measures will be taken to minimize any possible impacts.

Impacts to wetland resources are expected to be primarily short-term and temporary while the construction is in progress. There would be minimal permanent impacts to forested wetlands. However, it is important to note that only a small portion of the impacted wetlands are forested and the dominant species is Brazilian pepper in these habitats. The majority of the wetlands are herbaceous and expected to be restored once construction is complete. Furthermore, the wetland habitats are dominated by exotic species. The removal of these exotic species and the restoration of the wetlands to a more natural state would improve the quality of habitat for fish and wildlife. Additionally, there will be permanent impacts to two of the extractive ponds. A levee will be built to isolate the pipeline ROW, and work areas will not be removed. Water will be removed from the isolated areas that will be filled once the pipeline has been placed. These ponds have little to no vegetation or fish and wildlife resources and were formed during mining and other extractive activities. Therefore, impacts to these ponds are expected to be minimal.

Restoration will be the primary means of mitigation. Mitigation will be in accordance with the FERC *Upland Erosion Control, Revegetation, and Maintenance Plan* (17 January 2003). The non-wetland areas are expected to revegetate through natural recruitment with an exotic/nuisance species maintenance program.

Coordination with the appropriate state and federal agencies will be required to establish a final mitigation plan on a site specific basis. Mitigation methods will result in revegetation of impacted areas, control and maintenance of nuisance/exotics, and monitoring success of the impacted wetlands.

Table 9-7
Summary of Impacts to the Onshore Pipeline and Facilities

Phase	Impact	Descriptors	Significance	Mitigation
Fish, Wildlife, and Vegetation				
Construction	Open trenching for pipeline installation through 11 wetlands (13.07 acres)	• Certain • Direct • Reversible	Minor	• Implement a project-specific Wetland and Waterbody Construction and Mitigation Plan • Planting of appropriate tree species to replace exotic species • Restoration of the wetlands after pipeline placement • Environmental Coordinator on-site during installation.
	Vegetation disturbance during installation	• Certain • Direct • Reversible	Negligible	• Restore areas to original grade and revegetate areas • Utilizing BMPs and implement FERC's Upland Erosion Control, Revegetation and Maintenance Plan.
	Construction ROW of 100 feet along the pipeline and additional work spaces	• Certain • Direct • Reversible	Minor	• Size of ROW has been minimized • All construction activities along pipeline will be performed within the ROW and additional work spaces • Implement a project-specific Wetland and Waterbody Construction and Mitigation Plan
	Installation of two aboveground facilities and use of extra work space	• Certain • Direct • Irreversible	Negligible	• Sites selected based on minimal resources present. • Restoration of wetlands after work space is utilized
	Additional facilities needed for support of pipeline installation onshore and offshore such as pipe yard and batch plant	• Certain • Indirect • Reversible	Negligible	• Additional facilities required will be placed at Port Manatee in areas previously used for the same activities
Operations	Existence of two aboveground facilities	• Certain • Direct • Irreversible	Negligible	• Sites selected based on minimal resources present
	Permanent ROW of 30 feet centered on the pipeline	• Certain • Indirect • Irreversible	Negligible	• Size of ROW has been minimized
Decommissioning	Removal of aboveground facilities	• Likely • Direct • Reversible	Negligible	• Restore areas to original grade and revegetate • Utilize BMPs and implement FERC's *Upland Erosion Control, Revegetation and Maintenance Plan*

Phase	Impact	Descriptors	Significance	Mitigation
Accidents and Upsets	Release of natural gas to the atmosphere	• Unlikely • Indirect • Reversible	No Impact	• Implementing contingency planning and development of a spill response plan
	Frac-out during HDD	• Unlikely • Indirect • Reversible	Negligible	• Implementing contingency planning and development of a spill response plan • Environmental Coordinator on-site during installation
Water Use and Quality				
Construction	Temporary and short-term disturbance of surface waters and sedimentation	• Certain • Direct • Reversible	Minor Short-term, occurring only during construction	• Compliance with the *Wetland and Waterbody Construction and Mitigation Procedures* • Compliance with all state and federal permit conditions • Use of sediment barriers for soil piles adjacent to the waterbody • Minimization of the time that the pipeline excavation is open • Installation of silt fencing and other erosion control measures • Providing oversight by an Environmental Inspector • Development of a Stormwater Pollution Prevention Plan • Demarcation of the construction ROW • Segregation of topsoil from trench areas • Revegetation of the disturbed areas
Operations	Existence of two aboveground facilities	• Certain • Direct • Reversible	No Impact	• None
Decommissioning	Removal of aboveground facilities	• Likely • Direct • Reversible	Negligible	• Restore areas to original grade and revegetate • Utilize BMPs and implement FERC's *Upland Erosion Control, Revegetation and Maintenance Plan*
Upsets and Accidents	Release of fluids	• Unlikely • Direct • Reversible	Negligible	• Implementing contingency planning and development of a spill response plan

Phase	Impact	Descriptors	Significance	Mitigation
Soils and Geological Resources				
Construction	Open trenching for pipeline installation	• Certain • Direct • Reversible	Negligible	• Restoration of the areas after pipeline placement
	Soils disturbance during installation	• Certain • Direct • Reversible	Negligible	• Restore areas to original grade • Utilizing BMPs and implement FERC's *Upland Erosion Control, Revegetation and Maintenance Plan*
Operations	Existence of two aboveground facilities	• Certain • Direct • Reversible	No Impact	• None
Decommissioning	Removal of aboveground facilities	• Likely • Direct • Reversible	Negligible	• Restore areas to original grade and revegetate • Utilize BMPs and implement FERC's *Upland Erosion Control, Revegetation and Maintenance Plan*
Accidents and Upsets	Release of fluids	• Unlikely • Indirect • Reversible	Negligible	• Implementing contingency planning and development of a spill response plan
Wetlands				
Construction	Open trenching for pipeline installation through 9 wetlands (12.46 acres)	• Certain • Direct • Irreversible	Minor	• Implement a project-specific Wetland and Waterbody Construction and Mitigation Plan • Planting of appropriate tree species to replace exotic species • Restoration of the wetlands after pipeline placement • Environmental Coordinator on-site during installation
	Construction ROW of 100 feet along the pipeline and additional work spaces	• Certain • Direct • Reversible	Minor	• Size of ROW has been minimized • Implement a project-specific Wetland and Waterbody Construction and Mitigation Plan that will include planting
Operations	Placement located in 9 wetlands (12.46 acres)	• Certain • Direct • Reversible	No Impact	• Monitoring of wetland restoration • Implement a project-specific Wetland and Waterbody Construction and Mitigation Plan that will include planting
Decommissioning	Removal of aboveground facilities	• Likely • Direct • Reversible	No Impact	• None
Accidents and Upsets	Frac-out during HDD	• Unlikely • Indirect • Reversible	Negligible	• Implementing contingency planning and development of a spill response plan • Environmental Coordinator on-site during installation

Phase	Impact	Descriptors	Significance	Mitigation
Land Use, Recreation, and Aesthetics				
Construction	Crossing of CSX Railroad and roadways	• Certain • Direct • Irreversible	Negligible	• Using slick bores and dry jack and bore techniques
	Additional work areas needed	• Certain • Direct • Reversible	Minor	• Most extra work spaces to be placed at Port Manatee • Additional work spaces located adjacent to 100-foot construction ROW along the corridor in areas where HDD/bores will be performed. Areas will be restored to original condition
	Construction ROW of 100 feet along the pipeline and additional work spaces	• Certain • Direct • Reversible	Minor	• Size of ROW has been minimized • Most construction activities along pipeline will be performed within the ROW and additional work spaces
	Installation of two aboveground facilities	• Certain • Direct • Irreversible	Negligible	• Placement of facilities in areas with similar structures
	Additional facilities needed for support of pipeline installation onshore and offshore such as pipe yard and batch plant	• Certain • Direct • Reversible	Negligible	• Additional facilities required will be placed at Port Manatee in areas previously used for the similar activities
Operations	Existence of two aboveground facilities	• Certain • Direct • Irreversible	Minor	• Placement of facilities in areas with similar structures
	Permanent ROW of 30 feet centered on the pipeline	• Certain • Indirect • Irreversible	Negligible	• Size of ROW has been minimized
	Placement of markers along pipeline route	• Certain • Direct • Irreversible	Negligible	• Other markers are currently present with in the area
Decommissioning	Removal of aboveground facilities	• Likely • Direct • Reversible	Negligible	• Restore areas to original grade and revegetate
	Removal of markers along pipeline route	• Certain • Direct • Reversible	Negligible	• None needed

Phase	Impact	Descriptors	Significance	Mitigation
Accidents and Upsets	Release of fluids	• Unlikely • Indirect • Reversible	Negligible	• Implementing contingency planning and development of a spill response plan

BMP = Best Management Practices.
FERC = Federal Energy Regulatory Commission.
HDD = horizontal directional drill.
ROW = right-of-way.

10. LIST OF REFERENCES

ANUSKIEWICZ, R.J., 1988. Preliminary Archaeological Investigation at the Ray Hole Spring in the Estern Gulf of Mexico. *Florida Anthropologist*, 41,181-185.

ARDAMAN & ASSOCIATES, INC., 2007. *Evaluation of Process Water Seepage Plume South of Buckeye Road: Piney Point Phosphogypsum Stack System Manatee County, Florida.* Tallahassee, Florida: Prepared for U.S. Department of Environmental Protection. File No. 06-111.

ASHTON, Jr., R.E., and P.S. ASHTON, 1981. Handbook of Reptiles and Amphibians of Florida, The Snakes. Windward Publishing.

ATEN, L., 1983. *Indians of the Upper Texas Coast.* New York, NY: Academic Press.

BARTLETT, R.D., and P.P. BARTLETT, 1999. *A field Guide to Reptiles and Amphibians.* Gulf Publishing Co.

BENSE, J.A., 1994. *Archaeology of the Southeastern United States*: *Paleoindian to World War I.* San Diego, CA: Academic Press.

BERMAN, B.D., 1972. *Encyclopedia of American Shipwrecks.* Boston, Massachussetts: The Mariners Press Incorporated.

BROOKS, G.R. and L.J. DOYLE, 1998. Recent Sedimentary Development of Tampa Bay, Florida: A Microtidal Estuary Incised into Tertiary Platform Carbonates. *Estuaries*, 21 (3), 391-406.

BROWN, D.P., 1983 *Water Resources of Manatee County, Florida*. Tallahassee, Florida: U.S. Geological Survey WRI-81-74.

COASTAL ENVIRONMENTS, INC., 1977. *Cultural Resources Evaluation of the Northern Gulf of Mexico.* Baton Rouge, Louisiana: Interagency Archaeological Services, Office of Archaeology and Historical Preservation, National Park Service, U.S. Department of the Interior.

COASTAL ENVIRONMENTS, INC., 1982. *Sedimentary Studies of Prehistoric Archaeological Sites.* Baton Rouge, Louisiana: Division of State Plans and Grants, National Park Service, U.S. Department of the Interior.

COASTAL ENVIRONMENTS, INC., 1986. *Archaeological Investigations on the Outer Continental Shelf: A Study Within the Sabine River Valley, Offshore Louisiana and Texas.* Baton Rouge, Louisiana: Minerals Management Service, U.S. Department of the Interior.

COLEMAN, J.M. and W.G. SMITH, 1964. Late Recent Rise of Sea Level. *Geological Society of America Bulletin*, 75, 833-840.

COLQUHOUN, D.J. and M.J. BROOKS, 1986. New Evidence from the Southeastern U.S. for Eustatic Components in the Late Holocene Sea Levels. *Geoarchaeology,* 1 (3), 275-291.

COLQUHOUN, D.J., M.J. BROOKS, J. MICHIE, W.B. ABBOTT, F.W. STAPOR, W. NEWMAN, and R. PARDI, 1981. Location of Archaeological Sites with Respect to Sea Level in the Southeastern United States. *Stria,* 14, 145-150.

CURRAY, J.R., 1960. *Sediments and History of Holocene Transgressions, Continental Shelf, Northwest Gulf of Mexico. In Recent Sediments, Northwest Gulf of Mexico.* Tulsa, Oklahoma: F.P. Shepard, et al., eds., American Association of Petroleum Geologists, Special Publication.

DANIEL, I.R., Jr., and M. WISENBAKER. 1987. *Harney Flats: A Florida Paleo-Indian Site.* Farmingdale, NY: Baywood Publishing Company, Inc.

DOVELL, J.E., 1952. *Florida: Historic, Dramatic, Contemporary*. 4 volumes. New York: Lewis Historical Publishing Company, Inc.

DUNBAR, J.S., 1983. *A model for the Predictability of Clovis/Suwannee Paleo Indian Site Clusters in Florida—A Revival of the W. T. Neill's Oasis Hypothesis*. Paper presented at the 35th Annual Meeting of the Florida Anthropological Society, Tallahassee.

DUNBAR, J.S., 1991. Resource Orientation of Clovis and Suwannee Age Paleoindian Sites in Florida. *In:* Bonnichsen and K. Turnmier, ed. *Clovis: Origins and Adaptations*, Sorvalllis: Center for the First Americans, Oregon State University. pp. 185-213.

DUNBAR, J.S., M.K. FAUGHT, and D.S. WEBB, 1989a. Culturally and Naturally Modified Bones from a Paleoindian Site in the Aucilla River, North Florida. *In: First International Bone Modification Conference,* R. Bonnichsen (ed.), 473-497. Orono:Center for the Study of the First Americans, Univ. of ME.

DUNBAR, J.S., S.D. WEBB, M. FAUGHT, R.J. ANUSKIEWICZ, and M. STRIGHT, 1989b. Archaeological Sites in the Drowned Tertiary Karst Region of the Eastern Gulf of Mexico. Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference, J. Barto Arnold III (ed.), 25-31. Baltimore, MD.

DUNBAR, J.S., S.D WEBB, and M. FAUGHT, 1991. Inundated Prehistoric Sites in Apalachee Bay, Florida, and the Search for the Clovis Shoreline. *In: Paleoshorelines and Prehistory: An Investigation of Method,* Lucille Lewis Johnson (ed.), 117-146. CRC Press, Boca Raton, FL.

DUNCAN, D.S., 1992. *Neogene to Recent Seismic Stratigraphy of the lower Tampa Bay Estuary: West-Central Florida*. Master's Thesis. Univ. of S. FL, St. Petersburg.

FAUGHT, M.K., 1996. *Clovis Origins and Underwater Prehistoric Archaeology in Northwestern Florida.* Ph.D. Dissertation, Department of Anthropology, University of Arizona, Tucson.

FAUGHT, M.K., 2003. *Geophysical Remote Sensing and Underwater Cultural Resource Management of Submerged Prehisotric Sites in apalachee Bay: A Deep-Water Example, Site Predictive Models, and Site Discoveries. Proceedings:* New Orleans, Louisiana: Minerals Management Service, Twenty Second Annual Gulf of Mexico Information Transfer Meetings, 2002.

FAUGHT, M.K., 2004. The Underwater Archaeology of Paleolandscapes, Apalachee Bay, FL. *American Antiquity*, 69 (2), 235-249.

FAUGHT, M.K., and J.F. DONOGHUE, 1997. Marine Inundated Archaeological Sites and Paleofluvial Systems: Examples from a Karst Controlled Continental Shelf Setting in the Apalachee Bay, Northeastern Gulf of Mexico. *Geoarchaeology* 12 (5), 417-458.

FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION, May 2006. *Integrated Water Quality Assessment for Florida: 2006 305(b) Report and 303(d) List Update*.

FLORIDA NATURAL AREAS INVENTORY, 2007. Available from: http://www.fnai.org/.

GAGLIANO, S.M., 1984. *Geoarchaeology of the Northern Gulf Shore. In Perspectives on Gulf Coast Prehistory.* Dave D. Davis (ed.). Gainesville, FL: University Presses of Florida.

GANNON, M.V., 1996. *The New History of Florida*. Gainesville, FL: University Press of Florida.

GARRISON, E.G., 1992. *Recent Archaeogeophysical Studies of Paleoshorelines of the Gulf of Mexico. In Paleoshorelines and Prehistory: An Investigation of Method.* Lucille Lewis Johnson and Melanie Stright (eds.). Boca Raton, FL: CRC Press.

GARRISON, E.G., C.P. GIAMMONA, F.J. KELLY, A.R. TRIPP, and G.A. WOLFF. 1989. *Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico: Reevaluation of Archeological Resource Management Zone 1. Volume II: Technical Narrative.* OCS Study 89-0024. New Orleans, Louisiana: U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office.

GOODYEAR, A.C., and L.O. WARREN, 1972. Further Observations on the Submarine Oyster Shell Deposits of Tampa Bay. *Florida Anthropologist*, 25:52-66.

GOODYEAR, A.C., S.B. UPCHURCH, and M.J. BROOKS, 1980. Turtlecrawl Point: An Inundated Early Holocene Archeological Site on the West Coast of Florida. In *Southeastern Geological Society Guidebook 22*. Tallahassee, FL. Pp. 24-33.

GOODYEAR, A.C., S.B. UPCHURCH, M.J. BROOKS, and N.N. GOODYEAR, 1983. Paleoindian Manifestations in the Tampa Bay Region Florida. *Florida Anthropologist*, 36:40-66.

GOGGIN, J., 1947. A Preliminary Definition of Archaeological Areas and Periods in Florida. *American Antiquity*, 13:114-127.

GOGGIN, J., 1964. Florida Archeology and Recent Ecological Changes. In Indian and Spanish Selected Writings, 299-309. University of Miami Press, Coral Gables.

HINE, A.C., 1997. *Structural, stratigraphic, and paleoceanographic Development of the Margins of the Florida Platform.* A.F. Randazzo and D.S. Jones (eds). University Press of Florida: Geology of Florida.

HINE, A.C., G.R. BROOKS, R.A. DAVIS, Jr., L.J. DOYLE, G. GELFENBAUM, S.D. LOCKER, D.C. TWICHELL, and R.H. WEISBERG, 2001. *A Summary of Findings of the West-Central Florida Coastal Studies Project.* USGS Open File Report 01-03.

HOFFMAN, P.E., 1980. *The Spanish Crown and the Defense of the Caribbean, 1535-1585*. Baton Rouge, LA: Louisiana State University Press.

HYDE, A.G., 1983. *Soil Survey of Manatee County Florida*. USDA Soil Conservation Service.

KRAFT, J.C., D.F. BELKNAP, and I. KAYAN, 1983. Potentials of Discovery of Human Occupation Sites on the Continental Shelves and Nearshore Coastal Zone. In Quaternary Coastlines and Marine Archaeology, P.M. Masters and N.C. Flemming (eds.). London: Academic Press.

LEWIS, III, R.R. and E.D. ESTEVEZ, 1988. *The ecology of Tampa Bay, Florida: An estuarine profile*. U.S. Fish and Wildlife Service Biological Report, 85, 7.18. 132 pp.

MARX, R., 1985. *Shipwrecks in Florida Waters.* Chuluota, Florida: The Mickler House.

MILANICH, J.T., 1994. *Archaeology of Precolumbian Florida.* Gainesville, FL: University Press of Florida.

MURPHY, L.E., 1990. 8SL17: Natural Site-Formation Processes of a Multiple-Component Underwater Site in Florida. *Southwest Cultural Resources Center Professional Papers No. 39.* Santa Fe, NM.

NEILL, W.T., 1964. Trilisa Pond, An Early Site in Maarion County, Florida. *Florida Anthropologist*, 17,187-200.

PEARSON, C., S.R., JAMES, JR., M.C. KRIVOR, S.D. EL DARRAGI, and L. CUNNINGHAM., 2003. *Refining and Revising the Gulf of Mexico OCS Region High Probability Model for Historic Shipwrecks*: Volumes I, II, and III. OCS Study/MMS 2003-060. Revised in 2006. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana.

POTTER, J., 1988. *The Treasure Divers Guide.* Port Salerno, FL: Classics Press.

PURDY, B.A., 1981. *Florida's Prehistoric Stone Tool Technology*. Gainesville, FL: University Press of Florida.

ROGERS, J.A., Jr., H.W. KALE II, and H.T. SMITH (eds), 1996. *Rare and endangered Biota of Florida*, *Volume V.* Birds. University Press of Florida.

RUPPE, R.J., 1980. The Archaeology of Drowned Terrestrial Sites: A Preliminary Report. *Florida Bureau of Historic Sites and Properties Bulletin*, 6, 35-45.

SAVERCOOL, D.M. and R.R. LEWIS, III. 1994. *Hard bottom mapping of Tampa Bay*. Prepared for Tampa Bay National Estuary Program. 14 pp.

SCHOLL, D.W., F. CRAIGHEAD, and M. STUIVER, 1967. Florida Submergence Curve Revisited: Its Relation to Coastal Sedimentation Rates. *Science*, 163, 562-64.

SINCLAIR, W.C. and J.W. STEWART, 1985. *Sinkhole Type, Development, and Distribution in Florida*. USGS Map Series No. 110.

SINGER, S.D., 1992. *Shipwrecks of Florida.* Sarasota, Florida: Pineapple Press.

STRIGHT, M.J., 1986. Evaluation of Archaeological Site Potential on the Gulf of Mexico Continental Shelf Using High-Resolution Seismic Data. *Geophysics*, 51 (3), 605-622.

STRIGHT, M.J., 1987. Inundated Archaeological Sites of the Florida Coastal Region: A Regional Overview. Proceedings: Eighth Annual Gulf of Mexico Information Transfer Meeting. OCS-MMS 88-0035. New Orleans, LA.

STRIGHT, M.J., 1990. Archeological Sites on the North American Continental Shelf. In Archaeological Geology of North America, Centennial Special Volume 4, edited by Norman P. Lasca and Jack Donahue. *The Geological Society of America*. Boulder, CO.

TEBEAU, C.W., 1987. *A History of Florida. Revised edition*. Coral Gables, FL: University of Miami Press.

WEBB, S.D., J.T. MILANICH, R. ALEXON, and J.S. DUNBAR. 1984. A *Bison Antiquus* Kill Site, Wacissa River, Jefferson County, Florida. *American Antiquity*, 49,384-392.

WEDDLE, R.S., 1985. *Spanish Sea: The Gulf of Mexico in North American Discover, 1500-1685*. College Station, TX: Texas A&M University Press.

WEDDLE, R.S., 1991. *The French Thorn: Rival Explorers in the Spanish Sea, 1682-1762*. College Station, TX: Texas A&M University Press.

WEDDLE, R.S., 1995. *Changing Tides: Twilight and Dawn in the Spanish Sea, 1763-1803*. College Station, TX: Texas A&M University Press.

WILLIS, C., 1988. Controlled Surface Collection of the Little River Rapids Site (8Je603): A Stratified Deflated Site in the Aucilla River, North Florida. *Florida Anthropologist* 41 (3), 453-470.

WILLEY, G.R, 1949. *Archeology of the Florida Gulf Coast*. Washington, D.C.: Smithsonian Institution. Smithsonian Collections 113.

WORKS PROGRESS ADMINISTRATION, 1939. *A Guide to the Southernmost State*. New York, NY.

U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEAN SERVICE, 2007. *Automated Wreck and Obstruction Information System*. Washington, D.C.: National Oceanic and Atmospheric Administration.

U.S. FISH AND WILDLIFE SERVICE, 1979. *Classification of Wetlands and Deepwater Habitats of the United States*. Washington D.C: Office of Biological Services, U.S. Department of the Interior. FWS/OBS-79/31.

ATTACHMENT A.1

PortDolphin

TERRA CEIA RE-ROUTE SURVEY OF MARINE BENTHIC HABITATS WITHIN THE PROPOSED PORT DOLPHIN PIPELINE CORRIDOR WITHIN TAMPA BAY, FLORIDA

December 2007

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1.0 INTRODUCTION

1.1 BACKGROUND

Port Dolphin is an offshore liquefied natural gas (LNG) deepwater port project proposed for the importation of natural gas. The proposed *Port Dolphin* will be located 42 mi (68 km) south-southeast of Tampa Bay, Florida in federal waters in a water depth of approximately 100 ft (33 m) (**Figure 1**). The port will be able to accommodate mooring shuttle and regasification vessels (SRVs) with an approximate capacity range of 145,000 to 217,000 m^3. A natural gas pipeline will connect the LNG deepwater port to the Florida natural gas transmission and distribution system in Port Manatee, Florida. The pipeline will traverse federal, state, Hillsborough County, and Manatee County waters prior to making landfall. On 24 July 2006, Continental Shelf Associates, Inc. (CSA) was awarded a contract from Höegh LNG to perform detailed marine habitat surveys along and around the proposed offshore buoy system array and linear natural gas pipeline corridor offshore and within Tampa Bay, Florida.

The field surveys of the original preferred route (which passed through the Terra Ceia Aquatic Preserve) were conducted between 17 August and 14 December 2006. After meeting with the Florida Department of Environmental Protection (FDEP), Port Dolphin decided to develop alternative routes that would avoid crossing the Aquatic Preserve. After engineering analysis and discussions with Port Manatee, an alternative route was selected and then surveyed for benthic habitat characterization. **Figure 2** shows the original survey corridor and the revised corridor around the Aquatic Preserve.

1.2 RE-ROUTE SURVEY AREA

The original pipeline route and survey corridor were shifted north to avoid traversing the Terra Ceia Aquatic Preserve within Tampa Bay, however the re-route survey corridor (3,000 ft [915 m]) overlaps in some areas with the original survey corridor (**Figure 2**).

1.3 SURVEY OBJECTIVES

The primary objective of the survey was to collect the qualitative and quantitative data necessary to characterize and delineate all the defined marine habitats and seagrass communities within the proposed re-route pipeline area of the natural gas pipeline. Results from the survey will provide information for the locations of pipeline corridor development and serve as documentation during agency review for permitting purposes.

The FDEP, Office of Intergovernmental Programs, Offshore Projects Section has stated that each proposed offshore project within Florida state and federal offshore waters has the potential to impact natural resources, particularly live bottom habitats. As impacts to these important habitats are of major concern to the state, FDEP has developed guidelines for conducting offshore benthic surveys that, if followed, should provide data for full geophysical and biological seabed characterization (**Appendix A**). The FDEP guidelines recommend incorporation of the Minerals Management Services (MMS) Notice to Leasees (NTL) No. 2004-G05 requirements and additional elements into any offshore benthic survey conducted in state and adjacent federal waters per the federal consistency review.

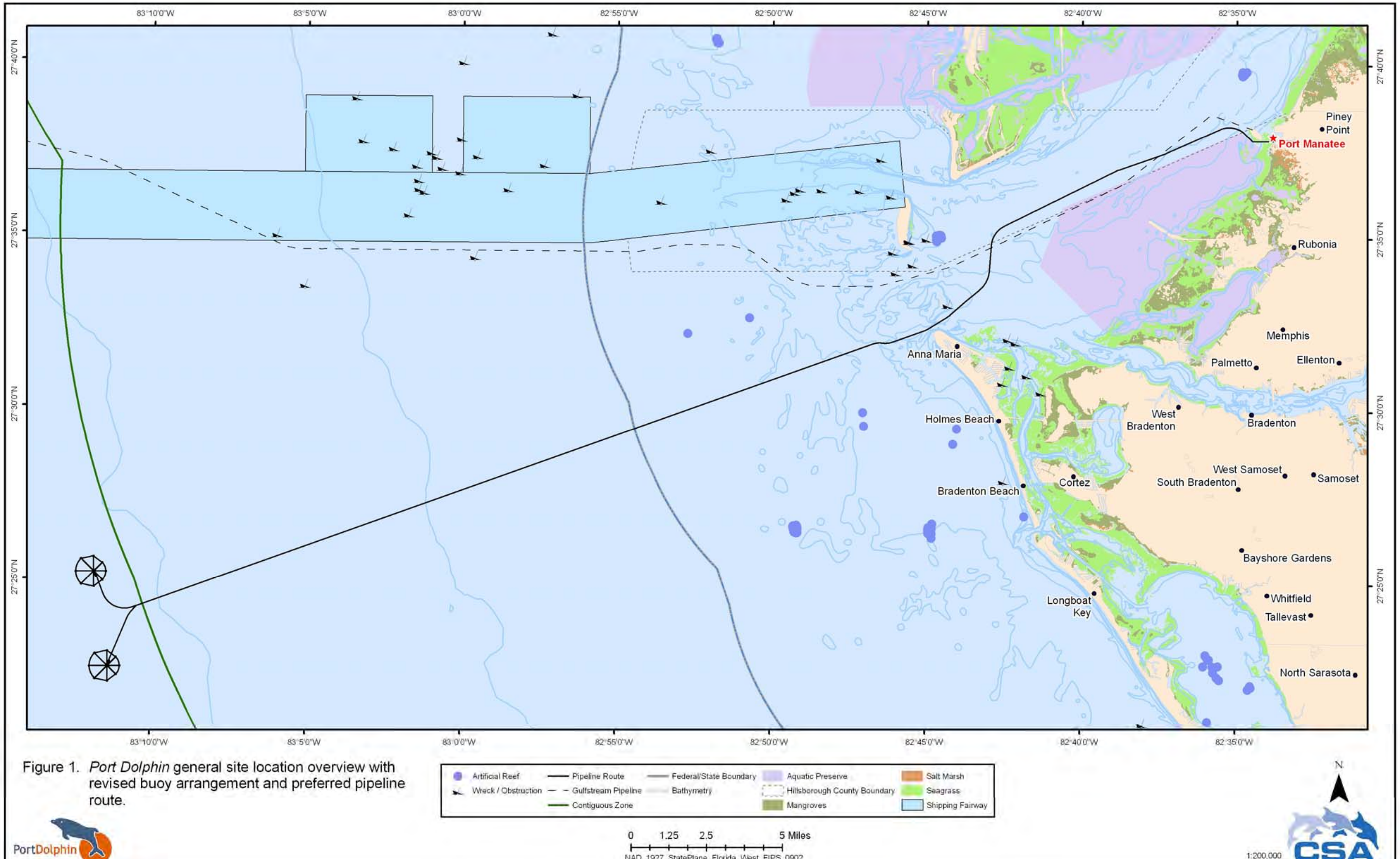


Figure 1. *Port Dolphin* general site location overview with revised buoy arrangement and preferred pipeline route.

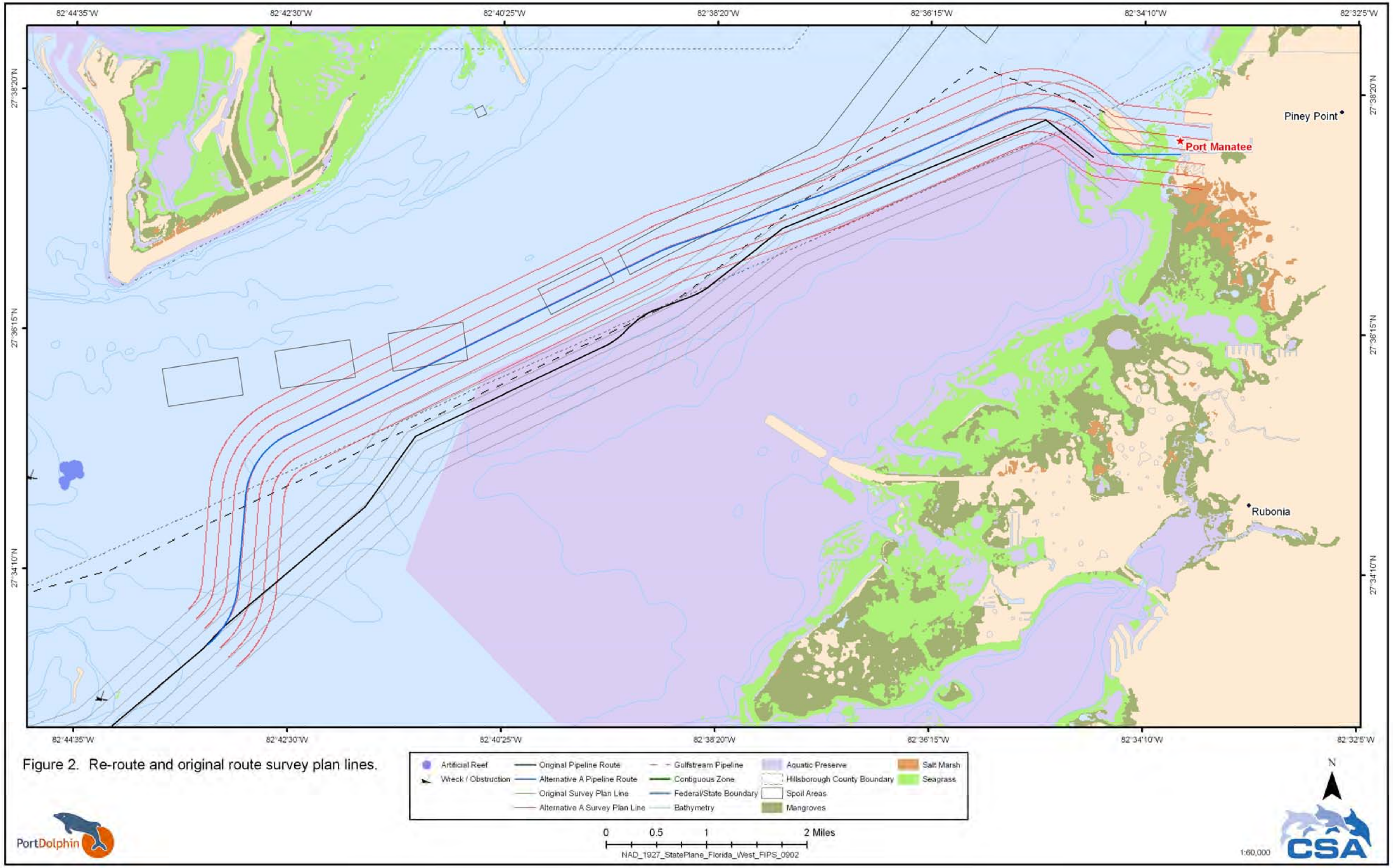


Figure 2. Re-route and original route survey plan lines.

In order to meet both State of Florida and federal requirements, CSA proposed survey methods that incorporate guidelines from both agencies (**Appendix B**). Coupled with the habitat characterization component for classifying benthic habitat types of the Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida (**Appendix C**) developed by State, Federal, and county resource management and regulatory agencies, the proposed survey methods incorporated all applicable elements of the referenced guidelines appropriate for offshore projects. Prior to initiating the survey, the protocols were provided to the FDEP and Florida Fish and Wildlife Conservation Commission (FWC) for comments and feedback to ensure all necessary components were included.

The Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida (**Appendix C**) defines the four marine habitat types used to delineate habitat areas for this project. Descriptions of the habitat types are presented in **Table 1**.

Table 1. Habitat delineation descriptions defined in the Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida.

Habitat Type	Description
Type A	20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).
Type B	5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.
Type D	Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.
Soft Substrate/Sand	Soft substrate/sedimentary habitats not associated with hard bottom ecotones.

Two field survey elements were conducted in order to meet the project objectives:

1) A photodocumentation survey of the re-route pipeline corridor was conducted. Descriptive and qualitative video and still photographic data were collected to document hard/live bottom and seagrass communities and soft bottom habitats. Plan-view photographs were collected every 656 ft (200 m) to meet federal and state requirements for documenting habitat types.

2) Following the photodocumentation surveys, diver surveys were conducted to collect quantitative still photographic data on representative habitats.

2.0 METHODS

2.1 RE-ROUTE SURVEY

2.1.1 Qualitative Hard/Live Bottom Surveys

The *Tracy Gayle*, a 30-ft (10-m) vessel out of Holmes Beach, Florida, was used during the qualitative hard/live bottom surveys conducted from 16 September through 19 October 2007. Surveys were started on 16 September; however, due to poor visibility, surveys ceased and resumed on 16 October. High-resolution qualitative video and still photographic data were collected with an underwater towed camera system along the re-routed portion of the proposed LNG pipeline corridor to provide baseline data for identification of seafloor substrate types and associated marine benthic habitats within the potential area of impact.

Figure 2 presents pre-plotted survey transect lines for the re-routed portion of the corridor and the orientations set using Hypack 6.2A. Hypack 6.2A was interfaced with a Leica MX-420 differential global positioning system (DGPS) for vessel guidance, digital navigation logging of the precise position of the towed video/still camera system, and a real-time display of the ship's track along the survey transects. Navigational positions were recorded three times per second along each transect. The offset of the specific sled position, relative to the vessel's DGPS position, was incorporated into the navigation database.

Qualitative survey transects included seven transects using 656-ft (200-m) line spacing (a single transect along the centerline of the pipeline corridor and three transects along each side of the centerline) within the re-routed pipeline corridor that avoids areas within the Aquatic Preserve. Some of the southern transect lines overlapped the original corridor (**Figure 2**) and therefore were not re-surveyed. A minimum of one qualitative still photograph was collected at 656-ft (200-m) intervals along each survey transect along the proposed re-route of the pipeline corridor.

Continuous video observations were made using an Insight Pacific, Inc. Aurora CCD camera, an advanced underwater video system with Deep Sea Power 500 W lights (**Figure 3**). Live video feed with time, location (X,Y coordinates), and transect number data was recorded directly to an on-board Panasonic DVD/hard disk drive model DMR-EH55. Back-up video was simultaneously recorded on mini-DV tapes using a Panasonic AG-DV1000 recorder. Real-time observations of habitat types, sediment characteristics, and notable species were logged by a scientific observer on board the survey vessel.

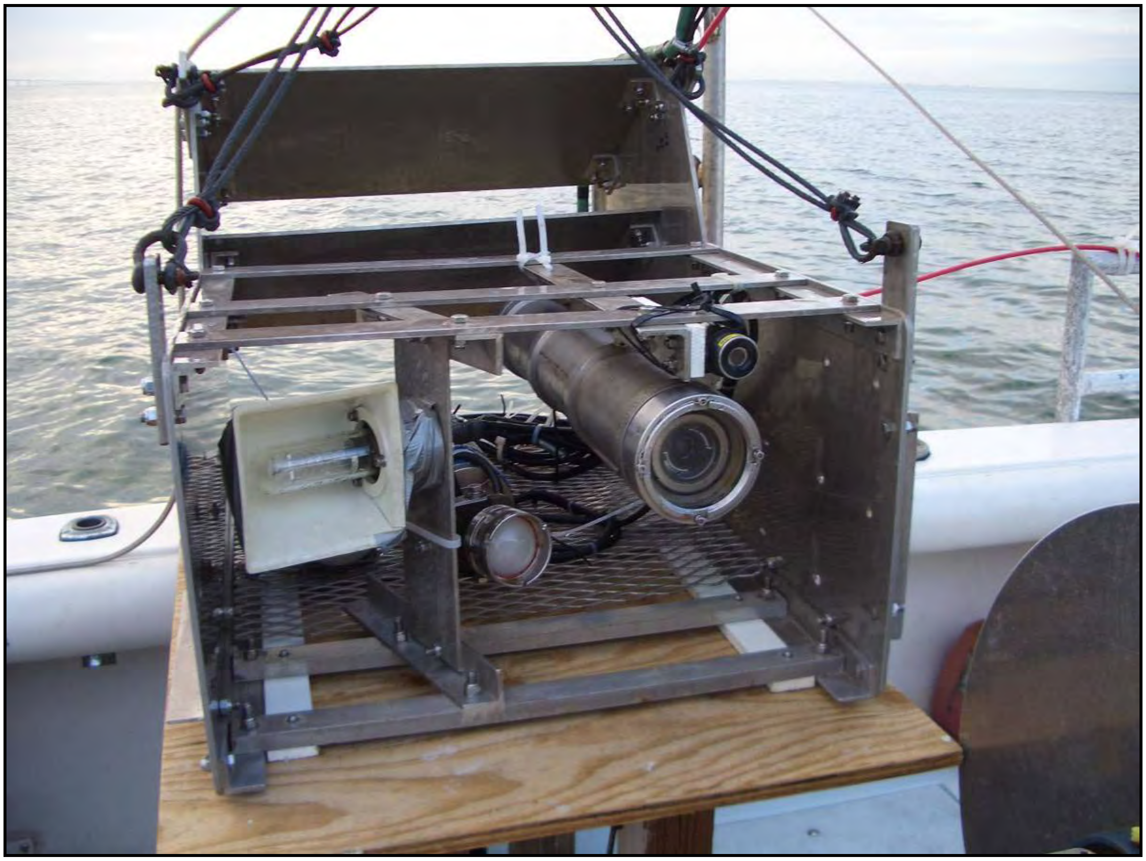


Figure 3. Underwater video/still camera system used for the qualitative survey.

Still photographs were taken with a Benthos Model 372 Deep Sea camera with a data chamber and a Model 386 flash pack strobe. The camera was loaded with 100-ft (30.5 m) rolls of Ektachrome E-6 (ASA 200) 35-mm film, providing a 750-exposure capacity. Still photographs were taken, at a minimum, every 656-ft (200-m); the camera was activated remotely by an on-board technician. The lower left-hand corner of each slide frame was inset with the time (hour, minute, second) of exposure, film roll number, and date, as shown in representative photographs (see **Figure 4** and **Appendix D**). The inset data on the film can be used to reference each still photograph to a specific geographic location (X,Y coordinates).

The underwater video and still cameras used for the qualitative surveys were mounted on a custom-made, stainless-steel, open-framed sled (**Figure 3**) that was towed approximately 0.5 to 1 ft (0.15 to 0.3 m) off the seafloor at vessel speeds of 0.4 to 2.4 kn (0.7 to 4.4 km/hr). The cameras were aligned (30º to 60º degrees below horizontal, depending on vessel speed and visibility) so that both had the same field of view at the time of shutter activation.

Figure 4. Representative photograph from the qualitative video survey.

2.1.2 Quantitative Hard/Live Bottom Surveys

Following the qualitative surveys, marine benthic habitats within the survey area were categorized into one of the general habitat types described in **Table 1**. Dive locations were selected based on field notes and video review to represent the range of habitats within various depths throughout the re-route survey area. Random quantitative still photographs and video data were collected by divers within the re-route survey area at two distinct sites (A-1 and A-2) (**Figure 5**) within the range of habitat types identified from the qualitative analysis. SCUBA divers used digital still cameras to collect quantitative data for analysis from the offshore sites. Randomly positioned quantitative still photographs and several minutes of high-quality video were collected at each dive site to pair with the inshore data, for a minimum of 100 photographs per discrete habitat type. Several other dive locations were attempted in the area of A-3, but the habitat was too sporadic to locate areas large enough for quantitative photographic data gathering.

2.1.3 Horizontal Directional Drill (HDD) Seagrass Clearance Survey

As part of the diver surveys, a seagrass clearance survey was performed in the area around the HDD exit point (**Figure 5**). This was done by sending divers to the GPS coordinates of the HDD exit point (27° 37’ 49.82” latitude, 82° 34’ 28.16” longitude) where they performed radial transects with a tape measure to identify the distance and bearing to the closest seagrass areas with respect to the HDD exit point. In addition, divers identified seagrass species for each distance and bearing measurement.

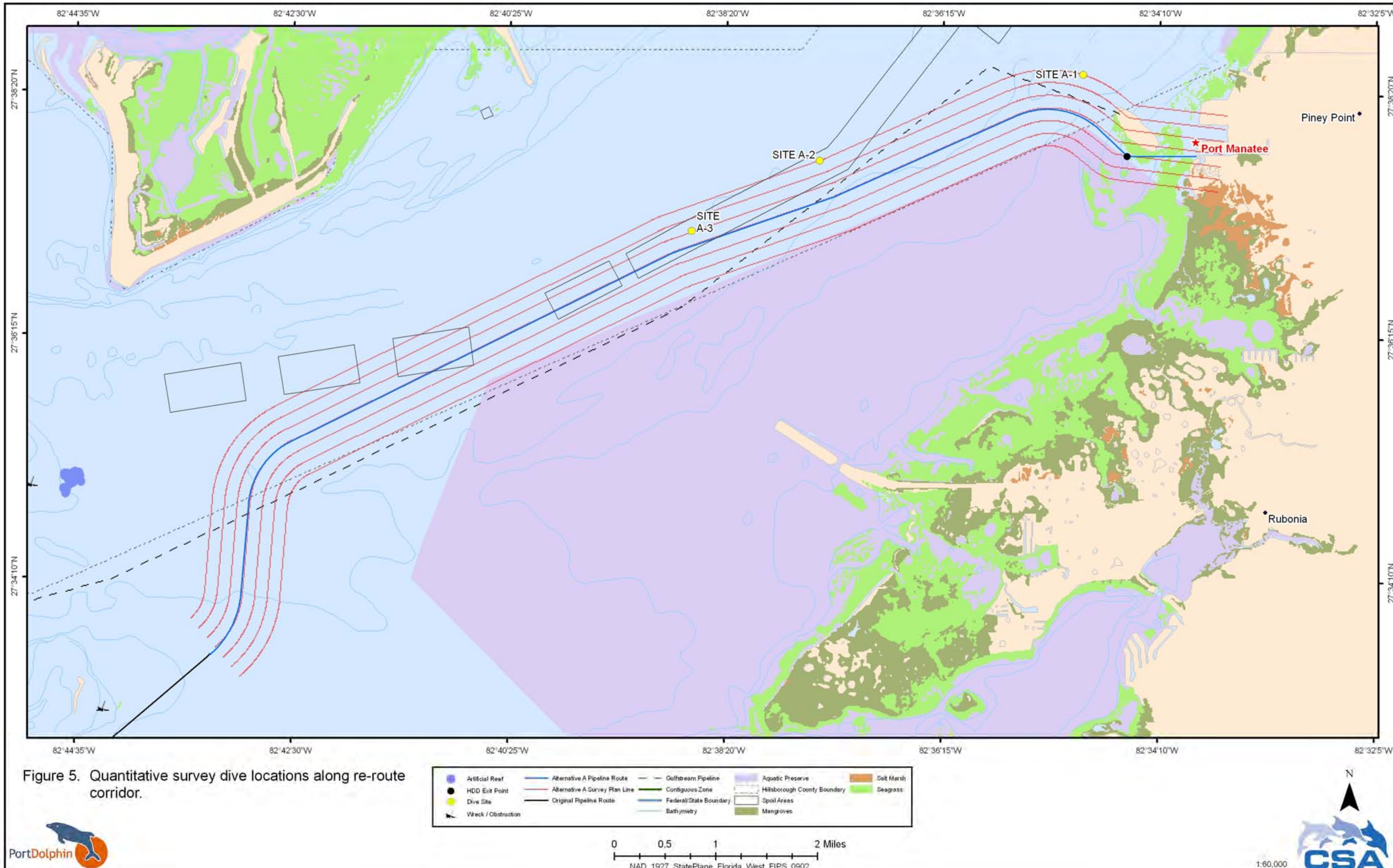


Figure 5. Quantitative survey dive locations along re-route corridor.

Quantitative surveys were conducted from the same vessel used during the qualitative surveys, the *Tracy Gayle*. Digital still photographs were collected using an Olympus 4040 (4.0 megapixel) digital camera within a Sea & Sea underwater housing with YS-90 DX strobes mounted on a custom-built, stainless-steel framer for a 3.1 ft^2 (0.29 m^2) field of view. Divers randomly collected still photographs (see **Figure 6** and **Appendix D**) within each discrete habitat type to determine percent cover and classify habitat type.

Figure 6. Representative photograph from the quantitative diver survey.

2.2 DATA ANALYSIS

2.2.1 Towed Video

A desktop analysis was performed to examine the qualitative video data for full description and characterization of the benthic habitats found within the re-route survey area. During the review, navigational data (X,Y coordinates) were recorded where the habitat types defined in **Table 1** were observed along each transect. All coordinates were compiled into a spreadsheet with an assigned habitat classification for importation into ArcGIS. Habitats were classified as Type A, B, or D based on FDEP definitions, visual observations during the video review, notes from logbooks recorded during video collection, and qualitative still photographs. Example photographs of representative habitat types are presented in **Appendix D**. Habitats estimated to have a vertical relief greater than or equal to 10 in. (0.25 m) as a characteristic feature were assigned as Type A habitat regardless of estimated percent cover. Habitats characterized by hard/live bottom features and estimated to have a vertical relief of less than 10 in. (25.4 cm) with approximately 5% to 20% epibiotic cover were assigned a habitat classification of Type B. In areas with estimated percent cover of less than 5% with no apparent relief but that were characterized by hard/live bottom organisms (e.g., corals, sponges, and octocorals), Type D habitat classification was assigned.

2.2.2 Quantitative Photographic Data

Quantitative still photographic data collected during the diver surveys were analyzed to confirm preliminary habitat classifications using percent coverage of attached epibiota, which were grouped into the following major categories:

- Live stony corals – includes total live scleractinian corals (e.g., *Solenastrea* sp. and *Siderastrea* sp.);
- Octocorals – includes soft corals, such as sea fans, sea whips (*Carijoa riisei* and *Pseudopterogorgia* sp.), and stony hydrocorals (*Millepora* sp.);
- Sponges – includes sponges identified to lowest possible taxon;
- Algae – includes fleshy, calcareous, and coralline taxa, as well as turf algal communities consisting of short articulate algae intermixed with red and brown macroalgae and other small epibenthic biota that form a mat or carpet over hard substrate;
- Other fauna – includes unidentified bryozoans, hydroids, and other small unidentified epibiota; and
- Abiotic substrate – includes unconsolidated sediment, bare rock, deep holes, and gaps.

Percent coverage for stony corals, octocorals, sponges, algae, hydroids, zooanthids, and macroalgae were estimated using the CPCe V3.3 (Coral Point Count with Excel extensions) software analysis program (Kohler and Gill, 2006). CPCe utilizes the random point method described by Bohnsack (1979) to accurately estimate percent coverage of benthic organisms and associated substrate from digital underwater images. There were 25 random points projected on the digital photographs to determine the percent cover of identifiable species and substrate categories (**Figure 7**). Individual coral colonies observed in each of the frames also were identified and counted to further characterize the habitat types.

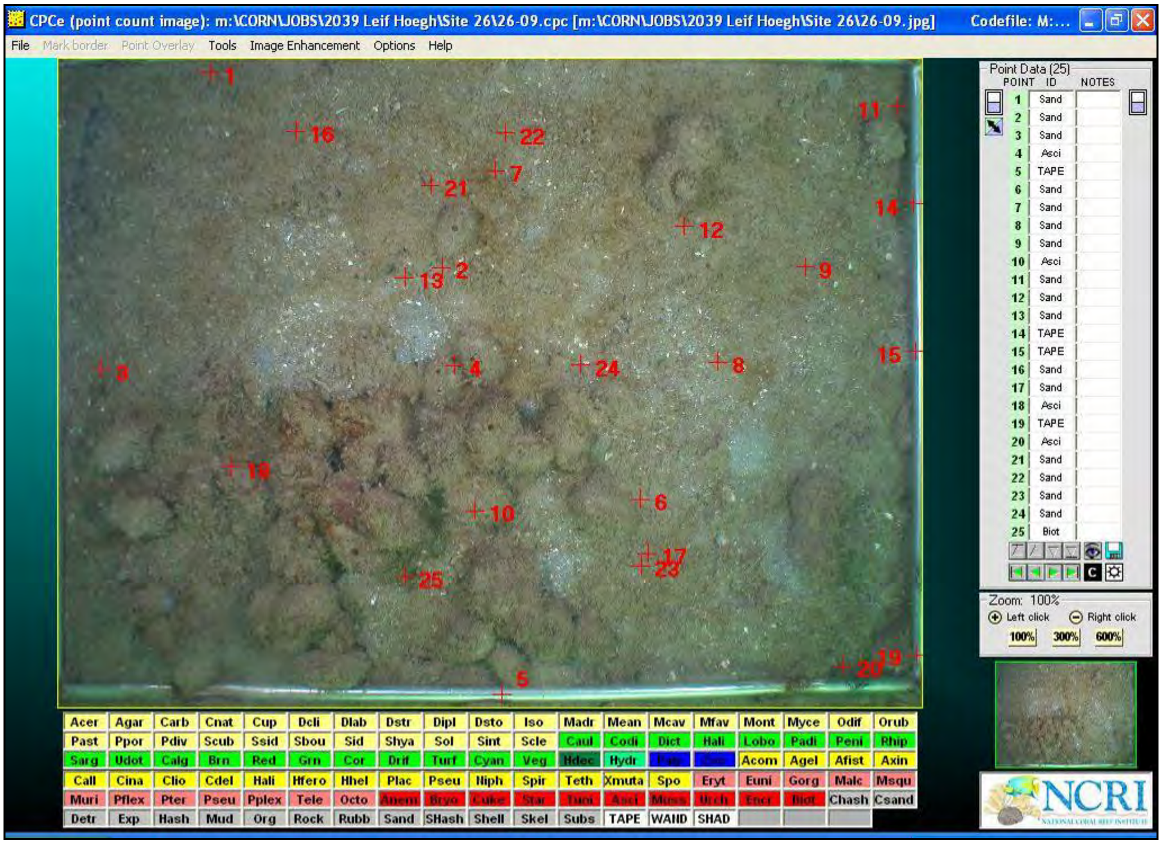


Figure 7. Example of a Coral Point Count with Excel extensions (CPCe) screen shot with project points.

2.2.3 Hard/Live Bottom Habitat Delineation and Quantification

Data from the desktop analysis were imported into ArcGIS for the plotting of each discrete habitat area. To produce maps showing linear boundaries of the habitats along each transect within the survey area, visual interpolation of data points between like habitat types was used to create polygons showing habitat distribution and allow for areal determination of each habitat type. In areas where one habitat type was clearly dominant, some smaller areas of similar coverage were incorporated within the larger polygon for areal interpretation.

2.3.4 HDD Seagrass Clearance Data Analysis

The distance, bearing, and seagrass species information were plotted on the seagrass maps prepared from the detailed surveys performed during the original route surveys in the summer of 2006. These points were then used to modify the outer edges of the previous seagrass polygons to reflect the current condition of seagrasses in the area of the HDD exit point.

3.0 RESULTS

3.1 QUALITATIVE HARD/LIVE BOTTOM HABITAT CLASSIFICATION

Following the FDEP protocol, four distinct marine benthic habitat types (Type A, Type B, Type D, and soft substrate/sand) were identified within the survey area (**Figure 8**). Representative still photographs of the habitats are presented in **Appendix D**. Classifications were based on specific seafloor substrate types and review of video data collected from the survey transects within the proposed re-route pipeline corridor. Sand/soft bottom habitat is the dominant habitat type in the re-route area, with small and patchy clusters of habitats Types A, B, and D. Most Type A habitats were identified east of the Sunshine Skyway Bridge.

3.2 QUANTITATIVE ANALYSIS OF PHOTOGRAPHIC DATA

Biotic cover at the two selected dive sites comprised 24.3% at Site A-1 and 22.2% at Site A-2 in the re-route survey area. During the initial pipeline corridor surveys, macroalgae comprised a significantly high percentage of the total epibiotal coverage and was, therefore, differentiated from other biota in the original results. Though macroalgae comprised a minimal percent cover (2.7% at Site A-1 and 2.1% at Site A-2) during the re-route survey, algal coverage was still differentiated from non-algal benthic biotic coverage (**Table 2**), and marine habitats in the survey area were mapped based on structural relief and non-algal benthic biotic coverage.

Macroalgae was composed of unidentified red algae (Rhodophyta), cyanobacteria, and unidentified macroalgae. Cyanobacteria comprised the greatest macroalgal cover at Site A-1 with 1.8%. Unidentified red algae comprised the greatest macroalgal cover at Site A-2 with 1.8%.

Fauna comprised only 22.5% and 22.2% cover at Sites A-1 and A-2, respectively. Faunal components included sponges, hydroids, octocorals (including *Carijoa riisei*), encrusting bryozoans, urchins (*Arbacia punctulata*), and colonial tunicates (*Clavilina gigantica*). Hydroids comprised the greatest percent cover of fauna at Site A-1 with 18.0%. Sponges comprised the greatest percent cover of fauna at Site A-2 with 14.0%.

Substrate had the highest percent cover at both Sites A-1 and A-2 with 74.8% and 75.7%, respectively. The primary substrate cover was sand (29.5%) at Site A-1 and shell-hash (34.9%) at Site A-2.

Based on the total biotal percent cover of 22.5% (Site A-1) and 22.2% (Site A-2) (excluding macroalgal cover), both Sites A-1 and A-2 were classified as Type A habitats.

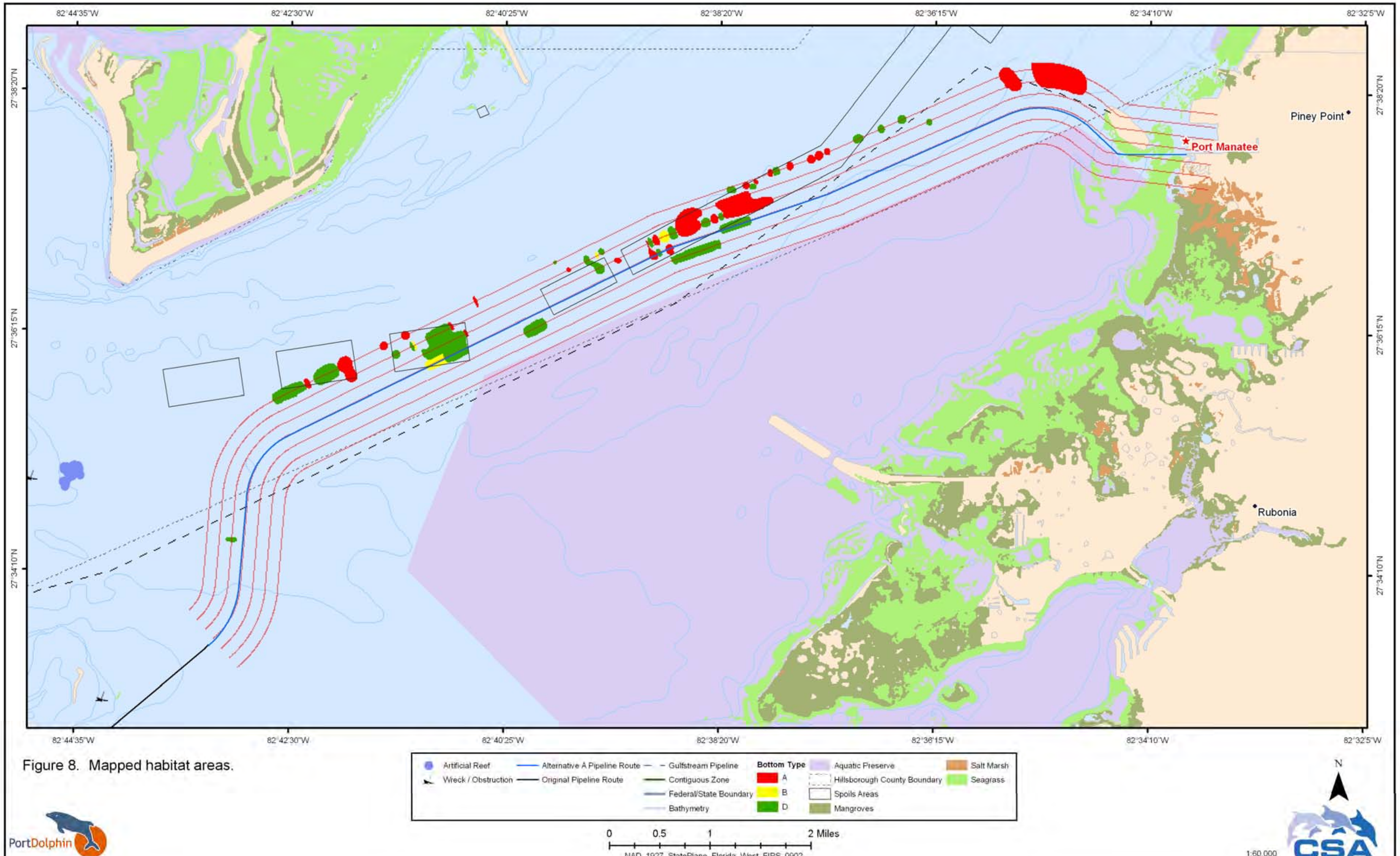


Figure 8. Mapped habitat areas.

Table 2. Habitat classifications based on percent coverage and/or structural relief.

Dive Site	Depth (ft)	Preliminary Habitat Classifications		Quantitative Analysis: Percent (%) Coverage (Non-algal)	Percent (%) Macroalgal Coverage	Final Habitat Classification
		Video Review	Diver Survey			
A-1	15	A	A	24.3	2.7	A
A-2	22	A	A	22.2	2.1	A

3.3 DELINEATION AND QUANTIFICATION OF IDENTIFIED HARD/LIVE BOTTOM HABITATS

Figure 9 shows the mapped habitat polygons (algal cover excluded) superimposed on the geophysical data. The total area surveyed for the benthic habitat characterization included 4,157 acres (1,682 ha). Within the survey area, 763 acres (309 ha) (18.3% of the total area) of hard/live bottom habitats were identified, which included Types A, B, and D classifications. Hard/live bottom habitat acreage by type is presented in **Table 3**. As discussed in **Section 3.2**, macroalgal coverage was not considered during the final classifications, but soft-bodied organisms such tunicates and octocorals commonly observed within Tampa Bay were included. Soft bottom/sand substrate was the dominant feature and encompassed 81.7% of the total survey area.

Table 3. Habitat coverage based on quantitative analysis of hard/live bottom habitats.

Survey Area	Habitat Coverage (acres) by Florida Department of Environmental Protection Classification			
	Type A	Type B	Type D	Total Habitat Area
Total survey area	312.0	68.4	383.1	763.5

3.4 DELINEATION OF SEAGRASS IN THE VICINITY OF HDD EXIT POINT

As discussed in **Section 2.3.4**, the distance and bearing from the HDD exit point to the nearest seagrass were plotted, and the seagrass polygons delineated during the surveys performed in the summer of 2006 were modified to reflect the current location of seagrasses in the area. **Figure 10** presents the HDD exit point area with modified seagrass polygons that shows seagrasses currently are not present at the HDD location, but do occur within 75 ft (23 m) to the southwest and more than 194 ft (60 m) to the northeast. Since seagrass beds are a dynamic habitat, a thorough seagrass survey will be performed prior to construction to determine the current status and location of seagrass in the area of the HDD exit location.

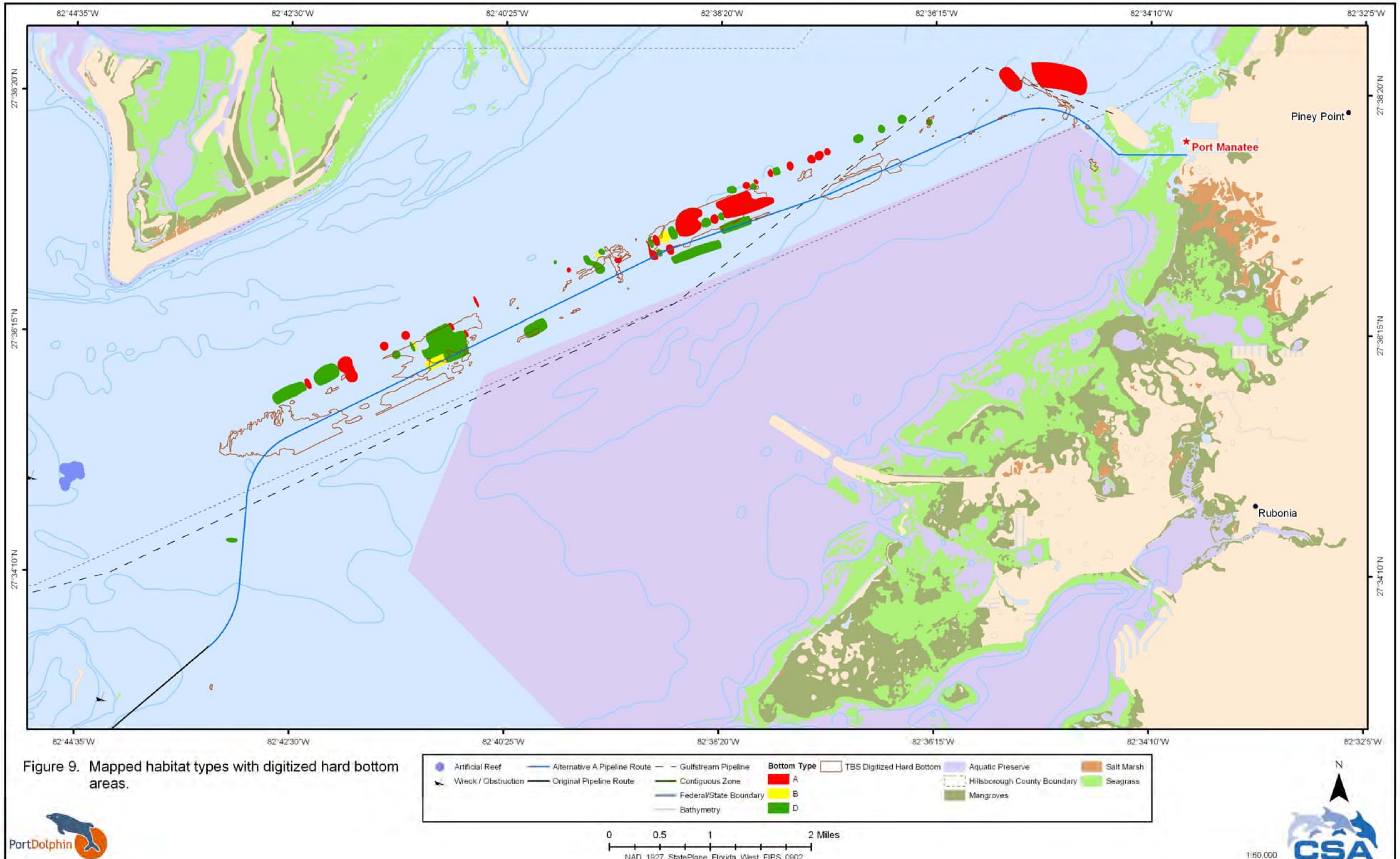


Figure 9. Mapped habitat types with digitized hard bottom areas.

Figure 10. Mapped seagrass polygons at horizontal directional drill (HDD) exit point.

4.0 DISCUSSION

The West Florida Shelf off west central Florida is composed mainly of carbonate sediments and consists primarily of a relatively flat limestone substratum with localized relief due to relict reef or erosional structures. Benthic habitat types in this large area include low-relief hard/live bottom (Parker et al., 1983; Phillips et al., 1990), coralline algal nodules and pavement, and unconsolidated shell rubble and soft bottom (primarily sand). Mostly covered by a thin veneer of sand (Phillips et al., 1990), these environments harbor scattered emergent hard substrates jutting upwards to a maximum of 6.6 ft (2 m) (Jaap and Hallock, 1990) and are colonized by a variety of tropical reef biota, such as algae (Cobb and Lawrence, 2003), sponges, stony corals, hydroids, octocorals, anemones, and bryozoans (Gulf of Mexico Fishery Management Council [GMFMC], 2003) intermingled with sand bottoms. Hardier species are most common due to abiotic factors from hydrodynamics and shifting sands. The West Florida Shelf harbors some deepwater seagrass beds (*Halophila decipiens*), which occur commonly out to 100 ft (30.5 m) (Phillips et al., 1990; Dawes et al., 2004) but rarely cover significant areas. Integrally connected to nearby Tampa Bay, these habitats interact with the nearshore and estuarine communities to support many commercially and recreationally important species.

Although most of Tampa Bay (80%) is covered by sand or mud bottom (Southwest Florida Water Management District [SWFWMD], 1999), hard/live bottom habitats are known to occur (Lewis and Estevez, 1988) and are characterized by sessile invertebrates such as hard corals, soft corals, sponges, tunicates (ascidians), hydroids, and anemones living on and attached to hard surfaces. Although relatively rare, these features comprise plants and animals unlike other habitats within the bay (SWFWMD, 1999). A study by Savercool and Lewis (1994) revealed more than 850 acres (344 ha) of hard/live bottom within Tampa Bay, in areas near Cockroach Bay, Rocky Point, and portions of the Lower Tampa Bay. It is not known what the coverage is to date as there is no long-term trend information available (SWFWMD, 1999). Artificial structures purposely placed as artificial reefs or relicts from bridge construction also are found within the bay. These man-made structures expand opportunities for natural colonization and habitat availability and enhance fishing opportunities within the bay.

Algal diversity varies seasonally at shallower depths (20 to 40 ft [6 to 12 m]), whereas a more stable diversity is found at intermediate depths (60 ft [18 m]) (Dawes and Van Breedveld, 1969). Considerable seasonal variation in plant and algal communities is characteristic of the central Gulf Coast shelf, where variations in temperature and hydrodynamics occur (Dawes and Lawrence, 1990; Cobb and Lawrence, 2003).

Survey results correspond to the known habitat types off west central Florida and the West Florida Shelf. Within the re-route survey area, soft bottom/sand was the dominant characteristic, with some sporadic hard/live bottom areas found scattered throughout the bay. Typically not covering large areas, these hard/live bottom communities harbor a variety of octocorals, sponges, hydroids, macroalgae, bryozoans, and various other invertebrate species.

Areas of Type A habitats identified along the sections of the survey route that traversed the dredge spoil areas were classified as Type A based partially on the increase in elevation (**Figure 9**). The elevation change occurring on each spoil pile varied, but average depth changes were between 5 and 10 ft (1.5 and 3 m). Some of the dredge spoil piles shoaled as shallow as 15 ft (4.6 m) from depths greater than 25 ft (7.6 m). These areas of higher relief were colonized primarily by sponges, tunicates, macroalgae, and some octocorals. In the areas between the spoil piles, the sediment consisted primarily of medium to coarse sand.

An artificial reef created as mitigation for hard/live bottom impacts from installation of the Gulfstream natural gas pipeline located within a dredge spoil pile area contributed to an area of Type A habitat within the re-route survey area. This area was identified as a Type A habitat based on both the change in relief and epibenthic coverage. The mitigation reefs provide substrate and subsequent habitat for octocorals, sponges, macroalgae, and various other invertebrate species.

5.0 LITERATURE CITED

Bohnsack, J.A. 1979. Photographic quantitative sampling of hard bottom communities. Bulletin of Marine Science 29(2):242-252.

Cobb, J. and J.M. Lawrence. 2003. Seasonal and spatial variation in algal composition and biomass on the Central Florida Gulf Coast Shelf. Gulf of Mexico Science 21(2):192-201.

Dawes, C.J. and J.M. Lawrence. 1990. Seasonal changes in limestone and plant communities off the Florida West Coast. Marine Ecology 11(2):97-104.

Dawes, C.J. and J.F. Van Breedveld. 1969. Memoirs of the Hourglass Cruises: Benthic marine algae. Volume 1: Part II. 47 pp.

Dawes, C.J., R.C. Phillips, and G. Morrison. 2004. Seagrass communities of the Gulf coast of Florida: Status and ecology. Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute and Tampa Bay Estuary Program, St. Petersburg, FL. 74 pp.

Jaap, W.C. and P. Hallock. 1990. Coral reefs in ecosystems of Florida, pp. 574-616. In: R.L. Myers and J.J. Ewel (eds). Ecosystems of Florida, University of Florida Press, Gainesville, FL.

Kohler, K.E. and S.M. Gill. 2006. Coral point count with excel extensions (CPCe): A visual basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences 32:1,259-1,269.

Lewis, III, R.R. and E.D. Estevez. 1988. The ecology of Tampa Bay, Florida: An estuarine profile. U.S. Fish and Wildlife Service Biological Report 85:7.18. 132 pp.

Parker, R.O. Jr., D.R. Colby, and T.D. Willis. 1983. Estimated amount of reef habitat on a portion of the U.S. South Atlantic and Gulf of Mexico continental shelf. Bulletin of Marine Science 33(4):935-940.

Phillips, N., D. Gettleson, and K. Spring. 1990. Benthic biological studies of the Southwest Florida Shelf. American Zoologist 30:65-75.

Savercool, D.M. and R.R. Lewis, III. 1994. Hard bottom mapping of Tampa Bay. Prepared for Tampa Bay National Estuary Program. 14 pp.

Southwest Florida Water Management District. 1999. Tampa Bay Surface Water Improvement and Management (SWIM) Plan. SWIM Section, Tampa, FL. 108 pp.

APPENDICES

APPENDIX A

GUIDELINES FOR CONDUCTING OFFSHORE BENTHIC SURVEYS DEP OFFICE OF INTERGOVERNMENTAL PROGRAMS OFFSHORE PROJECTS SECTION

Guidelines for Conducting Offshore Benthic Surveys
DEP Office of Intergovernmental Programs Offshore Projects Section
Updated March 2006

The intent of these guidelines is to provide applicants with a general description of the information necessary to accurately assess the impacts of projects proposed offshore of Florida. Because each project and its resulting impacts to resources may differ, necessary project-specific information or methods for collecting information may vary. The Department encourages applicants to work with staff in the early stages of project development to ensure that adequate information is collected and analyzed in reports. This will help to facilitate efficient and timely reviews by the state and avoid the necessity of conducting additional surveys.

Background
Live-bottom habitats are the foundation of the marine ecosystem of the Florida shelf, supporting fisheries, marine fauna and recreational activities. Hard or rocky live-bottom is especially important because its structure provides a stable substrate on which biological communities flourish, thereby attracting associated organisms. These habitats and their associated communities generally occur in clear, clean waters and contribute to the maintenance of water quality. Federal law describes this resource as "Essential Fish Habitat" for many marine species, including those found in Florida waters.

The potential for impacts to these important habitats in coastal and offshore waters is a major concern of the state. Avoiding impact to these communities is the preferred way to protect them. If avoidance is not possible, then actions that minimize impacts are required. As a last resort, where impacts to habitat cannot be avoided, mitigation is necessary.

General
Surveys conducted in both state and federal offshore waters should provide complete geophysical and biological characterization of the seabed and associated benthic communities potentially affected by installation and operational activities. Survey protocols should incorporate, as appropriate, the Minerals Management Service's requirements for outer continental shelf oil and gas exploration/development under 30 CFR 250 and described in detail in Notices to Lessees **(1)** No. 2005-G07, Archeological Resource Surveys and Reports; **(2)** No. 98-20 Shallow Hazards Requirements; **(3)** No. 2004-G05, Biologically Sensitive Areas of the Gulf of Mexico (see especially Live bottom Low Relief Features); and **(4)** No. 2003-G17, Guidelines for Submitting Exploration Plans and Development Operations Coordination Documents. The following guidelines are derived from these sources, previous experience, the requirements of the state of Florida's federal consistency review and some elements of the environmental resource permit review.

The footprint of the project includes all areas directly affected by the project, such as: bottom areas contacted by structures, anchors, cables; the construction swath for pipeline entrenchment; and associated impacts occurring in adjacent areas due to bottom disturbance, sedimentation, and anchor placement and cable sweep of pipelay barges and support vessels. In cases where project footprint details are not yet known (e.g., installation methodology has not been determined) surveys should cover the area corresponding to the project design with the greatest areal impacts (i.e., worst-case). The state encourages the use of construction methodologies that minimize benthic and water column impacts. Should significant live/hard-bottom communities be encountered at a preferred site or along a preferred route, alternative locations should be surveyed.

Companies may wish to consider using a phased approach, beginning with qualitative video reconnaissance surveys to scope broad areas and eliminate unsatisfactory locations, followed by more detailed qualitative and quantitative investigations at preferred locations. Ongoing consultation with state and federal resource agencies throughout this process will ensure a final site location that fully minimizes impacts to resources.

Geophysical

Survey components include: bathymetry (multibeam quality); high-resolution side scan sonar; subbottom profiling; cores; magnetometer; surficial sediment quality, percent fines and grain size analysis. Collectively, the information from these surveys should provide complete geophysical characterizations of the surface and subsurface geology in the areas affected by the project. Core and sediment samples should be of sufficient number and distribution to allow statistically reliable and valid interpretations throughout the area affected by the project.

All geophysical information should be displayed on a detailed map at an appropriate scale showing the preferred project location, alternative locations and routes surveyed, and the related construction impact zones. A depiction of the subbottom trace should be displayed adjacent to the plan view, at the same scale. The locations of all geologic and photographic sampling stations should be indicated on the map. Because it provides highly useful comparative information, a composite map that displays the interpreted geological and biological information together is required. All maps should display geographic coordinates and fix points so that locations in the survey area can be easily associated with photographic information.

Biological

Biological surveys include precise mapping and characterization of benthic habitats using high-resolution video photography and color still photography taken close to the seafloor in areas which will be directly (e.g., anchoring, trenching) or indirectly (e.g., sedimentation) impacted by the proposed project. Video and still photography together should allow not only presence/absence mapping of habitats and communities by type, but also quantitative interpretations of species composition and densities. Accurate benthic characterization should include a description of sediment types, organisms identified to the lowest practicable taxonomic level (species if possible) and percent cover of identified species. The number and spacing of video tracks should be sufficient to provide accurate documentation of the presence/absence and general characterization of each habitat/community type encountered. For linear projects, complete video surveys should be conducted from the shoreline to at least a depth of 200m. Video surveys beyond 200m may be necessary for all types of projects where geophysical data indicate hard/live bottom may exist. Where significant live/hard-bottom areas are found, the video record should be augmented with additional tracks, extending outward from the center line in the proper direction and in sufficient numbers to accurately document the full extent of the trend. In shallow waters, photographic surveys may be collected by divers. For those surveys conducted from a vessel, all videos should be operated with a surface monitor and recorder, preferably with an audio track on which navigation fix points are indicated. Regardless of the collection method, videos should also be annotated with date, time, and geographic coordinates (state plane or lat/long) that are clearly legible on the video monitor. Graphic coordinate annotations should also be depicted on project maps so that features on the map can be easily located and inspected on the video record. Video surveys should be conducted under the proper conditions of tow speed, water clarity and height above the bottom to enhance the reviewers' ability to determine presence/absence and characterize the communities present.

Qualitative and quantitative still photographs should be taken throughout the survey area, illustrating typical assemblages and densities of all epibenthic habitats encountered. Quantitative photography stations should be located in representative depth ranges and epibenthic habitat types. It is anticipated that a minimum of 100 quantitative photographs will be necessary to provide sufficient data for the proper characterization of each benthic community type. Quantitative assessments should be based on species counts obtained by analyzing a statistically sufficient number of photographs encompassing a standard surface area (e.g., 0.5 meter squared) at each habitat being surveyed. Quantitative and qualitative photos should be taken from a camera with surface control capability that is mounted with the video camera.

Reports
Using photographic and geophysical information collected in the surveys, maps should be prepared displaying the areal extent of all habitat types overlaid with geophysical information, including bathymetry with isobaths at appropriate intervals (e.g., 1, 2, or 5 meters), and geographic coordinates. A benthic habitat survey report should be prepared to describe in detail the survey and sampling methodologies used to produce the maps. The report should include species lists and the results of the quantitative assessment of species composition and density in live-bottom areas. Using the video and still photography, both soft (sand veneer) and hard/live bottom communities should be characterized. Habitat assessments should describe the geologic conditions, such as relief and substrate characteristics, associated with each habitat type. The report should also include a discussion of published and unpublished literature describing benthic communities, both hard and soft bottoms, on the Florida shelf and a comparison of survey results with information found in the literature.

The report should also quantify the potential acreage of each substrate and habitat type that would be directly and indirectly impacted by the proposed project. These estimates should account for a range of construction options if the precise method of construction, installation, anchor handling, etc. is not known.

Electronic Submission of Geophysical and Biological Data
Geophysical and biological data should be submitted on CD to the Department in either AutoCad or Arc compatible forms. Data should be recorded using the following formats:

All location data in decimal degrees to 6 places.
Longitude expressed as a decimal (regardless of coordinate system)
Longitude field name: lon_dd
Latitude field name: lat_dd

Projections:
Here is an example to UTM Zone 17N
NAD_1983_UTM-Zone17N
Projection: Transverse_Mercator
Parameters:
False_Easting: 500000.000000
False_Northing: 0.000000
Central_Meridian: -81.000000
Scale_Factor: 0.999600
Latitude_Of_Origin: 0.000000
Linear Unit: Meter (1.000000)
Geographic Coordinate System:
Name: GCS_North_American_1983
Angular Unit: Degree (0.017453292519943295)
Prime Meridian: Greenwich (0.000000000000000000)
Datum: D_North_American_1983
Spheroid: GRS_1980
Semimajor Axis: 6378137.000000000000000000
Semiminor Axis: 6356752.314140356100000000
Inverse Flattening: 298.257222101000020000

If Albers projection is used:
False_Easting: 400000.000000
False_Northing: 0.000000
Central_Meridian: -84.000000
Standard_Parallel_1: 24.000000
Standard_Parallel_2: 31.500000
Latitude_Of_Origin: 24.000000
GCS_North_American_1983
Datum: D_North_American_1983
Prime Meridian: 0

APPENDIX B

BENTHIC CHARACTERIZATION SURVEYS FOR PROPOSED DEEPWATER PORT OFFSHORE TAMPA BAY, FLORIDA

Benthic Characterization Surveys for Proposed Deepwater Port Offshore Tampa Bay, Florida

Continental Shelf Associates, Inc. (CSA), an agent for Höegh LNG, is preparing to conduct benthic characterization surveys for a proposed linear natural gas pipeline facility offshore Tampa Bay, Florida in Federal waters. The surveys will be conducted during the month of August 2006. The scope of the benthic characterization surveys includes side-scan sonar, towed video, and qualitative and quantitative still photography for the entire distance of the proposed pipeline facility, with diver ground-truthing for hard bottom and seagrass habitats in the nearshore habitats. The survey results and subsequent mapping products are to serve as submittals to the regulatory agencies in order to obtain permits and approvals for the installation and operation of the natural gas pipeline, and to serve as guides for avoidance and minimization of impacts to sensitive biological resources.

The natural gas pipeline facility begins as a buoy system array offshore in Federal waters in depths of approximately 100 ft. For permitting clearance purposes and to ensure avoidance and minimization practices, the side-scan sonar surveys will be conducted within the proposed pipeline corridor and barge anchoring areas (3,200 ft. in width), and within footprint (25,000 ft. x 12,000 ft.) in order to place a buoy system array within a footprint of 15,000 ft. x 6,000 ft. CSA will deploy a high resolution side-scan sonar system with a resolution of 8 to 10 inches to identify seafloor features that may be within the proposed corridor and buoy system array footprint. CSA plans to use this side-scan imagery to align the pipeline corridor away from sensitive biological habitats.

A photo-documentation survey will be conducted of the pipeline right-of-way and buoy system array footprint. Descriptive and qualitative video and still quantitative photographic data will be collected for hard/live bottom communities and seagrass communities. If the proposed corridor crosses hard bottom nearshore, scientific divers will collect data from the shallow reef areas to determine options for pipeline placement. A video/still camera system will be towed along the proposed pipeline center; and using a maximum 200-meter line spacing, three transects lines will be towed along each side of the centerline for a total of seven survey transects for a maximum total of a 3,900 ft. corridor. The towed system will collect video and still photographs of the bottom and associated marine communities. Video data will be collected using a color underwater video camera and lighting system. All camera operating functions are pre-set or automatic. Video and audio data will be recorded on mini DV videotapes. The video record will include position and local time, and the audio track will be annotated with water depth and brief descriptions of bottom substrates. Still photographs will be taken with a digital deep sea camera with a data chamber and a flash pack and strobe. The underwater video and still cameras are mounted on a sled that is towed above the bottom substrate at vessel speeds of 1.5 to 2.0 knots for the qualitative data collection. While the sled is towed along the survey transect lines, the video and still cameras are aligned so that both cameras are aimed ahead. Qualitative still photographs are required by the Minerals Management Service every 200 m along the transects. Video observations are recorded continuously, while qualitative format still photographs can be taken as often as every 10 sec. Following the qualitative video and still photograph data collection survey, the survey vessel will return to the different habitats identified during the video survey to collect quantitative still photograph data. This will be performed using the same sled mounted digital deep sea camera with data chamber and a flash pack and strobe with the still camera pointed down towards the bottom to collect plan-view photographs. Benthic habitats observed along the survey transects will be described and mapped using ArcGIS relative to water depth and classified using regulatory habitat type classifications and following Florida Department of Environmental Protection guidelines providing a minimum of 100 quantitative still photographs per habitat type as required.

In the shallow areas, divers will collect quantitative data for seagrass habitats and hardbottom habitats within the pipeline corridor identified by the side-scan sonar surveys. The surveys will be performed using a lead line and the Braun-Blanquet method for percent cover estimates within the seagrass habitats.

Water quality data will be collected as a baseline prior to pipeline installation and operation. Parameters will include temperature, salinity, dissolved oxygen, and turbidity vs. depth. The water quality data for the offshore areas will be collected during the side-scan sonar survey, and data for the nearshore area will be collected as part of the quantitative seagrass surveys. Both sets of data will provide background data for comparative purposes against any data collected during and post-construction.

In addition, several artificial reefs are known near the Sunshine Skyway that were deployed as mitigation for hard bottom impacts during the installation of the Gulfstream pipeline; however, the coordinates are not published. A formal request to obtain the mitigation reef coordinates will be submitted as part of the planning and permitting process to avoid impacts.

APPENDIX C

REGULATORY BASIS OF REVIEW MITIGATION PROTOCOL OFFSHORE SOUTHEAST FLORIDA

Regulatory Basis of Review Mitigation Protocol
Offshore Southeast Florida

Purpose

Federal, state and county agencies are tasked with protecting and managing live-bottom communities, including hard and soft corals, hard-bottom substrates and the integral adjacent soft substrate communities. Reef and hard bottom communities are a highly valuable ecological and economic resource in Southeast Florida (Johns et al., 2001). These resources are threatened by numerous anthropogenic and natural stresses as well as stochastic events. The U.S. Coral Reef Task Force, Southeast Florida Action Strategy Team has identified construction of submarine infrastructure such as pipelines, outfalls and cables as anthropogenic threats to the nearshore reef and hard bottom systems of southeast Florida (SEFAST 2003). A management tool to reduce these threats is the permitting/licensing process in which the applicant works with the agencies to provide reasonable assurances environmental impacts have been avoided and minimized. Once avoidance and minimization of unacceptable impacts is accomplished, some impacts may be considered unavoidable and require mitigation to enhance or replace lost ecosystem function and structure. A single standardized method for determining appropriate mitigation for reef and hard bottom communities has not been used in the permitting/licensing processes at various levels of regulatory control in the past.

The methodology currently used by the Florida Department of Environmental Protection (DEP) for determining mitigation ratios is outlined in the DEP Environmental Resource Program Basis of Review, which has been proven and used extensively with conventional wetlands systems. The Basis of Review was developed for the water management districts and adopted by Florida DEP (Chapter 62-330, F.A.C.) to assist staff by identifying the permit review criteria used and information needed when reviewing environmental resource permit applications. Section 4.3 offers guidance on evaluating mitigation proposals and for determining the best approach to offset adverse impacts resulting from the regulated activities and how much mitigation (mitigation ratios) is needed to offset the impacts.

The Basis of Review is not limited to freshwater or brackish systems and can be applied to reef systems. The mitigation protocol described below applies the Basis of Review to determine appropriate mitigation ratios for unavoidable permitted and licensed impacts to reefs, hard bottom systems and intermixed soft bottom communities in the Southeast Florida region. The ratios determined from this methodology will provide reasonable assurances that lost ecosystem structure and function will be replaced.

Habitat Characterizations

Habitat characterizations in proposed construction areas are typically based on video and quantitative photo-documentation surveys submitted by applicants, literature review, empirical observations and expert knowledge of the area. Using these sources of information, four important marine habitat types were defined as follows:

Habitat Type	**Description**
Type A:	20-100% cover by attached epi-benthic biota and/or hard bottom with greater than or equal to 0.25 meters in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH), Habitat Area of Particular Concern (HAPC)
Type B:	5-20% cover by attached epi-benthic biota and/or hard bottom with less than 0.25 meter in relief, inclusive of sand components integral to these habitats. EFH HAPC
Type C:	Breakwater spoil area. EFH HAPC
Type D:	Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% attached epi-benthic biotic coverage. EFH

* specific seagrass mitigation plans to be developed separately

**Impacts to soft substrate/sedimentary habitats not associated with hard bottom ecotones are not included in the matrix.

The value and function of habitat types A and B are well-established through literature and regulation. Type C habitat, the breakwater spoil area, was considered separately from Type B habitat since it is essentially an unconsolidated unstable rock rubble area subject to high wave energy which negatively effects coral growth and reproduction. Ecosystem function of Type D habitats includes production of biomass consumed by reef associated organisms which supports the trophic structure of the reef and hard bottom communities. Off-reef foraging of reef associated fishes and invertebrates transports production from the soft substrate systems to the reef and hard bottom communities. While temporary impacts to these communities recovers within 3-4 years, permanent conversion of these habitats to hard substrate by laying pipe and concrete mat on the seabed in depths less than 200' creates a loss of ecological function to the ecosystem (Wilber and Stern, 1992). This conversion of Type D habitat to a hard substrate community may change the trophic structure of the nearshore ecosystem in the vicinity of the Port Everglades Entrance Channel. Impacts to this component of the nearshore marine ecosystem should be addressed in the evaluation of impacts and mitigation necessary to protect ecosystem function and structure. Protocols for mitigation of seagrass impacts are explicit in the regulatory Basis of Review and are therefore not included in this matrix.

Quantifying Mitigation-

Baseline Replacement Value = 8

Value/function Habitat Type Adjustment	Type A: 0	Type B: -1	Type C: -3	Type D: -4
Special Designation: (Outstanding Florida Waters, Aquatic preserves, etc.)	Yes= +1	No = 0		
Time Lag (years)	> or = 35: +1	11 to 34: 0	6 to 10 years: -1.0	0 to 5 years: -2.0
Success Probability	high: -1.0	average: 0		low: + 1.0
On-site vs. off-site	on-site 0	off-site +1.0		

Rationale for the 5 evaluation factors (Section 4.3.2.1 of the Basis of Review):

The Basis of Review specifies certain factors to be considered, however, it does not designate a higher or lower importance to any specific factor. Therefore, we considered all factors equally and set adjustments in single value increments.

Baseline replacement value: The beginning base replacement of 8 was assigned based on the mean of mitigation ratios applied to previously permitted projects requiring mitigation. Mitigation requirements for the previously permitted/licensed projects impacting reef and hard bottom resources in habitats similar to those observed off Broward County provided reasonable assurances that lost spatial and temporal ecosystem structure and function would be adequately mitigated.

Value/function: This factor was evaluated based on the abundance, uniqueness and functional value of each habitat type. For further descriptions of each habitat type, please refer to the habitat characterization section.

Habitat Type Adjustment Rationale
Type A= 0 Includes reef systems and high relief hard bottoms, which are essential fish habitat and habitat areas of particular concern, high diversity, higher economic value, high habitat value.

Type B= - 1 Moderate occurrence, essential fish habitat and habitat areas of particular concern, medium diversity, hard substrate provides colonization of organisms, medium to high habitat value

Type C= - 3 Breakwater Spoil Area, essential fish habitat and habitat areas of particular concern

Type D= - 4 Commonly occurring, low epi-benthic coverage, sandy veneer over hard bottom

Special Designation: This factor was evaluated based on special designation or classification of the affected area Not located within a specially designated or classified area = 0; Located within a specially designated or classified area = + 1.

Time Lag: Time lag is defined as the length of time expected to elapse before the functions of the area adversely impacted will be offset. The time lag for coral reefs systems is expected to be very high, possibly up to 100 years.

Based on input from applicants and experts in marine ecology as well as interagency consultations regarding recovery rates of various biological components of southeast Florida nearshore marine communities, the following time lag categories and adjustments were developed using best professional judgment:
>35= +1.0; **11 to 35**= 0; **5 to 10**= -1.0 **0 to 5**= -2.0

(Note: this does not include adjustments for organism relocation to the impact area as that is accounted for in the success probability.)

Success Probability:

The probability of success addresses the uncertainties associated with reasonable assurance that proposed mitigation will successfully replace lost ecosystem structure or function resulting from impacts to important resources. Categories and adjustments were selected using professional judgment in consultation with resource management and regulatory agencies. This factor was evaluated using criteria such as organism transplantation, supporting documentation of mitigation success, special projects, recovery of impact area, etc.

Success Probability Adjustment Rationale

Low= +1.0: No transplanted organisms, no supporting literature for success of mitigation type, no recovery of impact area expected

Medium= 0: Only hard coral transplantation, minimal supporting literature, partial recovery of impact area expected

High= - 1.0: Transplanting hard corals > or = 25 cm in diameter, soft corals > 25 cm in height and rubble colonized with hard coral and octocorals; Agency preferred special mitigation projects; sufficient supporting literature, recovery of impact area

On-site vs. off-site: Mitigation which is within close proximity to the impact area is usually preferred mitigation over that which is not in close proximity. In certain circumstances, such as tire removal, mitigation was determined on-site regardless of the distance from the impacts since second reef/sand impacts will be mitigated by the enhancement of second reef/sand resources.

On-site 0 Within close proximity to the impact area or an agency recommended area
Off-site + 1 Not within close proximity to the impact area

Conclusion:

The interagency group concluded that methodology proposed under the Regulatory Basis of Review Mitigation Protocol will provide reasonable assurances that lost ecosystem structure and function will be replaced.

Mitigation Credit for Tire Recovery and Reef Enhancement

Tire Recovery:

In the 1970s and 1980s, bundled automobile tires were placed between the second and third reefs offshore of Broward County as artificial reefs. Due to instability and separation of the bundles, the tires have moved to the west and are now impacting the second reef. The proposed enhancement area is being adversely impacted by these tires that have moved onto important habitats similar to the resources expected to be impacted by projects proposed in this area. This situation provides a unique opportunity to enhance previously impacted natural reef, hard bottom and important soft substrates in the vicinity for projects with similar types of impacts (low relief hard bottom, Intra-reef sand areas, etc.) Determining appropriate mitigation credit for the removal, transportation to shore and approved disposal of the tires recovered from the enhancement/restoration area has been the subject of extensive interagency coordination. This document represents the conclusions and rationale for the decisions resulting from these interagency discussions.

Description of the Proposed Enhancement Area

Broward County staff conducted video surveys in June 2003, to define the areal extent of the tire field and characterize the impacts at the proposed enhancement site. Video records were geo-referenced using a Hypac system to allow integration into Geographic Information System (GIS) software. Results of the video surveys showed a total of 31.0 acres of nearshore marine habitats were impacted by tires. Approximately 17.0 acres are covered by more than one layer of tires, and 14.0 acres were observed to be covered continuously with a single layer. Areas of scattered or intermittent tires extend beyond this mapped tire pile.

Based on results of the video surveys, agency staff conducted dive operations to (1) characterize the hard bottom under tires; (2) determine the number of layers of tires in the multi-layer area; and (3) describe the eastern side of the tire pile, near the third reef. The location of and observations made from these dives were included on the GIS output from the video survey to describe the enhancement/restoration area (Figure 1). Results of this survey indicated a total of 2.1 acres of hard substrate was covered by tires. The multi-layer area varies from two to seven tires deep, with the highest density between transects 4 and 7 (Figure 1). Observations made along transect 13, located on the east side of the main tire pile, showed intact tire bundles that appear to be stable with large Scleractinian corals growing on some of the bundles. Relocation of these corals will be required if these tire bundles are to be removed.

Tire densities

The area covered by one tire is calculated to be to be 3 square feet and one acre totals 43,560 square feet. To determine the number of tires contained in one acre of a single layer of tires, divide 43,560 by 3 to calculate an estimated 14,520 tires per acre. Assuming an average of three layers of tires over the multi-layer area of 17.0 acres, there is an estimated 740,520 tires in the multi-layer area. The single layer area (14.0 acres) is estimated to include 203,280 tires.

Recovery Approach

Observations of net transport along the seafloor, surveys conducted by Broward County and empirical observation following previous tire recovery efforts have shown that tires in this area have been observed to move from the east/northeast to the west/southwest by storm waves and currents. Priority areas were defined to promote maximum restoration of the reef, hard bottom and surrounding soft substrate components of the system. Tire recovery efforts and enhancement activities should begin on the northern extent of the multi-layer portion of the area and move toward the south (Figure 2) and should be conducted in the following order:

1. Priority Area 1: Multi-layer tire area starting on the north and progressing to the south;
2. Priority Area 2: Single layer tire area north of the multi-layer area;
3. Priority Area 3: Single layer tire area south of the multi-layer area; and
4. Priority Area 4: Tires and bundles of tires east of the multi-layer area.

The specific details regarding the locations and requirements of recovery and restoration activities, including latitude/longitude of corner locations of the tire recovery areas, set-backs and buffers from important resources, Best Management Practices, GPS vessel monitoring systems and turbidity and sedimentation monitoring requirements will be provided through permit conditions.

Mitigation Credit

Regulatory and management agency staff agreed that one unit of mitigation would equal the removal, transport to shore and disposal of one acre or 14,520 tires from the restoration/enhancement area. One acre of required conventional mitigation equals one unit of tire recovery mitigation. Based on the video and diver surveys of the tire areas, the average tire depth within the multi-layer area is three tires deep. Therefore, in multi-layer areas, the actual area covered in the tire recovery mitigation activities would be less than the area of conventional mitigation required. For example, one acre of tires recovered from the Priority Area 1 (assumed to be three layers thick) would involve removal of approximately 43,560 tires. Three units of mitigation (3 acres of conventional mitigation) would be credited for clearing this one acre multi-layer area. Whereas, the recovery of one acre of tires in the single layer area will equate to one unit of mitigation (removal of 14,520 tires).

The locations and dimensions of the tire recovery areas will be defined in permit conditions based on the number of units required for a project using tire recovery as mitigation. The removal of tires must be performed in a manner that clears the entire defined area of tires. For example, removal of the top two layers of tires and leaving the third layer of tires in a multi-layer area will not be considered acceptable even if the required number of tires is removed. As an assurance that the required number of tires are removed, a verified copy of the disposal logbook kept by the landfill detailing the date of delivery and number of tires for each truckload and a receipt from the landfill will be required.

Methods of Tire Recovery

It is recognized that there may be a variety of innovative construction techniques used to achieve the goal of tire removal. Each applicant will present their preferred method of recovery for agency evaluation. Reasonable assurances must be provided that the proposed methodology will meet water quality and sedimentation standards applied to the impact site and not cause adverse impacts to marine resources.

Several agencies expressed concerns regarding the potential for increased sedimentation and turbidity, as well as inadvertent impacts to benthic resources and artificial reefs located in the tire field, from mechanical tire recovery. To address this concern, a setback/buffer distance from these resources will be established where diver recovery will be required to reduce the risk of physical damage or sedimentation and turbidity impacts to reef and hard bottom resources associated with mechanical removal. The setback will be evaluated based on evaluation of the risks associated with the means of mechanical recovery.

Tire recovery from Priority Area 4 includes the need to relocate Scleractinian corals before tire bundles are disturbed. An agency developed detailed relocation plan and an appropriate mitigation discount to account for coral relocation will be established prior to tire removal from Priority Area 4.

Monitoring

Monitoring of the enhancement/restoration area is needed to document (1) the status of the resources when the mitigation is complete; (2) the recovery and movement of tires; (3) the enhancement/restoration of the resources over time; and (4) planning for future recovery and restoration efforts. It is recommended that the permit holders provide funds for a holistic monitoring program to Broward County DPEP. The DPEP will administer and oversee the monitoring program and provide copies of monitoring reports to the other agencies issuing permits for the proposed projects. Appropriate funding levels for monitoring should be developed in consultation with applicants and agency staffs involved in the tire recovery and reef enhancement activities.

References:

Florida Department of Environmental Protection (2003) Submerged Lands & Environmental Resources Program Operations and Procedures Manual

Florida Department of Environmental Protection (1995). Basis of Review For Environmental Resource Permit Applications Within The South Florida Water Management District. August 1995.

Johns, Grace M.; Vernon R. Leeworthy; Frederick W. Bell and Mark A. Bonn. 2001. Socioeconmomic Study of Reefs in Southeast Florida Final Report. Hazen and Sawyer.

Southeast Florida Action Strategy Team (2003). Southeast Florida Coral Reef Initiative, Local Action Strategies. United States Coral Reef Task Force.

Wilber, P., and M. Stern. (1992.) A re-examination of infaunal studies that accompany beach renourishment projects. *In* S. Tait (ed.), Proceedings of the 5th Annual Conference on Beach Preservation Technology, p. 242-257. Florida Shore and Beach Preservation Association, St. Petersburg, Florida

APPENDIX D

REPRESENTATIVE PHOTOGRAPHS OF DESIGNATED HABITAT TYPES AND OTHER FEATURES

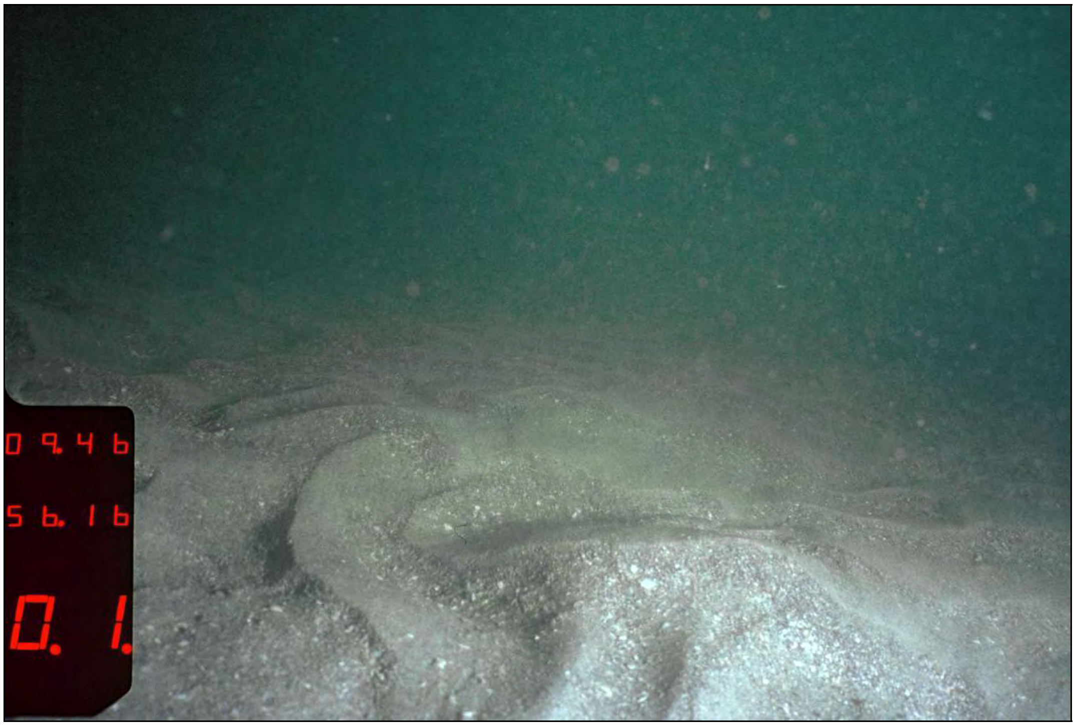


Photo D-1. Representative qualitative photograph of sand bottom along the re-route survey corridor.

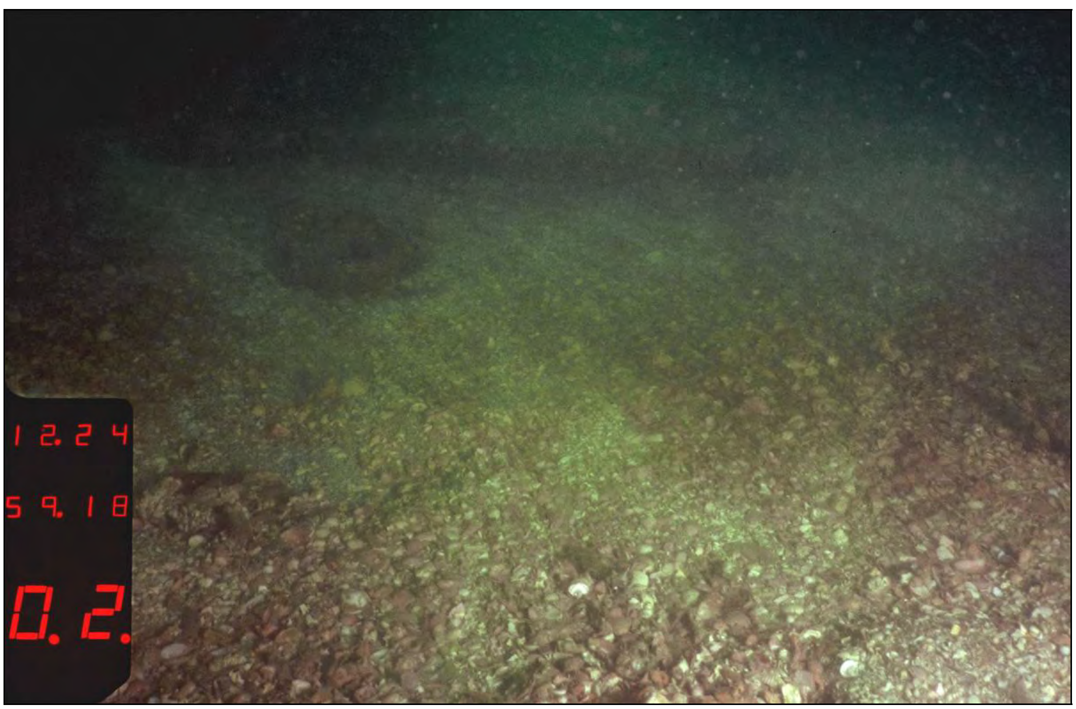


Photo D-2. Representative qualitative photograph of coarse sand bottom along the re-route survey corridor.

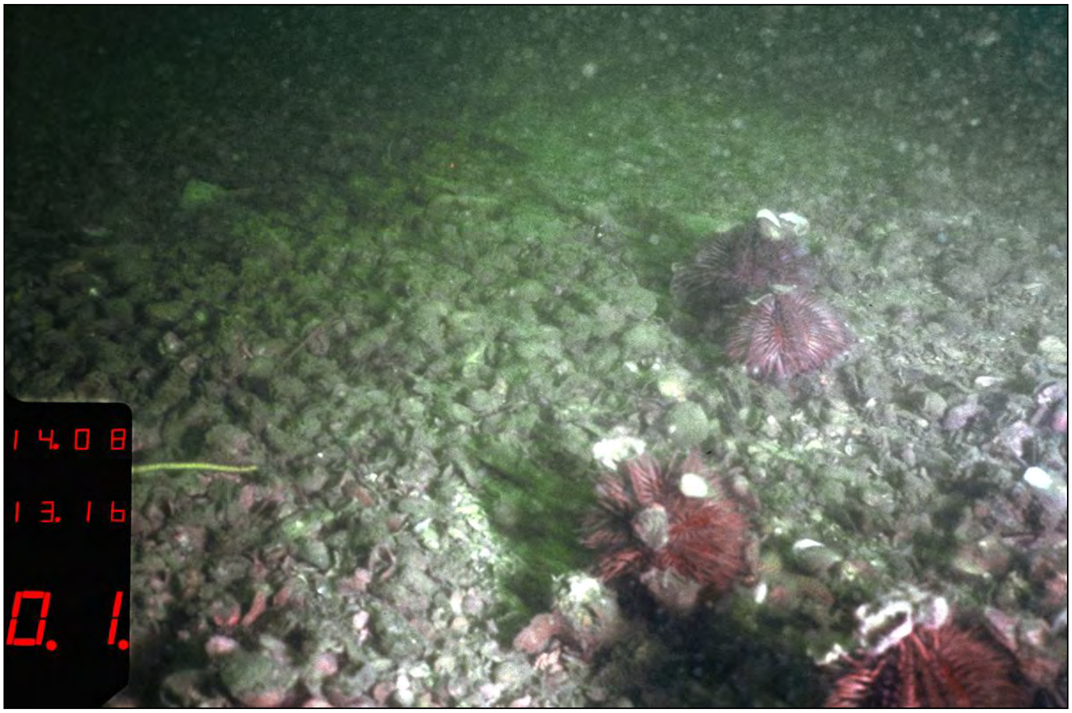


Photo D-3. Representative qualitative photograph of Type D habitat along the re-route survey corridor.

Photo D-4. Representative qualitative photograph of Type D habitat along there-route survey corridor.

Photo D-5. Representative qualitative photograph of Type B habitat along the re-route survey corridor.

Photo D-6. Representative qualitative photograph of Type A habitat along the re-route survey corridor.

Photo D-7. Representative qualitative photograph of Type A habitat along the re-route survey corridor.

Photo D-8. Representative quantitative photograph of Type A habitat from Dive Site A-1.

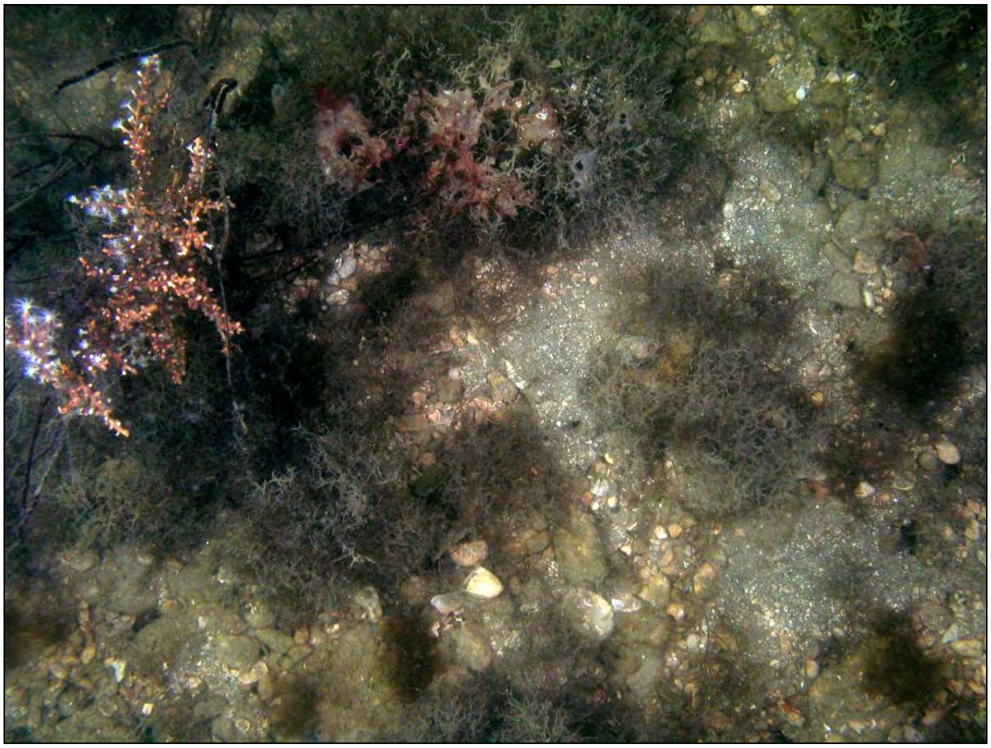


Photo D-9. Representative quantitative photograph of Type A habitat from Dive Site A-1.

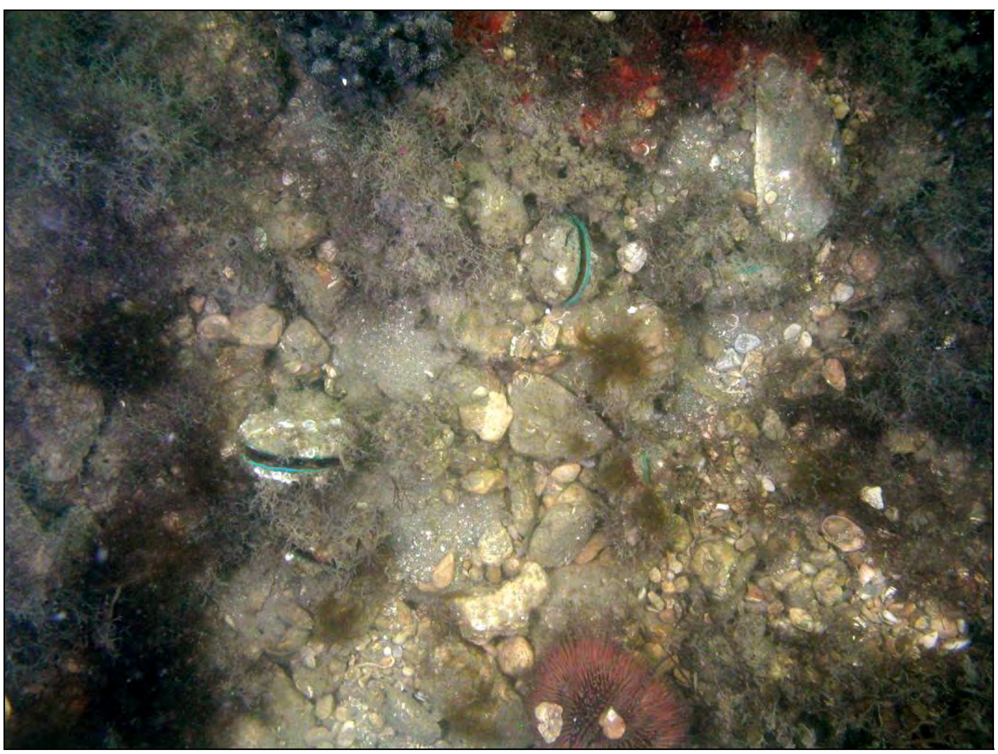


Photo D-10. Representative quantitative photograph of Type A habitat from Dive Site A-1.

Photo D-11. Representative quantitative photograph of Type A habitat from Dive Site A-2.

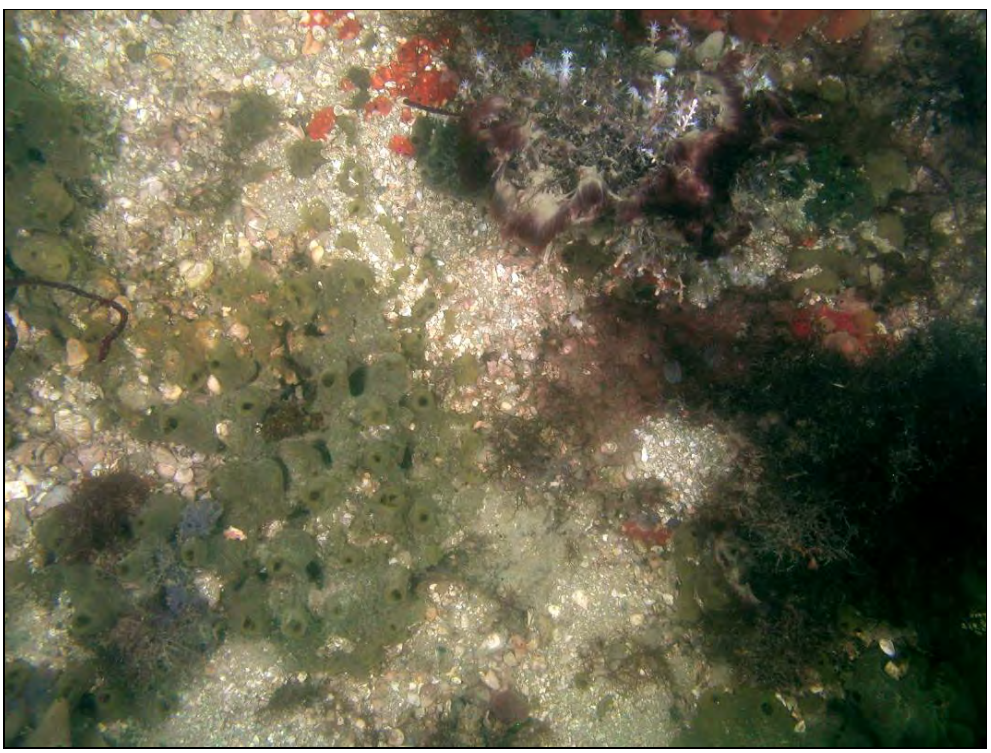


Photo D-12. Representative quantitative photograph of Type A habitat from Dive Site A-2.

Photo D-13. Representative quantitative photograph of Type A habitat from Dive Site A-2.

Wetland ZY (1)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Port dolphin	Date:	11/1/07
Applicant/Owner:		County:	Manatee
Investigator:	Luke Martinson Melissa Green	State:	FL

Do Normal Circumstances exist on the site?	(Yes)	No	Community ID:	
Is the site significantly disturbed (Atypical Situation)? Rip-rap	Yes	(No)	Transect ID:	
Is the area a potential Problem Area? (If needed, explain on reverse.)	Yes	(No)	Plot ID:	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Blutaparon vermiculare	GC	FACW+	9.		
2. Distichlis spicata	GC	FACW+	10.		
3. Phyla nodiflora	GC	FACW	11.		
4. Avicennia germinans	GC/SC	OBL	12.		
5. Solidago sp	GC	FACW	13.		
6. Baccharis hamifolia	SC	FAC	14.		
7. Typha sp	GC	OBL	15.		
8. Rhizophora mangle	SC	OBL	16.		

"Percent of Dominant Species that are OBL, FACW or FAC" (excluding FAC-). 100%

Remarks: Veg was located on the canal banks. B. vermiculare and D. spicata dominated the majority of wetland. Mangroves also on banks

HYDROLOGY

Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
___ Stream, Lake, or Tide Gauge	Primary Indicators:
✓ Aerial Photographs	✓ Inundated
___ Other	___ Saturated in Upper 12 Inches
___ No Recorded Data Available	✓ Water Marks
	✓ Drift Lines
	✓ Sediment Deposits
Field Observations:	___ Drainage Patterns in Wetlands
	Secondary Indicators (2 or more required):
Depth of Surface Water: 0-12 (in.)	___ Oxidized Root Channels in Upper 12 Inches
	___ Water-Stained Leaves
Depth to Free Water in Pit: 0-6 (in.)	___ Local Soil Survey Data
	___ FAC-Neutral Test
Depth to Saturated Soil: 0 (in.)	___ Other (Explain in Remarks)

Remarks: Site is a tidally influenced canal connected by culverts.

Wetland 24 (1) cont'd

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class ______
Field Observations
Taxonomy (Subgroup) ______ Confirm Mapped Type? Yes No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-4 in	A	10YR 4/2			
10 in	B	10YR 3/1			

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- Other (Explain in Remarks)

Remarks

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks Wetland was a tidally influenced canal

Approved by HQUSACE 3/92

Wetland M (2)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin
Applicant/Owner:
Investigator: Lino Martinson Melissa Green
Date: 11/15/07
County: Manatee
State: FL

Do Normal Circumstances exist on the site? **Yes** No
Is the site significantly disturbed (Atypical Situation)? Yes **No**
Is the area a potential Problem Area? Yes **No**
(If needed, explain on reverse.)

Community ID:
Transect ID:
Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Schinus terebinthifolius	SC/C	FAC	9. Serenoa repens	GC	FACU
2. Nyssa sylvatica	C	OBL	10. Hydrocotyl umbellata	GC	OBL
3. Quercus virginiana	C	FACU+	11.		
4. Sabal palmetto	C	FAC	12.		
5. Acer Rubrum	C	OBL	13.		
6. Acrostichum danaeifolium	GC	OBL	14.		
7. Woodwardia virginica	GC	OBL	15.		
8. Cornus foemina	SC	FACW-	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 95%

Remarks: Brazilian Pepper dominated interior portion of the wetlands. Other species found primarily on the outer wetland edges

HYDROLOGY

___ Recorded Data (Describe in Remarks):
___ Stream, Lake, or Tide Gauge
✓ Aerial Photographs
___ Other
___ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: 10+ (in.)

Depth to Saturated Soil: 6 (in.)

Wetland Hydrology Indicators:
Primary Indicators:
___ Inundated
✓ Saturated in Upper 12 Inches
___ Water Marks
___ Drift Lines
___ Sediment Deposits
✓ Drainage Patterns in Wetlands
Secondary Indicators (2 or more required):
✓ Oxidized Root Channels in Upper 12 Inches
___ Water-Stained Leaves
___ Local Soil Survey Data
___ FAC-Neutral Test
___ Other (Explain in Remarks)

Remarks: Site dry at time of survey; however tussocks & buttressing was observed. Ditch existed in wetland

Wetland M (2)

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class: ______
Field Observations
Taxonomy (Subgroup): ______ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
8	A	10YR/3/1	NA	N/A	Muck

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Muck in surface soils.

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No (Circle)	
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Site appears to be a wetland.

Approved by HQUSACE 2/92

Wetland L (3)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin Applicant/Owner: Investigator: Luke Mortensen Melissa Green	Date: 11/5/07 County: Manatee State: FL
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: Transect ID: Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Schinus terebinthifolium	C	FAC	9. Blutaparon vermiculare	GC	FACW+
2. Acrostichum danaeifolium	GC	OBL	10. Aster subulatus	GC	OBL
3. Setaria parviflora	GC	FAC	11.		
4. Eupatorium capillifolium	GC	FACU	12.		
5. Panicum virgatum	GC	FAC+	13.		
6. Bidens alba	GC	FACW-	14.		
7. Phyla nodiflora	GC	FACW	15.		
8. Distichlis spicata	GC	FACW+	16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 95%

Remarks: Site dominated by Brazilian pepper. D. spicata + B. vermiculare found in ROW on North end of wetland. Others species scattered along wetland edges

HYDROLOGY

__ Recorded Data (Describe in Remarks): __ Stream, Lake, or Tide Gauge ✓ Aerial Photographs __ Other __ No Recorded Data Available	Wetland Hydrology Indicators: Primary Indicators: ✓ Inundated ✓ Saturated in Upper 12 Inches ✓ Water Marks __ Drift Lines ✓ Sediment Deposits ✓ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ✓ Oxidized Root Channels in Upper 12 Inches ✓ Water-Stained Leaves __ Local Soil Survey Data __ FAC-Neutral Test __ Other (Explain in Remarks)
Field Observations: Depth of Surface Water: 0-4 (in.) Depth to Free Water in Pit: 0-8 (in.) Depth to Saturated Soil: 0-6 (in.)	

Remarks: Standing water in areas, with a ditch inside wetland limits. Salt stains + buttressing observed

Wetland L (3)

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class: ______
Field Observations
Taxonomy (Subgroup): ______ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
4	A	10YR/2/2	—	—	
4-6	B	10YR/3/1	—	—	
6+	C	10YR/4/1	—	-	

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: 3 distinct soil types. Muck in top layer

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No (Circle)	
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Site is a wetland

Approved by HQUSACE 2/92

Wetland E (4)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin
Applicant/Owner:
Investigator: Luke Martinson Melissa Green

Date: 10/24/07
County: Manatee
State: FL

Do Normal Circumstances exist on the site? Yes No
Is the site significantly disturbed (Atypical Situation)? Yes No
Is the area a potential Problem Area? Yes No
(If needed, explain on reverse.)

Community ID:
Transect ID:
Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Typha	GC		9.		
2. Ludwigia Peruviana	GC		10.		
3. Schinus terebinthifolius	SC/C		11.		
4. Salix Caroliniana	SC		12.		
5. Nuphar rosea	GC		13.		
6. Hydrocotyle umbellata	GC		14.		
7. Baccharis halimifolia	SC		15.		
8.			16.		

"Percent of Dominant Species that are OBL, FACW or FAC" (excluding FAC-). 100%

Remarks: The wetland was a burrow pit. Majority of vegetation was at bank line above and below wetland line

HYDROLOGY

Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ✓ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0-12+ (in.)
Depth to Free Water in Pit: to surface (in.)
Depth to Saturated Soil: surface (in.)

Wetland Hydrology Indicators:
Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ✓ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: Burrow pit

Wetland E (4)

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class ______
Field Observations
Taxonomy (Subgroup) ______ Confirm Mapped Type? Yes No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer in Sandy Soils
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- Other (Explain in Remarks)

Remarks Soils Muck

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Yes) (Circle) No

Remarks Wetland is a reservoir, line along bank

Approved by HQUSACE 3/92

Wetland D
(5)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Determination Manual)

Project / Site: Port Dolphin
Applicant / Owner:
Investigator: Luke Mortinsen Melissa Green

Date: 10/23/07
County: Manatee
State: FL

Do normal circumstances exist on the site? Yes ✓ No___
Is the site significantly disturbed (Atypical situation)? Yes___ No___
Is the area a potential problem area? Yes___ No___
(explain on reverse if needed)

Community ID:___
Transect ID:___
Plot ID:___

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Axonopus	GC		9.		
2. Paspalum sp	GC		10.		
3. Bacopa monnieri	GC		11.		
4. Commelina erecta	GC		12.		
5. Cyperus Spp	GC		13.		
6. Air potato	GC		14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW, or FAC excluding FAC-). ___

Remarks: Vegetation hard to identify due to recent spraying resulting in the majority of vegetation dead.

HYDROLOGY

___ Recorded Data (Describe In Remarks):
- ___ Stream, Lake, or Tide Gauge
- ✓ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0 (in.)

Depth to Free Water in Pit: >12in (in.)

Depth to Saturated Soil: ___ (in.)

Wetland Hydrology Indicators

Primary Indicators:
- ___ Inundated
- ___ Saturated in Upper 12"
- ✓ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ✓ Drainage Patterns in Wetlands

Secondary Indicators:
- ___ Oxidized Roots Channels in Upper 12"
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: The wetland appears to be a man made ditch, currently dry. West bank slope, East bank gradual slope.

SOILS

Wetland D (5)

Map Unit Name
(Series and Phase):______ Drainage Class:______

Taxonomy (Subgroup):______ Confirm Mapped Type? Yes___ No___

Profile Description:

Depth (inches)	Horizon	Matrix Colors (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.
1	A	10YR 3/1	NA	NA	Mucky top layer
2-12	B	10YR 6/1	NA	NA	Disturbed soils fill dirt

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed On Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ✓ Other (Explain in Remarks)

Remarks: Oxidation streaking near surface
Soil appears to be filled or distributed during creation of ditch

WETLAND DETERMINATION

Hydrophytic Vegetation Present? Yes___ No___
Wetland Hydrology Present? Yes___ No___
Hydric Soils Present? Yes___ No___

Is the Sampling Point Within a Wetland? Yes___ No___

Remarks: The site is recognized as County ditch. Wetland components present, but hard to recognize due to sprayed (dead) veg and lack of hydrology

Wetland C
(6)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Port Dolphin	Date:	
Applicant/Owner:		County:	
Investigator:	Luke Morrison Melissa Green	State:	

Do Normal Circumstances exist on the site?	(Yes)	No	Community ID:	
Is the site significantly disturbed (Atypical Situation)?	Yes	(No)	Transect ID:	
Is the area a potential Problem Area? (If needed, explain on reverse.)	Yes	(No)	Plot ID:	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Anthrocarpon mulhenbergi	GC	FACW	9.		
2. Sambucus nigra	SC		10.		
3. Luster bean	SC		11.		
4. Schinus terebinthifolius	SC	FAC	12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

"Percent of Dominant Species that are OBL, FACW or FAC" (excluding FAC-). 100%

Remarks: Anthrocarpon mulhenbergi dominate within site atleast 90%

HYDROLOGY

Recorded Data	Wetland Hydrology Indicators
___ Recorded Data (Describe in Remarks):	Primary Indicators:
___ Stream, Lake, or Tide Gauge	✓ Inundated
✓ Aerial Photographs	___ Saturated in Upper 12 Inches
___ Other	___ Water Marks
___ No Recorded Data Available	___ Drift Lines
	___ Sediment Deposits
Field Observations:	___ Drainage Patterns in Wetlands
	Secondary Indicators (2 or more required):
Depth of Surface Water: 0-2 (in.)	___ Oxidized Root Channels in Upper 12 Inches
Depth to Free Water in Pit: to Surface 0 (in.)	___ Water-Stained Leaves
	___ Local Soil Survey Data
Depth to Saturated Soil: 0 (in.)	___ FAC-Neutral Test
	___ Other (Explain in Remarks)

Remarks:

Wetland C
(6)

SOILS

Map Unit Name (Series and Phase):		Drainage Class	
		Field Observations	
Taxonomy (Subgroup)		Confirm Mapped Type?	Yes No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-12	A	10YR2/2	NA	NA	Mucky Soils 12+ inches

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ✓ Other (Explain in Remarks)

Remarks: Mucky soils + water to surface

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No	(Circle)
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	
Is this Sampling Point Within a Wetland?	(Yes) No	(Circle)

Remarks: Site is an inundated ditch

Approved by HQUSACE 3/92

Wetland B
(7)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site:	Port Dolphin	Date:	
Applicant/Owner:		County:	
Investigator:	Luke Mortimer Melissa Green	State:	

Do Normal Circumstances exist on the site?	(Yes)	No	Community ID:	
Is the site significantly disturbed (Atypical Situation)?	Yes	(No)	Transect ID:	
Is the area a potential Problem Area? (If needed, explain on reverse.)	Yes	No	Plot ID:	

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Andropogon mullenbergii	GC	FACW	9.		
2. Eudorum octovalvis	GC	OBL	10.		
3. Andropogon glomeratus	GC	FACW	11.		
4. Schinus terebinthifolius	SC/C	FAC	12.		
5. Bidens alba	GC		13.		
6. Setaria geniculata	GC		14.		
7. Cyperus spp	GC		15.		
8.			16.		

"Percent of Dominant Species that are OBL, FACW or FAC" (excluding FAC-). 100%

Remarks: Wetland is a ditch ~~[illegible]~~ with standing water.

HYDROLOGY

Recorded Data (Describe in Remarks):
- ___ Stream, Lake, or Tide Gauge
- ✓ Aerial Photographs
- ___ Other

___ No Recorded Data Available

Field Observations:

Depth of Surface Water: 0-4 (in.)

Depth to Free Water in Pit: to surface 0 (in.)

Depth to Saturated Soil: surface 0 (in.)

Wetland Hydrology Indicators:

Primary Indicators:
- ✓ Inundated
- ___ Saturated in Upper 12 Inches
- ___ Water Marks
- ___ Drift Lines
- ___ Sediment Deposits
- ___ Drainage Patterns in Wetlands

Secondary Indicators (2 or more required):
- ___ Oxidized Root Channels in Upper 12 Inches
- ___ Water-Stained Leaves
- ___ Local Soil Survey Data
- ___ FAC-Neutral Test
- ___ Other (Explain in Remarks)

Remarks: ditch was inundated throughout site. Water flowing from ~~[illegible]~~ ditch (south) to the north

Wetland B
(7)

SOILS

Map Unit Name
(Series and Phase): ____________________ Drainage Class ____________
Field Observations
Taxonomy (Subgroup) ____________________ Confirm Mapped Type? Yes No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
12+	A	10YR 2/1	NA	NA	Organic Muck to 12+ inches

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- Gleyed or Low-Chroma Colors
- ____ Concretions
- ____ High Organic Content in Surface Layer in Sandy Soils
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- ✓ Other (Explain in Remarks)

Remarks: Soils were inundated and mucky to 12+ inches

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes)	No	(Circle)
Wetland Hydrology Present?	(Yes)	No	
Hydric Soils Present?	(Yes)	No	

Is this Sampling Point Within a Wetland? (Circle) (Yes) No

Remarks: Site 6 an inundated ditch

Approved by HQUSACE 3/92

Wetland A (8)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin	Date: 10/23/07
Applicant/Owner:	County: Manatee
Investigator: Luke Marburger Melissa Green	State: FL

Do Normal Circumstances exist on the site?	(Yes)	No	Community ID:
Is the site significantly disturbed (Atypical Situation)?	Yes	(No)	Transect ID:
Is the area a potential Problem Area? (If needed, explain on reverse.)	Yes	No	Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Schinus terebinthifolius	Canopy/SS	FAC	9.		
2. Andropogon glomeratus	GC	FACW	10.		
3. Ludwigia peruviana	GC	OBL	11.		
4. Baccharis halimifolia	SC	FACW	12.		
5. Anthocarpum muhlenbergia	GC	FACW	13.		
6. Eupatorium capillifolium	GC	FACW	14.		
7. Urena lobata	GC	UPL	15.		
8.			16.		

"Percent of Dominant Species that are OBL, FACW or FAC" (excluding FAC-). In wetland 90%,

Remarks: Brazilian pepper was dominant in and adjacent to wetland

HYDROLOGY

___ Recorded Data (Describe in Remarks):	Wetland Hydrology Indicators:
___ Stream, Lake, or Tide Gauge	Primary Indicators:
✓ Aerial Photographs	___ Inundated
___ Other	___ Saturated in Upper 12 Inches
___ No Recorded Data Available	___ Water Marks
	___ Drift Lines
Field Observations:	___ Sediment Deposits
	✓ Drainage Patterns in Wetlands
Depth of Surface Water: 0 (in.)	Secondary Indicators (2 or more required):
	✓ Oxidized Root Channels in Upper 12 Inches
Depth to Free Water in Pit: 0 (in.)	___ Water-Stained Leaves
	✓ Local Soil Survey Data
Depth to Saturated Soil: 0-2 (in.)	___ FAC-Neutral Test
	___ Other (Explain in Remarks)

Remarks: Ditches through wetland and fill piles appear to have altered wetland hydrology

Wetland A (8)

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class ______

Taxonomy (Subgroup) ______ Field Observations
Confirm Mapped Type? Yes No

Profile Descriptions:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/ Size/Contrast	Texture, Concretions, Structure, etc.
0-2	A				Organic mucky & roots/sandy
2-12	B	10YR 4/2	10YR 5/4	Moderate/3/4" dia/High	Clayish

Hydric Soil Indicators:

- ____ Histosol
- ____ Histic Epipedon
- ____ Sulfidic Odor
- ____ Aquic Moisture Regime
- Gleyed or Low-Chroma Colors
- ____ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ____ Organic Streaking in Sandy Soils
- ____ Listed on Local Hydric Soils List
- ✓ Other (Explain in Remarks)
  - Oxidation streaking w/ upper 12"

Remarks

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Yes) No (Circle)

Remarks

Approved by HQUSACE 3/92

(9)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin Applicant/Owner: Investigator: Luke Markman Melissa Green	Date: 11/16/07 County: Manatee State: FL
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: Transect ID: Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Typha sp	GC	OBL	9.		
2. Salix caroliniana	SC	OBL	10.		
3. Andropogon glomeratus	GC	FACW+	11.		
4. Baccharis halimifolia	SC	FAC	12.		
5. Schinus terebinthifolius	C/SC	FAC	13.		
6. grasses			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 100%

Remarks: Site viewed from a distance.

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ✓ Aerial Photographs ___ Other ___ No Recorded Data Available	Wetland Hydrology Indicators: Primary Indicators: ✓ Inundated ___ Saturated in Upper 12 Inches ✓ Water Marks ___ Drift Lines ✓ Sediment Deposits ✓ Drainage Patterns in Wetlands
Field Observations: Depth of Surface Water: 0-12+ (in.) Depth to Free Water in Pit: 0-? (in.) Depth to Saturated Soil: 0-? (in.)	Secondary Indicators (2 or more required): ___ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)

Remarks: Based on visual observation (not on site)

(9)

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class: ______
Field Observations
Taxonomy (Subgroup): ______ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ✓ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Assumed based on other wetland features

WETLAND DETERMINATION

Hydrophytic Vegetation Present? ~~Yes~~ No (Circle)
Wetland Hydrology Present? ~~Yes~~ No
Hydric Soils Present? ~~Yes~~ No

(Circle)
Is this Sampling Point Within a Wetland? Yes (No)

Remarks: Access to the site was not obtained; therefore, actual ground truthing could not be completed. Wetland survey was completed from adjacent ROW and aerial photography interpretation.

Approved by HQUSACE 2/92

Wetland N (10)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin Applicant/Owner: Investigator: Luke Martinson Melissa Green	Date: 1/11/07 County: Manatee State: Fl
Do Normal Circumstances exist on the site? **(Yes)** No Is the site significantly disturbed (Atypical Situation)? Yes **(No)** Is the area a potential Problem Area? Yes **(No)** (If needed, explain on reverse.)	Community ID: Transect ID: Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Juncus effusus	GC	FACW+	9.		
2. Phyla nodiflora	GC	FACW	10.		
3. Panicum hemitomon	GC	OBL	11.		
4. Cyperus spp	GC	FAC-OBL	12.		
5. Mikania rosea	GC	FACW	13.		
6. Andropogon glomeratus	GC	FACW+	14.		
7. Cynodon dactylon	GC	FACU	15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). 90%

Remarks: Site is a fresh water marsh adjacent to cow pasture. Cow exist on site, grazing visible.

HYDROLOGY

___ Recorded Data (Describe in Remarks): ___ Stream, Lake, or Tide Gauge ✓ Aerial Photographs ___ Other ___ No Recorded Data Available Field Observations: Depth of Surface Water: 0 (in.) Depth to Free Water in Pit: 10+ (in.) Depth to Saturated Soil: 4 (in.)	Wetland Hydrology Indicators: Primary Indicators: ___ Inundated ✓ Saturated in Upper 12 Inches ___ Water Marks ___ Drift Lines ___ Sediment Deposits ✓ Drainage Patterns in Wetlands Secondary Indicators (2 or more required): ✓ Oxidized Root Channels in Upper 12 Inches ___ Water-Stained Leaves ___ Local Soil Survey Data ___ FAC-Neutral Test ___ Other (Explain in Remarks)

Remarks: Muck existed in surface soils

Wetland N (10)

SOILS

Map Unit Name
(Series and Phase): ________ Drainage Class: ________
Field Observations
Taxonomy (Subgroup): ________ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Muck existed

WETLAND DETERMINATION

Hydrophytic Vegetation Present?	(Yes) No (Circle)	(Circle)
Wetland Hydrology Present?	(Yes) No	
Hydric Soils Present?	(Yes) No	Is this Sampling Point Within a Wetland? (Yes) No

Remarks: The wetland did not appear to be a federal wetland due to isolated status; therefore Munsell soils data were not collected.

Approved by HQUSACE 2/92

(11)

DATA FORM
ROUTINE WETLAND DETERMINATION
(1987 COE Wetlands Delineation Manual)

Project/Site: Port Dolphin Applicant/Owner: Investigator: Like Martinson Melissa Green	Date: 11/16/07 County: Manatee State: FL
Do Normal Circumstances exist on the site? Yes No Is the site significantly disturbed (Atypical Situation)? Yes No Is the area a potential Problem Area? Yes No (If needed, explain on reverse.)	Community ID: Transect ID: Plot ID:

VEGETATION

Dominant Plant Species	Stratum	Indicator	Dominant Plant Species	Stratum	Indicator
1. Typha sp	GC	OBL	9.		
2. Baccharis halimifolia	SC	FAC	10.		
3. Maintained grasses			11.		
4.			12.		
5.			13.		
6.			14.		
7.			15.		
8.			16.		

Percent of Dominant Species that are OBL, FACW or FAC (excluding FAC-). ~ 90%-100%.

Remarks: Area observed from distance. Vegetation consistent with that of a pond wetland.

HYDROLOGY

__ Recorded Data (Describe in Remarks): __ Stream, Lake, or Tide Gauge ✓ Aerial Photographs __ Other __ No Recorded Data Available	Wetland Hydrology Indicators: Primary Indicators: ✓ Inundated __ Saturated in Upper 12 Inches __ Water Marks __ Drift Lines __ Sediment Deposits __ Drainage Patterns in Wetlands
Field Observations: Depth of Surface Water: 0 (in.) Depth to Free Water in Pit: 0 (in.) Depth to Saturated Soil: 0 (in.)	Secondary Indicators (2 or more required): __ Oxidized Root Channels in Upper 12 Inches __ Water-Stained Leaves __ Local Soil Survey Data __ FAC-Neutral Test __ Other (Explain in Remarks)

Remarks: Wetland was a stormwater pond.

(11)

SOILS

Map Unit Name
(Series and Phase): ______ Drainage Class: ______
Field Observations
Taxonomy (Subgroup): ______ Confirm Mapped Type? Yes No

Profile Description:

Depth (inches)	Horizon	Matrix Color (Munsell Moist)	Mottle Colors (Munsell Moist)	Mottle Abundance/Contrast	Texture, Concretions, Structure, etc.

Hydric Soil Indicators:

- ___ Histosol
- ___ Histic Epipedon
- ___ Sulfidic Odor
- ___ Aquic Moisture Regime
- ___ Reducing Conditions
- ___ Gleyed or Low-Chroma Colors
- ___ Concretions
- ___ High Organic Content in Surface Layer in Sandy Soils
- ___ Organic Streaking in Sandy Soils
- ___ Listed on Local Hydric Soils List
- ___ Listed on National Hydric Soils List
- ___ Other (Explain in Remarks)

Remarks: Most likely mucky soils due to inundation.

WETLAND DETERMINATION

Hydrophytic Vegetation Present? (Yes) No (Circle)
Wetland Hydrology Present? (Yes) No
Hydric Soils Present? (Yes) No

Is this Sampling Point Within a Wetland? (Circle) Yes (No)

Remarks: Site was unable to be accessed; therefore, field investigation was completed from adjacent road and aerial interpretation. Site was a storm water pond.

Approved by HQUSACE 2/92

1. W-1: South conveyance ditch facing south. View of western edge of mangrove swamp and canal.

2. W-1: South conveyance ditch facing east. View of mangrove swamp and ditch.

3. W-1: South conveyance ditch, facing east.

4. W-2: Freshwater Forested broad-leaved/Scrub-Shrub.

5. W-2: Freshwater Forested with Brazilian Pepper infestation.

6. W-3: Freshwater broad-leaved Scrub-Shrub/Forested wetland.

7. W-3: Brazilian pepper adjacent to Scrub-Shrub wetland.

8. W-4: Excavated freshwater borrow lake.

9. W-4: Exotic species present along shore of borrow lake.

10. W-5: Curiosity Creek. Notice the lack of vegetation and no water present.

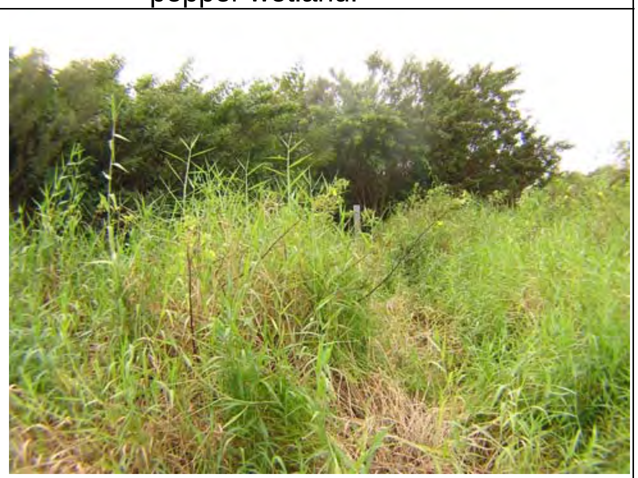
11. W-5: Exotic species present along bank of Curiosity Creek.

12. W-6: Freshwater ditch dominated by blue maidencane (*Amphicarpum muhlenbergianum*).

13. W-6: Brazilian pepper swamp that freshwater ditch leads into.

14. W-7: Freshwater Scrub-Shrub Brazilian pepper wetland.

15. W-7: Brazilian pepper Scrub-Shrub wetland (2).



16. W-8: Freshwater Scrub-Shrub/Emergent. Brazilian pepper in background.

17. W-8: Freshwater Scrub-Shrub/Emergent with Brazilian pepper (2).

18. W-9: Freshwater Emergent/Lacustrine Limnetic Open Water (excavated) dominated by *Typha* sp.

19. W-9: Freshwater Emergent/Lacustrine Limnetic Open Water (excavated) dominated by *Typha* sp.

20. W-10: Freshwater Emergent. This wetland does not satisfy federal criteria.

21. View of Australian pine forest to the east of US 41.

22. Tricolored heron (Species of Special Concern) present at the tidal canal.

23. Soils at Wetland 8.

24. Soils at Curiosity Creek.

PORT DOLPHIN PIPELINE
SYSTEM OVERVIEW

TERMINOLOGY

ABBR.	DESCRIPTION
LNG	LIQUEFIED NATURAL GAS
MAOP	MAXIMUM ALLOWABLE OPERATING PRESSURE
NOP	NORMAL OPERATING PRESSURE

NOTES

1. ALL VALVES, FLANGES AND FITTINGS ON THE PROPOSED OFFSHORE PIPELINE SYSTEM UP TO THE GULFSTREAM CONNECTION ARE B16.5, CLASS 900 OR EQUIVALENT AS A MINIMUM.
2. ALL VALVES AND FLANGES SIZED TO MATCH ADJOINING LINE PIPE UNLESS NOTED OTHERWISE. ALL VALVES ON THE PIPELINES ARE FULL BORE TO ALLOW FOR PIGGING.
3. LOCATIONS FOR REMOVABLE PIG LAUNCHERS ON THE PLEMS WILL BE BLIND FLANGED UNTIL NEEDED.
4. PLEM'S SHALL CONSIST OF AN ADAPTER FLANGE ON ONE END TO CONNECT THE FLEXIBLE RISERS. PLEM AND MANIFOLD PIPING WILL NOT HAVE WEIGHT COATING.
5. PRESSURE REGULATORS, SENSORS AND ASSOCIATED PRESSURE CONTROLS ARE LOCATED ON THE LNG SHIPS, THE BUOYS, PLEMS AND RECEIVING FACILITIES.

LEGEND

- CHECK VALVE
- FLANGE
- MANUAL BALL VALVE
- ACTUATED BALL VALVE
- FLOW DIRECTION
- SUBSEA MANIFOLD
- FLOW LINE
- FUTURE/TEMPORARY FACILITIES
- REMOVABLE PIG LAUNCHER

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS	
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION

REVISIONS			REVISIONS		
NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
0	3/9/07	ISSUED FOR FILING			
1	11/27/07	ISSUED FOR ADDENDUM FILING			

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE	NTS
DRAWN	DJR
DATE	10/06/07
CHK'D	
APPROVED	
PESI JOB NO.	26017
AFE/P.O.NO.	
CLIENT FILE NO.	1088
PESI FILE NO.	26017-4003-1

PortDolphin

TITLE: SYSTEM OVERVIEW
PORT DOLPHIN DEEPWATER PORT
FLORIDA

NO. 26017-D-4003 REV. 1

OWNERSHIP	FEDERAL WATER
RODDAGE	634.10 RODS
TERRAIN	WATER
FEET MARKER	0+00 MATCH LINE; 35+37.27 P.C.; 97+72.91 P.T.; 104+61.93 MATCH LINE

PLAN

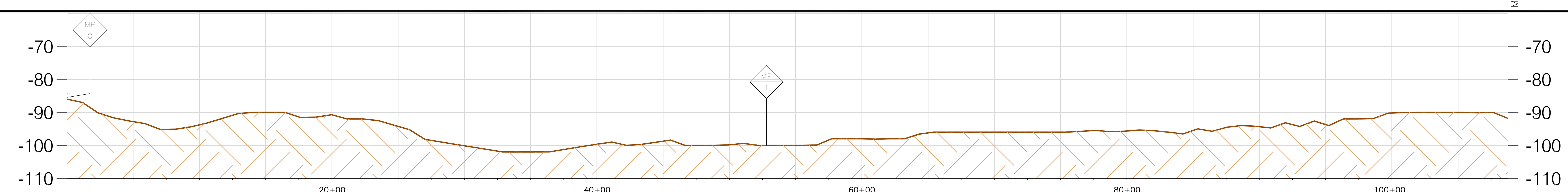
CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

NOTE:
THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

NORTH PLEM STA 0+00
BURIAL METHOD = MATTRESS
(1)
PROPOSED PORT DOLPHIN PIPELINE
BURIAL METHOD = MATTRESS
MATCH LINE STA 104+61.93
SEE DRAWING NO 26017-D-2003

PROFILE



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 0+00
1500'
200' EASEMENT
3000' PIPELINE SURVEY CORRIDOR
200' EASEMENT
3000' TEMPORARY WORK SPACE
1500'
STA 104+61.93

(1" = 500' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	10,550	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS	DATE	BY
ISSUED FOR BID		
CONST.		
AS-BUILT		

SCALE 1" = 500'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2001-0	

PortDolphin

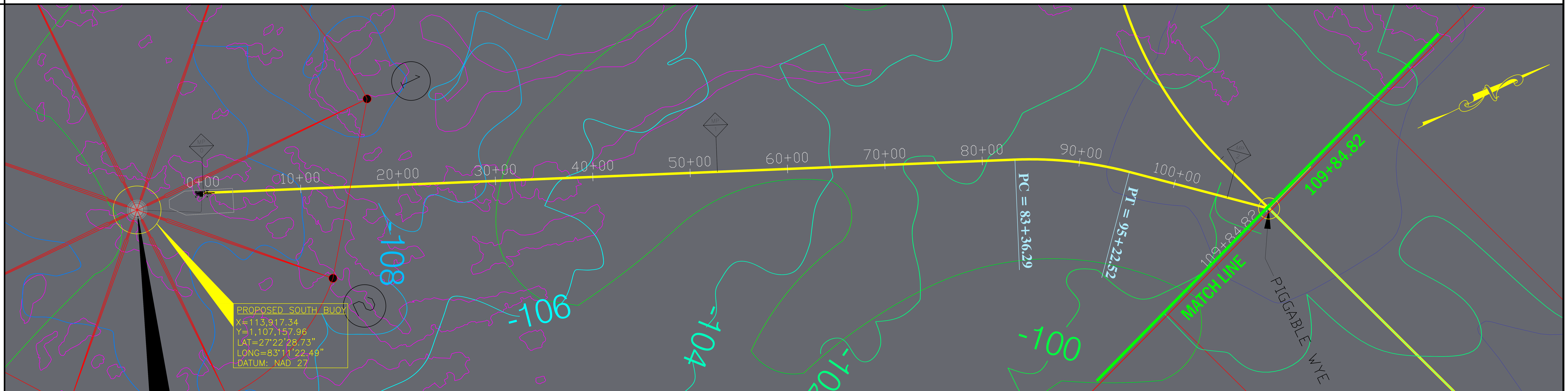
TITLE
ALIGNMENT SHEET 0+00 TO 104+61.93
NORTH FLOW LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2001 REV. 1

OWNERSHIP	FEDERAL WATER
RODDAGE	666.00 RODS
TERRAIN	WATER
STATIONING	0+00 MATCH LINE; 83+36.29 P.C.; 95+22.52 PT; 109+84.82 MATCH LINE

NOTE:
THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

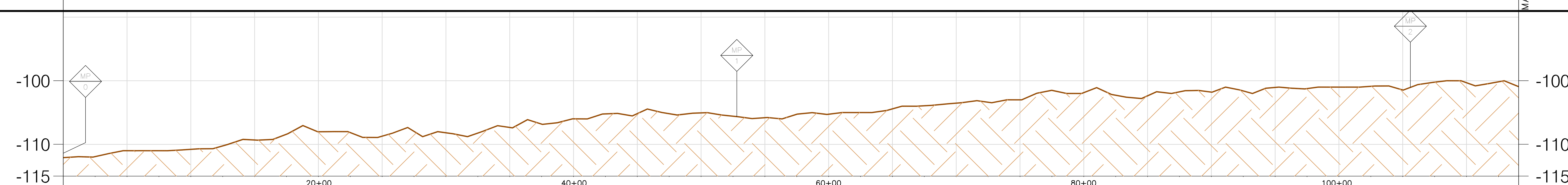
PIPE BAND

SOUTH PLEM STA 0+00 — 40+00 — 95+00 — MATCH LINE STA 109+84.82

BURIAL METHOD = MATTRESS (0+00 to 40+00)
BURIAL METHOD = PLOW (40+00 to 95+00)
BURIAL METHOD = MATTRESS (95+00 to 109+84.82)
PROPOSED PORT DOLPHIN PIPELINE

SEE DRAWING NO 26017-D-2003

PROFILE



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 0+00
1500'
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR
200' R.O.W. EASEMENT
3000' TEMPORARY WORK SPACE
1500'
STA 109+84.82

(1" = 500' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	11,000	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/29/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 500'	
DRAWN EHF	DATE 3/5/07
CHK'D DJR	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-2002-0	

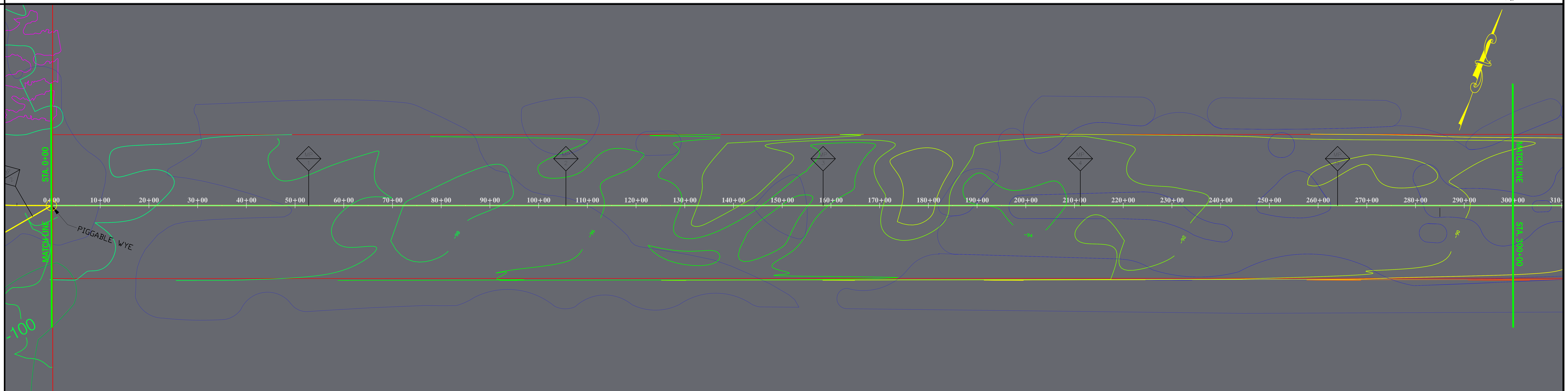
PortDolphin

TITLE ALIGNMENT SHEET 0+00 TO 109+84.82
SOUTH FLOW LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2002 REV. 1

OWNERSHIP	FEDERAL WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	0+00 MATCH LINE — 300+00 MATCH LINE

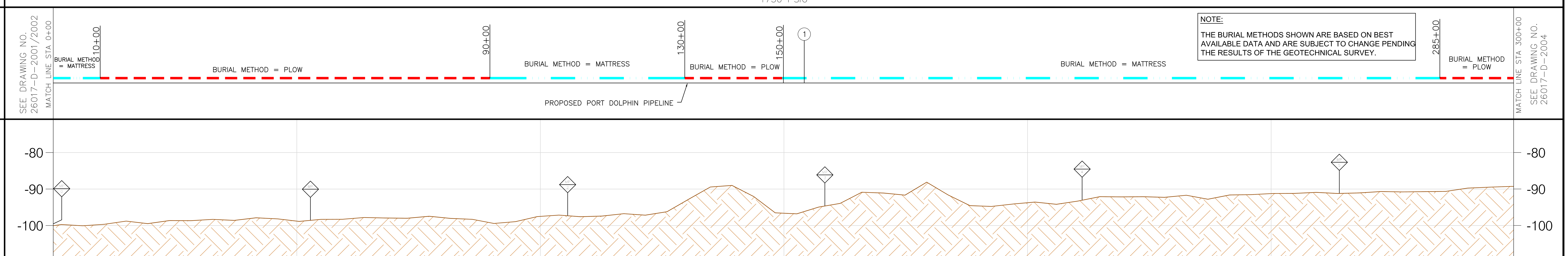
PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

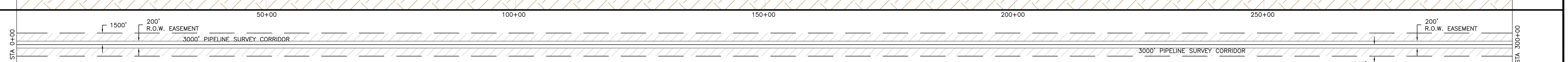
PIPE BAND

PROFILE



EASEMENT WORKSPACE

- PERM. EASEMENT
- TEMP. EASEMENT
- ADDITIONAL TEMP. WORK SPACE



(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.

13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2003-0	

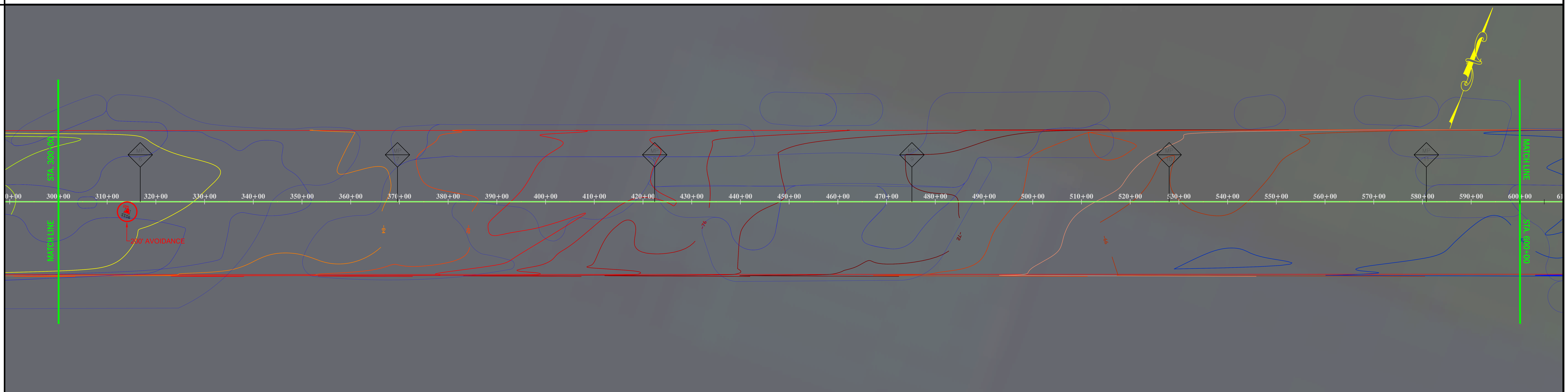
PortDolphin

TITLE ALIGNMENT SHEET 0+00 TO 300+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2003 REV. 1

OWNERSHIP	FEDERAL WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	300+00 MATCH LINE; 314+09.58 AVOIDANCE AREA; 600+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO. 26017-D-2003 — MATCH LINE STA 300+00

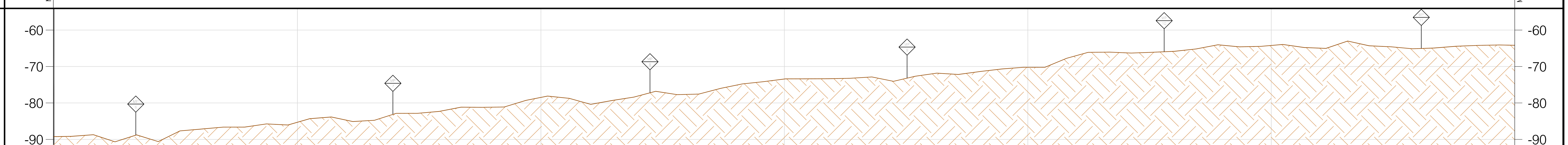
310+00 — BURIAL METHOD = PLOW
330+00 — BURIAL METHOD = MATTRESS
360+00 — BURIAL METHOD = PLOW
410+00 — BURIAL METHOD = MATTRESS
425+00 — BURIAL METHOD = PLOW
(1)
585+00 — BURIAL METHOD = MATTRESS
BURIAL METHOD = PLOW

PROPOSED PORT DOLPHIN PIPELINE

NOTE:
THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

MATCH LINE STA 600+00 — SEE DRAWING NO. 26017-D-2005

PROFILE



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 300+00 — 350+00 — 400+00 — 450+00 — 500+00 — 350+00 — STA 600+00

1500'
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR

(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2004-0	

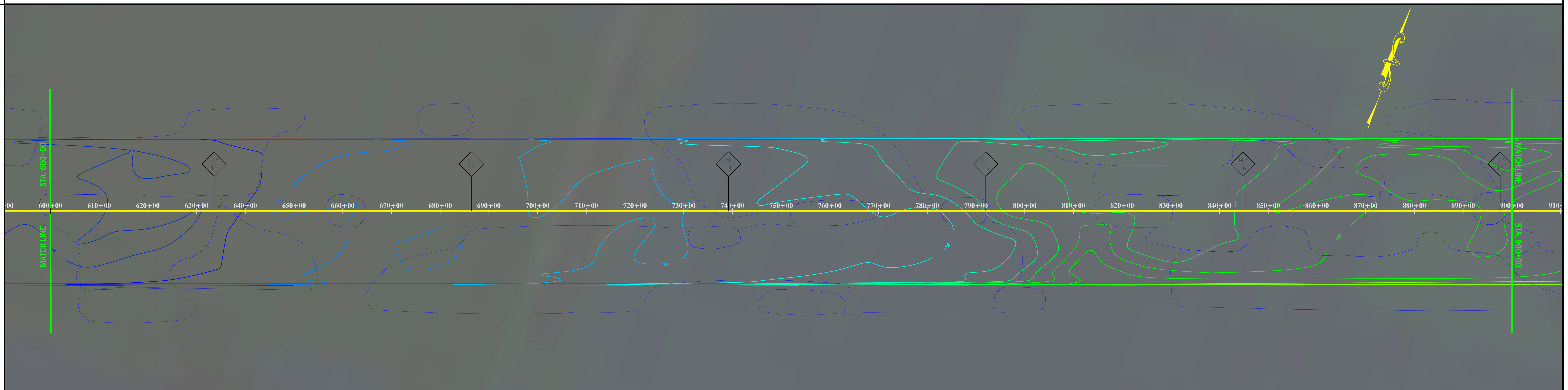
PortDolphin

TITLE
ALIGNMENT SHEET 300+00 TO 600+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2004 REV. 0

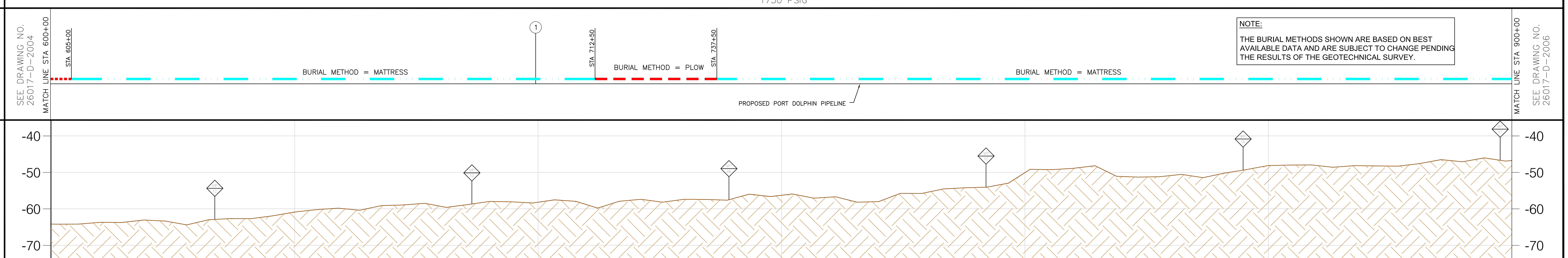
OWNERSHIP	FEDERAL WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	600+00 MATCHLINE — 900+00 MATCHLINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND / PROFILE



EASEMENT WORKSPACE

- PERM. EASEMENT
- TEMP. EASEMENT
- ADDITIONAL TEMP. WORK SPACE

STA 600+00 — 650+00 — 700+00 — 750+00 — 800+00 — 850+00 — STA 900+00

1500' — 200' R.O.W. EASEMENT — 3000 PIPELINE SURVEY CORRIDOR

3000' PIPELINE SURVEY CORRIDOR — 1500' — 200' R.O.W. EASEMENT

(1" = 500' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2005-0	

PortDolphin

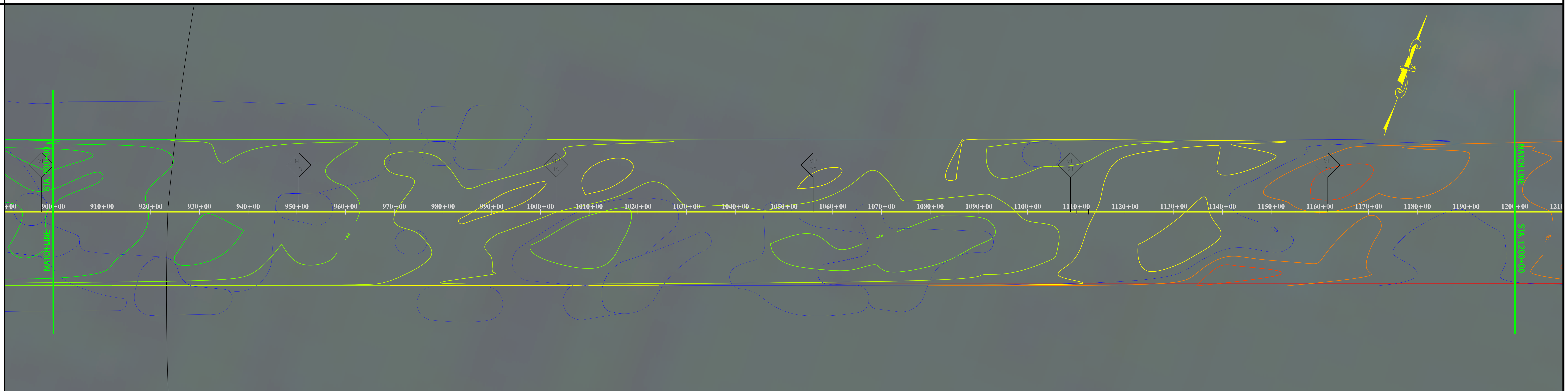
TITLE ALIGNMENT SHEET 600+00 TO 900+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2005 REV. 1

OWNERSHIP	FEDERAL WATER	STATE WATER
RODDAGE	1818.18 RODS	
TERRAIN	WATER	

STATIONING: 900+00 MATCH LINE; 923+51.05 3 LEAGUE LINE; 1200+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO. 26017-D-2005 MATCH LINE STA 900+00

NOTE:
THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

(1)

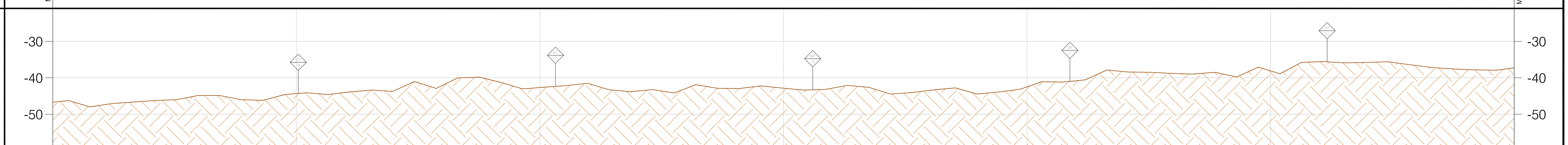
BURIAL METHOD = PLOW

STA 1092+50 BURIAL METHOD = PLOW STA 1110+00 STA 1112+50 BURIAL METHOD = PLOW STA 1137+50 BURIAL METHOD = MATTRESS STA 1165+00 BURIAL METHOD = PLOW

PROPOSED PORT DOLPHIN PIPELINE

MATCH LINE STA 1200+00 SEE DRAWING NO. 26017-D-2007

PROFILE



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 900+00 1500' 200' R.O.W. EASEMENT 3000' PIPELINE SURVEY CORRIDOR

3000' PIPELINE SURVEY CORRIDOR 1500' 200' R.O.W. EASEMENT STA 1200+00

(1" = 500' FOR 'D' SIZE DWGS.) NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2006-0	

PortDolphin

TITLE ALIGNMENT SHEET 900+00 TO 1200+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2006 REV. 0

OWNERSHIP	STATE WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	1200+00 MATCH LINE; 1287+77.63 3 LEAGUE LINE; 1500+00 MATCH LINE

PLAN

CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO 26017-D-2006 — MATCH LINE STA 1200+00

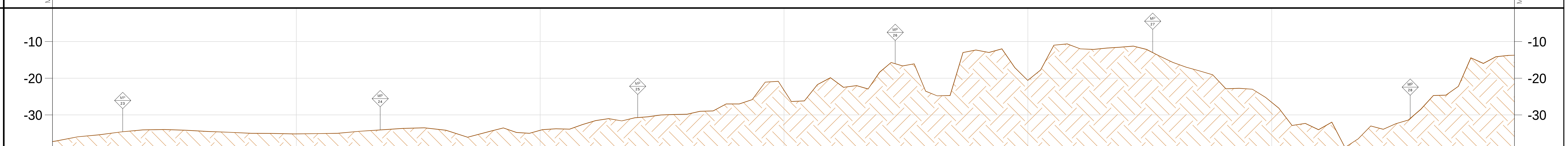
NOTE: THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

BURIAL METHOD = PLOW — BURIAL METHOD = PLOW — STA 1450+00 — BURIAL METHOD = MATTRESS — STA 1480+00 — BURIAL METHOD = PLOW

PROPOSED PORT DOLPHIN PIPELINE

MATCH LINE STA 1500+00 — SEE DRAWING NO 26017-D-2019

PROFILE



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 0+00 — 1250+00 — 1300+00 — 1350+00 — 1400+00 — 1450+00 — STA 300+00

1500' — 200' R.O.W. EASEMENT — 3000' PIPELINE SURVEY CORRIDOR

(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000	36.0" O.D. X 0.750" W.T. API 5L, X-60 PIPE W/ 14-16 MILS FBE, CONCRETE COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	9/10/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 9/10/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2007-0	

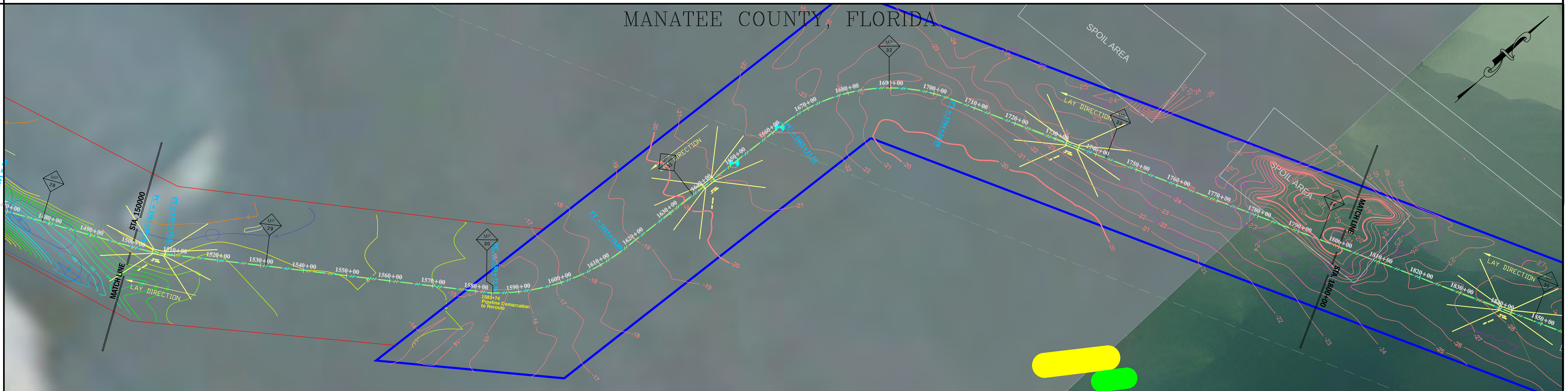
PortDolphin

TITLE ALIGNMENT SHEET 1200+00 TO 1500+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA / MANATEE COUNTY, FL

NO. 26017-D-2007 REV. 1

OWNERSHIP	STATE WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	1500+00 MATCH LINE; 1501+49.88 PC; 1507+79.57 PT; 1583+72.70 PC; 1615+18.89 PT; 1663+11.50 PC; 1704+24.59 PT; 1800+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO. 26017-D-2007 — MATCH LINE STA 1500+00

STA 1525+00 — STA 1535+00 — STA 1638+86 — STA 1648+86 — STA 1662+21 — STA 1672+21

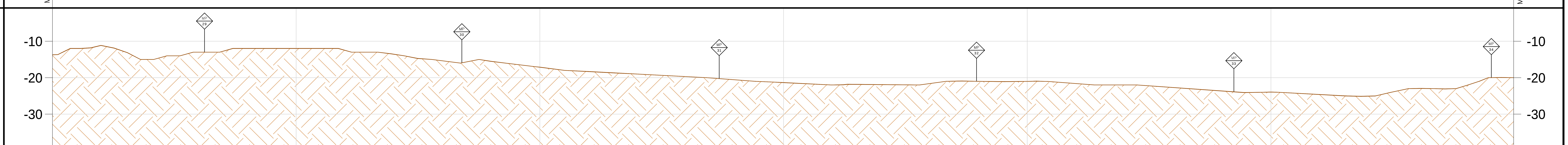
BURIAL METHOD = PLOW | BURIAL METHOD =MATTRESS | (1) BURIAL METHOD = PLOW | BURIAL METHOD =MATTRESS | (2) BURIAL METHOD = DRILL | BURIAL METHOD =MATTRESS | (1) BURIAL METHOD = PLOW

PROPOSED PORT DOLPHIN PIPELINE — HDD-1335' — PROPOSED PORT DOLPHIN PIPELINE

NOTE:
THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

MATCH LINE STA 1800+00 — SEE DRAWING NO. 26017-D-2020

PROFILE



1550+00 1600+00 1650+00 1700+00 1750+00

EASEMENT WORKSPACE

- PERM. EASEMENT
- TEMP. EASEMENT
- ADDITIONAL TEMP. WORK SPACE

STA 1500+00 — 1500' — 200' R.O.W. EASEMENT — 3000' PIPELINE SURVEY CORRIDOR — 3000' PIPELINE SURVEY CORRIDOR — 1500' — 200' R.O.W. EASEMENT — STA 1800+00

(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	28,665	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS
2	1,335	36.0" O.D. X 0.875" W.T. API 5L, X-60 DSAW
		PIPE W/ 14-16 MILS FBE, DOUBLE RANDOM
		JOINTS, W/ 22-30 MILS ARO

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2019-0	

PortDolphin

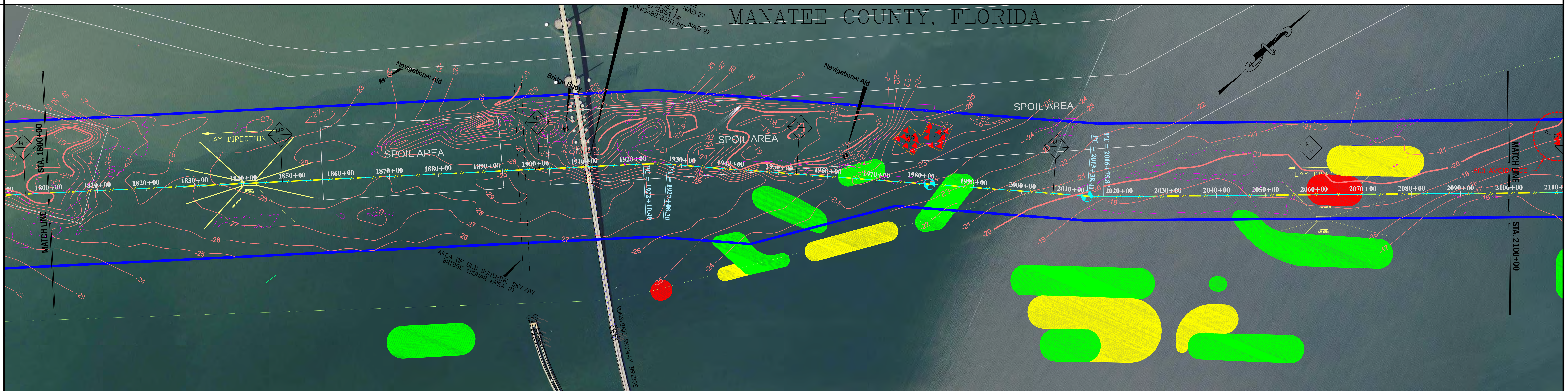
TITLE ALIGNMENT SHEET 1500+00 TO 1800+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2019 REV. 1

OWNERSHIP	STATE WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER

STATIONING: 1800+00 MATCH LINE; 1922+10.40 PC; 1927+08.20 PT; 1980+60.83 DRILL ENTRY; 2013+38.41 PC & DRILL EXIT; 2016+75.87 PT; 2100+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

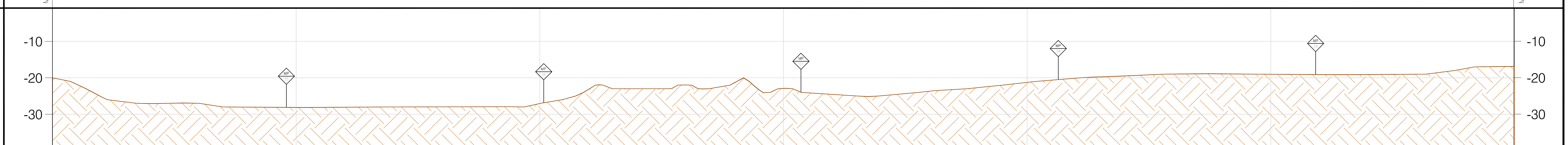
PIPE BAND

SEE DRAWING NO. 26017-D-2019 — MATCH LINE STA 1800+00

- BURIAL METHOD = PLOW (1)
- STA 1900+62 — STA 1910+62: BURIAL METHOD =DRAGLINE
- BURIAL METHOD = PLOW
- PROPOSED PORT DOLPHIN PIPELINE
- STA 1970+98 — STA 1980+98: BURIAL METHOD =MATTRESS
- BURIAL METHOD = DRILL (2) — HDD-2,947'
- STA 2010+45 — STA 2020+45: BURIAL METHOD =MATTRESS
- BURIAL METHOD = PLOW (1)
- PROPOSED PORT DOLPHIN PIPELINE

MATCH LINE STA 2100+00 — SEE DRAWING NO. 26017-D-2021

PROFILE



EASEMENT WORKSPACE

- PERM. EASEMENT
- TEMP. EASEMENT
- ADDITIONAL TEMP. WORK SPACE

STA 1800+00 — 1850+00 — 1900+00 — 1950+00 — 2000+00 — 2050+00 — STA 2100+00

1500' — 200' R.O.W. EASEMENT — 3000' PIPELINE SURVEY CORRIDOR

(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	27,053	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS
2	2,947	36.0" O.D. X 0.875" W.T. API 5L, X-60 DSAW
		PIPE, W/ 14-16 MILS FBE, DOUBLE RANDOM
		JOINTS, W/ 22-30 MILS ARO

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2020-0	

PortDolphin

TITLE ALIGNMENT SHEET 1800+00 TO 2100+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

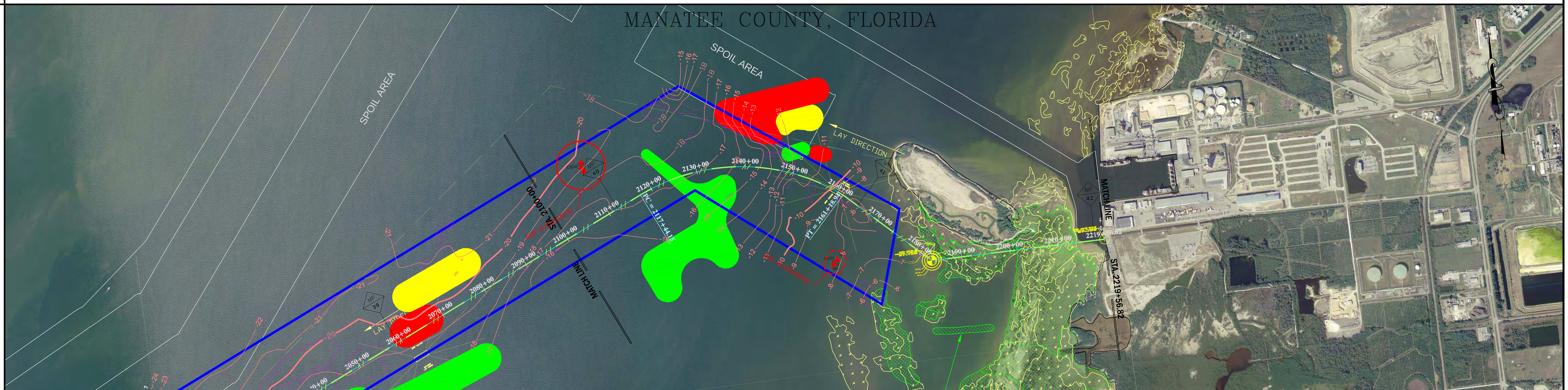
NO. 26017-D-2020 REV. 1

OWNERSHIP	STATE WATERS
RODDAGE	725 RODS
TERRAIN	WATER

STATIONING

2100+00 MATCH LINE
2117+44.15 PC
2161+18.94 PT
2173+84 PROPOSED ALTERNATE A HDD EXIT
2219+56.82 MATCH LINE

PLAN



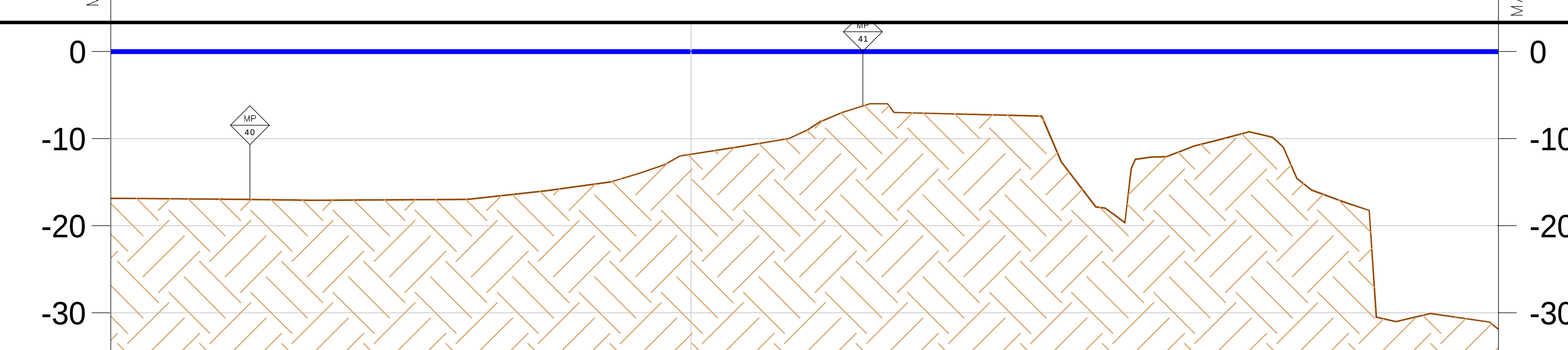
CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

NOTE:
THE BURIAL METHODS SHOWN ARE BASED ON BEST AVAILABLE DATA AND ARE SUBJECT TO CHANGE PENDING THE RESULTS OF THE GEOTECHNICAL SURVEY.

SEE DRAWING NO. 26017-D-2020
MATCH LINE STA 2100+00
STA 2140+00
STA 2183+84
MATCHLINE STA 2219+56.82
BURIAL METHOD = PLOW
BURIAL METHOD = MATTRESS
BURIAL METHOD = DRILL
PROPOSED PORT DOLPHIN PIPELINE
HDD-4900'

PROFILE



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 2100+00
2150+00
1500'
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR
2200+00
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR
1500'
STA 2219+56.82

LEGEND

TEST LEAD · FEDERAL HIGHWAY · STATE HIGHWAY · EQUATION · MILE POST · WARNING SIGN · U.S. HIGHWAY · COUNTY ROAD · ROAD SIGN · TREE · POWER POLE · WATER METER · VENT PIPE · FOREIGN PIPELINE · POWER LINE · FENCE · UNDERGROUND CABLE · WATER LINE · TELEPHONE LINE · GAS LINE · EXISTING MANHOLE · IRON ROD · PROPOSED PIPELINE · COUNTY LINE · TOWNSHIP & RANGE · CITY LIMITS · RIGHT-OF-WAY LINE · RIVER/STREAM · ℄ ROAD · ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	8,384	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS
2	3,573	36.0" O.D. X 0.875" W.T. API 5L, X-60 DSAW
		PIPE, W/ 14-16 MILS FBE, DOUBLE RANDOM
		JOINTS, W/ 22-30 MILS ARO

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

(1" = 1000' FOR 'D' SIZE DWGS.)

SCALE 1" = 1000'
DRAWN EHF — DATE 3/5/07
CHK'D BJ — DATE 11.29.07
APPROVED IAN — DATE 11/29/07
PESI JOB NO.
AFE/P.O.NO.
CLIENT FILE NO.
PESI FILE NO. 26017-2021-0

NOTE: PIPELINE STATION SHOWN IN FEET

PortDolphin

TITLE ALIGNMENT SHEET 2100+00 TO 2219+56.82
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

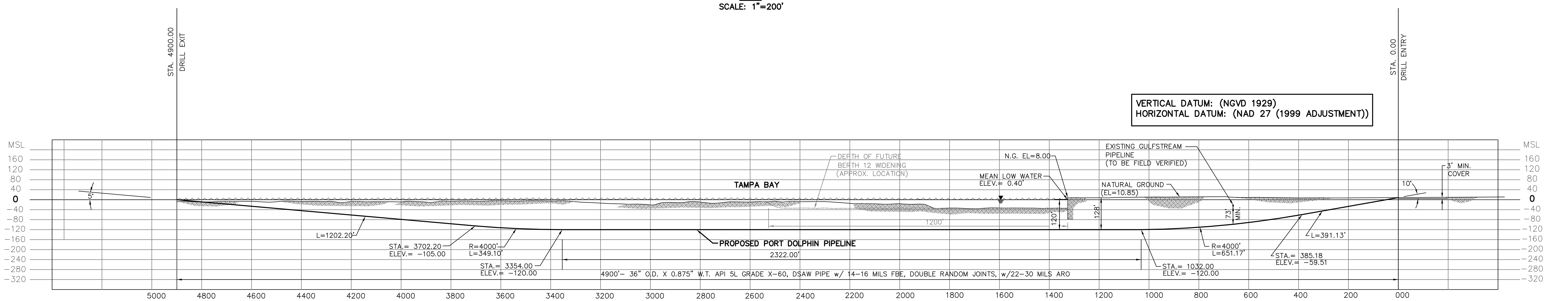
NO. 26017-D-2021 REV. 1

MANATEE COUNTY, FLORIDA

PORT DOLPHIN PIPELINE

HDD FOR ALTERNATIVE ROUTE "A"

PLAN
SCALE: 1"=200'



PROFILE
SCALE: 1"=200'

NOTE:
THE LOCATION OF THE GULFSTREAM 36" PIPELINE WILL BE FIELD VERIFIED PRIOR TO CONSTRUCTION

GENERAL NOTES

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REVISIONS

NO.	DATE	DESCRIPTION
A	8/23/07	ISSUED FOR INFORMATION
B	11/08/07	REVISED HDD DEPTH
0	11/28/07	ISSUED FOR ADDENDUM FILING

REVISIONS

NO.	DATE	DESCRIPTION

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1"=200'	
DRAWN B.J.	DATE 8/23/07
CHK'D DJR	DATE 11/27/07
APPROVED IAN	DATE 11/27/07
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017–D–2306	

PortDolphin

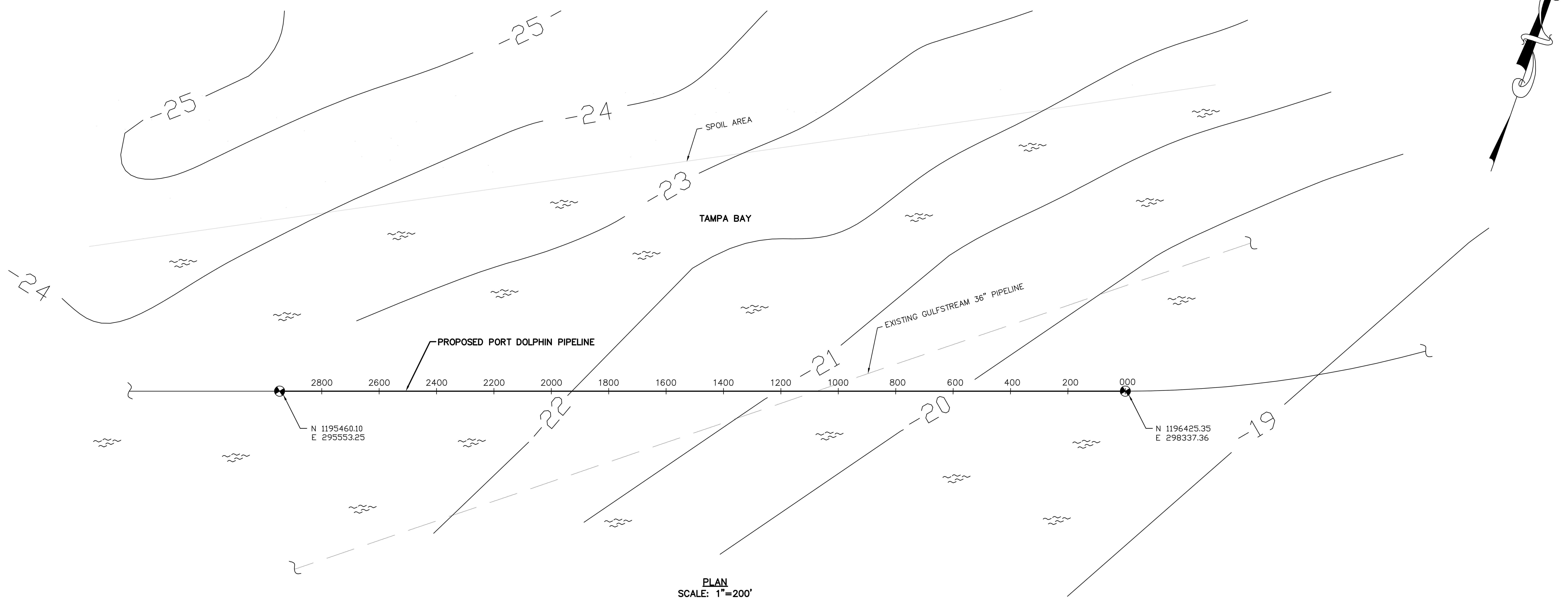
TITLE
HORIZONTAL DIRECTIONAL DRILL (HDD)
PORT MANATEE SHORE APPROACH
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017–D–2306 REV. 0

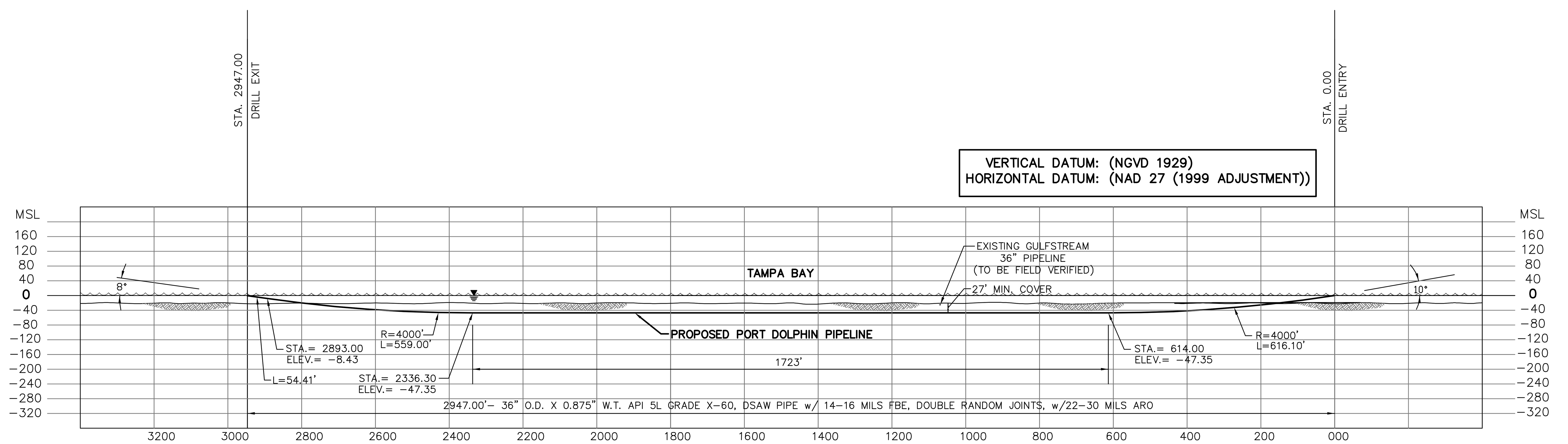
MANATEE COUNTY, FLORIDA

PORT DOLPHIN PIPELINE

ALTERNATIVE ROUTE "A" - GULFSTREAM PIPELINE CROSSING EAST



PLAN
SCALE: 1"=200'



PROFILE
SCALE: 1"=200'

NOTE:

THE LOCATION OF THE GULFSTREAM 36" PIPELINE WILL BE FIELD VERIFIED PRIOR TO CONSTRUCTION

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
					A	9/07/07	ISSUED FOR REVIEW			
					0	11/27/07	ISSUED FOR ADDENDUM FILING			

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1"=200'	
DRAWN B.J.	DATE 9/07/07
CHK'D DJR	DATE 11/27/07
APPROVED IAN	DATE 11/27/07
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO.	

PortDolphin

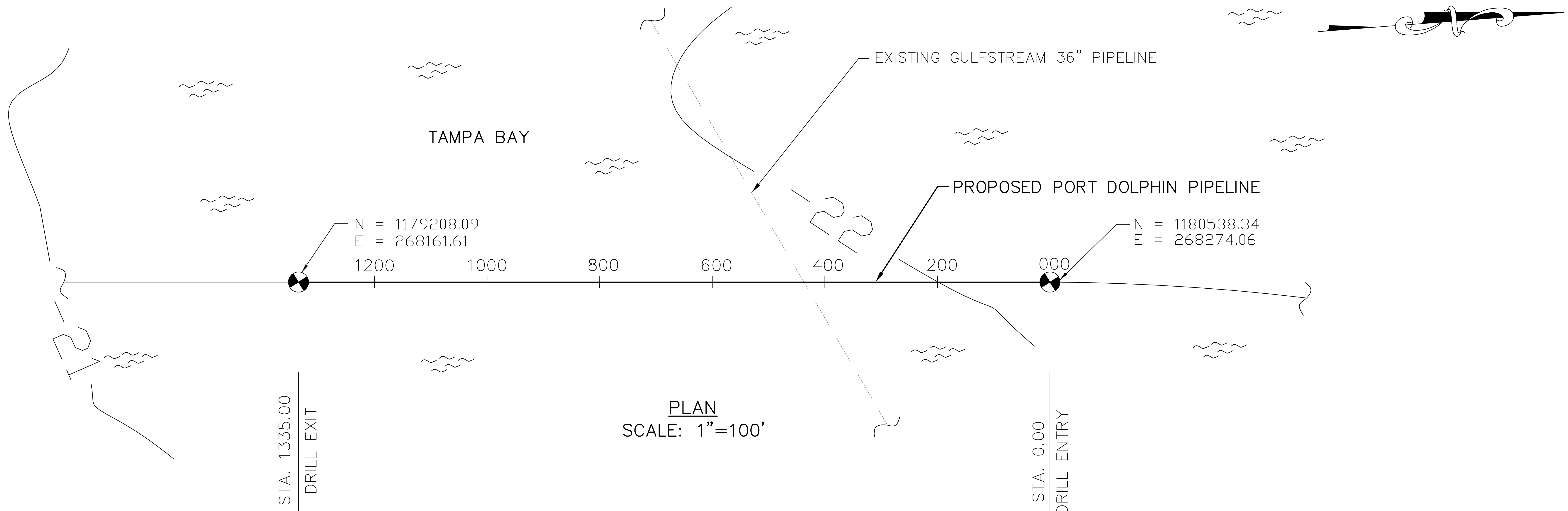
TITLE
HORIZONTAL DIRECTIONAL DRILL (HDD)
GULFSTREAM PIPELINE CROSSING EAST
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017–D–2307 REV. 0

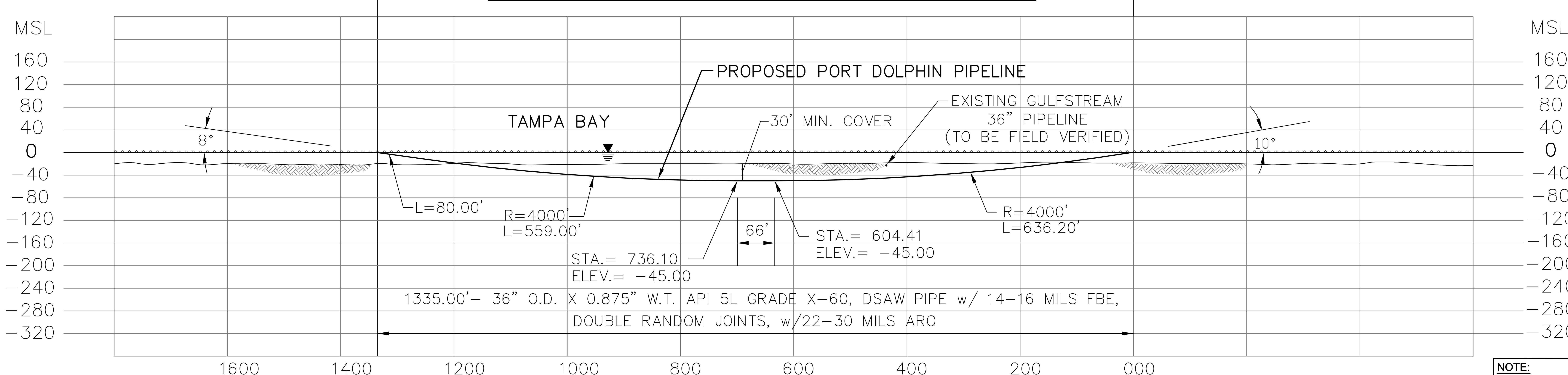
MANATEE COUNTY, FLORIDA

PORT DOLPHIN PIPELINE

ALTERNATIVE ROUTE "A" - GULFSTREAM PIPELINE CROSSING WEST



VERTICAL DATUM: (NGVD 1929)
HORIZONTAL DATUM: (NAD 27 (1999 ADJUSTMENT))



PROFILE
SCALE: 1"=100'

NOTE:

THE LOCATION OF THE GULFSTREAM 36" PIPELINE WILL BE FIELD VERIFIED PRIOR TO CONSTRUCTION

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
					A	9/07/07	ISSUED FOR INFORMATION			
					0	11/27/07	ISSUED FOR ADDENDUM FILING			

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1"=100'
DRAWN B.J. DATE 9/07/07
CHK'D DJR DATE 11/27/07
APPROVED IAN DATE 11/27/07
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO.

PortDolphin

TITLE
HORIZONTAL DIRECTIONAL DRILL (HDD)
GULFSTREAM PIPELINE CROSSING WEST
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-D-2308 REV. 0

REFERENCE DRAWINGS	
DWG. NO.	DESCRIPTION

REVISIONS		
NO	DATE	DESCRIPTION
0	2/24/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.

13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

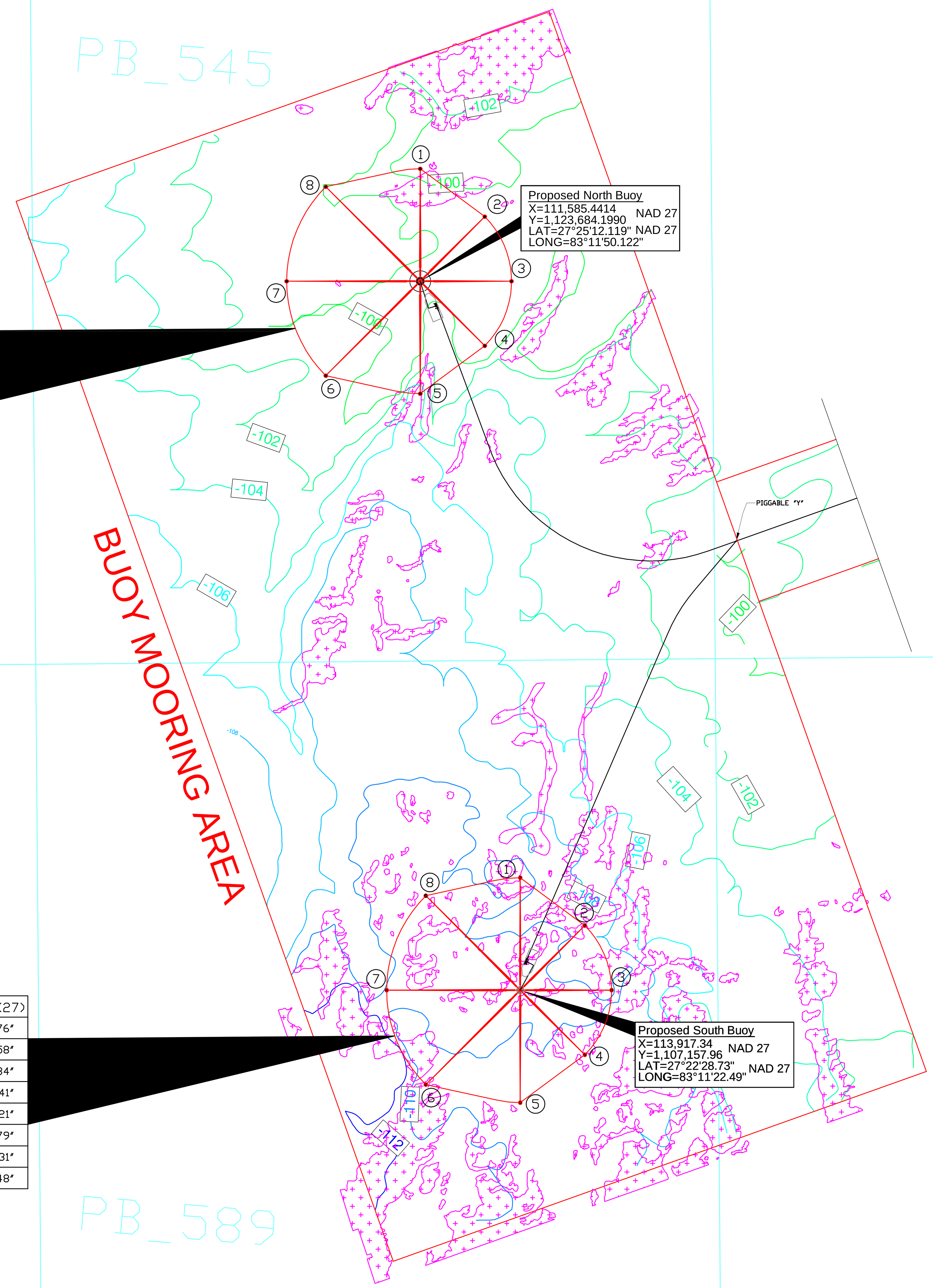
SCALE NTS	
DRAWN DJR	DATE 1/23/07
CHK'D	DATE
APPROVED	DATE
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-2701-1	

PortDolphin

TITLE
MOORING AREA SAFETY ZONES
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-B-2701 REV. 1

ST. PETERSBURG AREA
GULF OF MEXICO



Proposed North Buoy Anchor Locations

	X=NAD(27)	Y=NAD(27)	LAT=NAD(27)	LONG=NAD(27)
1	111,585.40	1,126,305.60	27° 25′ 38.704″	83° 11′ 50.402″
2	113,091.10	1,125,189.80	27° 25′ 27.169″	83° 11′ 33.577″
3	113,714.70	1,123,684.20	27° 25′ 12.321″	83° 11′ 26.498″
4	113,091.10	1,122,178.60	27° 24′ 57.355″	83° 11′ 33.257″
5	111,585.40	1,121,062.80	27° 24′ 46.164″	83° 11′ 49.842″
6	109,383.90	1,121,482.60	27° 24′ 50.110″	83° 12′ 14.311″
7	108,471.90	1,123,684.2	27° 25′ 11.821″	83° 12′ 24.665″
8	109,383.90	1,125,885.80	27° 25′ 33.707″	83° 12′ 14.783″

(1)● DENOTES PROPOSED BUOY ANCHOR LOCATIONS

Legend

HARD BOTTOM AREAS

NOTES:

SURVEY PERFORMED USING AUTOMATED GEOPHYSICAL SURVEY SYSTEM CONSISTING OF DUAL FREQUENCY FATHOMETER, SIDE SCAN SONAR, PROTON MAGNETOMETER, SUBBOTTOM PROFILER, DGPS & COMPUTER BASED DATA COLLECTION / NAVIGATION SYSTEM.

SURVEY PERFORMED OCTOBER 3 - OCTOBER 21, 2006 BY T. BAKER SMITH, INC. WITH M/V WHITE PONY.

ALL XY COORDINATES SHOWN ARE FLORIDA WEST ZONE, NORTH AMERICAN DATUM OF 1927. ALL LATITUDE AND LONGITUDE VALUES ARE GEOGRAPHIC NORTH AMERICAN DATUM OF 1927.

	NORTH BUOY	SOUTH BUOY
1) FEET OF PIPE CROSSING HABITAT AREA	4844.3′	5156.3′
2) NUMBER OF ANCHORS IN HARD BOTTOM AREAS.	1	5

Proposed South Buoy Anchor Locations

	X=NAD(27)	Y=NAD(27)	LAT=NAD(27)	LONG=NAD(27)
1	113,917.30	1,109,779.30	27° 22′ 54.665″	83° 11′ 22.776″
2	115,423.00	1,108,663.60	27° 22′ 43.761″	83° 11′ 5.958″
3	116,046.60	1,107,158.00	27° 22′ 28.912″	83° 10′ 58.884″
4	115,423.00	1,105,652.30	27° 22′ 13.945″	83° 11′ 5.641″
5	113,917.30	1,104,536.30	27° 22′ 2.753″	83° 11′ 22.221″
6	111,715.80	1,104,956.40	27° 22′ 6.704″	83° 11′ 46.679″
7	110,803.50	1,107,158.00	27° 22′ 28.416″	83° 11′ 57.031″
8	111,715.80	1,109,359.60	27° 22′ 50.301″	83° 11′ 47.148″

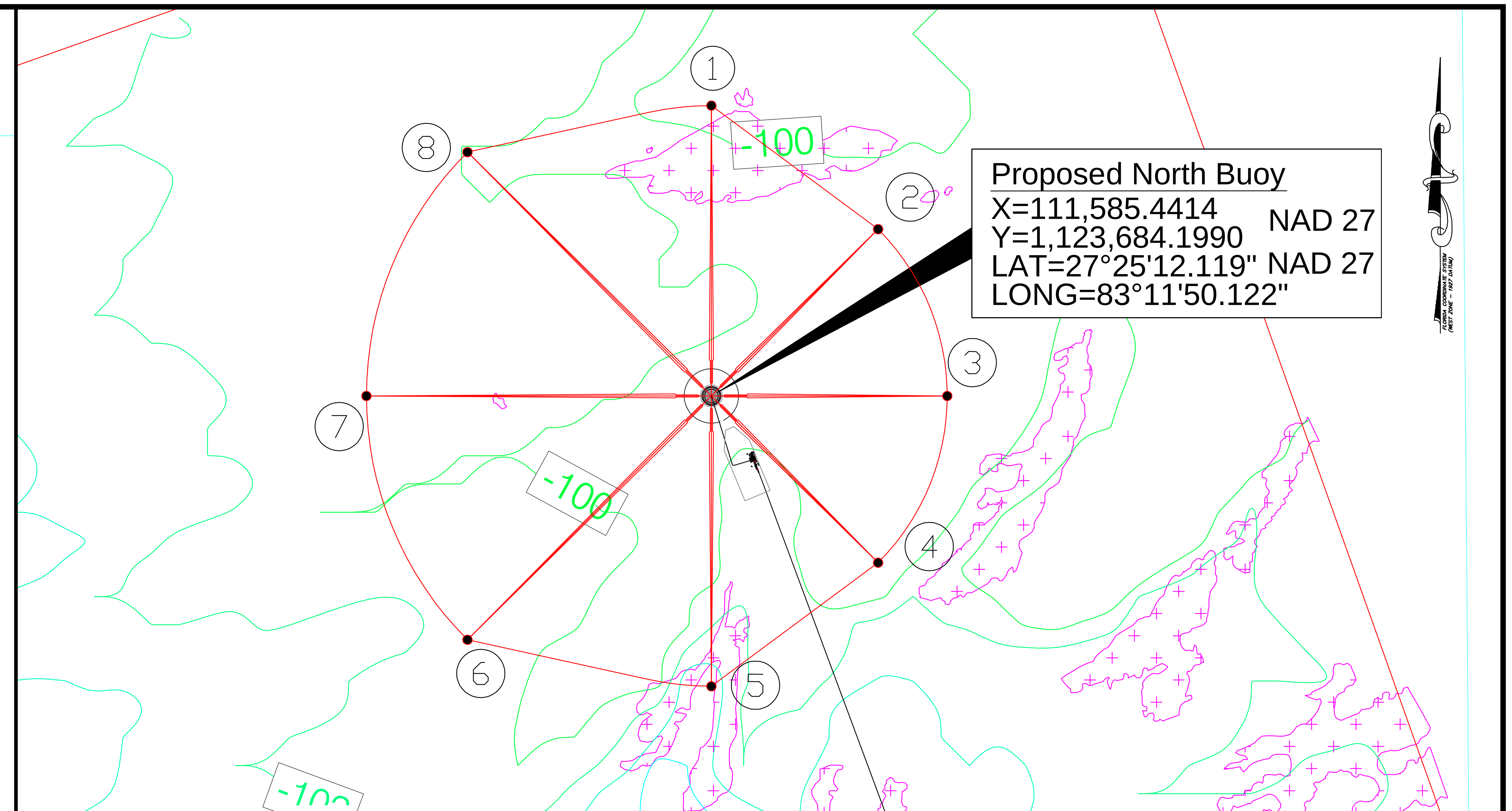
(1)● DENOTES PROPOSED BUOY ANCHOR LOCATIONS

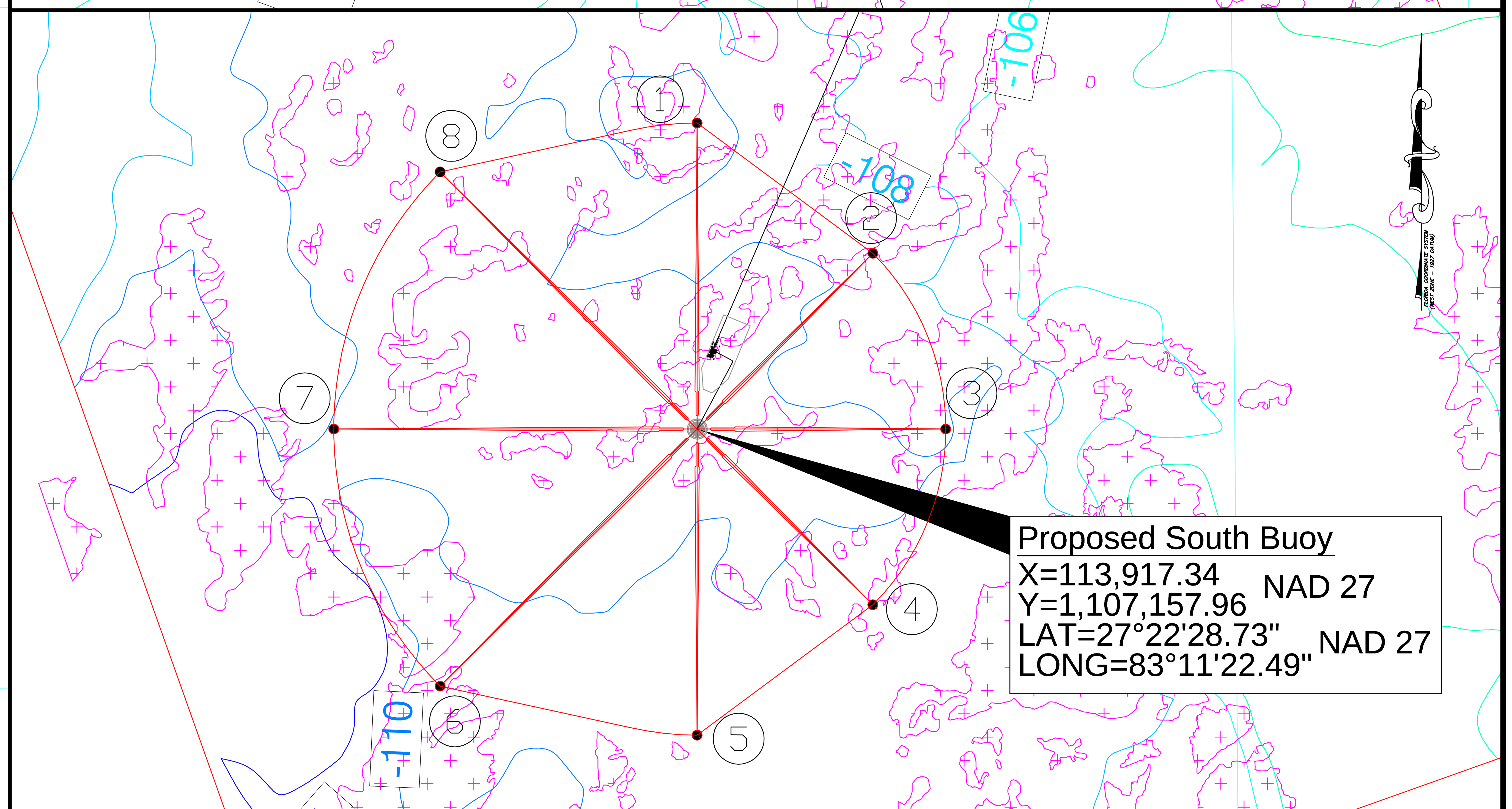
BUOY PLACEMENT AREA

PLAN VIEW

SCALE IN FEET

2000′ 1000′ 0 2000′ 4000′ 6000′





REFERENCE DRAWINGS	
DWG. NO.	DESCRIPTION

REVISIONS		
NO	DATE	DESCRIPTION
0	3/16/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

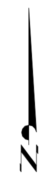
DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

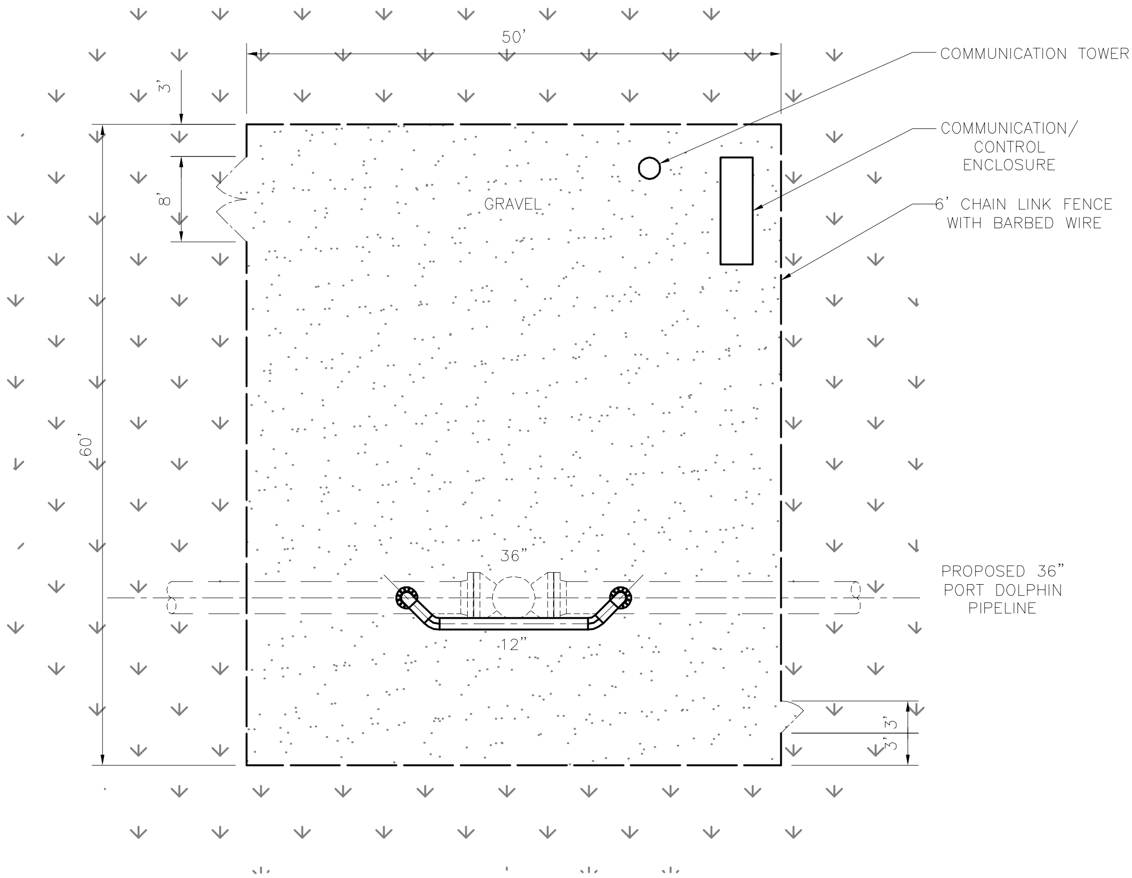
SCALE NTS
DRAWN DJR DATE 2/27/07
CHK'D IR DATE 11/29/07
APPROVED DATE
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-4206-1

PortDolphin

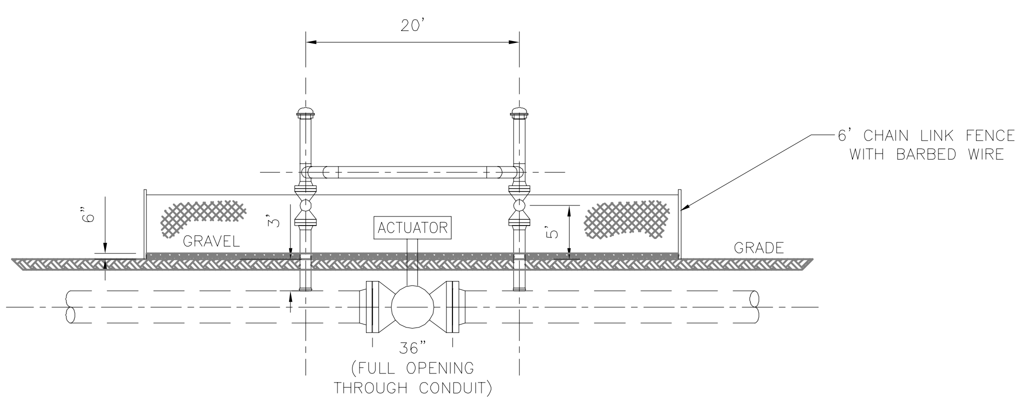
TITLE
MOORING AREA
AFFECTED HARD BOTTOM
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-B-4206 REV. 1





PLAN VIEW



ELEVATION

REVISION		
NO	DATE	DESCRIPTION
A	6/12/07	ISSUE FOR REVIEW
0	11/29/07	ISSUED FOR ADDENDUM FILING

PIPELINE ENGINEERING SOLUTIONS, INC.

13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

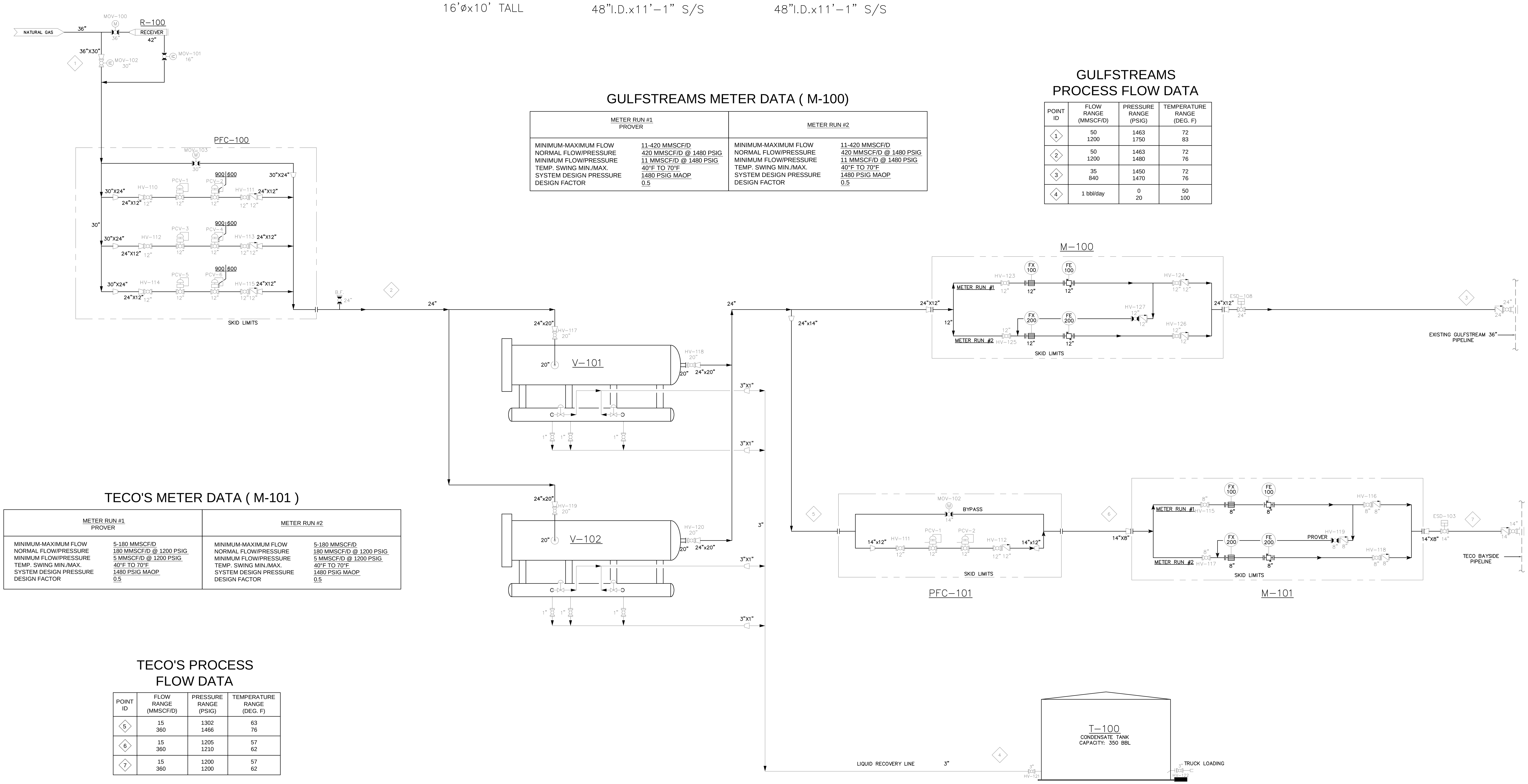
SCALE NONE
DRAWN DJR — DATE 6/12/07
CHK'D IR — DATE 11/29/07
APPROVED — DATE
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-4104-0

PortDolphin

TITLE
PLOT PLAN
MAINLINE BLOCK VALVE-PORT MANATEE
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-A-4104
REV. 0

R–100	PFC–100	T–100	V–101	V–102	PFC–101	M–100	M–101
PIG RECEIVER 42"O.D.x36"O.D.	PRESSURE/FLOW CONTROL STATION 12" ANSI–900 BALL–TROL CONTROL VALVES	CONDENSATE TANK CAPACITY: 350 BBL 1965 CU. FT. 16'ø x10' TALL	GAS FILTER/COALESCER FLOW: 600 MSCFD DESIGN PRESSURE: 1480 48"I.D.x11'–1" S/S	GAS FILTER/COALESCER FLOW: 600 MSCFD DESIGN PRESSURE: 1480 48"I.D.x11'–1" S/S	PRESSURE/FLOW CONTROL STATION 12" ANSI–600 BALL–TROL CONTROL VALVES	SALES GAS METER SKID 2–12" ANSI–600 DANIEL SENIOR SONIC METERS	SALES GAS METER SKID 2 8"–600 DANIEL SENIOR SONIC METERS



GULFSTREAMS METER DATA (M-100)

METER RUN #1 PROVER		METER RUN #2	
MINIMUM-MAXIMUM FLOW	11-420 MMSCF/D	MINIMUM-MAXIMUM FLOW	11-420 MMSCF/D
NORMAL FLOW/PRESSURE	420 MMSCF/D @ 1480 PSIG	NORMAL FLOW/PRESSURE	420 MMSCF/D @ 1480 PSIG
MINIMUM FLOW/PRESSURE	11 MMSCF/D @ 1480 PSIG	MINIMUM FLOW/PRESSURE	11 MMSCF/D @ 1480 PSIG
TEMP. SWING MIN./MAX.	40°F TO 70°F	TEMP. SWING MIN./MAX.	40°F TO 70°F
SYSTEM DESIGN PRESSURE	1480 PSIG MAOP	SYSTEM DESIGN PRESSURE	1480 PSIG MAOP
DESIGN FACTOR	0.5	DESIGN FACTOR	0.5

GULFSTREAMS PROCESS FLOW DATA

POINT ID	FLOW RANGE (MMSCF/D)	PRESSURE RANGE (PSIG)	TEMPERATURE RANGE (DEG. F)
1	50 1200	1463 1750	72 83
2	50 1200	1463 1480	72 76
3	35 840	1450 1470	72 76
4	1 bbl/day	0 20	50 100

TECO'S METER DATA (M-101)

METER RUN #1 PROVER		METER RUN #2	
MINIMUM-MAXIMUM FLOW	5-180 MMSCF/D	MINIMUM-MAXIMUM FLOW	5-180 MMSCF/D
NORMAL FLOW/PRESSURE	180 MMSCF/D @ 1200 PSIG	NORMAL FLOW/PRESSURE	180 MMSCF/D @ 1200 PSIG
MINIMUM FLOW/PRESSURE	5 MMSCF/D @ 1200 PSIG	MINIMUM FLOW/PRESSURE	5 MMSCF/D @ 1200 PSIG
TEMP. SWING MIN./MAX.	40°F TO 70°F	TEMP. SWING MIN./MAX.	40°F TO 70°F
SYSTEM DESIGN PRESSURE	1480 PSIG MAOP	SYSTEM DESIGN PRESSURE	1480 PSIG MAOP
DESIGN FACTOR	0.5	DESIGN FACTOR	0.5

TECO'S PROCESS FLOW DATA

POINT ID	FLOW RANGE (MMSCF/D)	PRESSURE RANGE (PSIG)	TEMPERATURE RANGE (DEG. F)
5	15 360	1302 1466	63 76
6	15 360	1205 1210	57 62
7	15 360	1200 1200	57 62

GENERAL NOTES

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REVISIONS

NO.	DATE	DESCRIPTION
0	3/7/07	ISSUED FOR FILLING
1	11/28/07	ISSUED FOR ADDENDUM FILING

REVISIONS

NO.	DATE	DESCRIPTION

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DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS–BUILT		

SCALE NTS	
DRAWN DJR	DATE 9/27/06
CHK'D	DATE
APPROVED	DATE
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017–4004–1	

PortDolphin

TITLE
PROCESS FLOW DIAGRAM
GULFSTREAM/TECO INTERCONNECTION STATION
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017–D–4004 REV. 1

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
					A	11/09/07	ISSUED FOR INFORMATION			
					B	11/15/07	ISSUED FOR REVIEW			
					0	11/30/07	ISSUED FOR ADDENDUM FILING			

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FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1"-500'	
DRAWN DJR	DATE 11/9/07
CHK'D	DATE
APPROVED	DATE
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-4105-0	

PortDolphin

TITLE
PIPING PLOT PLAN
PROPOSED PORT DOLPHIN
INTERCONNECTION STATIONS
MANATEE COUNTY, FLORIDA

NO. 26017-D-4105 REV. 0

APPENDIX 4

PORT DOLPHIN AGREEMENT
ADDENDUM 2

PortDolphin

Port Dolphin Energy LLC
400 North Tampa Street, Suite 1050
Tampa, FL 33602, USA

Telephone: 813 514 1398
Fax: 813 386 2069
www.portdolphin.com

December 18, 2008

By Overnight Delivery

Mr. Raymond W. Martin
Deepwater Ports Project Officer
Deepwater Ports Standards Division (CG-3PSO-5)
U.S. Coast Guard Headquarters, Room 1508
2100 Second Street, S.W.
Washington, D.C. 20593-0001

Regarding: Port Dolphin Energy LLC Liquefied Natural Gas Deepwater Port License Application, Public Docket USCG-2007-28532. 72 Fed. Reg. 34,741 (Jun. 25, 2007). **Deepwater Port Application Addendum II – Additional Project Design Changes and Corresponding Impacts - December 2008**

Dear Mr. Martin:

Enclosed for filing is Port Dolphin Energy LLC's Deepwater Port Application Addendum II – Additional Project Design Changes and Corresponding Impacts. This addendum partially amends the March 29, 2007, license application and Addendum I in the above-designated docket. The DEIS was issued on April 17, 2008. Processing was suspended on June 24, 2008, however, based on comments received on the DEIS and additional information required to develop the FEIS.

This addendum proposes a nearshore pipeline route modification outside the Tampa Bay area, and updates to the onshore pipeline route based on development changes unrelated to the Port Dolphin project. The nearshore route modification provides a routing around permitted sand resources, while onshore changes reflect modifications to road crossings based on current and future planned development along the pipeline route.

The principal sections and attachments enclosed in this addendum are:

1. Alternative Analysis of Pipeline Routes Around Permitted Sand Resources
2. Project Design Changes
3. Final Construction Plan
4. Water Quality
5. Marine Resources
6. Cultural Resources
7. Geology
8. Terrestrial Resources

A Public Attachments
B Confidential Attachments

Parts of this addendum, as well as other parts of this application, are labeled confidential. *E.g.,* Confidential Attachments titles, B.1 to B.3. Port Dolphin Energy LLC continues to request confidential treatment and withholding from public disclosure for such data from all recipients because the data are proprietary, and public disclosure could harm its competitive position. Also, such data include privileged archaeological survey and cultural resources materials.

Attachment B.3, Geotechnical Reports contains two reports, the first one from the Revised Preferred Route, which was previously provided to you on October 21, 2008 and the second report from the portion of the route that has been re-routed to avoid permitted sand resources. This second report is currently in final production and will be provided to you in January 2009. The electronic files included on the CDs includes the Geotechnical Report previously provided.

Due to Project-related commercial considerations, including both planning requirements in the Florida off-taker markets to receive the Project's regasified liquefied natural gas, and the need for conclusive arrangements to construct the Project's shuttle and regasification vessels (SRVs), Port Dolphin Energy LLC respectfully requests that the application be deemed complete, with processing resumed, at the earliest possible date. If there are questions, or if we can be of further service to support and advance the analysis to confirm completeness for this important application, we trust you will inform us.

Port Dolphin Energy LLC appreciates USCG's and MARAD's efforts in working to complete a technically sound Environmental Impact Statement.

Very truly yours,

German J. Castro
Project Development Manager
Port Dolphin Energy LLC

cc.: U.S. Department of Transportation, Maritime Administration, Office of Deepwater Ports and Offshore Activities, c/o Ms. Yvette Fields

BRUDER, GENTILE & MARCOUX, L.L.P.

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JESSE Y. HALPERN*

*NOT ADMITTED IN D.C.

GEORGE F. BRUDER
RETIRED 1997

December 18, 2008

VIA FEDERAL EXPRESS
Mr. Mark Peterson
USACE – Tampa Regulatory Office
10117 Princess Palm Avenue
Suite 120
Tampa, Florida 33610

Regarding: Port Dolphin Energy LLC Liquefied Natural Gas Deepwater Port License Application, Public Docket USCG-2007-28532. 72 Fed. Reg. 34,741 (June 25, 2007).

Dear Mr. Peterson:

Enclosed on electronic discs is a complete copy, both public and confidential parts, of Port Dolphin Energy LLC's December 18, 2008, Addendum II filing with USCG.

Very truly yours,

J. Michel Marcoux

J. Michel Marcoux
one of counsel for Port Dolphin Energy LLC

cc., w/o encls.: Ms. M. Perera; Mr. G. Castro; Ms. K. Olsen
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BRUDER, GENTILE & MARCOUX, L.L.P.

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GEORGE F. BRUDER
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jmmarcoux@brudergentile.com

December 18, 2008

VIA FEDERAL EXPRESS
Mr. Mark A. Sramek
National Oceanic and Atmospheric Administration
263 13th Avenue South
St. Petersburg, Florida 33701-5505

Regarding: Port Dolphin Energy LLC Liquefied Natural Gas Deepwater Port License Application, Public Docket USCG-2007-28532. 72 Fed. Reg. 34,741 (June 25, 2007).

Dear Mr. Sramek:

Enclosed is a public hard copy of Port Dolphin Energy LLC's December 18, 2008, Addendum II filing with USCG.

Very truly yours,

J. Michel Marcoux

J. Michel Marcoux
one of counsel for Port Dolphin Energy LLC

cc., w/o encls.: Ms. M. Perera; Mr. G. Castro; Ms. K. Olsen
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Port Dolphin Energy LLC

Deepwater Port License Application

Addendum II

Additional Project Design Changes and Corresponding Impacts

Port Dolphin Project, Tampa Bay, Florida

December 2008

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Figure **Page**

LIST OF FIGURES
(Continued)

Figure **Page**

LIST OF ACRONYMS

AWOIS	Automated Wreck and Obstruction Information System
BGS	below ground surface
BMP	Best Management Practice
CFR	Code of Federal Regulations
CPE	Coastal Planning and Engineering, Inc.
CWA	Clean Water Act
DEIS	Draft Environmental Impact Statement
DGPS	differential global positioning system
DOQQ	Digital Ortho Quarter Quads
EFH	Essential Fish Habitat
ERP	Environmental Resource Permit
F.A.C.	Florida Administrative Code
FDEP	Florida Department of Environmental Protection
FDOT	Florida Department of Transportation
FEIS	Final Environmental Impact Statement
FERC	Federal Energy Regulatory Commission
FLUCCS	Florida Land Use and Cover Classification System
FM	Feet Marker
FNAI	Florida Natural Areas Inventory
FPL	Florida Power & Light Company
FWC	Florida Fish and Wildlife Conservation Commission
GIS	geographic information systems
GPS	global positioning system
HAPC	Habitat Area of Particular Concern
HDD	horizontal directional drilling
LNG	liquefied natural gas
MARPOL	International Convention for the Prevention of Pollution From Ships
MCV	mean corpuscular volume
MLLW	mean low low water
MMS	Minerals Management Service
NEPA	National Environmental Policy Act
NHPA	National Historic Preservation Act
NOAA	National Oceanic and Atmospheric Administration
NOS	National Ocean Service
NPDES	National Pollutant Discharge Elimination System
NRHP	National Register of Historic Places
NTU	nephelometric turbidity units
NWI	National Wetlands Inventory
NWR	National Wildlife Refuge
OFW	Outstanding Florida Waters
OSI	Ocean Specialists Inc.

LIST OF ACRONYMS
(Continued)

PESI	Pipeline Engineering Services, Inc.
PLEM	pipeline end manifold
ROSS	Reconnaissance Offshore Sand Source
ROV	remotely operated vehicle
ROW	right-of-way
SRV	shuttle regasification vessel
STL	submerged turret loading
SWFWMD	Southwest Florida Water Management District
TECO	Tampa Electric Company
UMAM	Uniform Mitigation Assessment Methodology
USACE	U.S. Army Corps of Engineers
USC	U.S. Code
USCG	U.S. Coast Guard
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service

INTRODUCTION

During the public hearing held on May 6, 2008 for the Draft Environmental Impact Statement (DEIS) for the Port Dolphin Project, Manatee County and Town of Longboat Key officials indicated that the proposed offshore pipeline route would impact a permitted sand resource area – Borrow Area IX – and a potentially high volume sand shoal used for beach renourishment projects. On June 24, 2008, the U.S. Coast Guard (USCG) notified Port Dolphin Energy LLC (Port Dolphin) of the suspension of its application processing for the Port Dolphin Deepwater Port License. Based on the comments received on the DEIS, additional information is required for development of the Final Environmental Impact Statement (FEIS).

The decision to modify the offshore pipeline route was based on Port Dolphin's analysis of technical solutions available, as well as on consultation with the Florida Department of Environmental Protection, Town of Longboat Key, and Manatee County. Accordingly, Port Dolphin proceeded to modify its proposed nearshore pipeline route to avoid the identified sand resources and an area identified in the Reconnaissance Offshore Sand Source (ROSS) database as a potential sand source (**Figure I-1**). To date, geotechnical surveys carried out along the offshore pipeline route and its modification have been completed, which allows for the determination of the final offshore pipeline installation methods, and minor modifications to the terrestrial installation due to current and future development along the terrestrial route and unrelated to this project. With the finalized construction methodologies determined and additional project-specific plans prepared, the Coastal Zone Consistency Determination included in the original **Deepwater Port Application** has also been updated and is included as **Attachment A.1**.

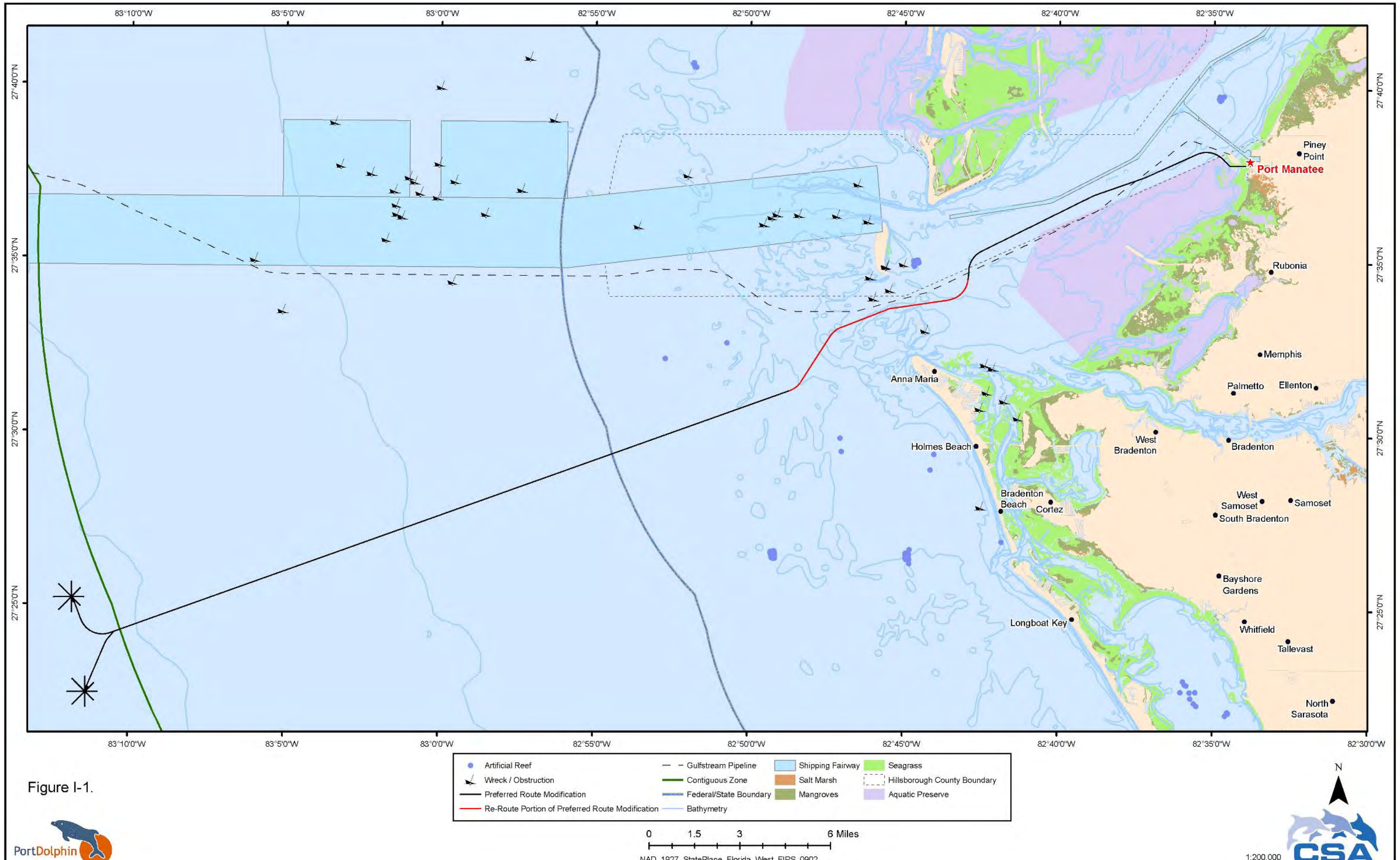
All of these modifications have required additional engineering and environmental work including the following:

- Engineering design including geophysical and geotechnical surveys and coordination with property owners and Manatee County to address technical issues of common interest, and consideration of applicable technical and operational criteria;
- Environmental surveys including benthic and archaeological surveys to fully describe baseline conditions of new areas to be impacted; and
- Supplemental impact analyses.

Therefore, this **Addendum II**, Additional Project Design Changes and Corresponding Impacts, has been designed to provide the information listed above and partially amends the March 29, 2007, **Deepwater Port Application** and the December 7, 2007 **Addendum I** in Public Docket No. USCG-2007-28532. The principal sections and attachments contained in this **Addendum II** are as follows:

1. Alternative Analysis of Pipeline Routes around Permitted Sand Resources: Includes an analysis of three pipeline route options, compares them to the equivalent portion of the Revised Preferred Route, and selects a Preferred Route Modification that avoids both the permitted Borrow Area IX and the potentially high volume sand shoal area and minimizes impacts to other identified potential sand resource areas.

Figure I-1
Port Dolphin Preferred Route Modification



2. Project Design Changes: Describes the preferred pipeline route modification, the modification to the Buckeye Road crossing, the additional slick bore across 31st Terrace East Road, the reduction in the number of wetlands impacted, and discusses an optional extra work space location at Port Manatee.

3. Construction Plan: Describes applicable construction methods and sequence of construction activities and identifies definitive construction methods for the gas transmission pipeline by sectors. In addition, this section describes an additional slick bore for crossing of a new road, as well as design modification to the proposed crossing of Buckeye Road.

4. Water Quality: Describes the existing conditions along the Preferred Route Modification pipeline corridor (based on available literature included in the original **Deepwater Port Application** and **Addendum I**), analyzes potential impacts applicable to construction/operation of the pipeline route modification, and summarizes overall project impacts resulting from implementation of the offshore design modification.

5. Marine Resources: Describes the existing conditions along the Preferred Route Modification pipeline corridor (based on results of a supplemental benthic survey carried out during August – September 2008), analyzes potential impacts applicable to construction/operation of the pipeline route modification, and summarizes overall project impacts resulting from implementation of the offshore design modification.

6. Cultural Resources: Describes the existing conditions along the Preferred Route Modification pipeline corridor (based on results of a supplemental geophysical investigation and review of remote sensing results carried out during August – September 2008), analyzes potential impacts applicable to construction/operation of the pipeline route modification, and summarizes overall project impacts resulting from implementation of the offshore design modification.

7. Geology: Describes the existing conditions along the Preferred Route Modification pipeline corridor (based on results of a supplemental geophysical investigation carried out during August – September 2008), analyzes potential impacts applicable to construction/operation of the pipeline route modification, and summarizes overall project impacts resulting from implementation of the offshore design modification.

8. Terrestrial Resources: Describes the existing conditions along the revised onshore pipeline corridor (based on results of land and archaeological surveys, wetlands delineation, and existing literature included in the original **Deepwater Port Application** and **Addendum I**) as changed from current and future development plans along the pipeline route unrelated to the Port Dolphin Project. This section discusses a potential alternative extra work space located at Port Manatee for pipe coating and storage, analyzes potential impacts applicable to construction/operation from the development changes, and summarizes overall project impacts resulting from implementation of the onshore design modification.

Attachments:

A. Public Attachments – Includes an updated Coastal Zone Management Certification and Analysis; Sand Source Re-route Benthic Survey Report; engineering drawings; the Installations Constructed with Horizontal Directional Drilling Plan; the Draft State Waters Mitigation Plan; the Draft Federal Waters Mitigation Plan; an Impacts to Fisheries Document; the Project-Specific Wetland and Waterbody Construction and Mitigation Procedures; the Project Specific Upland Erosion Control, Revegetation, and Maintenance Plan; the Dewatering Plan; and the Onshore Post-Construction Recovery and Mitigation Plan.

B. Confidential Attachments – Includes the supplemental Hazard/Archaeological (Geophysical) Survey Report; Optimal Line Sizing Study Hydraulics Analysis, and the Offshore Geotechnical Reports.

1. ALTERNATIVE ANALYSIS OF PIPELINE ROUTES AROUND PERMITTED SAND RESOURCES

Port Dolphin's gas transmission pipeline (hereafter referred to as "the Revised Preferred Route") was described in **Addendum I** to the **Deepwater Port Applicatio**n (hereafter referred to as "**Addendum I**"). On April 17, 2008, the U.S. Coast Guard (USCG) issued a Draft Environmental Impact Statement (DEIS) that analyzed project information presented in Port Dolphin's **Deepwater Port Application** and its **Addendum I**. On May 6, 2008, the USCG held a public hearing to gather public comments on the DEIS. During the public hearing, representatives of Manatee County and the Town of Longboat Key indicated that a portion of Port Dolphin's Revised Preferred Route would traverse a potentially high volume sand shoal area (also termed the Longboat Key default volume area) containing high quality sands ("whiter than white"), a designated/permitted sand source area (Borrow Area IX), and an area identified in the Reconnaissance Offshore Sand Source (ROSS) database for beach renourishment projects in Manatee County and Longboat Key. Upon learning about this issue, the Port Dolphin team immediately carried out an evaluation of technical options available, as well as participated in discussions with representatives of the Florida Department of Environmental Protection (FDEP), Manatee County, and the Town of Longboat Key. On June 19, 2008, Port Dolphin announced its decision to re-route a portion of the pipeline offshore the mouth of Tampa Bay in order to avoid impacts to designated sand resources identified by Manatee County and Longboat Key during the May 6, 2008 public hearing. The portion of the Revised Preferred Route that entailed a nearshore pipeline re-route around the Terra Ceia Aquatic Preserve would not be affected by this new pipeline re-route to avoid sand resources. For purposes of discussion in this document (**Addendum II**), the term Preferred Route Modification will be used when referring to the modified route.

1.1 Pipeline Distance and Dredging Buffer Recommendations

Port Dolphin's pipeline design and offshore construction consultants (Pipeline Engineering Services, Inc. [PESI] and Ocean Specialists Inc. [OSI]) have performed a background review of recent subsea pipeline installation projects to determine acceptable safe distances for installing the Port Dolphin gas transmission pipeline in proximity to the Gulfstream pipeline, and have had discussions with dredging contractors to establish a buffer zone for protecting Port Dolphin's pipeline integrity. The recommendations resulting from such review/discussions are as follows:

- ***Installation of a Subsea Pipeline Next to Another*** – Review of proceedings corresponding to two recently licensed projects – Excelerate's Northeast Gateway/Algonquin's Lateral pipeline and Suez' Neptune pipeline – indicates that both pipelines would be installed parallel and adjacent to each other for a significant portion of their routes (approximately 8 miles [13 kilometers]). Further, in several sections, the separation between the two would be equal to or less than 300 feet (91 meters), even reaching 200 feet (61 meters) or less along a short section where rocky outcrops create a narrow plowable passage. These pipeline projects constitute a recent precedent of applicable industry practices designed to safely allow parallel installation of pipelines through proper planning, prudent engineering, and experienced execution. Accordingly, in Port Dolphin's case, PESI and OSI propose to maintain a minimum separation of 400 feet (122 meters) from the existing Gulfstream pipeline. This will provide an added safety margin of 200 feet (61 meters) to what is already achievable and proven through use of existing plowing technologies. It is important to emphasize that all re-route options studied for the Port Dolphin pipeline are located at least 1,000 feet (305 meters) from the Gulfstream pipeline, which is at least 600 feet (183 meters) greater than the required minimum separation.

- ***Dredging Distance to Port Dolphin Pipeline*** **–** PESI and OSI have had discussions with three dredging companies, two of which perform dredging services for the U.S. Army Corps of Engineers (USACE) in Tampa Bay. Comments received from one of these dredging companies indicate that they would dredge up to within 25 feet (7.6 meters) of the Port Dolphin pipeline if the line was adequately marked with buoys. However, other important considerations must be made when establishing the safe distance for dredging operations, e.g., the possibility of the sandy bottom migrating into a dredged area, which could cause scouring and possibly expose Port Dolphin's pipeline. Taking into account the comments from the dredging companies and discussions held with both FDEP and Minerals Management Service (MMS) indicating that it is the sole decision of Port Dolphin to specify an acceptable separation (above and beyond applicable submerged easement distances) to be maintained by dredging operations, PESI and OSI propose to establish a buffer zone that would extend out 200 feet (61 meters) to either side of the Port Dolphin pipeline centerline.

1.2 Alternative Routes Around Sand Resources

The Revised Preferred Route, described in **Addendum I**, would traverse a permitted borrow area (Borrow Area IX), a potentially high volume sand shoal, and an area identified in the FDEP ROSS database as a potential sand source, which has caused significant public, regulatory, and political concern. This situation was brought to Port Dolphin's attention at the May 6, 2008 Public Meeting. Since the sand source issue was revealed, Port Dolphin's team carried out a detailed analysis of technical options available, as well as held discussions with a variety of FDEP divisions, Manatee County, and the Town of Longboat Key (the permittee of the sand source area) to discuss associated concerns and issues. On June 19, 2008, Port Dolphin announced its decision to re-route a portion of the pipeline offshore the mouth of Tampa Bay in order to avoid the identified impacts to designated sand resources. Moreover, later on August 18, 2008, Longboat Key provided Port Dolphin with a number of additional potential sand source areas identified by its consultant (Coastal Planning & Engineering, Inc. [CPE]) during a recent survey.

Accordingly, Port Dolphin performed extensive additional surveys to identify alternative routes around sand resources (**Figure 1-1**). Both geophysical and benthic characterization surveys were performed according to the same protocols used for all previous surveys. **Attachment A.2** provides the detailed benthic characterization survey results, and *Confidential* **Attachment B.1** provides the geophysical survey results. Based on the data obtained from these surveys, three options were developed for the selection of an Alternative Route around Sand Resources. All three options involve different technical and environmental considerations, as discussed below. The selected Alternative Route, incorporated into the Revised Preferred Route, will be termed the Preferred Route Modification.

Revised Preferred Route

As proposed in **Addendum I**, the Revised Preferred Route would pass through the middle of a permitted borrow area (Borrow Area IX) used by the Town of Longboat Key, entering the west side at approximately 27°31’57” N, 82°46’33” W, passing through the borrow area for a distance of 1,755 feet (534 m), and exiting the east side at approximately 27°31’57” N, 82°46’14” W. With a proposed buffer area of 200 feet (61 meters) on either side of the pipeline, the Revised Preferred Route would have denied the Town of Longboat Key access to approximately 16 acres (6.5 hectares) of the 264-acre (106.8-hectare) borrow area. The Revised Preferred Route also would pass through a potentially high volume sand shoal for a distance of 2.2 miles (3.6 kilometers); an area identified in the ROSS database as a potential sand source for a distance of approximately 8.4 miles (13.5 kilometers); and three areas identified in a recent investigation conducted by Coastal Planning and Engineering, Inc. (CPE) as potential sand sources for the Town of Longboat Key (a total distance of approximately 2.1 miles [3.4 kilometers]). The Revised Preferred Route did not alter the course of the Original Preferred Route through the sand sources.

Re-Route Option A

From the point of its divergence from the Revised Preferred Route at pipeline station No. 1252+43.01, Option A would turn to the northeast to avoid permitted Borrow Area IX, the high volume shoal, and two of Longboat Key’s potential sand source areas. Option A would diverge from the Revised Preferred Route within the area defined in the ROSS database as a potential sand source, passing through it for a distance of approximately 2.2 miles (3.6 kilometers) before exiting the northern boundary. Approximately 2.7 miles (4.3 kilometers) from its point of divergence from the Revised Preferred Route, Option A and the other two re-route options converge and turn toward the east, and then curve toward the north for a distance of approximately 4.7 miles (7.5 kilometers), returning to the Revised Preferred Route at pipeline station No. 1645+95.83, approximately 197 feet (60 meters) beyond the south end of the western horizontal directional drilling (HDD) beneath the Gulfstream pipeline in Tampa Bay (**Figure 1-2**).

Figure 1-1
Sand Source Re-Route Survey Area Showing Revised Preferred Route and Sand Borrow Areas

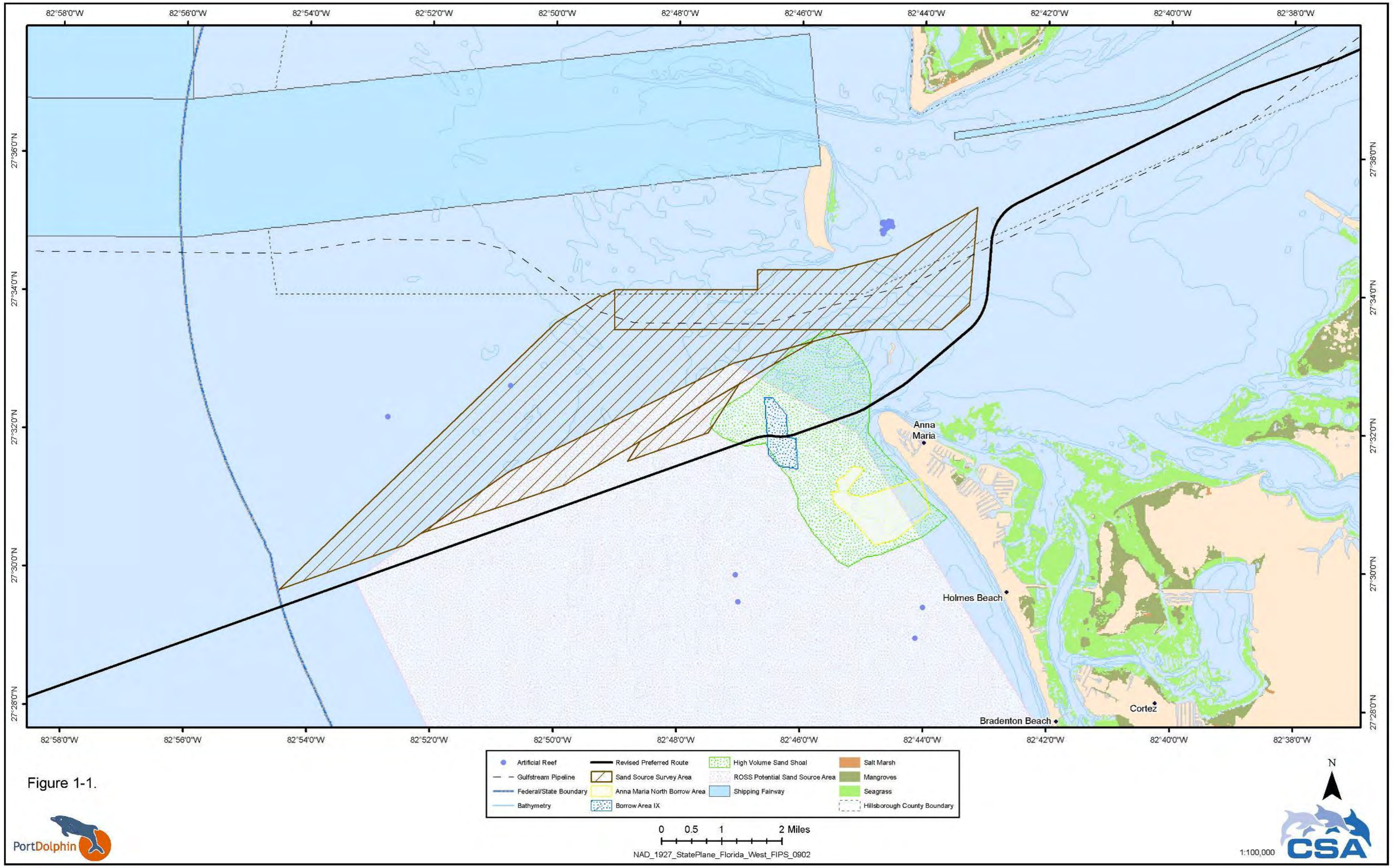
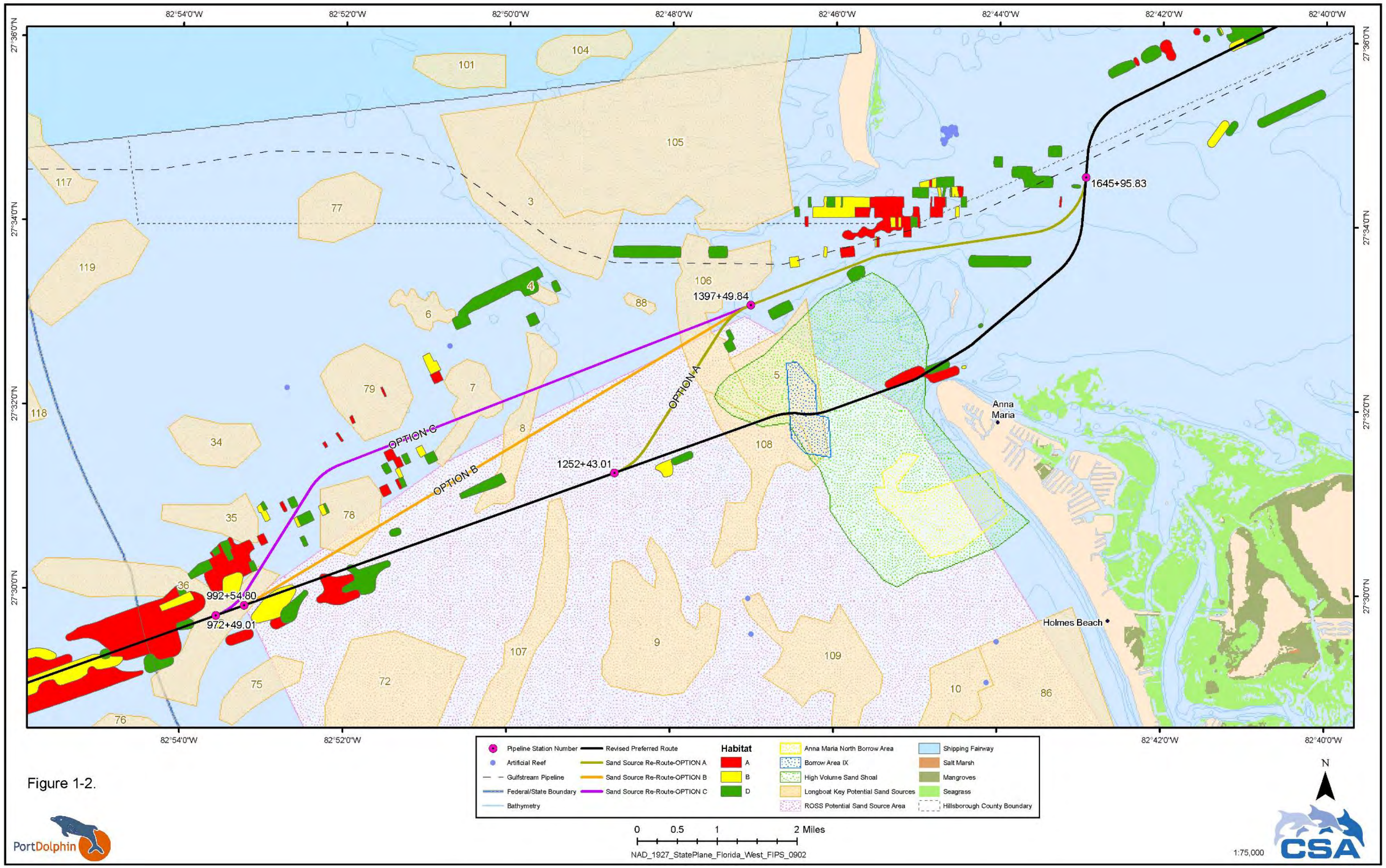


Figure 1-2
Revised Preferred Route and Sand Source Re-route Options A, B, and C



Re-Route Option B

Option B diverges from the Revised Preferred Route approximately 6,234 feet (1,900 meters) from the State/Federal boundary (pipeline station No. 972+49.01), at which point it takes a more northerly course for a distance of approximately 7.3 miles (11.7 kilometers) until joining with Options A and C at the eastern convergence point (pipeline station No. 1397+49.84) (**Figure 1-2**). Option B would avoid permitted Borrow Area IX and the high volume shoal area. This option passes through four areas identified by the Town of Longboat Key as potential sand sources.

Re-Route Option C

At 6,234 feet (1,900 meters) from the State/Federal boundary (pipeline station No. 992+54.80), Option C takes a more northerly course than the other two options, traveling approximately 2.1 miles (3.4 kilometers) before turning toward the east. From that point, it travels approximately 5.7 miles (9.1 kilometers) before joining Options A and B at the eastern convergence point (pipeline station No. 1397+49.84) (**Figure 1-2**). Option C avoids permitted Borrow Area IX, as well as the high volume shoal and the ROSS-defined potential sand source. This option passes through four areas identified by the Town of Longboat Key as potential sand sources.

1.3 Evaluation Criteria

Key criteria for evaluating the three options proposed as possible Alternative Routes around Sand Resources include the following:

- Engineering and construction constraints – Minimum pipeline “bend” radius of 4,000-foot (1,219-meter) for allowable free stress and to meet laying and burial requirements;
- Avoidance of mapped habitat;
- Avoidance of hard bottom;
- Avoidance of permitted Borrow Area IX;
- Avoidance of the high volume sand shoal (Longboat Key default volume area);
- Avoidance of Longboat Key mapped potential sand source areas;
- Avoidance of the ROSS database potential sand source area;
- Avoidance of shipwrecks or other obstructions;
- Maintenance of a safe distance from the Gulfstream pipeline (minimum of 400 feet [122 meters]);
- Avoidance of mapped environmental resources in the area (based on publicly available information, including Gulfstream);
- Avoidance of artificial reefs; and
- Pipeline length.

Analysis and comparison of the three re-route options based on an evaluation of these criteria are presented below in **Section 1.4**.

1.4 Analysis of Alternatives

Port Dolphin's analysis of Alternative Routes around Sand Resources (**Figure 1-2**) is summarized below.

1. **Engineering and construction constraints – Minimum pipeline "bend" radius of 4,000-feet (1,219-meter) radius for allowable free stress and to meet laying and burial requirements.** This minimum radius constraint must be met in order to accomplish a continuous pipelay operation. *Scoring: Does/does not meet this requirement.*

   - **Analysis –** All three Options meet this requirement.

2. **Avoidance of mapped habitat.** Several areas of live bottom have been mapped in the vicinity of the Revised Preferred Route and within the area surveyed for the development of the Alternative Route around Sand Resources. Three types of live bottom habitat have been identified within this area, with classifications based upon a protocol developed by the FDEP. These classifications are defined below. *Scoring: Options that avoid impacts to live bottom habitat (particularly Type A) are preferable.*

   Type A 20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 feet (0.25 meters) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).

   Type B 5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 feet (0.25 meters) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.

   Type D Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.

   Analysis – The seafloor within the project corridor was mapped during benthic characterization surveys. The sand source re-route survey was conducted to delineate benthic habitats within the area. The results of the survey are presented in detail in **Attachment A.2**. All three options avoid impacts to additional areas of mapped live bottom habitats (**Figure 1-3**).

Figure 1-3
Revised Preferred Route and Sand Source Re-Route Options A, B, and C Around All Constraints

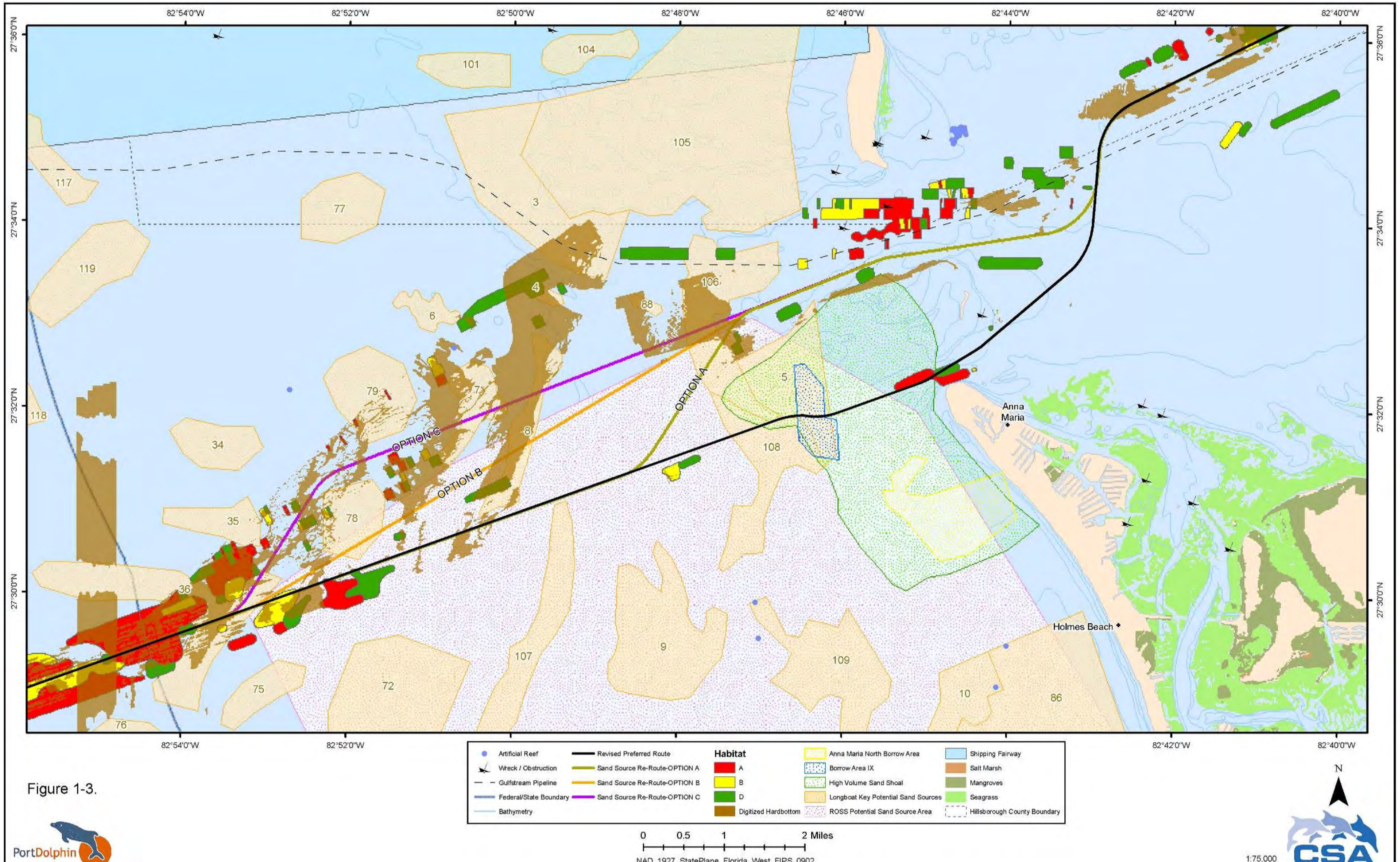


Figure 1-3.

3. **Avoidance of hard bottom.** A geophysical survey was conducted within the area of the Alternative Routes around Sand Resources in order to identify potential hard bottom habitat. Additional impacts to hard bottom mapped by the geophysical survey would be minimized by the selected Re-route Option. *Scoring: Area of impact (smaller is better).*

   - **Analysis –** Option A crosses approximately 1,468 feet (447 meters) of additional hard bottom in one area. Option B crosses approximately 6,433 feet (1,961 meters) of additional hard bottom in three areas. Option C crosses approximately 13,477 feet (4,108 meters) of additional hard bottom as it passes through four areas of extensive hard bottom (**Figure 1-3**).

4. **Avoidance of permitted Borrow Area IX.** Borrow Area IX is a 264-acre (107-hectare) permitted borrow area used by the Town of Longboat Key as a source of sand for beach renourishment projects. From meetings with stakeholders, it was recommended that this area be avoided to the extent practicable. *Scoring: Meets/does not meet.*

   - **Analysis –** All three options avoid Borrow Area IX (**Figure 1-3**).

5. **Avoidance of the high volume sand shoal**. The Longboat Key default volume area is a potentially high volume sand shoal offshore northern Anna Maria Island. From meetings with stakeholders, it was recommended that this area be avoided to the extent practicable. *Scoring: Meets/does not meet.*

   - **Analysis –** All three options avoid the Longboat Key default volume area (**Figure 1-3**).

6. **Avoidance of Longboat Key mapped potential sand source areas.** CPE conducted a survey in order to identify potential sand sources for the Town of Longboat Key. Each area defined by CPE was characterized according to the observed quality of the sand within. While the results of the survey are preliminary and further investigation will be required to identify areas of beach quality sand, it was recommended during meetings with stakeholders that these areas be avoided to the extent practicable. Alternatives were developed to avoid these identified sand source areas, but because they are densely clustered throughout the approach to Tampa Bay, completely avoiding them is impossible. *Scoring: Area of impact (smaller is better).*

   - **Analysis –** Option A passes through two potential sand source areas for a total distance of 7,413 feet (2,259 meters). One of these areas (No. 36) has been classified by CPE as containing fine grained gray to light gray quartz sand with little shell hash from a vibracore sample to approximately 5.3 feet (1.6 meters). Option A passes through 4,345 feet (1,324 meters) of this 1,086-acre (439-hectare) area. Option A also passes through another area (No. 106) classified by CPE as containing fine grained gray and light gray quartz sand with trace shell hash from a vibracore sample to approximately 8.6 feet (2.6 meters). Option A passes through 3,068 feet (935 meters) of this 901-acre (364-hectare) area. Using the 400-foot (122-meter) wide buffer that would be required around the pipeline for dredging activities, Option A would impact 68 acres (27.5 hectares) of the 1,987 acres (804 hectares) of the combined area of Areas No. 36 and 106, which is 3.4% of the area. It has been indicated that Area No. 106 is not of beach quality sand.

Option B passes through four potential sand sources for a total distance of 11,778 feet (3,590 meters). This option passes through 4,577 feet (1,395 meters) of Area No. 36 and 2,173 feet (662 meters) of Area No. 106 (both previously described). Option B also passes through Areas No. 8 (371 acres [150 hectares)] and No. 78 (381 acres [154 hectares]), for distances of 1,927 feet (587 meters) and 3,084 feet (940 meters), respectively. Area No. 8 has been classified by CPE as containing fine grained light gray quartz sand with trace shell hash and silt with some shell fragments from a vibracore sample to approximately 9.5 feet (2.9 meters). Area No. 78 has been classified as fine to coarse grained light gray to gray sand with trace to little shell hash and trace silt coral fragments to 5.3 feet. Using the 400-foot (121-meter) wide buffer that would be required around the pipeline for dredging activities, Option B would impact 108 acres (44 hectares) of the 2,739 acres (1,108 hectares) of the combined area of Areas No. 36, 106, 8, and 78, which is 3.9% of the area, much of which is not beach quality sand.

Option C passes through four potential sand source areas for a total of 12,500 feet (3,810 meters). This re-route option passes through Areas No. 8, 36, and 106 (previously described) for distances of 1,080 feet (329 meters), 6,085 feet (1,854 meters), and 2,010 feet (612 meters), respectively. Option C also passes through Area No. 7 (318 acres [129 hectares]) preliminarily classified with a mean corpuscular volume (MCV) of 5 to 7 and not further investigated in the most recent field investigation preformed by CPE, for a distance of 3,314 feet (1,010 meters). Using the 400-foot (122-meter) wide buffer that would be required around the pipeline for dredging activities, Option C would impact 115 acres (46 hectares) of the 2,676 acres (1,083 hectares) of the combined area of Areas No. 36, 106, 8, and 7, which is 4.3% of the area, much of which is not beach quality sand.

Of the three options, Option A impacts these potential sand sources the least, while Options B and C each impact a greater area (**Figure 1-3**).

7. **Avoidance of the ROSS database potential sand source area.** The FDEP ROSS database identifies a potential sand source area off the southern coastline of the Tampa Bay area. From meetings with stakeholders, it was recommended that this area be avoided to the extent practicable. *Scoring: Length of route in feet (shorter is preferable).*

   - **Analysis –** Option A would diverge from the Revised Preferred Route after it has passed through approximately 5.0 miles (8.1 kilometers) of the area defined in the ROSS database as a potential sand source. Following this divergence, Option A would pass through the ROSS sand source for a distance of approximately 2.2 miles (3.6 kilometers) before exiting near the northeast corner for a total of 7.2 miles (11.6 kilometers).

Option B would diverge from the Revised Preferred Route approximately 164 feet (50 meters) inside the western edge of the ROSS sand source and pass through it for approximately 6.1 miles (9.8 kilometers) before exiting near the northeast corner for a total of 6.1 miles (9.8 kilometers). Option C would avoid this potential sand source area. While both Options A and B pass through the ROSS potential sand source, the northern portion of the ROSS database area through which they pass contains several areas of hard and live bottom as determined by both the geophysical and benthic video surveys, making the northern portion of this area an unlikely source of beach-quality sand (**Figure 1-3**).

8. **Avoidance of shipwrecks or other obstructions.** Mapped shipwrecks and other obstructions should be avoided. *Scoring: Avoids/doesn't avoid*.

   - **Analysis** – All three options avoid mapped shipwrecks and other obstructions (**Figure 1-3**).

9. **Maintenance of a safe distance from the Gulfstream pipeline (minimum of 400 feet [122 meters]).** Based on research presented above, Port Dolphin proposes to maintain a minimum separation of 400 feet (122 meters) from the existing Gulfstream pipeline. This will provide an added safety margin of 200 feet to what is already achievable and proven through use of existing plowing technologies. *Scoring: Meets/does not meet*.

   - **Analysis –** All three options come no closer than approximately 1,000 feet (305 meters) from the Gulfstream pipeline (**Figure 1-3**).

10. **Avoidance of mapped environmental resources in the area (based on publicly available information).** Bottom areas with mapped environmental resources should be avoided to the maximum extent practicable. *Scoring: Meets/does not meet*.

    - **Analysis –** All three options avoid mapped environmental resources (**Figure 1-3**).

11. **Avoidance of artificial reefs.** There are numerous existing artificial reefs in the Tampa area that should be avoided for pipeline routing. *Scoring: Meets/does not meet*.

    - **Analysis –** All three options avoid artificial reefs (**Figure 1-3**).

12. **Pipeline length.** Significant pipeline length differences directly impact the cost of the project. This criterion was used after evaluation and balancing of all other criteria as a secondary evaluation factor. *Scoring: Length of route (shorter is better).*

    - **Analysis –** Re-Route Option A has a length of 7.39 miles (11.9 kilometers) and a total length of 42.02 miles (67.6 kilometers) from the piggable wye to the pier bulkhead; Option B has a length of 12.4 miles (19.9 kilometers) and a total length of 41.7 miles (67.1 kilometers) from the piggable wye to the pier bulkhead; and Option C has a length of 12.66 miles (20.4 kilometers) and a total length of 41.98 miles (67.6 kilometers) from the piggable wye to the pier bulkhead. While Option A is the longest route, it is only 1,608 feet (490 meters) longer than the shortest route, Option B.

1.5 Discussion

The Revised Preferred Route would pass through a permitted borrow area (Borrow Area IX) for a distance of 0.33 miles (0.53 kilometers), denying access by the Town of Longboat Key to 16 acres (6.5 hectares) of this 264-acre (107-hectare) site. The Revised Preferred Route would also pass through 2.26 miles (3.64 kilometers) of a 4,489-acre (1,817-hectare) potentially high volume sand shoal (default volume area), 8.4 miles (13.5 kilometers) of a 538,707-acre (218,007-hectare) area identified in the ROSS database as a potential sand source, and a total of 2.09 miles (3.36 kilometers) in three different potential sand sources identified in preliminary surveys conducted by CPE.

Option A would avoid the permitted borrow area (Borrow Area IX), as well as the potentially high volume sand shoal (i.e., default volume area). Option A intrudes the least on the CPE-identified potential sand source areas (1.40 miles [2.26 kilometers]); however, it does pass through the northern edge of the potential sand source area identified in the ROSS database for a distance of approximately 7.2 miles (11.6 kilometers). It should be noted however, that most of the area of the ROSS sand source through which Option A would travel does not include any areas identified as potential sand sources by CPE during their survey. In addition, hard and live bottom have been mapped, both by the geophysical survey and by the benthic characterization survey, within this northern area of the ROSS potential sand source. Therefore, most of the small area on the north edge of this potential sand source through which Option A would run has been determined to not be suitable as a source of beach-quality sand. CPE had determined that only one potential sand source area (Area No. 36) potentially contains sand of the appropriate grain size and color for beach nourishment projects; however, it may not produce sufficient quantities for its sole use in any beach nourishment project. Option A would avoid any new impacts to mapped habitat areas and would intrude on additional hard bottom, as determined by the geophysical survey, to a lesser extent (1,468 feet [447 meters]) than the other two options (**Figure 1-3**).

Option B would avoid Borrow Area IX and the potentially high volume sand shoal. This option would pass through 6.1 miles (9.8 kilometers) of the northern area of the potential sand source area identified in the ROSS database. Like Option A, most of the area of the ROSS sand source through which Option B would intrude is likely to be unsuitable as a source of beach-quality sand. This option includes 2.23 miles (3.58 kilometers) of pipeline passing through four CPE potential sand source areas, more than Option A but less than Option C. Option B would avoid any new impacts on mapped live bottom resources but would impact an additional 6,433 feet (1,961 meters) of additional hard bottom, as determined by the geophysical survey (**Figure 1-3**).

Option C would avoid Borrow Area IX, the potentially high volume sand shoal, and the potential sand source area identified in the ROSS database. This option intrudes upon potential sand sources identified by CPE to a greater extent than the other two options, passing through four potential sand source areas for a total distance of 2.37 miles (3.81 kilometers). Option C would avoid any new impacts on mapped live bottom resources, but would impact an additional 13,477 feet (4,108 meters) of additional hard bottom, as determined by the geophysical survey (**Figure 1-3**).

1.6 Conclusions

Based on this evaluation, which is summarized in **Table 1-1**, Option A is selected as the Preferred Route Modification that best meets the technical and environmental requirements for the Port Dolphin project and the other stakeholders involved.

Based on the analysis discussed above, a reconfigured alternative route was defined: the Preferred Route Modification (i.e., Revised Preferred Route incorporating Option A). **Figure 1-4** shows the Preferred Route Modification. Subsequent environmental analysis in **Addendum II** focuses on the Preferred Route Modification.

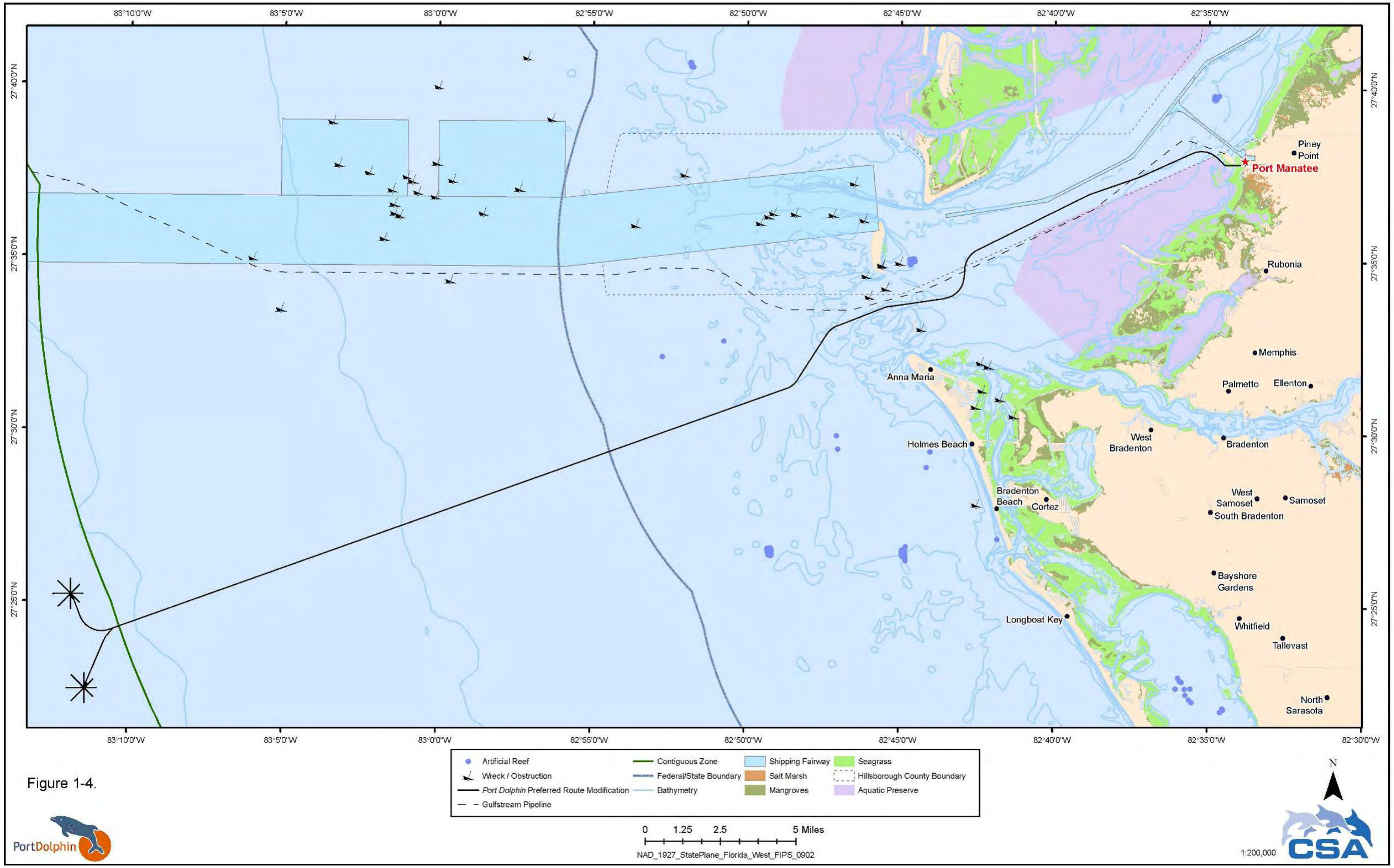
Detailed archaeological, engineering, geohazards, and benthic biological surveys were performed for the Alternative Route around Sand Resources as described in **Attachment A.2** and *Confidential* **Attachment B.1**.

Table 1-1
Summary of Criteria Evaluation for Sand Source Re-route Options

Criteria	Data Source	Re-route Option A	Re-route Option B	Re-route Option C
Meet engineering and construction constraints on the pipeline "bends" of 4,000 (1,219)-ft radius for allowable free stress and to meet laying and burial requirements.	Engineering and construction experts	Meets this requirement	Meets this requirement	Meets this requirement
Avoidance of mapped habitat (live bottom)	Port Dolphin benthic survey	Avoids all new habitat polygons	Avoids all new habitat polygons	Avoids all new habitat polygons
Avoidance of hard bottom	Port Dolphin geophysical survey	Crosses one new area of hard bottom, impacting an approximate additional total length of 1,468 feet (447 meters)	Crosses three new areas of hard bottom impacting an approximate additional total length of 6,433 feet (1,961 meters)	Crosses four extensive new areas of hard bottom impacting an approximate additional total length of 13,477 feet (4,108 meters)
Avoidance of permitted Borrow Area IX	Manatee County	Avoids	Avoids	Avoids
Avoidance of the high volume sand shoal (Longboat Key default volume area)	Manatee County	Avoids	Avoids	Avoids
Avoidance of Longboat Key mapped potential sand source areas	Coastal Planning & Engineering, Inc. (CPE)	Crosses two polygons. Crosses Polygon 106 for a distance of 3,068 feet (935 meters), which is identified by CPE as shell hash sand and crosses Polygon 36 for a distance of 4,345 feet (1,324 meters), and is classified based on CPE-limited field analysis	Crosses four polygons (36, 78, 8, and 106). Crosses Polygon 36 for a distance of 4,577 feet (1,395 meters), Polygon 78 for a distance of 3,084 feet (940 meters), and Polygon 8 for a distance of 1,927 feet (587 meters), and is classified based on CPE-limited field analysis. Crosses Polygon 106 for a distance of 2,173 feet (662 meters) and is identified by CPE as shell hash sand	Crosses four polygons (36, 8, 7, and 106). Crosses Polygon 36 for a distance of 6,085 feet (1,855 meters) and Polygon 8 for a distance of 1,080 feet (329 meters), and is classified based on CPE-limited field analysis. Crosses Polygon 7 for 3,321 feet (1,012 meters) and is classified based on jet probes with a mean corpuscular volume of 5 to 7. Crosses Polygon 106 for 2,010 feet (612 meters) and is identified by CPE as shell hash sand
Avoidance of ROSS database potential sand source area	Florida Department of Environmental Protection (FDEP)	Crosses approximately 38,000 feet (11,582 meters) of potential sand source area	Crosses approximately 32,000 feet (9,754 meters) of potential sand source area	Avoids
Avoidance of mapped shipwrecks or other obstructions	Global maritime wrecks database	Avoids all	Avoids all	Avoids all
Maintain safe distance from Gulfstream pipeline (minimum 400 feet [122 meters])	Engineering and construction experts	Maintains a minimum distance of approximately 1,000 feet (305 meters) from Gulfstream	Maintains a minimum distance of approximately 1,000 feet (305 meters) from Gulfstream	Maintains a minimum distance of approximately 1,000 feet (305 meters) from Gulfstream
Avoidance of mapped environmental resources in the area (based on publicly available information, including Gulfstream)	National Oceanic and Atmospheric Administration (NOAA), FDEP, Florida Geographic Data Library	Avoids	Avoids	Avoids
Avoidance of artificial reefs	FDEP, NOAA	Avoids all mapped reefs	Avoids all mapped reefs	Avoids all mapped reefs
Pipeline length		Approximately 39,024 feet (11,894 meters) Total length 221,865 feet (67,624 meters)	Approximately 65,503 feet (19,965 meters) Total length 220,257 feet (67,134 meters)	Approximately 66,874 feet (20,383 meters) Total length 221,627 feet (67,552 meters)

- In addition, several of the sand source areas identified by CPE (Polygons 8, 88, and portions of Polygons 106, 78, and 7) correlate with digitized hard bottom areas determined from thorough geophysical survey data.
- CPE Polygon 36 contains not only digitized hard bottom, but also habitats as delineated from detailed Port Dolphin benthic habitat video surveys.

Figure 1-4
Port Dolphin Preferred Route Modification



2. PROJECT DESIGN CHANGES

This section describes the proposed project design changes to Port Dolphin that are being implemented to minimize impacts to designated sand resources and terrestrial modifications made based on current conditions associated with installation/construction of the project's fixed components. **Table 2-1** lists each proposed design change and describes the corresponding objective/purpose.

Table 2-1
Design Changes and Purpose/Objectives

Design Change	Purpose/Objective
Alternative Route around Sand Resources	• Avoid occupation of permitted borrow area used by the Town of Longboat Key. • Avoid or minimize impacts to other identified potential offshore sand sources.
Modification of Buckeye Road Crossing	• Avoid issues with potential future widening of Buckeye Road to a maximum of 150 feet (46 meters).
Additional Crossing of New Road, 31st Terrace East	• Due to development in the area, unrelated to this project, an additional County road must be crossed.
Removal of Wetlands W-4 and W-5 from Impact Area	• Development in the area, unrelated to this project, filled Wetland W-4. • Refined definition of jurisdictional wetlands indicates Wetland W-5 is not jurisdictional according to both State and Federal rules as W-5 is a borrow pond excavated in upland habitat.
Optional Extra Work Space Area Location	• Port Manatee areas identified as alternative locations available for use.

2.1 Alternative Routes around Sand Resources

2.1.1 Selection Process and Criteria

Methods utilized for identifying an Alternative Route around Sand Resources, evaluation of the re-route options, and selection of a Preferred Route Modification are explained in detail in **Section 1**. Port Dolphin's design basis has not changed with respect to the natural gas transmission pipeline (see **Addendum I**, *Confidential* **Attachment B.3**) The Preferred Route Modification proposed by Port Dolphin includes the same design parameters, routing strategies, and constructability and safety considerations previously applied in the original **Deepwater Port Application** submitted by Port Dolphin, including:

- Minimum pipeline bend radius of 4,000 feet (1,219 meters) to facilitate a safe and efficient lay operation;
- To the extent possible, routing around high value hard bottoms, habitats, and artificial reefs while attempting to stay in areas that would allow a reasonable and effective pipeline burial using a plow;
- Avoiding permitted borrow areas and minimizing intrusion upon potential sand sources; and
- Consideration of archaeological avoidance areas.

Figure 2-1 illustrates the Preferred Route Modification incorporating the design change of the re-route portion.

2.1.2 Preferred Route Modification

The Original Preferred Route, as described in the **Deepwater Port Application**, as well as the Revised Preferred Route described in **Addendum I** to the **Deepwater Port Application**, would traverse a permitted borrow area (Borrow Area IX), a potentially high volume sand shoal, and an area identified in the ROSS database as a potential sand source. This situation was brought to Port Dolphin's attention at the Public Meeting on May 6, 2008. In response to discussions held with the FDEP, Manatee County, and Town of Longboat Key regarding the intrusion of the Preferred Route through Borrow Area IX, a permitted borrow area used as a sand source for beach nourishment by the Town of Longboat Key, Port Dolphin performed extensive additional geophysical and environmental surveys. Three route options were designed to be evaluated for the selection of an Alternative Route around Sand Resources to avoid both Borrow Area IX as well as the potentially high volume sand shoal within which it is located (**Figure 2-2**). In designing these options, Port Dolphin attempted to minimize impacts to other potential sand sources in the vicinity of the pipeline corridor. These sources include a large (538,707-acre [218,007-hectare]) area identified in the ROSS database as a potential sand source, as well as several smaller areas identified as potential sand sources during a recent investigation conducted by CPE for the Town of Longboat Key. In the selection of a Preferred Route Modification, Port Dolphin also attempted to reduce impacts to hard bottom habitats as compared to the Revised Preferred Route. The Preferred Route Modification eliminates 0.02 miles (0.03 kilometers) from the total length of the water segment of the Port Dolphin pipeline system. The adjusted length of the offshore gas transmission pipeline (from piggable wye to the bulkhead at Port Manatee) is 42.04 miles (67.57 kilometers). This additional length of the pipeline results in a minor change in the overall pressure drop; therefore, a revised Hydraulics Report is included in *Confidential* **Attachment B.2** to reflect this change in pressure**.**

Figure 2-1
Port Dolphin Preferred Route Modification

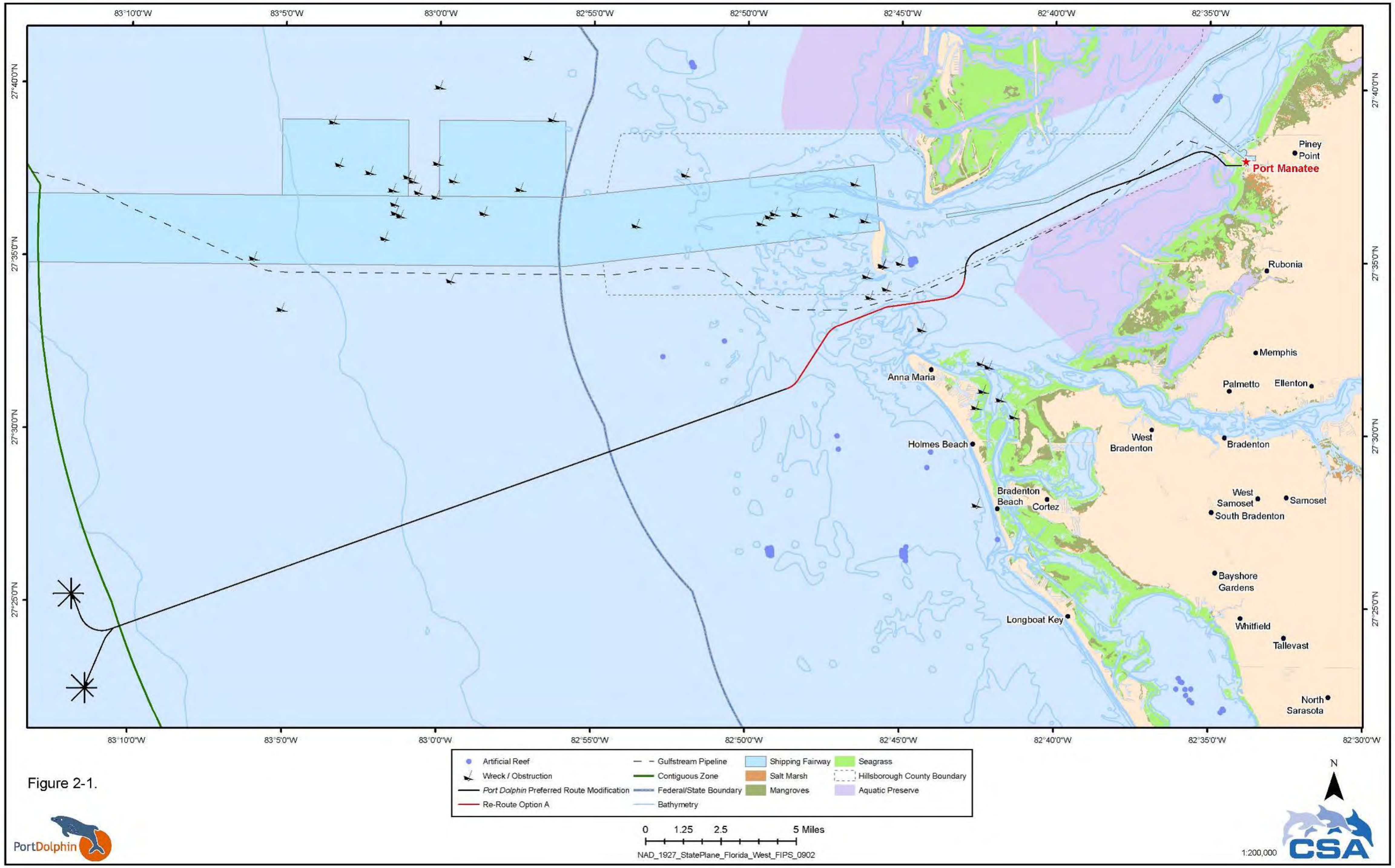
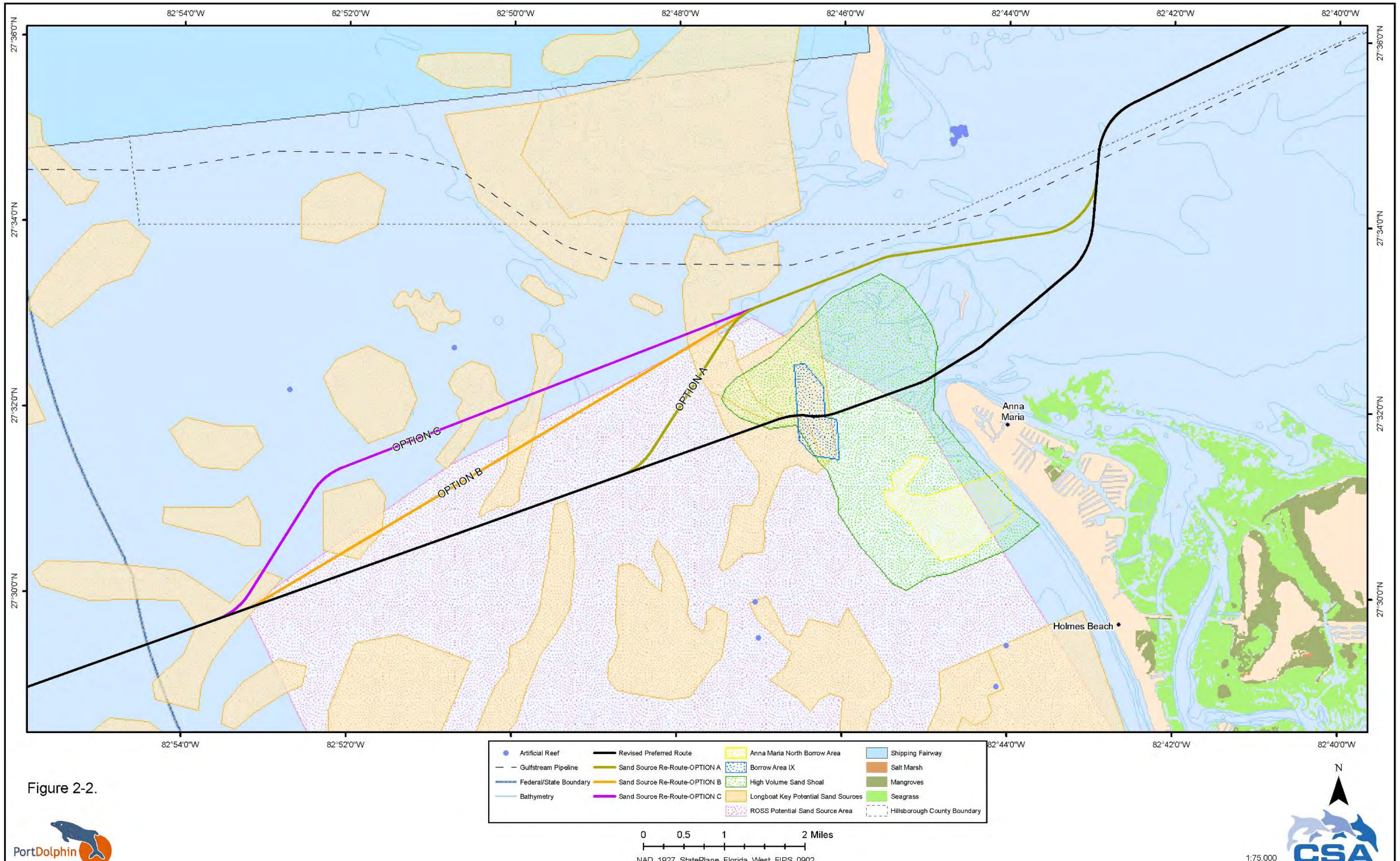


Figure 2-2
Port Dolphin Alternative Routes around Sand Resources in Comparison to Revised Preferred Route



The Preferred Route Modification diverges from the Revised Preferred Route at pipeline station No. 1252+43.01, turning to the northeast to avoid permitted Borrow Area IX, the high volume shoal, and two of Longboat Key's potential sand source areas. The Preferred Route Modification diverges from the Revised Preferred Route within the area defined in the ROSS database as a potential sand source, passing through it for a distance of approximately 2.2 miles (3.6 kilometers) before exiting the northern boundary. Approximately 2.7 miles (4.3 kilometers) from its point of divergence from the Revised Preferred Route, the Preferred Route Modification turns toward the east, then maintains this course for approximately 1.8 miles (2.8 kilometers). It then curves slightly toward the south, maintaining a more easterly course for approximately 2.0 miles (3.2 kilometers) before turning toward the north using a 4,000-foot (1,219-meter) bend radius. The pipeline traverses approximately 0.9 miles (1.5 km) through the bend. Immediately after completing this bend, the Preferred Route Modification returns to the Revised Preferred Route at pipeline station No. 1645+95.83, approximately 197 feet (60 meters) west of the south end of the western HDD beneath the Gulfstream pipeline in Tampa Bay (**Figure 2-2** and Alignment Sheets in **Attachment A.3**). The entire Preferred Route Modification from the piggable wye to the bulkhead at Port Manatee is described in **Table 2-2**.

Table 2-2
Offshore Gas Transmission Pipeline Route Positions

Notable Point ID	Description	Latitude (N)	Longitude (W)	Station No.
P1	Piggable wye	27°24'12.846"	83°10'27.711"	0+00
P2	Federal/State Waters	27°29'26.302"	82°54'24.858"	923+51.02
P3	PC – Begin curve #1 (begin Preferred Route Modification)	27°31'17.505"	82°48'41.548"	1252+43.01
P4	PC- End curve #1	27°31'33.539"	82°48'19.172"	1278+74.87
P5	PC – Begin curve #2	27°32'51.772"	82°47'23.552"	1372+28.40
P6	PC – End curve #2	27°33'07.415"	82°47'02.316"	1397+49.84
P7	PC – Begin curve #3	27°33'38.452"	82°45'33.937"	1482+99.88
P8	PC – End curve #3	27°33'40.748"	82°45'24.404"	1491+90.56
P9	PC – Begin curve #4	27°33'55.852"	82°43'34.088"	1592+35.74
P10	PC – End curve #4 (end Preferred Route Modification)	27°34'31.897"	82°42'56.520"	1645+95.83
P11	Gulfstream West Crossing	27°34'42.345"	82°42'55.597"	1656+54.24
P12	PC – Begin curve #5	27°34'47.924"	82°42'55.104"	1662+19.33
P13	PC – End curve #5	27°35'20.237"	82°42'30.680"	1703+32.44
P14	PC – Begin curve #6	27°36'56.720"	82°38'54.101"	1921+18.24
P15	PC – End curve #6	27°36'58.644"	82°38'49.010"	1926+16.05
P16	Gulfstream East Crossing	27°37'23.470"	82°37'29.941"	2001+57.56
P17	PC – Begin curve #7	27°37'27.053"	82°37'18.526"	2012+46.26
P18	PC – End curve #7	27°37'28.295"	82°37'15.044"	2015+83.72
P19	PC – Begin curve #8	27°38'09.223"	82°35'32.974"	2116+51.99
P20	PC – End curve #8	27°38'04.128"	82°34'47.070"	2160+26.78
P21	PI – HDD exit (shore approach)	27°37'48.673"	82°34'28.820"	2182+92.19
P22	Bulkhead	27°37'48.652"	82°33'49.102"	2218+64.67

The revised portion of the Preferred Route Modification begins at Notable Point P3 and ends at Notable Point P10.

2.2 Onshore Pipeline Route and Support Facilities

2.2.1 Modification of Buckeye Road Crossing

During discussions with Manatee County, Port Dolphin was informed of the potential future widening of Buckeye Road to a maximum of 150 feet (46 meters). To accommodate for this change, the slick bore across that road has been lengthened to 310 feet (95 meters), which changes the entrance and exit points of the bore and the angle of crossing (**Attachment A.3**, **Drawing 26017-B-2321**).

2.2.2 Additional Crossing of New Road, 31st Terrace East

A portion of the property formerly owned by Buckeye Industrial Limited has been sold to Scannel Revex, LLC, and a FedEx distribution center has been constructed. As part of the construction of that facility, an additional County road, 31st Terrace East, must be crossed by the pipeline. The road will be crossed with a slick bore, the same method used to cross all other roads along the pipeline route (**Attachment A.3**, **Drawing 26017-B-2320**). This slick bore will be 94 feet (28.6 meters) in length.

2.2.3 Removal of Wetlands W-4 and W-5 from Impact Area

The number of wetlands along the proposed pipeline route has been reduced from 11 to 9 due to development in an area unrelated to this project and a refined definition of jurisdictional wetlands. The property on which Wetland W-5 was located has been sold, and a FedEx distribution center has been constructed on the site. As part of the construction of that facility, Wetland W-5 was disturbed and filled. No wetland portion remains in the project area. In addition, the Florida Power & Light Company (FPL) borrow pond was originally delineated as Wetland W-4, but according to both the State and Federal rules, a borrow pond constructed in upland habitat is not jurisdictional. Therefore, both Wetlands W-4 and W-5 were removed form the impact area.

2.2.4 Optional Extra Work Space Area Location

Port Manatee has identified an optional area within its property for use by Port Dolphin for extra work space for concrete coating of the pipe, pipe storage, and concrete mattress production. A portion of this area was used by Gulfstream for similar activities and contains existing gravel and grassy areas. This area will require modification to meet Port Dolphin's needs including but not limited to paving, fencing, and lighting of a 5.4-acre (2.2-hectare) area to relocate an existing tenant that currently is using the optional area identified for Port Dolphin; the construction of additional gravel "fingers" for pipe storage; construction of laydown areas for raw material storage; and construction of a detention pond. A second parcel (4.7 acres [1.9 hectares] is currently a grassy upland area that will be modified for the concrete mattress production and storage facility (**Figure 2-3**). The previous area identified by Port Manatee for use for this extra work space is still an option for use and is illustrated in **Figure 2-4**. The exact parcel that will be used by Port Dolphin at Port Manatee for these extra work spaces will be determined by Port Manatee based on the Port's development plans and finalized closer to the time of construction.

Figure 2-3
Optional Extra Work/Staging Areas Locations at Port Manatee

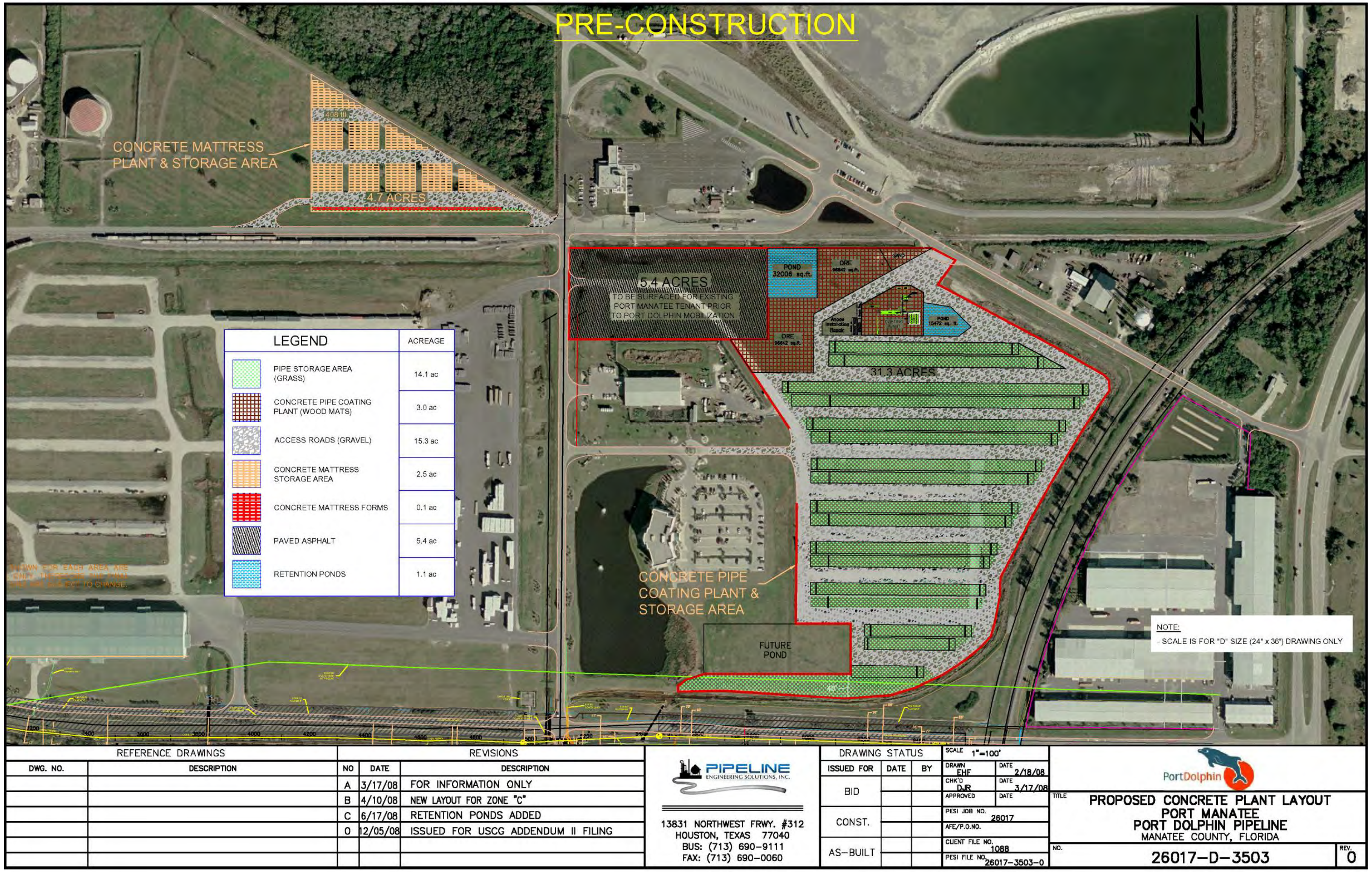
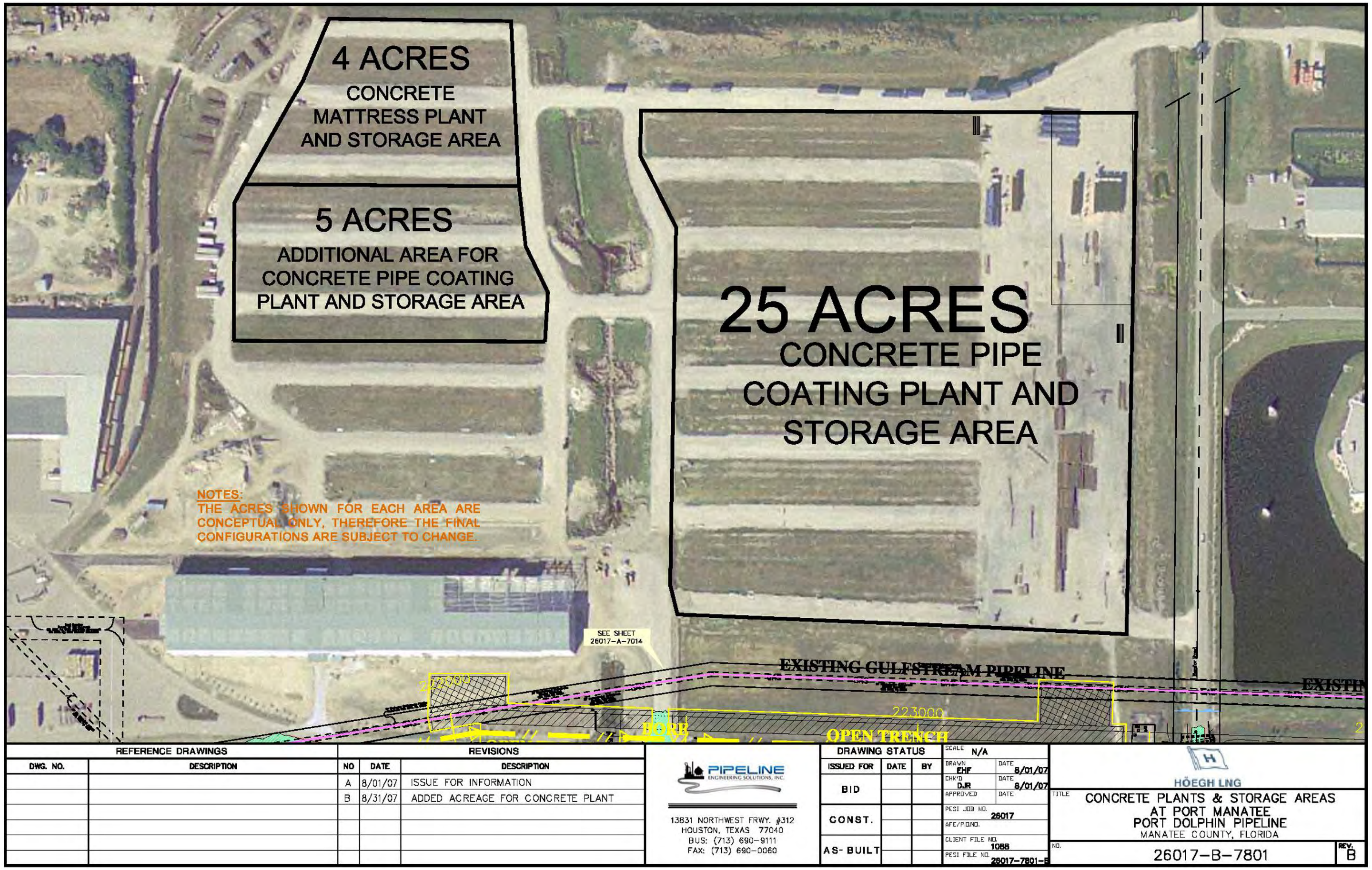


Figure 2-4
Original Extra Work/Staging Areas Locations at Port Manatee



3. FINAL CONSTRUCTION PLAN

Based on comments provided by the USCG after completing review of the original **Deepwater Port Application**, this section presents a comprehensive project construction plan that (1) describes applicable construction assets and methods, (2) identifies specific construction methods to be utilized for each project component and/or component segments (if applicable), (3) establishes the sequence of activities to be followed for completing construction, and (4) defines a construction schedule for fixed project components.

3.1 Offshore Pipeline Construction Plan

This section describes the proposed offshore construction assets and plan for Port Dolphin's gas transmission pipeline, pigable wye, flowlines, and pipeline end manifolds (PLEMs).

3.1.1 Description of Offshore Pipeline Construction Assets

3.1.1.1 Typical Pipelay, Plowing, and Backfill Spread

The main pipeline installation vessel would be a dedicated inshore pipelay barge in the maximum size range, approximately 400-feet (122-meters) long by 100-feet (30.5-meters) wide (**Figure 3-1**). The barge would be fully equipped with pipeline welding stations, pipeline tensioners, and a heavy duty winch for abandonment and recovery of the pipeline. Cranes on the barge would facilitate loading of the individual pipe joints onto the barge following transportation from the onshore supply/fabrication base. The barge would be equipped with a complete anchoring/positioning system. For a barge in the 400-foot (122-meter) long by 100-foot (30.5-meter) wide size range, as is planned for the Port Dolphin pipeline installation (e.g., the *Sea Horizon*), there would likely be 10 anchors weighing about 20,000 pounds each. To deploy and recover these anchors, two anchor handling support vessels with a power rating of 3,000 to 5,000 horsepower (HP) each would be used.

Figure 3-1
Typical Pipelay, Plowing, and Backfill Spread
(courtesy of Horizon Offshore)

During operations, there would be a total crew of approximately 190 persons present on the barge and anchor handling support vessels. Using dedicated tugs and barges, pipe segments (joints of pipe) would be shuttled from the onshore staging area to the pipeline installation barge offshore. It is anticipated that all construction operations would operate 24 hours per day, 7 days per week.

3.1.1.2 Shallow Water Lay Barge

The extreme inshore section of the route, currently estimated to be from the shore approach HDD exit to a water depth of 15 feet (4.6 meters; a distance of approximately 4,384 feet [1,336 meters]), would be installed with the use of a shallow water lay spread. Additionally, the section of pipe to be installed under the Sunshine Skyway Bridge would be installed with the assistance of the same shallow water lay spread.

A typical shallow water spread would be assembled by joining two barges (usually 140-foot [43-meter] length and 40-foot [12-meter] beam) end-to-end, fitted with spuds for positioning in the constricted area of the HDD shore approach (between Manbirdtee Key and Terra Ceia Aquatic Preserve). The spread also will be equipped with automated welding equipment to allow for the assembly of pipe sections on board and an eight-point anchor spread.

3.1.1.3 Spud Barge and Clamshell Dredge (Sunshine Skyway Bridge Section)

Non-plowing techniques would be used to bury certain sections of the pipeline route (i.e., the section of the route that passes beneath the Sunshine Skyway Bridge). A satellite-deployed differential global positioning system (DGPS) would be used to accurately position an inshore dredge barge along the proposed pipeline corridor, and the barge would be moored in position with either temporary spudded legs or anchors (**Figure 3-2**). A clamshell dredge grab would be deployed to seabed from a crane on the barge, and an acoustic sonar system would be used to accurately monitor the depth of the dredged ditch.

Figure 3-2
Conventional Spudded Leg Clamshell Dredge (courtesy of U.S. Army Corps of Engineers)

3.1.1.4 Jack-up Barge (HDD Shore Approach)

One jack-up barge in the 200-class range would be used to assist with the HDD shore approach. These barges typically are self-propelled, with spuds 197-feet (60-meters) long, 3,100 square feet (288 square meters) of deck space, and up to 181 tonnes of deck loading capacity.

3.1.1.5 Horizontal Directional Drilling Spread (HDD Crossings)

The spread to be utilized for water-to-water HDDs would include

- Four jack-up barges in the 200-class range (described above in **Section 3.1.1.4**);
- Three hopper barges moored to one jack-up barge (12 hopper barges total) at each crossing location to collect slurry and cuttings, along with water barges to provide fresh water for slurry make-up; and
- Two tugs (1,200 HP each) for barge towing, and crew boats for personnel transport and logistics.

3.1.1.6 Diving Support Vessels

Four barges in the 140-foot (43-meter) length by 40-foot (12-meter) beam size range, each equipped with a four-point mooring system, would be utilized for diving support. These barges would be used to support the tie-in and mattressing operations.

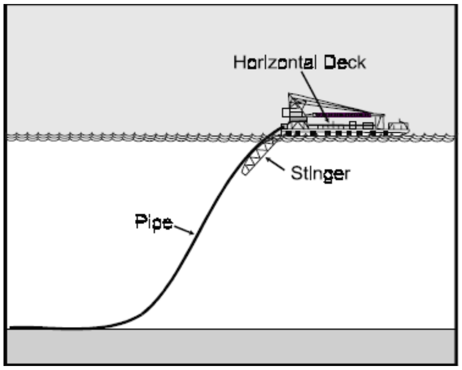
3.1.2 Offshore Pipeline Construction Methods

3.1.2.1 Base Case Methods

Pipelay (Deep Water – Greater than 15 feet)

The pipeline would be installed onto the seabed with the "S-Lay" method. The "S-Lay" method is the traditional and most extensively proven technique for installing pipe in the relatively shallow water Gulf of Mexico conditions characteristic of the Port Dolphin location. The technique is known as "S-Lay" because the shape taken by the pipe as it moves from the welding and inspection stations on the deck of the pipelay barge across the stern of the pipelay barge and on to the ocean floor forms an elongated "S" (**Figure 3-3**). As the pipeline moves across the stern of the lay barge and before it reaches the ocean floor, the pipe is supported by a truss-like structure equipped with rollers, known as a stinger. The purpose of a stinger is to minimize curvature, and therefore the bending stress, of the pipe as it leaves the vessel.

Figure 3-3
Diagram Showing
"S-Lay" Technique



Pipelay (Shallow Water – 15 feet or less)

The shallow water pipelay spread would be used to install the section of pipe between the Port Manatee shore approach HDD exit and a water depth of 15 feet (4.6 meters; a distance of approximately 4,384 feet [1,336 meters]). This section of pipe would be installed in a manner similar to the deepwater construction method described above but would not use a stinger to guide the pipe to the seabed. For the inshore tie-in operation, during which the barge would be positioned in proximity to Manbirdtee Key and the Terra Ceia Aquatic Preserve, it is expected that the barge would be held on station by spuds and would be moved away from the tie-in location only by repositioning of the barge's bow anchors. Additional anchors could be used as the barge moves forward and additional space is available. No anchors would be deployed within the Terra Ceia Aquatic Preserve. No burial would be conducted within the inshore section of the route.

Pipeline Plowing and Burial

In the plowing technique, the pipeline is lowered below seabed level by creating a "V" shaped ditch in the soil underneath the pipeline with a burial plow (**Figure 3-4**). The plow is towed along the pipeline directly behind the burial barge. As the ditch is cut, spoil is removed and passively pushed to the side by specially-shaped moldboards that are fitted to the main plowshare.

It is planned to use a "conventionally moored" barge, which means that the position of the pipeline installation will be maintained through anchors, associated anchor chains, and/or cables. The anchor re-set distance for each mile of offshore pipeline burial route will be a function of the size of the lay/bury barge, weather conditions, water depth, seabed type, and the amount of anchor line that can be stored, deployed, and retrieved by the barge. Based on previous experience and accepted practice in similar conditions, and also following discussions with an experienced pipelay/bury contractor, it is currently assumed that each anchor will be re-set approximately every 2,000 feet [610 meters] along the pipeline route.

The barge first will be positioned directly over the burial initiation point on the pipeline. The plow is then launched with its share in the open position (**Figure 3-5**) and lowered towards the burial initiation point. The plow will be fitted with cameras, sonar, and sensor instruments, which will assist with final positioning. Divers or robotic submersibles also will be deployed as necessary to monitor the plow as it is located and placed astride the pipeline.

Figure 3-4
A Typical Pipeline Burial Plow
(courtesy of Horizon Offshore)

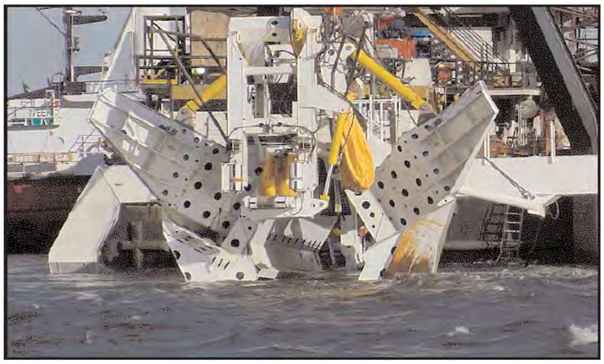


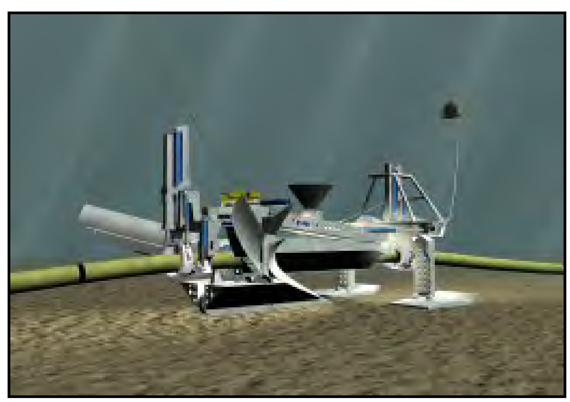
Figure 3-5
Lowering Plow with Share Open

When it is confirmed that the plow safely and effectively straddles the pipeline and all in-water system checks have indicated that it is safe to proceed, the plow's pipeline lifters are activated. The pipeline is raised into the plowshare, which is then closed around it (**Figure 3-6**). At this point, the barge would recover the plow's main lifting line and advance forward along the pipeline route in order to establish a proper tow catenary. Barge advancement is achieved by winching-in/paying-out anchor cable while "walking" and relocating the anchor array as required.

Once a proper tow catenary is established, the plow is pulled forward under tension while operators monitor and adjust the depth of the ditch being cut. The latest generation of burial plow is fitted with sophisticated computer control systems and instrumentation, enabling the operators to select and continuously monitor the depth of the ditch as it is formed in real time (**Figure 3-7**). The process continues as the barge simultaneously advances along the pipeline route and lowers the pipeline into the ditch cut by the plow.

Figure 3-6
Pipeline Raised into Plowshare

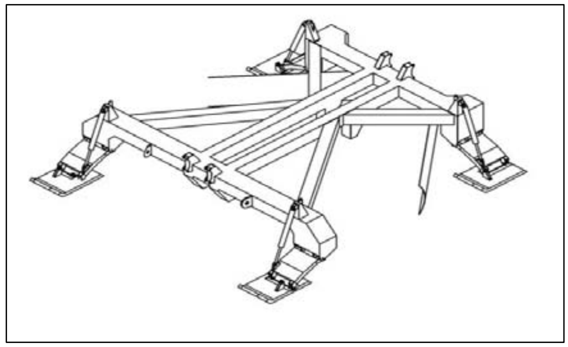
Figure 3-7
Monitoring and Adjustment of
Ditch Being Cut



Once the end of the pipeline route is reached, the procedure above is reversed in order to lift and recover the plow back onto the deck of the barge. The pipeline route is then surveyed either by the barge itself or by a separate survey vessel to determine where full pipeline lowering has been achieved.

One additional pass will be made along the pipeline route to backfill the pipeline lying in the ditch. For this purpose, the plow blades are reversed to scrape the spoils back into the ditch (**Figure 3-8**). As the backfill plow is advanced, the spoil is simultaneously pushed back into the ditch and on top of the pipeline. A typical detail of the plow and burial pass is included in **Attachment A.3**, **Drawing 26017-A-7723**. Upon completion of the backfill operations, a final survey is run to confirm and document the conclusion of all burial operations.

Figure 3-8
Backfill Plow Configuration
(courtesy of Horizon Offshore)



Trench and Burial (Sunshine Skyway Bridge Section)

It is anticipated that the section of the route that passes beneath the Sunshine Skyway Bridge would be buried by means of bucket dredging (**Attachment A.3**, **Drawing 26017-D-2319**). In this section, dredging of the pipeline ditch would be carried out "pre-lay" prior to passage of the pipelay barge. An inshore dredge barge would be accurately positioned at all times along the proposed pipeline corridor with a satellite-deployed DGPS operated and supervised by suitably qualified professional surveyors. The barge will be moored in position using either temporary spudded legs or anchors.

Depending on access restrictions for the anchor handling support vessels in the shallowest water zones, it may be temporarily required to operate the barge with a reduced number of anchors. In such a case it may be necessary to use the anchor handling support vessels as tugs to aid barge positioning.

A clamshell dredge grab would be deployed to seabed from a crane on the barge, and an acoustic sonar system would be used to accurately monitor the depth of the ditch dredged. Excavated spoil will be carefully placed adjacent to the ditch formed, and its location will be recorded. Following passage of the pipelay barge, the spoil will be backfilled into the ditch with the same spread of equipment.

Pipeline Installation (Sunshine Skyway Bridge Section)

The primary lay barge would approach the bridge from the east side, bearing west. At a pre-determined station, the barge would blind flange the pipe and lay it on the seafloor. The barge would then reposition 180 degrees, heading due east.

A second, smaller, pull-in barge would be positioned on the west side of the bridge. It is currently anticipated that the shallow water lay barge would be used in this capacity. A pulling wire is passed from the pull-in barge to the primary lay barge, and the wire attached to a pulling head on the section of pipe to be pulled under the bridge. The primary lay barge then begins welding and stalking pipe, which is pulled under the bridge into the pre-cut trench.

Once the pull is complete, the pull-in barge blind flanges the western end of the line and lays the end to the seabed. The pull-in barge is then demobilized. The primary lay barge then repositions on the west side of the bridge, retrieves the pipe, and begins lay away to the offshore location. On the east side of the bridge, a closing spool (used to connect the pipeline section east of the Sunshine Skyway Bridge to the pipe section under the Sunshine Skyway Bridge) will be installed through subsea diving operations.

External Pipeline Protection – Concrete Mattresses

In order to provide equivalent protection and stabilization in areas where burial is not achieved, the use of concrete mattress placement is planned. These areas include the North and South flowlines, the piggable wye, the transition zones at each end of the HDDs, along the transmission pipeline where 3-foot burial is not achieved, and under the Sunshine Skyway Bridge.

The final burial survey will identify any zones where full burial has not been achieved. In such zones, an alternative protection technology would be installed. The primary technique planned is the placement of flexible concrete mattresses. These concrete mattresses will be selected to conform to applicable regulatory requirements and designed to provide an equivalent level of stabilization and protection of the pipeline (**Attachment A.3**, **Drawing 26017-B-4331**).

The concrete mattresses would be installed from a specialist diving support or construction barge that will be moored in position with an anchoring system similar to that of the burial barge. The barge crane and a special deployment frame (**Figure 3-9**) will be used to lift the mattresses and position them on top of the pipeline. Divers or a robotic submersible vehicle would assist with the final positioning and attachment of the mattresses to the pipeline.

Figure 3-9
Concrete Mattress on Deployment Frame

A typical example of a proprietary concrete mattress product widely used for protection of large-diameter pipelines in the Gulf of Mexico is 20 feet (6.1 meters) wide, 8 feet (2.4 meters) long, and 9 inches (23 centimeters) thick. Each mattress weighs 10,500 pounds in air (6,000 pounds submerged). Such mattresses are normally laid together to provide continuous protective cover over the pipeline.

Port Manatee HDD Shore Approach

The HDD operation on the Port Dolphin shore approach would involve drilling from onshore to offshore, ultimately pulling the carrier pipe into the drill bore from the offshore exit site. Employing HDD for the bay to shore transition at Port Manatee offers three distinct advantages over an "open trench" approach:

- It is not environmentally intrusive, as the entry and exit construction sites are temporary in nature and will be restored to pre-construction condition;
- It offers excellent protection for the pipeline from mechanical and/or storm damage; and
- It avoids active industrial areas present on the shore approach.

A drill rig would be positioned at the HDD entry site approximately 1,300 feet (9,396 meters) east of the bulkhead, which would be inside the Port Manatee industrial complex. This drill would be 4,900 feet (91,494 meters) in length. Upon exit from the HDD, the pipeline would be routed northwest into Tampa Bay, in a water depth of 7 feet (2.1 meters) mean low low water (MLLW). The apex of the drill bore curve would be 120 feet (37 meters) below MLLW.

The drilling operation consists of progressively larger drill strings with increasingly larger reamers that are inserted into the pilot hole, ultimately producing a drill bore approximately 48 inches in diameter. As the drilling operation is underway, a jack-up barge would be positioned offshore at the exit station to excavate an "exit" hole. This excavation would be accomplished by either the use of a long-boom backhoe or bucket dredging (refer to description above of trenching method to be utilized under the Sunshine Skyway Bridge).

A teardrop-shaped exit pit would be excavated as an elevation transition to facilitate the pull-in of the line pipe string and the final tie-in to the pipeline. The spoil from the pit(s) would be side-cast and reused later for backfill after the HDD string is tied in to the pipeline. The fluids and muds to be utilized (i.e., water and Super Gel-X® or equivalent) are environmentally-benign and pose no danger to the environment. The exit pits are not constructed or intended for recovery of drilling fluids or muds.

Simultaneously, or even in advance of onshore drilling at Port Manatee, the 36-inch carrier pipe would be constructed onshore in close proximity to the entry point. The carrier pipe would be constructed in several long sections to be welded together once the pull is started. This method is intended to minimize any logistical impacts to Port Manatee operations.

Once the exit pit is constructed, a jack-up barge would be positioned near the pit for the pulling operation. The drilling commences at shore and proceeds until the drill string is punched through at the exit pit. The exit angle would be between 3 and 10 degrees. The definitive exit angle would be determined during detailed design engineering.

A shallow-water diving operation would connect the drill string to the pulling winch on the jack-up barge. The pull wire is retrieved to the entry point, the sections of pipe are positioned in alignment with the entry hole, and the pipeline is pulled offshore to the exit point. At this point, the HDD operation is complete.

East and West HDD Crossings of the Gulfstream Pipeline

In order to avoid potential sand sources, the Port Dolphin pipeline route follows a norteasterly direction through the Southwest Channel. This route still requires the Port Dolphin pipeline to cross the existing Gulfstream pipeline in two locations. The results of an acoustic bathymetric survey conducted in October 2007 by Port Dolphin confirm that the Gulfstream pipeline, also located in the Tampa Bay area, is below or at minimum flush with the natural bottom.

The first crossing would be east of the Sunshine Skyway Bridge causeway in a water depth of 21 feet (6.4 meters). This crossing would be 2,947 feet (898 meters) in length. The second crossing would be west of the Sunshine Skyway Bridge causeway, also in a water depth of 21 feet (6.4 meters). This crossing would be 1,335 feet (407 meters) in length. Other than the difference in total length (due to a difference in crossing angles), the crossing construction requirements are the same for each crossing. There is a 500-foot transition on each end of each HDD where the pipeline exits and enters the seafloor. These transitions are necessary for the pipeline to free stress back under the seafloor to achieve the 3 foot of cover, and therefore these areas will be protected with concrete mattresses to achieve the necessary pipeline protection (**Attachment A.3**, **Drawings 26017-D-4339** through **26017-D 4343**).

For all practical purposes, the water-to-water HDD crossings would be identical to the water-to-land HDD, as would be conducted for the final approach into Port Manatee, with two basic exceptions:

- The crossing would require two jack-up barges in the 200-class range; and
- The depth of the drill below the Gulfstream pipeline would be approximately 20 feet (6.4 meters).

For construction continuity and economy, the two crossings can be drilled while other segments of the pipeline are under construction. To achieve this, the two pull-in strings (or carrier pipes) would be constructed by the lay barge and wet-stored on the seafloor. Both strings would be wet-stored on the north side of the pipeline route, as the pull-in would be from the south side. The strings would not be concrete-coated but would be flooded with filtered and treated seawater. The water, which would be treated with an environmentally-benign corrosion inhibitor (i.e., HydroHib P or equivalent), would be discharged subsea into the bay. Flooding of the pipe is required in order to provide stability on the seafloor. The south end of the west string will be wet-stored approximately 650 feet (198 meters) north of the Gulfstream pipeline within the surveyed corridor. The west end of the east string will be wet-stored approximately 1,500 feet (457 meters) east of the Gulfstream pipeline within the surveyed corridor. Each string would be hydrostatically-tested after installation on the seafloor, prior to tie-in.

The two jack-up barges would work in unison during the drilling operation. A teardrop-shaped exit pit would be excavated on both ends of each crossing, using either the backhoe or bucket dredge methods described previously. The spoil from the pit(s) would be side-cast and reused later for backfill after the HDD string is tied in to the pipeline. The exit pits are constructed as an elevation transition to facilitate the pull-in of the string and the final tie-in to the pipeline. The fluids and muds (i.e., water and Super Gel-X® or equivalent) utilized are environmentally-benign and pose no danger to the environment. The exit pits are not constructed or intended for containment and recovery of drilling fluids or muds.

Upon completion of the drilling operation, the carrier pipe stored on the seafloor is dewatered by a pigging operation. The dewatered carrier pipe is pulled in the drill shaft (reamed hole) utilizing the drill string pipe. Upon completion of the pull-in, the ends of the carrier would be raised to the surface by each of the jack-up barges. On one end, the pulling head would be removed and the end fitted with a temporary pig launcher. The other end would be prepped and fitted with a pig receiver. Both ends would be prepped with swivel flanges mated to the pig launcher and pig receiver assemblies. The string would again be flooded with filtered and treated seawater while awaiting tie-in to the main pipeline.

The HDD process is more fully described in **Attachment A.4**.

Advanced Piggable Wye Installation

A "Y"-shaped pipeline fitting called an advanced piggable wye will be installed in the pipeline to connect the north and south flow lines to the main transmission line to Port Manatee. This fitting is designed to facilitate the pigging and cleaning of lateral subsea pipeline systems that tie into transmission lines. The wye is manufactured from a single carbon steel forging. The fitting consists of two piping inlets, each configured at an angle of 15 degrees from the centerline of the fitting, allowing for a 30-degree angle of entry from the two flow lines. This wye design is capable of bi-directional and/or reverse flow pigging in the mainline of the wye due to a unique diverting mechanism that can be actuated via an external torque bucket by a remotely operated vehicle (ROV) or diver. This design permits bi-directional pigging through both the mainline and the lateral legs of the wye. The design readily accepts all standard pipeline pigs deployed for the initial commissioning of the pipeline and future integrity assessment and maintenance runs.

Upon arrival at the target box (the area where the pipeline is connected to the piggable wye) the pipeline would be laid down on the seabed with a welded flange and lay-down head/pig launcher. The pig launcher is required, as the line must be flooded prior to connecting the wye to the gas transmission pipeline.

At this point, the lay barge installs a "dead man" pile (suction or driven) or anchor for each of the north and south flowlines and lays away from each dead man to construct the two flowline segments off the respective wye tangent. Concrete mattress placement would be used to protect the piggable wye.

Tie-Ins

A tie-in is a section of pipe that has been constructed to "tie" the pipeline together. This tie-in section of pipe is typically described as a "completion spool" that consists of a straight section of pipe with appropriate flanges and connectors on each end used to facilitate the tie-in operation by bolting this completion spool to the carrier pipe. Tying in each pipeline segment is a mechanical operation accomplished with specially designed connectors. It is a manned diving operation and does not require underwater welding. Depending on the construction progress, there may be two or more diving tie-in operations going on at the same time. Subsea tie-in operations are commonly practiced in the pipeline industry.

There are 11 locations where tie-in operations would be required:

1) Port Manatee HDD exit;
2) East HDD crossing (east);
3) East HDD crossing (west);
4) Sunshine Skyway Bridge (east);
5) West HDD crossing (north);
6) West HDD crossing (south);
7) Piggable wye (east);
8) Piggable wye (north);
9) Piggable wye (south);
10) North PLEM; and
11) South PLEM.

Under tie-in scenarios, pipeline protection adjacent to the HDD exits will consist of external protection provided by either backfill of the exit pit spoil or concrete mattress placement.

Pipeline Hydrostatic Testing

Hydrostatic testing is conducted after the entire pipeline has been constructed and all segments have been tied-in and either buried or mechanically protected. The two PLEMs would not yet be connected, and the north and south flowlines would be connected to temporary pig receivers. At this point, the pipeline would be flooded with filtered, treated seawater totaling approximately 12 million gallons.

From the beach side, a gauging pig train is launched to determine that the pipeline does not have any mechanical damage (buckles). This pig run will discharge the 12 million gallons of seawater from within the pipeline. The water, which has been filtered and treated with an environmentally-benign corrosion inhibitor (i.e., HydroHib P or equivalent), would be discharged subsea offshore.

The gauging pig train is pushed with 12 million gallons of filtered (untreated) seawater, so the pipeline is again in a flooded condition. This seawater is supplied via a seawater intake located in Port Manatee. The pig receivers are removed, and the two flowlines are fitted with high-pressure blind flanges. On the beach side, high-pressure compressors are connected to the pipeline. The pipeline is pressurized to 2,200 psi and held for 24 hours. Once the hydrostatic test is complete, the blind flanges are removed from the flowlines and the PLEMs are connected to the flowlines with temporary pig launchers.

At this point, successive dewatering and drying (using dry air) pig trains would be run from onshore to offshore. The water received offshore would not be treated with any chemicals and would be discharged subsea at the PLEM locations. Upon reaching a dew point of -40 degrees, the pipeline would be, certified, commissioned, and ready for service.

Subject to a successful gauging pig run and Florida Department of Transportation (DOT) hydrotest, the pipeline will have been filled and flushed a total of two times, with an approximate total of 24 million gallons of filtered seawater (half of which also is treated with corrosion inhibitor).

PLEMs Installation

After each flowline is laid, the lay barge will deploy each PLEM overboard to a predetermined target box for connection/tie-in by subsea diving operations after the flowline is hydrotested. The PLEMs will be constructed with "mud mats" to ensure horizontal alignment with the flowlines and maximum stability on the seafloor.

Out-of-Service Cable Crossings

For any out-of-service cable crossings encountered, the cable is located, excavated, and cut subsea by divers. Each end is then pulled perpendicular to the route, clear of the pipeline construction corridor.

3.1.2.2 Optional Methods

Below are descriptions of optional construction methods that are not part of Port Dolphin's base case construction plan but could still be considered during future discussions with permitting agencies (i.e., FDEP, USACE, etc.).

Alternative Method of Pipeline Installation (Sunshine Skyway Bridge Section)

An alternative method for installation of the pipeline beneath the Sunshine Skyway Bridge would be to utilize a HDD operation. The HDD process is more fully described in **Attachment A.4**.

Pipeline Lowering – Jetting

Althought jetting was previously considered as an optional construction method, based on the geotechnical survey results, jetting is no longer considered for use during the installation of the Port Dolphin pipeline.

External Pipeline Protection – Rock Armoring

Rock armoring is a common and proven methodology to externally protect pipelines that cannot be buried and backfilled due to extreme soil substrates. A conventional anchor barge is mobilized with hoppers, shakers, and a Tremmie chute, and a natural material, procured locally, is sized to withstand existing ambient current conditions with consideration for storm surge. This material is placed over and around the pipeline through the Tremmie chute from the barge. The operation is monitored by subsurface sonar mounted on the chute. Once the operation is complete, an as-built survey is conducted with side-scan or multi-beam sonar to ensure the engineered cover has been achieved.

3.1.3 Construction Sequence

In general, the Port Dolphin pipeline would be constructed in an onshore to offshore direction through a number of construction phases and critical path activities. The construction phases may be conducted concurrently or, in several cases, in parallel. Once mobilized, the construction activity would be 24 hours per day, 7 days per week, including nationally recognized holidays.

The pipeline would be laid in a dry condition. During all tie-in operations (11), the pipeline would be in a flooded condition. Whenever the pipeline or a section of it is to be flooded, it would be flooded with filtered seawater and treated with an environmentally-benign water treatment (with the exception of the hydrotest, for which the water would be filtered but not treated).

The major phases and activities that would occur are listed below:

- Mobilization – The majority of the construction assets and support vessels would be mobilized from bases in Louisiana or Texas. The mobilization would be staggered, as the travel times to the Tampa Bay location would be different for each asset;
- Port Manatee HDD – As this is an onshore to offshore drill, with an onshore to offshore pull, this phase requires only the support of one 200-class jack-up barge;
- HDD Carrier Pipe – The carrier pipe for both the east and west crossings would be constructed by the primary lay barge and wet-stored in a flooded condition;
- Sunshine Skyway Bridge Dredging – The trench under the causeway would be dredged with the clamshell or bucket-dredge barge;
- Port Manatee HDD Tie-In – Upon completion of the Port Manatee HDD, the shallow water lay barge would initiate pipelay from a "dead man" anchor, laying out to a water depth of approximately 15 feet (4.6 meters);
- East and West HDD Crossings – Both crossings would be drilled simultaneously with the support of two jack-up barges per HDD location;
- Sunshine Skyway Bridge Pipe String – Once the causeway dredging is complete, the causeway pipe string is constructed and pulled through the causeway section (into the pre-dredged trench) using the primary lay barge and the shallow water lay barge (pull-in);
- Pipeline Segments – Upon completion of the east and west HDD drilling, the pipelay segments are sequentially installed with the shallow water and primary lay barges from the Port Manatee tie-in to the west crossing. At this point, the four drilling support jack-up barges are demobilized;
- Pipe Lay – Following installation of the sections between the crossings, the primary lay barge picks up the pipeline south of the west crossing and commences lay through Southwest Channel and towards the piggable wye;
- Diving Operations – During the deepwater pipelay operation, diving operations commence to complete the tie-ins at the three HDD sites and the Sunshine Skyway Bridge, and the shallow water barge is demobilized;
- Pipe Lay – Pipe installation proceeds to the lay down at the piggable wye location, and continues to lay the north and south flowlines on the seafloor;

- Wye tie-in – At this point, divers tie-in the two flowlines and the main line to the piggable wye, and three of the four diving spreads are demobilized;
- Burial Operations – Upon completion of all tie-in operations, burial and backfill operations would commence, including plowing or placement of concrete mattresses for the sections to be externally armored (where necessary). The primary lay barge is reconfigured to support burial operations, and the remaining diver support barge is employed in the mattressing operations. Following completion of the burial operations, the primary lay barge is demobilized;
- Gauging and Testing – Upon completion of the burial operations, the physical integrity of the pipeline is proven with a gauging pig train. Upon completion of the gauging pig run, the line is hydrostatically tested. Gauging and testing are done prior to installation of the PLEMs;
- North and South PLEMs – Upon completion of the hydrostatic test, the two PLEMs are installed and equipped with pig receivers;
- Drying – Dry the pipeline to -40° dew point with air. The drying pig runs would be from onshore to offshore;
- As Built – As the final testing and commissioning is ongoing, the final as-built survey would be conducted; and
- Demobilization – All remaining assets are demobilized.

3.1.4 Identification of Construction Methods by Segments

It should be noted that under any installation scenario contemplated, the installation of the Port Dolphin pipeline and associated infrastructure would be conducted in compliance with all local, State, and Federal regulations, including those governing safety, environmental, and socioeconomic considerations.

The offshore section of Port Dolphin's gas transmission pipeline and flow lines would be fully protected and stabilized throughout the entire length in accordance with all applicable regulatory requirements. Where possible, the burial technique would be used. The pipeline would be lowered into a ditch to a point where the top of the pipeline is at a target depth of 3 feet (0.9 meters) below seabed level and then backfilled.

In certain areas of the offshore pipeline route, full burial would likely not be achievable because the geophysical and geotechnical survey data collected by Port Dolphin to date has indicated localized occurrences of hard bottom conditions that could be impenetrable with a plow. Port Dolphin has analyzed the geophysical and geotechnical survey results for both the Revised Preferred Route and the Alternative Route around Sand Resources, and the construction plan and planned burial methods are based on the results of the analysis (*Confidential* **Attachment B.3**). In order to provide equivalent protection and stabilization in areas where burial is not achieved, the use of proven external protection techniques such as concrete mattress placement is planned.

Table 3-1 presents a detailed identification of construction methods applicable to segments of Port Dolphin's offshore gas transmission pipeline. In addition, the offshore pipeline alignment sheets presented in **Attachment A.3** (**Drawings 26017-D-2001** through **26017-D-207** and **26017-D-2031** through **26017-D-2033**) include a graphic representation of these construction methods by segments.

Information in the previously submitted **Table 4.1** in **Addendum I**, **Section 4** was based on geophysical data alone to determine how the pipeline might be buried. The Final Geotechnical Survey Report (**Attachment B.3**) for the Revised Preferred Route was completed and submitted to the USCG in October 2008. Port Dolphin has conducted an additional geotechnical survey of the Alternative Route around Sand Resources to obtain data for determining construction methods (**Attachment B.3**). The re-route of the Port Dolphin pipeline was done in order to avoid potential sand resources. The final report for the recent geotechnical survey of the Alternative Route around Sand Resources is expected to be submitted in January 2009. **Table 3-1** presents revised information based on the results of the geotechnical survey performed for both the Revised Preferred Route and the Alternative Route around Sand Resources and geophysical survey results for the Alternative Route around Sand Resources.

The Deepwater Port Act and its regulations state that a deepwater port license for a proposed project requires the approval of the adjacent coastal state's governor, 33 U.S.C. § 1508(b)(1), and that an applicant must prepare and submit applications to State agencies requiring permits. 33 C.F.R § 148.700(b). The information contained in the geotechnical survey report will allow FDEP to complete an administrative review of Port Dolphin's project-wide Environmental Resource Permit (ERP) application concurrently with the Coastal Zone Management consistency review of the National Environmental Policy Act (NEPA) FEIS being prepared for this project. Port Dolphin expects these reviews would provide FDEP with all elements necessary for providing a recommendation to the Florida Governor.

Port Dolphin would review the results of the geotechnical survey and incorporate any necessary construction plan adjustments in consultation with FDEP and the USACE during the ERP and Section 10/404 permit proceedings.

3.2 Submerged Turret Loading (STL) Buoy Installation

The STL buoy installation methods have not changed; for the description of the STL installation, see **Addendum I, Section 4.2**.

3.3 Onshore Construction Plan

This section covers the Onshore Construction Plan for the Port Dolphin pipeline, located in Manatee County, Florida. The only new information presented here is for changes in the Construction Plan. The subsections below describe two changes (i.e., one additional slick bore under 31st Terrace East Road, and a modification of the slick bore design under Buckeye Road). The rest of the Onshore Construction Plan is definitive, and the appropriate sections in **Addendum I** are being referenced.

Table 3-1
Identification of Base Case Construction Methods by Offshore Pipeline Segments[(1)]

Segment Description		Pipeline Station Numbers		Segment Lengths				
		Start	End	Plow (feet)	Plow/Mattress (feet)	Mats/Rock (feet)	HDD (feet)	Causeway Clamshell Dredging (feet)
North Flow Line	Transition spool	0+00.00	00+21.00			21.00		
	North flowline	00+21.00	104+36.93			10,415.93		
	Transition spool	104+36.93	104+61.93			25.00		
	Piggable wye					21.00		
South Flow Line	Transition spool	0+00.00	00+21.00			21.00		
	South flowline	00+21.00	109+59.82			10,938.82		
	Transition spool	109+59.82	109+84.82			25.00		
	Piggable wye					21.00		
Transmission Line	Transition spool	0+00.00	00+25.00			25.00		
	Transmission line	00+25.00	50+00.00	4,975.00				
	Transmission line	50+00.00	760+00.00		71,000.00			
	Transmission line	760+00.00	923+51.02	16,351.02				
	Federal/State Boundary							
	Transmission line	923+51.02	945+00.00	2148.98				
	Transmission line	945+00.00	1000+00.00		5,500.00			
	Transmission line	1000+00.00	1642.94.20	64,294.20				
	HDD exit transition spool	1642+94.20	1647+94.20			500.00		
	HDD west crossing	1647+94.20	1661+29.20				1,335.00	
	HDD entry transition spool	1661+29.20	1666+29.20			500.00		
	Transmission line	1666+29.20	1905+09.38	23,880.18				
	Transmission line	1905+09.38	1916+13.86					1,104.48
	Transmission line	1916+13.86	1974+68.67	5,854.81				
	HDD exit transition spool	1974+68.67	1979+68.67			500.00		
	HDD east crossing	1979+68.67	2009+15.36				2,946.67	
	HDD entry transition spool	2009+15.36	2014+15.36			500.00		
	Transmission line	2014+15.36	2139+08.19	11,992.83				
	Transmission line	2139+08.19	2177+92.19			4,384.00		
	HDD exit transition spool	2177+92.19	2182+92.19			500.00		
	HDD shore approach to bulkhead	2182+92.19	2218+64.67				3,572.48	

[(1)]Assumptions
1 Plowed areas will be between 3 feet below natural bottom to less than 1 foot below natural bottom. (Areas with less than 3 feet will require external protection).
2 Transition areas for the tie ins will be mats and/or rock.
3 It is assumed that the pipeline under the causeway will be lowered in a trench constructed by clamshell dredging. The option would be to construct this segment with horizontal directional drilling (HDD).
4 Wye will be externally protected by mats.

3.3.1 Identification of Onshore Construction Equipment

The construction equipment to be used for onshore construction has not changed. For the description of construction equipment, see **Addendum I**, **Section 4.3.1**.

3.3.2 Description of Construction Methods

The descriptions of the construction methods to be used for the onshore pipeline have not changed. For the description of these construction methods, see **Addendum I**, **Section 4.3.2**.

3.3.3 Construction Sequence

The construction sequence of the onshore construction has not changed. For the description of construction sequence, see **Addendum I**, **Section 4.3.3**.

3.3.4 Description of Construction Methods by Segment

Table 3-2 identifies the construction methods that Port Dolphin proposes to use along all onshore pipeline route segments.

Table 3-2
Onshore Pipeline Construction Methods by Segment

Location	Construction Method
Revised Route through Port Manatee	
Conveyance Ditch in Port Manatee	Open trench & joint-by-joint stalking
Reeder Road Crossing	Slick bore (uncased)
Revised Route from Port Manatee to Interconnection Station	
South Across Florida Power & Light Company (FPL) Property	Open trench
Across FPL Tank Farm	Horizontal directional drilling
South Across JJC-Port Manatee and FPL Properties	Open trench
CSX Railroad Crossing	Uncased dry jack & bore
East Across FPL Property (West of US 41)	Open trench
US41 Crossing	Slick bore (uncased)
East Across FPL Property (East of US 41)	Open trench
North Across FPL Property (East of US 41)	Open trench
East Across Scannel Revex, LLC Property (FedEx Facility)	Open trench
31st Terrace East Crossing	Slick bore (uncased)
East Across Port Manatee Industrial Park, LLC Property	Open trench
Bud Rhoden Road Crossing	Open trench
East Across Tami Sola Property	Open trench
Oneil Road Crossing	Slick bore (uncased)
North Across Gene Citrus Property	Open trench
Buckeye Road Crossing	Slick bore (uncased)

Attachment A.3, **Drawings 26017-B-2321** and **26017-B-2320**, present the two changes to the onshore pipeline route, which include a modified slick bore across Buckeye Road and an additional slick bore to cross 31st Terrace East Road, is a new county road constructed to support a new FedEx facility along the pipeline route.

Port Dolphin will conduct a comprehensive site survey of this proposed route prior to detailed design and construction. In addition, Port Dolphin will continue coordinating with property and facility owners during development of the detailed engineering design.

3.3.4.1 Route through Port Manatee

The route through Port Manatee has not changed. For the description of construction methods, see **Addendum I, Section 4.3.4.1**.

3.3.4.2 Revised Route from Port Manatee to Interconnection Station

This onshore pipeline route segment has been developed in consultation with key property owners (i.e., FPL, Buckeye Industrial, and the Mock family). The design of this onshore pipeline route segment requires consideration of existing facilities and property development plans. Port Dolphin remains committed to continue working closely with property owners to coordinate development of the detailed pipeline engineering design.

South across FPL Property

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

South across FPL Tank Farm

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

South across JJC-Port Manatee and FPL Properties

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

Crossing of CSX Railroad

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

East across FPL Property (West of US 41)

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

US 41 Crossing

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

East across FPL Property (East of US 41)

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

North across FPL Property (East of US 41)

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

East across 31st Terrace East Road

This segment is being added due to the construction of a new road not related to this project. The Port Dolphin pipeline would cross 31st Terrace East Road horizontally. Port Dolphin proposes to use the slick bore method to install an uncased crossing under 31st Terrace East Road. This method is an accepted method for crossing roads without a casing. This uncased slick bore is designed to begin approximately 43 feet (13 meters) west of the center line of 31st Terrace East Road and would be approximately 15 feet (4.6 meters) deep over a length of 94 feet (29 meters). After crossing 31st Terrace East Road, the slick bore will terminate 51 feet (15 meters) east of the centerline of 31st Terrace East Road back onto Port Manatee Industrial Park, LLC (**Attachment A.3**, **Drawing 26017-D-2320**).

East across Buckeye Industrial Property

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

Bud Rhoden Road Crossing

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

East across Tami Sola Property

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

Oneil Road Crossing

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

North across Gene Citrus Property

This segment will be constructed as described in **Addendum I**, **Section 4.3.4.2**.

North across FPL Powerlines and Buckeye Road

The FPL powerline right-of-way (ROW) is 170 feet (52 meters) wide. In order to avoid any contact with the existing FPL overhead powerlines, Port Dolphin proposes to cross both the FPL easement and Buckeye Road with a single uncased slick bore crossing. In addition, during discussions with Manatee County, Port Dolphin was informed of the potential future widening of Buckeye Road to a maximum of 150 feet (46 meters). To accommodate for this change, the slick bore across that road has been lengthened to 310 feet (95 meters), which modified the entrance and exit points of the slick bore as well as its angle across the road. This uncased slick bore is designed to begin approximately 200 feet (61 meters) south of Buckeye Road and will be approximately 15 feet (4.6 meters) deep and 310 feet (95 meters) long (**Attachment A.3**, **Drawing 26017-D-2321**). Once across Buckeye Road, the pipeline enters the Mock family property (which Port Dolphin holds an option for a portion of), where it would be terminated at a pig receiver (**Attachment A.3**, **Drawing 26017-D-4105**).

3.3.4.3 Construction of Interconnection Station

The interconnection station will be constructed as described in **Addendum I**, **Section 4.3.4.3**.

3.4 Construction Schedule

On-site construction activities in Tampa Bay will occur as described in **Addendum I**, **Section 4.4**. A more detailed schedule encompassing offshore and onshore construction activities was included in **Addendum I**, *Confidential* **Attachment B.6**.

4. WATER QUALITY

This section addresses water quality impacts associated with the Preferred Route Modification offshore the mouth of Tampa Bay. The Preferred Route Modification was developed to avoid passing through a permitted borrow area (Borrow Area IX) used by the Town of Longboat Key as a sand source for beach renourishment projects. In designing this Alternative Route around Sand Resources, attention was given to avoiding, to the maximum extent possible, all other potential sand sources identified in this area. Water quality impacts related to the re-routing of the pipeline corridor to avoid or minimize intruding upon offshore sand resources are described in the following sections.

4.1 Existing Conditions

Water quality along the pipeline route has been described in **Volume II**, **Section 3.2** of the **Deepwater Port Application**. Water quality along the section of the pipeline re-routed around the Terra Ceia Aquatic Preserve has been described in **Section 5** of **Addendum I** to the **Deepwater Port Application**. The only new information presented here is for water quality along the portion of the pipeline re-routed to avoid offshore sand resources.

The Preferred Route Modification would diverge from the Revised Preferred Route at 27° 31’ 17.505” N, 82° 48' 41.548" W, turning north to avoid Borrow Area IX as well as the potentially high volume sand shoal within which the borrow area is located. The Preferred Route Modification then proceeds east-northeast, entering Outstanding Florida Waters (OFW) at approximately 27° 33’ 43.1” N, 82° 45’ 7.1” W. After passing through OFW for approximately 2.58 miles (4.16 kilometers), the Preferred Route Modification then converges with the Revised Preferred Route, continuing through OFW for approximately 0.64 miles (1.03 kilometers) before exiting. The total distance the Preferred Route Modification would pass through OFW is approximately 3.24 miles (5.19 kilometers) (**Figure 4-1**).

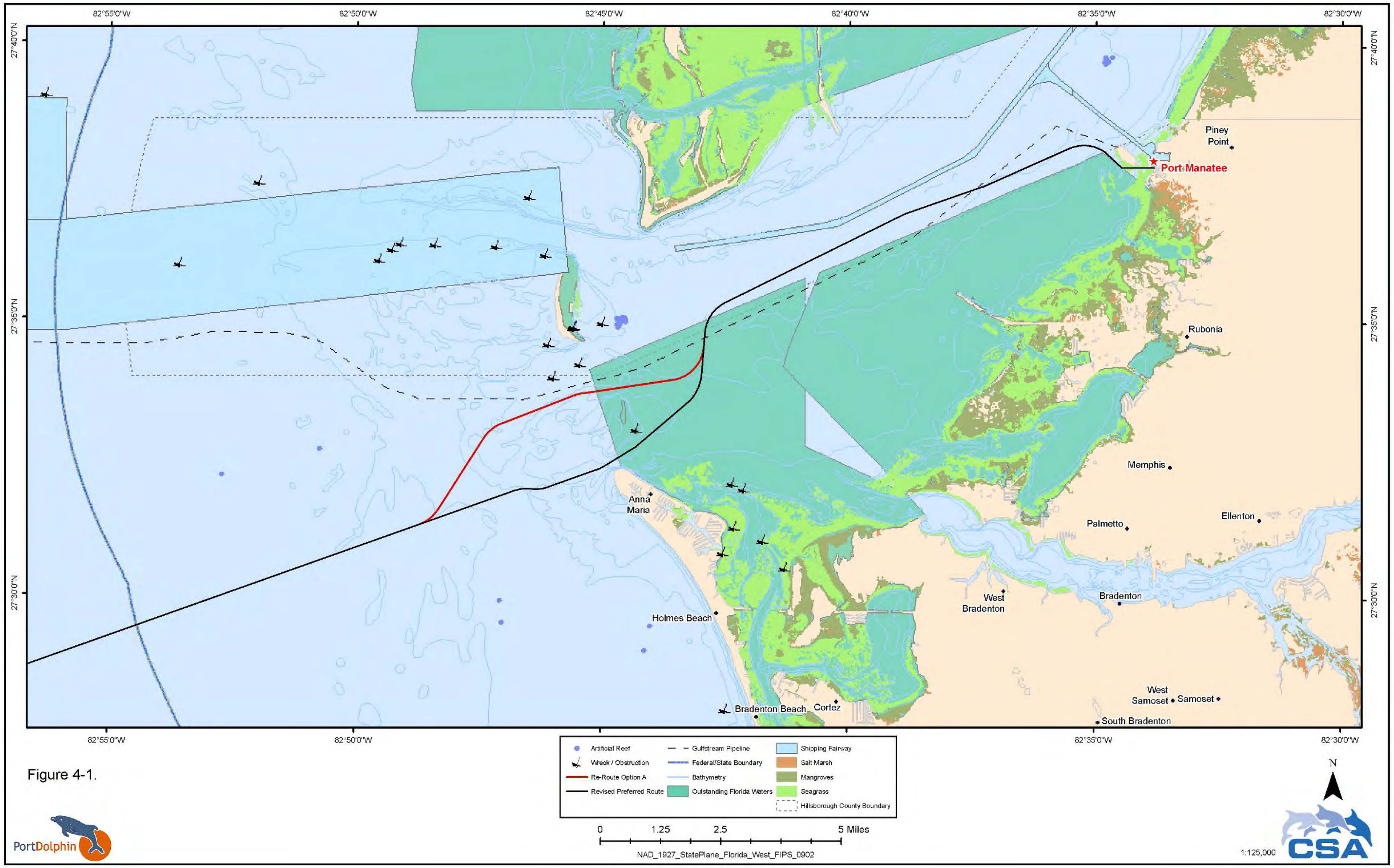
4.2 Analysis of Potential Consequences

The following new or revised activities (project design changes) are included in this impact analysis:

- **<u>Alternative Route around Sand Resources</u>** – The pipeline corridor offshore the mouth of Tampa Bay has been re-routed to avoid a permitted borrow area and to reduce impacts to other potential sand sources in the area.

In addition to these changes, impacts of pipeline installation along the entire Revised Preferred Route have been re-evaluated based on the Preferred Route Modification.

Figure 4-1
Portions of the Preferred Route Modification Passing through Outstanding Florida Waters



The following impact-producing factors are relevant to the project design changes:

- **Turbidity Due to Sediment Resuspension –** The extent and location of seafloor disturbance and turbidity offshore the mouth of Tampa Bay during pipeline installation have changed due to re-routing of the pipeline to avoid offshore sand resources.

The following impact-producing factors are not analyzed in detail in this **Addendum II**, either because they are irrelevant to the project design changes or they would not differ in any meaningful way from those previously discussed in the **Deepwater Port Application** or in **Addendum I**:

- **Discharges from Construction Vessels** – The proposed project design change would not alter the discharges from construction vessels, since the vessels used would be the same or similar and would have the same operating mitigation measures required.

- **Operational Seawater Intakes** – The proposed project design change would not alter the operational seawater intake and discharge process described in the **Deepwater Port Application**.

- **Hydrocarbon Spill or Natural Gas Release** – The proposed project design change would not significantly alter the potential for an accidental hydrocarbon spill or natural gas release.

- **Sediment Quality** – The proposed project design change would not alter the existing sediment quality in the project area.

- **Hydrostatic Test Discharges** – The volume of hydrostatic test water will be basically the same as the original estimate, as the reduction in pipeline length (92 feet [28 meters]) is insignificant. There are no changes to the anticipated discharges during construction, operations, or decommissioning.

- **Turbidity Due to Excavation of HDD Entrance and Exit Pits and Bridge Crossing** – The proposed project design change would not alter either the number or location of HDDs. HDD methods also remain the same.

Water quality offshore the mouth of Tampa Bay is described in **Volume II**, **Section 3.2.2.2** of the **Deepwater Port Application**. Impacts discussed here are those resulting from direct physical disturbance to the seafloor during plowing of the seafloor, placement of concrete mattresses, and anchoring of barges during construction activities.

An impact on water quality is considered significant if it is likely to result in violation of discharge regulations or ambient water quality standards. The relevant discharge regulations for operational discharges from the shuttle regasification vessels (SRVs) while in port, as well as hydrostatic test discharges, will be specified in the National Pollutant Discharge Elimination System (NPDES) permit from the U.S. Environmental Protection Agency (USEPA). For construction and support vessels, USCG discharge regulations apply, which also ensures compliance with international guidelines (e.g., the International Convention for the Prevention of Pollution from Ships [MARPOL]). Relevant ambient water quality standards include the USEPA (1986) standards for Federal waters, and State of Florida standards (Florida Administrative Code [F.A.C.] Chapter 62-302) for those portions of the pipeline route in State waters. Much of the pipeline route passes through Class III marine waters; portions of lower Tampa Bay, however, are classified as OFW, which have more stringent standards. The most important difference is that Class III standards allow turbidity <29 nephelometric turbidity units (NTUs) above natural background conditions, whereas OFW standards prohibit discharges that would lower ambient water quality. A temporary variance to temporarily lower water quality during construction activities (with special restrictions) will be applied for in order to avoid potential non-compliance.

4.2.1 Construction

Turbidity from Seafloor Disturbance – Pipeline Installation. The areal extent of seafloor disturbance during pipeline installation has decreased by 92 feet (28 meters) due to re-routing of the pipeline around Borrow Area IX and other potential sand sources. Also, the specific location of some impacts offshore the mouth of Tampa Bay has changed due to the re-routing.

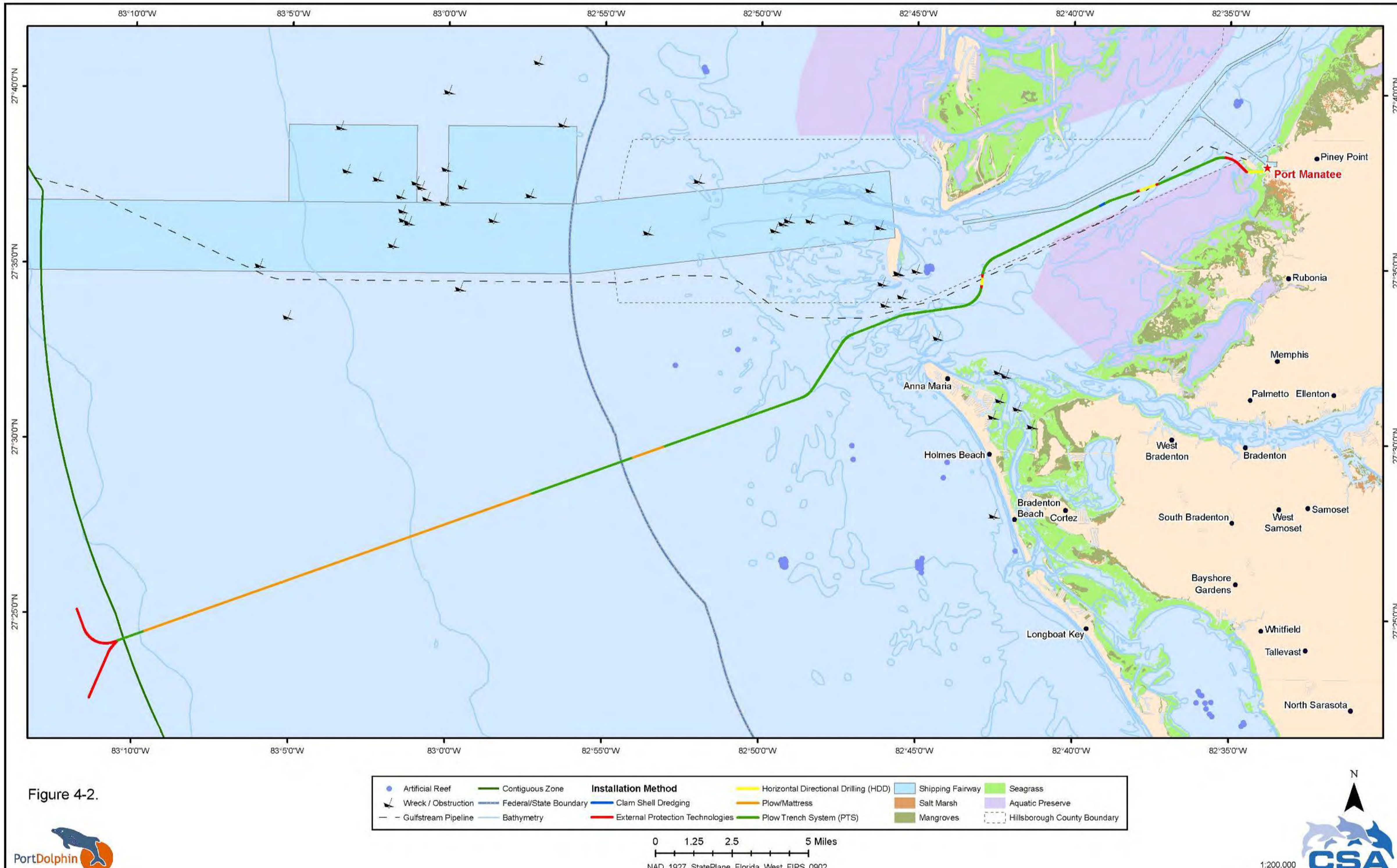
Plowing and Mattress Placement – Pipeline installation will be the greatest source of turbidity. Plowing is the preferred methodology for pipeline burial, and the baseline installation methods presented include 87% (205,997 feet [62,804 meters]) of the pipeline to be laid on the seafloor by a pipelaying barge and then buried (**Figure 4-2**). It is expected that in some plowed areas, the plow may not achieve burial to the design depth, in which case these areas subsequently would be covered by concrete mattresses or rock armoring. Although plowing is the preferred methodology for pipeline burial, other techniques, such as dredging and HDD, will be used in certain areas. External protection with concrete mattresses or other armoring will be used where full burial is not achieved by plowing.

For the portions of the pipeline that are trenched with the plowing technique, it is expected that turbidity levels would not exceed the Florida Class III Marine water quality criterion of 29 NTU above natural background. A temporary variance will be applied for to ensure that there is no violation.

Although jetting is not anticipated to be used, it has been discussed here in the event it ultimately is needed during installation. For conventional pipeline jetting, it has been estimated that about 6,540 cubic yards (5,000 cubic meters) of sediment is re-suspended for each kilometer of pipeline jetted MMS, 2001). The plowing method is expected to produce much less turbidity, but the amount of re-suspension has not been quantified.

Anchoring – During pipeline installation, the installation vessels will require anchor placement, which is a source of turbidity. The Preferred Route Modification eliminates only 92 feet (28 meters) from the Revised Preferred Route; the minimum anchor reset distance is 1,000 feet (305 meters), which is for the smaller barge that places the concrete mattresses. As a result, there is expected to be no change in the number of anchor re-sets along the route.

Figure 4-2
Pipeline Installation Methods along the Preferred Route Modification



Each barge anchor cable also may contact (sweep) the seafloor. During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard bottom. Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep.

A portion of the Preferred Route Modification passes through OFW, although to a slightly lesser extent than the Revised Preferred Route (**Figure 4-1**). OFW standards prohibit discharges that would lower ambient water quality, although there is a provision for temporary lowering of water quality during construction activities (with special restrictions). Turbidity curtains and/or other mitigation measures may be used as practicable to ensure that the installation complies with OFW standards. A temporary variance will be applied for to ensure that there is no violation.

4.2.2 Operations

None of the project changes would significantly alter the potential impacts of operations on water quality as discussed in the **Deepwater Port Application**, **Section 3.3.1.1**.

4.2.3 Decommissioning

None of the project changes would significantly alter the potential impacts of decommissioning on water quality as discussed in **Deepwater Port Application**, **Section 3.3.1.1**.

4.2.4 Accidents and Upsets

None of the project changes would significantly alter the potential impacts of accidents or upsets on water quality as discussed in **Deepwater Port Application**, **Section 3.3.1.1**.

4.3 Summary of Potential Impacts and Mitigation

Table 4-1 summarizes the impact characteristics for water and sediment quality. Potential impacts are rated as significant, minor, or negligible according to the following criteria:

- **Significant –** An impact is significant if it is likely to result in violation of discharge regulations or ambient water quality standards, or elevated concentrations of metals, hydrocarbons, or other sediment contaminants.
- **Minor –** changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible –** changes that are unlikely to be noticed or measurable against background conditions.

Table 4-1 also summarizes the effect of project design changes and categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible.

Table 4-1
Summary of Impacts to Water and Sediment Quality

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Water Quality					
Construction *Pipeline Installation*	Seafloor disturbance would cause turbidity/reduced water clarity due to suspended sediments during pipeline installation (plowing and trenching of seafloor, anchoring of barges, and placement of pipeline and mattresses)	Areal extent of turbidity should remain similar to original route because change in pipeline length is insignificant	• Localized • Certain • Direct • Reversible	Minor for turbidity	• Use of a plow (where feasible) to bury the pipeline will produce much less turbidity than conventional jetting or dredging because it does not fluidize bottom sediments • Where the pipeline route passes through Outstanding Florida Waters (OFW), turbidity curtains or other mitigation measures will be used, as practicable, to avoid water quality impact • Monitoring will be done during pipeline trenching to ensure compliance with water quality standards • A temporary water quality variance from OFW will be applied to ensure no violations
Vessels	*No change*	*No change*	*No change*	*No change*	*No change*
Routine Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Sediment Quality					
Construction	*No change*	*No change*	*No change*	*No change*	*No change*
Routine Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Water quality and sediment impacts related to the Preferred Route Modification would not be very different from the Revised Preferred Route impacts. The main impact to water quality would be turbidity and reduction in water clarity due to sediment re-suspension caused by disturbance of the bottom. Water quality degradation would be most prevalent during pipeline installation and only in the general vicinity of where a pipe was being laid. Use of a plow to bury 95% of the pipeline would minimize turbidity compared to jetting or dredging methods.

Although the Preferred Route Modification would pass through a slightly smaller area of OFW than the Revised Preferred Route, utmost care will be taken when laying the pipeline in this vicinity of OFW to ensure any impact is minimized. Any increase in turbidity in this area would be a violation of OFW standards. Turbidity curtains and/or other mitigation measures may be used to comply with OFW standards. A temporary variance will be applied for to ensure that there is no violation. With careful mitigation and monitoring, no violation of water quality standards is expected, and water quality impacts would be considered negligible to minor. While laying the pipeline, anchoring and pipeline systems would temporarily disrupt seafloor habitat. Upset would be localized and temporary. No mitigation would be required, as sediment would soon re-settle.

5. MARINE RESOURCES

5.1 Existing Conditions

Marine resources at the offshore terminal site and along the Original Preferred Route have been described in **Volume II**, **Section 4.2** of the **Deepwater Port Applicatio**n. Marine resources along the nearshore re-route around the Terra Ceia Aquatic Preserve (Revised Preferred Route) have been described in **Section 6** of **Addendum I**. The only new information presented here is for benthic communities along the Alternative Route around Sand Resources. The pipeline route with all revisions incorporated is termed the Preferred Route Modification.

5.1.1 New Photodocumentation Survey

A photodocumentation survey of the Alternative Route around Sand Resources was conducted from 23 July through 4 August 2008 and again on 16 October 2008 with a towed underwater camera system (**Attachment A.2**). Qualitative video and still photographs of the seafloor were collected along 49 transects within the survey area (**Figure 5-1**). The spacing between transect lines was 656 feet (200 meters). Some of the northern transect lines crossed over the existing Gulfstream pipeline and a high relief sand shoal and therefore were not surveyed. Plan-view photographs were collected approximately every 656 feet (200 meters) to meet Federal and State requirements for photodocumentation. After the towed camera surveys, divers collected quantitative still photographs at eight locations within mapped areas of hard bottom habitat.

Based on the survey, benthic habitats were categorized based on the FDEP "Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida," as follows:

- **Type A** – defined as 20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 feet (0.25 meters) in relief, inclusive of sand components integral to these habitats.
- **Type B** – defined as 5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 feet (0.25 meters) in relief, inclusive of sand components integral to these habitats.
- **Type D** – defined as sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage.
- **Soft substrate/sand** – defined as soft substrate/sedimentary habitats not associated with hard bottom ecotones.

Representative photographs that illustrate the habitat types are shown in **Figure 5-2**.

Figure 5-1
Survey Lines for Alternative Route around Sand Resources

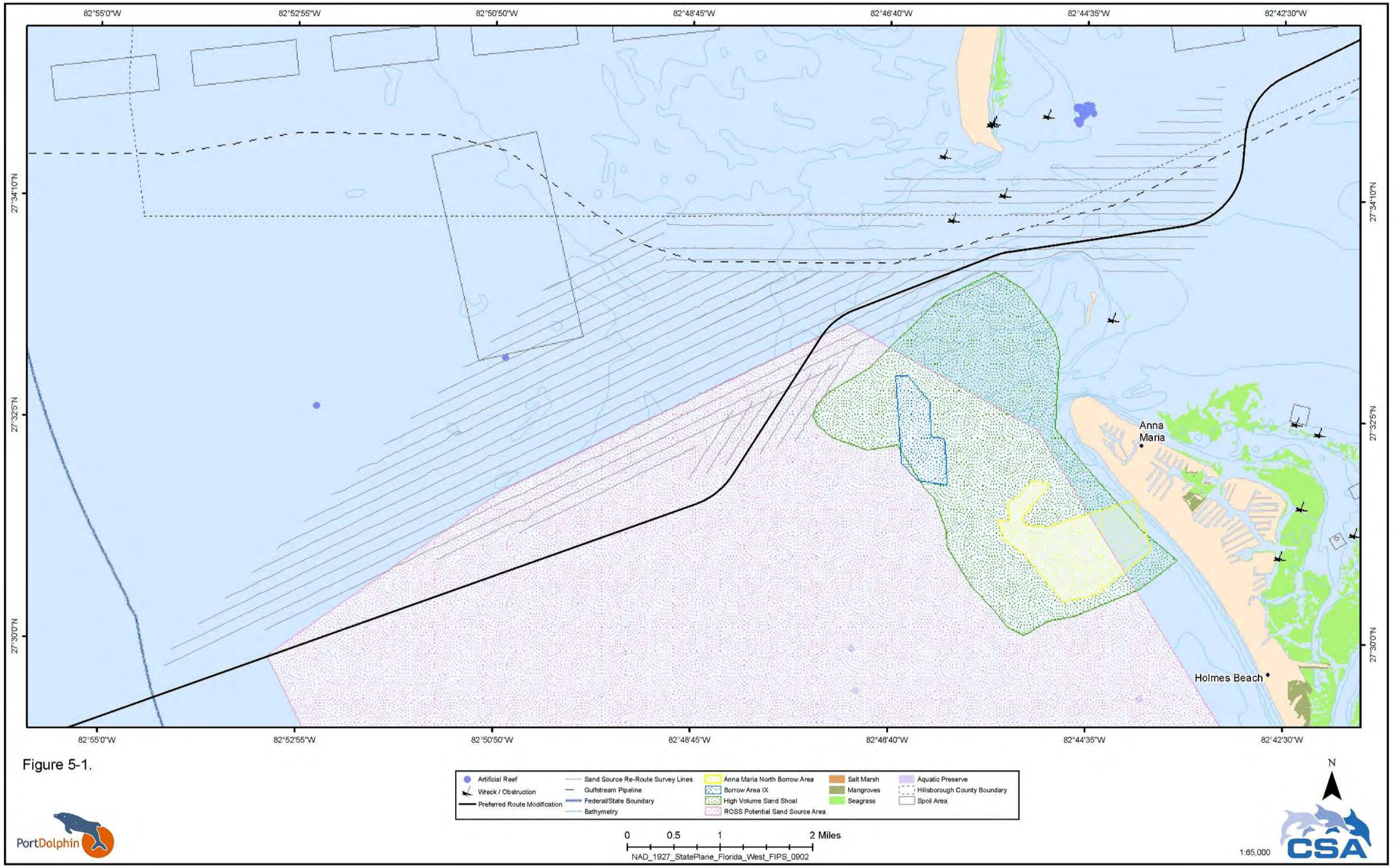
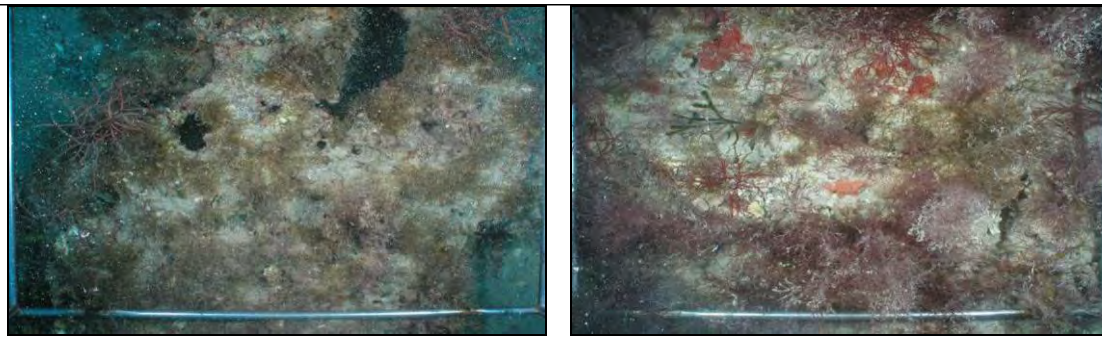


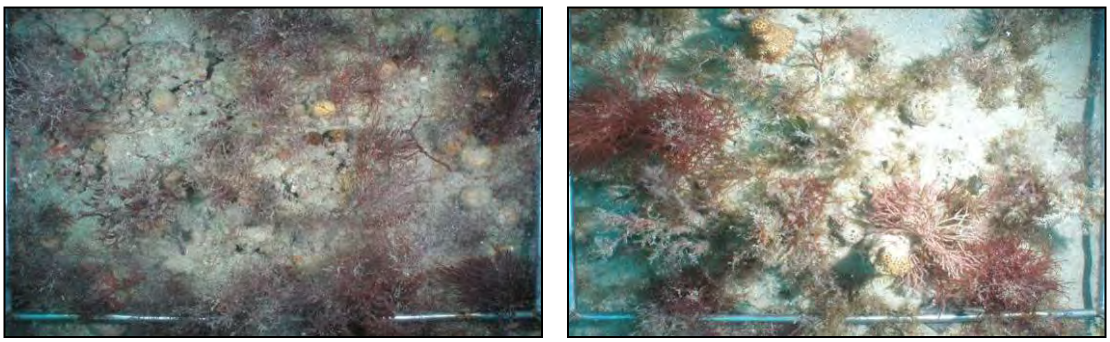
Figure 5-2
Representative Photographs of Habitat Types

a)



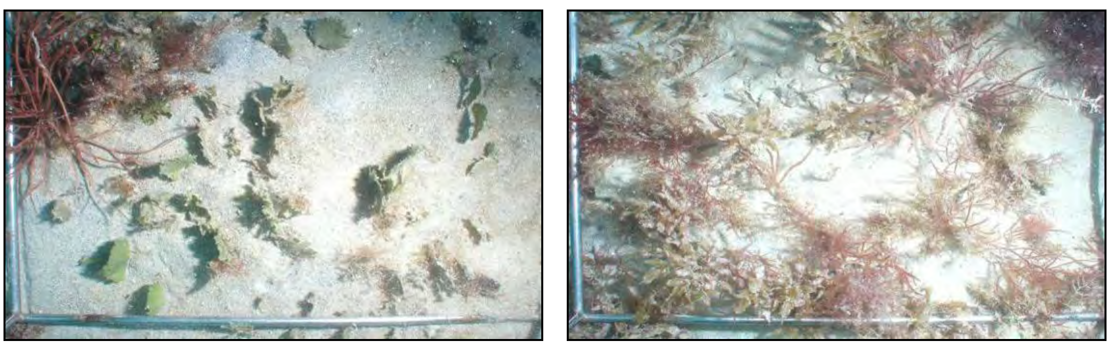
Type A habitat.

b)



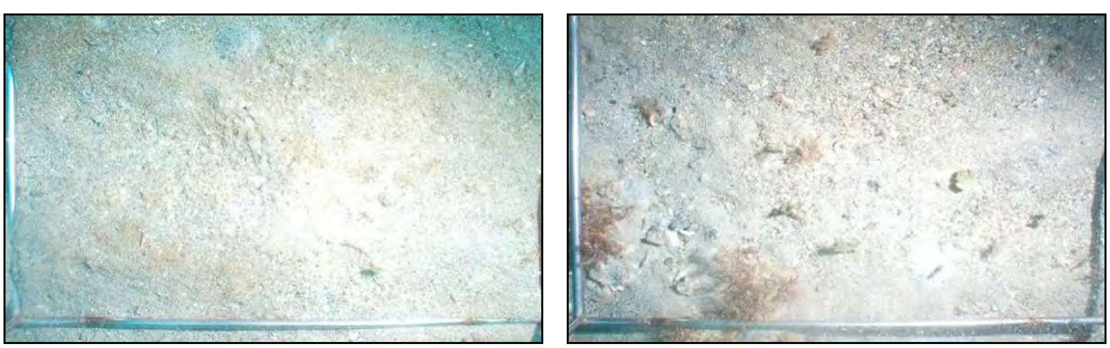
Type B habitat.

c)



Type D habitat.

d)



Soft substrate/sand habitat.

The total survey area was 12,399.1 acres (5,017.9 hectares). **Figure 5-3** shows the distribution of benthic habitats within the area. These habitat polygons are determined by extrapolating data collected between the survey lines and represent a very conservative estimate of the habitats present within the survey area. The survey mapped 410.41 acres (166.09 hectares) of Type A habitat, 203.34 acres (82.29 hectares) of Type B habitat, 706.25 acres (285.81 hectares) of Type D habitat, and 11,079.10 acres (4,483.55 hectares) of soft substrate/sand habitat. Most of the survey area was soft substrate/sand habitat (89%), with small and patchy clusters of Type A, Type B, and Type D habitats (combined total of 11%). Most Type A habitats were identified near the southern end of Egmont Key and at the offshore end of the survey corridor.

5.1.2 Habitat Areas – Alternative Route around Sand Resources Corridor

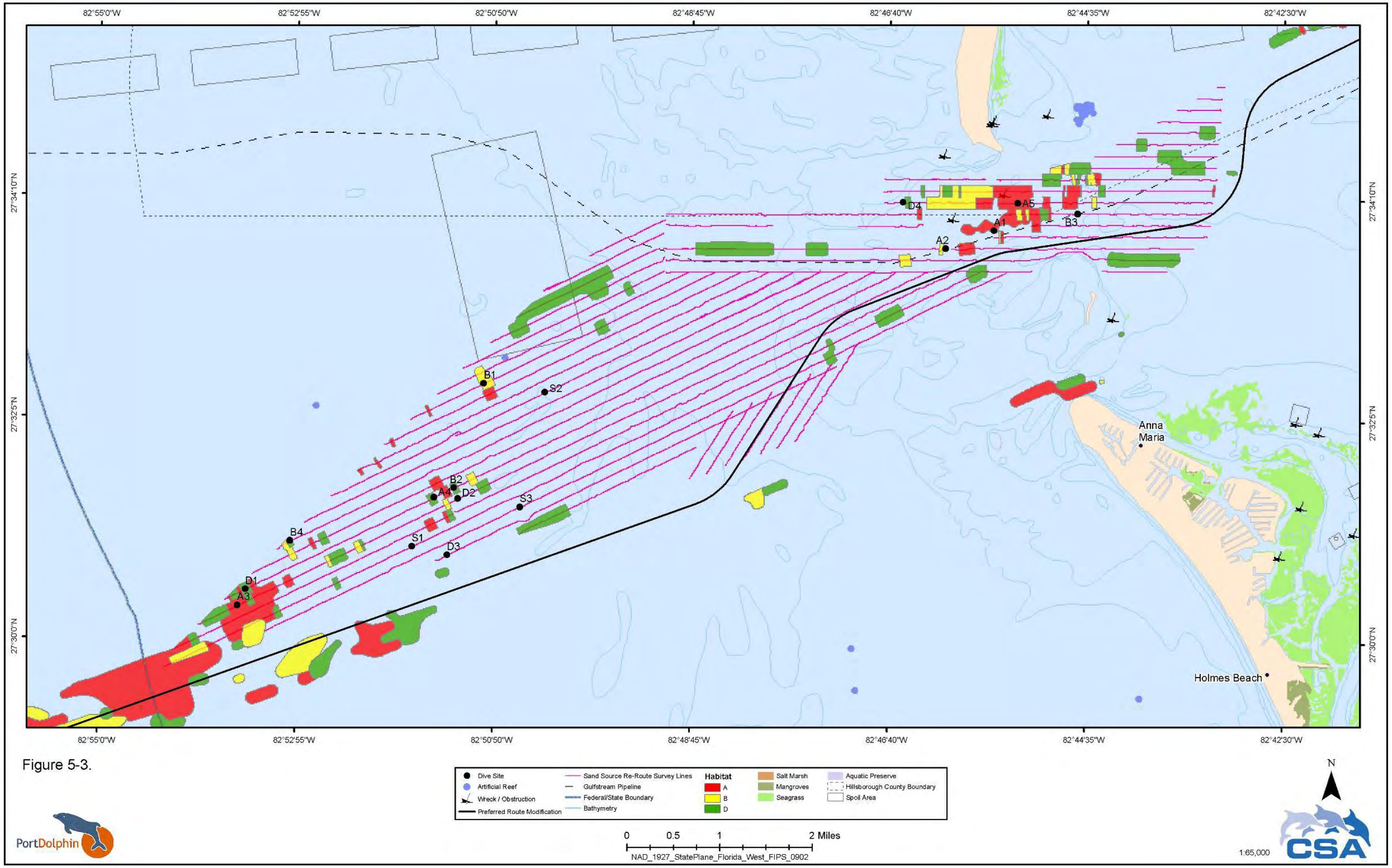
The acreages cited above are for the photodocumentation survey area. **Table 5-1** shows the habitat acreages within the 3,936-foot (1,200-meter) wide pipeline corridor, from the beginning to end of the Alternative Route around Sand Resources corridor. For comparison, data are also presented for the corresponding section of the Revised Preferred Corridor (i.e., the corridor without the re-route around sand resources).

Both corridors are predominantly soft/sand bottom with patchy areas of hard/live bottom. The Alternative Route around Sand Resources corridor has more hard/live bottom habitat (6.67% vs. 4.04%) but about the same percentage of Type A habitat (1.99% vs. 2.07%) in comparison with the Revised Preferred Route. The observations of patchy hard/live bottom are consistent with other previous observations in Tampa Bay (Lewis and Estevez 1988; Savercool and Lewis 1994).

Table 5-1
Benthic Habitat Areas within the Alternative Route around Sand Resources Corridor, as Compared with the Corresponding Section of the Revised Preferred Route

Benthic Habitat Type	Corresponding Section of Revised Preferred Route (Addendum I)			Alternative Route around Sand Resources Corridor (this Addendum II)		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Type A Habitat	73.73	29.84	2.07	70.93	28.70	1.99
Type B Habitat	21.59	8.74	0.61	31.36	12.69	0.88
Type D Habitat	48.84	19.76	1.37	134.91	54.59	3.79
Total Hard/Live Bottom (A+B+D)	144.16	58.34	4.04	237.20	95.99	6.67
Soft Substrate/Sand Habitat	3,422.04	1,384.86	95.96	3,318.01	1,342.76	93.33

Figure 5-3
Benthic Habitat Types Mapped within the Survey Area, including Dive Sites



5.1.3 Habitat Areas – Entire Preferred Route Modification

For impact calculations, habitat percentages along the entire Preferred Route Modification corridor were used. These data are presented in **Table 5-2** along with a comparison to the Revised Preferred Route (from **Section 6** of **Addendum I**). **Figure 5-4** shows the distribution of benthic habitat types within the Preferred Route Modification corridor.

Table 5-2
Benthic Habitat Areas along the Preferred Route Modification as Compared with the Revised Preferred Route (Entire Corridors including Buoy Areas)

Benthic Habitat Type	Revised Preferred Route (Addendum I)			Preferred Route Modification (this Addendum II)		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Type A Habitat	1,887	764	7.1	1,635	662	5.8
Type B Habitat	4,806	1,945	18.0	4,712	1,907	16.8
Type D Habitat	2,917	1,180	10.9	2,786	1,128	10.0
Total Hard /Live Bottom (A+B+D)	9,609	3,889	35.9	9,134	3,696	32.6
Soft Substrate/Sand Habitat	19,409	7,855	64.1	18,851	7,629	67.4

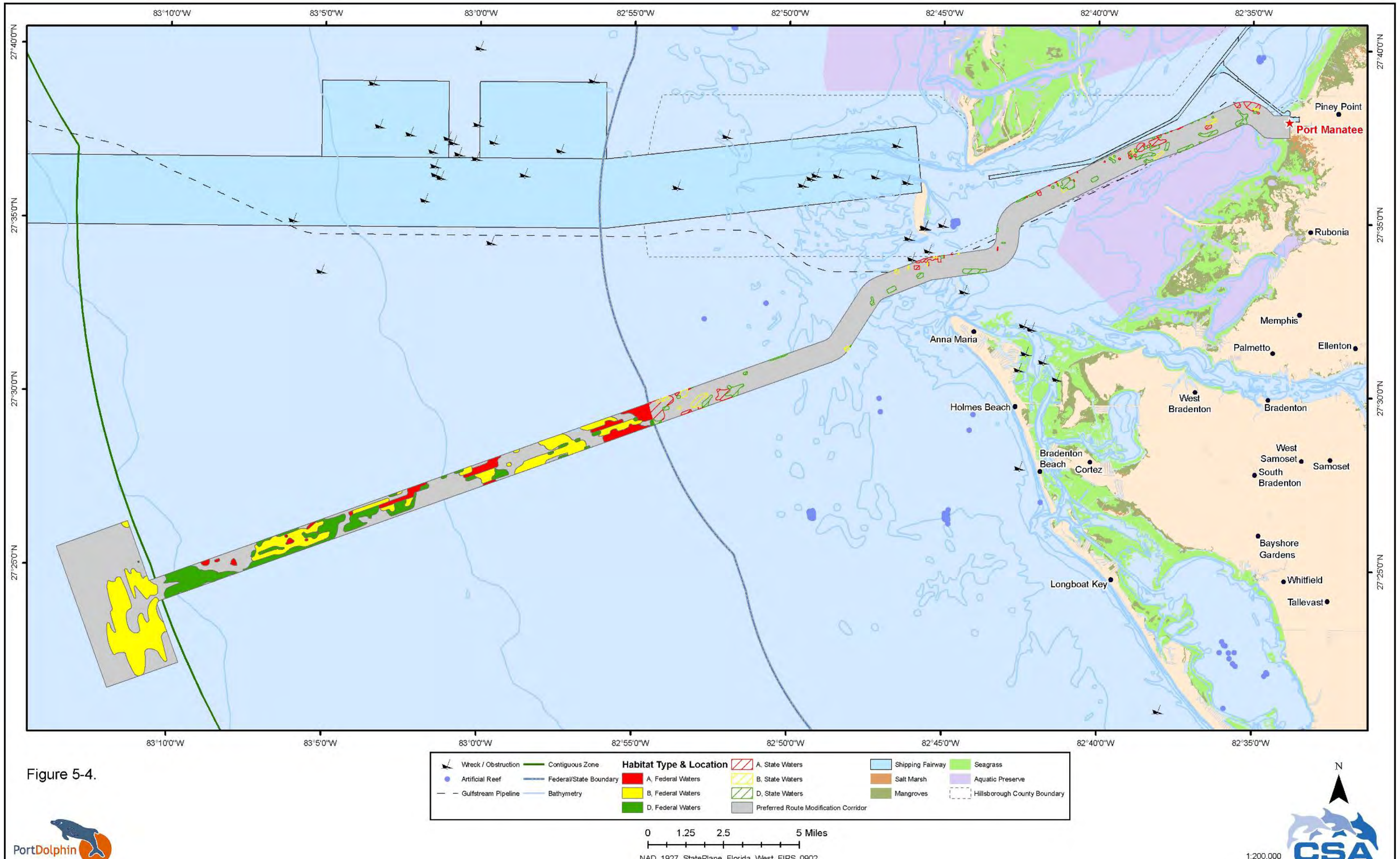
The total corridor area is about 3% less for the Preferred Route Modification, due to the slightly shorter pipeline route as noted in **Section 2**. The Preferred Route Modification has slightly higher percentages of soft substrate/sand habitat (67.4% vs. 64.1%) and slightly lower percentages of hard/live bottom habitat (32.6% vs. 35.9%).

5.2 Analysis of Potential Consequences

Impacts to marine resources are discussed in **Volume II**, **Section 4.3** of the **Deepwater Port Application** and in **Section 6.2** of **Addendum I**. This section evaluates changes in impacts resulting from re-routing of the nearshore pipeline corridor to avoid sand resources.

The only relevant impact factor is "seafloor disturbance and turbidity." Specifically, the areal extent and location of seafloor disturbance and turbidity within State of Florida waters during pipeline installation has changed due to re-routing of the pipeline around the sand resources. Other impact-producing factors are not analyzed in detail in this **Addendum II**, either because they are irrelevant to the project design changes or they would not differ in any meaningful way from those previously discussed in the **Deepwater Port Application** or **Addendum I.**

Figure 5-4
Benthic Habitat Types Mapped within the Preferred Route Modification Corridor



5.2.1 Recalculation of Seafloor Disturbance

Impacts of pipeline installation along the entire Preferred Route Modification have been recalculated based on the re-routing of the pipeline around sand resources. The calculations differ from those in **Addendum I** in the following ways:

- Due to the re-routing around sand resources, the corridor length has decreased slightly and the average percentage of benthic habitats (A, B, D, and soft substrate/sand) within the corridor has changed (see **Table 5-2**).
- Project engineers have revised the spreadsheet based on the geotechnical survey results indicating which pipeline segments will be plowed. As summarized in **Table 5-3**, the revised analysis indicates that, excluding HDD areas, 87% of the pipeline length will be plowed, compared with 49% estimated in **Addendum I**. It is expected that in some plowed areas, the plow may not achieve burial to the design depth, in which case these areas would subsequently be covered by concrete mattresses or rock armoring. However, for direct disturbance calculations, these areas are simply assumed to be plowed, since the impact width for plowing is greater than that for mattress placement.
- Estimates of anchor sweep for the pipelaying barge have been added. Although not included in **Addendum I**, anchor sweep estimates were subsequently submitted to the USCG on 31 March 2008 in Data Gaps/Response No. 61. The same methodology was used here.

Table 5-3
Estimated Linear Extent of Pipeline Burial Techniques

Burial Technique	Revised Preferred Route (Addendum I)	Preferred Route Modification (this Addendum II)
Plowing/trenching (feet)	115,468	205,997[A]
Concrete mattress/rock armoring (feet)	120,081	28,398
Clamshell dredging/dragline burial (feet)	1,000	1,104
Horizontal directional drilling (HDD) (feet)	7,855	7,854
Total length (feet)	243,404	243,353
Total length (feet) excluding HDD segments	235,548	235,499
Plowing/trenching / total non-HDD length	49%	87%

[a] Includes an estimated 76,500 feet (23,316 meters) that may not achieve the design depth and may require concrete mattresses or rock armoring.

The following sections discuss specific aspects of the seafloor disturbance calculations, including direct impacts of pipeline burial, anchoring, and anchor sweep.

5.2.1.1 Direct Impacts of Pipeline Burial

As described in the **Deepwater Port Application**, the pipeline will be laid on the seafloor by a pipelaying barge, and then buried, most likely using a plowing technique, after which the trench will be backfilled. The estimated width of the trench (including sediments initially pushed to each side) is 67 feet (20.4 meters). In areas that cannot be plowed, the pipeline will be covered with concrete mattresses or rock armoring. In one location in Tampa Bay, a combination of clamshell dredging/dragline burial is planned.

The following methods were used to estimate the areal extent of impacts:

- The pipeline corridor was divided into segments that were identified as suitable for plowing/trenching or mattress placement;
- A geographic information system (GIS) was used to overlay the pipeline (i.e., center of the pipeline corridor) on the map of benthic habitats.
- Wherever the centerline of the pipeline crossed a habitat polygon (e.g., Type A), the impact length was measured and multiplied by the appropriate impact width for plowing or mattress placement. For plowing, an impact width of 67 feet (20.4 meters) was assumed. (This width was used for all plowed areas, including those where the plow does not achieve burial, necessitating covering by concrete mattresses.) For mattress placement, an impact width of 20 feet (6.1 meters) was assumed.[1] At one location in Tampa Bay where clamshell dredging/dragline burial is planned, an effect width of 60 feet (18.3 meters) was assumed.

The analysis predicts that 331.39 acres (134.11 hectares) would be directly affected by pipeline installation including plowing, mattress placement, and clamshell dredging/dragline burial. The total area includes 217.01 acres (87.82 hectares) of soft substrate/sand habitat and 114.39 acres (46.29 hectares) of hard/live bottom habitat (Types A, B, and D) (**Table 5-4**). About 49% of the hard/live bottom habitat affected would be Type D, 37% would be Type B, and 14% would be Type A.

Most of the impact is due to plowing (96% of the area). Mattress placement accounts for about 4% of the impact area, and a small area of 1.52 acres (0.62 hectares) would be affected by clamshell dredging/dragline burial at a single location in Tampa Bay. In **Addendum I**, the clamshell/dragline area was identified as all soft substrate/sand, but this segment is now slightly longer and includes a small area of Type A habitat (0.24 acres or 0.10 hectares).

[1] This differs from the 13 feet (4.0 meters) assumed in the **Deepwater Port Application** and **Addendum I**. The mattresses are 20 feet (6.1 meters) wide. The 13-foot (4.0-meter) width was based on the assumption that mattresses would cover pipe that was laying on the seafloor (i.e., width is shorter because the mattress goes up and over the pipeline). In cases where the pipeline is buried but achieves less than 3 feet (0.9 m) of cover, a mattress would impact a width of 20 feet (6.1 m). For simplicity it is assumed that any mattressed areas could affect a width up to 20 feet (6.1 meters).

Table 5-4
Areal Extent of Direct Impacts of Pipeline Installation
(Preferred Route Modification)

Activity	Area Affected Acres (Hectares)				
	Total	Soft /Sand	Type A	Type B	Type D
Plowing	316.85 (128.22)	207.13 (83.82)	15.48 (6.26)	38.52 (15.59)	55.72 (22.55)
Mattress placement	13.03 (5.27)	8.60 (3.48)	0	4.43 (1.79)	0
Clamshell/dragline	1.52 (0.62)	1.28 (0.52)	0.24 (0.10)	0	0
Total	331.39 (134.11)	217.01 (87.82)	15.72 (6.36)	42.95 (17.38)	55.72 (22.55)

5.2.1.2 Anchoring

The following assumptions were made to calculate the extent of anchoring impacts:

- A barge will make four passes along the route, for pipelaying, plowing, backfilling, and mattress placement.
- The first three passes will be done by a barge with 10 anchors, which will be reset every 2,000 feet (610 meters). Each anchor set contact with the seafloor will directly affect an area of 360 square feet (33.4 square meters).
- The fourth pass (mattress placement) will be done by a smaller barge with four smaller anchors, which will be reset every 1,000 feet (305 meters). The anchors would affect a smaller area of 90 square feet (8.4 square meters).
- Hard/live bottom areas will be affected in direct proportion to the percentage of these habitats within the Preferred Route Modification corridor.

The actual sequence of events involved in pipelaying is more complicated than indicated by these assumptions, particularly in Tampa Bay where three HDD operations will be conducted. However, the assumptions are considered a reasonable basis for estimating the number and extent of anchor impacts.

The revised analysis (**Table 5-5**) predicts that 27.56 acres (11.15 hectares) will be affected by anchoring. About 67% of the total impacts would be in soft bottom habitats (18.57 acres or 7.51 hectares) and 33% would be in hard/live bottom habitats (8.99 acres or 3.64 hectares).

Table 5-5
Areal Extent of Impacts from Anchoring During Pipeline Installation
(Preferred Route Modification)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	No. of Anchor Impacts	Area Affected by Anchoring[b] Acres (Hectares)				
					Total	Soft Bottom	Type A	Type B	Type D
1st	Pipelaying	235,499	117	1,170	9.66 (3.91)	6.51 (2.64)	0.56 (0.23)	1.63 (0.66)	0.96 (0.39)
2nd	Plowing	205,997	103	1,030	8.51 (3.44)	5.74 (2.32)	0.50 (0.20)	1.43 (0.58)	0.85 (0.34)
3rd	Backfilling	205,997	103	1,030	8.51 (3.44)	5.74 (2.32)	0.50 (0.20)	1.43 (0.58)	0.85 (0.34)
4th	Mattress placement	104,898	105	420	0.87 (0.35)	0.58 (0.24)	0.05 (0.02)	0.15 (0.06)	0.09 (0.04)
				Total	27.56 (11.15)	18.57 (7.51)	1.61 (0.65)	4.63 (1.88)	2.75 (1.11)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each would affect an area of 360 square feet (33.4 square meters). For the fourth pass, assumed four smaller anchors would be reset every 1,000 feet (305 meters) and each would affect an area of 90 square feet (8.4 square meters).
[b] Assumed anchors would contact habitats in proportion to their occurrence within the pipeline corridor (5.84% Type A, 16.84% Type B, 9.96% Type D, and 67.36% soft bottom).
[c] Includes 28,398 feet (8,655 meters) not planned to be plowed, plus an estimated 76,500 feet (23,316 meters) where plowing may not achieve the design depth and concrete mattresses or rock armoring may be required.

The recalculated anchoring impacts are about 36% greater than those estimated in **Addendum I** for the Revised Preferred Route. The increase is due to the greater percentage of the pipeline corridor that was identified as "plowable," as noted previously (**Table 5-3**), which affects the number of anchor resets during the second, third, and fourth passes. It has been indicated that attempting to achieve as much burial as possible is the method preferred by the State agencies.

5.2.1.3 Anchor Cable Sweep

In addition to the direct impacts, each anchor cable will also contact (sweep) the seafloor due to movement of the pipelaying barge's anchor cables. The areal extent of anchor sweep impacts was not estimated in the **Deepwater Port Application** or **Addendum I**. However, subsequently, Port Dolphin developed an estimate in Data Gaps/Response No. 61 submitted to the USCG on 31 March 2008. The same calculation methods are used here, but the numbers have changed, due mainly to the greater percentage of the pipeline corridor that is now identified as "plowable" (**Table 5-3**).

The following assumptions were made to calculate the extent of anchor sweep impacts:

- The pipelaying barge was assumed to make four passes along the route – for pipelaying, plowing, backfilling, and mattress placement.
- The first three passes will be done by a barge using 10 anchors, which will be reset every 2,000 feet (610 meters). For each reset, the 10-anchor array was estimated to sweep an area of 1,199,162 square feet (111,395 square meters) of seafloor. The derivation of this estimate is explained below.
- The fourth pass (mattress placement) will be done by smaller barges with 4-point mooring systems, which will be used as static moorings; therefore, no anchor cable sweep impact is anticipated.
- Habitats were assumed to be affected in proportion to their average percentage occurrence within the pipeline corridor (5.84% Type A, 16.84% Type B, 9.96% Type D, and 67.36% sand/soft substrate).

The actual sequence of events involved in pipelaying is more complicated than indicated by these assumptions, particularly in Tampa Bay where three HDD operations will be conducted. However, the assumptions are considered a reasonable basis for estimating the number and extent of anchor sweep impacts.

Figure 5-5 illustrates the estimated anchor sweep area for a single anchor deployment. To calculate the extent of anchor sweep impacts, analyses were performed using a standard static catenary program. This program allows a determination of catenary touchdown point on the seabed for a given input of water depth, tension, and cable weight. Using the catenary touchdown point, in conjunction with the anchor array model, a theoretical sweep area was predicted. For the base case, a water depth of 75 feet (23 meters) was adopted as a conservative representation of average water depth along the route. The ratio of anchor wire length to water depth (sometimes known as the anchor "scope") was conservatively assumed to be in the range of about 20 to 50. Using these methods and assumptions, anchor wire sweep is estimated to be 1,598,882 square feet (148,526 square meters) for the 10-anchor array for each 2,000-foot (600-meter) barge reset length.

A detailed anchoring plan will be developed during detailed design that will provide specific procedures to minimize anchor sweep impacts on hard/live bottom habitat. Depending on the detailed methodology, it will be possible to reduce anchor sweep areas by use of low-weight anchor wires or buoyancy elements (e.g., mid-line buoys). This would have the effect of supporting the catenary further off the seabed. An assessment of an anchor wire weight reduction of about 50% suggests that corresponding reductions in seabed contact area could be 25% or greater. For this analysis, a reduction in overall footprint of 25% has been assumed, yielding a revised impact area of 1,199,162 square feet (111,395 square meters) per anchor reset. **Table 5-6** summarizes the predicted the areal extent of anchor sweep impacts taking into account this estimated 25% reduction due to the use of mid-line buoys.

Figure 5-5
Diagram of Seafloor Areas Swept by Anchor Cables from a Typical Pipelaying Barge

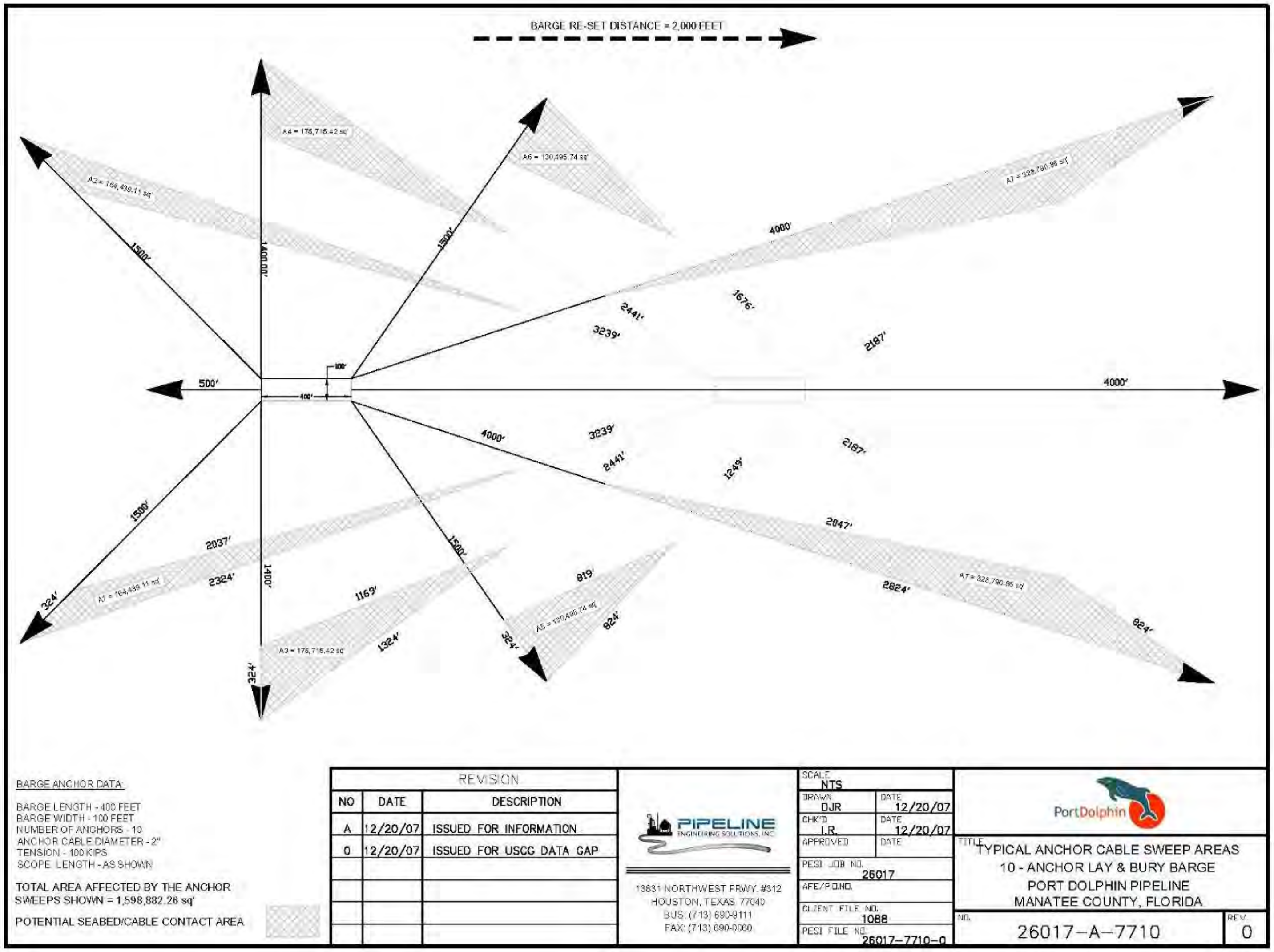


Table 5-6
Anchor Sweep Impacts during Pipeline Installation for the Preferred Route Modification (including 25% Reduction Due to Mid-Line Buoys)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	Anchor Sweep Area[b] Acres (Hectares)				
				Total	Soft Bottom	Type A	Type B	Type D
1st	Pipelaying	235,499	117	3,220.89 (1,303.45)	2,169.64 (878.02)	188.22 (76.17)	542.33 (219.47)	320.70 (129.78)
2nd	Plowing	205,997	103	2,835.48 (1,147.48)	1,910.02 (772.96)	165.70 (67.06)	477.43 (193.21)	282.33 (114.25)
3rd	Backfilling	205,997	103	2,835.48 (1,147.48)	1,910.02 (772.96)	165.70 (67.06)	477.43 (193.21)	282.33 (114.25)
4th	Mattress placement	No sweep impacts						
			Total	8,891.85 (3,598.41)	5,989.69 (2,423.94)	519.62 (210.28)	1,497.20 (605.90)	885.35 (358.29)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each reset would affect an area of 1,199,162 square feet (111,395 square meters). For the fourth pass, assumed smaller barges with 4-point, static mooring systems (no anchor cable sweep).
[b] Assumed anchors would contact habitats in proportion to their occurrence within the pipeline corridor (5.84% Type A, 16.84% Type B, 9.96% Type D, and 67.36% soft bottom).

The analysis predicts that 8,891.85 acres (3,598.41 hectares) would be affected by anchor cable sweep. This includes 5,989.69 acres (2,423.94 hectares) of sand/soft bottom habitat and 2,902.17 acres (1,174.47 hectares) of hard/live bottom habitats. Many aspects of the anchor sweep calculations are considered to be very conservative. Consequently, impacts are likely to be less than calculated, and further reductions may be possible depending on prevailing field and operational conditions. For example:

- A relatively large ratio of anchor wire length to water depth (sometimes known as the anchor "scope") has been conservatively assumed in the range of about 20 to 50. The "scope" could be reduced with judicious anchor placement, subject to detailed route engineering.
- There is also some degree of overlapping (redundancy) in the swept area calculations between anchor resetting positions, which has not been accounted for in the results. In other words, as the barge moves along the route, some of the swept areas will be locations that have already have been swept and thus are "double-counted."
- There will most likely be a degree of overlapping (redundancy) of seabed impact areas between the different passes (pipelaying, plowing, and backfilling), which has not been accounted for in the final results presentation. With judicious anchor placement on each pass, this may represent a significant impact area that is being "double-counted."

There are two types of injuries that occur to live bottom communities associated with the installation of the Port Dolphin Project, structural and biological. Anchor sweep impacts to live bottom habitat differ from direct impact from pipeline installation (i.e., plowing, mattress placement, dredging, or direct anchor placement). The direct impacts from installation of the pipeline create injuries to the structure (live bottom/hard bottom substrate) as well as the biological component (organisms growing on the substrate), whereas the impacts from anchor sweep are typically injurious to the biological component (living organisms growing on the structure) and not the structure. Impacts from anchor sweep typically recover much more quickly than the types of injuries that will be caused from direct impact from pipeline installation.

5.2.1.4 Summary of Seafloor Disturbance Calculations

Table 5-7 summarizes the area affected by plowing, mattress placement, anchoring, and anchor cable sweep. The total impact area for the Preferred Route Modification is estimated to be 9,250.80 acres (3,743.67 hectares), of which about 33% or 3,025.54 acres (1,224.39 hectares) would be hard/live bottom habitats. About 96% of the total impact area is due to anchor sweep.

The totals are not directly comparable with those presented in **Addendum I** for the Revised Preferred Route because anchor sweep was not estimated in that document. However, anchor sweep estimates were subsequently submitted to the USCG on 31 March 2008 in Data Gaps/Response No. 61. If those numbers are included (see **Table 5-7**), the total impact area for the Preferred Route Modification is about 39% greater than for the Revised Preferred Route. The increase is due mainly to the greater percentage of the pipeline corridor that is now identified as “plowable,” which affects both the direct plowing impacts and the number of anchor resets during the second, third, and fourth passes of the pipelaying barge. The percentage of habitats within the pipeline corridor also changed due to the re-route around sand resources.

Table 5-7
Summary of Seafloor Disturbance Impacts from Pipeline Installation

Activity	Area Affected Acres (Hectares)							
	Revised Preferred Route (Addendum I)				Preferred Route Modification (this Addendum II)			
	Soft Bottom	Type A	Type B	Type D	Soft Bottom	Type A	Type B	Type D
Plowing	146.66 (59.35)	4.19 (1.70)	3.63 (1.47)	21.62 (8.75)	207.13 (83.82)	15.48 (6.26)	38.52 (15.59)	55.72 (22.55)
Mattress placement	16.32 (6.60)	2.48 (1.00)	9.64 (3.90)	7.30 (2.96)	8.60 (3.48)	0	4.43 (1.79)	0
Clamshell/dragline	1.38 (0.56)	0	0	0	1.28 (0.52)	0.24 (0.10)	0	0
Anchoring	13.55 (5.49)	1.32 (0.53)	3.36 (1.36)	2.04 (0.82)	18.57 (7.51)	1.61 (0.65)	4.63 (1.88)	2.75 (1.11)
Subtotal	177.91 (72.00)	7.99 (3.23)	16.63 (6.73)	30.96 (12.53)	235.57 (95.33)	17.32 (7.01)	47.59 (19.26)	58.47 (23.66)
Anchor cable sweep[a]	4,854 (1,964)	293 (119)	614 (248)	653 (264)	5,989.69 (2,423.94)	519.62 (210.28)	1,497.20 (605.90)	885.35 (358.29)
Total including anchor cable sweep	**5,031.91 (2,108.00)**	**300.99 (125.46)**	**630.63 (261.46)**	**683.96 (289.06)**	**6,225.26 (2,519.27)**	**536.94 (217.29)**	**1,544.78 (625.15)**	**943.82 (381.95)**

[a] Anchor sweep estimates were not included in **Addendum I**, but subsequently provided to the USCG in Data Gaps/Response No. 61 on 31 March 2008.

5.2.2 Marine Fish Resources and Essential Fish Habitat

Impacts to fish resources and EFH are discussed in **Volume II**, **Section 4.3.1** and **Appendix D** of the **Deepwater Port Application**, and in **Section 6** of **Addendum I**. In addition, a summary of potential impacts to fishing activities and loss of fishing grounds is included in **Attachment A.7**.

Impact factors relevant to the project design changes include seafloor disturbance and turbidity during pipeline installation. Other impact factors such as operational seawater intake and discharge, underwater noise, offshore lighting, and accidental spills or LNG release either are not relevant to the revised activities or would not differ in any meaningful way from those discussed previously.

5.2.2.1 Construction

Re-routing the pipeline around the sand source areas slightly shortened the pipeline length. However, due to changes in impact calculations, including the assumption that a higher percentage of the pipeline route would be plowable, the estimated areal extent of seafloor disturbance and turbidity has increased (see **Section 5.2.1**).

Although the areal extent of seafloor disturbance and turbidity impacts has increased, the overall significance of impacts remains negligible to minor as determined in Volume II, Section 4.3.1 of the **Deepwater Port Application**. The seafloor disturbance represents a small percentage of the seafloor in the region, and the turbidity impacts will be transient. Due to the fast settling rates of the relatively coarse sediments (82% to 96% sand) along the pipeline route, suspended sediment plumes should be short-lived and remain fairly close to their source. The exposure of any given fish to turbidity from resuspended sediments would be short-lived (e.g., minutes to hours). Fish may temporarily avoid areas of turbidity and seafloor disturbance until the conditions return to background.

5.2.2.2 Operations

Project design changes would not significantly alter the impacts of operations on fish or EFH.

5.2.2.3 Decommissioning

Project design changes would not significantly alter the impacts of decommissioning on fish or EFH.

5.2.2.4 Accidents and Upsets

Project design changes would not significantly alter the impacts of accidents and upsets on fish or EFH.

5.2.3 Benthic Communities

Impacts to benthic communities are discussed in **Volume II**, **Section 4.3.2** of the **Deepwater Port Application** and **Section 6.2.2** of **Addendum I**. The only change is the areal extent of seafloor disturbance during construction (pipeline installation).

5.2.3.1 Construction

Re-routing the pipeline around the sand source areas slightly shortened the pipeline length. However, due to changes in impact calculations, including the assumption that a higher percentage of the pipeline route would be plowable, the estimated areal extent of seafloor disturbance has increased (see **Section 5.2.1**).

The revised calculations in **Section 5.2.1** predict that a total of 9,250.80 acres (3,743.67 hectares) would be affected by pipeline installation including plowing, mattresses, anchoring, and anchor sweep. This includes 6,225.26 acres (2,519.27 hectares) of soft substrate/sand habitat and 3,025.54 acres (1,224.39 hectares) of hard/live bottom habitat (Types A, B, and D). The affected area is about 39% larger than previously estimated (i.e., relative to **Addendum I** and the anchor sweep estimates in Data Gaps/Response No. 61).

About 96% of the total impact area is due to anchor sweep. In interpreting these impacts, it is important to consider the different types of hard/live bottom habitats mapped. Of the total hard/live bottom habitats affected, about 18% would be Type A, 51% Type B, and 31% Type D. In areas of Type A and B habitats, the substrate, as well as the organisms attached to it, may be damaged by anchor cable sweep. In Type D areas, there would be no anchor cable damage to emergent hard substrate, as the cables are assumed to sweep the top few inches of the seafloor. However, depending on the thickness of the sand veneer, some organisms may be attached to the underlying hard substrate and could be dislodged by the anchor cable. Overall, the damage to hard/live bottom communities due to anchor sweep in Type D areas is considered less severe than impacts to Type A and B habitats.

The analysis in **Volume II**, **Section 4.3.1** of the **Deepwater Port Application** concluded that seafloor disturbance impacts on benthic communities would be minor for soft substrate/sand communities and significant for hard/live bottom communities. Although the areal extent of seafloor disturbance has increased significantly, the overall significance of impacts is unchanged. The soft bottom impacts are considered minor because the affected area represents a small percentage of the soft bottom habitat in the region. Impacts to hard bottom habitats are significant because these are considered ecologically important due to their physical structure and dense epibiota. Damage to the hard bottom substrate is considered irreversible. The recovery of benthic communities associated with damaged hard bottom areas would be much slower than for soft bottom areas due to the slow growth rate of corals and other hard bottom epibiota. Draft Mitigation Plans for Unavoidable Impacts to Live/Hard Bottom areas for State and Federal Waters are included in **Attachments A.5** and **A.6**, respectively.

5.2.3.2 Operations

Project design changes would not significantly alter the impacts of operations on benthic communities.

5.2.3.3 Decommissioning

Project design changes would not significantly alter the impacts of decommissioning on benthic communities.

5.2.3.4 Accidents and Upsets

Project design changes would not significantly alter the impacts of accidents and upsets on benthic communities.

5.2.4 Plankton

Plankton assemblages are discussed in **Volume II**, **Section 4.2.3** of the **Deepwater Port Application**. The relevant impact factors for project design changes are turbidity due to sediment resuspension. Other impact factors are irrelevant to the project design changes or they would not differ in any meaningful way from those previously discussed in the **Deepwater Port Application**.

5.2.4.1 Construction

The areal extent of seafloor disturbance during pipeline installation has increased due to changes in impact calculations, including the assumption that a higher percentage of the pipeline route would be plowable (see **Section 5.2.1**). The increase would be expected to result in more widespread turbidity due to sediment resuspension.

Although the areal extent of turbidity impacts has increased, the overall significance of impacts remains minor as determined in **Volume II**, **Section 4.3.3** of the **Deepwater Port Application**. The seafloor disturbance represents a small percentage of the seafloor in the region, and the turbidity impacts will be transient. Due to the fast settling rates of the relatively coarse sediments (82% to 96% sand) along the pipeline route, suspended sediment plumes should be short-lived and remain fairly close to their source. The exposure of any given water column organism to turbidity from resuspended sediments would be short-lived (e.g., minutes to hours) because water movement would carry them away from the turbidity source as the suspended solids concentrations gradually return to background levels. Plankton populations affected by turbidity would be replaced by new populations, since regeneration times are short (days to weeks). The Draft Mitigation Plan for Federal Waters that includes fisheries impacts and monitoring is included in **Attachment A.6**.

5.2.4.2 Operations

Project design changes would not significantly alter the impacts of routine Port operations on plankton.

5.2.4.3 Decommissioning

Project design changes would not significantly alter the impacts of decommissioning on plankton.

5.2.4.4 Accidents and Upsets

Project design changes would not significantly alter the impacts of accidents and upsets on plankton.

5.2.5 Marine Mammals

Three marine mammals are most likely to occur in the project area (see **Volume II**, **Section 4.2.4** of the **Deepwater Port Application**). Bottlenose dolphins and Atlantic spotted dolphins are likely to be present in continental shelf and coastal waters, including the pipeline route area. The Florida manatee occurs primarily in coastal waters within Tampa Bay and would not be expected to occur at open-water, offshore portions of the pipeline route.

Factors potentially affecting marine mammals include vessel traffic, turbidity and discharges, underwater noise, debris (entanglement/ingestion), and accidental spills. Project design changes will result in no significant change in construction vessel traffic, turbidity, and noise during construction. Impacts during routine Port operations and decommissioning would be essentially unchanged. The risk of debris-related impacts and accidental spills would also be unchanged.

5.2.5.1 Construction

The main potential impact during construction is the risk of a vessel striking a marine mammal such as a manatee within coastal waters. Project design changes would not be likely to result in any change in the volume of vessel traffic as the change in pipeline length is insignificant. The location of vessel traffic would shift, at most, approximately 2.5 kilometers (1.6 miles) to the north along the area where the pipeline would be re-routed. Construction vessels would be of the same size and type previously identified, and they would be moving slowly. The Preferred Route Modification does not pass through any manatee protection zones. The **Deepwater Port Application** included extensive mitigation measures to avoid vessel strikes. In addition, further detailed measures have been developed in "Revised Appendix F. Mitigation Measures" submitted to the USCG in response to completeness comments.

The analysis in **Section 6.2.4** of **Addendum I** concluded that impacts of vessel traffic on marine mammals would be minor. Project design changes will result in no significant changes in vessel traffic, and therefore would not change this conclusion.

The re-route would also increase the areal extent of turbidity from seafloor disturbance during pipeline installation. However, this change would not significantly alter turbidity impacts on marine mammals, which are considered negligible to minor in the original analysis.

5.2.5.2 Operations

None of the project design changes would significantly alter the impacts of routine operations on marine mammals.

5.2.5.3 Decommissioning

None of the project design changes would significantly alter the impacts of decommissioning on marine mammals.

5.2.5.4 Accidents and Upsets

None of the project design changes would significantly alter the impacts of accidents and upsets on marine mammals.

5.2.6 Sea Turtles

Five species of sea turtles, the green, hawksbill, Kemp's ridley, leatherback, and loggerhead, are known to inhabit the eastern Gulf of Mexico (see **Volume II**, **Section 4.2.5** of the **Deepwater Port Application**). Gulf waters adjacent to Tampa Bay can be expected to be visited by both reproductive males and females during the summer mating and nesting season. Nearly all ocean-facing (Gulf) sandy beaches in the Tampa Bay area are used as nesting habitat by sea turtles, primarily loggerheads. Occasional green turtle nesting has also been recorded. Other sea turtles are not expected to nest in the area.

Factors potentially affecting sea turtles include vessel traffic, turbidity and discharges, entrainment/impingement during seawater intake, underwater noise, lighting, debris (entanglement/ingestion), and accidental spills. Project design changes will result in no significant change in construction vessel traffic during construction. Impacts during routine Port operations, and decommissioning would be essentially unchanged. There is no change in seawater intake, and therefore the risk of entrainment/impingement would not differ. The risk of debris-related impacts and accidental spills would also be unchanged.

5.2.6.1 Construction

The main potential impact during construction is the risk of a vessel striking a sea turtle. Project design changes would not be likely to result in any change in the volume of vessel traffic, as the change in pipeline length is insignificant. The location of vessel traffic would shift, at most, approximately 2.5 kilometers (1.6 miles) to the north along the area where the pipeline would be re-routed. Construction vessels would be of the same size and type previously identified, and they would be moving slowly. The **Deepwater Port Application** included extensive mitigation measures to avoid vessel strikes. In addition, further detailed measures have been developed in

"Revised Appendix F: Mitigation Measures" submitted to the USCG in response to completeness comments.

The analysis in **Volume II**, **Section 4.3.5** of the **Deepwater Port Application** concluded that impacts of vessel traffic on sea turtles would be minor. Changes in vessel traffic patterns due to the re-route do not change this conclusion.

The re-route would also increase the areal extent of turbidity from seafloor disturbance during pipeline installation. However, this change would not significantly alter turbidity impacts on sea turtles, which are considered negligible to minor in the original analysis.

5.2.6.2 Operations

None of the project design changes would significantly alter the impacts of routine operations on sea turtles.

5.2.6.3 Decommissioning

None of the project design changes would significantly alter the impacts of decommissioning on sea turtles.

5.2.6.4 Accidents and Upsets

None of the project design changes would significantly alter the impacts of accidents and upsets on sea turtles.

5.2.7 Marine and Coastal Birds

The project area is inhabited by a diverse assemblage of resident and migratory birds, including seabirds, shorebirds, wetland birds, and waterfowl (see **Volume II**, **Section 4.2.6** of the **Deepwater Port Application**). Although five endangered or threatened bird species occur in the area, none are likely to be affected by any project activities.

As discussed in the **Volume II**, **Section 4.3.6** of the **Deepwater Port Application**, sources of potential impacts on other marine and coastal birds include lighting on vessels during construction, operations, and decommissioning; disturbance by vessel traffic during construction; and debris (entanglement/ingestion). In addition, marine and coastal birds could be affected in the unlikely event of a minor hydrocarbon spill, LNG release, or natural gas release.

Project design changes will result in no significant change in the volume of construction vessel traffic. Impacts during routine Port operations and decommissioning would be essentially unchanged. The risk of debris-related impacts and accidental spills would be unchanged.

5.2.7.1 Construction

The main potential impact during construction is disturbance due to vessel traffic in coastal waters. Project design changes would not be likely to result in any change in the volume of vessel traffic, as the change in pipeline length (28 meters [92 feet]) is insignificant. The location of vessel traffic would shift, at most, approximately 2.5 kilometers (1.6 miles) to the north along the area where the pipeline would be re-routed. Near the mouth of Tampa Bay, the re-routed pipeline would pass between two National Wildlife Refuges (NWRs) that are important bird areas (**Figure 5-6**). In comparison with the original corridor, the Preferred Route Modification is slightly farther from Passage Key and closer to Egmont Key (**Table 5-8**).

Figure 5-6
Location of Preferred Route Modification in Relation to Egmont Key and Passage Key National Wildlife Refuges

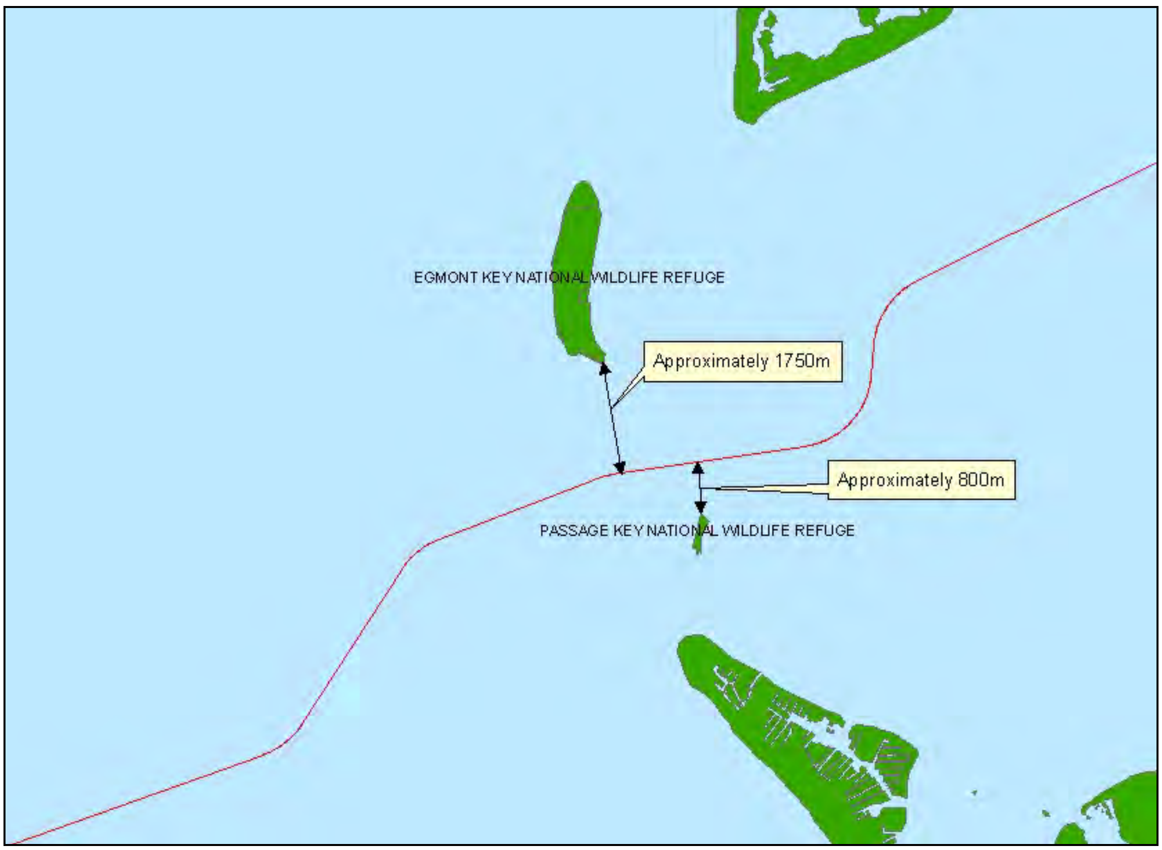


Table 5-8
Minimum Distances to Bird Nesting, Breeding, and Roosting Areas

Location	Minimum Distance Feet (Meters)	
	Revised Preferred Route (Addendum I)	Preferred Route Modification (this Addendum II)
Passage Key National Wildlife Refuge	2,040 (622)	2,625 (800)
Egmont Key National Wildlife Refuge	12,765 (3,890)	5,742 (1,750)

Construction vessels would be of the same size and type previously identified, and they would be moving slowly. Several mitigation measures were proposed in **Volume II**, **Section 4.3.6** of the **Deepwater Port Application** to minimize disturbance. The original analysis concluded that impacts of vessel traffic on marine and coastal birds would be minor. Taking into account the proposed mitigation measures, the slight change in location of construction vessel traffic would not change this conclusion.

5.2.7.2 Operations

None of the project design changes would significantly alter the impacts of routine operations on marine and coastal birds.

5.2.7.3 Decommissioning

None of the project design changes would significantly alter the impacts of decommissioning on marine and coastal birds.

5.2.7.4 Accidents and Upsets

None of the project design changes would significantly alter the impacts of accidents and upsets on marine and coastal birds.

5.2.8 Threatened and Endangered Species

Threatened and endangered species that may occur in and near the area include the Florida manatee, five sea turtle species, and five bird species, as discussed in **Volume II**, **Section 4.2.7** of the **Deepwater Port Application**.

Potential impacts on threatened and endangered marine mammals are discussed in **Volume II**, **Section 4.3.7** of the **Deepwater Port Application**. Impacts of project design changes on marine mammals and sea turtles have been discussed in the preceding sections. None of the project design changes would significantly alter the impacts on these animals.

As discussed in **Volume II**, **Section 4.3.7** of the **Deepwater Port Application**, the project is not expected to have any impact on threatened or endangered birds. None of the project design changes would significantly alter this conclusion.

5.2.9 Aquatic Preserves and Protected Areas

Within the Tampa Bay estuary, there are four Aquatic Preserves (Boca Ciega Bay, Cockroach Bay, Pinellas County, and Terra Ceia). As discussed in **Volume II**, **Section 4.3.8** of the **Deepwater Port Application**, the project is not near or expected to have any impact on Boca Ciega Bay, Cockroach Bay, or Pinellas County Aquatic Preserves. There are no aquatic preserves or protected areas in the vicinity of the Alternative Route around Sand Resources.

5.2.9.1 Construction

Section 6.2.8 of **Addendum I** addressed the re-routing of the pipeline to avoid the Terra Ceia Aquatic Preserve. Project design changes would not alter the impacts to aquatic preserves and protected areas as described there.

5.2.9.2 Operations

Routine operations are not expected to have any impact on Aquatic Preserves. Project design changes would not alter this conclusion.

5.2.9.3 Decommissioning

Decommissioning is not expected to have any impact on Aquatic Preserves. Project design changes would not alter this conclusion.

5.2.9.4 Accidents and Upsets

Accidents and upsets are not expected to have any impact on Aquatic Preserves. Project design changes would not alter this conclusion.

5.3 Summary of Impacts

Table 5-9 summarizes potential impacts on marine resources. Impacts are rated as significant, minor, or negligible using the following criteria:

- **Significant –** likely to result in violation of applicable laws, regulations, or standards; death, injury, disruption of critical activities, or adverse modifications to the critical habitat of an endangered or threatened species; mortalities, injuries, or habitat degradation of non-endangered wildlife in sufficient numbers to adversely affect their population; and/or broad-scale, persistent shifts in species composition, ecological relationships, or ecosystem function.
- **Minor –** changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible –** changes that are unlikely to be noticed or measurable against background conditions.

Table 5-9
Summary of Impacts to Marine Resources Due to Project Design Changes

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Fish and Essential Fish Habitat					
Construction	Physical disturbance to benthic fish habitat during pipeline installation	Areal extent of hard/live bottom impacts increased due to re-route and changes in impact assumptions for calculations	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard/live bottom)	• Hard/live bottom habitats within the pipeline corridor have been mapped and avoided to the extent practicable • During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard/live bottom habitat • Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep • Anchoring on areas of significant benthic resources (i.e., Type A habitat) will be avoided to the extent practicable • During installation, vessel sizes will be selected to provide vessels adequate to perform the work, but minimized to reduce the number and type of anchors, where possible
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Table 5-9
(Continued)

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Benthic Communities					
Construction	Physical disturbance to benthic communities during pipeline installation	Areal extent of hard/live bottom impacts increased due to re-route and changes in impact assumptions for calculations	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard/live bottom)	• Hard/live bottom habitats within the pipeline corridor have been mapped and avoided to the extent practicable • During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard/live bottom habitat • Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep • Anchoring on areas of significant benthic resources (i.e., Type A habitat) will be avoided to the extent practicable • During installation, vessel sizes will be selected to provide vessels adequate to perform the work, but minimized to reduce the number and type of anchors, where possible
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Plankton					
Construction	*No change*	*No change*	*No change*	*No change*	*No change*
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Table 5-9
(Continued)

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Marine Mammals					
Construction	Risk of a vessel striking a manatee or dolphin	Minor change in location of vessel traffic, no change in number or size of vessels. No vessels operating in manatee protection zones	• Unlikely • Direct • Reversible	Minor	• Extensive mitigation program as detailed in the **Deepwater Port Application** and "Revised Appendix F: Mitigation Measures" submitted in response to completeness comment
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Sea Turtles					
Construction	Risk of a vessel striking a sea turtle	Minor change in location of vessel traffic, no change in number or size of vessels	• Unlikely • Direct • Reversible	Minor	• Extensive mitigation program as detailed in the **Deepwater Port Application** and "Revised Appendix F: Mitigation Measures" submitted in response to completeness comments
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Marine and Coastal Birds					
Construction	Vessel traffic (disturbance)	Minor change in location of vessel traffic, no change in number or size of vessels	• Likely • Direct • Reversible	Minor	• Plan vessel transit routes to avoid sensitive receptors (e.g., bird colonies) to the extent feasible • Limit the number of vessel trips by using full-capacity crew boats as much as possible • To minimize excessive noise, maintain vessel engines and equipment in accordance with manufacturer recommendations; use sound-muffling devices or engine covers where appropriate, and turn off engines and equipment when not in use
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Table 5-9
(Continued)

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Threatened and Endangered Species					
Construction	Risk of a vessel striking a manatee, dolphin, or sea turtle	Minor change in location of vessel traffic, no change in number or size of vessels. No vessels operating in manatee protection zones	• Unlikely • Direct • Reversible	Minor	• Extensive mitigation program as detailed in the **Deepwater Port Application** and "Revised Appendix F: Mitigation Measures" submitted in response to completeness comments
	Disturbance of endangered or threatened coastal birds	Minor change in location of vessel traffic, no change in number or size of vessels	• Unlikely • Direct • Reversible	Minor	• See measures for Marine and Coastal Birds in the **Deepwater Port Application**
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*
Aquatic Preserves and Protected Areas					
Construction	*No change*	*No change*	*No change*	*No change*	*No change*
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

The table also categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible. Reversibility is based on the population-level impact rather than the individual organism (e.g., individuals may be killed, but the population would recover).

The most important difference related to project design changes is the increased areal extent of seafloor disturbance. Re-routing the pipeline around the sand source areas slightly shortened the pipeline length. However, due to changes in impact calculations, including the assumption that a higher percentage of the pipeline route would be plowable, the areal extent of seafloor disturbance has increased (see **Section 5.2.1**). The affected area is about 39% larger than previously estimated (i.e., relative to **Addendum I** and the anchor sweep estimates in Data Gaps/Response No. 61). Anchor sweep accounts for 96% of the total impact area in the revised analysis.

The revised calculations predict that a total of 9,250.80 acres (3,743.67 hectares) would be affected, of which about 33% or 3,025.54 acres (1,224.39 hectares) would be hard/live bottom habitats. Construction will physically damage hard/live bottom areas, including Type A, Type B, and Type D habitat, all of which are considered EFH for reef fishes. Most of the damage would occur during pipeline installation, including plowing of the seafloor, placement of barge anchors, and anchor sweep. Hard bottom areas are considered important or valuable habitat because of their physical structure and the dense epibiota that grow in these areas. Damage to the hard bottom substrate is considered irreversible. The recovery of benthic communities associated with damaged hard bottom areas would be much slower than for soft bottom areas due to the slow growth rate of corals and other hard bottom epibiota.

The analysis in **Volume II**, **Section 4.3.1** of the **Deepwater Port Application** concluded that seafloor disturbance impacts on benthic communities during construction would be minor for soft substrate/sand communities and significant for hard/live bottom communities. Although the areal extent of seafloor disturbance has increased, the overall significance of impacts is unchanged. From a broad perspective, the impact area represents less than 1% of the area within 50-mile radius semicircle offshore of the pipeline landfall (total area: about 2.5 million acres or about 1 million hectares). The amount of seafloor disturbance represents a relatively small, incremental impact.

6. CULTURAL RESOURCES

6.1 Existing Conditions

An offshore cultural resources evaluation performed for Port Dolphin was prepared and conducted in compliance with Section 106 of the National Historic Preservation Act (NHPA), Florida State requirements, and MMS requirements. The offshore cultural resources report is included as Appendix A of the Archaeological, Engineering, & Hazard Study Proposed 36-Inch Gas Pipeline Sand Resource Avoidance Reroute, Tampa Bay, Florida (*Confidential* **Attachment B.1**).

6.1.1 Prehistoric Resources Background

The Port Dolphin project area is situated on the broad Gulf inner continental shelf off the west coast of Florida and extends into the shallow estuary of Tampa Bay, which comprises a system of interconnected bays and lagoons bordered by coastal barrier islands (Brooks and Doyle, 1998). The present day coastal configuration has been determined by pre-Holocene geologic history (Hine, 1997; Hine et al., 2001). Tampa Bay occupies a local structural depression that has most probably resulted from the dissolution of underlying limestones within the Florida Platform during the late Paleogene and early Neogene (Hine, 1997). Seismic reflections indicate that a major east-west paleofluvial channel extended from beneath modern Tampa Bay, flowing north of Egmont Key, across the inner continental shelf to approximately ~24 miles (40 kilometers) seaward of the present day coastline at Tampa Bay (Willis, 1988; Duncan, 1992; Hine, 1997; Hine et al., 2001). Buried relict channeling in profiles from within the Bay appears extensively truncated with cut and fill structures (Brooks and Doyle, 1998). Sediments near the modern coastline are predominantly quartz-sands that have contributed to the formation of the coastal barrier island system. Sediments that occupy the lower end of Tampa Bay are predominantly carbonate-rich, marine-derived sands and gravels derived from Pleistocene terrace deposits and biogenic carbonates that formed *in situ* or were transported in from the Gulf of Mexico (Doyle and Brooks, 1998).

Previous geological and archaeological studies have examined the sea level fluctuations of the late Pleistocene and early Holocene epochs (Curray, 1960; Coleman and Smith, 1964; Scholl et al., 1967; Colquhoun and Brooks, 1986; Coastal Environments, Inc., 1977, 1982, 1986; Garrison, 1992). While complexities and differences occur between models based on local studies (Colquhoun et al., 1981; Colquhoun and Brooks, 1986), the Holocene marine transgression is generally summarized as a rapid rise from 14,000 years B.P. to 6,000 B.P., with a slower transgression marked by periodic fluctuations from 6,000 B.P. to the present. Dunbar et al. (1991) and Faught and Donoghue (1997) suggest that the approximately 130-foot (40-meter) isobath offshore the western coast of Florida (outside of the survey area) represents a Paleo Indian or "Clovis Shoreline." By about 3,000 B.P., sea level reached its current stand.

Between 5,000 and 3,000 B.P., in response to the declining rate of sea level rise, the barrier islands across the mouth of Tampa Bay began to take on their present configurations. The regional west coast study reported on by Hine et al. (2001) showed that the barriers essentially exhibit the same basic stratigraphy, that of development by initial upward shoaling on a Holocene bedrock foundation dating to about 4,000 B.P., followed by the aggradation of sediments, and in some areas, by the progradation of sediments.

Predictive models based on correlations between prehistoric archaeological sites and geomorphic landforms, which have been proposed by Coastal Environments, Inc. (1977, 1982, 1986), Colquhoun et al. (1981), Aten (1983), Kraft et al. (1983), Gagliano (1984), Dunbar et al. (1989a,b 1991), Faught (2003, 2004), Stright (1986, 1987, 1990), and others, suggest that submerged Paleo Indian and Archaic period sites in Florida may be associated with natural levees, margins, point bars, and terraces of alluvial streams; margins of bays, lakes and estuaries; sinkholes; and relict beach ridges. Numerous reports on investigations of Paleo Indian, Archaic, and later cultural occupations of now submerged landforms have examined these early land-man relationships off the coasts of Florida (Goggin, 1964; Ruppe, 1980; Stright, 1987; Dunbar, 1983, 1991; Dunbar et al., 1989a,b; Murphy, 1990; Milanich, 1994). The identification of these or related landforms in presently submerged areas would represent high probability areas for the occurrence of prehistoric archaeological sites.

The archaeological culture history of Tampa Bay and offshore Florida has been presented in depth by numerous sources (e.g., Bense, 1994; Milanich, 1994; and others), with one of the earliest cultural syntheses provided by Willey (1949), and for an introduction to inundated site potential, by Goggin (1947). More recent frameworks of the Paleo Indian and Archaic stages, whose artifact assemblages would be represented off the present west Florida Gulf of Mexico coast, have been described by Ruppe (1980), Stright (1987), Dunbar et al. (1989a,b), and Murphy (1990), among others. Because sea level reached its current stand about 3,000 B.P., archaeological cultural complexes younger than this date are unlikely to be present in the now submerged area of Tampa Bay. However, it is possible that isolated finds of dugout canoes or artifacts used for exploiting marine resources by more recent cultures could be present.

The Paleo Indian stage is dated roughly to the period between about 12,000 and 8,000 B.P. The late Pleistocene period was characterized geographically by greatly lowered sea levels, with the Florida Gulf coastline located some 40 to 85 miles (64 to 137 kilometers) west of its present site (Faught, 1996). Arid conditions prevailed with much lower groundwater tables. Many Paleo Indian sites in Florida are situated adjacent to Tertiary Karst and Marginal Karst water sources represented by deep springs and still water retention basins, and a model for this settlement pattern, the Oasis model, has been proposed by James Dunbar and S. David Webb (Dunbar, 1983, 1991; Webb et al., 1984; Dunbar et al., 1989a,b), which built upon the earlier premise of Wilfred T. Neill (1964). Resources found at these sinks would have included chert sources and fauna. Clovis, Suwannee, and Simpson lanceolate projectile points are typical diagnostic tools, and are sometimes associated with the remains of Pleistocene megafauna. Evidence of now inundated sites dating from the Paleo Indian and Archaic stages has been found on the continental shelf off of the Big Bend region of Florida (Anuskiewicz, 1988; Dunbar et al., 1989a,b). Possible Paleo Indian shell middens in Tampa Bay have been reported by Goodyear with others in 1972, 1980, and 1983. A prominent excavation of a Paleo Indian site in the Tampa Bay area was conducted at Harney Flats (Daniel and Wisenbaker, 1987).

The Archaic stage defines the cultures that adapted to the post-Pleistocene environmental changes and economic strategies necessitated by climatic shifts. Three stages have been defined: early Archaic from about 8,000 to 7,000 B.P., the middle Archaic from 7,000 to about 4,500 B.P., and the late Archaic from about 4,500 to about 3,200 B.P. (Bense, 1994; Milanich, 1994). Climatic conditions became wetter as a result of postglacial warming, and marine transgression inundated the continental shelf, reaching its current position some 3,000 years ago during the late Archaic stage. Pollen analyses reflect variations in local ecologies and the shift in coastal environments. With stabilizing and more easily accessible water sources, an increase in population occupying established base camps is associated with the early Archaic stage. In Florida, as elsewhere, the archaeological convention ends this tradition characterized by hunting and gathering with the development of more complex technologies, including ceramics; however, hunting and gathering strategies persisted along the Florida coast through later prehistoric cultures until European contact.

New technologies introduced during the Archaic Period reflect a more settled population, and include the use of more diverse lithic assemblages used for a multitude of tasks (Milanich, 1994). Noted in the Archaic artifact assemblages are milling implements, hearths and baking pits, polished stone artifacts, mortuary rituals with cemeteries, including the earliest mound building, horticulture, textiles for clothing, nets, and baskets, and, at the end of the period during the transition to Late Prehistoric or Woodland period, the introduction of ceramics around 2,100 B.P. (Purdy, 1981; Bense, 1994). Diagnostic lithic artifacts of the Early Archaic period include Bolen-Kirk, Dalton, and Kirk projectile points, while those of the Middle Archaic include Newnan and Eva points. The ceramic sequence on the upper northwest Florida coast begins about 2,100 B.P. with fiber tempered wares assigned to the Norwood series (Bense, 1994).

6.1.2 Historic Cultural Resources

Tampa Bay and its offshore approaches are the primary locations for possible shipwrecks, and many wrecks have been reported and documented in the bay and along the west Florida coast that are representative of vessels dating from the Spanish and British periods of European colonization, the American period of colonization and immigration of the 19th century, through the present day. Colonial and historic period shipping routes commonly traversed this area, typically hugging the coast to provide access to trade and provisioning centers such as those developed in Tampa, Pensacola, Mobile Bay, Biloxi, and Galveston (Coastal Environments, Inc., 1977; Garrison et al., 1989). Overland transport of goods and materials was difficult until the mid- and late 19th century when railroad and canal networks were established and the early 1900’s when roads were improved.

Settlers were dependent upon a variety of different vessel types to support their transportation needs. For more than 200 years, many versions of canoes, skiffs, and flatboats were used for lightering goods and people in shoaled waters. Caravels, galleons, and frigates were the principal vessel types of the Spanish and British colonial periods. During the late 18th century and early 19th century, schooners were the principal sailing rigs used for fishing and the transport of passengers and freight and also were popular as pleasure craft. By the 1830's, steamboats were becoming increasingly common offshore, as well as on the inland waterways.

Garrison et al. (1989) presented a regional historic framework for the northern Gulf of Mexico outlining historic and technological changes in their synthesis of archaeological, environmental, and geographic data relevant to shipwreck occurrence in the Gulf of Mexico. These periods include the New Spain Period (1500-1699), the Colonial period (1700-1803), the American Period (1803-1865), the Victorian Period (1866-1899), and the 20th Century Period (1900-present). They have been well described in regional literature pertinent to the west coast of Florida (Works Progress Administration, 1939; Dovell, 1952; Tebeau, 1987; Gannon, 1996), as well as on a broader scale (Coastal Environments, Inc., 1977; Weddle, 1985, 1991, 1995; Hoffman, 1980). The Geographic and Cultural Context Section in the Archaeological Assessment submitted to the USCG as part of Data Gap Responses 64 and 81 (31 August 2007) addresses the historic period and incorporates particular references to the Tampa Bay area.

Modern cultural features identified along the route include the Gulfstream 36-inch pipeline (Segment No. 12373) and artificial reef sites established by the Gulfstream Natural Gas System as mitigation for impacts incurred during pipeline installation, the Pinellas County Department of Environmental Protection Artificial Reef Program, and the Florida Fish and Wildlife Conservation Commission.

An archival search was conducted to determine the presence or reported incidence of shipwrecks within or adjacent to the project area. No sites listed on the National Register of Historic Places (NRHP) are in the project area. Reference to lists and charts published by the U.S. Department of Transportation, USCG Local Notices to Mariners, National Ocean Service (NOS) Navigation Charts, the NOS Automated Wreck and Obstruction Information System (AWOIS) database (2007), Berman (1972), Marx (1985), Potter (1988), Singer (1992), and the MMS shipwreck database (Pearson et al., 2003) indicates that there have been numerous vessels reported from the colonial, historic, and modern periods off the coast of Florida, as well as in Tampa Bay, whose wreck sites remain undetermined.

Possible 19th and 20th century wrecks in the project vicinity in Tampa Bay include the following: the *Isis*, burned in 1842; the *Eugene Batty*, sunk through collision in 1906; the *Wave*, burned in 1908; the *Davy Crockett*, stranded in 1909; the *Water Boy*, sunk in 1911; the *City of Sarasota*, foundered in 1919; the *Thomas B. Garland*, stranded in 1921; the *Bon Temps*, sunk in 1921; the *Gwalia*, foundered in 1925; the *Stranger*, burned in 1927; the *Belmont*, sunk in 1940; the *Kim Too*, stranded in 1955; *Barge No. B-29*, foundered in 1955; the *Miss Powerama*, stranded in 1962; the *Buhnday*, sunk in 1966; and the *Ranger III*, sunk in 1966.

Four obstructions are listed in the AWOIS files in the vicinity of the Alternative Route around Sand Resources survey area in Tampa Bay: Nos. 10318, 9833, 10310, and 10312. These obstructions were confirmed in the geophysical data set. No. 10318 was reported to be a cylindrical tank. No. 9833 was a metal-hulled watercraft identified as similar to an aluminum SeaArk boat. No. 10310 was found to represent several chunks of concrete, and No. 10312 represents a metal tank.

6.1.3 Geophysical Survey of the Alternative Route around Sand Resources

Field operations were conducted aboard the R/V *Hydro II*, R/V *Echotra*c, and R/V *Miss Casey*, survey boats. Data acquisition operations took place from September 10 – 14, 2007; July 28 – 31 to August 1 – 7, 10, 11, and 15 – 17, 2008; and November 2 – 5, 2008. Sea conditions during data acquisition operations varied from 1 to 4 feet. These efforts and conditions resulted in complete data sets. Geophysical instruments used during the survey consisted of a Klein Model 3000 side-scan sonar, a Marine Magnetics SeaSPY marine magnetometer, an EdgeTech Model 3200-XS subbottom profiler, an Odom Echotrac Mark III echo sounder, an Odom Digibar Pro Model DB1200 velocimeter, and a VT TSS Model HS-50 heave sensor (*Confidential* **Attachment B.1**). Horizontal positioning of the survey vessel was accomplished using HyPack navigation software with a Trimble Model DSM-232 global positioning receiver. Horizontal accuracy of this positioning as stated by the manufacturer is ±3 meters.

The survey grid covering the proposed pipeline realignment corridor was run in four sections and was designed to provide complete geophysical coverage (3,000 feet [914 meters] wide) of the seafloor when supplemented by the survey data collected along the Original Preferred Route.

6.1.4 Summary of Cultural Resource Findings

6.1.4.1 Objectives

The objective of the cultural resource evaluation was to locate and identify cultural resources that exist in the project site area that potentially could be physically disturbed by project activities within the survey area of the nearshore portion of the Alternative Route around Sand Resources in Tampa Bay. Any potentially significant submerged cultural resources that might be eligible for listing on the NRHP will require avoidance or additional archaeological investigation.

6.1.4.2 Prehistoric Resources

Water depths along the nearshore portion of the Alternative Route around Sand Resources range from 36 to 6 feet (~11 to 2 meters) MLLW. Seafloor slope is variable across the area, but decreases notably to the east in Tampa Bay.

Across much of the area the seafloor exhibits a generally smooth seafloor interrupted by migrating sands and shoals and hard bottom zones. These features were corroborated in the side-scan sonar data. Possible remnant shoals exhibit heights from 2 to 3 feet (0.6 to 1 meters), extending over areas up to 1,000 feet (304 meters). Acoustic penetration of the subbottom profiler below the sandy seafloor ranged from little or no penetration (between 5 and 20 feet [1.5 to 6 meters]). Strong seafloor multiples, indicating hard seafloor or buried pipelines, occur throughout the data set. No fluvial channels, possible sinkholes, or other geomorphic features that could represent high probability areas for prehistoric archaeological sites were recorded in the data set.

6.1.4.3 Historic Cultural Resources

A total of 500 magnetic anomalies was recorded, 461 of which remain unidentified. Most of the anomalies present throughout the survey are low amplitude, short duration features representing small ferrous debris that is densely scattered within the surveyed area. Four clusters of anomalies have been identified and recommended for avoidance. If avoidance is not possible, further archaeological diver investigation shall take place prior to project activities to determine the exact nature and extent of the anomalies.

Nine unidentified individual sonar contacts were recorded during the survey. Five of the sonar contacts corresponded with magnetic anomalies in magnetic cluster one, a single sonar contact corresponds to magnetic anomaly 330, another sonar contact corresponds with magnetic anomaly 371, and two sonar contacts do not correspond with any magnetic anomalies. In total, four magnetic anomaly clusters have been recommended for avoidance. If avoidance is not possible, further archaeological diver investigation shall take place prior to project activities to determine the exact nature and extent of the anomalies.

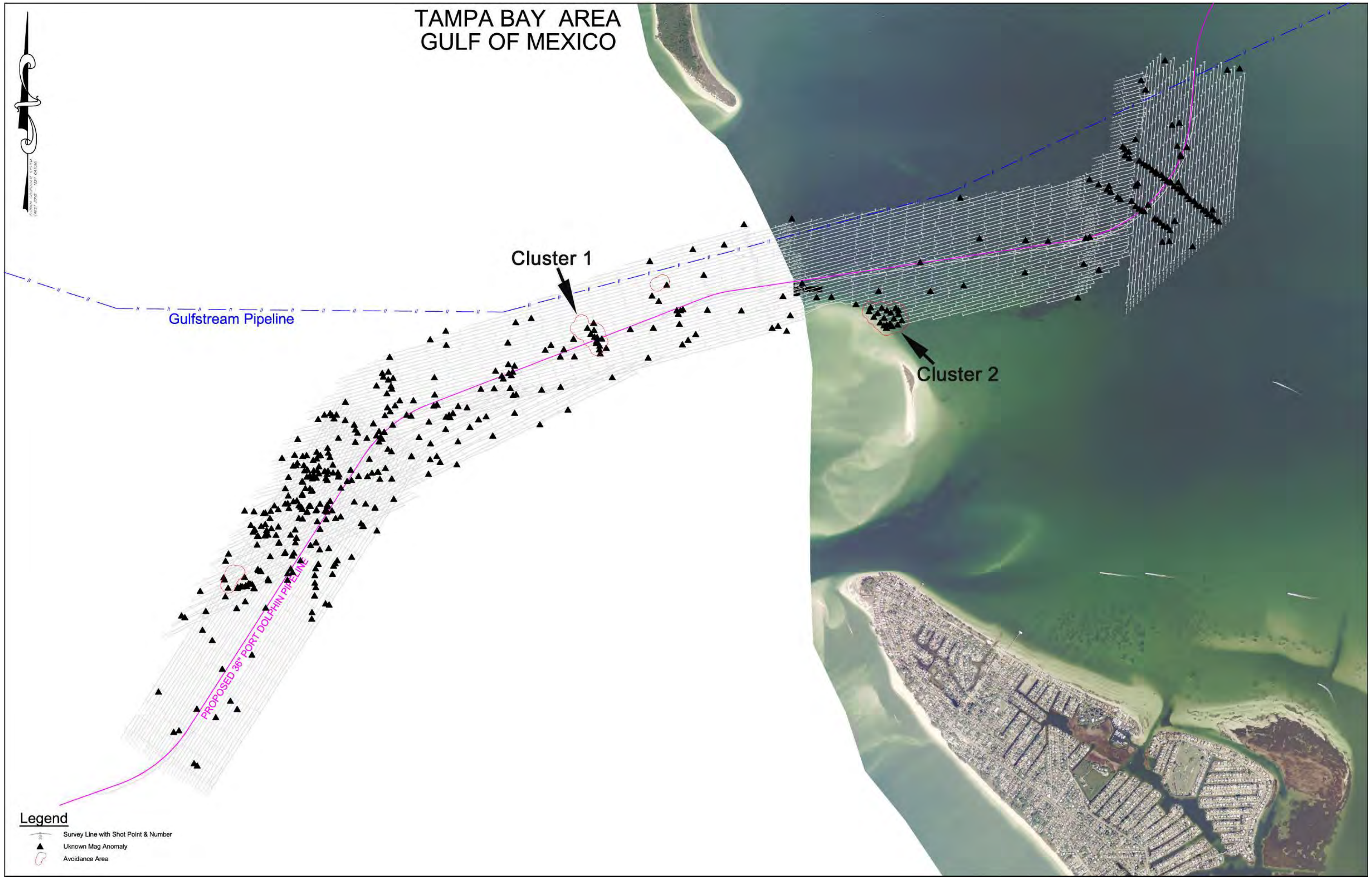
The Phase 1 cultural resources evaluation for the nearshore portion of the Alternative Route around Sand Resources identified four features of potential cultural significance in the side scan-sonar and magnetometer data. Magnetic anomaly Cluster 2 is located in the vicinity of the shipwreck *Water Boy*. An avoidance zone of 200 feet (61 meters) has been designated around all four clusters of magnetic anomalies (**Figure 6-1**). If avoidance is not possible, further archaeological diver investigation shall take place prior to project activities to determine the exact nature and extent of the anomalies.

6.2 Analysis of Potential Consequences

Adverse impacts to cultural resources occur when an activity is likely to damage or disturb a unique feature such as an historic site (shipwreck) or prehistoric site (former human occupation areas). The nature of any impacts to cultural resources as a result of project activities would be direct, in that the consequence of offshore installation/decommissioning activities could have an immediate effect upon the resource. In all cases, the duration of environmental consequences to cultural resources resulting from project activities would be long-term or permanent, as opposed to temporary. In addition, any impacts to cultural resources may be irreversible.

Impacts were evaluated based on consequence-producing factors related to the following phases of the project.

Figure 6-1
Avoidance Zone Around Unidentified Feature



6.2.1 Construction

The primary potential impacts to cultural resources associated with offshore construction activities would be potential impacts to prehistoric and historic sites. Construction of the pipeline would involve derrick/lay barges, anchor handling tug support vessels, and other such vessels. Potential disturbance of historic and prehistoric sites could occur from anchors used by these vessels if used within the designated avoidance zones.

The Phase 1 geophysical survey performed for the Alternative Route around Sand Resources revealed no geomorphic features representing high probability areas for prehistoric archaeological sites.

Four clusters of magnetic anomalies, three of which contain sonar contacts, have been identified in the survey area. An avoidance zone of 200 feet (61 meters) has been designated around these clusters (**Figure 6-1**). If avoidance is not possible, further archaeological diver investigation shall take place prior to project activities to determine the exact nature and extent of the anomalies.

In the event that any cultural resources are discovered during construction, the details and procedures for handling these unanticipated discoveries are outlined in an Unanticipated Discoveries Plan, which was submitted with the archaeological assessment.

6.2.2 Operations

Magnetic anomaly Cluster 1 and magnetic anomaly Cluster 4 are located near the proposed pipeline location. It is recommended that the pipeline be rerouted so that it is not located within 1,000 feet (304 meters) of potentially significant prehistoric or historic resources. If avoidance is not possible, further archaeological diver investigation shall take place prior to project activities to determine the exact nature and extent of the anomalies.

6.2.3 Decommissioning

Due to the proximity of the proposed pipeline to potentially significant targets, decommissioning activities should be conducted at a minimum distance of 1,000 feet (304 meters) from any potentially significant targets.

The pipeline would be decommissioned by filling it with seawater and leaving in place subject to MMS guidelines and the terms of the submerged lands lease to be obtained from the State of Florida. Maintaining a minimum distance of 1,000 feet (304 meters) from potentially significant resources should avoid impacts on prehistoric or historic cultural resources during pipeline decommissioning procedures.

6.2.4 Accidents and Upsets

It is not anticipated that releases of LNG, natural gas, or other petroleum products from vessels or operations would impact the seafloor. Therefore, cultural resources are not expected to be impacted by upsets or accidents.

6.3 Summary of Impacts and Mitigation Measures

The proposed STL buoy site and Preferred Route Modification have been designed to avoid prehistoric and historic cultural resources. Installation, operation, and decommissioning activities would avoid impact to resources, if found. If avoidance of these areas of potential resources is not possible, then these resources would be retrieved and curated at a State or federally recognized facility in accordance with applicable procedures.

The main objective of the cultural resource evaluation was to locate and identify cultural resources that exist in the project site area that potentially could be physically disturbed by project activities. Any potentially significant submerged cultural resources that might be eligible for listing on the NRHP would require avoidance or additional archaeological investigation.

6.3.1 Prehistoric Resources

The subbottom profiler data were very limited in its penetration and resolution due to the sandy nature of the surficial deposits. This dataset did not define any faults or other subbottom constraints to the proposed pipeline alignment. No geomorphic features that could represent high probability areas for prehistoric archaeological sites were recorded along the Alternative Route around Sand Resources.

Strong seafloor multiples, indicating hard seafloor or buried pipelines, occur throughout the data set. No fluvial channels, possible sinkholes, or other geomorphic features that could represent high probability areas for prehistoric archaeological sites were recorded in the data set.

6.3.2 Historic Cultural Resources

A total of 500 magnetic anomalies were recorded, 461 of which remain unidentified. Twenty magnetic anomalies (Cluster 2) are located in the vicinity of the 1911 shipwreck *Water Boy*, and 13 magnetic anomalies and four sonar targets (Cluster 1) are located seaward for the pass and are near a documented navigational buoy. Eleven magnetic anomalies in the southwest section of the survey area make up Cluster 3, and Cluster 4 consists of three magnetic anomalies and one sonar target. All clusters are recommended for avoidance. If avoidance is not possible, further archaeological diver investigation shall take place prior to project activities to determine the exact nature of the anomalies.

The Phase 1 geophysical survey magnetometer and side-scan sonar data cultural resources evaluation identified a number of features of potential cultural significance. Four clusters of magnetic anomalies have been identified as being potentially significant and recommended for avoidance. Cluster 2 contains 20 magnetic anomalies and is located in the recorded vicinity of the historic shipwreck *Water Boy*. Magnetic anomalies identified as Cluster 1 are located in the vicinity a known navigational marker.

In the event of unanticipated discovery of cultural resources, Port Dolphin would follow an Unanticipated Discoveries Plan, which was submitted to the USCG as part of Data Gap Response 65 (3 August 2007). Under this Plan, all activity in the area of work would be halted immediately, and an avoidance zone of at least 1,000 feet (305 meters) for further work in that area would be established. Within 48 hours of the discovery, the Regional Supervisor, Leasing and Environment, and archaeologists at the MMS office in New Orleans, as well as the USCG and the appropriate Florida State Historic Preservation Officer with the Florida Division of Historical Resources would be notified.

7. GEOLOGY

7.1 Existing Conditions

Existing geological conditions at the offshore terminal site and along the offshore portions of the Original Preferred Route have been described in **Volume II**, **Section 7** of the **Deepwater Port Application**. Geological conditions in the Revised Preferred Route developed to avoid the Terra Ceia Aquatic Preserve are discussed in **Section 8** of **Addendum I**. The only new information presented here is for geological conditions along the Alternate Route around Sand Resources. The pipeline route with all revisions incorporated is termed the Preferred Route Modification.

7.1.1 New Geophysical Survey

A geophysical survey of the area of the Alternate Route around Sand Resources was completed by T. Baker Smith in July/August and October/November 2008 (*Confidential* **Attachment B.1**). **Figure 7-1** shows the distribution of hard bottom within the survey area. Of the total area surveyed (12,399.1 acres or 5,017.9 hectares), most was soft bottom (85.4%), with only 14.6% classified as hard bottom.

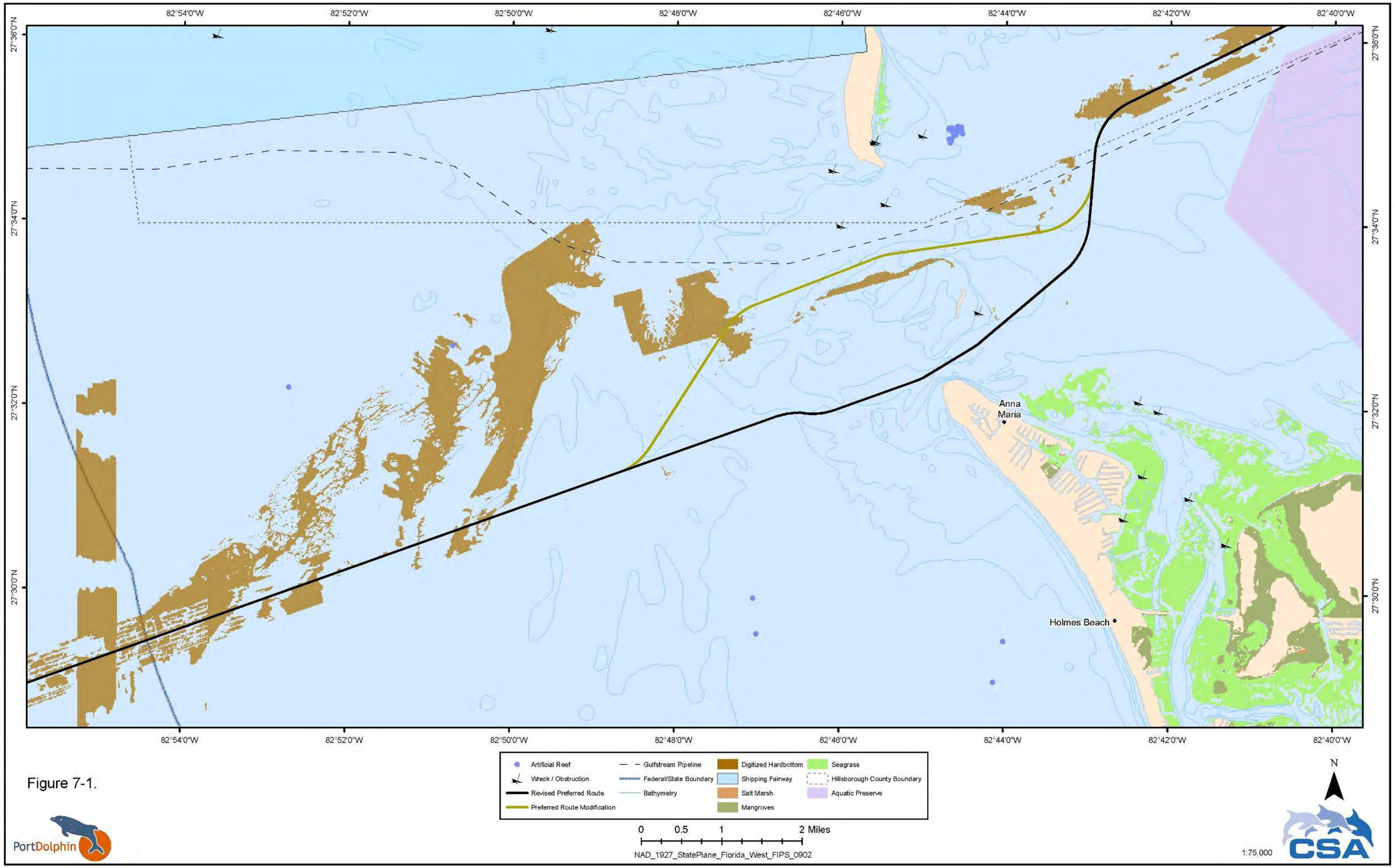
7.1.2 Seafloor Substrates – Alternative Route around Sand Resources Corridor

Table 7-1 shows the acreages of seafloor substrate types within the 3,936-foot (1,200-meter) wide pipeline corridor, from the beginning to end of the Alternative Route around Sand Resources Corridor. For comparison, data are also presented for the corresponding section of the Revised Preferred Corridor (i.e., the corridor without the re-route around sand resources).

Table 7-1
Seafloor Substrates within the Alternative Route around Sand Resources Corridor, as Compared with the Corresponding Section of the Revised Preferred Route

Seafloor Substrate	Corresponding Section of Revised Preferred Route (Addendum I)			Alternative Route around Sand Resources Corridor (this Addendum II)		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Hard Bottom	8.16	3.30	0.23	311.06	125.88	8.75
Soft Bottom	3,555.96	1,439.05	99.77	3,244.77	1,313.12	91.25
Total Area	3,564.12	1,442.36	100.00	3,555.83	1,439.00	100.00

Figure 7-1
Distribution of Geophysically Mapped Hard Bottom within the Alternative Route around Sand Resources



The pipeline corridor is predominantly soft bottom with patchy areas of hard bottom. The Alternative Route around Sand Resources Corridor has about 40 times more hard bottom (8.75% vs. 0.23%) than the corresponding portion of the Revised Preferred Route (**Figure 7-2**). The higher incidence of hard bottom along the re-routed corridor is due to avoiding potential sand resource areas. Also, some areas classified as hard bottom may represent areas of sandy and granular sediments that show up as high reflectivity areas in the side-scan sonar data. The exact classification of these features could not be entirely made on the basis of the side-scan sonar data alone. In general, the geophysical survey tended to classify higher percentages of the seafloor as hard bottom when compared with the video survey (e.g., 8.75% hard bottom from the geophysical survey vs. 6.67% hard/live bottom habitat types from the video survey) (**Attachment A.1**).

7.1.3 Seafloor Substrates – Entire Preferred Route Modification

For impact calculations, seafloor substrate percentages along the entire Preferred Route Modification corridor were used. These data are presented in **Table 7-2** along with a comparison to the Revised Preferred Route. **Figure 7-3** shows the distribution of geophysically mapped hard bottom within the entire Preferred Route Modification corridor.

Table 7-2
Seafloor Substrates along the Preferred Route Modification as Compared with the Revised Preferred Route (Entire Corridors including Buoy Areas)

Seafloor Substrate	Revised Preferred Route (Addendum I)			Preferred Route Modification (this Addendum II)		
	Acres	Hectares	% of Corridor Area	Acres	Hectares	% of Corridor Area
Hard bottom	3,377.57	1,366.85	12.62	4,083.71	1,652.62	14.59
Soft bottom	23,379.99	9,461.56	87.38	23,901.45	9,672.57	85.41
Total	26,757.56	10,828.41	100.00	27,985.16	11,325.19	100.00

The total corridor area is about 4% less for the Preferred Route Modification due to the slightly shorter pipeline route, as noted in **Section 2**. The Preferred Route Modification has slightly higher percentages of hard bottom (14.59% vs. 12.62%) and slightly lower percentages of soft bottom (85.41% vs. 87.38%).

Figure 7-2
Comparison of Geophysically Mapped Hard Bottom within the Preferred Route Modification and Revised Preferred Route

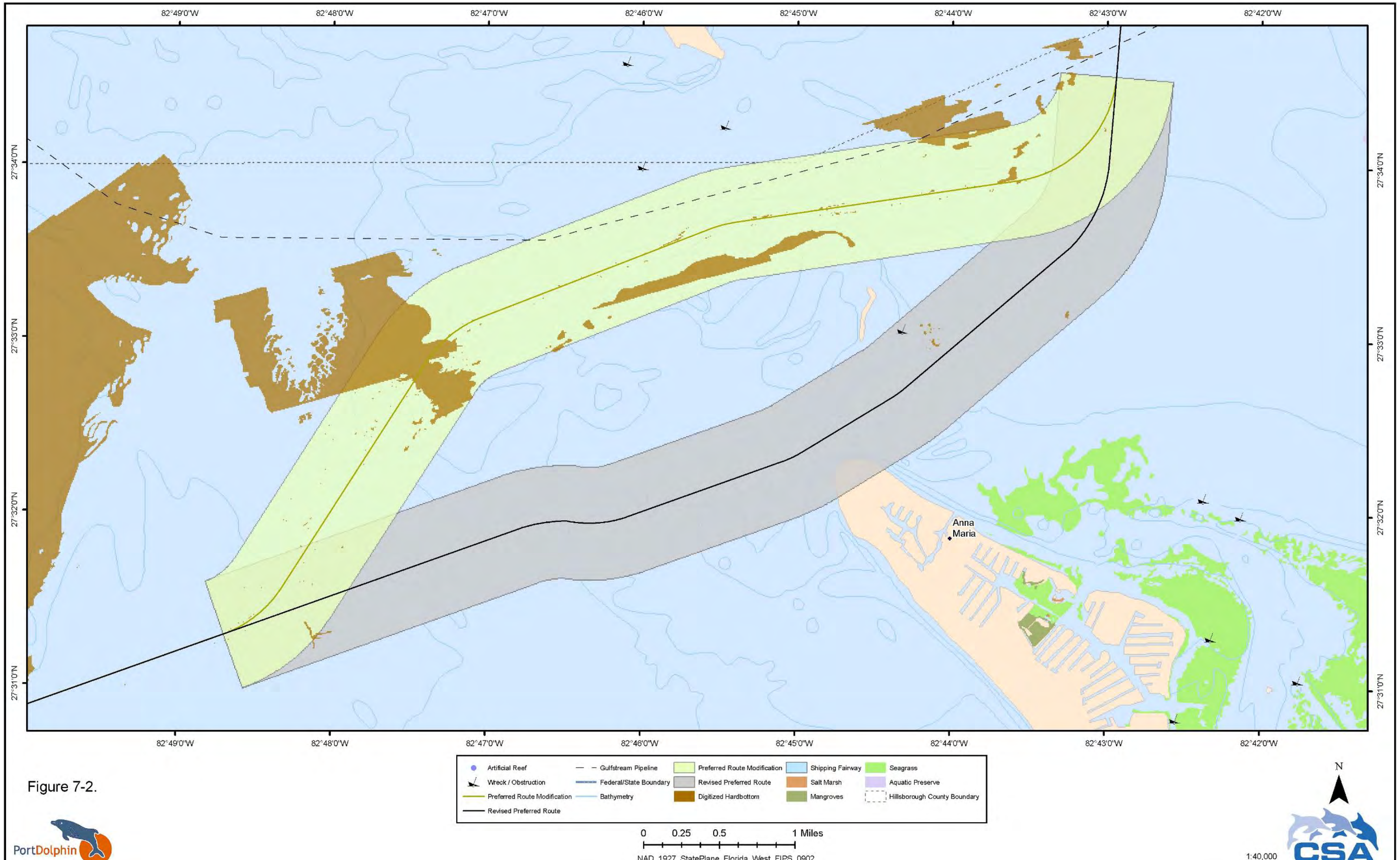
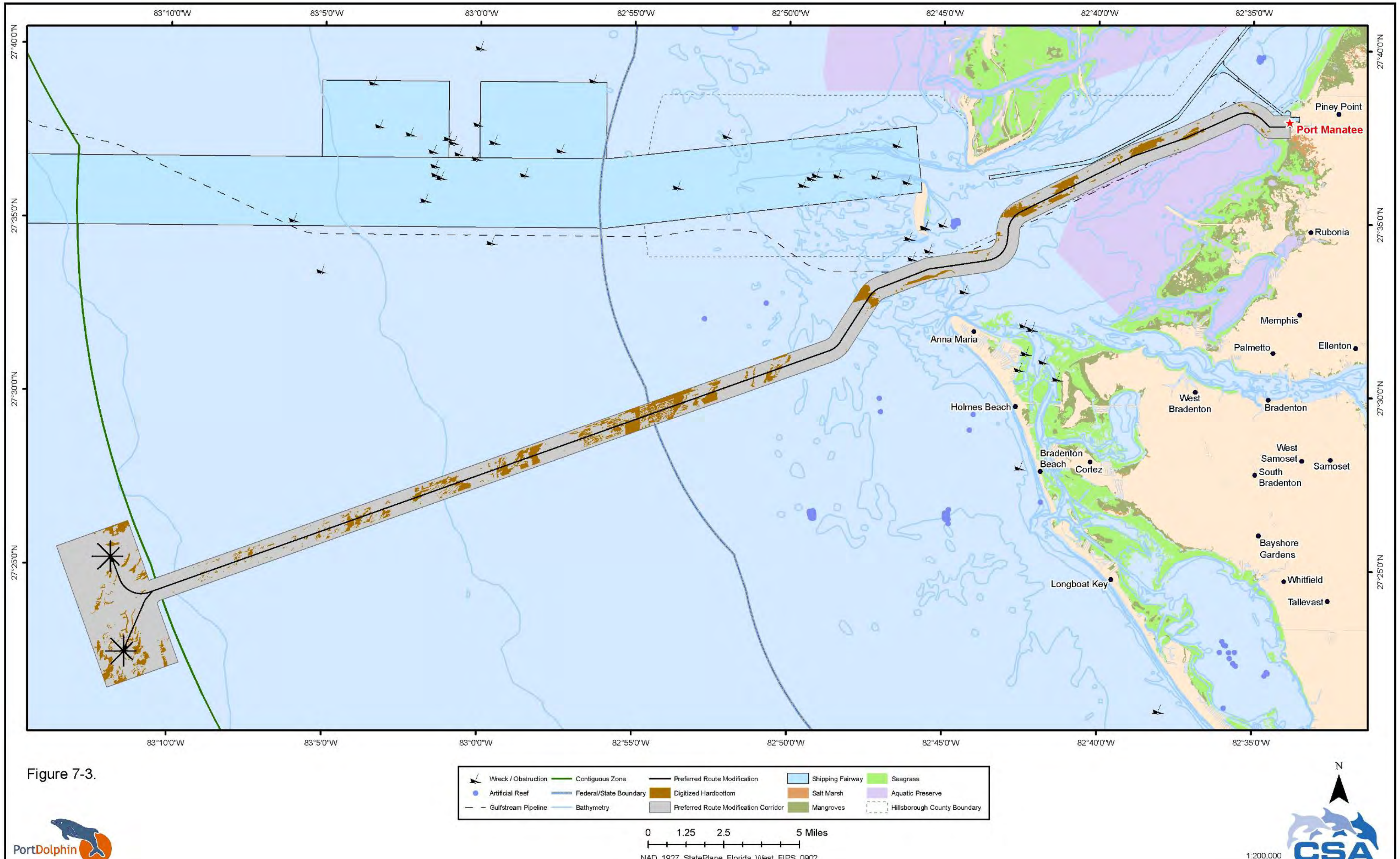


Figure 7-2.

Figure 7-3
Geophysically Mapped Hard Bottom within the Entire Preferred Route Modification



7.2 Analysis of Potential Consequences

Impacts to geology and sediments are discussed in **Volume II**, **Section 7.3.1** of the **Deepwater Port Application**. This section evaluates changes in impacts resulting from re-routing of the nearshore pipeline corridor to avoid sand resources. Impacts of pipeline installation along the entire route have been recalculated based on the revisions caused by the Preferred Route Modification.

The main construction-related impacts associated with the Preferred Route Modification will consist of direct physical disturbance to the seafloor during pipeline installation. These impacts will result from plowing of the seafloor, placement of concrete mattresses, and anchoring of barges during pipeline installation. There are no project design changes relevant to operations, decommissioning, or accidents or upsets, and so potential impacts from these sources are unchanged from the original analysis.

7.2.1 Recalculation of Seafloor Disturbance

Impacts of pipeline installation along the entire Preferred Route Modification have been recalculated based on the re-routing of the pipeline around sand resources. The calculations differ from those in **Addendum I** in the following ways:

- Due to the re-routing around sand resources, the corridor length has decreased slightly and the average percentage of seafloor substrates (hard and soft bottom) within the corridor has changed slightly (see **Table 7-2**).
- Project engineers have revised the spreadsheet indicating which pipeline segments will be plowed. As summarized in **Table 7-3**, the revised analysis indicates that, excluding HDD areas, 87% of the pipeline length will be plowed, compared with 49% estimated in **Addendum I**. It is expected that in some plowed areas, the plow may not achieve burial to the design depth, in which case these areas would subsequently be covered by concrete mattresses or rock armoring. However, for direct disturbance calculations, these areas are simply assumed to be plowed, since the impact width for plowing is greater than that for mattress placement.
- Estimates of anchor sweep for the pipelaying barge have been added. Although not included in **Addendum I**, anchor sweep estimates were subsequently submitted to the USCG on 31 March 2008 in Data Gaps/Response No. 61. The same methodology was used here.

The following sections discuss specific aspects of the seafloor disturbance calculations, including direct impacts of pipeline burial, anchoring, and anchor sweep.

Table 7-3
Estimated Linear Extent of Pipeline Burial Techniques

Burial Technique	Revised Preferred Route (Addendum I)	Preferred Route Modification (this Addendum II)
Plowing/trenching (feet)	115,468	205,997[a]
Concrete mattress/rock armoring (feet)	120,081	28,398
Clamshell dredging/dragline burial (feet)	1,000	1,104
Horizontal directional drilling (HDD) (feet)	7,855	7,854
Total length (feet)	243,404	243,353
Total length (feet) excluding HDD segments	235,548	235,499
Plowing/trenching / total non-HDD length	49%	87%

[a] Includes an estimated 76,500 feet that may not achieve the design depth and may require concrete mattresses or rock armoring.

7.2.1.1 Direct Impacts of Pipeline Burial

As described in the **Deepwater Port Application**, the pipeline will be laid on the seafloor by a pipelaying barge, and then buried, most likely with a plowing technique. The trench will then be backfilled. The estimated width of the trench (including sediments initially pushed to each side) is 67 feet (20.4 meters). In areas that cannot be plowed or does not achieve the required burial depth of 3 feet below the seafloor, the pipeline will be covered with concrete mattresses or rock armoring. In one location in Tampa Bay, a combination of clamshell dredging/dragline burial is planned.

The following methods were used to estimate the areal extent of impacts:

- The pipeline corridor was divided into segments that were identified as suitable for plowing/trenching or mattress placement;
- A GIS was used to overlay the pipeline (i.e., center of the pipeline corridor) on the map of benthic habitats.
- Wherever the centerline of the pipeline crossed a substrate polygon (e.g., hard bottom), the impact length was measured and multiplied by the appropriate impact width for plowing or mattress placement. For plowing, an impact width of 67 feet (20.4 meters) was assumed. (This width was used for all plowed areas, including those where the plow does not achieve burial, necessitating covering by concrete mattresses.) For mattress placement, an impact

width of 20 feet (6.1 meters) was assumed.[1] At one location in Tampa Bay where clamshell dredging/dragline burial is planned, an effect width of 60 feet (18.3 meters) was assumed.

The analysis predicts that 331.39 acres (134.11 hectares) would be directly affected by pipeline installation including plowing, mattress placement, and clamshell dredging/dragline burial. The total area includes 262.08 acres (106.06 hectares) of soft bottom and 69.31 acres (28.05 hectares) of hard bottom (**Table 7-4**).

Most of the impact is due to plowing (96% of the area). Mattress placement accounts for about 4% of the impact area, and a small area of 1.52 acres (0.62 hectares) would be affected by clamshell dredging/dragline burial at a single location in Tampa Bay.

Table 7-4
Areal Extent of Direct Impacts of Pipeline Installation (Preferred Route Modification)

Activity	Area Affected Acres (Hectares)		
	Total	Soft Bottom	Hard Bottom
Plowing	316.85 (128.22)	248.97 (100.76)	67.87 (27.47)
Mattress placement	13.03 (5.27)	11.59 (4.69)	1.44 (0.58)
Clamshell/dragline	1.52 (0.62)	1.52 (0.62)	0.00
Total	331.39 (134.11)	262.08 (106.06)	69.31 (28.05)

7.2.1.2 Anchoring

The following assumptions were made to calculate the extent of anchoring impacts:

- A barge will make four passes along the route, for pipelaying, plowing, backfilling, and mattress placement.
- The first three passes will be done by a barge with 10 anchors, which will be reset every 2,000 feet (610 meters). Each anchor contact with the seafloor will directly affect an area of 360 square feet (33.4 square meters).

[1] This differs from the 13 feet (4.0 meters) assumed in the Deepwater Port Application and Addendum I. The mattresses are 20 feet (6.1 meters) wide. The 13-foot (4.0-meter) width was based on the assumption that mattresses would cover pipe that was laying on the seafloor (i.e., width is shorter because the mattress goes up and over the pipeline). In cases where the pipeline is buried but achieves less than 3 feet (0.9 m) of cover, a mattress would impact a width of 20 feet (6.1 meters). For simplicity it is assumed that any mattressed areas could affect a width up to 20 feet (6.1 meters).

- The fourth pass (mattress placement) will be done by a smaller barge with four smaller anchors, which will be reset every 1,000 feet (305 meters). The anchors would affect a smaller area of 90 square feet (8.4 square meters).
- Seafloor substrates will be affected in direct proportion to their percentage occurrence within the Preferred Route Modification corridor.

The actual sequence of events involved in pipelaying is more complicated than indicated by these assumptions, particularly in Tampa Bay where three HDD operations will be conducted. However, the assumptions are considered a reasonable basis for estimating the number and extent of anchor impacts.

The revised analysis (**Table 7-5**) predicts that 27.56 acres (11.15 hectares) will be affected by anchoring. About 23.54 acres (9.53 hectares) would be in soft bottom areas, and 4.02 acres (1.63 hectares) would be in hard bottom areas.

Table 7-5
Areal Extent of Impacts from Anchoring During Pipeline Installation
(Preferred Route Modification)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	No. of Anchor Impacts	Area Affected by Anchoring[b] Acres (Hectares)		
					Total	Soft Bottom	Hard Bottom
1st	Pipelaying	235,499	117	1,170	9.67 (3.91)	8.26 (3.34)	1.41 (0.57)
2nd	Plowing	205,997	103	1,030	8.51 (3.44)	7.27 (2.94)	1.24 (0.50)
3rd	Backfilling	205,997	103	1,030	8.51 (3.44)	7.27 (2.94)	1.24 (0.50)
4th	Mattress placement	104,898[c]	105	420	0.87 (0.35)	0.74 (0.30)	0.13 (0.05)
				Total	27.56 (11.15)	23.54 (9.53)	4.02 (1.63)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each would affect an area of 360 square feet (33.4 square meters). For the fourth pass, assumed four smaller anchors would be reset every 1,000 feet (305 meters) and each would affect an area of 90 square feet (8.4 square meters).
[b] Assumed anchors would contact seafloor subtrates in proportion to their occurrence within the pipeline corridor (85.41% soft bottom and 14.59% hard bottom).
[c] Includes 28,398 feet (8,655 meters) not planned to be plowed, plus an estimated 76,500 feet (23,316 meters) where plowing may not achieve the design depth and concrete mattresses or rock armoring may be required.

The recalculated anchoring impacts are about 36% greater than those estimated in **Addendum I** for the Revised Preferred Route. The increase is due to the greater percentage of the pipeline corridor that was identified as "plowable" as noted previously (**Table 7-3**), which affects the number of anchor resets during the second, third, and fourth passes.

7.2.1.3 Anchor Cable Sweep

In addition to the direct impacts, each anchor cable will also contact (sweep) the seafloor due to movement of the pipelaying barge's anchor cables. The areal extent of anchor sweep impacts was not estimated in the **Deepwater Port Application** or **Addendum I**. However, subsequently, Port Dolphin developed an estimate in Data Gaps/Response No. 61 submitted to the USCG on 31 March 2008. The same calculation methods are used here, but the numbers have changed, due mainly to the greater percentage of the pipeline corridor that is now identified as "plowable" (**Table 7-3**).

The following assumptions were made to calculate the extent of anchor sweep impacts:

- The pipelaying barge was assumed to make four passes along the route – for pipelaying, plowing, backfilling, and mattress placement.
- The first three passes will be done by a barge using 10 anchors, which will be reset every 2,000 ft (610 m). For each reset, the 10-anchor array was estimated to sweep an area of 1,199,162 square feet (111,395 square meters) of seafloor. The derivation of this estimate is explained below.
- The fourth pass (mattress placement) will be done by smaller barges with 4-point mooring systems, which will be used as static moorings; therefore, no anchor cable sweep impact is anticipated.
- Seafloor substrates were assumed to be affected in proportion to their average percentage occurrence within the pipeline corridor (85.41% soft bottom and 14.59% hard bottom).

The actual sequence of events involved in pipelaying is more complicated than indicated by these assumptions, particularly in Tampa Bay where three HDD operations will be conducted. However, the assumptions are considered a reasonable basis for estimating the number and extent of anchor sweep impacts.

To calculate the extent of anchor sweep impacts, analyses were performed using a standard static catenary program. This program allows a determination of catenary touchdown point on the seabed for a given input of water depth, tension, and cable weight. Using the catenary touchdown point, in conjunction with the anchor array model, a theoretical sweep area was predicted. For the base case, a water depth of 75 feet (23 m) was adopted as a conservative representation of average water depth along the route. The ratio of anchor wire length to water depth (sometimes known as the anchor "scope") was conservatively assumed to be in the range of about 20 to 50. Using these methods and assumptions, anchor wire sweep is estimated to be 1,598,882 square feet (148,526 square meters) for the 10-anchor array for each 2,000-foot (610-meter) barge reset length.

An anchoring plan will be developed during detailed design that will provide specific procedures to minimize anchor sweep impacts on hard bottom. Depending on the methodology, it may be possible to reduce anchor sweep areas by use of low-weight anchor wires or buoyancy elements (mid-line buoys). This would have the effect of supporting the catenary further off the seabed. An assessment of an anchor wire weight reduction of about 50% suggests that corresponding reductions in seabed contact area could be 25% or greater. For this analysis, a reduction in overall footprint of 25% has been assumed, yielding a revised impact area of 1,199,162 square feet (111,395 square meters) per anchor reset. **Table 7-6** summarizes the predicted the areal extent of anchor sweep taking into account this estimated 25% reduction due to mid-line buoys.

Table 7-6
Anchor Sweep Impacts during Pipeline Installation for the Preferred Route Modification (including 25% Reduction due to Mid-Line Buoys)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	Anchor Sweep Area[b] Acres (Hectares)		
				Total	Soft Bottom	Hard Bottom
1st	Pipelaying	235,499	117	3,220.89 (1,303.45)	2,750.88 (1,113.24)	470.00 (190.20)
2nd	Plowing	205,997	103	2,835.48 (1,147.48)	2,421.72 (980.04)	413.77 (167.44)
3rd	Backfilling	205,997	103	2,835.48 (1,147.48)	2,421.72 (980.04)	413.77 (167.44)
4th	Mattress placement	No sweep impacts				
			Total	8,891.85 (3,598.41)	7,594.32 (3,073.31)	1,297.53 (525.09)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each reset would affect an area of 1,199,162 square feet (111,395 square meters). For the fourth pass, assumed smaller barges with 4-point, static mooring systems (no anchor cable sweep).
[b] Assumed anchors would contact seafloor substrates in proportion to their occurrence within the pipeline corridor (85.41% soft bottom and 14.59% hard bottom).

The analysis predicts that 8,891.85 acres (3,598.41 hectares) would be affected by anchor sweep. This includes 7,594.32 acres (3,073.31 hectares) of soft bottom and 1,297.53 acres (525.09 hectares) of hard bottom. Many aspects of the anchor sweep calculations are conservative. Consequently, impacts are likely to be less than calculated, and further reductions may be possible depending on prevailing field and operational conditions. For example:

- A relatively large ratio of anchor wire length to water depth (sometimes known as the anchor “scope”) has been conservatively assumed in the range of about 20 to 50. The “scope” could be reduced with judicious anchor placement, subject to detailed route engineering.
- There is also some degree of overlapping (redundancy) in the swept area calculations between anchor resetting positions, which has not been accounted for in the results. In other words, as the barge moves along the route, some of the swept areas will be locations that have already have been swept and thus are “double-counted.”
- There will most likely be a degree of overlapping (redundancy) of seabed impact areas between the different passes (pipelaying, plowing, and backfilling), which has not been accounted for in the final results presentation. With judicious anchor placement on each pass this may represent a significant impact area which is being “double-counted.”

There are two types of injuries that occur to live bottom communities associated with the installation of the Port Dolphin Project, structural and biological. Anchor sweep impacts to hard bottom habitat differ from direct impact from pipeline installation (i.e., plowing, mattress placement, dredging, or direct anchor placement). The direct impacts from installation of the pipeline create injuries to the structure (live bottom/hard bottom substrate) as well as the biological component (organisms growing on the substrate), whereas the impacts from anchor sweep are typically injurious to the biological component (living organisms growing on the structure) and not the structure. Impacts from anchor sweep typically recover much more quickly than the types of injuries that will be caused from direct impact from pipeline installation.

7.2.1.4 Summary of Seafloor Disturbance Calculations

Table 7-7 summarizes the area affected by plowing, mattress placement, anchoring, and anchor cable sweep. The total impact area for the Preferred Route Modification is estimated to be 9,250.81 acres (3,743.67 hectares), of which about 85% or 7,879.95 acres (3,188.90 hectares) would be soft bottom and 15% or 1,370.86 acres (554.77 hectares) would be hard bottom. About 96% of the total impact area is due to anchor sweep.

The totals are not directly comparable with those presented in **Addendum I** for the Revised Preferred Route because anchor sweep was not estimated in that document. However, anchor sweep estimates were subsequently submitted to the USCG on 31 March 2008 in Data Gaps/Response No. 61. If those numbers are included (see **Table 7-7**), the total impact area for the Preferred Route Modification is about 39% greater than for the Revised Preferred Route. The increase is due mainly to the greater percentage of the pipeline corridor that is now identified as “plowable,” which affects both the direct plowing impacts and the number of anchor resets during the second, third, and fourth passes of the pipelaying barge. The percentage of substrate types within the pipeline corridor also changed due to the re-route around sand resources.

Table 7-7
Summary of Seafloor Disturbance Impacts from Pipeline Installation

Activity	Area Affected Acres (Hectares)					
	Revised Preferred Route (Addendum I)			Preferred Route Modification (this Addendum II)		
	Total	Soft Bottom	Hard Bottom	Total	Soft Bottom	Hard Bottom
Plowing	176.10 (71.27)	159.5 (64.56)	16.57 (6.71)	316.85 (128.22)	248.97 (100.76)	67.87 (27.47)
Mattress placement	35.74 (14.47)	27.15 (10.99)	8.59 (3.48)	13.03 (5.27)	11.59 (4.69)	1.44 (0.58)
Clamshell/dragline	1.38 (0.56)	1.38 (0.56)	0	1.52 (0.62)	1.52 (0.62)	0
Anchoring	20.26 (8.19)	17.70 (7.16)	2.56 (1.03)	27.56 (11.15)	23.54 (9.53)	4.02 (1.63)
Subtotal	*233.48 (94.49)*	*205.76 (83.27)*	*27.72 (11.22)*	*358.96 (145.26)*	*285.63 (115.59)*	*73.33 (29.68)*
Anchor cable sweep[a]	6,414.00 (2595.00)	Not estimated	Not estimated	8,891.85 (3,598.41)	7,594.32 (3,073.31)	1,297.53 (525.09)
Total including anchor cable sweep	**6,647.48 (2,689.49)**	**Not estimated**	**Not estimated**	**9,250.81 (3,743.67)**	**7,879.95 (3,188.90)**	**1,370.86 (554.77)**

[a] Anchor sweep estimates were not included in **Addendum I**, but were subsequently provided to the USCG in Data Gaps/Response No. 61 on 31 March 2008.

7.2.2 Geology and Sediments

7.2.2.1 Construction

Re-routing the pipeline around the sand source areas slightly shortened the pipeline length. However, due to changes in impact calculations, including the assumption that a higher percentage of the pipeline route would be plowable, the estimated areal extent of seafloor disturbance has increased (see **Section 7.2.1**).

The revised calculations predict that a total of 9,250.81 acres (3,743.67 hectares) would be affected by pipeline installation including plowing, mattresses, anchoring, and anchor sweep. This includes 7,879.95 acres (3,188.90 hectares) of soft bottom and 1,370.86 acres (554.77 hectares) of hard bottom. The affected area is about 39% larger than previously estimated (i.e., relative to **Addendum I** and the anchor sweep estimates in Data Gaps/Response No. 61).

The analysis in **Volume II**, **Section 7.3.1** of the **Deepwater Port Application** concluded that seafloor disturbance impacts on sediments would be minor because the affected area represents a small percentage of the soft bottom substrate in the region. Although the areal extent of seafloor disturbance has increased, the overall significance of impacts is unchanged.

7.2.2.2 Operations

The project design change would not significantly alter the potential impacts of operations on geological conditions.

7.2.2.3 Decommissioning

The project design change would not significantly alter the potential impacts of decommissioning on geological conditions.

7.2.2.4 Accidents and Upsets

The project design change would not significantly alter the potential impacts of accidents and upsets on geological conditions.

7.2.3 Mineral Resources

The only active mineral resource use in the region consists of dredging of nearshore sand for beach nourishment and other coastal engineering projects in Florida. The original impact analysis in **Volume II**, **Section 7.3.2** of the **Deepwater Port Application** identified a "potential borrow site" offshore the mouth of Tampa Bay that has been studied by the ROSS project, concluding that the proportion of the area excluded from use as a sand source would be less than 5%.

Subsequent to the submission of the **Deepwater Port Application** and **Addendum I**, discussions with the FDEP, Manatee County, and the Town of Longboat Key revealed that in addition to the potential borrow site identified in the ROSS database, the Revised Preferred Route crossed several identified sand sources. The Preferred Route Modification has been designed to avoid these sand source areas to the extent feasible.

Figure 7-4 shows the relevant sand source areas, and **Table 7-8** summarizes the changes in impacts due to the re-routing of the pipeline. The Revised Preferred Route (**Addendum I**) passed through the following potential sand source areas:

- A permitted borrow area (Borrow Area IX), used by Longboat Key for beach renourishment projects, for a distance of 0.33 miles (0.53 kilometers). With a buffer area of 200 feet (61 meters) on either side, this would deny Longboat Key access to approximately 16 acres (6.5 hectares) of an approximately 264 acre (106.7 hectare) borrow area.
- A potentially high volume sand shoal (4,489 acres [1,816 hectares]) for a distance of 2.26 miles (3.64 kilometers).
- Three potential sand source areas identified during a survey conducted for the Town of Longboat Key by CPE, for a distance of 2.09 miles (3.36 kilometers). A 200-foot (61-meter) buffer on either side of the pipeline would result in a loss of access to 101.32 acres (41.00 hectares) of these three potential sand sources by the Town of Longboat Key; this represents 4.06% of the total area of these three potential sand sources.
- The 538,707 acre (218,007 hectare) potential sand source area identified in the ROSS database, for a distance of 8.4 miles (13.5 kilometers).

Table 7-8
Impacts of Pipeline Corridors on Potential Use of Sand Source Areas

Sand Source Area	Total Area	Revised Preferred Route (Addendum I)		Preferred Route Modification (This Addendum II)	
		Impact Length	Impact Area	Impact Length	Impact Area
Borrow Area IX (Town of Longboat Key)	264 acres (106.7 hectares)	0.33 miles (0.53 km)	16 acres (6.5 hectares)	0	0
High volume sand shoal	4,489 acres (1,816 hectares)	2.26 miles (3.64 km)	110 acres (44.3 hectares)	0	0
Potential sand source area (ROSS database)	538,707 acres (218,007 hectares)	8.4 miles (13.5 km)	407 acres (164.8 hectares)	7.2 miles (11.6 km)	349 acres (141.3 hectares)
Potential sand source areas for Town of Longboat Key (identified by CPE)	2,495 acres (1,010 hectares)	2.09 miles (3.36 km)	101 acres (41.0 hectares)	1.40 miles (2.26 km)	68 acres (27.5 hectares)

Figure 7-4
Revised Preferred Route and Preferred Route Modification in Relation to Sand Resources

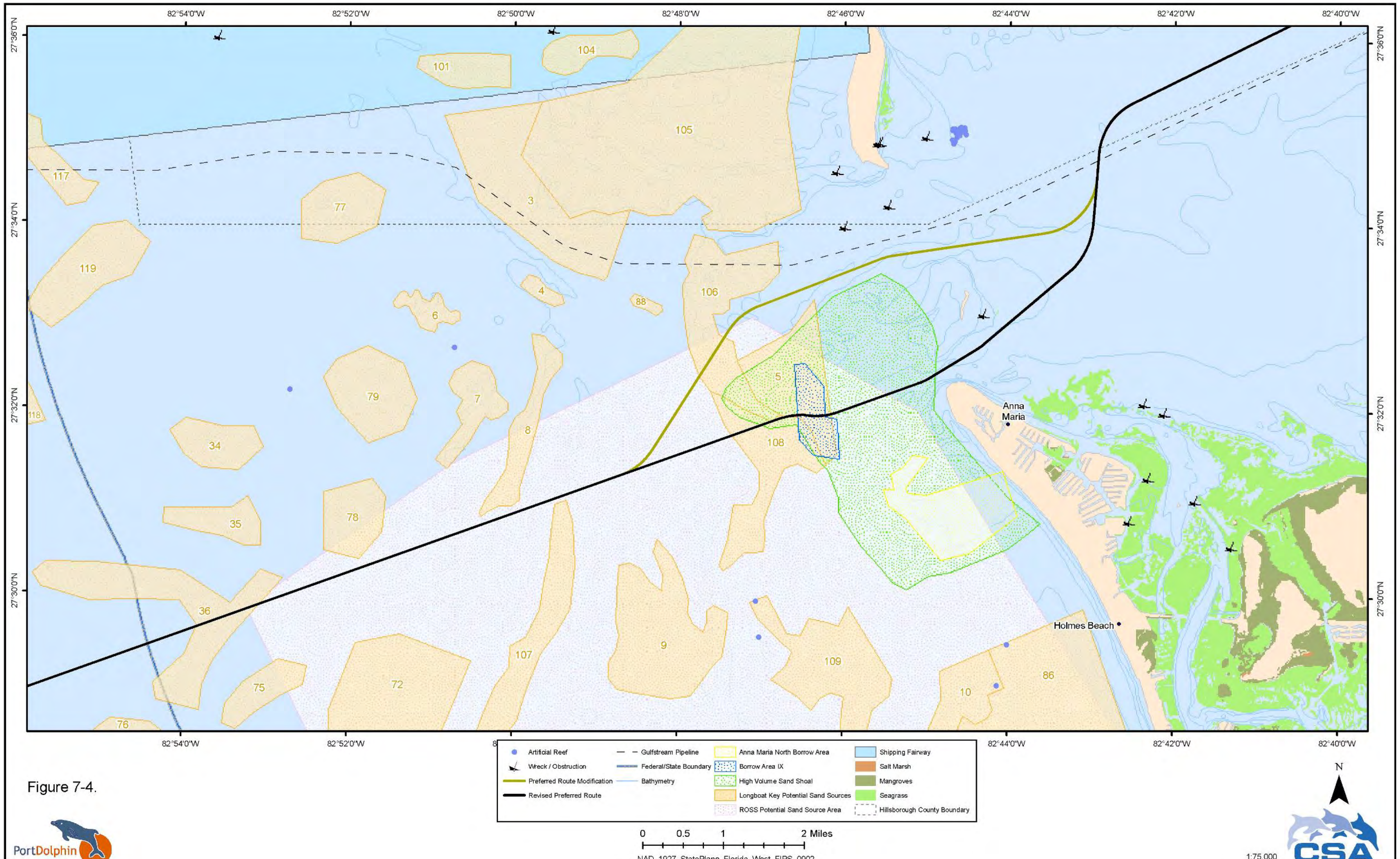


Figure 7-4.

In contrast, the Preferred Route Modification would:

- Avoid Borrow Area IX.
- Avoid the high volume sand shoal.
- Pass through only two of the three potential sand sources identified by CPE for a reduced distance of 1.40 miles (2.26 kilometers), effectively excluding only 68 acres (27.5 hectares) of the 1,987 acres (724 hectares) (3.4%) within these two areas. These potential sand sources have been identified based on limited data, and some of the areas have been ruled out as suitable sources of beach-quality sand, but final determinations for all potential areas have not been made.
- Pass through the northern edge of the ROSS-identified potential borrow site for a reduced distance of 7.2 miles (11.6 kilometers). This area contains hard bottom mapped by both geophysical and video surveys, and therefore may be unsuitable as a source of beach-quality sand. While the CPE survey mapped potential sand sources in the northeast corner of this area, the area where the Preferred Route Modification would pass has been described as shell hash sand and therefore is not likely to provide an acceptable source of beach-quality sand.

7.2.3.1 Construction

Installation of the pipeline would exclude certain areas from use as sand source areas. A 200-foot (61-meter) buffer area on either side of the pipeline is assumed in order to avoid potential damage to the pipeline and dredging equipment. The Preferred Route Modification has been designed to avoid sand source areas to the extent feasible. The re-routed corridor would reduce the areal extent of impacts on the use of these mineral resources by avoiding Borrow Area IX and the high volume sand shoal and by reducing the length of the pipeline that crosses other identified sand sources.

7.2.3.2 Operations

Due to the presence of the pipeline, the operational phase would have the same impacts to mineral resources as the construction phase – i.e., excluding certain areas from possible use as sand source areas. A 200-foot (61-meter) buffer area on either side of the pipeline would continue to be observed in order to avoid potential damage to the pipeline and dredging equipment.

7.2.3.3 Decommissioning

Impacts to geological resources within the pipeline corridor are expected to be permanent. Upon decommissioning, the pipeline would be flooded and left in place. A 200-foot (61-meter) buffer area on either side of the pipeline would continue to be observed in order to avoid potential damage to dredging equipment.

7.2.3.4 Accidents and Upsets

Potential impacts to geological resources due to accidents and upsets would be slightly reduced by the proposed re-route because it avoids the permitted borrow area and passes through less of the potential sand sources.

7.3 Summary of Impacts

Table 7-9 summarizes the impact characteristics for geological resources. Potential impacts to geological resources are rated as significant, minor, or negligible using the following criteria:

- **Significant –** impacts that would damage or disturb a unique geological feature, modify seafloor stability, or conflict with an active existing or planned use of mineral resources.
- **Minor** – changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- **Negligible –** changes that are unlikely to be noticed or measurable against background conditions.

The table also categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible. The following are the key changes in geological impacts:

- **Increased areal extent of impacts to geology and sediments**. Due to the pipeline re-route and changes in impact calculations, including the assumption that a higher percentage of the corridor would be plowable, the areal extent of seafloor disturbance is about 39% larger than previously estimated (i.e., relative to **Addendum I** and the anchor sweep estimates in Data Gaps/Response No. 61). Anchor sweep accounts for 96% of the total impact area in the revised analysis. The overall impact ratings for geology and sediments are unchanged (minor for soft bottom, significant for hard bottom).

- **Decreased areal extent of impacts to mineral resources (sand source areas)**. The Preferred Route Modification avoids a permitted borrow area and a high volume sand shoal, and reduces the pipeline length that crosses other potential sand sources. It should be noted that these other potential sand sources have been identified based on limited data, and some of the areas have been ruled out as suitable sources of beach-quality sand, but final determinations for all potential areas have not been made. The overall impact ratings for mineral resources are unchanged (minor).

Table 7-9
Summary of Impacts to Marine Resources Due to Project Design Changes

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Geology and Sediments					
Construction	Physical disturbance to sediments during pipeline installation, including plowing and anchoring	Areal extent of seafloor impacts increased due to re-route and changes in impact assumptions for calculations	• Certain • Direct • Reversible (soft bottom) • Irreversible (hard bottom)	Minor (soft bottom) Significant (hard bottom)	• Hard bottom areas within the pipeline corridor and in STL buoy locations have been mapped and avoided to the extent practicable • During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard bottom • Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep • Anchoring on areas of significant hard bottom will be avoided to the extent practicable • During installation, vessel sizes will be selected to provide vessels adequate to perform the work, but minimized to reduce the number and type of anchors, where possible
Operations	*No change*	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*	*No change*
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

Table 7-9
(Continued)

Phase	Impact	Effect of Project Design Changes	Descriptors	Significance	Mitigation
Mineral Resources					
Construction	Reduced access to potential sand sources due to exclusionary zone around construction activities	Pipeline corridor re-routed to avoid an active borrow area and high volume sand source area. Reduced area of potential exclusion within other potential sand source areas	• Certain • Direct • Reversible (construction-related exclusion) • Irreversible (exclusion due to presence of pipeline)	Minor	• Pipeline corridor has been re-routed to avoid sand source areas to the extent feasible
Operations	Loss of access to potential sand sources due to presence of pipeline and buffer area	Pipeline corridor re-routed to avoid an active borrow area and high volume sand source area. Reduced area of potential exclusion within other potential sand source areas	*No change*	*No change*	• Pipeline corridor has been re-routed to avoid sand source areas to the extent feasible
Decommissioning	Loss of access to potential sand sources due to presence of flooded, decommissioned pipeline and buffer area	Pipeline corridor re-routed to avoid an active borrow area and high volume sand source area. Reduced area of potential exclusion within other potential sand source areas	*No change*	*No change*	• Pipeline corridor has been re-routed to avoid sand source areas to the extent feasible
Accidents and Upsets	*No change*	*No change*	*No change*	*No change*	*No change*

8. TERRESTRIAL RESOURCES

8.1 Existing Conditions

This section addresses existing conditions onshore for the proposed route. The route has not changed from **Addendum I**; however, some aspects of the existing conditions have changed. The onshore proposed pipeline project site begins at the pier bulkhead at Port Manatee (Feet Marker [FM] 0.00) and terminates at the Gulfstream/Tampa Electric Company (TECO) interconnection station (FM 20509.01). The description of existing conditions is based on surveys conducted specifically for this project.

8.1.1 Fish, Wildlife, and Vegetation

The existing conditions for fish, wildlife, and vegetation provided in **Addendum I** have not changed significantly. Two additional species were added to the list of terrestrial State- and federally-listed species potentially occurring near the pipeline route, including the State-threatened bald eagle (*Haliaeetus leucocephalus*) and the Florida mouse (*Peromyscus floridanus*), which is listed as a species of special concern. Also, additional surveys were performed to investigate the presence or absence of suspected threatened and endangered species.

Species-specific surveys were conducted from May 13 to 17, 2008 for State- and federally-listed species. The surveys were conducted to address the potential presence of southeastern American kestrel (*Falco sparverius paulus*), gopher tortoise (*Gopherus polyphemus*), Florida scrub jay (*Amphelecoma coerulescens*), and listed wading birds within potential habitats for these species along the proposed pipeline corridor. The species-specific survey for scrub jays was performed utilizing the standard protocols as outlined by the USFWS and the Florida Fish and Wildlife Conservation Commission (FWC). No scrub jays or evidence of presence of the species were observed.

Southeastern American Kestrel

Several songbirds such as mockingbirds and red-winged blackbirds were observed during the spring follow-up survey, but no kestrel was noted during any of the investigations. As a result, it can be concluded that the unidentified kestrel observed during the November 2007 survey was an American kestrel, which is not protected in Florida.

Gopher Tortoise

The majority of the habitat along the proposed pipeline corridor contains disturbed lands dominated by Brazilian pepper and other exotic/nuisance species. As a result, only minimal habitat is available for gopher tortoises along the pipeline route. No gopher tortoises or burrows were observed at the time of the initial investigations, and as a result, no follow-up survey was scheduled. However, during the species-specific surveys, a gopher tortoise burrow was observed. The investigations were conducted at the Scrub and Brushland habitat (Florida Land Use and Cover Classification System [FLUCCS] 210) in the location proposed for the

Interconnection Station in May 2008. The burrow was marked via a global positioning system (GPS) and classified as active.

Florida Scrub Jay

The species-specific survey for scrub jays was performed utilizing the standard protocols as outlined by the USFWS and the FWC. No scrub jays or evidence of presence of the species was observed. As stated in USFWS and FWC Florida scrub jay survey protocols, the Port Dolphin scrub jay surveys were conducted within a few hours of sunrise for 5 days across potential habitat. Pedestrian transects were surveyed in suitable scrub jay habitat, which included the Shrub and Brushland habitat (FLUCCS 320) located at the very end of the proposed project area. Each transect was walked, and specific locations were chosen for playback of scrub jay vocalizations.

Wading Birds

Additionally, during the follow-up spring surveys at the conveyance ditch, two species of wading birds were noted. A roseate spoonbill (*Platalea ajaja*) and a white ibis (*Eudocimus albus*) were observed foraging in the conveyance ditch in May 2008. The Florida Natural Areas Inventory (FNAI) database report did not show the presence of any wading bird rookeries in or within close proximity to the Port Dolphin project area. Due to the temporary nature of the majority of the impacts from the proposed project, the mobility of wading bird species, the lack of known rookeries in close proximity to the project area, and the presence of suitable habitat located outside of the influence of construction, it is not anticipated that the proposed Port Dolphin project will significantly impact wading birds or their habitat.

State- and federally-listed threatened, endangered, and species of special concern that may be found either within or adjacent to the onshore Port Dolphin pipeline area, based on habitat types, are presented in **Table 8-1**. State- and federally-listed species present in Manatee County that are not present in the project area are not included in **Table 8-1**. This species listing was developed based on a search of the FNAI tracking list for Manatee County for protected species observed and the beta-test version of the FWC's wildlife tool.

A listed species field investigation was conducted in association with the wetland delineation and consisted of pedestrian surveys in suitable habitat along the proposed pipeline route. The field methodologies employed generally were designed to conform to accepted guidelines for determining the presence of listed species by the FWC. The field surveys consisted of biologists walking parallel transects in search of listed plant and animal species potentially present on the proposed site based upon vegetative habitat types, direct observation, or sign (tracks, burrows, nests, etc.). Spacing of transects varied and was based on habitat type and potential habitat. The locations of all observed listed species were denoted on 1 inch = 500 feet aerial photography maps, recorded in field books, and mapped with GPS. The survey also included recording any potential nesting and roosting areas for wading and shorebirds, including nesting colonies for wood storks.

Table 8-1
Terrestrial State- and Federally-Listed Species Potentially Occurring Near the Port Dolphin Pipeline Route

Common Name	Scientific Name	Status*		Likelihood of Encounter	Habitat
		State	Federal		
Birds					
Audubon's crested caracara	*Caracara cheriway*	T	T	Not likely – species is mobile	Open lands, pastureland, arid and moist habitats
Florida burrowing owl	*Speotyto cunicularia floridana*	SSC		Possible – site-specific surveys conducted and none observed	Open, well-drained areas with herbaceous ground cover
Brown pelican	*Pelecanus occidentalis*	SSC		Not likely – species is mobile	Mangroves
Wood stork	*Mycteria americana*	E	E	Not likely – species is mobile	Wetlands and other waterbodies
White ibis	*Eudocimus albus*	SSC		Not likely – species is mobile	Freshwater, brackish, and saline environments
Snowy egret	*Egretta thula*	SSC		Not likely – species is mobile	Coastal and inland wetlands, mangroves
Tricolor heron	*Egretta tricolor*	SSC		Not likely – species is mobile	Mangroves and willow thickets
Peregrine falcon	*Falco peregrinis*	E		Not likely – species is mobile	Prairies, coastal ponds, marshes, and urban areas
Roseate spoonbill	*Platalea ajaja*	SSC		Not likely – species is mobile	Mangroves
Little blue heron	*Egretta caerulea*	SSc		Not likely – species is mobile	Shallow freshwater, brackish and saltwater environments
Southeastern American kestrel	*Falco sparverius paulus*	T		Not likely – species is mobile	Open fields, forest edges, and marshes; require perching apparatus
Bald eagle	*Haliaeetus leucocephalus*	T		Not likely – species is mobile	Older, taller trees with unimpeded view of the surrounding area and high water-to-land edge
Reptiles					
Eastern indigo snake	*Dymarchon corais couperi*		T	Not likely – species is mobile	Dry habitats bordered by water
Gopher tortoise	*Gopherus polyphemus*	SSC		Possible – any individuals will be relocated	Sandy, open scrub habitats
American alligator	*Alligator mississippiensis*	SSC		Not likely – species is mobile	Water-retaining habitats
Amphibians					
Florida gopher frog	*Rana capito aesopus*	SSC		Possible – commensal with gopher tortoises; any individuals will be relocated	Sandy scrub wet areas
Mammals					
Florida mouse	*Peromyscus floridanus*	SSC		Not likely – species is mobile	Fire-maintained, xeric, upland vegetation occurring drier pine flatwoods that are not present

* E = Endangered; SSC = Species of special concern; T = Threatened.
Source: Ashton and Sawyer-Ashton, 1981; Rogers et al., 1996; Bartlett and Bartlett, 1999; Florida Natural Areas Inventory, 2007; U.S. Fish and Wildlife Service, 2007.

Pedestrian transects were surveyed along the length of the ROW for highly visible species such as alligators and wading birds. Any species observed during the survey was noted and the location marked with a GPS unit.

8.1.2 Water Use and Quality

Water use and quality along the pipeline route have been described in **Addendum I**, **Section 9.1.2**. The only new information presented here is for changes in water use and quality within the area along the 3.88-mile (20,509-foot) pipeline route, from the pier bulkhead to the proposed interconnection station.

8.1.2.1 Surface Waters

Federal Energy Regulatory Commission (FERC) (2003) defines a waterbody as any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies, such as ponds and lakes. The State of Florida defines a surface water or waterbody as any water contained in bounds created naturally or artificially, including the Atlantic Ocean, the Gulf of Mexico, bays, bayous, sounds, estuaries, lagoons, lakes, ponds, impoundments, rivers, streams, springs, creeks, branches, sloughs, tributaries, and other watercourses.

The Port Dolphin pipeline will traverse adjacent to an extractive borrow pond, also known as the FPL borrow pond. This borrow pond was excavated in uplands to provide fill for the adjacent FPL ROW. The borrow pond has little vegetation, and the banks and surrounding habitat contain exotic/nuisance species. Portions of the pond are located in the construction areas of the project; however, the pipeline will not directly cross the pond.

Waterbodies Crossed

Surface waterbodies within the pipeline project areas were identified through the use of aerial photographs, literature reviews, and on-site surveys (**Figures 8-1**, **8-2**, and **8-3**). The pipeline route will cross four main surface waterbodies.

The first of these surface waterbodies is the tidally-influenced drainage canal (conveyance ditch) within Port Manatee that is used as a stormwater and road runoff site, discussed in **Addendum I**, **Section 9.1.2.2**.

The second waterbody to be crossed is a man-made drainage ditch at FM 10050. The ditch is approximately 20 feet (6.1 meters) wide and contains perceptible flow but no vegetation. The ditch is connected to the matrix of drainage ditches traversing the region.

The third waterbody to be crossed is an extractive man-made borrow pit at FMs 11875 to 12900 (FPL property). The site will not be directly crossed by the pipeline; however, portions of the open water will be drained and filled via a levee system in order to be utilized as a construction work space. The borrow pond has little vegetation, and the banks and surrounding habitat contain exotic/nuisance species.

The fourth waterbody to be crossed, located at FMs 15850 to 19370 (Tami Sola property), is also a man-made borrow pit previously utilized during mining activities. Additionally, multiple freshwater wetlands containing periodic flooding, a stormwater pond, and other minor stormwater and agricultural drainage ditches will be crossed and temporarily impacted during pipeline construction.

Figure 8-1
Wetlands – Port Dolphin Pipeline, Manatee County, FL (1 of 3)

Figure 8-1.

Figure 8-2
Wetlands – Port Dolphin Pipeline, Manatee County, FL (2 of 3)

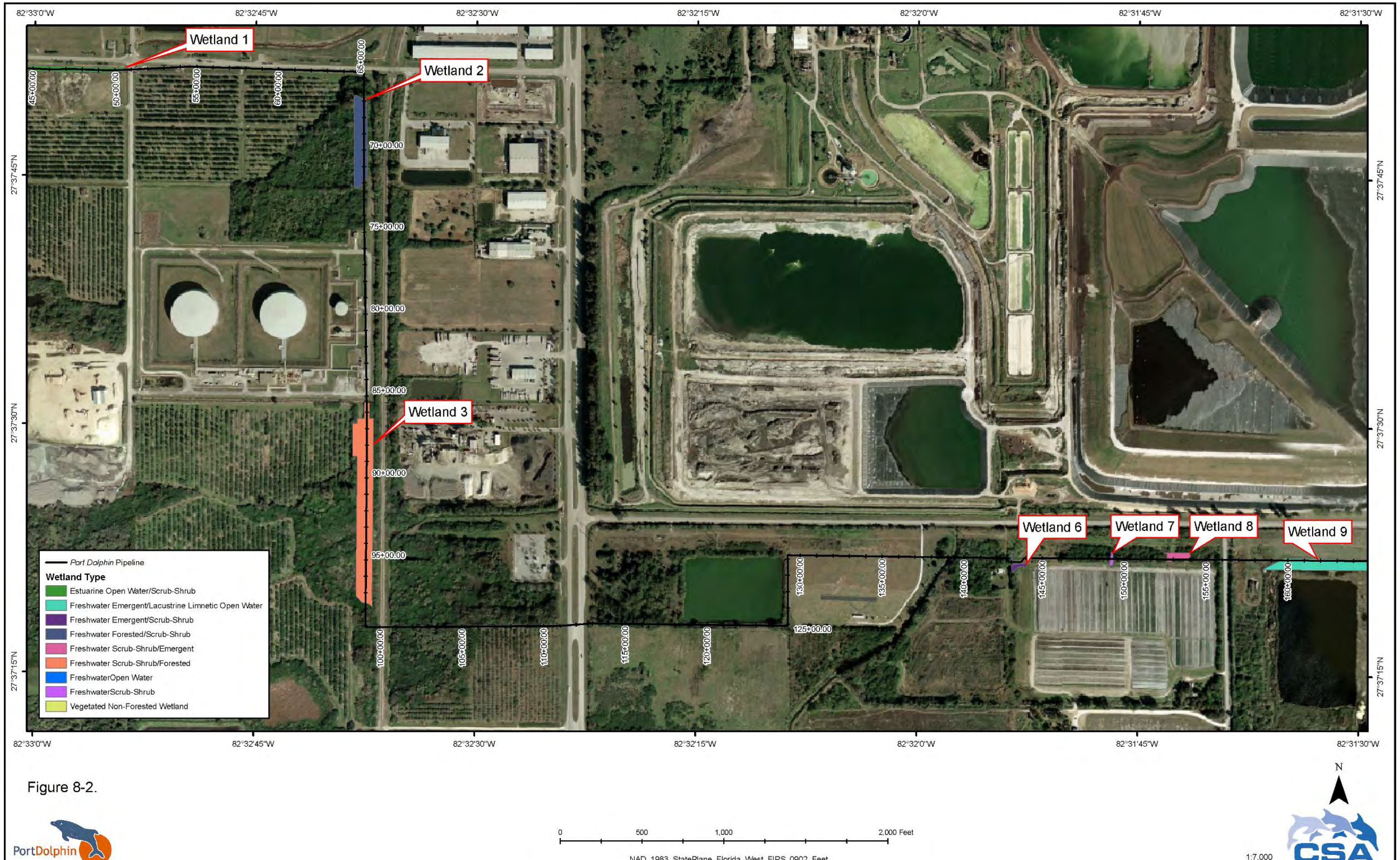


Figure 8-2.

Figure 8-3
Wetlands – Port Dolphin Pipeline, Manatee County, FL (3 of 3)

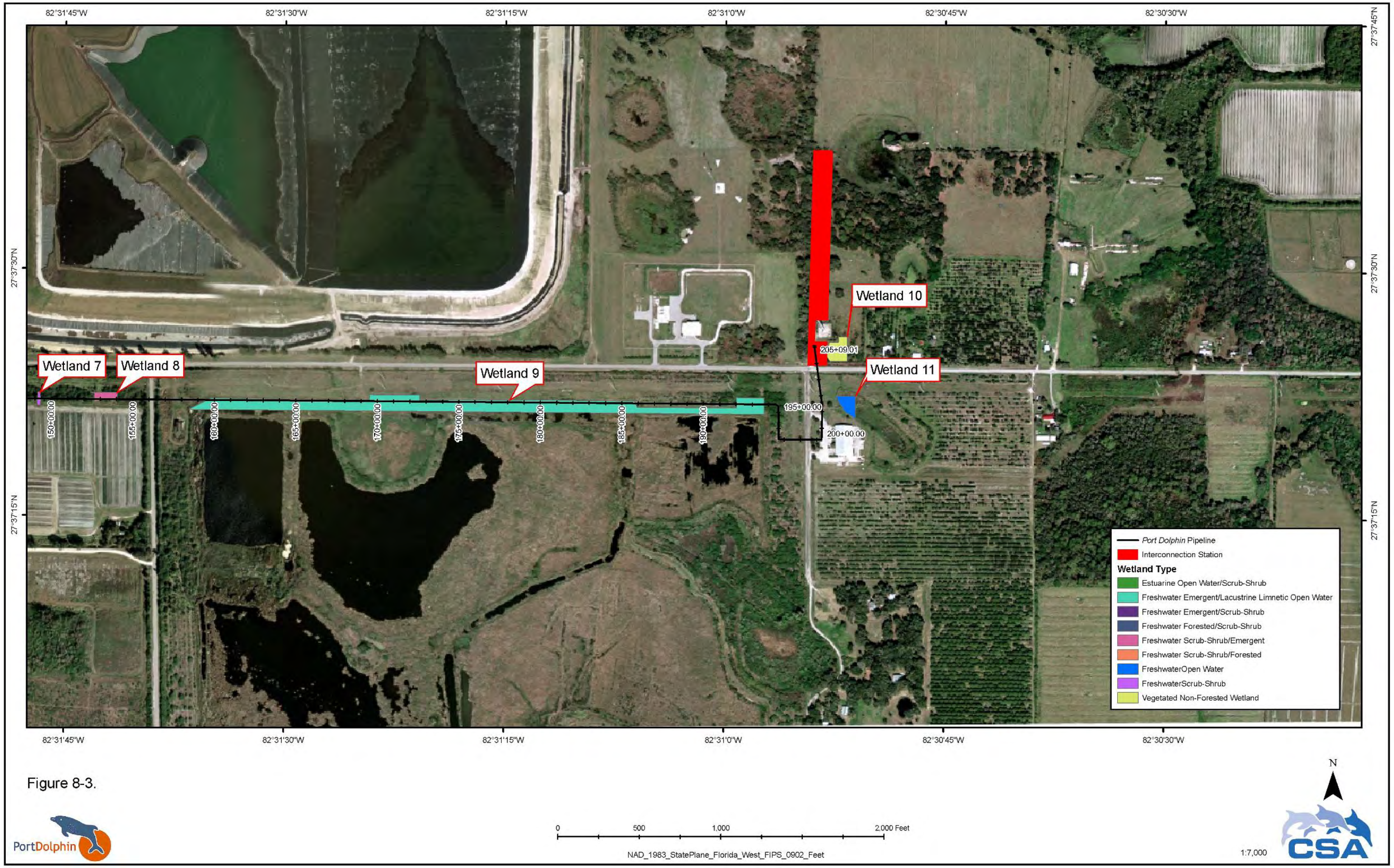


Figure 8-3.

8.1.3 Soils and Geological Resources

Soils and geological resources along the pipeline route have been described in **Addendum I, Section 9.1.3.**

8.1.4 Wetlands

The number of wetlands along the proposed pipeline route has been reduced from 11 to 9 due to development in the area, unrelated to this project, and a refined definition of jurisdictional wetlands. It is important to note that Wetland W-5 was recently disturbed and filled (as of May 13, 2008). No wetland portion remains in the project area. Additionally, the FPL borrow pond was originally delineated as Wetland 4, but according to both the State and Federal rules, a borrow pond constructed in upland habitat is not jurisdictional. Therefore, both Wetlands 4 and 5 are no longer included in the identified wetlands along the pipeline route. For clarity, the complete discussion of the existing environment is included below.

National Wetlands Inventory (NWI) and FLUCCS maps were reviewed to determine the potential presence of wetland habitats within the pipeline project area. NWI or FLUCCS maps indicated that nine wetlands were present along the corridor (**Table 8-2**). Field surveys were conducted to verify NWI and FLUCCS classifications. Wetlands were reclassified, as appropriate, based on current condition determined during the field survey. **Figures 8-1**, **8-2**, and **8-3** identify the nine wetlands delineated along the corridor. The wetland habitats were delineated with both State and Federal methodologies. Wetlands were classified in accordance with the Wetlands and Deepwater Habitat Classification System provided by NWI and FLUCCS code. The land types traversed by the Port Dolphin pipeline were assigned to FLUCCS land use categories and are discussed in **Section 8.1.5**.

Table 8-2
Wetlands Located along the Port Dolphin Pipeline Corridor

Wetland	NWI Code	FLUCCS Code	Feet Marker (Approximate)
W-1	EOW/SS (3)	510	23+00.00 to 50+50.00
W-2	PFO/SS	619/630	67+00.00 to 72+00.00
W-3	PSS	631	85+50.00 to 97+50.00
W-6	PEM/SS	6414/619	143+00.00 to 144+00.00
W-7	PSS	619	149+20.00 to 149+40.00
W-8	PSS/EM	619/641	152+60.00 to 154+00.00
W-9	PEM/L1OW(x)	6412/641	158+50.00 to 193+70.00
W-10	PEM	640	204+00.00 to 205+09.01
W-11	POW	530	200+60.00 to 202+00.00

EOW = Estuarine Open Water; FLUCCS = Florida Land Use and Cover Classification System; L1OW = Lacustrine Limnetic Open Water (excavated); NWI = National Wetlands Inventory; PFO = Freshwater Forested; PSS = Freshwater Scrub Shrub; PEM = Freshwater Emergent; POW = Freshwater Open Water; ROW = Right-of-way; SS = Scrub Shrub.

Wetlands surveys were conducted over most of the onshore proposed Port Dolphin project areas. Certain parcels were not delineated due to denial of ROW access; these areas were assessed via aerial interpretation and ground-truthing conducted from the adjacent FPL ROW areas. Specific field methodologies regarding wetland delineation techniques, quantitative analysis, qualitative analysis, and consultations are described below.

Wetlands Delineation Surveys

Field surveys were conducted along the proposed pipeline route to identify and delineate State and Federal jurisdictional wetlands. The basis for wetlands delineations was obtained from the 1987 USACE Wetland Delineation Manual and Florida State Rule 62-340, F.A.C.

The Florida wetland delineation methodology, pursuant to Rule 62-340, F.A.C., states that an area must be examined for, and exhibit, the following characteristics in order to be considered as a wetland:

1. Dominance of appropriate vegetative stratum as discussed in Chapter 62-340.450, F.A.C., which states that facultative plants shall not be considered in determining dominance.

2. Presence of hydrologic indicators, including, but not limited to, the following:
   - algal mats;
   - aquatic mosses or liverworts on trees or substrates;
   - aquatic plants;
   - aufwuchs;
   - drift lines and rafted debris;
   - elevated lichen lines;
   - evidence of aquatic fauna;
   - existing hydrologic data;
   - morphological plant adaptations;
   - secondary flow channels;
   - sediment deposition;
   - vegetated tussocks or hummocks; and
   - water marks.

3. Appropriate hydrologic data must indicate that inundation for at least 7 consecutive days, or saturation for at least 20 consecutive days, occurs during conditions that represent long-term hydrologic conditions.

According to USACE (1987), areas must exhibit three distinct characteristics to be considered wetlands:

1. The prevalent vegetation must consist of plants adapted to life in hydric soils. These species, due to morphological, physiological, and/or reproductive adaptations, can and do persist in anaerobic soils.

2. Soils in wetlands must be classified as hydric, or they must possess characteristics that are associated with reducing soil conditions.

3. The area must be inundated either permanently or periodically at mean water depths less than 6.5 inches, or the soil is saturated at the surface for some time during the growing season of the prevalent vegetation.

All of the above mentioned characteristics were investigated during the field surveys in order to determine whether the criteria were satisfied within each suspect wetland habitat. Vegetation, soils, and hydrology were recorded on USACE data sheets, and electronic GPS points were taken of each wetland flag placed in the field. A single line was delineated using both the USACE and FDEP methodologies. However, in wetlands where only two of the three criteria were satisfied, the USACE does not claim jurisdiction, but the State does; such areas were identified solely as FDEP jurisdictional wetlands.

Vegetative data collected during the field investigations included a list of dominant plants within the canopy, shrub, herbaceous, and woody vine strata of each vegetation unit. The determination of plant species dominance was based on visual estimates of species abundance. The hydrophytic vegetation criterion was met for the USACE when more than 50% of the dominant plant species identified was obligate wetland, facultative wetland, or facultative plants (USACE, 1987). The hydrophytic vegetation criterion was met for the FDEP when the obligate plant species were greater than the upland species or the obligate plants plus the facultative wetland plants were greater than 80% (62-340, F.A.C.). Wetlands also were classified utilizing the NWI classification as Freshwater Forested (PFO), Freshwater Scrub Shrub (PSS), Freshwater Emergent (PEM), or Estuarine Scrub Shrub (ESS).

Soil sampling was conducted in each suspected wetland area. The presence or absence of histosol soils or a histic epipedon was determined for each soil sample. Soil color, according to a Munsell chart, as well as the presence or absence of a clay layer, soil mottles, hydrogen sulfide odor, or other hydric soil indicators were determined below the “A” horizon and at 12 and 18 inches below ground surface (BGS). The hydric soil criterion was satisfied when the soil series was listed in the Hydric Soils of the United States (U.S. Department of Agriculture Soils Conservation Service, 2003) or county hydric soils lists, or when hydric soil characteristics were encountered at the appropriate depth within the soil profile (USACE, 1987).

Site hydrology was evaluated during field surveys by noting whether the soil at the surface was inundated or saturated. If the ground surface was dry, the depth to free-standing surface water was measured, and the presence or absence of other field evidence of wetland hydrology (e.g., drift lines, water-stained leaves, oxidized root channels) was noted. The wetland hydrology criterion was satisfied for the USACE if one or more field indicators was present (USACE, 1987). The FDEP utilizes other hydrologic indicators, as mentioned above. The wetland hydrology criterion was met for the FDEP if one or more field indicators listed above were present (e.g., drift lines, morphological plant adaptations, water marks, etc.).

Quantitative Assessment

In areas where property access was granted, wetland data were collected in the field with GPS technology. This information was later transferred into a geographic information system (GIS) database format (ArcView) for quantitative wetland analysis. Wetland data were analyzed to determine the beginning and ending feet marker locations, linear footage, and acreage of each wetland proposed to be traversed by the pipeline. These features, after analysis, provided the acreage of proposed impact from the permanent and temporary ROWs.

In areas where property access was not possible, wetlands were identified utilizing top of bank survey results, aerial photograph interpretation, and estimations based on field investigations conducted from the adjacent FPL ROWs. The estimated wetland lines were spatially referenced utilizing GIS and superimposed on aerial photography. The linear footage and proposed acreage of impact was then calculated with GIS.

Qualitative Assessment

Qualitative wetland assessments were performed to evaluate the current wetland quality and potential construction impact on wetland habitats, as well as to assist in the development of the Port Dolphin Post-Construction Recovery Plan. As of February 2, 2004, the Uniform Mitigation Assessment Methodology (UMAM) is the method utilized in Florida to assist in evaluating permanent impacts to wetlands. UMAM takes into account the location and landscape, the water environment, and the community structure of each wetland and how each will potentially change with the proposed project. A number is calculated based on a value assigned for each criterion to determine the wetland credits needed for mitigation either on site, off site, or at a mitigation bank. UMAM determinations were utilized to determine the mitigation needed for the proposed impacts of the project.

Rapanos Assessment

Additionally, Rapanos evaluations were completed for each identified wetland to determine if a significant nexus existed between the wetland and a traditional navigable waterway. A Supreme Court decision was made in the consolidated cases Rapanos v. United States and Carabell v. United States (referred to as “Rapanos”). The Rapanos case provided that the Federal agencies (USACE and USEPA) no longer have jurisdiction over isolated wetlands under the Clean Water Act (CWA). Therefore, it must be shown that the wetland must be directly connected to traditional navigable waters and to “wetlands with a continuous surface connection to” (otherwise known as having a significant nexus to) relatively permanent waters. Relatively permanent waters, under the Rapanos ruling, are classified as those waters that have “relatively permanent, standing or continuously flowing bodies of water” (USACE and USEPA, 2007). Rapanos evaluations were completed for each wetland to determine whether the wetlands are jurisdictional for the USACE. The Rapanos forms will be provided in the updated Section 10/404 Permit application to the USACE.

8.1.5 Land Use, Recreation, and Aesthetics

Land use information has been updated since **Addendum I** due to land use changes along pipeline routing and is presented below. There was one recreational parcel along the route that was used as a radio controlled airplane fly zone. This parcel has been sold, and a new FedEx distribution center has been constructed on the site. The pipeline construction ROW no longer traverses any recreational lands. No changes in the existing conditions of aesthetics have occurred since **Addendum I**.

Land use within the Port Dolphin pipeline corridor was classified according to the guidelines provided in the FLUCCS (FDOT, 1999). This system was developed by the FDOT and has been adopted by the State as a standard for land use classification. The FLUCCS designates a numeric code for each specific land use type.

The land types traversed by the Port Dolphin pipeline were assigned to FLUCCS land use categories through preliminary site reconnaissance and aerial interpretation of the 2004 FDEP Land Boundary Information System (Labins) Digital Ortho Quarter Quads (DOQQs, scale 1:24,000) with 1-meter resolution and existing land use data from Manatee County. The FLUCCS categories listed in **Table 8-3** were identified in the Port Dolphin pipeline corridor. In some instances, FLUCCS categories were modified based on ground-truthing.

Table 8-3
FLUCCS Codes for Land Use Type Categories in the Port Dolphin Pipeline Corridor

Level I (code)	Level II (code)	Level III (code)	Level IV (code)
Urban and Built-Up (100)	Commercial and Services (140) Extractive (160) Openland (190)	Wholesale Sales and Services (142) Oil and Gas Storage (146)	
Agriculture (200)	Cropland and Pastureland (210) Tree Crops (220)	Abandoned Groves (224)	
Upland Forest (400)	Upland Hardwood Forest (420)	Brazilian Pepper (422) Australian Pine (437)	
Water (500)	Streams and Waterways (510)		
Wetlands (600)	Wetland Hardwood Forests (610) Wetland Forested Mixed (630) Vegetated Non-Forested Wetlands (640)	Exotic Wetland Hardwoods (619) Wetland Shrub (631) Freshwater Marshes (641)	Cattail (6412) Maidencane (6414)
Transportation, Communication and Utilities (800)	Transportation (810)	Railroads (812) Roads and Highways (814) Port Facilities (815)	

The land use information presented in **Table 8-3** was recorded on digital DOQQs and digitized into ArcGIS (**Figures 8-4**, **8-5**, and **8-6**). From these maps, the distances crossed for each land use type and location of each land use type measured by feet marker were compiled (**Table 8-4**).

Table 8-4
Land Use Along Port Dolphin Pipeline Corridor

Land Use (code)	Pipeline Feet Marker	Pipeline Length (feet)
Urban and Built-Up (100)		
• Commercial and Services (140)	198+64.55 to 203+32.27	467.72
o Wholesale Sales and Services (142)	126+26.3 to 139+44.22	1,317.92
o Oil and Gas Storage (146)	74+76.24 to 85+40.4	1,064.16
• Openland (190)	156+35.38 to 159+58.86	323.48
	197+07.1 to 198+19.07	111.97
Agriculture (200)		
• Cropland and Pastureland (210)	118+21.41 to 126+26.3	804.88
	143+09.89 to 145+83.24	273.35
	203+89.59 to 205+09.01	119.42
• Tree Crops (220)	106+06.42 to 111+06.87	500.45
o Abandoned Groves (224)	51+17.13 to 65+49.58	1,432.45
	185+89.59 to 191+94.61	605.02
Upland Forest (400)		
• Upland Hardwood Forest (420)		
o Brazilian Pepper (422)	65+49.58 to 66+88.45	138.87
	71+91.72 to 74+76.24	284.52
	97+67.91 to 99+86.7	218.78
	139+44.22 to 142+96.47	352.25
	145+83.24 to 149+12.79	329.55
	149+38.05 to 152+56.84	318.79
	154+03.29 to 155+88.77	185.48
	193+69.6 to 197+07.1	337.51
o Temperate Hardwood Forest (425)	100+64.94 to 106+06.42	541.48
• Australian Pine (437)	112+96.32 to 118+21.41	525.09
Water (500)		
• Streams and Waterways (510)	14+80.47 to 50+37.48	3,557.00
Wetlands (600)		
• Wetland Hardwood Forests (610)		
o Exotic Wetland Hardwoods (619)	66+88.45 to 71+91.72	503.27
	149+12.79 to 149+38.05	25.27
	152+56.84 to 153+06.06	49.22
	153+57.03 to 154+03.29	46.26
	191+94.61 to 193+69.6	174.99
• Wetland Forested Mixed (630)	85+40.4 to 93+68.15	827.75
o Wetland Shrub (631)	93+68.15 to 97+67.91	399.76
• Vegetated Non-Forested Wetlands (640)		
o Freshwater Marshes (641)	153+06.06 to 153+57.03	50.97
	169+67.95 to 178+04.44	836.49
o Cattail (6412)	159+58.86 to 169+67.95	1009.10
	178+04.44 to 185+89.59	785.14
o Maidencane (6414)	142+96.47 to 143+09.89	13.42
Transportation, Communication and Utilities (800)		
• Transportation (810)		
o Railroads (812)	99+86.7 to 100+64.94	78.25
o Roads and Highways (814)	50+84.38 to 51+17.13	32.75
	111+06.87 to 112+96.32	189.45
	155+88.77 to 156+35.38	46.61
	198+19.07 to 198+64.55	45.48
	203+32.27 to 203+89.59	57.32
o Port Facilities (815)	0+0.00 to 14+80.47	1,480.47
	50+37.48 to 50+84.38	46.90

Figure 8-4
FLUCCS Codes for Land Use Categories along Port Dolphin Pipeline (1 of 3)

Figure 8-4.

Figure 8-5
FLUCCS Codes for Land Use Categories along Port Dolphin Pipeline (2 of 3)

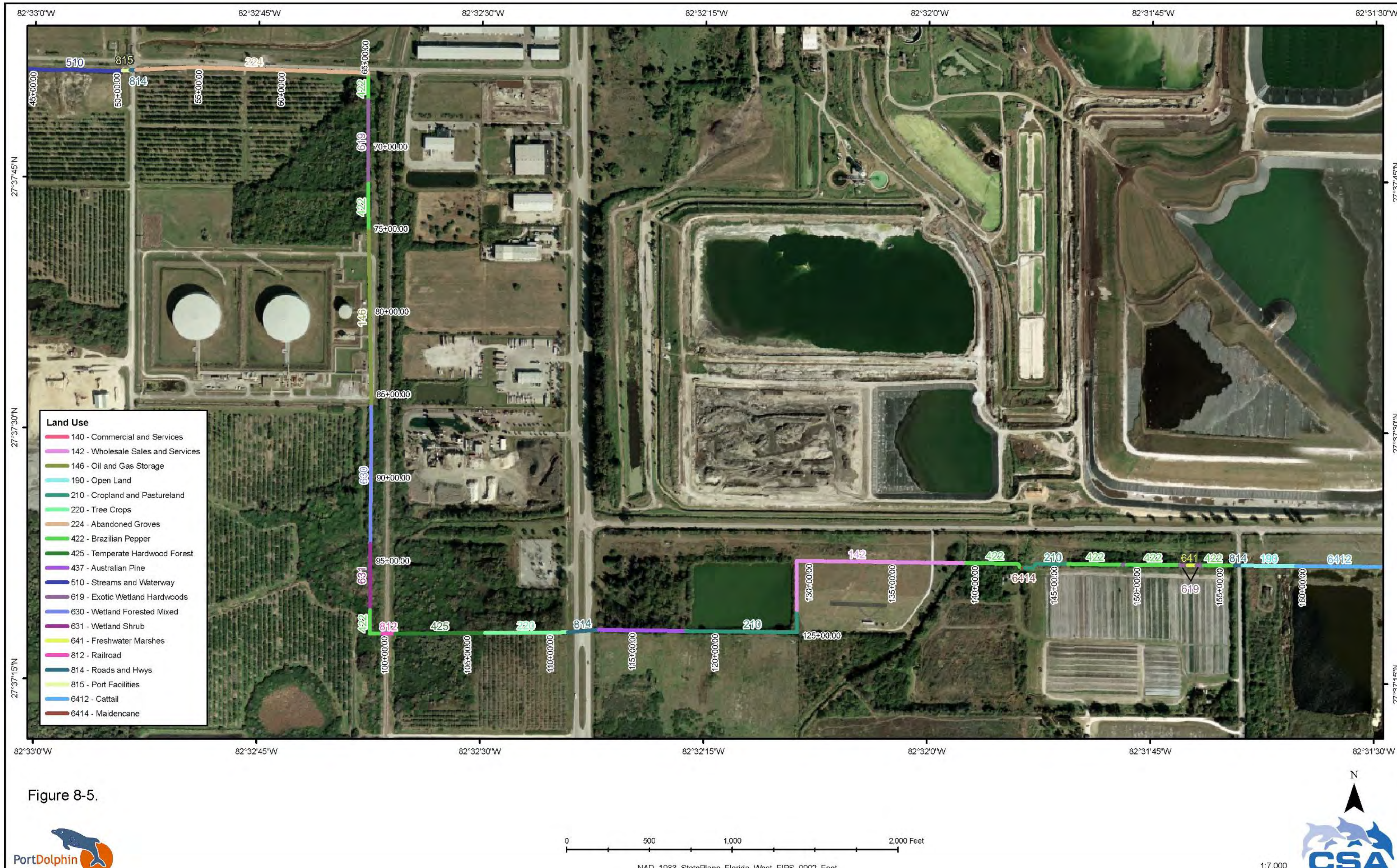


Figure 8-5.

Figure 8-6
FLUCCS Codes for Land Use Categories along Port Dolphin Pipeline (3 of 3)

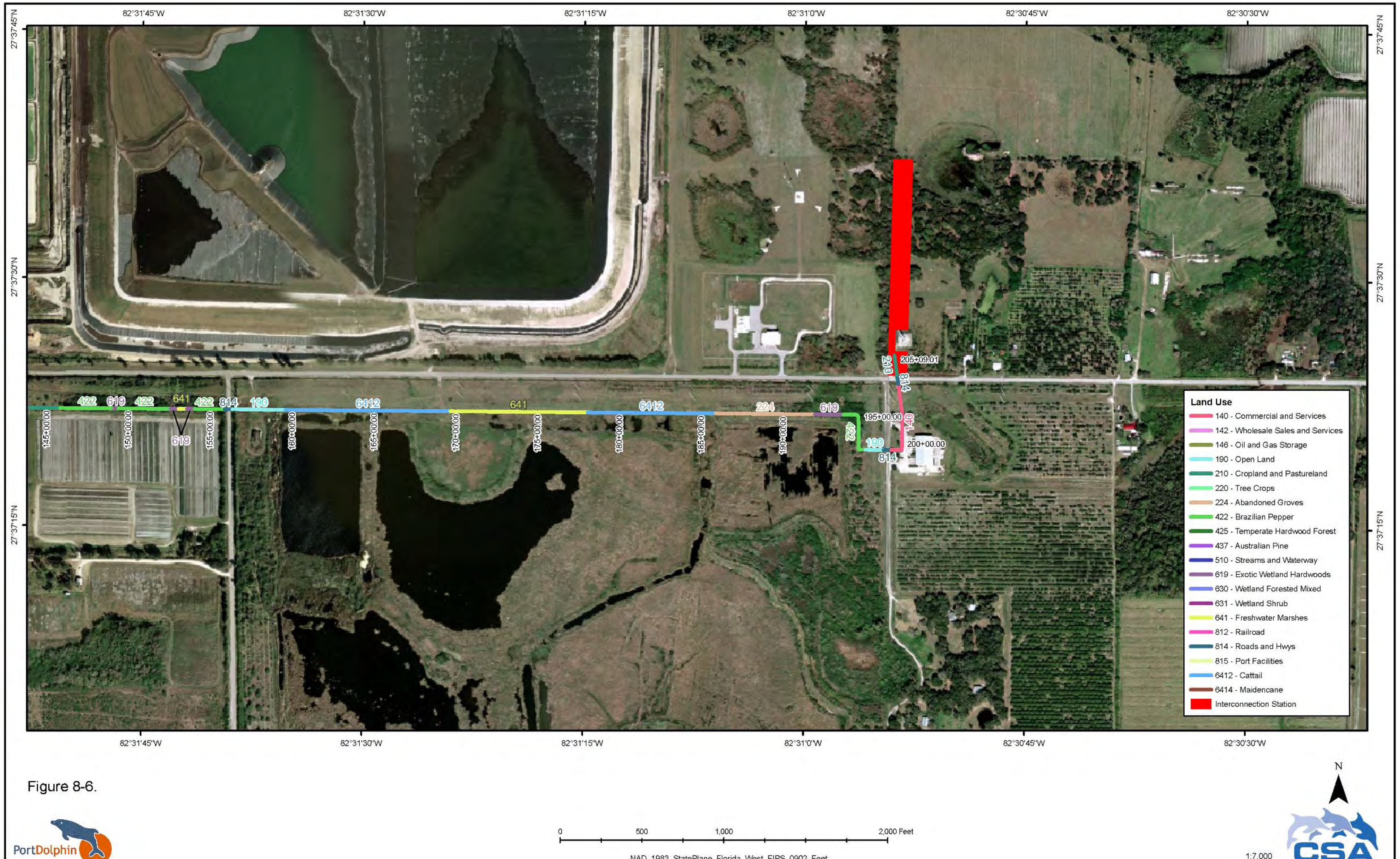


Figure 8-6.

8.2 Analysis of Potential Consequences

The following new or revised activities (project design changes and development in the project area) are included in this impact analysis.

- **Revised slick bore across Buckeye Road** – Port Dolphin was informed of the potential future widening of Buckeye Road by Manatee County to a maximum of 150 feet (46 meters). To accommodate for this change, the slick bore across that road has been lengthened to 310 feet (95 meters), which changes the entrance and exit points of the bore, and the angle has been modified.
- **Removal of Wetlands 4 and 5 from impact area** – Development in the area, unrelated to this project, and a refined definition of jurisdictional wetlands have reduced the number of wetlands impacted by the Port Dolphin project from 11 to 9.
- **Modification to the location of extra work spaces at Port Manatee** – The extra work space required by Port Dolphin for concrete coating of the pipe, pipe storage, and concrete mattress production has been moved to a different location within Port Manatee.

Due to these changes, impacts to wetlands, FLUCCS codes, and land use, recreation, and aesthetics along the entire terrestrial routing have been recalculated, and the stationing along the pipeline route has been modified.

8.2.1 Fish, Wildlife, and Vegetation

There is a wide variety of fish, wildlife, and vegetation occurring along the pipeline corridor, as discussed in **Addendum I**, **Section 9.2.1**. The design changes included in this **Addendum II** and development in the project area will not affect impacts to these resources during construction, operations, decommissioning, or accidents or upsets.

8.2.2 Water Use and Quality

The Port Dolphin pipeline will not affect a large amount of aquatic habitat. In addition, the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**) and the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**) will be implemented along with the Dewatering Plan (**Attachment A.10**) and Best Management Practices (BMPs) to reduce any impacts that may occur to the existing waters.

8.2.2.1 Construction

Removal of Wetlands 4 and 5 from impact area – The FPL borrow pond was originally delineated as Wetland W-4, but according to both the State and Federal rules, a borrow pond constructed in upland habitat is not jurisdictional. In addition, Wetland W-5 has been disturbed and filled by the new property owner during activities not related to the Port Dolphin project. Therefore, Wetlands W-4 and W-5 are not included in the impacts to water use and quality.

8.2.2.2 Operations

None of the project changes would significantly alter the potential impacts of operations on water use and quality as discussed in **Addendum I**, **Section 9.2.2.2**.

8.2.2.3 Decommissioning

None of the project changes would significantly alter the potential impacts of decommissioning on water use and quality as discussed in **Addendum I**, **Section 9.2.2.3**.

8.2.2.4 Accidents and Upsets

None of the project changes would significantly alter the potential impacts of accidents or upsets on water use and quality as discussed in **Addendum I**, **Section 9.2.2.4**.

8.2.3 Soils and Geological Resources

The impacts to soils and geological resources along the pipeline corridor are discussed in **Addendum I**, **Section 9.2.3**. The design changes included in this **Addendum II** and development in the project area will not affect impacts to these resources during construction, operations, decommissioning, or accidents or upsets.

8.2.4 Wetlands

Impacts to wetlands are discussed in **Addendum I**, **Section 9.2.4.** The pipeline was routed to avoid wetlands and/or sensitive sites wherever possible. The majority of wetland sites that will be crossed with trenching techniques have previously been disturbed by existing ROWs. All of the wetlands will be crossed with standard open cut methods. The Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**) provides excavated materials handling details.

The pipeline will cross a total of nine wetlands with a total crossing length of 8,516 feet (2,596 meters) (**Table 8-5**). These wetlands were identified during field surveys and include any area that satisfies the requirements of the State and Federal methodology for identifying and delineating wetlands. Construction across wetlands typically will be accompanied by conventional pipeline construction techniques. The procedures include the use of either low-ground-weight construction equipment or the use of timber riprap, prefabricated equipment mats, or terra mats for standard excavation equipment, and the installation of erosion control devices to minimize sediment flow into the wetland. The majority of impacts to the wetlands along the onshore route will be temporary and short-term while pipeline construction is taking place. The estimated time for construction of the pipeline is approximately 3 months.

Table 8-5
Summary of Wetland Impacts

Wetland	National Wetlands Inventory (NWI) Code	NWI Classification Type	Acres of Temporary Impact (acres)	Permanent Impacts (acres)	Length of Crossing (feet)	Percentage
W-1	EOW/SS (3)	Estuarine Open Water/Scrub-Shrub	1.88	0.0	2,769.4	3.6
W-2	PFO/SS	Freshwater Forested/Scrub-Shrub	0.60	0.35	505.2	1.8
W-3	PSS	Freshwater Scrub-Shrub	1.91	0.84	1,224.5	5.2
W-6	PEM/SS	Freshwater Emergent/Scrub-Shrub	0.07	0.00	120.6	0.1
W-7	PSS	Freshwater Scrub-Shrub	0.03	0.00	22.3	0.06
W-8	PSS/EM	Freshwater Scrub-Shrub/Emergent	0.15	0.00	168.7	0.3
W-9	PEM/L1OW(x)	Freshwater Emergent/Lacustrine Limnetic Open Water (excavated)	5.46	0.00	3,533.2	10.4
W-10	PEM	Freshwater Emergent	0.37	0.00	137.9	0.7
W-11	POW	Freshwater Open Water	0.24	0.00	34.0	0.4
Total			**10.71**	**1.19**	**8,515.8**	**22.56**

8.2.4.1 Construction

Removal of Wetlands 4 and 5 from impact area. The open-trench construction method to be employed to cross all wetlands along the pipeline route will comply with the open trenching methods standardized by FERC (2003). The Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures document (**Attachment A.8**) will be implemented during construction activities. A total of 11.9 acres (4.82 hectares) of wetlands will be impacted during the construction and operation phases of the project (**Table 8-5**). Approximately 10.71 acres (4.33 hectares) of wetland impacts will be temporary, and recovery measures will be taken to ensure restoration of the wetlands. Prior to construction activities, the wetland boundaries and buffer areas will be clearly flagged. Other mitigating measures include removal of topsoils, use of appropriate stabilizer (rip-rap, terra mats, etc.), use of low ground weight construction equipment, minimal access roads, and removal of vegetation only within the ROW.

It is important to note that the construction will not involve a permanent loss in wetland areas. The only long-term wetland alteration includes the permanent conversion of Forested and Scrub-Shrub wetland habitats to Emergent marsh wetland habitats in the 30-foot (9-meter) permanent ROW. This conversion is necessary to maintain the operational ROW in accordance with Federal regulations. These permanent impacts account for only 1.19 acres, or 2.3% of the entire project area.

Only small portions of the wetlands are Forested/Shrubby, and those areas are dominated by exotic species. The majority of the wetlands are herbaceous and expected to be restored through natural recruitment once construction is complete. The removal of these exotic species and the restoration of the wetlands to a more natural state will improve the quality of habitat for fish and wildlife. An Onshore Post-Construction Recovery and Mitigation Plan has been developed with consultation of the appropriate agencies (**Attachment A.11**). The plan will address methods for restoring wetland vegetation, planting of appropriate species, if necessary, and the mitigation needed for any potential permanent impacts.

A restoration plan has been developed to ensure the wetlands are restored to pre-construction conditions. The plan addresses methods for restoring wetlands to pre-construction conditions and replanting of native forested vegetation in the temporary construction areas of Wetland 2; see **Attachment A.11** for additional information.

UMAM has been utilized to assess the function of two of the nine wetlands that are expected to be permanently impacted as a result of the proposed project. The remaining seven wetlands would have only temporary impacts and be restored to pre-construction conditions. As a result, mitigation and UMAM forms are not needed.

Wetlands 2 and 3 would be impacted as a result of the loss of their Forested and/or Shrubby wetland component due to the clearing activities and maintenance of the 30-foot (9-meter) permanent ROW for the proposed pipeline.

Additionally, Wetlands 6 and 7 are ditches constructed in uplands and, according to the Southwest Florida Water Management District (SWFWMD) Basis of Review, would not require mitigation. UMAM forms have not been provided for Wetlands 6 and 7.

Compensation for the loss in the Forested/Shrub-Scrub component of Wetlands 2 and 3 equates to a 0.13 functional loss based on the calculations from UMAM. Credits (0.13) will be obtained from the Braden River Mitigation Bank; see **Attachment A.11** (Onshore Post-Construction Recovery and Mitigation Plan) for additional information.

8.2.4.2 Operations

None of the project changes would significantly alter the potential impacts of operations on wetlands as discussed in **Addendum I**, **Section 9.2.4.2**.

8.2.4.3 Decommissioning

None of the project changes would significantly alter the potential impacts of decommissioning on wetlands as discussed in **Addendum I**, **Section 9.2.4.3**.

8.2.4.4 Accidents and Upsets

None of the project changes would not significantly alter the potential impacts of accidents or upsets on wetlands as discussed in **Addendum I**, **Section 9.2.4.4**.

8.2.5 Land Use, Recreation, and Aesthetics

In addition to the removal of Wetlands W-4 and W-5 and the modification to the location of the extra work spaces at Port Manatee, due to development along the pipeline corridor unrelated to this project, the FLUCCS and land use along the pipeline route have changed. This section provides the updated information based on conditions currently present at the site.

8.2.5.1 Construction

Optional Location of Extra Work Spaces at Port Manatee

Land Use. All staging areas, pipe yard, and contractor facilities will be located at Port Manatee. Port Manatee has identified an optional area within its property for use by Port Dolphin for extra work space for concrete coating of the pipe, pipe storage, and concrete mattress production. A portion of this area was used by Gulfstream for similar activities and contains existing gravel and grassy areas. This area will require modification to meet Port Dolphin's needs including but not limited to paving, fencing, and lighting of a 5.4-acre (2.2-hectare) area to relocate an existing tenant that currently is using the optional area identified for Port Dolphin; the construction of additional gravel "fingers" for pipe storage; construction of laydown areas for raw material storage; and construction of a retention pond. A second parcel (4.7 acres [1.9 hectares]) is currently a grassy upland area that will be modified for the concrete mattress production and storage facility (**Figure 8-7**). The previous area identified by Port Manatee for use for this extra work space is still an option and is illustrated in **Figure 8-8**. The exact parcel that will be used by Port Dolphin at Port Manatee for these extra work spaces will be determined by Port Manatee based on the Port's development plans and finalized closer to the time of construction. The contractor facilities will be housed in existing office space at the Port. Construction for the onshore Port Dolphin pipeline is anticipated to last approximately 5 months. Additionally, construction for the Port Dolphin deepwater port and pipeline, which will use the pipe yard and contractor facilities, will last approximately 10 months and overlap with the construction of the onshore pipeline and facilities.

The cleanup and restoration will encompass all disturbed areas. The sites will be finish graded, and any remaining trash and debris will be properly disposed of in compliance with Federal, State, and local regulations. After construction is completed, the entire ROW will be protected by the implementation of permanent and temporary erosion control measures, including site-specific contouring, permanent slope breakers, mulch, and reseeding or sodding with soil-holding grasses. Contouring will be accomplished using acceptable soil stockpiled during initial grading. The erosion control measures used will be in accordance with the Soil and Erosion Control Plans approved by the local soil conservation districts, appropriate State agencies, the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**), and Port Dolphin BMPs.

Figure 8-7
Extra Work/Staging Areas Locations at Port Manatee

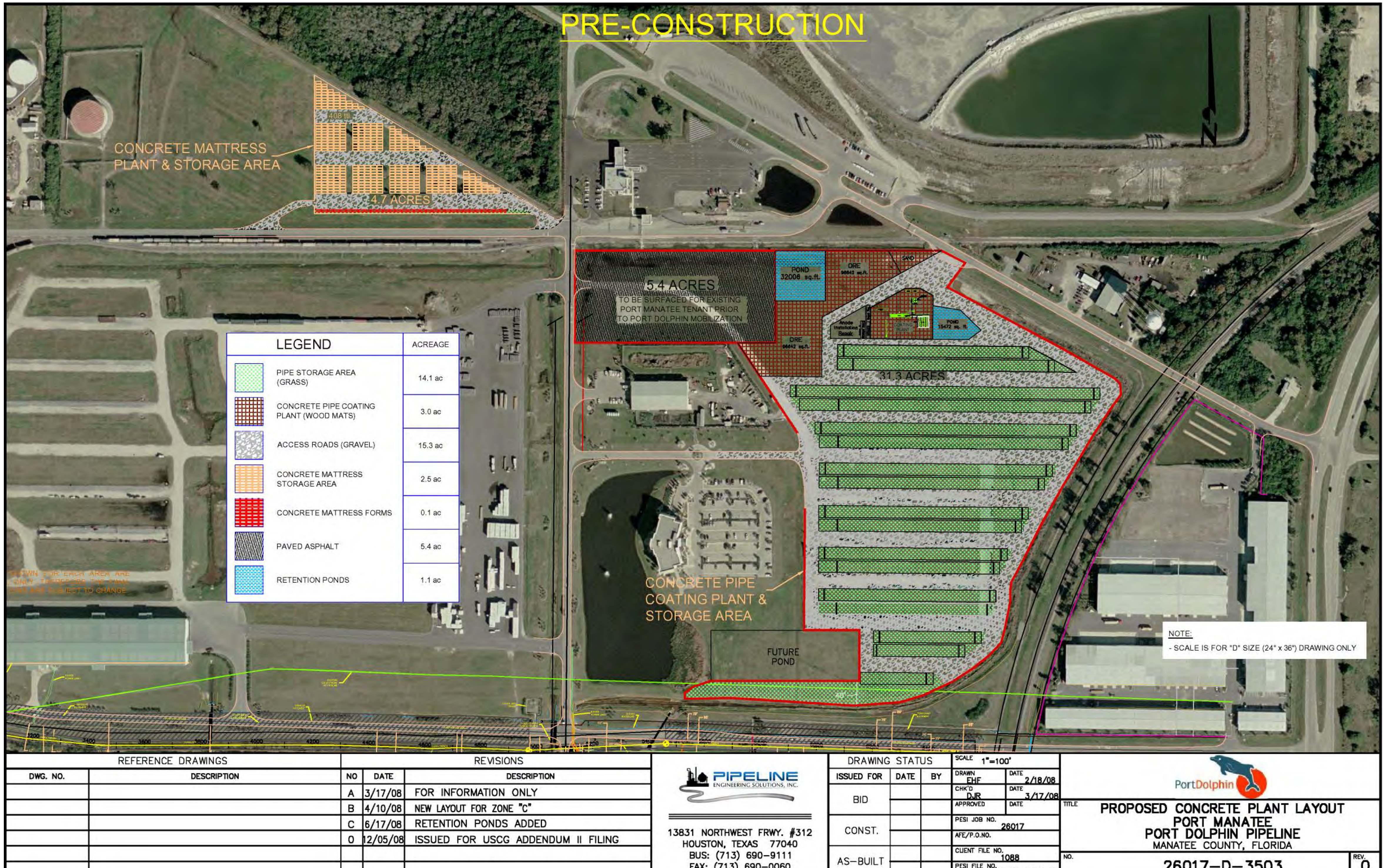
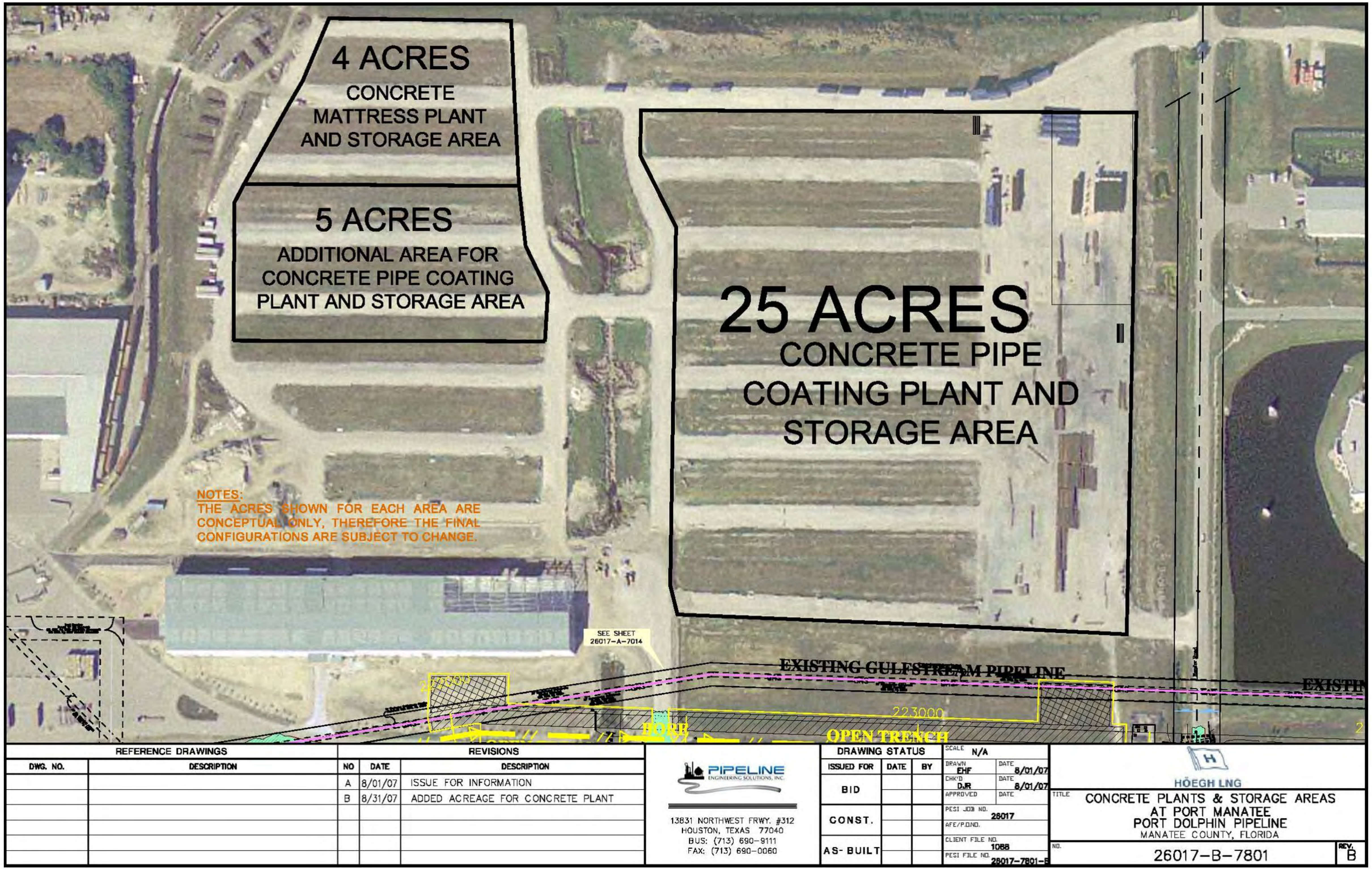


Figure 8-8
Original Extra Work/Staging Areas Locations at Port Manatee



Due to the existing land uses, mitigation measures to be implemented, and restoration activities to take place, impacts from the construction activities are considered minor.

Recreation. There was one parcel along the Revised Preferred Onshore Route that was used as a radio-controlled airplane fly zone. This parcel has been sold, and a new FedEx distribution center has been constructed on the site. The pipeline construction ROW no longer traverses any recreational lands; therefore, there are no impacts to recreational activities.

Aesthetics. Additional extra work and staging areas outside of the 100-foot (30.5-meter) ROW required for the proposed project will include a temporary concrete coating batch plant, a concrete mattress production facility, and pipe yard set up at Port Manatee, which will require approximately 36 acres (14.6 hectares). The batch plant, mattress facility, and pipe yard will be located within the Port. Since the area is already an industrial area, visual impacts from this activity will be negligible and short-term. In addition, after dismantling of the temporary batch plant and mattress facility, the site will be returned to existing conditions. Contractor facilities will be housed in existing office space at Port Manatee and will have no visual impacts from the proposed project.

8.2.5.2 Operations

Land Use. The modification to the extra work space location would not significantly alter the potential impacts of operations on land use as discussed in **Addendum I**, **Section 9.2.5.2**.

Recreation. Since there are no longer recreational lands along the pipeline route, there would be no impacts to recreational activities.

Aesthetics. The modification to the extra work space location would not significantly alter the potential impacts of operations on aesthetics as discussed in **Addendum I**, **Section 9.2.5.2**.

8.2.5.3 Decommissioning

Land Use. The extra work spaces located at Port Manatee that will be used for pipe laydown, concrete coating, and mattress production would remain in the enhanced condition per a request from the Port. These areas will provide improvements to the Port property; therefore, the land use at the Port will be enhanced.

Recreation. Since there are no longer recreational lands along the pipeline route, there would be no impacts to recreational activities.

Aesthetics. The extra work spaces located at Port Manatee that will be used for pipe laydown, concrete coating, and mattress production would remain in the enhanced condition per a request from the Port. These areas will provide improvements to the Port property; therefore, the aesthetics at the Port will be enhanced.

8.2.5.4 Accidents and Upsets

Land Use. The modification to the extra work space location would not significantly alter the potential impacts of accidents or upsets on land use as discussed in **Addendum I**, **Section 9.2.5.4**.

Recreation. Since there are no longer recreational lands along the pipeline route, there would be no impacts to recreational activities.

Aesthetics. The modification to the extra work space location would not significantly alter the potential impacts of accidents or upsets on aesthetics as discussed in **Addendum I**, **Section 9.2.5.4**.

8.3 Cumulative Impacts

The proposed Port Dolphin pipeline project is not expected to cause violations of water quality standards or adverse impacts to the functions of wetlands or other surface waters.

Cumulative impacts in the project area are expected to be minimal and short-term. Actions requiring cumulative impacts analysis include past, present, and reasonably foreseeable future actions. Past impacts include the development of Port Manatee, which is still in operation today. Piney Point phosphate plant is no longer in operation but was at one time considered a contaminated site. The plant is now privately owned and may be permitted as a commercial or industrial site. Agricultural sites once used as citrus groves occur in the area but are now utilized as work stations. The Gulfstream pipeline ROW was constructed in the area and is now currently in operation along the pipeline route. These existing ROWs are proposed to be utilized to the best of Port Dolphin's ability to minimize impacts. In addition, FPL ROWs and work sites exist and will be utilized to reduce areas of impact.

Impacts to mangroves are not expected to occur. Wetlands will be restored after construction is complete. Permanent impacts are expected to occur due to the loss of the Forested and Shrub components in the permanent ROW of Wetlands 2 and 3. The remaining impacts will be only temporary while construction is ongoing. In fact, the temporary construction areas of Wetland 2 will be replanted with native forested species after construction is complete, removing the presence of the significant exotic/nuisance species present in the area for at least a temporary period of time. Steps will be taken to keep impacts at a minimum. FERC procedures also will be followed to ensure the wetlands are restored according to the criteria outlined in the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**). Open-cut freshwater wetlands will be restored following construction and allowed to naturally recruit native wetland vegetation. It is important to note that the wetlands and uplands contain a strong dominance of exotic and nuisance species. These exotic/nuisance species will be removed during construction and replaced with native wetland or upland vegetation once construction is complete. Appropriate mitigation at a nearby mitigation bank will compensate for proposed impacts. Therefore, only minimal and short-term cumulative impacts are anticipated.

8.4 Mitigation and Summary of Potential Impacts

The Port Dolphin project will implement minimization and avoidance techniques wherever possible in order to help avoid or reduce impacts from pipeline construction. The pipeline was routed to parallel existing ROWs for the majority of the project and avoid the sensitive mangrove swamp habitat in Port Manatee. Special consideration also was taken to utilize existing ROWs through the sensitive areas, such as wetlands sites.

The wetlands that the project will impact were selected because they are of low quality and dominated by exotic and nuisance species such as Brazilian pepper, cattails, and air potato and provide little support to fish and wildlife. Turbidity and erosion control measures will be implemented to ensure that no violations to water quality standards will occur. All construction areas in and adjacent to wetlands will be sectioned off with the placement of silt fencing or turbidity curtains. This will ensure that impacts to adjacent habitats will not occur. The wetland habitats will be cleared of all vegetation during construction, including the exotic/nuisance species cover that dominates almost every one of the nine wetlands. The wetlands will be allowed to naturally recruit. Therefore, impacts are expected to be temporary in nature. Wildlife will have to temporarily move out of the construction areas but will be allowed to quickly return once construction is complete. Monitoring and maintenance will be conducted in accordance with **Attachments A.9** and **A.11**.

Minimal permanent impacts will result from pipeline construction and aboveground facilities. Minimization techniques also have been employed through the reduction of access roads outside the existing roadways and the ROW corridor. In instances where permanent work spaces were required, sites providing the least benefit to wildlife due to previous disturbances also were selected.

Mitigation for Impacts

In addition to the mitigation measures set forth below, Port Dolphin Energy LLC; its affiliated parent company, Höegh LNG AS (Höegh); and other affiliated companies have a deep and broad commitment to environmental stewardship, sustainability, and social responsibility. Höegh's objective is to continuously seek to reduce the impact of its activities on the environment. Höegh not only strives to comply with all applicable environmental conventions, laws, and regulations but also, through its environmental policy, is taking active measures to seek new technology and methods to go beyond these requirements. As examples, Höegh and affiliated companies have made it their goal to reduce 1) the risk of spreading invasive or harmful organisms through ballast water, 2) emissions of exhaust gases to the atmosphere by reducing consumption of lubricating oil, and 3) the consumption of and impacts from chemical cleaners. In addition, Höegh's affiliated company, Höegh Fleet Services, has instituted a compliance program that includes upgrading and improving bilge water systems on board, improving routines and procedures for waste stream handling, introducing an extensive MARPOL inspection and training scheme on board, and developing a training course in "bilge water/waste oil operation" and reporting to the USCG. It is Höegh's policy to be open and transparent, and this policy includes the publication of an annual environmental and sustainability report that details the company's efforts in these arenas.

In addition, Höegh is committed to providing onshore recovery activities that are expected to provide an additional benefit to the area. The wetlands located in the project area are low-quality and dominated by exotic/nuisance species such as Brazilian pepper. The project will remove the exotic/nuisance species cover during and after construction, and some replanting of native vegetation will occur; see **Attachment A.9** for additional information.

Minimal impacts are expected to occur to terrestrial resources as a result of this project. Overall, potential impacts to the project site will be minimal. There will be temporary impacts during the construction activities due to open trenching methods. Vegetation within the ROW will be cleared, and associated wildlife will have to relocate. However, the habitat will be restored, and the wildlife will be allowed to return. Permanent impacts from the aboveground facilities will occur; however, the location of the facilities is such that no wetland vegetation or substantial wildlife habitat will be affected. There is the potential for fluid spills during the HDD operation. Appropriate measures have been taken to minimize any possible impacts.

Impacts are expected to be short-term and temporary while the construction is in progress. Restoration of the uplands will be in accordance with the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**). Recovery also will take place in the wetland sites where the construction of the pipeline has impacted the habitat. Due to utilizing existing ROWs and disturbed areas, impacts will be minimal. The non-wetland areas are expected to revegetate through natural recruitment with an exotic/nuisance species maintenance program. Wetland habitats will be regraded, naturally revegetated, and replanted if necessary. Prior to the start of construction activities, BMPs and the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures will be implemented during construction activities (**Attachment A.8**). The specific recovery plan will address returning the wetlands to pre-construction conditions, and the revegetation activities proposed for the project (**Attachment A.9**).

Long-term impacts to wetlands will consist of the permanent conversion of the forested and shrubby habitat to emergent herbaceous wetlands. This is necessary to maintain the operational ROW in accordance with Federal regulations. Port Dolphin has made every effort to utilize existing disturbed lands and ROWs to the maximum extent possible to reduce overall impacts to wetlands. The loss of the forested component of the wetland habitats is not expected to have a significant impact on the system's ability to provide valuable wildlife habitat. In fact, the forested habitats in the project area are dominated by exotic species. The removal of the exotic component of the system is expected to benefit the habitat as well as the fish and wildlife that may potentially utilize it. Port Dolphin also is willing to provide compensatory mitigation for the loss of the forested and shrubby component, even though there is no net loss in wetland habitat.

Compensatory mitigation for the long-term impacts from the Port Dolphin project will be provided through mitigation banks located in close proximity to the proposed project area. Port Dolphin has commenced discussions with the Braden River Mitigation Bank. Both forested and herbaceous mitigation are available. The Onshore Post-Construction Recovery and Mitigation Plan (**Attachment A.11**) provides detailed descriptions of the onshore wetland impacts recovery and mitigation.

As stated above, the Port Dolphin pipeline project is anticipated to have minimal impacts on the terrestrial environment within the project area with regards to fish, wildlife, and vegetation; cultural resources; soils and geological resources; wetlands; and land use, recreation, and aesthetics during the construction and long-term operations.

Table 8-6 below summarizes the potential impacts on terrestrial resources and associated mitigation measures for the preferred alternative for the Port Dolphin project. Potential impacts to the terrestrial resources are rated as significant, minor, or negligible according to the following criteria:

- Significant – impacts that would damage a unique or environmentally valuable resource, change a planned use of the land, or create aesthetics that are obtrusive.
- Minor – changes that can be restored, monitored, and/or noticed but do not meet the definition of a significant impact (above).
- Negligible – changes that are unlikely to be noticed or measurable against existing conditions.
- No Impact – no changes to existing conditions.

The table also categorizes impacts as certain, likely, or unlikely; direct or indirect; and reversible or irreversible.

Table 8-6
Summary of Impacts to the Terrestrial Pipeline and Facilities

Phase	Impact	Descriptors	Significance	Mitigation
Fish, Wildlife, and Vegetation				
Construction	Open trenching for pipeline installation through 9 wetlands (11.9 acres).	• Certain • Direct • Reversible	Minor	• Implement the Port Dolphin Project-Specific Wetland and Waterbody Construction and Mitigation Procedures. • Restoration of the wetlands after pipeline placement. • Environmental coordinator on site during installation.
Operations	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*
Upsets/Accidents	*No change*	*No change*	*No change*	*No change*
Water Use and Quality				
Construction	Temporary and short-term disturbance of surface waters and sedimentation	• Certain • Direct • Reversible	Minor Short-term, occurring only during construction	• Compliance with the Port Dolphin Project-Specific Wetland and Waterbody Construction and Mitigation Procedures. • Compliance with all State and Federal permit conditions. • Use of sediment barriers for soil piles adjacent to the waterbody. • Minimization of the time that the pipeline excavation is open. • Installation of silt fencing and other erosion control measures. • Providing oversight by an environmental inspector. • Development of a Stormwater Pollution Prevention Plan. • Demarcation of the construction ROW. • Segregation of topsoil from trench areas. • Revegetation of the disturbed areas.
Operations	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*
Upsets and Accidents	*No change*	*No change*	*No change*	*No change*
Soils and Geological Resources				
Construction	*No change*	*No change*	*No change*	*No change*
Operations	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*
Upsets/Accidents	*No change*	*No change*	*No change*	*No change*

Phase	Impact	Descriptors	Significance	Mitigation
Wetlands				
Construction	Open trenching for pipeline installation through nine wetlands (11.9 acres).	• Certain • Direct • Reversible	Minor	• Implement the Port Dolphin Project-Specific Wetland and Waterbody Construction and Mitigation Procedures. • Restoration of the wetlands after pipeline placement. • Environmental coordinator on site during installation. • Compensatory mitigation from local mitigation bank(s).
Operations	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*
Upsets/Accidents	*No change*	*No change*	*No change*	*No change*
Land Use, Recreation, and Aesthetics				
Construction	Additional work areas needed.	• Certain • Direct • Reversible	Minor	• Most extra work spaces to be placed at Port Manatee. • Additional work spaces located adjacent to 100-foot (30.5 meters) construction ROW on the former Piney Point Plant property.
Operations	*No change*	*No change*	*No change*	*No change*
Decommissioning	*No change*	*No change*	*No change*	*No change*
Upsets/Accidents	*No change*	*No change*	*No change*	*No change*

ROW = right-of-way.

9. LIST OF REFERENCES

ANUSKIEWICZ, R.J., 1988. Preliminary Archaeological Investigation at the Ray Hole Spring in the Estern Gulf of Mexico. *Florida Anthropologist*, 41,181-185.

ASHTON, Jr., R.E., and P.S. ASHTON, 1981. Handbook of Reptiles and Amphibians of Florida, The Snakes. Windward Publishing.

ATEN, L., 1983. *Indians of the Upper Texas Coast.* New York, NY: Academic Press.

BARTLETT, R.D., and P.P. BARTLETT, 1999. *A field Guide to Reptiles and Amphibians.* Gulf Publishing Co.

BENSE, J.A., 1994. *Archaeology of the Southeastern United States*: *Paleoindian to World War I.* San Diego, CA: Academic Press.

BERMAN, B.D., 1972. *Encyclopedia of American Shipwrecks.* Boston, Massachussetts: The Mariners Press Incorporated.

BROOKS, G.R., and L.J. DOYLE, 1998. Recent Sedimentary Development of Tampa Bay, Florida: A Microtidal Estuary Incised into Tertiary Platform Carbonates. *Estuaries*, 21 (3), 391-406.

COASTAL ENVIRONMENTS, INC., 1977. *Cultural Resources Evaluation of the Northern Gulf of Mexico.* Baton Rouge, Louisiana: Interagency Archaeological Services, Office of Archaeology and Historical Preservation, National Park Service, U.S. Department of the Interior.

COASTAL ENVIRONMENTS, INC., 1982. *Sedimentary Studies of Prehistoric Archaeological Sites.* Baton Rouge, Louisiana: Division of State Plans and Grants, National Park Service, U.S. Department of the Interior.

COASTAL ENVIRONMENTS, INC., 1986. *Archaeological Investigations on the Outer Continental Shelf: A Study Within the Sabine River Valley, Offshore Louisiana and Texas.* Baton Rouge, Louisiana: Minerals Management Service, U.S. Department of the Interior.

COLEMAN, J.M., and W.G. SMITH, 1964. Late Recent Rise of Sea Level. *Geological Society of America Bulletin*, 75, 833-840.

COLQUHOUN, D.J., and M.J. BROOKS, 1986. New Evidence from the Southeastern U.S. for Eustatic Components in the Late Holocene Sea Levels. *Geoarchaeology,* 1 (3), 275-291.

COLQUHOUN, D.J., M.J. BROOKS, J. MICHIE, W.B. ABBOTT, F.W. STAPOR, W. NEWMAN, and R. PARDI, 1981. Location of Archaeological Sites with Respect to Sea Level in the Southeastern United States. *Stria*, 14, 145-150.

CURRAY, J.R., 1960. *Sediments and History of Holocene Transgressions, Continental Shelf, Northwest Gulf of Mexico. In Recent Sediments, Northwest Gulf of Mexico.* Tulsa, Oklahoma: F.P. Shepard, et al., eds., American Association of Petroleum Geologists, Special Publication.

DANIEL, I.R., Jr., and M. WISENBAKER. 1987. *Harney Flats: A Florida Paleo-Indian Site.* Farmingdale, NY: Baywood Publishing Company, Inc.

DOVELL, J.E., 1952. *Florida: Historic, Dramatic, Contemporary*. 4 volumes. New York: Lewis Historical Publishing Company, Inc.

DUNBAR, J.S., 1983. *A model for the Predictability of Clovis/Suwannee Paleo Indian Site Clusters in Florida—A Revival of the W. T. Neill's Oasis Hypothesis*. Paper presented at the 35th Annual Meeting of the Florida Anthropological Society, Tallahassee.

DUNBAR, J.S., 1991. Resource Orientation of Clovis and Suwannee Age Paleoindian Sites in Florida. *In:* Bonnichsen and K. Turnmier, ed. *Clovis: Origins and Adaptations*, Sorvalllis: Center for the First Americans, Oregon State University. pp. 185-213.

DUNBAR, J.S., M.K. FAUGHT, and D.S. WEBB, 1989a. Culturally and Naturally Modified Bones from a Paleoindian Site in the Aucilla River, North Florida. *In: First International Bone Modification Conference*, R. Bonnichsen (ed.), 473-497. Orono:Center for the Study of the First Americans, Univ. of ME.

DUNBAR, J.S., S.D. WEBB, M. FAUGHT, R.J. ANUSKIEWICZ, and M. STRIGHT, 1989b. Archaeological Sites in the Drowned Tertiary Karst Region of the Eastern Gulf of Mexico. Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference, J. Barto Arnold III (ed.), 25-31. Baltimore, MD.

DUNBAR, J.S., S.D WEBB, and M. FAUGHT, 1991. Inundated Prehistoric Sites in Apalachee Bay, Florida, and the Search for the Clovis Shoreline. *In: Paleoshorelines and Prehistory: An Investigation of Method*, Lucille Lewis Johnson (ed.), 117-146. CRC Press, Boca Raton, FL.

DUNCAN, D.S., 1992. *Neogene to Recent Seismic Stratigraphy of the lower Tampa Bay Estuary: West-Central Florida*. Master's Thesis. Univ. of S. FL, St. Petersburg.

FAUGHT, M.K., 1996. *Clovis Origins and Underwater Prehistoric Archaeology in Northwestern Florida.* Ph.D. Dissertation, Department of Anthropology, University of Arizona, Tucson.

FAUGHT, M.K., 2003. *Geophysical Remote Sensing and Underwater Cultural Resource Management of Submerged Prehisotric Sites in apalachee Bay: A Deep-Water Example, Site Predictive Models, and Site Discoveries. Proceedings:* New Orleans, Louisiana: Minerals Management Service, Twenty Second Annual Gulf of Mexico Information Transfer Meetings, 2002.

FAUGHT, M.K., 2004. The Underwater Archaeology of Paleolandscapes, Apalachee Bay, FL. *American Antiquity*, 69 (2), 235-249.

FAUGHT, M.K., and J.F. DONOGHUE, 1997. Marine Inundated Archaeological Sites and Paleofluvial Systems: Examples from a Karst Controlled Continental Shelf Setting in the Apalachee Bay, Northeastern Gulf of Mexico. *Geoarchaeology* 12 (5), 417-458.

FEDERAL ENERGY REGULATORY COMMISSION (FERC). 2003. Wetland and Waterbodies Construction and Mitigation Procedures.

FLORIDA NATURAL AREAS INVENTORY, 2007. Available from: http://www.fnai.org/.

GAGLIANO, S.M., 1984. *Geoarchaeology of the Northern Gulf Shore. In Perspectives on Gulf Coast Prehistory.* Dave D. Davis (ed.). Gainesville, FL: University Presses of Florida.

GANNON, M.V., 1996. *The New History of Florida*. Gainesville, FL: University Press of Florida.

GARRISON, E.G., 1992. *Recent Archaeogeophysical Studies of Paleoshorelines of the Gulf of Mexico. In Paleoshorelines and Prehistory: An Investigation of Method.* Lucille Lewis Johnson and Melanie Stright (eds.). Boca Raton, FL: CRC Press.

GARRISON, E.G., C.P. GIAMMONA, F.J. KELLY, A.R. TRIPP, and G.A. WOLFF. 1989. *Historic Shipwrecks and Magnetic Anomalies of the Northern Gulf of Mexico: Reevaluation of Archeological Resource Management Zone 1. Volume II: Technical Narrative.* OCS Study 89-0024. New Orleans, Louisiana: U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office.

GOGGIN, J., 1964. Florida Archeology and Recent Ecological Changes. In Indian and Spanish Selected Writings, 299-309. University of Miami Press, Coral Gables.

GOODYEAR, A.C., and L.O. WARREN, 1972. Further Observations on the Submarine Oyster Shell Deposits of Tampa Bay. *Florida Anthropologist*, 25:52-66.

GOODYEAR, A.C., S.B. UPCHURCH, and M.J. BROOKS, 1980. Turtlecrawl Point: An Inundated Early Holocene Archeological Site on the West Coast of Florida. In *Southeastern Geological Society Guidebook 22*. Tallahassee, FL. Pp. 24-33.

GOODYEAR, A.C., S.B. UPCHURCH, M.J. BROOKS, and N.N. GOODYEAR, 1983. Paleoindian Manifestations in the Tampa Bay Region Florida. *Florida Anthropologist*, 36:40-66.

HINE, A.C., 1997. *Structural, stratigraphic, and paleoceanographic Development of the Margins of the Florida Platform.* A.F. Randazzo and D.S. Jones (eds). University Press of Florida: Geology of Florida.

HINE, A.C., G.R. BROOKS, R.A. DAVIS, Jr., L.J. DOYLE, G. GELFENBAUM, S.D. LOCKER, D.C. TWICHELL, and R.H. WEISBERG, 2001. *A Summary of Findings of the West-Central Florida Coastal Studies Project.* USGS Open File Report 01-03.

HOFFMAN, P.E., 1980. *The Spanish Crown and the Defense of the Caribbean, 1535-1585*. Baton Rouge, LA: Louisiana State University Press.

KRAFT, J.C., D.F. BELKNAP, and I. KAYAN, 1983. Potentials of Discovery of Human Occupation Sites on the Continental Shelves and Nearshore Coastal Zone. In Quaternary Coastlines and Marine Archaeology, P.M. Masters and N.C. Flemming (eds.). London: Academic Press.

LEWIS, III, R.R. and E.D. ESTEVEZ, 1988. *The ecology of Tampa Bay, Florida: An estuarine profile*. U.S. Fish and Wildlife Service Biological Report, 85, 7.18. 132 pp.

MARX, R., 1985. *Shipwrecks in Florida Waters.* Chuluota, Florida: The Mickler House.

MILANICH, J.T., 1994. *Archaeology of Precolumbian Florida.* Gainesville, FL: University Press of Florida.

MINERALS MANAGEMENT SERVICE, 2001. *Brief Overview of Gulf of Mexico OCS Oil and Gas Pipelines: Installation, Potential Impacts, and Mitigation Measures.* Gulf of Mexico OCS Region, MMS 2001-067.

MURPHY, L.E., 1990. 8SL17: Natural Site-Formation Processes of a Multiple-Component Underwater Site in Florida. *Southwest Cultural Resources Center Professional Papers No. 39.* Santa Fe, NM.

NEILL, W.T., 1964. Trilisa Pond, An Early Site in Maarion County, Florida. *Florida Anthropologist*, 17,187-200.

PEARSON, C., S.R., JAMES, JR., M.C. KRIVOR, S.D. EL DARRAGI, and L. CUNNINGHAM., 2003. *Refining and Revising the Gulf of Mexico OCS Region High Probability Model for Historic Shipwrecks*: Volumes I, II, and III. OCS Study/MMS 2003-060. Revised in 2006. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Regional Office, New Orleans, Louisiana.

POTTER, J., 1988. *The Treasure Divers Guide.* Port Salerno, FL: Classics Press.

PURDY, B.A., 1981. *Florida's Prehistoric Stone Tool Technology*. Gainesville, FL: University Press of Florida.

ROGERS, J.A., Jr., H.W. KALE II, and H.T. SMITH (eds), 1996. *Rare and endangered Biota of Florida*, *Volume V*. Birds. University Press of Florida.

RUPPE, R.J., 1980. The Archaeology of Drowned Terrestrial Sites: A Preliminary Report. *Florida Bureau of Historic Sites and Properties Bulletin*, 6, 35-45.

SAVERCOOL, D.M. and R.R. LEWIS, III. 1994. *Hard bottom mapping of Tampa Bay*. Prepared for Tampa Bay National Estuary Program. 14 pp.

SCHOLL, D.W., F. CRAIGHEAD, and M. STUIVER, 1967. Florida Submergence Curve Revisited: Its Relation to Coastal Sedimentation Rates. *Science*, 163, 562-64.

SINGER, S.D., 1992. *Shipwrecks of Florida*. Sarasota, Florida: Pineapple Press.

STRIGHT, M.J., 1986. Evaluation of Archaeological Site Potential on the Gulf of Mexico Continental Shelf Using High-Resolution Seismic Data. *Geophysics*, 51 (3), 605-622.

STRIGHT, M.J., 1987. Inundated Archaeological Sites of the Florida Coastal Region: A Regional Overview. Proceedings: Eighth Annual Gulf of Mexico Information Transfer Meeting. OCS-MMS 88-0035. New Orleans, LA.

STRIGHT, M.J., 1990. Archeological Sites on the North American Continental Shelf. In Archaeological Geology of North America, Centennial Special Volume 4, edited by Norman P. Lasca and Jack Donahue. *The Geological Society of America*. Boulder, CO.

TEBEAU, C.W., 1987. *A History of Florida. Revised edition*. Coral Gables, FL: University of Miami Press.

U.S. ARMY CORPS OF ENGINEERS. 1987. Corps of Engineers Wetland Delineation Manual. USACE Environmental Laboratory, Technical Report Y-87-1, USACE Waterways Experiment Station, Vicksburg, Washington, D.C.

U.S. ARMY CORPS OF ENGINEERS AND U.S. ENVIRONMENTAL PROTECTION AGENCY. 2007. Clean Water Act Jurisdiction Following the U.S. Supreme Court's Decision In Rapanos v. United States & Carabell v. United States. 12 pp.

U.S. DEPARTMENT OF AGRICULTURE, NRCS. 2003. Field Indicatorsof Hydric Soils in the United States—Guide for Identifying and Delineating Hydric Soils, Version 5.01. G.W. Hurt, P.M. Whited, and R.F. Pringle (eds.). USDA, NRCS in cooperation with the National Technical Committee for Hydric Soils, Fort Worth, TX.

U.S. DEPARTMENT OF COMMERCE, NATIONAL OCEAN SERVICE, 2007. *Automated Wreck and Obstruction Information System*. Washington, D.C.: National Oceanic and Atmospheric Administration.

U.S. FISH AND WILDLIFE SERVICE website, http://www.fws.gov/nwi/, 2007

WEBB, S.D., J.T. MILANICH, R. ALEXON, and J.S. DUNBAR. 1984. A *Bison Antiquus* Kill Site, Wacissa River, Jefferson County, Florida. *American Antiquity*, 49,384-392.

WILLEY, G.R, 1949. *Archeology of the Florida Gulf Coast*. Washington, D.C.: Smithsonian Institution. Smithsonian Collections 113.

WILLIS, C., 1988. Controlled Surface Collection of the Little River Rapids Site (8Je603): A Stratified Deflated Site in the Aucilla River, North Florida. *Florida Anthropologist* 41 (3), 453-470.

WORKS PROGRESS ADMINISTRATION, 1939. *A Guide to the Southernmost State*. New York, NY.

WEDDLE, R.S., 1985. *Spanish Sea: The Gulf of Mexico in North American Discover, 1500-1685*. College Station, TX: Texas A&M University Press.

WEDDLE, R.S., 1991. *The French Thorn: Rival Explorers in the Spanish Sea, 1682-1762*. College Station, TX: Texas A&M University Press.

WEDDLE, R.S., 1995. *Changing Tides: Twilight and Dawn in the Spanish Sea, 1763-1803*. College Station, TX: Texas A&M University Press.

ATTACHMENT A.1

FLORIDA COASTAL MANAGEMENT PROGRAM FEDERAL CONSISTENCY CERTIFICATION

Port Dolphin Energy LLC

FLORIDA COASTAL MANAGEMENT PROGRAM
FEDERAL CONSISTENCY CERTIFICATION

Attachment A.1

Deepwater Port License Application Addendum II
Port Dolphin Project, Tampa Bay, Florida

PUBLIC

Florida Coastal Management Program
Federal Consistency Certification
Port Dolphin LNG Project, Florida

Introduction

Port Dolphin Energy LLC (Applicant) is filing for a license pursuant to the Deepwater Port Act of 1974, as amended (DWPA), and the United State Coast Guard's (USCG) regulations, 33 Code of Federal Regulations (C.F.R.) Part 148 (2006), to construct, own and operate a deepwater port. The unloading portion of the deepwater port, named Port Dolphin, -will be located in federal waters approximately 28-miles offshore the Tampa Bay area of Florida in 100 feet (30-meters) of water. This area lies within the St. Petersburg blocks of the Outer Continental Shelf: PB 463, PB 504, PB 505, PB 506, PB 507, PB-545, PB 546, PB-547, PB-548, and PB-589.

The Port Dolphin deepwater port – will be capable of mooring LNG carriers with a re-gasification capability known as Shuttle and Re-gasification Vessels (SRV). These vessels -will have a capacity range of 145,000 cubic meters (m^3) to 217,000 m^3. Up to two SRVs -will temporarily moor at the proposed deepwater port by means of a submerged loading buoy system. Two unloading buoys, also known as submerged turret loading (STL– Buoys), would be separated by a distance of approximately 3.1miles (5-kilometers). The -STL -Buoys would moor each SRV on location throughout the unloading cycle. Each unloading buoy would have eight mooring lines consisting of wire rope and chain. The mooring lines would connect each unloading buoy to eight anchor points consisting of driven piles on the seabed. An SRV (LNG carrier with re-gasification capability) would typically moor at the deepwater port for between four and eight days, depending on vessel size and send-out rate. The two separate buoys would allow natural gas to be delivered in a continuous flow, without interruption, by scheduling an overlap between arriving and departing SRVs. The unloading buoy technology and associated equipage proposed for Port Dolphin is similar to that used in the *Gulf Gateway* deepwater port and is planned for the *Northeast Gateway* and *Neptune* projects as well as being proposed for the *Calypso* project. It has also been successfully used at several locations overseas including the North Sea.

When not connected to an SRV, the unloading buoy would be submerged 60-70 feet (18-21 meters) below the sea surface. -When submerged, the STL Buoy would be held in position by the mooring lines and would be resting on the STL Buoy landing pad. A marker buoy and retrieval line would be used to locate and recover the STL Buoy as the SRV arrives at the deepwater port. The STL Buoy would be retrieved from its submerged position by means of a winch and recovery line. It would be hoisted up through a moon-pool in the forward part of the SRV where it would be located in a receiving cone within the hull trunk (see illustrations). After the buoy is locked in position, unloading of natural gas would begin. The gas would be unloaded through the flexible riser into the pipeline end manifold (PLEM) for transportation to shore via the subsea pipeline.

The SRVs would be equipped to transport, store, vaporize, odorize and meter natural gas. The SRVs would have insulated LNG storage tanks located within the hull. Each tank would be equipped with an in-tank pump to circulate and transfer LNG, at a temperature of approximately -261 degrees Fahrenheit (ºF), to the vaporization facilities located on the deck of the SRV. The vaporization system would have a closed-loop cycle utilizing glycol/water brine as the re-circulating heating medium. This re-circulating medium would be warmed using steam from the SRV's natural gas boilers and heat the LNG.

When fully operational, Port Dolphin would be capable of achieving an average throughput of 800 million standard cubic feet per day (mmscfd) and a peak capacity of approximately 1200 million mmscfd. Natural gas would be sent out, by means of a 16-inch flexible riser from each STL Buoy down to two 36-inch subsea flowlines through a piggable-Y to a 36-inch gas transmission line. The gas transmission line would transport natural gas to one shore facility for interconnection with the Gulfstream Natural Gas System and Tampa Electric Company ("TECO") respectively, located approximately 3.9-miles (6.3-kilometers) inland in Manatee County, Florida. From there, the natural gas would be available to serve residential, commercial, industrial and electrical generation customers primarily in Florida and the Southeastern United States.

Construction of Port Dolphin would proceed in two phases lasting a total of approximately 22 months with the port expected to commence operations in the second quarter of 2011. The first phase would consist of the fabrication of major components including the STL Buoys and associated equipment and marine piping. The second phase would consist of siting the STL Buoys and associated equipment and laying the marine pipeline. Separate construction activities would involve the construction of the onshore interconnection facilities in Manatee County, Florida that are described in a companion application filed with the Federal Energy Regulatory Commission under Section 7 of the Natural Gas Act.

In addition to increasing the natural gas supply to the local area and the corporate taxes generated by operation of the facility, the Project would have additional direct and indirect economic benefits. Details on the proposed Port Dolphin Project (the Project) are contained in the **Deepwater Port License Application** for the Port Dolphin Project, Florida and the **Addendums I and II** to the **Deepwater Port License Application**. Descriptions of the environmental and socioeconomic conditions and impact analyses, upon which this consistency certification is based, are contained in the Environmental Evaluation (Volume II of the **Deepwater Port License Application**) and in the **Addendums I and II** to the **Deepwater Port License Application.**

State of Florida Coastal Zone Management Program

The Coastal Zone Management Program federal consistency review process is described at 15 C.F.R. 930: Federal Consistency with Approved Coastal Management Programs Regulation, as amended. Federal consistency is the Coastal Zone Management Act provision requiring that - federal agency activities that have reasonably foreseeable effects on any land or water use or natural resource of the coastal zone be consistent to the maximum extent practicable with the enforceable policies of a coastal state's federally approved coastal management program. The

State of Florida's Coastal Management Program (FCMP) was accepted by the National Oceanic and Atmospheric Administration in 1981 and is based on a network of multiple state agencies implementing 23 state statutes that protect and enhance the state's natural, cultural, and economic coastal resources. The goal of the program is to coordinate local, state, and federal agency activities using existing laws to protect Florida's "coast". The Florida Department of Environmental Protection is responsible for directing and coordinating the implementation of the state-wide Coastal Management Program.

Florida's coastal zone stretches beyond its coastal counties to include the entire state's land area and territorial seas minus the lands the federal government owns, leases, holds in trust, or whose use is otherwise by law subject to the sole discretion of the federal government, its officers, or agents, as well as lands held by the Seminole and Miccosukee Indian Tribes. Federal consistency review is required for any project that is within, or is expected to affect the resources, land or water uses of the Florida coastal zone and requires a federal license or permit, is federally funded, or is a direct activity of a federal agency. As Port Dolphin requires a federal license to operate as a deepwater port and federal approval of the required pipeline, the Project meets the criteria for federal consistency review.

The proposed Deepwater Port terminal and its gas transmission pipeline would lie in waters off the west coast of Florida and may have effects on land or water uses of Florida's coastal zone. This federal consistency certification, along with the necessary data and information provided in Port Dolphin's **Deepwater Port License Application** and its corresponding **Addendums I and II** to the **Deepwater Port License** Application, describe the project's compliance with the policies of the FCMP. An Area To Be Avoided (ATBA) to be in effect during construction and decommissioning around all construction/decommissioning-related activities, and Safety and Precautionary (no anchor) Zones around the STL Buoys to be in effect during Project operation, would be established by the United States Coast Guard (USCG). These Zones would be created to prevent conflicts between construction/operation of the deepwater port and other uses, as well as to prevent damage to the port's infrastructure and/or, vice versa, to fishing vessels/gear. In addition, Port Dolphin is recommending an additional zone be established that includes 200 feet (61 meters) along each side of the pipeline as a No Dredging Zone, which would be created as a safety buffer for protecting the pipeline integrity by preventing dredging of sand resources within it. Establishment of this dredging restriction in state waters is considered a state agency activity.
The FDEP's coastal consistency determination would assess the effects of all of these zones on Florida coastal uses and resources.

Florida Coastal Management Program Consistency Evaluation and Applicable Statutes

This consistency certification is an evaluation of the **Deepwater Port License Application** and the **Addendums I and II** to the **Deepwater Port License Application** for the Port Dolphin Project. The deepwater port license application describes the Project, the expected timeline, information concerning the location of the deepwater port, and other relevant information. This evaluation is a review to determine if there would be any reasonably foreseeable coastal effects on the land, water uses, or natural resources of the coastal zone of Florida, pursuant to the enforceable policies of the Florida Coastal Management Program (FCMP). The deepwater port license application is supported by sufficient data and information concerning the potential impacts associated with the proposed actions.

The proposed action would be conducted in accordance with all federal and state regulations associated with the construction and operation of a deepwater port. The proposed deepwater port project has been sited and designed to avoid, minimize, or mitigate potential effects to coastal areas. The Project complies with the program policies of the FCMP and will be conducted in a manner consistent with such policies. The Florida Statutes Chapters that are part of the FCMP are:

FLORIDA STATUTES CHAPTER	STATUTORY SUBJECT
Chapter 161	Beach and Shore Preservation;
Chapter 163, Part II	Local Government Comprehensive Planning and Land Development Regulation Act
Chapter 186	State and Regional Planning
Chapter 252	Emergency Management
Chapters 253, 258, 259, 260, and 375	State Resources, Lands, Parks, and Land Acquisitions
Chapter 267	Historic Preservation
Chapter 288	Economic Development and Tourism
Chapter 334 and 339	Transportation Administration and Finance
Chapters 370 and 372	Fish and Wildlife Resources
Chapter 373	Water Resources
Chapter 376	Pollutant Discharge Prevention and Removal
Chapter 377	Energy Resources
Chapter 380	Environmental Land and Water Management
Chapter 381, Sections 381.001, 381.0011, 381.0012, 381.006, 381.0061, 381.0065, 381.0066, 381.0067	Public Health; General Provisions
Chapter 388	Mosquito Control
Chapter 403	Environmental Control
Chapter 582	Soil and Water Conservation

A description of each of these statutes is provided in the following pages. For this consistency certification, the proposed action has been evaluated with each statute. Based on this analysis, Port Dolphin Energy LLC has determined that the proposed action is consistent with the FCMP.

Chapter 161 -- Beach and Shore Preservation

Chapter 161, Florida Statutes (F.S.), regulates construction, reconstruction and other physical activities that occur from the seasonal high water mark to 1,500 feet inland. On barrier islands, the regulated area is extended to 5,000 feet inland of the seasonal high water mark. Florida regulates construction in these areas to ensure it is carried out in a manner that protects coastal resources. The enforceable policies recognize that coastal areas are among the state's most valuable natural, aesthetic and economic resources and that they protect and provide habitat for a variety of plant and animal life. The state is required to protect beach and dune systems from imprudent activities that could weaken, damage, or destroy the integrity of the system, and to manage coastal sediments to reduce erosion and restore and maintain critically eroding beaches. The state also designates coastal areas that are used or likely to be used by sea turtles for nesting and prohibits the removal of vegetative cover that binds sand.

Subsequent to the submittal of Addendum I discussions with Florida Department of Environmental Protection (FDEP), Manatee County, and the Town of Longboat Key brought to light the need to re-route a portion of the pipeline offshore from the mouth of Tampa Bay in order to avoid permitted sand resources needed for beach renourishment projects. Port Dolphin is committed to avoiding the offshore Longboat Key permitted sand borrow area and the sand shoal area. Port Dolphin has worked with both Manatee County and the City of Longboat Key to identify a pipeline route that will avoid the permitted sand sources located offshore while also balancing the impacts to hard/live bottom in determining the routing location of the pipeline. Port Dolphin analyzed routing options to avoid, to the extent practicable, other identified potential sand resource areas. Port Dolphin performed extensive additional surveys to identify alternative routes around sand resources. Both geophysical and benthic characterization surveys were performed to evaluate routing options. **Appendix A.2** of the **Addendum II** to the **Deepwater Port License Application** provides the detailed benthic characterization survey results and *Confidential* **Appendix B.1** of the **Addendum II** to the **Deepwater Port License Application** provides the geophysical survey results.

Construction and operation activities would be approximately 42 miles from the landing location of Port Manatee and 28 miles offshore in water depths of 100 feet and would not affect beach and coastal systems. LNG is not toxic and it evaporates rapidly into the atmosphere; therefore, environmental impacts from a minor release would occur in the immediate vicinity and would be negligible.

Due to the distance from shore, any accidental spill of petroleum lubricants and fuel during construction or operational activities would not be likely to affect nearshore environments. However, the applicant will develop a spill response plan to avoid or minimize impacts to coastal resources from hazardous materials. All vessels would be fitted with an approximately 4-inch-high welded steel containment barrier around all open working deck areas where diesel or oil spills potentially could occur. All deck machinery also would have spill pans. The containment barrier is intended to prevent any rainwater contaminated with petroleum products from washing over the side. Rainwater gathered in the collection pans would be visually inspected for the presence of an oily sheen. If no oily sheen is observed, the water would be drained onto the deck and overboard. If an oily sheen is observed, the water would be collected, treated by the onboard oil/water separator, and discharged. Residual oil would be stored and disposed of in compliance with international standards of the MARPOL Convention. Consequently, there would be no discharges of petroleum products from vessel operations at the port facilities. Therefore, the proposed activities are consistent with Chapter 161, F.S.

Chapter 186 -- State and Regional Planning

Chapter 186, Florida Statutes (F.S.), establishes the State's Comprehensive Plan, setting forth the goals that articulate a strategic vision of the State's future. The purpose of the Comprehensive Plan is to develop in a broad sense the goals and policies that provide decision-makers directions for the future and to provide long-range guidance for social, economic, and physical growth of the state. The implemented statute mandates coordination among the levels of government to ensure effective and efficient delivery of governmental services by establishing an integrated planning system and to coordinate the state's continued growth and development.

Port Dolphin's land component consists of a natural gas pipeline entering at Port Manatee in Manatee County, Florida and traversing 3.88 miles of unincorporated Manatee County. All applicable land use and zoning requirements of Manatee County, Florida will be followed in the construction of this project and coordination with the Manatee County Comprehensive Plan will be achieved through the FCMP review process. Therefore, the proposed activities are consistent with Chapter 186, F.S.

Chapter 252 -- Emergency Management

Chapter 252, Florida Statutes, authorizes the Florida Division of Emergency Management (DEM) to serve as the state's emergency management agency. Chapter 252, F.S., provides for the planning and implementation of the state's response to natural and manmade hazards, the planning and implementation of the efforts to recover from natural and manmade disasters, and the mitigation of natural and manmade hazards. The DEM is authorized by Chapter 252 to provide for the common defense of Floridians' lives and property, and to protect the public peace, health, and safety. As part of these efforts, DEM implements programs to avoid or reduce the impacts of natural or manmade disasters, decrease the time and resources needed to recover from the impacts of disasters, and discourages actions that increase the state's vulnerability to disasters.

The proposed deepwater port would involve the regasification of LNG at an STL Buoy system located 28 miles offshore the State of Florida. Because of Port Dolphin's distance from shore, potential safety impacts would involve only the maritime public (i.e., boaters, fishermen, commercial vessel operators, etc.). Due to the safety measures that are a standard part of marine construction, and the temporary nature of these construction activities, impacts on the risk of collision from construction would be minor. While there may be a possibility of entanglement of fishing gear with the construction equipment, the human health risks to non-Project personnel from such an entanglement would be negligible.

Federal requirements in 33 CFR §150 provide the foundation for the security plan that would be implemented by the deepwater port and visiting SRVs. For the duration of the Project, the

Applicant proposes that a 2,788-foot (850-meter) radius Safety Zone be established by the USCG around each buoy. The Safety Zone would be a mandatory avoidance zone when a SRV is present. Monitoring of the Safety Zone by radar would be required when any vessel approaches or enters the zone. Unauthorized vessels must be identified and warned off via radio. Existing mitigation measures for maritime safety and security are robust and comprehensive, and would be either met or exceeded by the Port Dolphin Project. In addition, the deepwater port would be surrounded by a No Anchor (Precautionary) Zone extending approximately 4,920 feet (1500-meters) from each STL buoy anchor and includes the area between the buoys. This area's applicable uses and restrictions are yet to be defined in coordination with the USCG. As stated above, information on the safety and security zones is provided as reference information only, and is not evaluated in this coastal consistency determination. Once established by the USCG, a separate and independent consistency determination would be conducted.

Major factors in reducing safety and security risks to the public are 1) the extensive application of design codes and standards of the marine and LNG industry, and best industry practices in port operation, 2) oversight by the Classification Society as well as government agencies, including the USCG, and 3) siting the Project away from on-land populations. These factors combine to reduce risks to the public to a minor level.

An accidental tank rupture of diesel or LNG is another emergency that is considered relevant to this analysis. The spill response plan will outline response actions, inspection, and maintenance of response equipment, required spill response drills, governmental notification procedures, inventories of response equipment, response team organization, spill movement monitoring, and contingency plans for spill containment, recovery and removal. Any effects from an accident are considered highly unlikely due to the distance from shore, the use of state-of-the-art SRVs, and the measures detailed in the spill response plan. The precautions included in the **Deepwater Port License Application** and the **Addendums I and II** to the **Deepwater Port License Application** for the Port Dolphin Project are consistent with the core policies of preparing for and responding to any accident and reducing the vulnerability of Florida's people and resources to potential impacts if an accident occurs. Therefore, the proposed activities are consistent with Chapter 252, F.S.

Chapters 253, 258, 259, 260, and 375 – State Lands Acquisition and Management

Chapters 253, 258, 259, 260, and 375, Florida Statutes authorize the acquisition and management of state lands. These chapters ensure the protection of state parks, aquatic preserves, and recreational areas. The Governor and Cabinet, sitting as the Board of Trustees of the Internal Improvement Trust Fund, are responsible for holding state lands in trust for the benefit of Floridians and for acquiring new lands to preserve natural areas throughout the state, including beaches, wetlands, and estuarine areas. Although each statute chapter addresses state acquisition and use of state-owned land, each chapter is focused upon a particular type of land and provides different criteria for use in the acquisition and management of the acquired lands.

The applicant's proposed action will use state-owned uplands within the right-of-way to cross a state highway. In addition, the lands of Port Manatee will be used. The applicant's proposed action will use state submerged lands for the portion of the pipeline that traverses state waters. The pipeline will begin in federal waters, enter state submerged lands, cross a small section of Hillsborough County waters managed by the Tampa Port Authority, and then return to state submerged lands up to the shore of Port Manatee. The applicant will enter into a submerged lands lease with the Tampa Port Authority for the Hillsborough County lands crossed. The applicant will enter into a lease with Port Manatee for the use of the Port's property, will obtain an easement from the Port of Tampa for use of its submerged lands, and will submit an application to the Florida Department of Transportation for the use of the state's highway right-of-way. The applicant will also submit an application to use state submerged lands to the Board of Trustees of the Internal Improvement Fund as part of the state permitting required for this project. The proposed Port Dolphin deepwater port would be sited approximately 28 miles offshore the state in federal OCS waters, more than 18 miles away from the state/federal waters boundary. Spill prevention and response and proper waste disposal on the vessels ensure the continued protection of Florida state waters and managed areas from this deepwater port. Therefore, the proposed plan is consistent with Chapters 253, 258, 259, 260, and 375, F.S.

Chapter 267 -- Archives, History, and Records Management

Under Chapter 267, Florida Statutes (F.S.), the Florida Department of State, Division of Historical Resources is charged with protecting the state's historical assets. Florida's historical resources include any district, site, building, object, or other property of historical, archeological, or architectural value.

No historic resources (shipwrecks) were identified within approximately 1 mile of the deepwater port STL Buoys alternative locations during the desktop cultural resource evaluation. Three unidentified side scan sonar contacts and 15 unidentified magnetic anomalies may represent possible historic shipwreck remains. Avoidance zones of 300-foot radii have been established around the sonar contacts and magnetic anomaly and will be avoided by a distance of 200 feet. Prior to commencing construction, any features that cannot be avoided will be investigated to assess their potential historic significance. Once the infrastructure is in place, there would be no further contact with the seafloor other than the periodic scouring of mooring anchor chains/cables. Since no potentially significant historic resources would be within 1,000 feet of any STL Buoy components, there would be no impacts on cultural resources by routine operations. Therefore, the project would have no effect on archaeological or historical resources in the region and is consistent with Chapter 267, F.S.

Chapter 288 -- Economic Development and Capital Improvements

Chapter 288, Florida Statutes (F.S.), is administered by the Governor's Office of Tourism, Trade, and Economic Development (OTTED). The OTTED is charged with promoting tourism and economic diversification to increase employment opportunities, which are accomplished by encouraging visitors from other states and countries to come to Florida, and by providing services and information to the tourists who do come.

Operation of the Port Dolphin deepwater port is expected to have no impact on shore-based tourism. The pipeline portion of the project will come aground at Port Manatee, an existing commercial port, and will follow the route taken by existing oil and gas pipelines. Given the distance from shore and the water depths, impacts to recreational diving and snorkeling are not anticipated.

Port Dolphin would have short term and long term economic benefits to Manatee County and the surrounding area and the state. It is estimated that approximately 54 non-local personnel would be used during installation. In addition to construction jobs, basic materials such as aggregate, cement, and reinforcing mesh will be sourced locally. It is anticipated that the construction staging area will be located locally as well, which will also provide income from land lease fees. The local construction operations will occur for approximately 9 months. The Project is expected to commence operations in second quarter of 2011 and have an economic life expectancy of 25 years. Over this time period, approximately 17 full-time local employees are expected to support the offshore operations. It is possible that a number of these staff and their associated dependents would likely permanently relocate to Manatee County, but all would be expected to reside locally in the Tampa Bay region. In addition there are required pipeline maintenance activities which would be contracted locally to a qualified pipeline contractor. A full analysis of the economic impacts is provided in the original **Deepwater Port License Application** , Volume II, Section 6.3.2.

During offshore project construction, a Clearance Zone would be established by the USCG to ensure that commercial and recreational vessels maintained a safe distance from installation operations. The Clearance Zone would cover an area of approximately 50.83 square miles (500 m radius). For the duration of the Project, the Applicant proposes that a 2789-foot (850-meter) radius Safety Zone and a 4921-foot (1500-meter) No Anchor (Precautionary) Zone be established by the USCG around each lighted buoy and 656-feet (200-meters) along each side of the pipeline. These zones are intended to reduce the likelihood of vessel collisions, reduce conflicts between the public and Port Dolphin, and to minimize any security threat. As stated above, information on the safety and security zones is provided as reference information only, and is not evaluated in this coastal consistency determination. Once established by the USCG, a separate and independent determination regarding consistency of the use restrictions with the FCMP would be conducted. Therefore, the project is consistent with Chapter 288, F.S.

Chapter 334 and 339 -- Transportation Administration and Finance

Chapters 334 and 339, Florida Statutes (F.S.), authorize the planning and development of a safe, balanced, and efficient transportation system within the State of Florida. It is not anticipated that Port Dolphin will have a significant impact on the state's transportation system as the existing infrastructure of the Port of Tampa and Port Manatee are sufficient to meet the project's requirements. Some additional trucks will provide supplies to Port Manatee during the project construction; however, the number of additional trucks is insignificant. The proposed activities, therefore, are consistent with Chapters 334 and 339, F.S.

Chapters 370 and 372 -- Fish and Wildlife

Chapters 370 and 372, Florida Statutes (F.S.), address the use, management, and protection of the state's fish and wildlife resources. These chapters authorize the Florida Fish and Wildlife Conservation Commission (FWC) to establish regulations for the administration, supervision, development, conservation, and protection of marine fishery resources, wild animal life, freshwater aquatic life, and upland endangered and threatened species.

There would be a very low probability of a vessel strike on marine mammals (cetaceans or manatees) during construction and operation because of the minimal number of transits expected and the low speeds of the vessels (**Volume II, Revised Appendix F** of the **Deepwater Port License Application)**. The area surrounding of the STL Buoys is not known to have any concentration or congregation of cetaceans, and manatees are not likely to occur that far offshore. The reactions of marine mammals to the types of underwater sound that would be generated by installation and commissioning of the STL Buoys also would be variable and would depend on the species involved, time of year, and the activity of the animal at the time of exposure to the particular sound. It is expected that the sounds produced from the proposed Port Dolphin LNG Project will pose no acoustic impacts to marine mammals. Construction and operations mitigation measures would be implemented to minimize vessel strike probability and decrease acoustic disturbance (**Volume II, Revised Appendix F** of the **Deepwater Port License Application).** Because most sea turtles prefer shallower habitats for feeding and resting, there would be negligible to no impacts to sea turtles or their habitat.

The Project is located on the west Florida Shelf with benthic habitat types including low-relief hard/live bottom coralline algal nodules and pavement, and unconsolidated shell rubble and soft bottom (primarily sand). Based on results of the geotechnical survey and benthic video survey conducted in the summer and fall of 2006, there are benthic communities present along the pipeline corridor. It was determined that 32.6% of the seafloor area was classified as hard/live bottom. During the surveys, additional N-S transects were run 3-nm north and 3-nm south of the highest relief habitat to determine if a gap was present; however, no such gap was observed. There would be long-term impacts to approximately 123.38 acres of benthic habitat along the pipeline route as a result of the pipeline construction which includes impacts of the installation equipment anchor placement. The buoys and anchor arrays were placed to avoid high populations of benthic communities. Some disturbance to the benthic and pelagic communities that exist in the STL Buoy areas would occur during construction and operations. There would be long-term impacts to approximately 0.1 acres of benthic habitat as a result of the STL Buoys construction and 6.39 acres from the anchor sweeps during operations.

STL Buoy operation activities such as mooring anchor installation and buoy and mooring chain/line installation that disturb sediments have the potential to negatively impact early life stages of susceptible fish species whose egg or larval stages are demersal, bottom-dwelling species and benthic organisms upon which fishery species feed in a limited portion of the existing habitat. In Florida offshore waters, the highest plankton densities are generally correlated with the euphotic zone and it is expected that most planktonic organisms will be found in near-surface waters. As a result, construction activities would have negligible impacts on plankton, marine fish, and benthic organisms.

Routine operations will include the intake of ambient seawater and discharging water of higher temperature than ambient. A consequence of seawater intake is impingement and entrainment of plankton including fish eggs and larvae as well as phytoplankton and other zooplankton. Innovative engineering design of the Project and utilization of Best Technology Available (BTA) would significantly reduce the potential loss of marine organisms during Project operations. The Project proposes a closed-loop vaporization system. By using warm water from engine cooling for LNG vaporization, no additional seawater would be used in this process, thereby eliminating the potential for additional entrainment of planktonic individuals. The maximum intake rate of 9.5 million gallons per day (MGD) of seawater for engine-cooling purposes (from operation of each SRV) would substantially reduce the potential for entrainment of plankton individuals from open loop systems. Limiting seawater intake velocity to less than 0.5 feet per second would ensure that older larval stages and juveniles would be able to avoid impingement or entrainment. Also, the intake ports are located at 14.8 ft and 24.6 ft below the surface where ichthyoplankton are generally less dense than they are in near-surface waters. The SRVs are capable of changing seasonally which intake port (shallow or deep) is used for drawing in cooling water to help minimize impacts to ichthyoplankton. The loss of small marine organisms as a result of impingement and entrainment would be negligible when compared to the biomass that would transit the proposed STL Buoys area. Effects of ichthyoplankton mortality on adult populations can be difficult to interpret due to both the high natural fecundity of fish and the low natural survival rates of eggs and larvae. There is currently no consensus within the scientific community or responsible agencies regarding what levels of impact to ichthyoplankton are considered significant. Based on the volume of seawater that would be taken in by the port during operations, the depth and location of the seawater intake ports, the ability to seasonally change which intake port is used, and the flow rates at the intake ports, an adverse impact to ichthyoplankton from impingement or entrainment would not be expected. The number of ichthyoplankton eggs or larvae lost likely would not affect or alter adult-age fishery populations.

Thermal plume modeling was conducted for the engine cooling-water discharge. Model results showed that all plumes generated by the SRV would be heated and buoyant, and would rise to the surface. Also, because the water depth at the Project location is approximately 100 feet (30.5 meters), the cooling-water discharge plume would never extend vertically to the bottom. Because the regasification process proposed for Port Dolphin is a closed loop system, with water being used primarily for engine cooling, there will be no large cold water discharge associated with this project as would be typical of an open-loop system. Water used for engine cooling in the SRVs will be discharged at a higher temperature than ambient water temperatures. The intensity of impacts would vary within the impacted area depending on seasonality, prevailing currents, operational activities, the location and conditions within the impacted zone where larvae are exposed, and the sensitivity of the organisms to changes in temperature. Water would be released from a discharge 11.5 feet (3.5 meters) below the SRV waterline and rise rapidly to the surface. The discharge would be less than 18ºF (10ºC) above ambient water temperature; modeling shows that it would typically mix to within 1.8ºF (1ºC) of ambient water temperature within 66 feet (20 meters) of the discharge. The discharge would extend further during summer months, but mix to within 1.8ºF (1ºC) of ambient water temperature within the 328 feet (100 meters) mixing zone of the SRV discharge. The cooling water discharge is not expected to reach the seafloor. Most mobile organisms would be expected to avoid the cooling water discharge plume during the summer and attracted to it in the winter. Because the plume of cooling water will be of relatively small volume, any impacts would be expected to be minor.

A detailed Monitoring Plan for ichthyoplankton will be developed by Port Dolphin in coordination with the FWC and the FDEP. This plan would generally follow the sampling approach provided to Port Dolphin by FWC in the memo dated August 27, 2007, enhanced with applicable requirements based on concerns raised by both agencies in subsequent correspondence, and other items identified by the Port Dolphin. Specific plan details (i.e., species to be sampled, sample collection methodology, sampling location/frequency, format and frequency of reports, etc.) would be thoroughly discussed and coordinated with FWC and FDEP to develop the final plan.

Port Dolphin is committed to conducting 3 years of post MARAD license ichthyoplankton monitoring in accordance with the approved Monitoring Plan. This sampling would be conducted by the permittee in accordance with the approved Monitoring Plan as a condition of the FDEP Environmental Resource Permit (ERP) and the CZM consistency determination, should they be issued, and would consist of 1 year of monitoring pre-construction and 2 years of monitoring during operation of the deepwater port. The data collected during the first sampling year (pre-construction) (for total eggs, total fish larvae, and larvae of selected commercial and recreational important species) would be used to supplement baseline data, and would be input into an empirical transport model (ETM) to confirm the accuracy of the level of impacts stated in the FEIS from this closed-loop system. In the event that the levels of impacts derived from the ETM from the pre-construction year of sampling are not consistent with (or less than) the level of impacts included in the FEIS, adaptive management techniques would be provided, as appropriate. The data collected during the second/third sampling years (for total eggs, total fish larvae, and larvae of selected commercial and recreational important species) would be used to confirm that the actual level of ichthyoplankton impacts are consistent with (or less than) the level of impacts forecasted with the empirical transport model. Monitoring reports completed by the applicant would be provided to the FWC and FDEP as well as the USCG, MARAD, and NOAA –NMFS for review at regular intervals during the monitoring period.

The Safety Zone (Exclusion Zone) consists of a 2,788-foot (850-meter) radius around each STL buoy where all vessel traffic is prohibited. The 19.18-square mile No-Anchor (Precautionary) Zone proposed by the Applicant for establishment by the USCG would limit fishing activities due to no anchoring restrictions. This Safety Zone may act as a positive, albeit small, contribution to the potential of closure areas to increase fish populations. Although there are differing positions regarding the value of protected areas to fish stock enhancement, the fishing exclusion zone may provide some protection to small portions of various fish stocks that occur in the immediate area surrounding the port. Overall, it is expected that no long-term negative impacts to fish or wildlife populations would occur as a result of the construction or operation of the facility. Therefore, the proposed project is consistent with Chapter 370 and 372, F.S.

Chapter 373 -- Water Resources

Chapter 373, Florida Statutes, addresses the state's water resources and establishes the minimum flows and levels that are acceptable in the rivers and water bodies throughout the state for the preservation of fish and wildlife. It also creates the water management districts, which assist the FDEP in the implementation of the state water plan, and which issue permits established in this chapter. These permits regulate consumptive uses of water, dredging and filling of waters and wetlands, the management and storage of surface waters for flood control and water quality protection, and a host of other water-related activities to ensure they are conducted in a manner that will not harm or destroy the state's natural resources. All waters of the state are subject to the provisions of Chapter 373, F.S., unless exempted by law.

The proposed Port Dolphin deepwater port would be located approximately 28 miles offshore and 42 miles from the landing location at Port Manatee. A 3.93 mile terrestrial pipeline, Port Dolphin pipeline, will be constructed in the vicinity of Port Manatee. Water quality effects to the marine water resources could occur for the offshore portion of the project from the vicinity of the port located within the Gulf of Mexico to the Florida coastline at Port Manatee. The primary effects to water quality would be from the potential temporary increases in suspended sediments and turbidity in the immediate area during construction activities, the normal operational discharges from barge and carrier deck drains, engine-cooling water, and other miscellaneous drains during construction and from SRV discharges and mooring chain drag during normal port operations. Due to the dynamic character of currents in the region and the sediment grain size, turbidity plumes during construction are expected to dissipate and settle relatively quickly and would not persist in any particular location. The area of impact would be small and would occur entirely within the proposed footprint area of the STL buoys and its pipeline. Onshore effects to water quality would be associated with open cut construction through wetlands and ditches. Adherence to Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures and the Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Appendices A.8 and A.9** of the **Addendum II** to the **Deepwater Port License Application** will ensure protection of water quality for the terrestrial portion of the project. A Dewatering Plan has been developed by Port Dolphin, and is included as **Appendix A.10** of the **Addendum II** to the **Deepwater Port License Application.** An FDEP NPDES permit is required for activities at the port, trench dewatering, and the construction and operation of above-ground facilities including the valve station and interconnection station. The NPDES permit application is scheduled to be submitted in April 2009. In addition, a consumptive use permit is expected to be submitted in August 2009.

Domestic and sanitary wastes would be stored in the construction vessels, SRVs, and support vessels and would be pre-treated and discharged according to MARPOL Convention requirements. There will be no domestic and sanitary wastes discharged by the SRVs while connected to the buoys.

The inadvertent release of petroleum lubricants and fuel during construction could result in potential impacts to marine waters. These could occur from the construction vessels or support boats, loss of fuel during fuel transfers, or accidents resulting from collisions. The Applicant would develop a spill response plan to avoid or minimize impacts to water resources from hazardous materials. All construction vessels would have an approximately four-inch-high welded steel containment barrier around all open working deck areas where diesel or oil spills potentially could occur. All deck machinery would also have spill pans. The containment barrier is intended to prevent any rainwater contaminated with petroleum products from washing over the side. Rainwater gathered in the collection pans would be visually inspected for the presence of an oily sheen. If no oily sheen is observed, the water would be drained onto the deck and overboard. If an oily sheen is observed the water would be collected, treated by the onboard oil / water separator, and discharged. Residual oil would be stored and disposed of in compliance with international standards of the MARPOL Convention. Consequently, there would be no discharges of petroleum products from vessel operations at the port facilities.

Routine operations while the SRVs are moored at the port would cause periodic seabed disturbances due to dragging of anchor chains and risers, resulting in localized, temporary increases in turbidity in the vicinity of disturbed areas. These disturbances would occur periodically during the entire life-span of the Project, but would have an overall negligible effect to water resources in the region.

The SRVs would discharge engine cooling water associated with normal ship operations. CORMIX computer modeling was conducted to evaluate potential impacts from the SRV water discharge temperatures associated with engine cooling. Although cooling water discharges would be a periodic and long-term activity, the Applicant anticipates that the discharges would cause only a temporary and localized negligible effect to water quality.

In general, work activities associated with the installation of the proposed Port Dolphin deepwater port would result in increased turbidity in the immediate work areas during the nine-month construction period. There also may be the potential for accidental spills or releases to occur, but best management practices would be implemented to avoid these incidents. These impacts would be temporary, localized and minor. Therefore, the proposed project would be consistent with Chapter 373, F.S.

Chapter 376 -- Pollutant Discharge Prevention and Removal

Chapter 376, F.S., regulates the storage and transportation of pollutants and the cleanup of pollutant discharges. Chapter 376 also establishes standards for how pollution is handled throughout the state so its negative effects on natural resources are eliminated or mitigated, and it establishes penalties for coastal polluters. This chapter is intended to compliment the Clean

Water Act, specifically those provisions relating to the National Contingency Plan for removal of pollutants.

LNG is not toxic and it evaporates rapidly into the atmosphere; therefore, long-term environmental impacts solely from its release would be negligible. During construction and operation activities, the barge, support vessels, and SRVs would have stored fuels and possibly other hazardous materials on board that are required for normal operations (e.g., heavy fuel oil, diesel, etc.). Therefore, there would be a potential for accidental spillage of these materials into marine waters.

All vessels would be in compliance with MARPOL Annex I and Annex IV and other applicable regulations to minimize the risk of accidental discharges to the extent possible. All vessels also would have spill response plans, which would identify specific measures to avoid or minimize potential impacts of a hazardous spill into marine water resources during construction and operation. While a spill is unlikely, any accident would be responded to quickly and would likely have minor effects on the marine environment. The following mitigation measures would be implemented to further minimize any effects on water quality:

- The vaporization process used by the SRVs would operate as a closed system; therefore, there would be no intake of a large volume of heating water, and there would be no discharge of a large volume of water colder than ambient seawater.
- While SRVs are present within the operational area of the port, they would have sufficient storage capacity for all wastewater generated onboard, including black water, gray water, and bilge water. Therefore, there would be no discharges of these waste water sources from SRVs while at the port. All wastewater would be stored onboard, treated, and discharged according to MARPOL Convention requirements when in transit within international waters, or disposed of according to other pre-approved procedures.
- Freshwater storage capacity would be sufficient so that the freshwater generators would not require operation while the SRVs are at the port; therefore, they would have no discharge of hypersaline water.
- The SRVs would not need to operate their electrochemical chlorination biofouling system during the short time they are at the deepwater port, so they would have no discharge of sodium hypochlorite.
- To conserve use of seawater at the deepwater port, the SRVs would operate in a closed-loop mode during LNG vaporization. Therefore, under normal operations there would be intake and discharge of a maximum of 9.5 MGD per vessel for engine cooling water which would not contain biofouling control additives (i.e., sodium hypochlorite).

Therefore, the proposed project is consistent with Chapter 376, F.S.

Chapter 377 -- Energy Resources

Chapter 377, Florida Statutes, addresses the regulation of oil and gas resources. It establishes the requirements for obtaining permits needed for activities on state lands and the acceptable locations for drilling and exploration activities to ensure that these activities are carried out in a manner that protects the coastal resources of the State of Florida.

The Port Dolphin LNG Project is a deepwater port that has limited impact on state lands and does not involve drilling or exploration activities. The proposed Project is expected to have a positive long-term impact on energy markets in West and Central Florida. The proposed Project would also provide a relatively cleaner energy supply source from those presently available that has potential to moderate future volatility in regional energy prices. In addition, natural gas has a fraction of the emissions produced by burning fossil fuels such as coal and oil. Therefore, the proposed project is consistent with Chapter 377, F.S.

Chapter 380 - Environmental Land and Water Management

A description of each of these statutes is provided in the following pages. For this consistency certification, the proposed action has been evaluated with each statute pursuant to Chapter 380, Florida Statutes. Based on this analysis, Port Dolphin Energy LLC has determined that the proposed action is consistent with the Chapter 380, F.S. and the Florida Coastal Management Program.

Chapter 381 – Public Health; General Provisions

Chapter 381, Florida Statutes, contains the provisions for regulating on-site sewage treatment and disposal systems to protect the public health and to keep pollutants away from beaches, estuaries, and wetlands and the wildlife that inhabits them.

The Port Dolphin LNG Project would not release any sanitary wastes that could affect beaches, estuaries, or wetlands, or wildlife inhabiting these areas. Sanitary wastes would be treated on the SRVs and discharged at sea while these vessels are in transit, in compliance with international standards of the MARPOL Convention. The SRVs would be equipped with a marine sanitary device (MSD) with the capability of treating both black water and gray water discharges. The MSD would be IMO–USCG certified and all discharges would be compliant with permitted requirements. Overall, water discharges by support vessels at the port would be similar to other vessels operating and transiting the Tampa Bay area. Discharges would be intermittent, and water quality impacts, if any, would be temporary and negligible. Therefore, the proposed project is consistent with Chapter 381, F.S.

Chapter 388 – Mosquito Control

Chapter 388, Florida Statutes (F.S.), provides for a comprehensive approach for the abatement and suppression of mosquitoes and other arthropods within the State of Florida. It is not anticipated that the activities of Port Dolphin will have any impact on the propagation of mosquitoes or other arthropods. Therefore, the proposed project is consistent with Chapter 388, F.S.

Chapter 403 -- Environmental Control

Chapter 403, Florida Statutes, authorizes the FDEP to regulate pollution released into the air and waters of the state. The statute directs FDEP to control pollution in order to protect waters of the state and to maintain their quality for beneficial uses. The state regulates pollution because the conservation and protection of air and water resources protects the public health and welfare.

Chapter 403 is divided into nine parts, many of which address activities with the potential to impact the state's coastal resources. Part I addresses water and air pollution control. Part II addresses electrical power plant siting and the permits required to operate an electrical facility. This is relevant to coastal natural resources because these facilities require water and can be sources of pollution. Part III enables the governor to enter into Environmental Control Compacts with other states to address environmental problems affecting more than one state, including threats to coastal resources. Part IV addresses solid waste disposal and provides regulations for the operation and siting of dumps and for the treatment of the waste that these dumps receive. Part V addresses permits needed for dredging and filling projects and ensures that these activities are carried out in a manner that will not harm coastal resources. Part VI addresses water supply, and water treatment plants. Part VII establishes provisions for the alteration or removal of mangroves which are important to coastal resources because of the role they play in the filtration of water and the habitat they provide for wildlife. Part VIII regulates natural gas transmission and pipeline siting and authorizes the FDEP to adopt rules regulating and monitoring the gas transmission lines so that this activity can be carried out in the manner least likely to harm the natural resources of the state. Part IX is a legislative effort to encourage corporations to establish operations in Florida by expediting the processing of permits needed by the businesses. However, it requires the consideration of the environmental effects of drawing businesses to Florida prior to issuance of any permits for the new businesses in order to ensure that coastal resources will not be sacrificed for the sake of jobs.

The Project does not propose onshore electrical power plant siting; prevent the Governor from entering into contracts with other states; involve solid waste removal or operation and siting of dumps; affect water supply or water treatment plants; alter or remove mangroves; or prevent the State from permit approval. Therefore, Parts II, III, IV, VI, VII, VIII, and IX of Chapter 403 are not applicable to the Project. Consistency of the Project with Parts I and V is discussed below.

Chapter 403, Part I, directs the FDEP to develop a comprehensive program for the prevention, control, and abatement of pollution of the air and waters of the state. Chapter 403, Part V, also directs the FDEP to adopt rules necessary to obtain approval from the Environmental Protection Agency to administer the federal National Pollution Discharge Elimination System (NPDES) permitting program to promote effective and efficient regulation of the discharge of pollutants into state waters. Other sections of Chapter 403 identify and establish various permits that must be obtained and standards that must be met by facilities treating or discharging waste and the penalties for non-compliance. Provisions for the "adopt-a-shore" program to involve the general public in keeping beaches and waters clean for the marine life that live and reproduce there are also included.

The proposed Port Dolphin deepwater port would be compliant with all regulatory requirements associated with the NPDES, USACE, as well as the FDEP ERP process. Domestic and sanitary wastes would be pre-treated and discharged according to MARPOL Convention requirements. Measures will be taken to ensure debris generated during installation or operation is kept out of marine waters. A draft NPDES permit and USACE Section 10 permit have been included in Volume I of the Port Dolphin LNG Project March 2007 **Deepwater Port License Application**. A final NPDES permit application will be submitted February 2009. The updated USACE Section 10 permit application is anticipated to be submitted in March of 2009.

Port Dolphin Energy LLC has filed draft portions of the application for a Florida Environmental Resource Permit (ERP) seeking submerged lands authorization. Final documents are expected to be filed in January of 2009. The ERP consolidates the State of Florida environmental permitting process allowing all interested agencies to comment and add appropriate conditions. The Port Dolphin LNG Project will obtain an ERP and all necessary state approvals for operation.

The proposed deepwater port also would be subject to the Title V Operating Permit Program because both nitrogen oxide (NOX) and carbon monoxide (CO) emissions exceed the 100.0 tons per year (tpy) Title V major source applicability threshold. The emissions from the natural-gas-fired boilers and power-generating engines on the SRV would be in compliance with applicable federal and state emission standards. Ambient air quality effects from the boilers and engines, using potential emission rates during vaporization, would be in compliance with Florida AAQS and NAAQS, which has been be demonstrated by air quality dispersion modeling. Because the Project would be a major source located in federal waters, preconstruction approval would be required from the U.S. EPA, following Florida requirements and applicable federal regulations. A draft PSD air permit application was included in Volume I of the March 2007 Port Dolphin LNG Project **Deepwater Port License Application**. A final PSD air permit application was submitted in April of 2008.

During construction and operation activities, the barge, support vessels, and SRVs would have stored fuels and possibly other hazardous materials on board that are required for normal operations (e.g., heavy fuel oil, diesel, etc.). Therefore, there would be a potential for accidental spillage of these materials into marine waters. All vessels would be in compliance with MARPOL Annex I and Annex IV and other applicable regulations to minimize the risk of accidental discharges to the extent possible. All vessels also would have spill response plans, which would identify specific measures to avoid or minimize potential impacts of a hazardous spill into marine water resources during construction and operation. While a spill is unlikely, any accident would be responded to quickly and would likely have minor effects on the marine environment. The Operations Manual, included in **Volume III, Section 9** ***(Confidential)*** of the **Deepwater Port License Application**, contains operational procedures to be implemented in the event of a spill. The following mitigation measures would be implemented to further minimize any effects on water quality and are summarized in **Volume II, Appendix F** of the **Deepwater Port License Application**:

- The vaporization process used by the SRVs would operate as a closed system; therefore, there would be no intake of a large volume of heating water, and there would be no discharge of a large volume of water colder than ambient seawater.
- While SRVs are present within the operational area of the port, they would have sufficient storage capacity for all wastewater generated onboard, including black water, gray water, and bilge water. Therefore, there would be discharges of these waste water sources from SRVs while at the port. All waste water would be stored onboard, treated and discharged according to MARPOL Convention requirements when in transit within international waters, or disposed of according to other pre-approved procedures.
- Freshwater storage capacity would be sufficient so that the freshwater generators would not require operation while the SRVs are at the port; therefore, they would have no discharge of hypersaline water.
- On the SRVs, gutter bars shall be placed around equipment where oil leaks could occur, (e.g. mooring winches, cranes, etc.). Rain water from these utility areas shall be drained to a bilge holding tank. No rain-water from the utility areas will therefore be discharged overboard while at the buoy
- During the regasification operation the vessel will not discharge any ballast water.
- The SRVs would not need to operate their electrochemical chlorination biofouling system during the time they are at the port, so they would have no discharge of sodium hypochlorite.
- To conserve use of seawater at the deepwater port, the SRV would operate in a closed-loop engine cooling mode during LNG vaporization, with heat generated by engines being absorbed entirely by the LNG vaporization system. Therefore, under normal operations there would be intake and discharge of a maximum of 9.5 MGD per vessel for engine cooling water which would not contain biofouling control additives (i.e., sodium hypochlorite).
- A spill response plan and Emergency Response Plan will be developed and implemented.
- Marine engines would be maintained in accordance with recommended manufacturer operation and maintenance procedures.
- Machinery would be turned off when not in use.
- The Applicant has designed its project and operations to meet the U.S. Environmental Protection Agency’s Best Available Control Technology requirements and comply with National Ambient Air Quality Standards. NOX emissions would be reduced by 85% over conventional propulsion and vaporization equipment.

The proposed Port Dolphin LNG Project is expected to have insignificant negative pollutant discharges and impacts on the environment. Thus, the project is consistent with Chapter 403, F.S.

Chapter 582 -- Soil and Water Conservation

Chapter 582, Florida Statutes, administered by the Florida Department of Agriculture and Consumer Services, provides for the control and prevention of soil erosion. Chapter 582 provides for the creation of soil and water conservation districts throughout the state to preserve the state's water and land resources. The district offices are responsible for implementing programs in their respective districts to combat erosion and promote the conservation of soil and water resources. Erosion prevention is important to the state for several reasons. By encouraging the proper use of the state's water and land resources, this chapter helps protect wetlands, estuaries, and beaches from uses that would accelerate erosion or divert the water resources they need. It also preserves state lands and the animals that dwell on them, assists in the maintenance of navigable waterways, and prevents the impairment of dams and reservoirs.

Construction and operation activities of the deepwater port would be approximately 28 miles offshore at depths of approximately 100 feet and would not cause soil erosion or impact water conservation or navigable waterways in the state of Florida. Construction of the pipeline coming aground at Port Manatee will be conducted pursuant to the permitting requirements of the Federal Energy Regulatory Commission (FERC), the Florida Department of Environmental Protection, and Port Manatee. The STL buoys' distance from shore is also not likely to affect the state's wetlands, estuaries or beaches during operation. In addition, a Port Dolphin project specific Erosion Control, Revegetation, and Maintenance Plan has been prepared and is included as **Appendix A.9** of the **Addendum II** to the **Deepwater Port License Application**. The plan will be implemented during the FERC-jurisdictional construction activities. Therefore, this Project is consistent with Chapter 582, F.S.

Additional Information for Offshore Projects

Table 1 lists additional information that the State of Florida requires for offshore projects, which in the past have included oil and gas exploration plans that have been proposed in the Eastern Gulf of Mexico. Since this is a deepwater LNG port, some of this information is not applicable to the Project and is noted. Other information is cross-referenced to the Project's **Deepwater Port License Application** and the **Addendums I and II** to the **Deepwater Port License Application** where it is more fully described.

Table 1. Specific information required for the Florida Coastal Management Program

Information Required	Response
A discussion of the measures used to prevent the discharge of oils and greases from drilling rigs or platforms during rainfall and routine operations.	All rainwater from utility areas would be collected in storage tanks and either treated by onboard oil/ water separators or sent by tank barge to be processed onshore at a recognized treatment facility. Consequently, there would be no discharges of petroleum products from operation of construction vessels during the construction of the STL buoys.
The following socioeconomic information: . Estimated number of persons expected to be employed in support of the Applicant's plan within the State of Florida, and where possible, the approximate number of new employees and families likely to move into the affected area; . An estimate of the major supplies, services, energy, water, or other resources you expect to purchase within the State of Florida and that are necessary for you to carry out the activities; and . The types of contractors or vendors within the State of Florida that the Applicant will need to carry out the activities.	. It is estimated that approximately 250 to 300 non-local personnel would be used during installation. The Project is expected to commence operations in mid 2012 and have an economic life of 25 years. Over this time period, about 80 full-time local employees are expected to support offshore operations. It is possible that a small number of these staff and their associated dependents would likely permanently relocate to Manatee County. . Refer to Volume II, Section 6 of the **Deepwater Port License Application** and *Confidential* **Appendix B.6** of the **Addendum I** to the **Deepwater Port License Application** for detailed information regarding project-related expenditures. . Given the nature of the highly specialized offshore infrastructure, SRVs to be used in the Project, most of the capital equipment and civil works for the Project would be procured from outside the State of Florida. During construction, it is expected that the use of specialized survey vessels, a derrick-type barge, and Port Manatee staging areas and office space would stimulate economic activity at the Port.
A complete description of any dredging and filling activities associated with the construction or expansion of any onshore facilities in Florida.	The onshore project starts at the high water mark at Port Manatee and traverses 3.93 miles to an interconnect station with the Gulfstream pipeline and TECO pipeline. The pipeline comes ashore approximately 1,350 feet east of the bulkhead seawall using directional drilling from a point located 4,900 feet (1,772 meters) from the exit point. Most of the pipeline route traverses lands currently used as Port Manatee or adjacent to utility corridors for both overhead and buried linear facilities. Nine separate wetlands habitats were identified along the Port Dolphin Pipeline corridor. HDD and open trenching will be the methods utilized to cross of pipeline installation through these habitats. All excavated materials will be side casted and returned to the trench for pipeline burial. The total area of impacted wetlands will be 11.9 acres (4.8 ha) of mainly freshwater emergent scrub/shrub habitat which have reduced vegetation and an influx of nuisance/exotics due to existing ROW impacts. Once the construction is complete, the areas will be restored in accordance with the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Appendix A.9** of the **Addendum II** to the **Deepwater Port License Application)**. The mangrove wetlands will be crossed using HDD methodology and will not be impacted by the pipeline construction.
The type and volume of chemical constituents of drilling muds.	Drilling mud will be primarily water mixed with bentonite, which is a naturally occurring clay that forms a viscous, gel material when mixed with water. Based on drilling conditions encountered in the field, additives may be added to the drilling fluid, such as starch, cellulose, non-toxic polymers, and crystalline silica to modify the fluid properties. It is anticipated that 598,400 gallons of drilling fluids will be required for the four HDDs and five bores under roads.

Information Required	**Response**
Detailed information on the presence of threatened and endangered species in the Project area.	The vicinity of the STL buoys is not known to have any concentration or congregation of cetaceans. However manatees and sea turtles do occur along the pipeline route in Tampa Bay (refer to **Volume II, Section 4** of the **Deepwater Port License Application** for further information concerning protected species). No threatened and endangered species or Species of Special Concern have been observed in the terrestrial portion of the project area.
A discussion of air and water quality in and adjacent to the area or the potential impact area.	Refer to **Volume II, Sections 9 and 3** of the **Deepwater Port License Application** for detailed information regarding air and water quality in the Project area. Water quality information along the routing around the Terra Ceia Aquatic Preserve has been described in **Section 5** of the **Addendum I to the Deepwater Port License Application**. Water quality information along the routing around the sand borrow area has been described in **Section 4** of the **Addendum II to the Deepwater Port License Application**
A thorough description of the coastal habitats (including bays, bayous, sounds, estuaries, lagoons, rivers, streams, or other bodies of water) and their associated flora and fauna that could be affected.	Refer to **Volume II, Sections 4 and 10** of the **Deepwater Port License Application**, Sections 6 and 9 of the **Addendum I to the Deepwater Port License Application**, and Sections 5 and 8 of the **Addendum II to the Deepwater Port License Application** for detailed information regarding coastal habitats, flora and fauna, bodies of water, and wetlands located in the Project area and surrounding region.
A description of any historical and archaeological resources that could be affected.	STL buoys and associated components would be sited more than 1,000 feet from any significant target in proximity to the pipeline route, in accordance with MMS regulations (NTL No. 2005-G07) (refer to **Volume II, Section 5** of the **Deepwater Port License Application**). Cultural resources information along the routing around the Terra Ceia Aquatic Preserve has been described in **Section 7** of the **Addendum I to the Deepwater Port License Application**. Cultural resources information along the routing around the potential sand source area has been described in **Section 6** of the **Addendum II to the Deepwater Port License Application**
A discussion of sensitive or critical state and federal resources, including specially designated and managed areas that may be impacted by the project (planned activities or accidental discharges).	A description of regulations that govern critical state and federal resources is provided in each resource section in the **Deepwater Port License Application** (**Volume II, Environmental Evaluation**). Specifically, refer to **Sections 4 and 10** for detailed information regarding managed resources and areas in the vicinity of the Project Area. Additional information can be found in **Sections 6 and 9** of the **Addendum I to the Deepwater Port License Application** and in **Sections 5 and 8** of the **Addendum II to the Deepwater Port License Application**
A description of the potential for and types of direct, indirect or secondary, and cumulative impacts of the project (planned activities and accidents) on air quality; water quality and quantity; marine and coastal habitats; flora and fauna (including threatened and endangered species); coastal littoral processes; publicly owned and managed lands; cultural or historic resources; recreational and commercial fisheries; communities, the state and local economy; navigation; marine productivity; and other uses of the area.	This information is summarized in this consistency certification and is further detailed in the relevant environmental consequences sections of **Volume II, Environmental Evaluation** in the **Deepwater Port License Application** and the **Addendums I and II to the Deepwater Port License Application**.

Information Required	Response
A description of measures that will be taken to avoid, minimize, and mitigate impacts to marine and coastal environments and habitats, biota, and threatened and endangered species.	Mitigation measures are summarized in this consistency certification and are further detailed in the relevant environment consequences sections of Volume II, Environmental Evaluation and **Appendix F** of the **Deepwater Port License Application**. The draft State Waters Mitigation Plan and draft Federal Waters Mitigation Plan are included as **Appendices A.5 and A.6** of the **Addendum II to the Deepwater Port License Application**. The Onshore Post-Construction Recovery and Mitigation Plan is included as **Appendix A.11** of the **Addendum II to the Deepwater Port License Application.**
Existing and planned monitoring that will measure environmental conditions, including but not limited to that required by lease stipulation.	Refer to **Volume II, Appendix F** of the **Deepwater Port License Application** for monitoring and mitigation measures for further information. The draft State Waters Mitigation Plan and draft Federal Waters Mitigation Plan are included as **Appendices A.5 and A.6** of the **Addendum II to the Deepwater Port License Application**. The Onshore Post-Construction Recovery and Mitigation Plan is included as **Appendix A.11** of the **Addendum II to the Deepwater Port License Application.** Monitoring protocols will be further developed during the permitting process.

COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

DEEPWATER PORT

TYPE OF PROJECT

GULF OF MEXICO 28 MILES OFFSHORE FLORIDA [OCS St. Petersburg Area Blocks (PB) PB-463, PB-504, PB-505, PB-506, PB-507, PB-545, PB-546, PB-547, PB-548, and PB-589]

LOCATION

The proposed activities described in detail in the **Deepwater Port License Application** and the **Addendums I and II to the Deepwater Prot License Application**, *Port Dolphin LNG Project, Florida* comply with the State of Florida's approved Coastal Management Program and the enforceable policies of the state. The proposed activities will be conducted in a manner consistent with this program and its enforceable policies.

Port Dolphin Energy LLC

Dec 12th, 2008 [signature] RAGNAR WISLØFF
DIRECTOR

OPERATOR

[NAME - Florida Department of Environmental Protection]
CERTIFYING OFFICIAL

DATE

ATTACHMENT A.2

REVISED SAND SOURCE RE-ROUTE SURVEY OF MARINE BENTHIC HABITATS WITHIN THE PROPOSED PORT DOLPHIN PIPELINE CORRIDOR WITHIN TAMPA BAY, FLORIDA

REVISED SAND SOURCE RE-ROUTE SURVEY OF MARINE BENTHIC HABITATS WITHIN THE PROPOSED PORT DOLPHIN PIPELINE CORRIDOR WITHIN TAMPA BAY, FLORIDA

November 2008

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1.0 INTRODUCTION

1.1 BACKGROUND

Port Dolphin is an offshore liquefied natural gas (LNG) deepwater port project proposed for the importation of natural gas. The proposed Port Dolphin will be located 42 mi (68 km) south-southwest of Tampa Bay, Florida in federal waters in a water depth of approximately 100 ft (33 m) (**Figure 1**). The port will be able to accommodate mooring shuttle and regasification vessels (SRVs) with an approximate capacity range of 145,000 to 217,000 m^3. A natural gas pipeline will connect the LNG deepwater port to the Florida natural gas transmission and distribution system in Port Manatee, Florida. The pipeline will traverse Federal, State, Hillsborough County, and Manatee County waters prior to making landfall.

On 24 July 2006, CSA International, Inc. (CSA) initiated detailed marine habitat surveys along and around the proposed offshore buoy system array and linear natural gas pipeline corridor offshore and within Tampa Bay, Florida. Field surveys of the original preferred route (which passed through the Terra Ceia Aquatic Preserve) were conducted between 17 August and 14 December 2006. After meeting with the Florida Department of Environmental Protection (FDEP), Port Dolphin decided to develop alternative routes that would avoid crossing the Aquatic Preserve. **Figure 2** shows the original survey corridor and the revised corridor around the Aquatic Preserve. After meeting with both Manatee County and the Town of Longboat Key, it was determined that the alternative route traversed potential sand sources (**Figure 3**) for the Anna Maria Island Shore Protection Project, and another alternative route was selected and surveyed for benthic habitat characterization. **Figure 4** shows the original survey corridor, the Terra Ceia re-route corridor, and the sand source re-route corridor.

1.2 RE-ROUTE SURVEY AREA

The original pipeline route and survey corridor were shifted north to avoid traversing the potential sand source area to the west of Anna Maria Island. However, the sand source re-route survey corridor (3,000 ft [915 m]) overlaps in some areas with the original survey corridor (**Figure 4**).

1.3 SURVEY OBJECTIVES

The primary objective of the survey was to collect the qualitative and quantitative data necessary to characterize and delineate all the defined marine habitats and seagrass communities within the proposed pipeline re-route area. Results from the survey will provide information for the locations of pipeline corridor development and serve as documentation during agency review for permitting purposes.

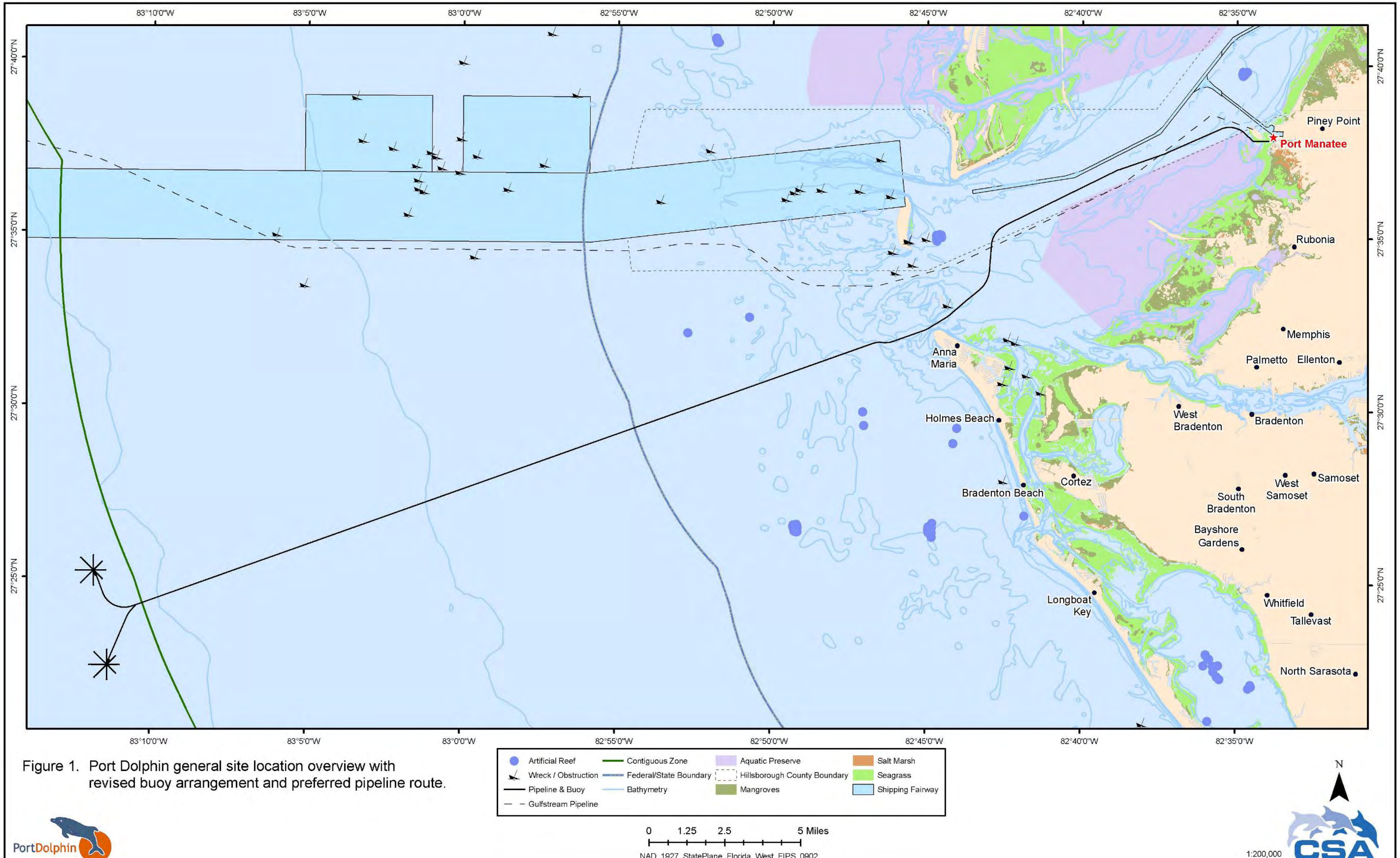


Figure 1. Port Dolphin general site location overview with revised buoy arrangement and preferred pipeline route.

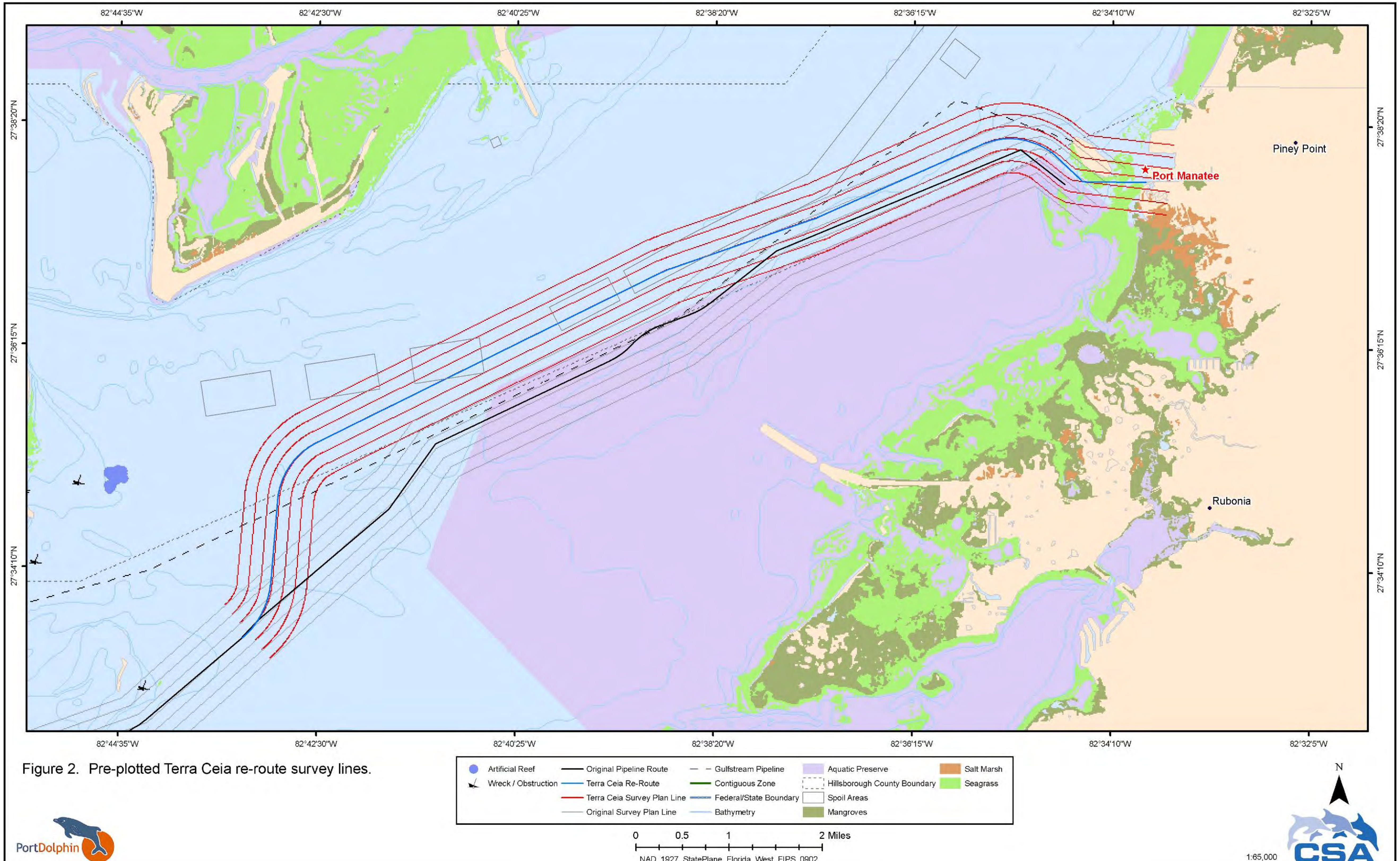


Figure 2. Pre-plotted Terra Ceia re-route survey lines.

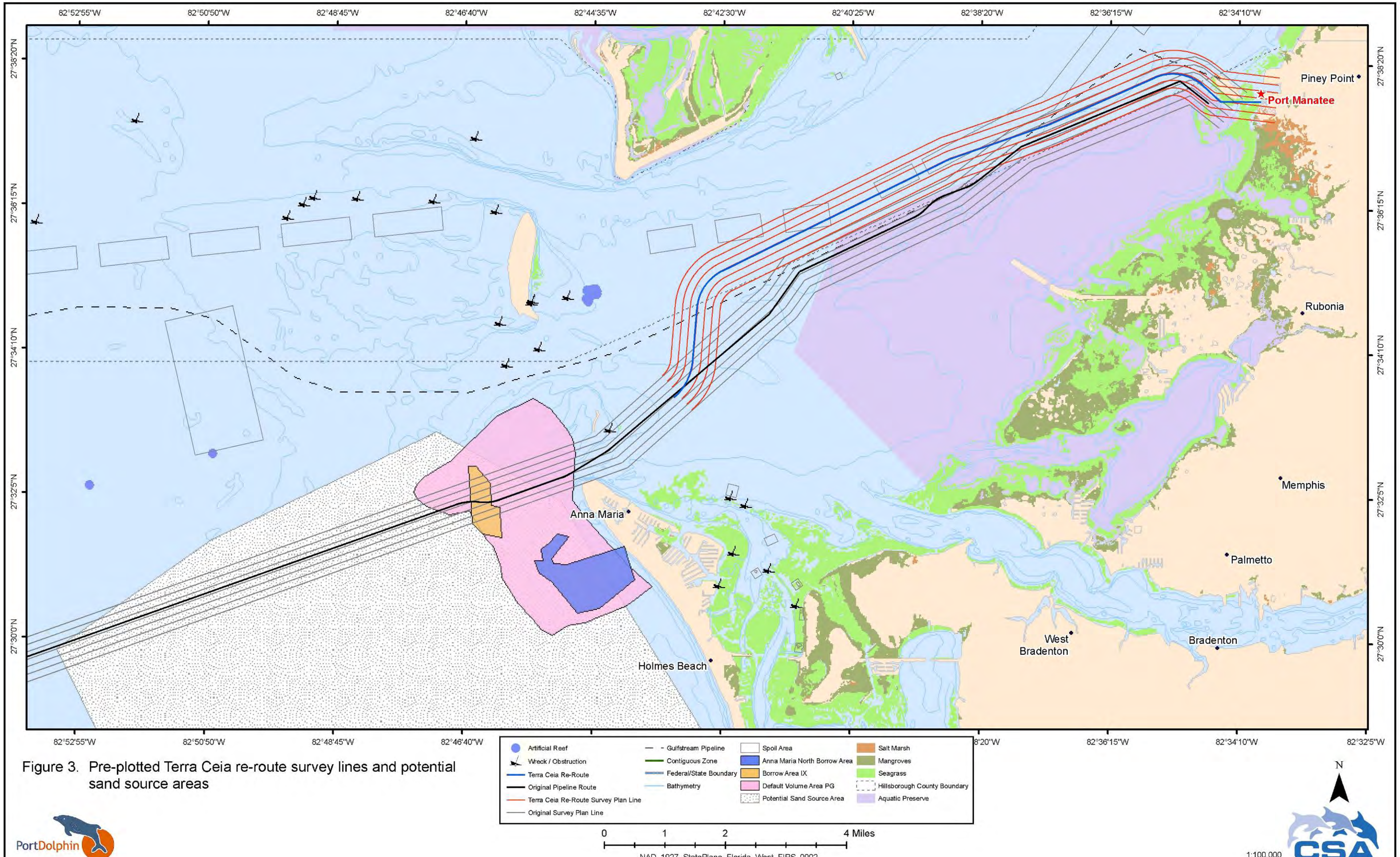


Figure 3. Pre-plotted Terra Ceia re-route survey lines and potential sand source areas

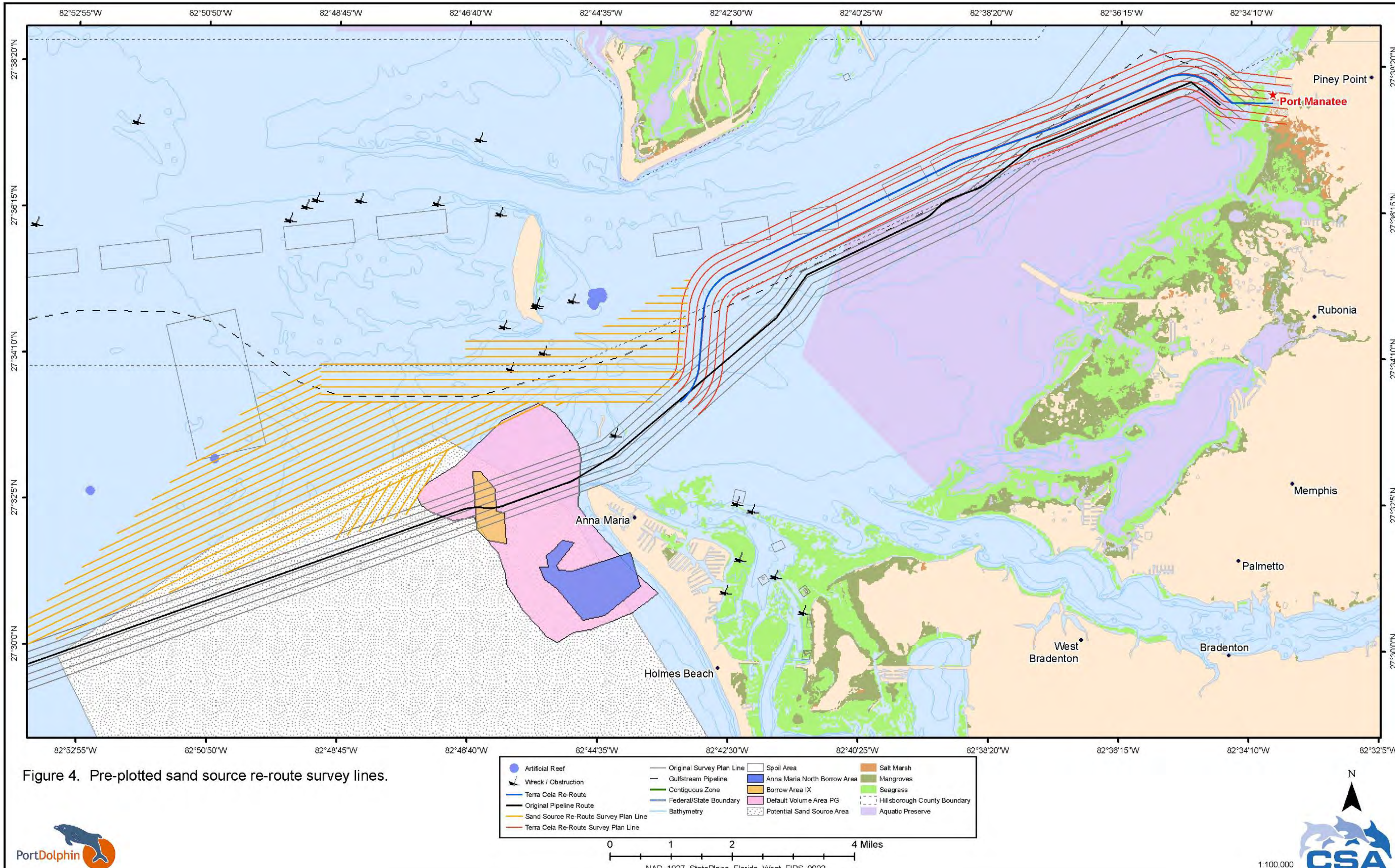


Figure 4. Pre-plotted sand source re-route survey lines.

The FDEP, Office of Intergovernmental Programs, Offshore Projects Section has stated that each proposed offshore project within Florida State and Federal offshore waters has the potential to impact natural resources, particularly live bottom habitats. As impacts to these important habitats are of major concern to the State, FDEP has developed guidelines for conducting offshore benthic surveys (Basis of Review Mitigation Protocol Offshore Southeast Florida; see CSA International, Inc., 2007) that, if followed, should provide data for full geophysical and biological seabed characterization. The FDEP guidelines recommend incorporation of Minerals Management Service (MMS) Notice to Lessees (NTL) No. 2004-G05 requirements and additional elements into any offshore benthic survey conducted in State and adjacent Federal waters per the Federal consistency review.

The FDEP Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida defines the four marine habitat types used to delineate habitat areas for this project. Descriptions of the habitat types are presented in **Table 1**.

Table 1. Habitat delineation descriptions defined in the Florida Department of Environmental Protection Regulatory Basis of Review Mitigation Protocol Offshore Southeast Florida.

Habitat Type	Description
Type A	20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).
Type B	5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 ft (0.25 m) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.
Type D	Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.
Soft Substrate/Sand	Soft substrate/sedimentary habitats not associated with hard bottom ecotones.

Two field survey elements were conducted in order to meet the project objectives:

1) A photodocumentation survey of the re-route pipeline corridor was conducted. Descriptive and qualitative video and still photographic data were collected to document hard/live bottom and seagrass communities and soft bottom habitats. Plan-view photographs were collected every 656 ft (200 m) to meet State and Federal requirements for documenting habitat types.

2) Following the photodocumentation surveys, diver surveys were conducted to collect quantitative still photographic data on representative habitats.

2.0 METHODS

2.1 RE-ROUTE SURVEY

2.1.1 Qualitative Hard/Live Bottom Surveys

The *Miss Casey*, a 70-ft (21-m) vessel out of Holmes Beach, Florida, was used during the qualitative hard/live bottom surveys conducted from 23 July through 4 August 2008 and again on 16 October 2008. High-resolution qualitative video and still photographic data were collected with an underwater towed camera system along the re-routed portion of the proposed LNG pipeline corridor to provide baseline data for identification of seafloor substrate types and associated marine benthic habitats within the potential area of impact.

Figure 4 presents pre-plotted survey transect lines for the re-routed portion of the corridor. Hypack 6.2A was interfaced with a Leica MX-420 differential global positioning system (DGPS) for vessel guidance, digital navigation logging of the precise position of the towed video/still camera system, and a real-time display of the ship's track along the survey transects. Navigational positions were recorded three times per second along each transect. The offset of the specific sled position relative to the vessel's DGPS position was incorporated into the navigation database.

A total of 49 qualitative transects were surveyed with 656-ft (200-m) line spacing within the re-routed pipeline corridor. Some of the northern transect lines crossed over the existing Gulfstream pipeline and a high relief sand shoal and therefore were not surveyed (**Figure 5**).

Continuous video observations were made using an Insight Pacific, Inc. Aurora CCD camera, an advanced underwater video system with Deep Sea Power 500 W lights. Live video feed with time, location (X,Y coordinates), and transect number data was recorded directly to an on-board Panasonic DVD/hard disk drive model DMR-EH55. Back-up video was simultaneously recorded on mini-DV tapes using a Panasonic AG-DV1000 recorder. Real-time observations of habitat types, sediment characteristics, and notable species were logged by a scientific observer on board the survey vessel.

Still photographs were taken with an IMENCO digital camera system and a Model 386 flash pack strobe. Still photographs were taken, at a minimum, every 656 ft (200 m); the camera was activated remotely by an on-board technician. Each digital photograph file was encoded with the time (hour, minute, second) of exposure, date, and geographic coordinates (X,Y coordinates) so that each still photograph can be referenced to a specific geographic location in the survey area.

The underwater video and digital still cameras used for the qualitative surveys were mounted on a custom-made, stainless-steel, open-framed sled that was towed approximately 0.5 to 1 ft (0.15 to 0.3 m) off the seafloor at vessel speeds of 0.8 to 2.5 kn (1.5 to 4.6 km/hr). The cameras were aligned (30º to 60º degrees below horizontal, depending on vessel speed and visibility) so that both had a similar field of view at the time of shutter activation.

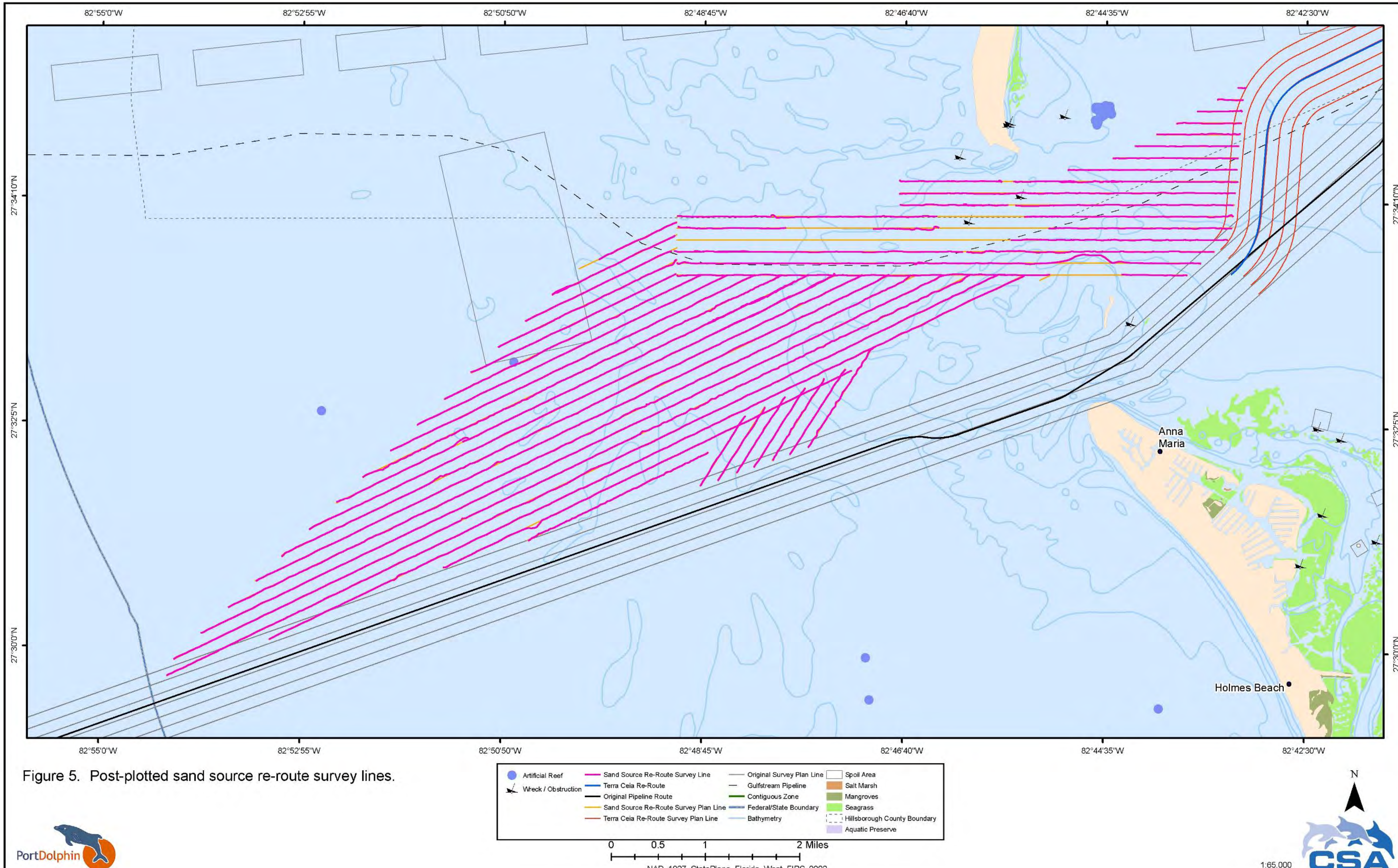


Figure 5. Post-plotted sand source re-route survey lines.

2.1.2 Quantitative Hard/Live Bottom Surveys

Following the qualitative surveys, marine benthic habitats within the survey area were categorized into one of the general habitat types described in **Table 1**. Dive locations were selected based on field notes and video review to represent the range of habitats within various depths throughout the sand source re-route survey area. Dives were conducted on 16 and 17 August at 16 sites for the purposes of verifying data collected during the qualitative video survey. Geographic coordinates of the dive sites are listed in **Table 2**. Random quantitative still photographs were collected by divers within the sand source re-route survey area at eight distinct sites (A-1, A-3, A-4, A-5, B-1, B-1, B-4, and D-1) (**Figure 6**) within the range of habitat types identified from the qualitative analysis. Still photographs were not collected at sites where the bottom habitat differentiated from expected results based on data collected during the qualitative video survey. SCUBA divers used digital still cameras to collect quantitative data for analysis from the offshore sites. An attempt was made to collect approximately 60 quantitative still photographs per dive site in order to obtain a minimum of 100 photographs per discrete habitat type (A, B, D, and potential seagrass).

Table 2. Geographic coordinates of the sand source re-route survey dive sites.

Dive Site	Latitude (°N)	Longitude (°W)	X (UTM 17N, WGS 84M)	Y (UTM 17N, WGS 84M)	Quantitative Photographs Collected
A1	27°33.89’	82°45.56’	326314.02	3050239.86	Yes
A2	27°33.73’	82°46.07’	325474.65	3049939.80	No[2]
A3	27°30.33’	82°53.52’	313108.13	3043856.07	Yes
A4	27°31.36’	82°51.45’	316543.67	3045696.44	Yes
A5	27°34.16’	82°45.31’	326731.73	3050717.45	Yes
B1	27°32.44’	82°50.94’	317425.10	3047667.69	Yes
B2	27°31.45’	82°51.24’	316890.86	3045858.01	Yes
B3	27°34.06’	82°44.68’	327771.84	3050522.32	No[2]
B4	27°30.94’	82°52.97’	314034.08	3044966.96	Yes
D1	27°30.48’	82°53.44’	313250.77	3044130.66	Yes
D2	27°31.35’	82°51.20’	316957.34	3045673.16	No[2]
D3	27°30.82’	82°51.31’	316758.46	3044695.81	No[2]
D4	27°34.16’	82°46.52’	324741.20	3050749.29	No[2]
S1[1]	27°30.90’	82°51.69’	316148.54	3044849.58	No[2]
S2[1]	27°32.35’	82°50.29’	318486.17	3047504.03	No[2]
S3[1]	27°31.27’	82°50.55’	318033.12	3045515.40	No[2]

[1] Potential seagrass location.
[2] Bottom type observed did not match expected results from video survey.

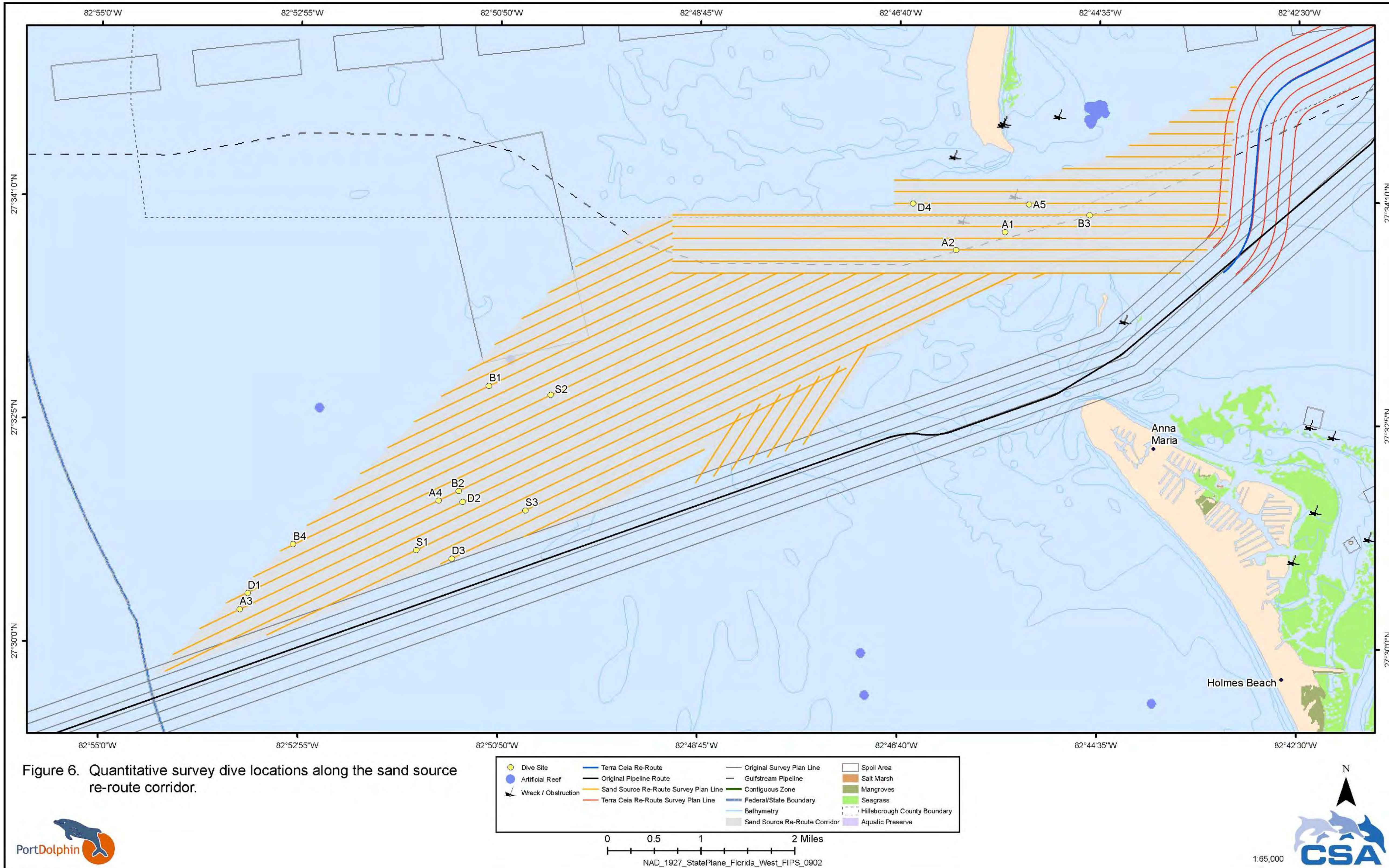


Figure 6. Quantitative survey dive locations along the sand source re-route corridor.

The quantitative still photographic survey was conducted from the *Miss Tracy II*, a 28-ft (8.5-m) skiff out of Holmes Beach, Florida. Digital still photographs were collected with an Olympus 4040 (4.0 megapixel) digital camera within a Sea & Sea underwater housing with YS-90 DX strobes mounted on a custom-built, stainless-steel framer for a 3.1 ft^2 (0.29 m^2) field of view. Divers randomly collected still photographs (see **Appendix**) within each discrete habitat type to determine percent cover and classify habitat type.

2.2 DATA ANALYSIS

2.2.1 Towed Video

A desktop analysis was performed to examine the qualitative video data for full description and characterization of the benthic habitats found within the sand source re-route survey area. During the review, navigational data (X,Y coordinates) were recorded where the habitat types defined in **Table 1** were observed along each transect. All coordinates were compiled into a spreadsheet with an assigned habitat classification for importation into ArcGIS. Habitats were classified as Type A, B, or D based on FDEP definitions, visual observations during the video review, notes from logbooks recorded during video collection, and qualitative still photographs. Example photographs of representative habitat types are presented in the **Appendix**. Habitats estimated to have a vertical relief greater than or equal to 10 in. (0.25 m) as a characteristic feature were assigned as Type A habitat regardless of estimated percent cover. Habitats characterized by hard/live bottom features and estimated to have a vertical relief of less than 10 in. (0.25 m) with approximately 5% to 20% epibiotic cover were assigned a habitat classification of Type B. In areas with estimated percent cover of less than 5% with no apparent relief but that were characterized by hard/live bottom organisms (e.g., corals, sponges, and octocorals), Type D habitat classification was assigned.

2.2.2 Quantitative Photographic Data

Quantitative still photographic data collected during the diver surveys were analyzed to confirm preliminary habitat classifications using percent coverage of attached epibiota, which were grouped into the following major categories:

- Live stony corals – included total live scleractinian corals (e.g., *Solenastrea* sp. and *Siderastrea* sp.);
- Octocorals – included soft corals, such as sea fans, sea whips (*Carijoa riisei* and *Pseudopterogorgia* sp.), and stony hydrocorals (*Millepora* sp.);
- Sponges – included sponges identified to lowest possible taxon;
- Algae – included fleshy, calcareous, and coralline taxa, as well as turf algal communities consisting of short articulate algae intermixed with red and brown macroalgae and other small epibenthic biota that form a mat or carpet over hard substrate;
- Other fauna – included unidentified bryozoans, hydroids, and other small unidentified epibiota; and
- Abiotic substrate – included unconsolidated sediment, bare rock, deep holes, and gaps.

Percent coverage for stony corals, octocorals, sponges, algae, hydroids, zooanthids, and macroalgae were estimated using the CPCe V3.3 (Coral Point Count with Excel extensions) software analysis program (Kohler and Gill, 2006). CPCe utilizes the random point method described by Bohnsack (1979) to accurately estimate percent coverage of benthic organisms and associated substrate from digital underwater images. There were 25 random points projected on the digital photographs to determine the percent cover of identifiable species and substrate categories. Individual coral colonies observed in each of the frames also were identified and counted to further characterize the habitat types.

2.2.3 Hard/Live Bottom Habitat Delineation and Quantification

Data from the desktop analysis were imported into ArcGIS for the plotting of each discrete habitat area. To produce maps showing linear boundaries of the habitats along each transect within the survey area, visual interpolation of data points between like habitat types was used to create polygons showing habitat distribution and allow for areal determination of each habitat type. In areas where one habitat type was clearly dominant, some smaller areas of similar coverage were incorporated within the larger polygon for areal interpretation.

3.0 RESULTS

3.1 QUALITATIVE HARD/LIVE BOTTOM HABITAT CLASSIFICATION

Following the FDEP protocol, four distinct marine benthic habitat types (Type A, Type B, Type D, and soft substrate/sand) were identified within the survey area (**Figure 7**). Representative still photographs of the habitats are presented in the **Appendix**. Classifications were based on specific seafloor substrate types and review of video data collected from the survey transects within the proposed sand source re-route pipeline corridor. Sand/soft bottom habitat is the dominant habitat type in the sand source re-route area, with small and patchy clusters of habitats Types A, B, and D. Most Type A habitats were identified to the south of Egmont Key and to the east of the Federal/State boundary.

3.2 QUANTITATIVE ANALYSIS OF PHOTOGRAPHIC DATA

Biotic cover at the eight selected dive sites in the sand source re-route survey area is shown in **Table 3**. During the initial pipeline corridor surveys, macroalgae comprised a significantly high percentage of the total epibiotic coverage and was, therefore, differentiated from other biota in the original results. Macroalgal coverage was again differentiated from non-algal benthic biotic coverage (**Table 3**) for the sand source re-route survey, and marine habitats in the survey area were mapped based on structural relief and non-algal benthic biotic coverage.

Table 3. Habitat classifications based on percent coverage and/or structural relief.

Dive Site	Preliminary Habitat Classifications		Percent (%) Faunal Coverage (Non-algal)	Percent (%) Macroalgal Coverage	Final Habitat Classification
	Video Review	Diver Survey			
A-1	A	A	25.1	1.5	A
A-2	A	Sand/soft substrate	--	--	Sand/soft substrate
A-3	A	A	1.8	45.8	D
A-4	A	A	0.6	49.5	D
A-5	A	A	26.3	23.1	A
B-1	B	B	5.6	42.8	B
B-2	B	D	1.8	13.9	D
B-3	B	Sand/soft substrate	--	--	Sand/soft substrate
B-4	B	B	1.0	51.8	D
D-1	D	B	0.2	39.4	D
D-2	D	Sand/soft substrate	--	--	Sand/soft substrate
D-3	D	Sand/soft substrate	--	--	Sand/soft substrate
D-4	D	Sand/soft substrate	--	--	Sand/soft substrate
S-1[1]	Seagrass	*Caulerpa prolifera*	--	--	*Caulerpa prolifera*
S-2[1]	Seagrass	Sand/soft substrate	--	--	Sand/soft substrate
S-3[1]	Seagrass	*Caulerpa prolifera*	--	--	*Caulerpa prolifera*

[1] Potential seagrass habitat.

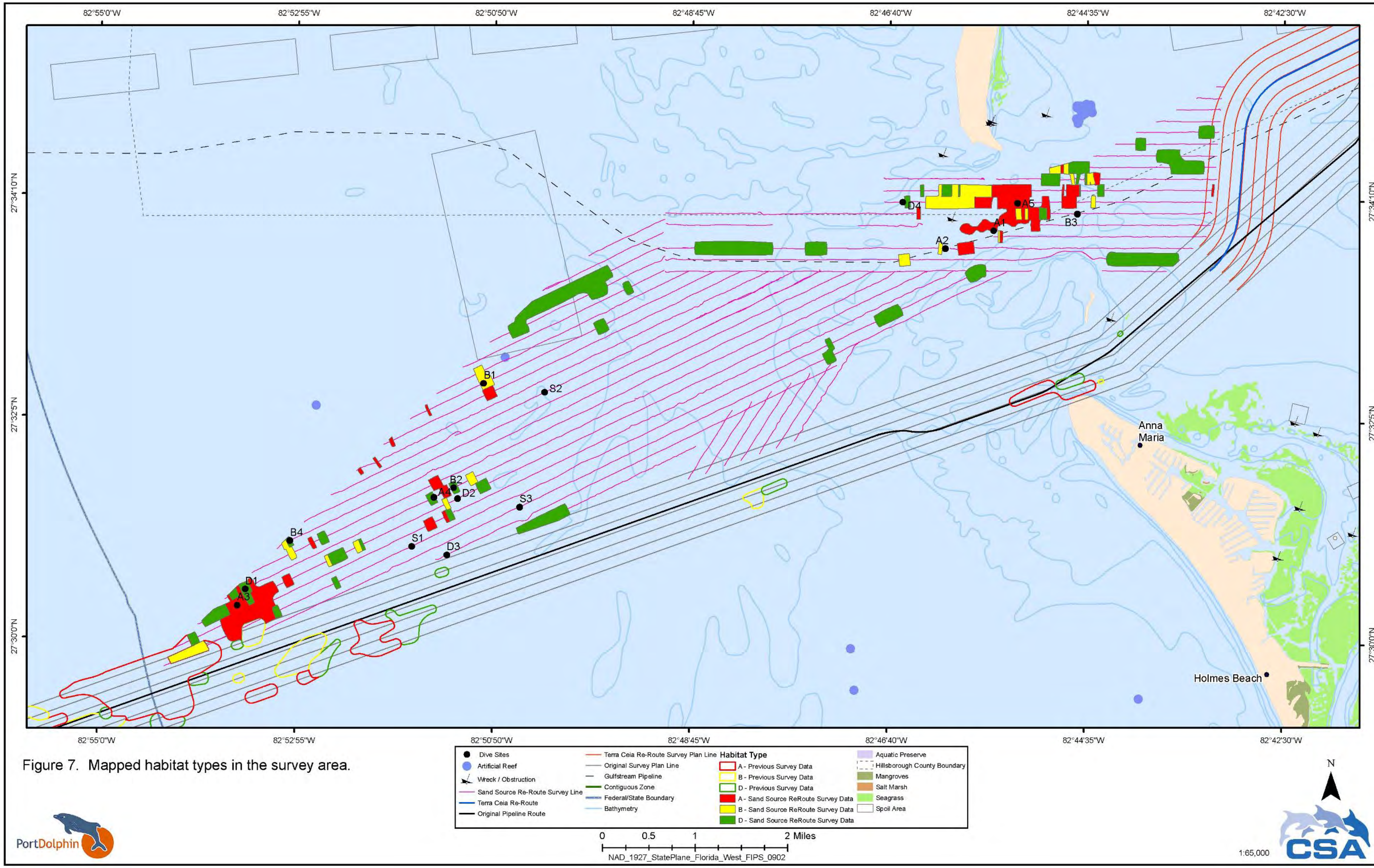


Figure 7. Mapped habitat types in the survey area.

Macroalgae was composed of *Codium* sp., *Halimeda* sp., *Udotea* sp., unidentified green algae (Chlorophyta), *Dictyota* sp., *Sargassum* sp., unidentified brown algae (Phaeophyta), unidentified red algae (Rhodophyta), coralline red algae, unidentified macroalgae, turf algae, and biotic turf. Biotic turf comprised the greatest macroalgal cover at Dive Site A-1 (1.4%). Turf algae comprised the greatest cover at Dive Sites A-3 (13.1%) and A-5 (11.9%). Unidentified red algae comprised the greatest macroalgal cover at Dive Sites A-4 (45.8%), B-1 (38.3%), B-2 (5.5%), B-4 (34.5%), and D-1 (18.5%).

Faunal cover (excluding algae) at the eight dive sites is shown in **Table 3**. Faunal components included sponges, hydroids, octocorals (including *Carijoa riisei*), unidentified sea urchins, and unidentified biota. Unidentified octocorals comprised the greatest cover at Site A-1 (9.6%). Unidentified sponges comprised the greatest percent cover of fauna at Dive Sites A-3 (0.7%), A-4 (0.4%), A-5 (21.3%), B-1 (3.7%), B-2 (1.0%), and D-1 (0.1%). Hydroids comprised the greatest percent cover of fauna at Site B-4 with 0.2%.

Substrate had the highest percent cover at all dive sites with 73.4% (A-1), 52.4% (A-3), 49.9% (A-4), 50.6% (A-5), 51.6% (B-1), 84.4% (B-2), 47.2% (B-4), and 60.4% (D-1). The primary substrate cover was shell hash at Dive Sites A-1 (73%) and B-2 (68%); sediment on hard substrate at Dive Sites A-3 (26.9%), A-4 (28.0%), A-5 (29.7%), and B-1 (24.5%); and sand at Dive Sites B-4 (28.0%) and D-1 (33.7%).

Based on total biotic percent cover (excluding macroalgal cover), Dive Sites A-1 (25.1% total biotic percent cover) and A-5 (26.3% total biotic percent cover) were classified as Type A habitats.

3.3 DELINEATION AND QUANTIFICATION OF IDENTIFIED HARD/LIVE BOTTOM HABITATS

Figure 8 shows the mapped habitat polygons (algal cover excluded) superimposed on the geophysical data. The total area surveyed for the benthic habitat characterization included 12,399.1 acres (5,017.7 ha). Within the survey area, 1,320 acres (534 ha) (11.0% of the total area) of hard/live bottom habitats were identified, which included Types A, B, and D classifications. Hard/live bottom habitat acreage by type is presented in **Table 4**. As discussed in **Section 3.2**, macroalgal coverage was not considered during the final classifications, but soft-bodied organisms such as tunicates and octocorals commonly observed within Tampa Bay were included. Soft bottom/sand substrate was the dominant feature and encompassed 89.0% of the total survey area.

Table 4. Habitat coverage based on quantitative analysis of hard/live bottom habitats.

Survey Area	Habitat Coverage (acres) by Florida Department of Environmental Protection Classification			
	Type A	Type B	Type D	Total Habitat Area
Total survey area	410.4	203.3	706.3	1,320.0

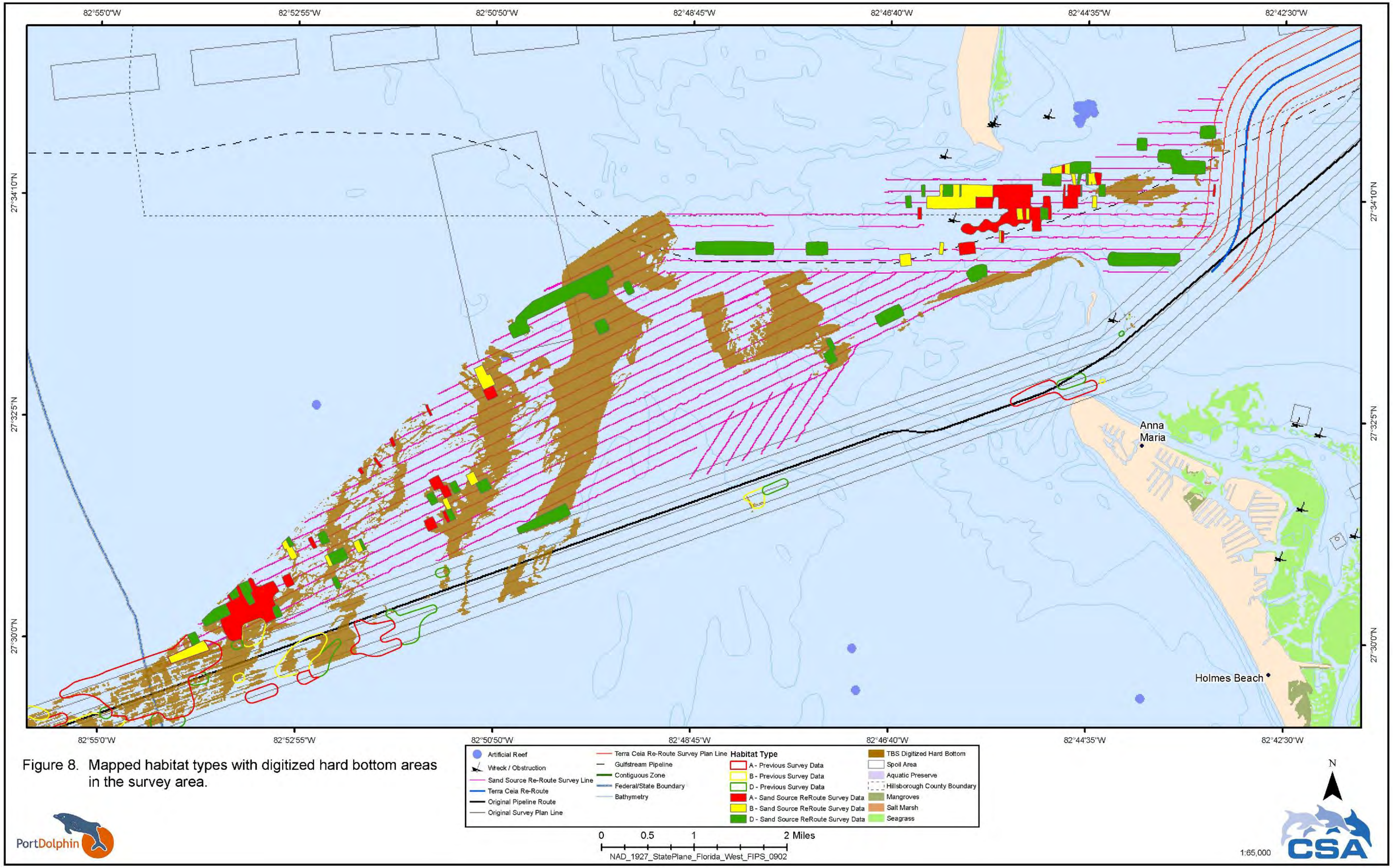


Figure 8. Mapped habitat types with digitized hard bottom areas in the survey area.

4.0 DISCUSSION

The West Florida Shelf off west central Florida is composed mainly of carbonate sediments and consists primarily of a relatively flat limestone substratum with localized relief due to relict reef or erosional structures. Benthic habitat types in the area include low-relief hard/live bottom (Parker et al., 1983; Phillips et al., 1990), coralline algal nodules and pavement, and unconsolidated shell rubble and soft bottom (primarily sand). Most areas of the shelf are covered by a thin veneer of sand (Phillips et al., 1990) and contain scattered emergent hard substrates with a maximum relief up to 6.6 ft (2 m) (Jaap and Hallock, 1990) and are colonized by a variety of tropical reef biota, such as algae (Cobb and Lawrence, 2003), sponges, stony corals, hydroids, octocorals, anemones, and bryozoans intermingled with sand bottoms. Hardier species are most common due to abiotic factors from hydrodynamics and shifting sands. The West Florida Shelf harbors some deepwater seagrass beds (*Halophila decipiens*), which occur commonly out to 100 ft (30.5 m) (Phillips et al., 1990; Dawes et al., 2004) but rarely cover significant areas. These habitats interact with the nearshore and estuarine communities of Tampa Bay to provide nursery grounds to many commercially and recreationally important species.

Although 80% of Tampa Bay is covered by sand or mud bottom (Southwest Florida Water Management District [SWFWMD], 1999), hard/live bottom habitats are known to occur (Lewis and Estevez, 1988) and are characterized by sessile invertebrates such as hard corals, soft corals, sponges, tunicates (ascidians), hydroids, and anemones living on and attached to hard surfaces. While relatively rare, these features comprise plants and animals unlike other habitats within the bay (SWFWMD, 1999). Areas near Cockroach Bay, Rocky Point, and portions of the Lower Tampa Bay have been shown to consist of more than 850 acres (344 ha) of hard/live bottom within Tampa Bay (Savercool and Lewis, 1994). More recent data on the extent of hard bottom coverage within Tampa Bay does not exist within the literature as there is no long-term trend information available (SWFWMD, 1999). Artificial structures purposely placed as artificial reefs or relicts from bridge construction also are found within the bay. These man-made structures expand opportunities for natural colonization and habitat availability and enhance fishing opportunities within the bay.

Algal diversity within Tampa Bay varies seasonally at shallower depths (20 to 40 ft [6 to 12 m]), whereas a more stable diversity is found at intermediate depths (60 ft [18 m]) (Dawes and Van Breedveld, 1969). Considerable seasonal variation in plant and algal communities is characteristic of the central Gulf Coast shelf, where variations in temperature and hydrodynamics occur (Dawes and Lawrence, 1990; Cobb and Lawrence, 2003).

Survey results correspond to the known habitat types off west central Florida and the West Florida Shelf. Within the sand source re-route survey area, soft bottom/sand was the dominant characteristic, with some sporadic hard/live bottom areas found scattered throughout portions of the bay. Typically not covering large areas, these hard/live bottom communities support a variety of octocorals, sponges, hydroids, macroalgae, bryozoans, and various other invertebrate species.

5.0 LITERATURE CITED

Bohnsack, J.A. 1979. Photographic quantitative sampling of hard bottom communities. Bulletin of Marine Science 29(2):242-252.

Cobb, J. and J.M. Lawrence. 2003. Seasonal and spatial variation in algal composition and biomass on the Central Florida Gulf Coast Shelf. Gulf of Mexico Science 21(2):192-201.

CSA International, Inc. 2007. Attachment A.1: Terra Ceia re-route survey of marine benthic habitats within the proposed Port Dolphin pipeline corridor within Tampa Bay, Florida. In: Port Dolphin Energy LLC Deepwater Port License Application Addendum Project Design Changes and Corresponding Impacts, Port Dolphin Project, Tampa Bay, Florida.

Dawes, C.J. and J.M. Lawrence. 1990. Seasonal changes in limestone and plant communities off the Florida West Coast. Marine Ecology 11(2):97-104.

Dawes, C.J. and J.F. Van Breedveld. 1969. Memoirs of the Hourglass Cruises: Benthic marine algae. Volume 1: Part II. 47 pp.

Dawes, C.J., R.C. Phillips, and G. Morrison. 2004. Seagrass communities of the Gulf coast of Florida: Status and ecology. Florida Fish and Wildlife Conservation Commission Fish and Wildlife Research Institute and Tampa Bay Estuary Program, St. Petersburg, FL. 74 pp.

Jaap, W.C. and P. Hallock. 1990. Coral reefs in ecosystems of Florida, pp. 574-616. In: R.L. Myers and J.J. Ewel (eds). Ecosystems of Florida, University of Florida Press, Gainesville, FL.

Kohler, K.E. and S.M. Gill. 2006. Coral point count with excel extensions (CPCe): A visual basic program for the determination of coral and substrate coverage using random point count methodology. Computers and Geosciences 32:1,259-1,269.

Lewis, III, R.R. and E.D. Estevez. 1988. The ecology of Tampa Bay, Florida: An estuarine profile. U.S. Fish and Wildlife Service Biological Report 85:7.18. 132 pp.

Parker, R.O. Jr., D.R. Colby, and T.D. Willis. 1983. Estimated amount of reef habitat on a portion of the U.S. South Atlantic and Gulf of Mexico continental shelf. Bulletin of Marine Science 33(4):935-940.

Phillips, N., D. Gettleson, and K. Spring. 1990. Benthic biological studies of the Southwest Florida Shelf. American Zoologist 30:65-75.

Savercool, D.M. and R.R. Lewis, III. 1994. Hard bottom mapping of Tampa Bay. Prepared for Tampa Bay National Estuary Program. 14 pp.

Southwest Florida Water Management District. 1999. Tampa Bay Surface Water Improvement and Management (SWIM) Plan. SWIM Section, Tampa, FL. 108 pp.

APPENDIX

REPRESENTATIVE PHOTOGRAPHS OF DESIGNATED HABITAT TYPES AND OTHER FEATURES

Photo A-1. Representative quantitative photograph of Type A habitat from Dive Site A-1.

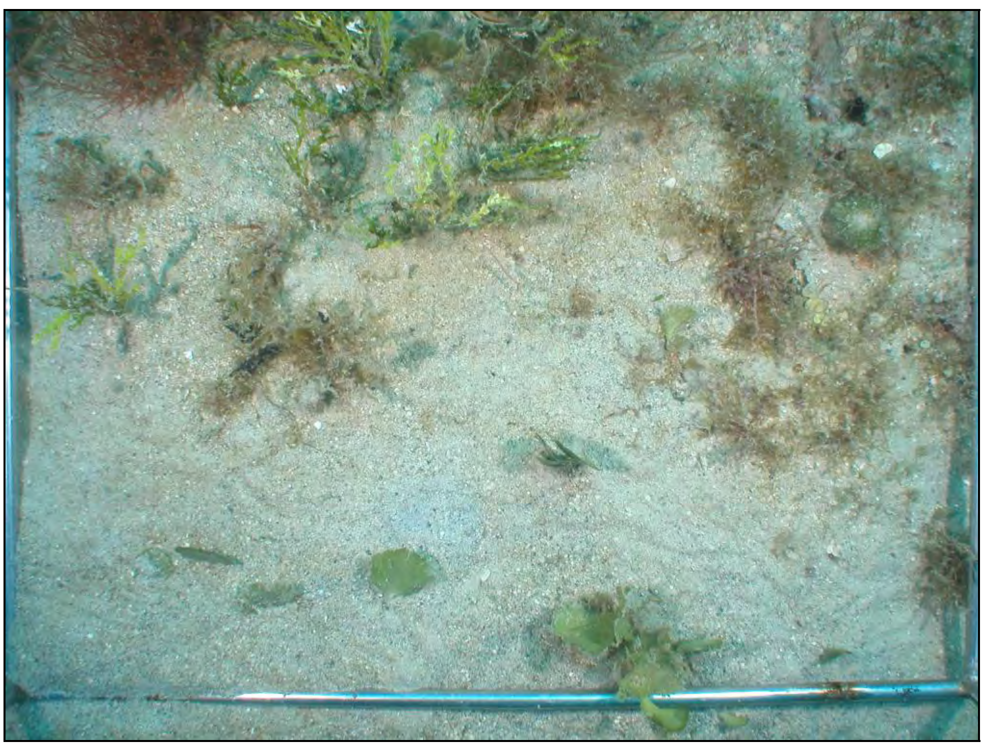


Photo A-2. Representative quantitative photograph of Type D habitat from Dive Site A-3.

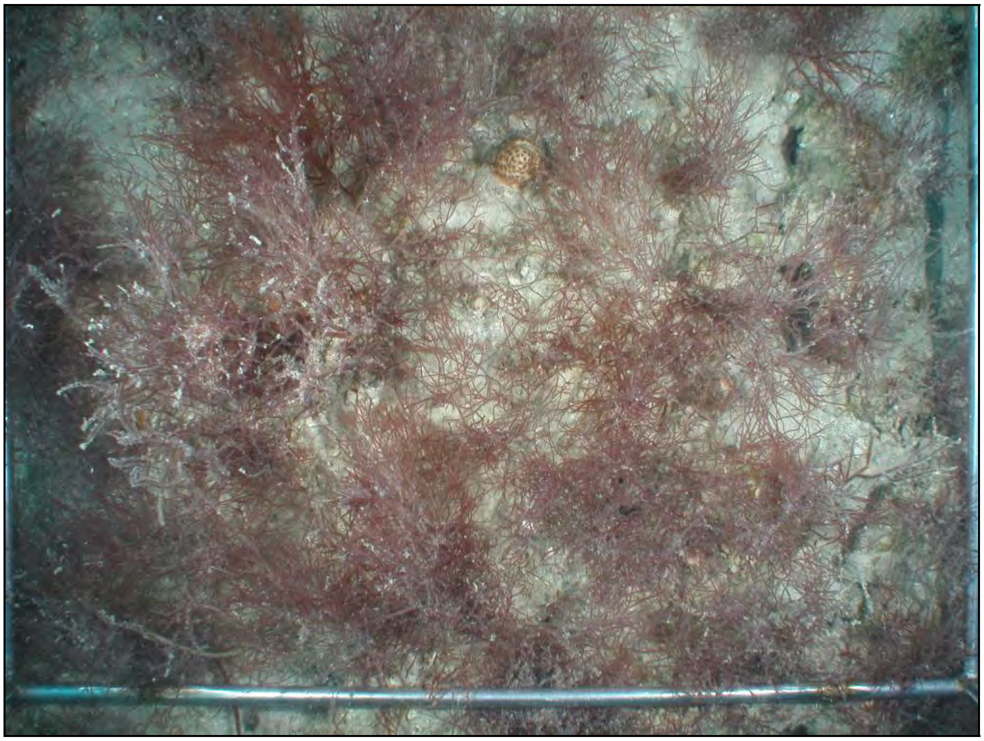


Photo A-3. Representative quantitative photograph of Type D habitat from Dive Site A-4.

Photo A-4. Representative quantitative photograph of Type A habitat from Dive Site A-5.

Photo A-5. Representative quantitative photograph of Type B habitat from Dive Site B-1.

Photo A-6. Representative quantitative photograph of Type D habitat from Dive Site B-2.

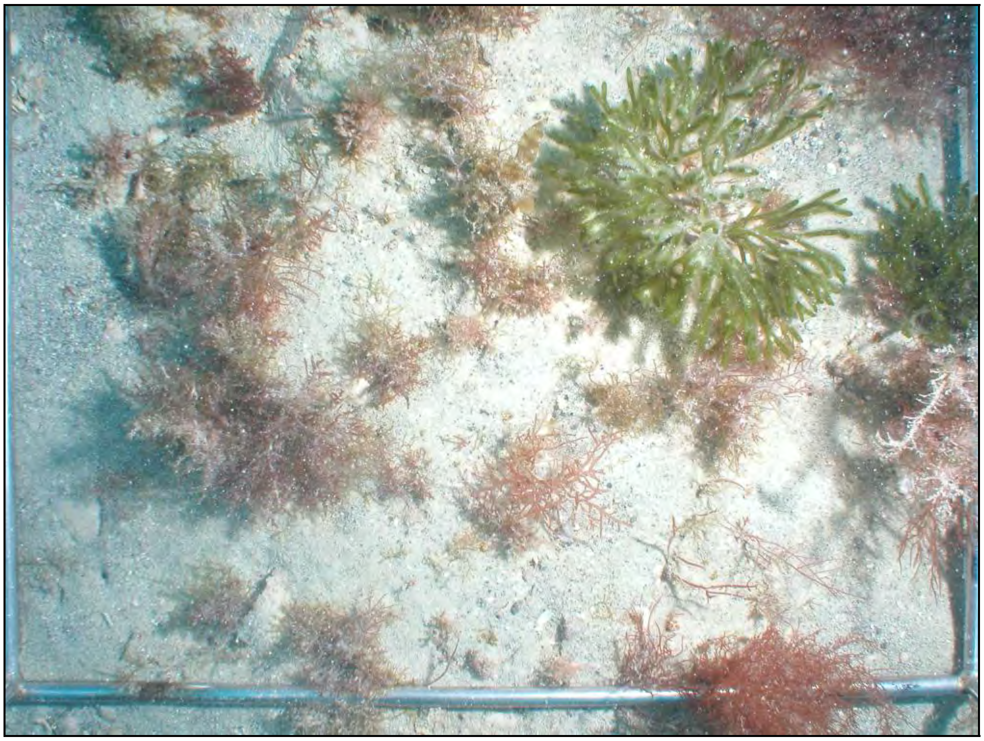


Photo A-7. Representative quantitative photograph of Type D habitat from Dive Site B-4.

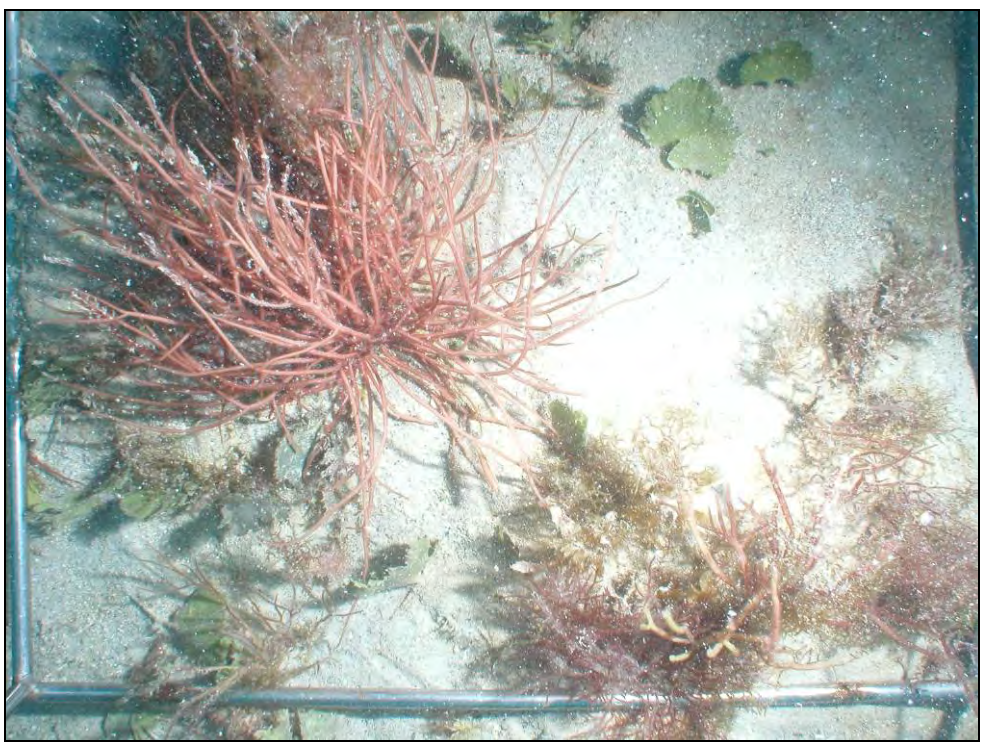


Photo A-8. Representative quantitative photograph of Type D habitat from Dive Site D-1.

PORT DOLPHIN DEEPWATER PORT
HILSBOROUGH / MANATEE COUNTY, FLORIDA
"ISSUED FOR USCG ADDENDUM II FILING"

DWG. NO.	REV.	DRAWING DESCRIPTION
26017-D-1005	0	COVER SHEET/DRAWING INDEX
26017-D-2001	2	PIPELINE ALIGNMENT SHEET NORTH FLOWLINE
26017-D-2002	2	PIPELINE ALIGNMENT SHEET SOUTH FLOWLINE
26017-D-2003	2	PIPELINE ALIGNMENT SHEET
26017-D-2004	2	PIPELINE ALIGNMENT SHEET
26017-D-2005	2	PIPELINE ALIGNMENT SHEET
26017-D-2006	2	PIPELINE ALIGNMENT SHEET
26017-D-2007	2	PIPELINE ALIGNMENT SHEET
26017-D-2031	2	PIPELINE ALIGNMENT SHEET
26017-D-2032	2	PIPELINE ALIGNMENT SHEET
26017-D-2033	2	PIPELINE ALIGNMENT SHEET
26017-D-2319	1	SKYWAY BRIDGE DREDGE DRAWING
26017-D-2320	0	PLAN & PROFILE SLICK BORE @ 31st TERRACE EAST
26017-D-2321	0	PLAN & PROFILE SLICK BORE @ BUCKEYE ROAD
26017-D-3503	0	PRECONSTRUCTION – PROPOSED CONCRETE PLANT LAYOUT
26017-D-4105	1	PLOT PLAN
26017-B-4331	1	TYPICAL CONCRETE MATTRESS INSTALLATION – SECTIONS & DETAILS
26017-A-4339	0	TRANSITION DETAIL WITH MATTRESSES – HDD EXIT @ WEST GULFSTREAM CROSSING
26017-A-4340	0	TRANSITION DETAIL WITH MATTRESSES – HDD ENTRY @ WEST GULFSTREAM CROSSING
26017-A-4341	0	TRANSITION DETAIL WITH MATTRESSES – HDD EXIT @ EAST GULFSTREAM CROSSING
26017-A-4342	0	TRANSITION DETAIL WITH MATTRESSES – HDD EXIT @ EAST GULFSTREAM CROSSING
26017-A-4343	0	TRANSITION DETAIL WITH MATTRESSES – HDD EXIT @ SHORE APPROACH
26017-A-7723	1	OFFSHORE PLOWED DITCH AND BACKFILL DETAIL

GENERAL NOTES

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REVISIONS

NO.	DATE	DESCRIPTION
A	12/03/08	ISSUED FOR REVIEW
0	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

REVISIONS

NO.	DATE	DESCRIPTION

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

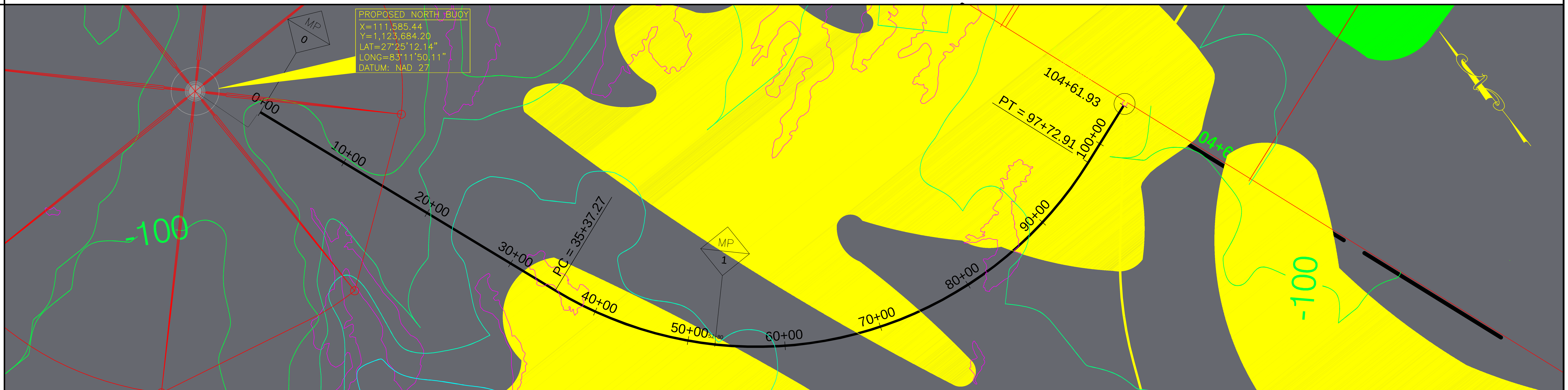
SCALE NTS
DRAWN HEW DATE 12/03/08
CHK'D DATE
APPROVED DATE
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-1005-0

TITLE
COVER SHEET
USCG ADDENDUM II FILING
PORT DOLPHIN PIPELINE
HILSBOROUGH / MANATEE COUNTY, FLORIDA

NO. 26017-D-1005 REV. 0

OWNERSHIP	FEDERAL WATER
RODDAGE	634.06 RODS
TERRAIN	WATER
STATIONING	0+00 MATCH LINE; 35+37.27 P.C.; 97+72.91 PT; 104+61.93 MATCH LINE

PLAN



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TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

NORTH PLEM STA 0+00

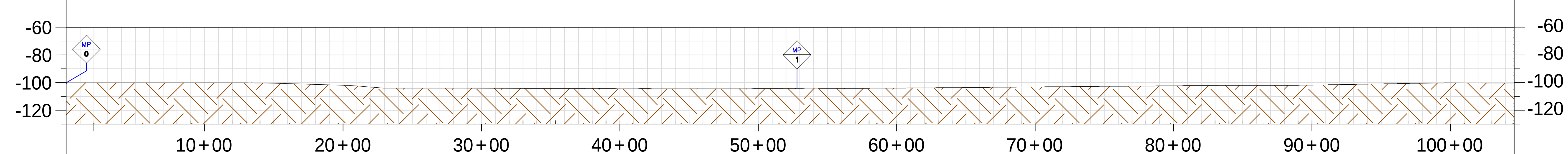
BURIAL METHOD = MATTRESS

BURIAL METHOD = MATTRESS

PROPOSED PORT DOLPHIN PIPELINE

MATCH LINE STA 104+61.93 SEE DRAWING NO 26017-D-2003

PROFILE



EASEMENT WORKSPACE N.T.S.

PERM. EASEMENT

TEMP. EASEMENT

ADDITIONAL TEMP. WORK SPACE

STA 0+00 — 1500' — 200' EASEMENT — 3000' PIPELINE SURVEY CORRIDOR

200' EASEMENT — 3000' PIPELINE SURVEY CORRIDOR — 1500' — STA 104+61.93

(1" = 500' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	10,550	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING
2	12/10/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
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BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 500'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED MM	DATE 12/10/08
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2001-2	

PortDolphin

TITLE

ALIGNMENT SHEET 0+00 TO 104+61.93
NORTH FLOW LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

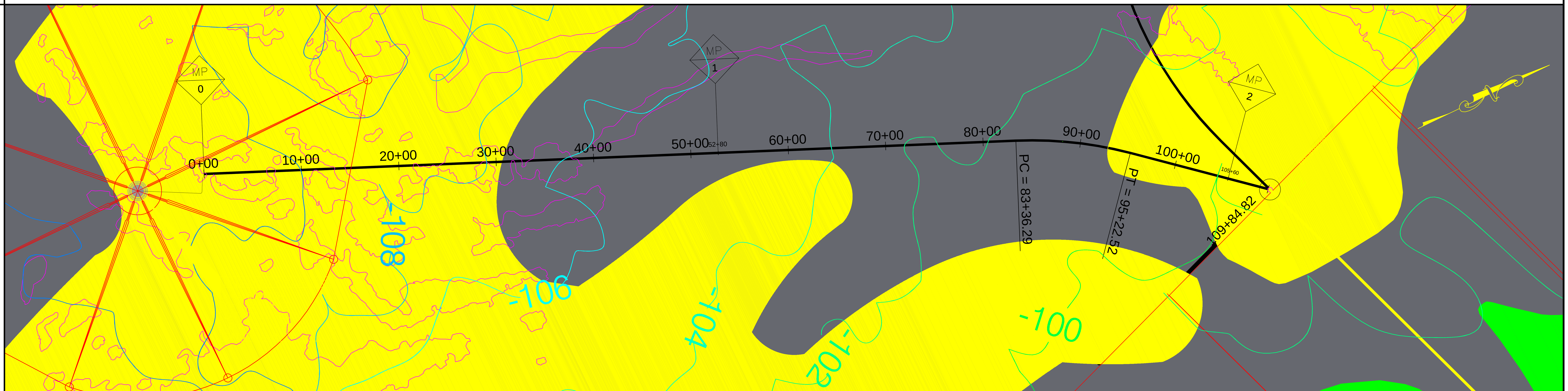
NO. 26017-D-2001 REV. 2

OWNERSHIP	FEDERAL WATER
RODDAGE	665.75
TERRAIN	WATER

STATIONING

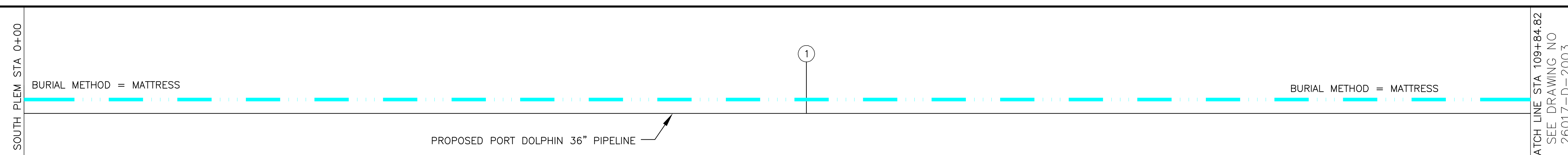
0+00 MATCH LINE | 83+36.29 P.C. | 95+22.52 P.T. | 109+84.82 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND



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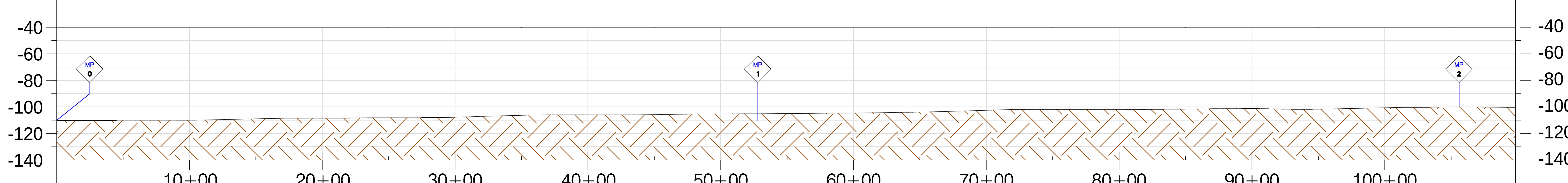

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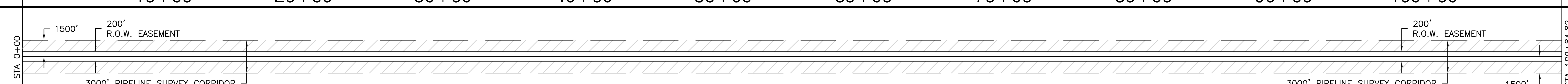
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE



(1" = 500' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD; FEDERAL HIGHWAY; STATE HIGHWAY; EQUATION; MILE POST; WARNING SIGN; U.S. HIGHWAY; COUNTY ROAD; ROAD SIGN; TREE; POWER POLE; WATER METER; VENT PIPE; FOREIGN PIPELINE; POWER LINE; FENCE; UNDERGROUND CABLE; WATER LINE; TELEPHONE LINE; GAS LINE; EXISTING MANHOLE; IRON ROD; PROPOSED PIPELINE; COUNTY LINE; TOWNSHIP & RANGE; CITY LIMITS; RIGHT-OF-WAY LINE; RIVER/STREAM; ℄ ROAD; ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	11,000	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	FINAL ISSUE FOR FILING
1	11/29/07	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

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HOUSTON, TEXAS 77040
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FAX: (713) 690-0060

DRAWING STATUS

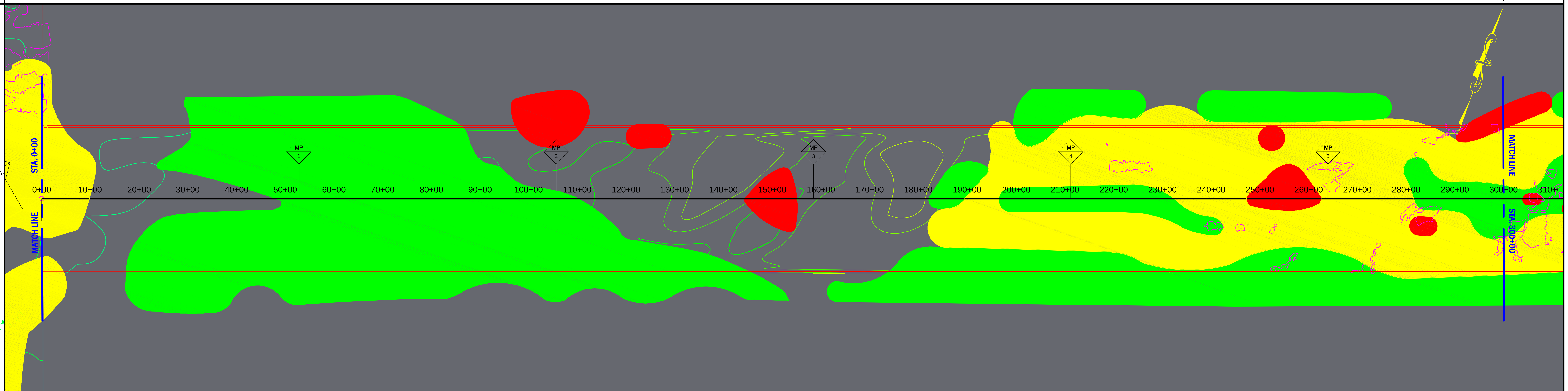
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 500'	
DRAWN EHF	DATE 3/5/07
CHK'D DJR	DATE 11/29/07
APPROVED MM	DATE 12/10/08
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-2002-2	

PortDolphin

TITLE: ALIGNMENT SHEET 0+00 TO 109+84.82
SOUTH FLOW LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2002 REV. 2

OWNERSHIP	FEDERAL WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	0+00 MATCH LINE ... 300+00 MATCH LINE
PLAN	
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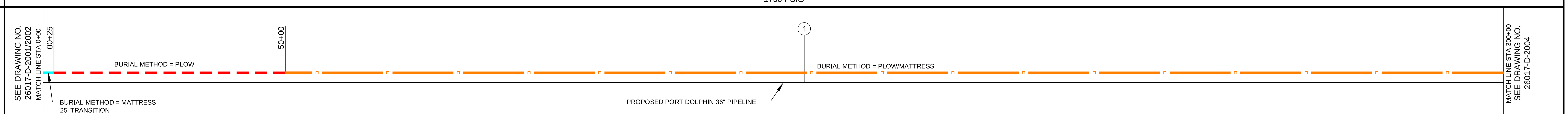
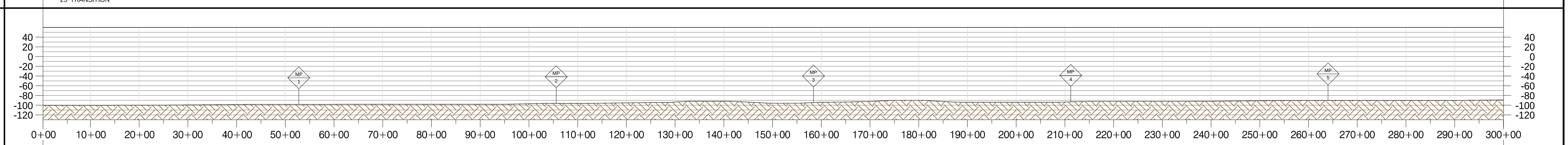
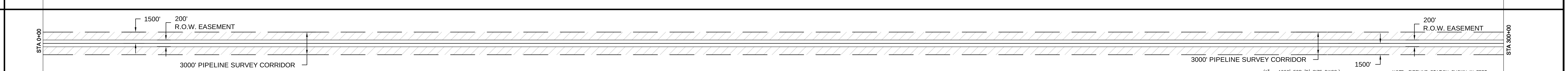
PIPE BAND	
PROFILE HORT. SCALE: 1" = 1000' VERT. SCALE: 1" = 100'	
EASEMENT WORKSPACE N.T.S. PERM. EASEMENT TEMP. EASEMENT ADDITIONAL TEMP. WORK SPACE	

(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD		U.S. HIGHWAY		FOREIGN PIPELINE		EXISTING MANHOLE	
FEDERAL HIGHWAY		COUNTY ROAD		POWER LINE		IRON ROD	
STATE HIGHWAY		ROAD SIGN		FENCE		PROPOSED PIPELINE	
EQUATION		TREE		UNDERGROUND CABLE		COUNTY LINE	
MILE POST		POWER POLE		WATER LINE		TOWNSHIP & RANGE	
WARNING SIGN		WATER METER		TELEPHONE LINE		CITY LIMITS	
		VENT PIPE		GAS LINE		RIGHT-OF-WAY LINE	
						RIVER/STREAM	
						℄ ROAD	
						℄ RR TRACKS	

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

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BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2003-2	

PortDolphin

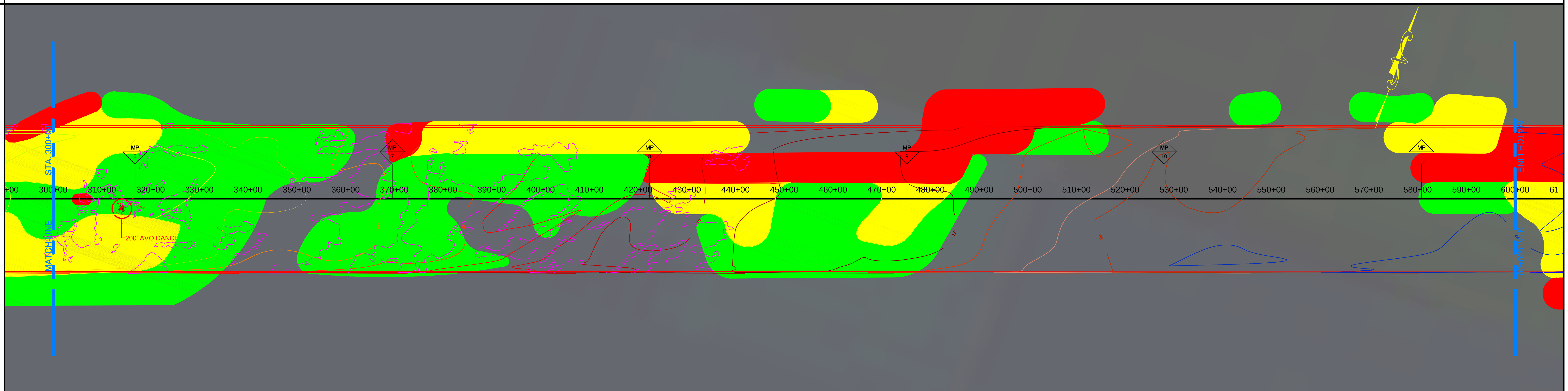
TITLE
ALIGNMENT SHEET 0+00 TO 300+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2003

REV. 2

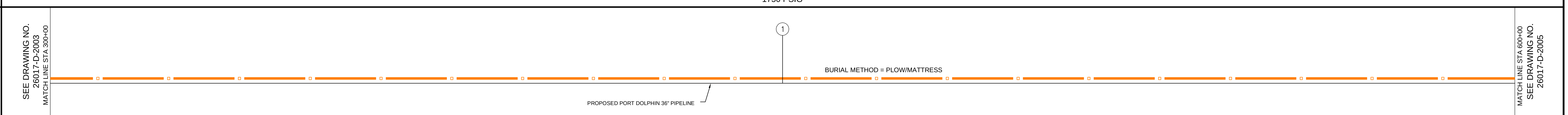
OWNERSHIP	FEDERAL WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	300+00 MATCH LINE; 314+09.58 AVOIDANCE AREA; 600+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND



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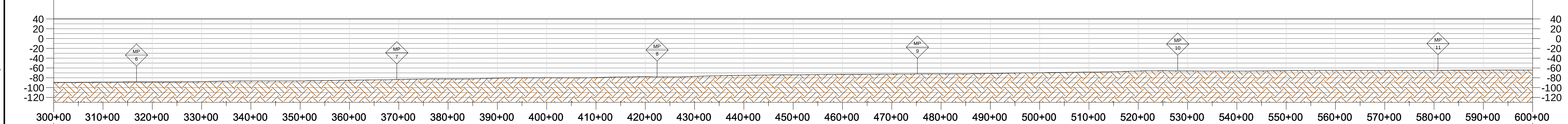
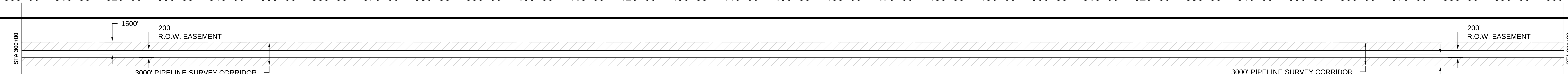


EASEMENT WORKSPACE
N.T.S.
PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE



(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2004-2	

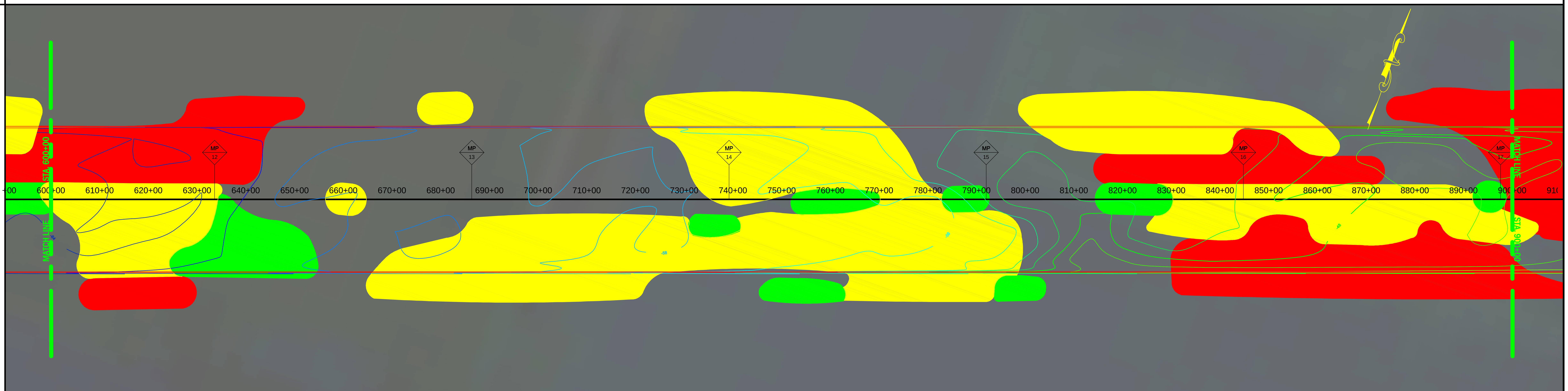
PortDolphin

TITLE
ALIGNMENT SHEET 300+00 TO 600+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2004 REV. 2

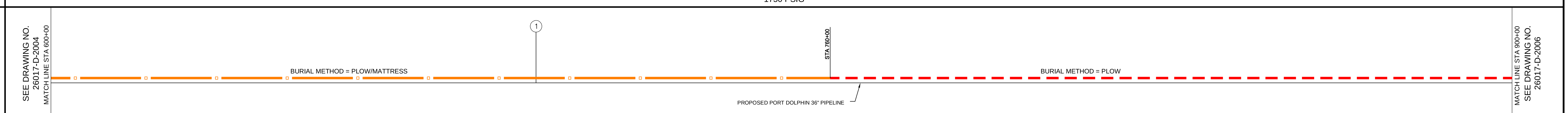
OWNERSHIP	FEDERAL WATER
RODDAGE	1818.18 RODS
TERRAIN	WATER
STATIONING	600+00 MATCHLINE … 900+00 MATCHLINE

PLAN

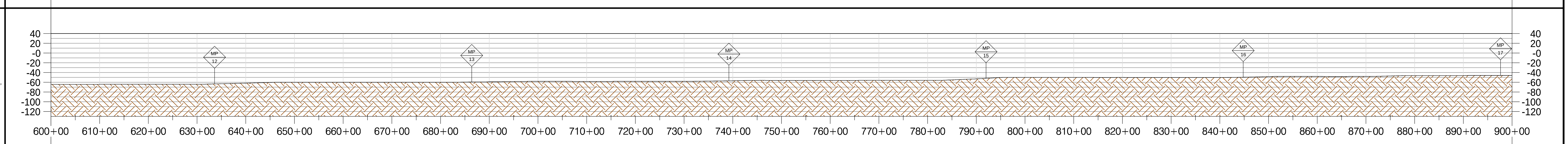


CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

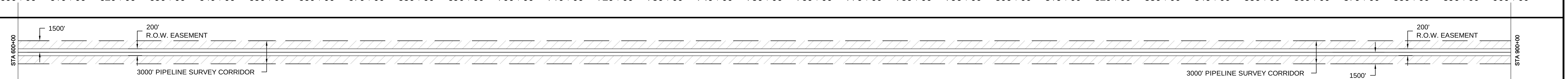


PROFILE
HORT. SCALE: 1" = 1000'
VERT. SCALE: 1" = 100'



EASEMENT WORKSPACE

PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE



LEGEND

TEST LEAD
FEDERAL HIGHWAY
STATE HIGHWAY
EQUATION
MILE POST
WARNING SIGN
U.S. HIGHWAY
COUNTY ROAD
ROAD SIGN
TREE
POWER POLE
WATER METER
VENT PIPE
FOREIGN PIPELINE
POWER LINE
FENCE
UNDERGROUND CABLE
WATER LINE
TELEPHONE LINE
GAS LINE
EXISTING MANHOLE
IRON ROD
PROPOSED PIPELINE
COUNTY LINE
TOWNSHIP & RANGE
CITY LIMITS
RIGHT-OF-WAY LINE
RIVER/STREAM
℄ ROAD
℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2005-2	

PortDolphin

TITLE
ALIGNMENT SHEET 600+00 TO 900+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

NO. 26017-D-2005 REV. 2

OWNERSHIP	FEDERAL WATER	STATE WATER
RODDAGE	142.49 RODS	1675.69 RODS
TERRAIN	WATER	

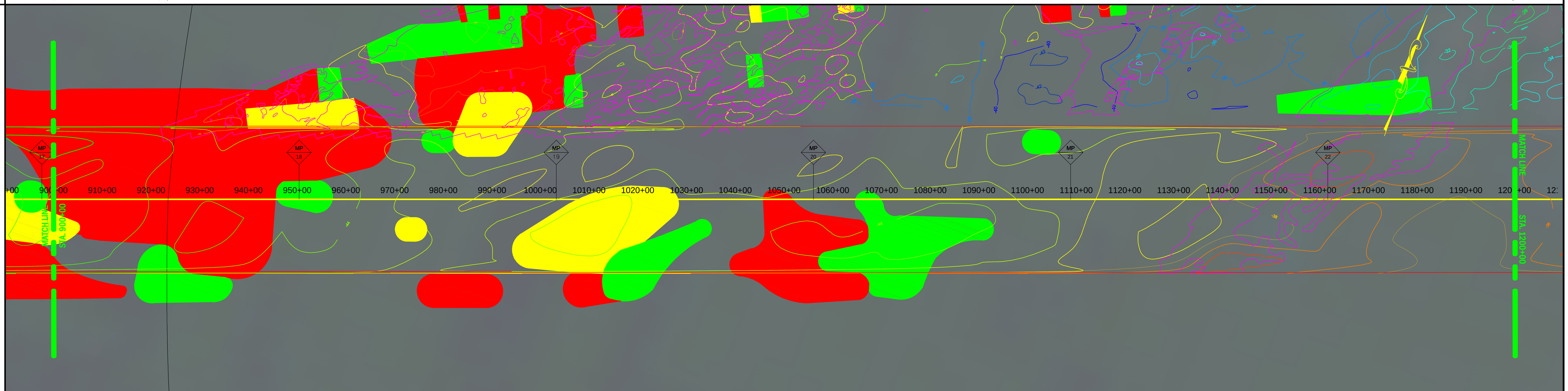
STATIONING

900+00 MATCH LINE

923+51.05 3 LEAGUE LINE FEDERAL/STATE LINE

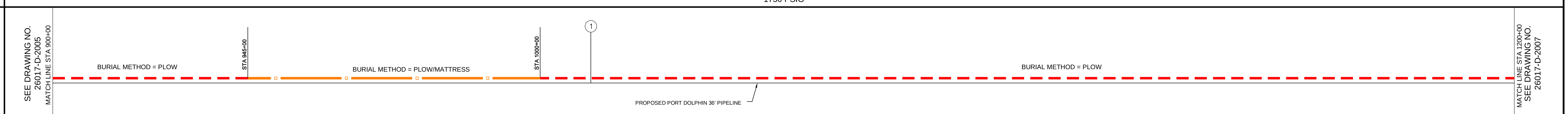
1200+00 MATCH LINE

PLAN

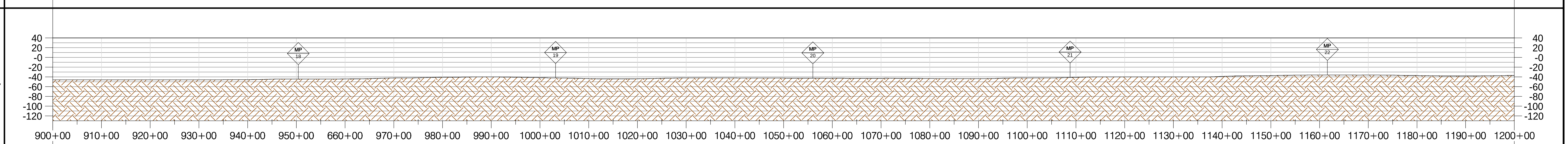


CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

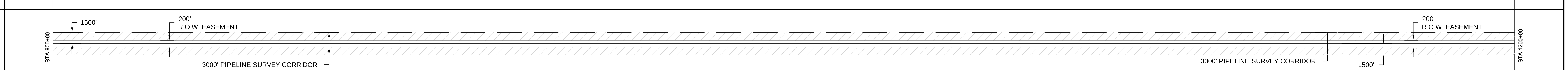
PIPE BAND



PROFILE
HORT. SCALE: 1" = 1000'
VERT. SCALE: 1" = 100'



EASEMENT WORKSPACE
N.T.S.
PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE



(1" = 1000' FOR 'D' SIZE DWGS.)

NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	30,000'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 3/5/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2006-2	

PortDolphin

TITLE ALIGNMENT SHEET 900+00 TO 1200+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
GULF OF MEXICO, ST. PETERSBURG AREA

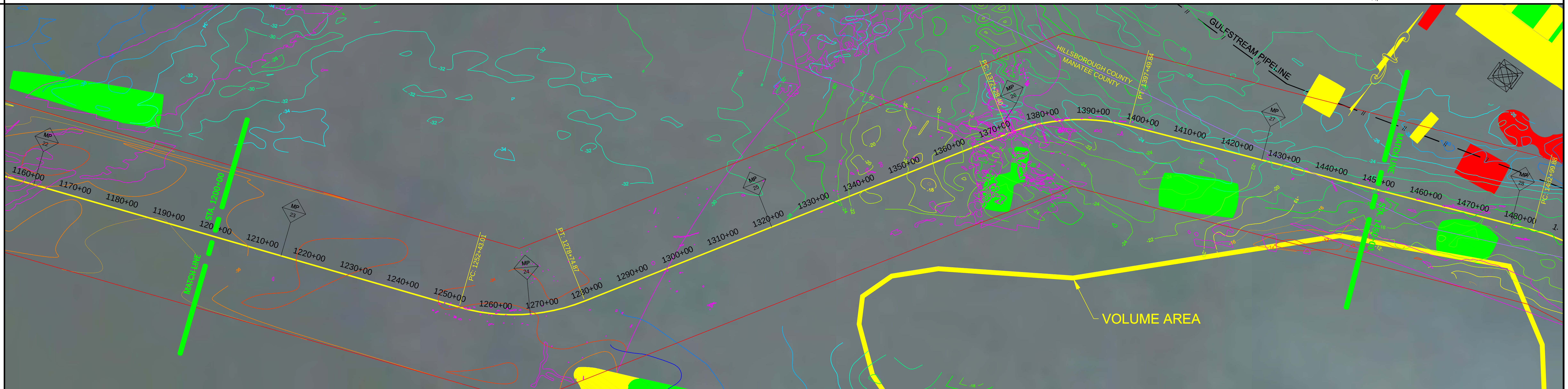
NO. 26017-D-2006 REV. 2

OWNERSHIP		MANATEE COUNTY	HILLSBOROUGH COUNTY	
RODDAGE		1433.6 RODS	81.6 RODS	
TERRAIN	WATER			

STATIONING

1200+00 MATCH LINE
1252+43.01 PC
1278+74.87 PT
1372+28.40 PC
1397+49.84 PT
1436+54.20 MANATEE COUNTY TO HILLSBOROUGH COUNTY
1450+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO 26017-D-2006
MATCH LINE STA 1200+00

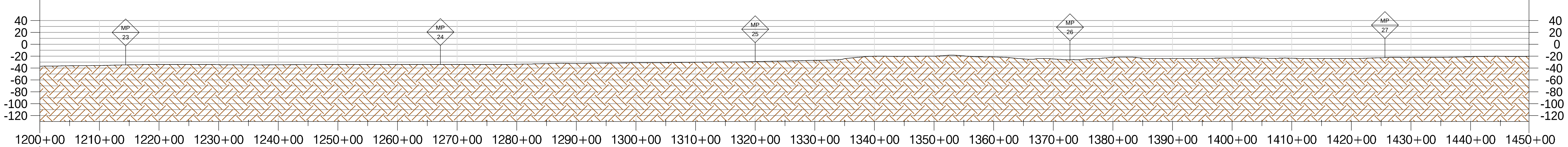
BURIAL METHOD = PLOW

BURIAL METHOD = PLOW

PROPOSED PORT DOLPHIN 36" PIPELINE

MATCH LINE STA 1450+00
SEE DRAWING NO 26017-D-2031

PROFILE
HORT. SCALE: 1" = 1000'
VERT. SCALE: 1" = 100'



EASEMENT WORKSPACE
N.T.S.
PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 1200+00
1500'
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR

200' R.O.W. EASEMENT
1500'
3000' PIPELINE SURVEY CORRIDOR
(1" = 1000' FOR 'D' SIZE DWGS.)
STA 1450+00
NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD
FEDERAL HIGHWAY
STATE HIGHWAY
EQUATION
MILE POST
WARNING SIGN
U.S. HIGHWAY
COUNTY ROAD
ROAD SIGN
TREE
POWER POLE
WATER METER
VENT PIPE
FOREIGN PIPELINE
POWER LINE
FENCE
UNDERGROUND CABLE
WATER LINE
TELEPHONE LINE
GAS LINE
EXISTING MANHOLE
IRON ROD
PROPOSED PIPELINE
COUNTY LINE
TOWNSHIP & RANGE
CITY LIMITS
RIGHT-OF-WAY LINE
RIVER/STREAM
℄ ROAD
℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	25,000'	36.0" O.D. X 0.750" W.T. API 5L, X-60 PIPE
		W/ 14-16 MILS FBE, CONCRETE COATING 4.5",
		DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	9/10/07	ISSUED FOR FILING
1	11/28/07	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS - BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 9/10/07
CHK'D BJ	DATE 11/29/07
APPROVED IAN	DATE 11/29/07
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2007-2	

PortDolphin

TITLE
ALIGNMENT SHEET 1200+00 TO 1450+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
MANATEE COUNTY / HILLSBOROUGH COUNTY, FL

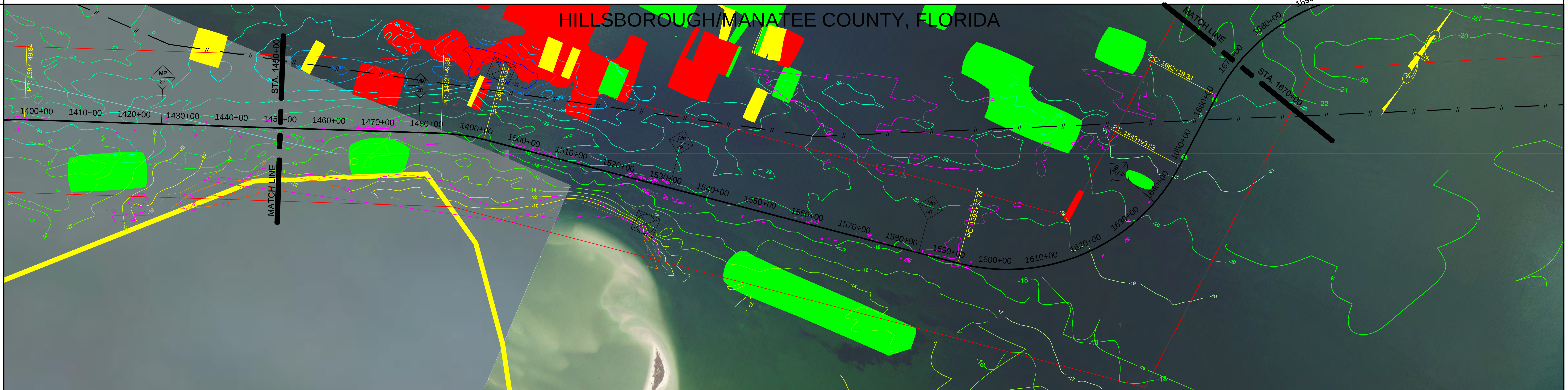
NO. 26017-D-2007
REV. 2

OWNERSHIP		HILLSBOROUGH COUNTY	MANATEE COUNTY	HILLSBOROUGH COUNTY	
RODDAGE		324.9 RODS	879.3 RODS	129.2 RODS	
TERRAIN	WATER				

STATIONING

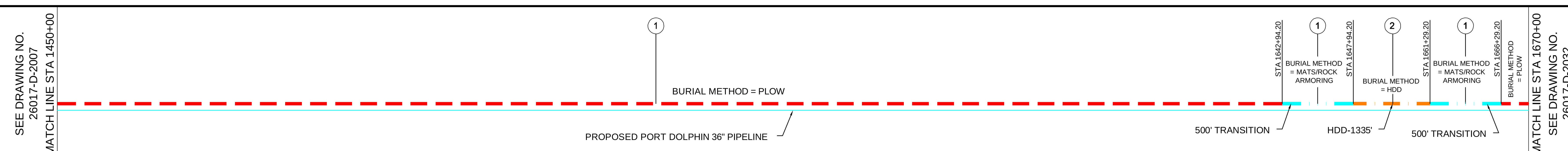
1450+00 MATCH LINE
1482+99.88 PC
1491+90.56 PT
1503+61.01 HILLSBOROUGH / MANATEE COUNTY
1592+35.74 PC
1645+95.83 PT
1647+94.20 EXIT
1648+69.20 MANATEE / HILLSBOROUGH COUNTY
1656+54.24 GULFSTREAM PIPELINE CROSSING
1661+29.20 DRILL ENTRY
1662+19.31 PC
1670+00 MATCH LINE

PLAN

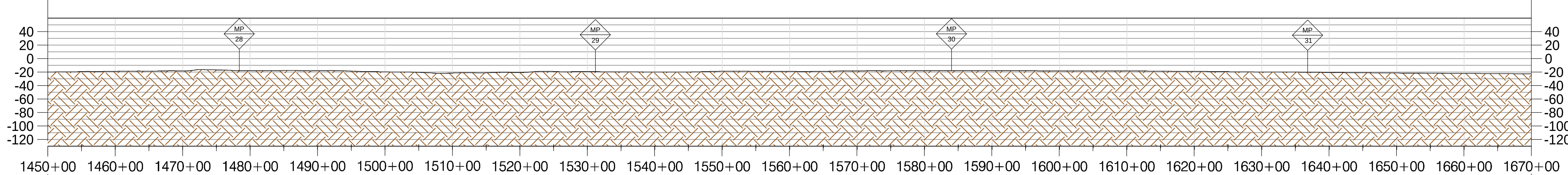


CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

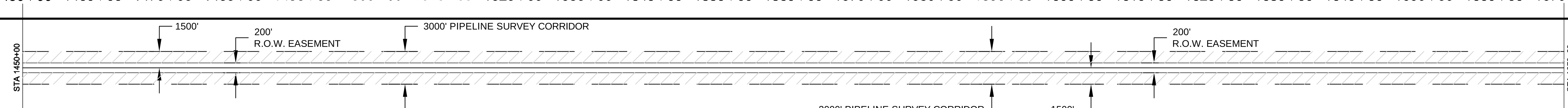
PIPE BAND



PROFILE
HORT. SCALE: 1" = 1000'
VERT. SCALE: 1" = 100'



EASEMENT WORKSPACE
N.T.S.
PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE



(1" = 1000' FOR 'D' SIZE DWGS.) NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD	U.S. HIGHWAY	FOREIGN PIPELINE	EXISTING MANHOLE
FEDERAL HIGHWAY	COUNTY ROAD	POWER LINE	IRON ROD
STATE HIGHWAY	ROAD SIGN	FENCE	PROPOSED PIPELINE
EQUATION	TREE	UNDERGROUND CABLE	COUNTY LINE
MILE POST	POWER POLE	WATER LINE	TOWNSHIP & RANGE
WARNING SIGN	WATER METER	TELEPHONE LINE	CITY LIMITS
	VENT PIPE	GAS LINE	RIGHT-OF-WAY LINE
			RIVER/STREAM
			℄ ROAD
			℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	20,665'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS
2	1,335'	36.0" O.D. X 0.875" W.T. API 5L, X-60 DSAW
		PIPE W/ 14-16 MILS FBE, DOUBLE RANDOM

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/24/08	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 11/24/08
CHK'D DJR	DATE 12/12/08
APPROVED	DATE
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO.	

PortDolphin

TITLE ALIGNMENT SHEET 1450+00 TO 1670+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
HILLSBOROUGH/MANATEE COUNTIES, FL

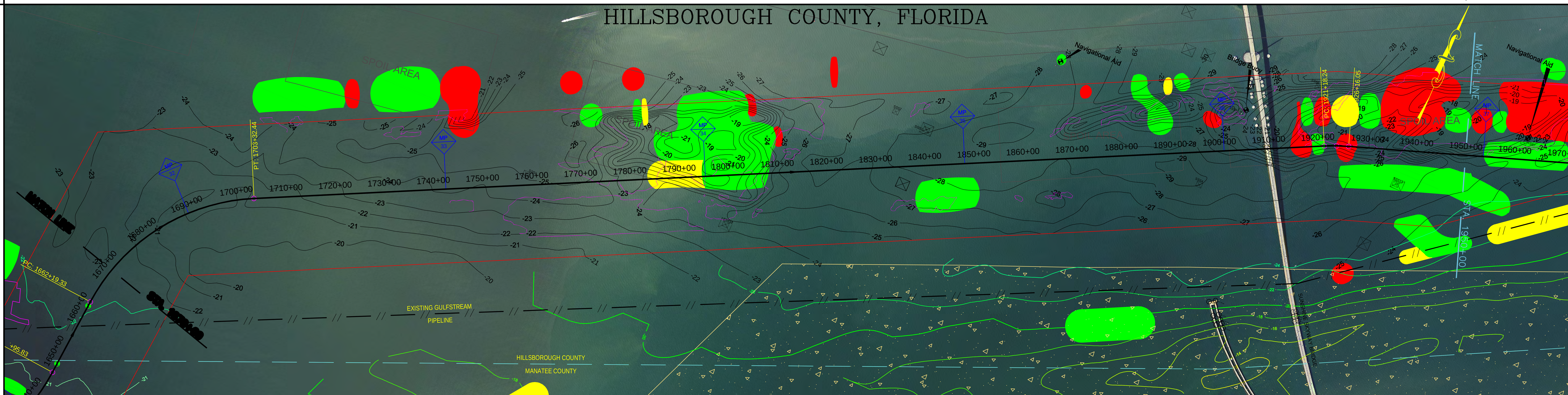
NO. 26017-D-2031 REV. 2

OWNERSHIP	HILLSBOROUGH COUNTY
RODDAGE	1697.0 RODS
TERRAIN	WATER

STATIONING

1670+00 MATCH LINE
1703+32.44 PT
1909+17.51 BEGIN SKYWAY BRIDGE
1910+21.69 END SKYWAY BRIDGE
1921+18.24 PC
1926+16.05 PT
1950+00 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO. 26017-D-2031
MATCH LINE STA 1670+00

(1) BURIAL METHOD = PLOW

PROPOSED PORT DOLPHIN 36" PIPELINE

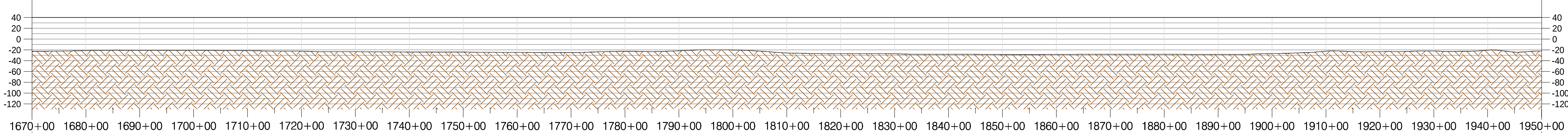
(1) BURIAL METHOD = PLOW

STA 1905+09.38 (3) BURIAL METHOD =CLAMSHELL DREDGING STA 1916+13.86

(1) BURIAL METHOD = PLOW

MATCH LINE STA 1950+00
SEE DRAWING NO. 26017-D-2033

PROFILE
HORT. SCALE: 1" = 1000'
VERT. SCALE: 1" = 100'



EASEMENT WORKSPACE
N.T.S.
PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 1670+00
1500'
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR
STA 1950+00
(1" = 1000' FOR 'D' SIZE DWGS.)
NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD · FEDERAL HIGHWAY · STATE HIGHWAY · EQUATION · MILE POST · WARNING SIGN · U.S. HIGHWAY · COUNTY ROAD · ROAD SIGN · TREE · POWER POLE · WATER METER · VENT PIPE · FOREIGN PIPELINE · POWER LINE · FENCE · UNDERGROUND CABLE · WATER LINE · TELEPHONE LINE · GAS LINE · EXISTING MANHOLE · IRON ROD · PROPOSED PIPELINE · COUNTY LINE · TOWNSHIP & RANGE · CITY LIMITS · RIGHT-OF-WAY LINE · RIVER/STREAM · ℄ ROAD · ℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	26,895'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS
3	1,105'	36.0" O.D. X 0.875" W.T. API 5L, X-60 DSAW
		PIPE, W/ 14-16 MILS FBE, CONCRETE COATING 4.5",
		DOUBLE RANDOM JOINTS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/25/08	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 11/25/08
CHK'D DJR	DATE 12/12/08
APPROVED	DATE
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2032-2	

PortDolphin

TITLE ALIGNMENT SHEET 1670+00 TO 1950+00
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
HILLSBOROUGH COUNTY, FL

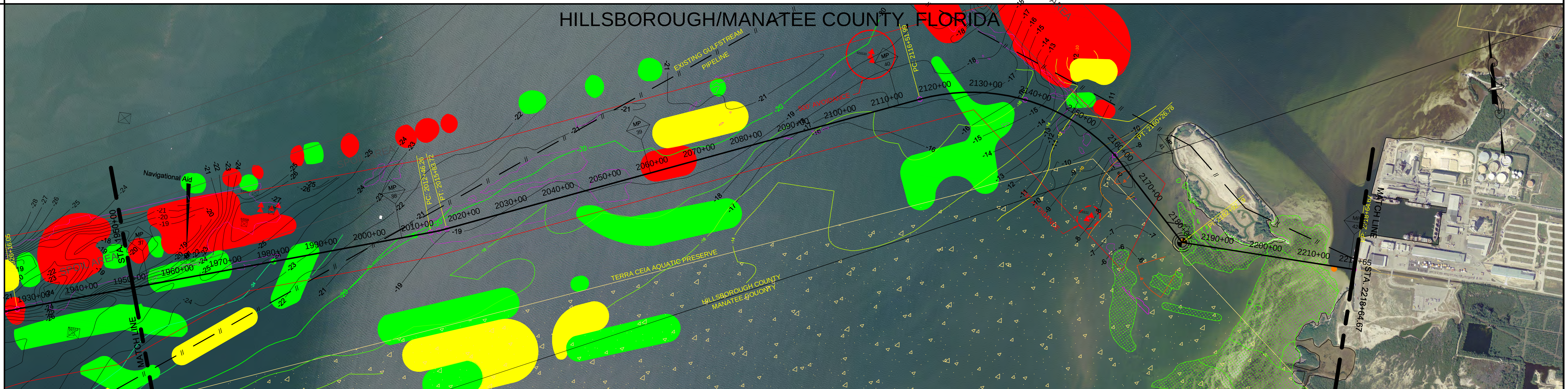
NO. 26017-D-2032 REV. 2

OWNERSHIP		HILLSBOROUGH COUNTY	MANATEE COUNTY	
RODDAGE		1292.4 RODS	335.7 RODS	
TERRAIN	WATER			

STATIONING

1950+00 MATCH LINE
1979+68.67 HDD EXIT
2002+20.21 GULFSTREAM PIPELINE CROSSING
2009+15.36 HDD ENTRY
2012+46.26 PC
2015+83.72 PT
2116+51.99 PC
2160+26.78 PT
2163+25.23 HILLSBOROUGH TO MANATEE COUNTY
2182+92.19 PI HDD EXIT
2218+64.67 MATCH LINE

PLAN



CLASS LOCATION	1
TEST PRESSURE	2188 PSIG
MAOP	1750 PSIG

PIPE BAND

SEE DRAWING NO. 26017-D-2032 MATCH LINE STA 1950+00

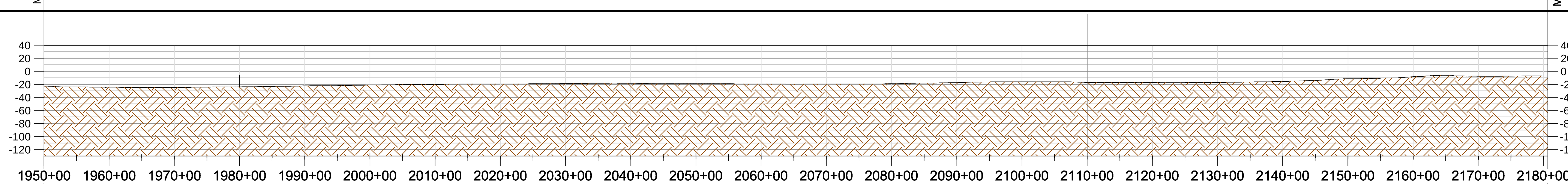
STA 1974+68.67 | STA 1979+68.67 | STA 2009+15.36 | STA 2014+15.36 | STA 2139+08.19 | STA 2177+92.19 | STA 2182+92.19

(1) BURIAL METHOD = PLOW
(2) BURIAL METHOD = DRILL
(1) BURIAL METHOD = PLOW
(1) BURIAL METHOD = MATTRESS / ROCK AMORING
(2) BURIAL METHOD = DRILL

500' TRANSITION SPOOL
TOTAL HDD LENGTH-2947'
500' TRANSITION SPOOL
PROPOSED PORT DOLPHIN 36" PIPELINE
500' TRANSITION SPOOL
TOTAL HDD LENGTH-4900'
HDD-3572.48' TO BULKHEAD

MATCHLINE STA 2218+64.67 SEE DRAWING NO. 26017-D-2022 MATCHLINE STA 0+00

PROFILE
HORT. SCALE: 1" = 1000'
VERT. SCALE: 1" = 100'



EASEMENT WORKSPACE
N.T.S.
PERM. EASEMENT
TEMP. EASEMENT
ADDITIONAL TEMP. WORK SPACE

STA 1950+00
1500'
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR
200' R.O.W. EASEMENT
3000' PIPELINE SURVEY CORRIDOR
1500'
STA 2218+64.67

(1" = 1000' FOR 'D' SIZE DWGS.)
NOTE: PIPELINE STATION SHOWN IN FEET

LEGEND

TEST LEAD
FEDERAL HIGHWAY
STATE HIGHWAY
EQUATION
MILE POST
WARNING SIGN
U.S. HIGHWAY
COUNTY ROAD
ROAD SIGN
TREE
POWER POLE
WATER METER
VENT PIPE
FOREIGN PIPELINE
POWER LINE
FENCE
UNDERGROUND CABLE
WATER LINE
TELEPHONE LINE
GAS LINE
EXISTING MANHOLE
IRON ROD
PROPOSED PIPELINE
COUNTY LINE
TOWNSHIP & RANGE
CITY LIMITS
RIGHT-OF-WAY LINE
RIVER/STREAM
℄ ROAD
℄ RR TRACKS

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION
1	20,345'	36.0" O.D. X 0.750" W.T. API 5L, X-60
		PIPE W/ 14-16 MILS FBE, CONCRETE
		COATING 4.5", DOUBLE RANDOM JOINTS
2	6,520'	36.0" O.D. X 0.875" W.T. API 5L, X-60 DSAW
		PIPE, W/ 14-16 MILS FBE, DOUBLE RANDOM
		JOINTS W/ 22-30 MILS ARO

MATERIAL SUMMARY

MK. NO.	QTY.	DESCRIPTION

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
0	3/5/07	ISSUED FOR FILING
1	11/25/08	ISSUED FOR ADDENDUM FILING
2	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1" = 1000'	
DRAWN EHF	DATE 11/25/08
CHK'D DJR	DATE 12/12/08
APPROVED	DATE
PESI JOB NO.	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-2033-2	

PortDolphin

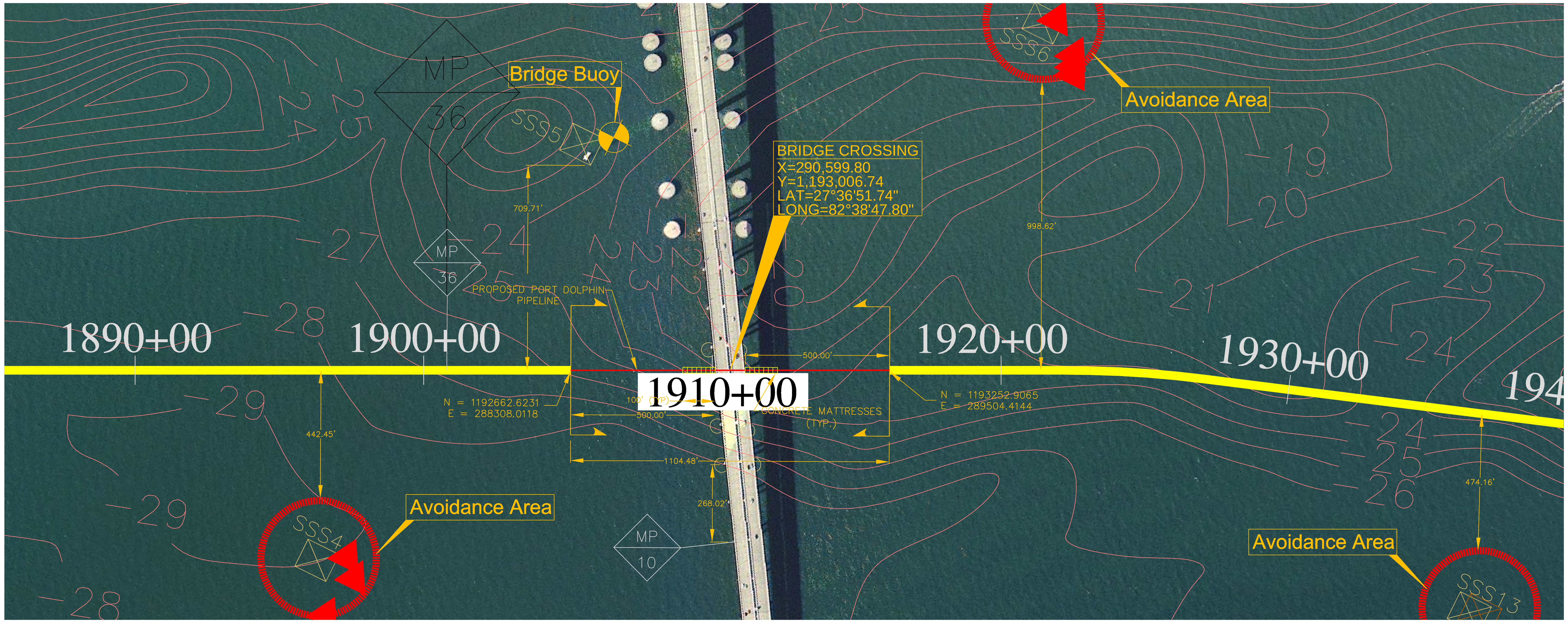
TITLE: ALIGNMENT SHEET 1950+00 TO 2218+64.67
TRANSMISSION LINE
PORT DOLPHIN DEEPWATER PORT
HILLSBOROUGH COUNTY / MANATEE COUNTY, FL

NO. 26017-D-2033 REV. 2

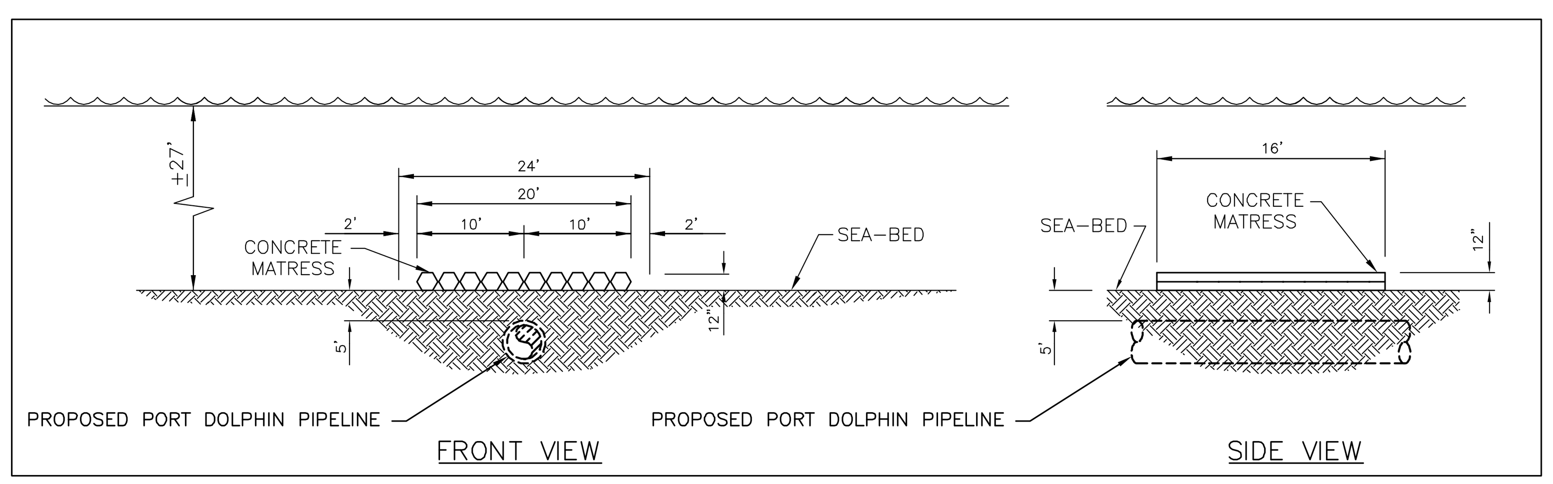
MANATEE COUNTY, FLORIDA

PORT DOLPHIN PIPELINE

SUNSHINE SKYWAY BRIDGE



PLAN
SCALE: 1"=200'



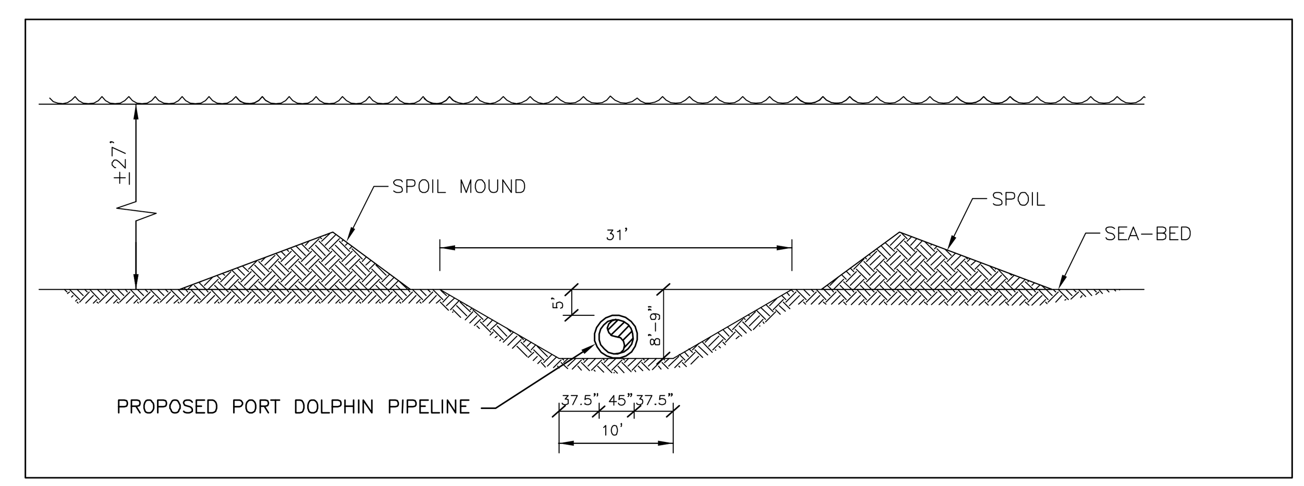
TYPICAL OFFSHORE PIPELINE DETAIL
SCALE: N.T.S.

STA. 1905+09 OPEN CUT EXIT

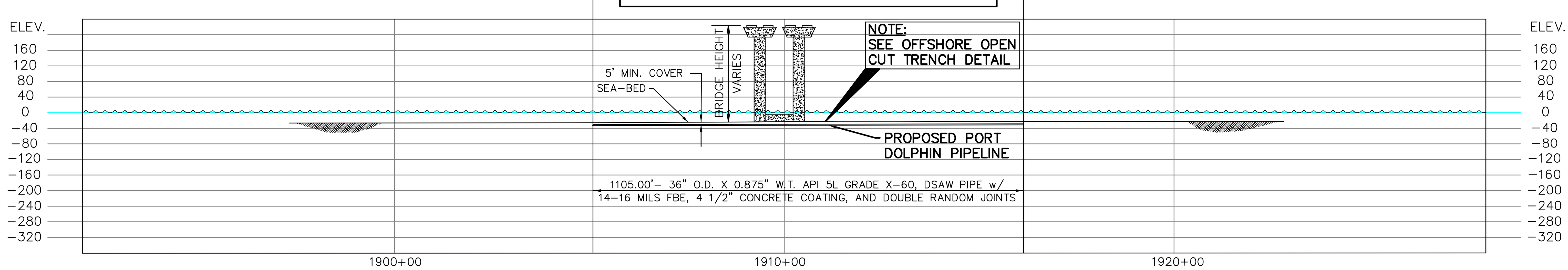
NOTE:
THE LOCATION OF THE GULFSTREAM 36" PIPELINE WILL BE FIELD VERIFIED PRIOR TO CONSTRUCTION

VERTICAL DATUM: (NGVD 1929) HORIZONTAL DATUM: (NAD 27 (1999 ADJUSTMENT))

STA. 1916+13 OPEN CUT ENTRY



TYPICAL OFFSHORE OPEN CUT TRENCH DETAIL
SCALE: N.T.S.



PROFILE
SCALE: 1"=200'

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
					A	7/11/08	ISSUED FOR INFORMATION			
					0	10/30/08	ISSUED FOR ERP DRAFT APPLICATION			
					1	12/09/08	ISSUED FOR USCG ADDENDUM II FILING			

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

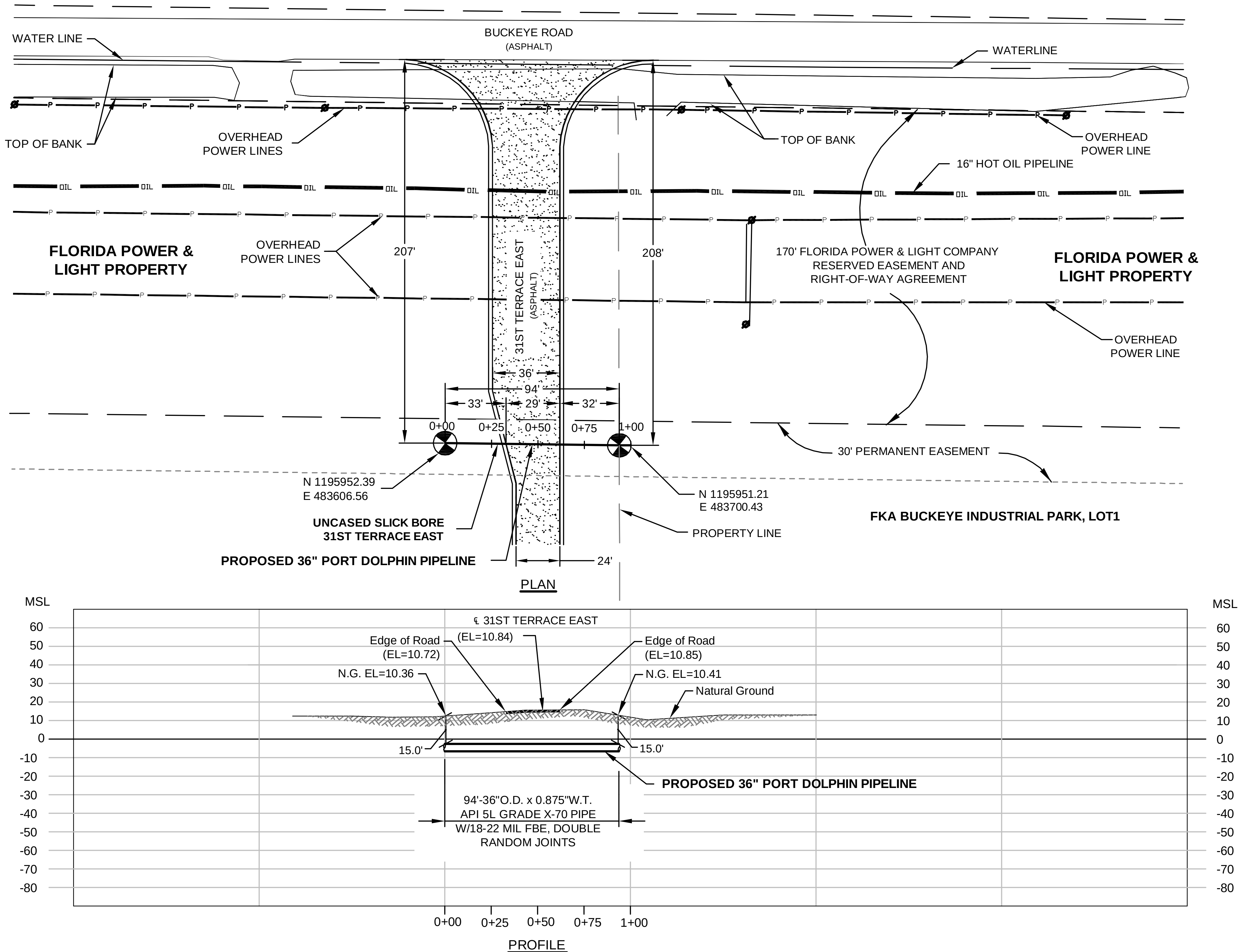
DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1"=200'
DRAWN B.J. DATE 7/11/08
CHK'D DJR DATE 10/30/08
APPROVED MM DATE 12/09/08
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-2319-1

PortDolphin

TITLE
SUNSHINE SKYWAY BRIDGE CROSSING
OPEN CUT DETAIL
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-D-2319 REV. 1



NOTES:

SLICK BORE DESIGNED USING BEST AVAILABLE DATA AND IS SUBJECT TO CHANGE PENDING RESULTS OF THE SURVEY

REFERENCE DRAWINGS		REVISIONS		
DWG. NO.	DESCRIPTION	NO	DATE	DESCRIPTION
		A	07/28/08	ISSUED FOR REVIEW
		0	12/08/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

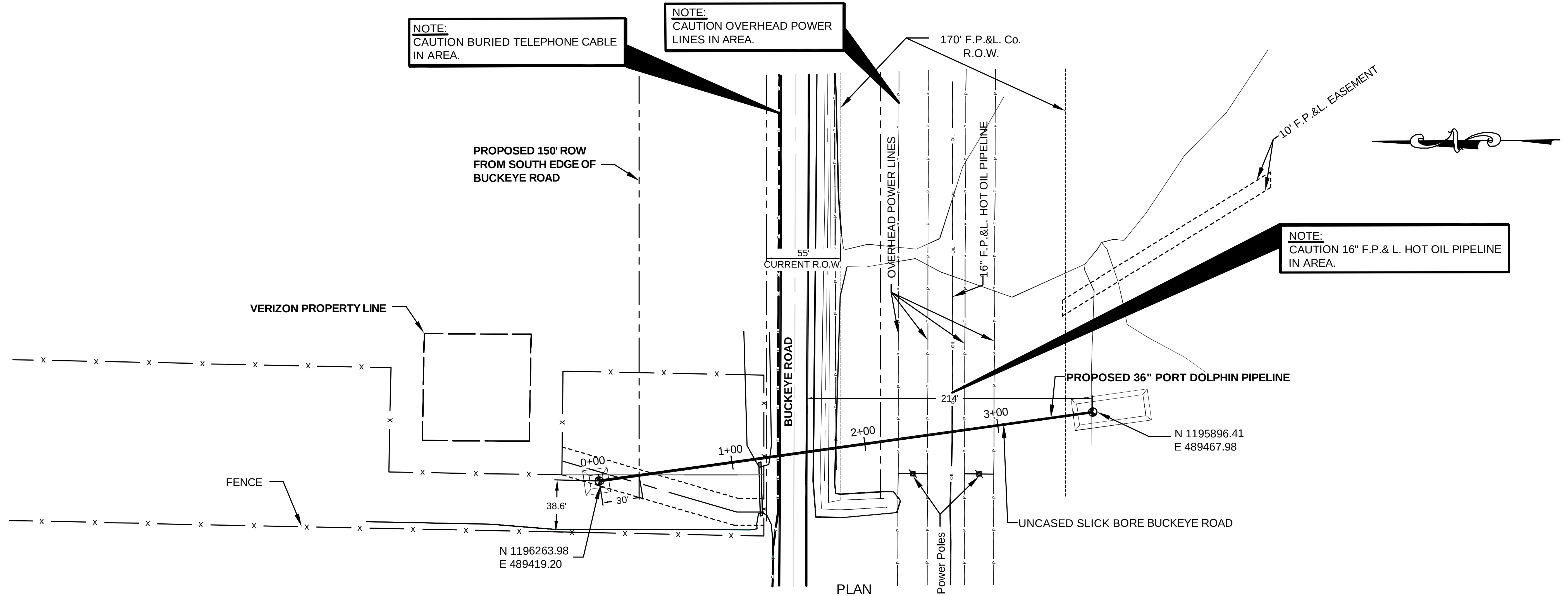
DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

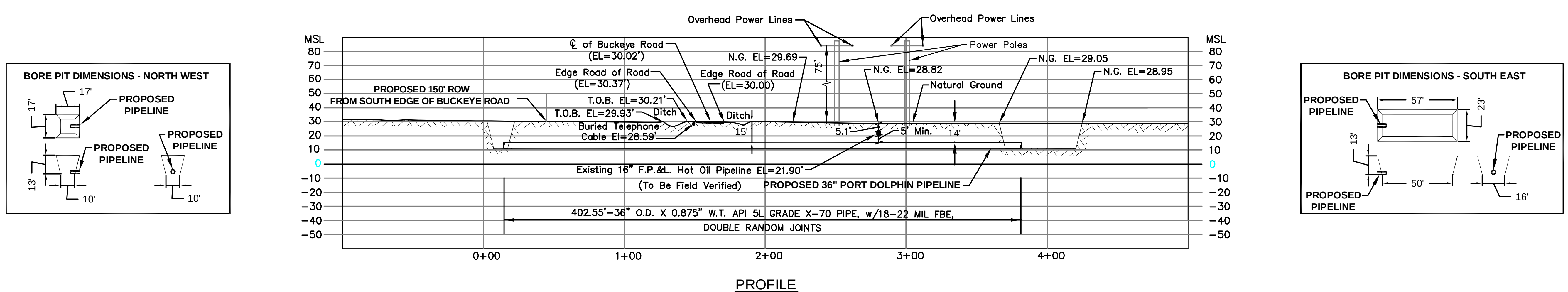
SCALE 1"= 60'
DRAWN NBG DATE 07/29/08
CHK'D D.J.R. DATE 07/30/08
APPROVED M.M. DATE 8/08/08
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-2320-0

PortDolphin

TITLE
PLAN & PROFILE
SLICK BORE AT 31ST TERRACE EAST
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-B-2320
REV. 0





REFERENCE DRAWINGS	
DWG. NO.	DESCRIPTION

REVISIONS		
NO	DATE	DESCRIPTION
A	8-26-08	ISSUED FOR REVIEW
0	12/08/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

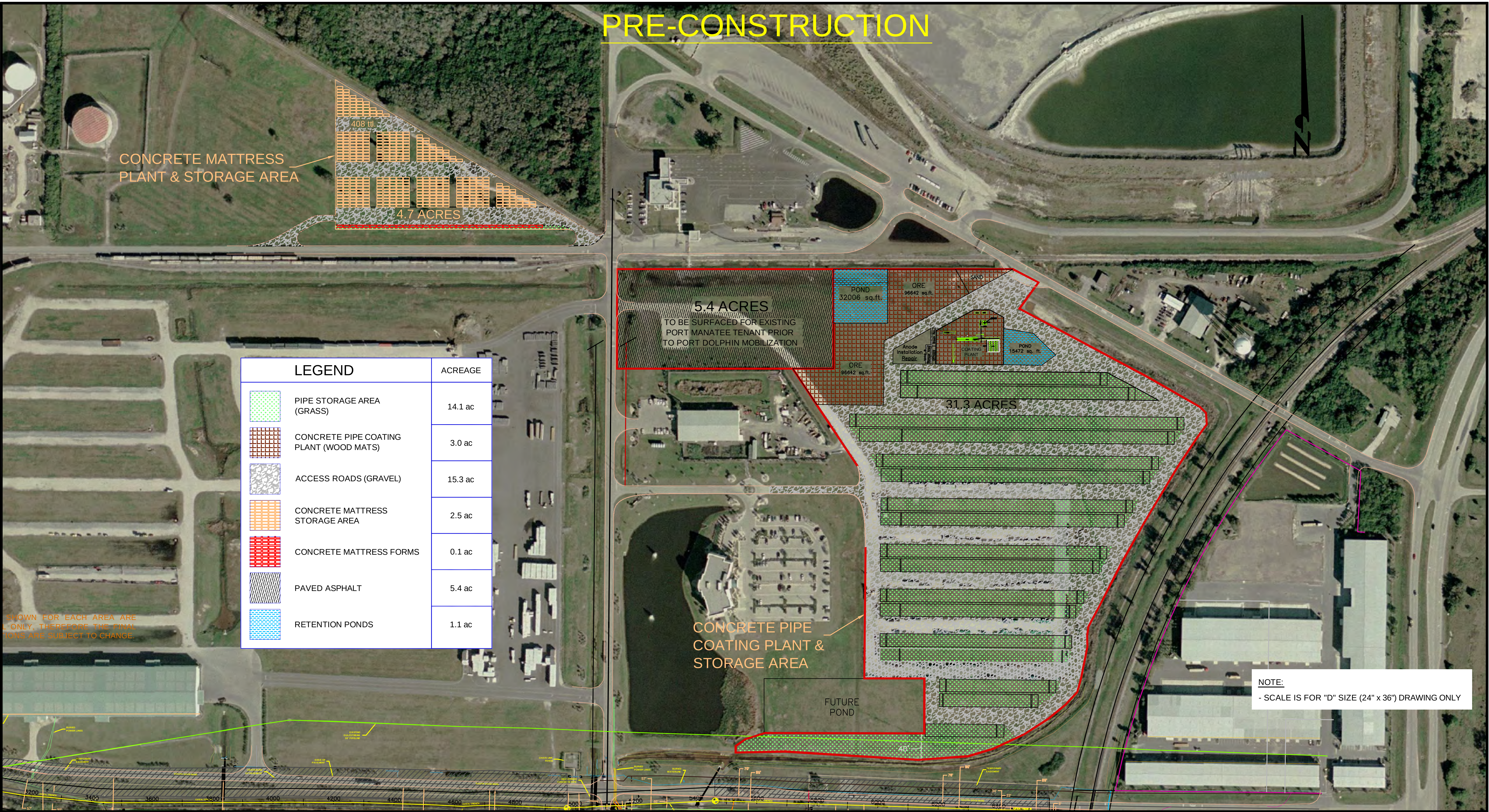
DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1"= 80'
DRAWN EHF DATE 8/26/08
CHK'D DJR DATE 8/26/08
APPROVED MM DATE 12/09/08
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-2321-0

PortDolphin

TITLE
PLAN & PROFILE SLICK BORE AT BUCKEYE ROAD PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-B-2321
REV. 0



REFERENCE DRAWINGS	
DWG. NO.	DESCRIPTION

REVISIONS		
NO	DATE	DESCRIPTION
A	3/17/08	FOR INFORMATION ONLY
B	4/10/08	NEW LAYOUT FOR ZONE "C"
C	6/17/08	RETENTION PONDS ADDED
0	12/05/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.

13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE	1"=100'
DRAWN EHF	DATE 2/18/08
CHK'D DJR	DATE 3/17/08
APPROVED	DATE
PESI JOB NO.	26017
AFE/P.O.NO.	
CLIENT FILE NO.	1088
PESI FILE NO.	26017-3503-0

PortDolphin

TITLE
PROPOSED CONCRETE PLANT LAYOUT
PORT MANATEE
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-D-3503

REV. 0

GENERAL NOTES

1. THE LOCATION OF THE GULFSTREAM 36" PIPELINE WILL BE FIELD VERIFIED PRIOR TON CONSTRUCTION.
2. SCALE 1/32"=1'-0" FOR "D" SIZE (24"x36") DRAWING ONLY.

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION
26017-D-4203	PIPING AREA PLAN - GULFSTREAM PRESSURE REDUCTION SKID
26017-D-4204	PIPING AREA PLAN - TECO METER & PRESSURE REDUCTION SKID
26017-D-4208	PIPING AREA PLAN - GULFSTREAM METER SKID
26017-D-4209	PIPING AREA PLAN - TANK & SEPERATOR
26017-D-4210	PIPING AREA PLAN - CONTROL BUILDING

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REVISIONS

NO.	DATE	DESCRIPTION
A	11/09/07	ISSUED FOR INFORMATION
B	11/15/07	ISSUED FOR REVIEW
0	11/30/07	ISSUED FOR ADDENDUM FILING
1	12/08/08	ISSUED FOR USCG ADDENDUM II FILING

REVISIONS

NO.	DATE	DESCRIPTION

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

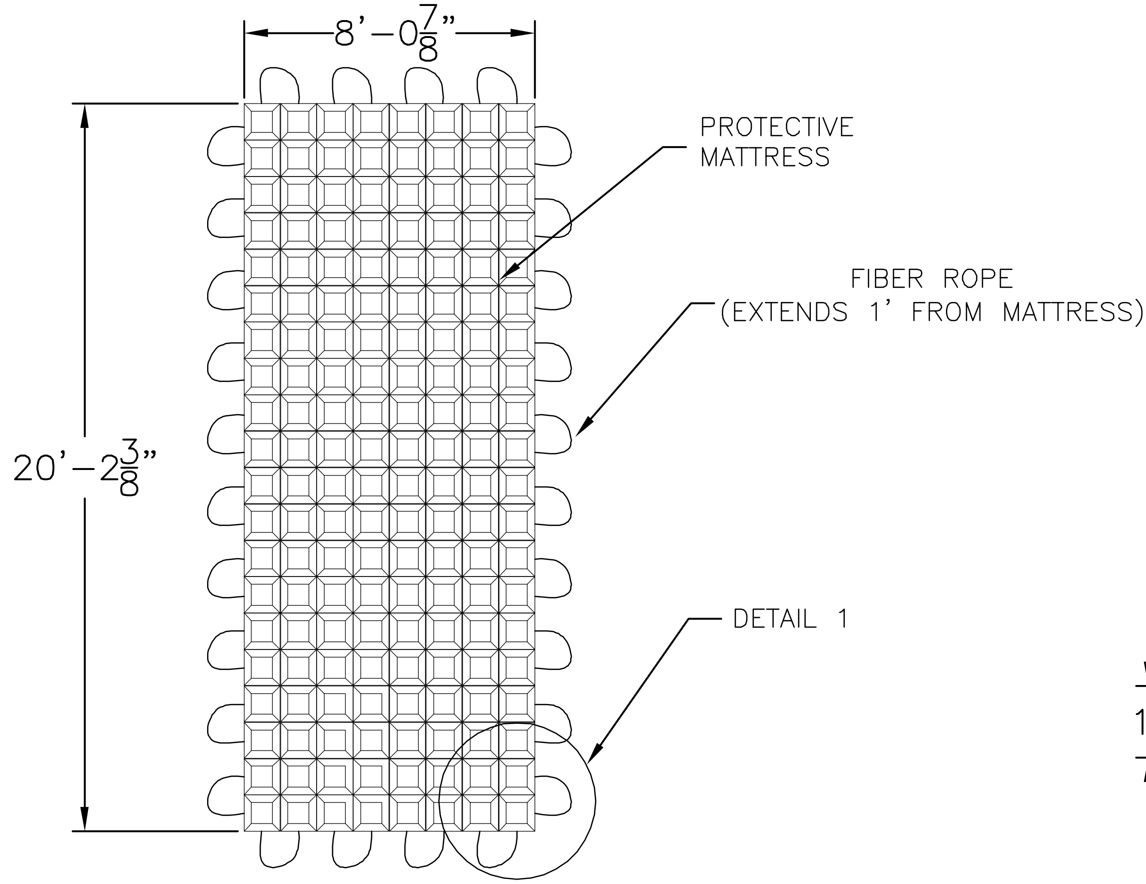
SCALE 1/32"=1'-0"	
DRAWN HEW	DATE 12/08/08
CHK'D DJR	DATE 12/09/08
APPROVED MM	DATE 12/09/08
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-4105-1	

PortDolphin

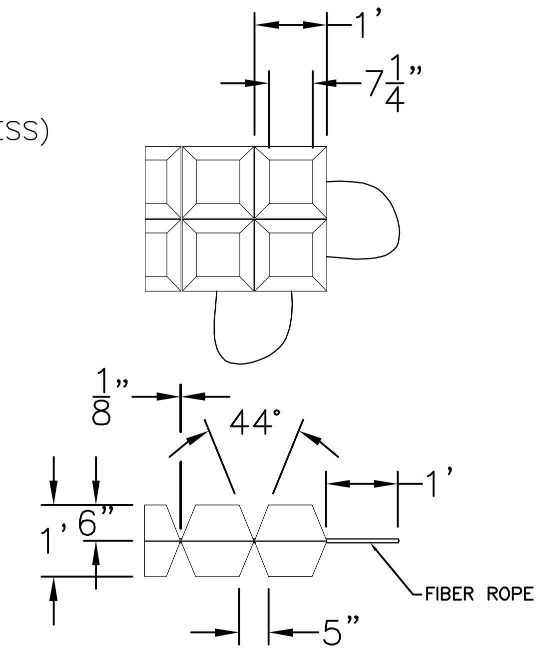
TITLE
PIPING PLOT PLAN
PROPOSED PORT DOLPHIN
INTERCONNECTION STATIONS
MANATEE COUNTY, FLORIDA

NO. 26017-D-4105 REV. 1

TYPICAL CONCRETE MATTRESS INSTALLATION IN PLACES WHERE PIPE IS NOT BURIED

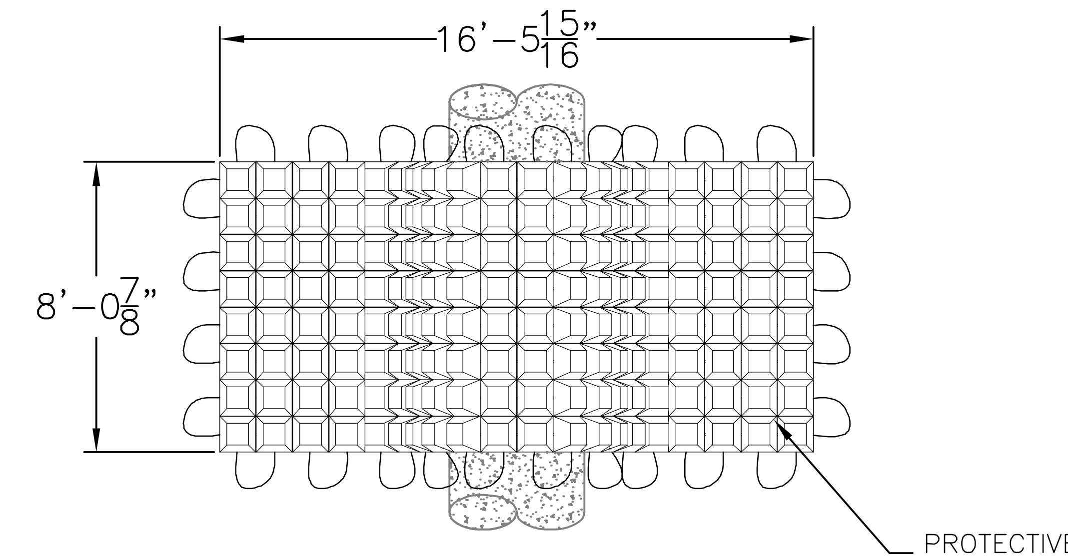


PLAN

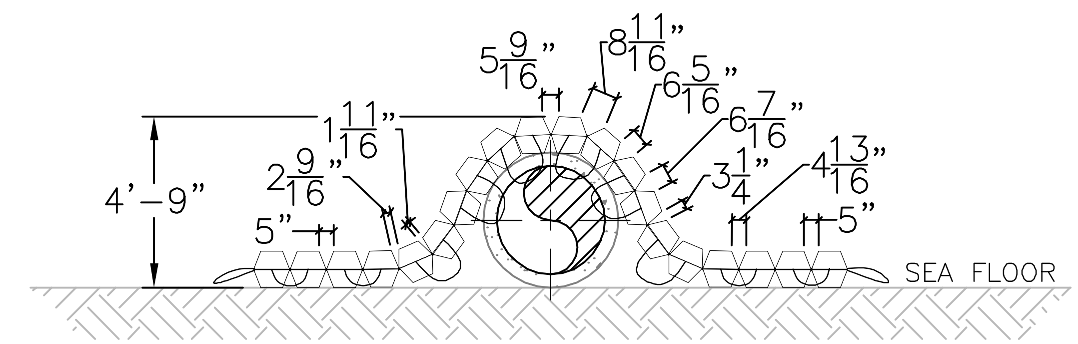


DETAIL 1

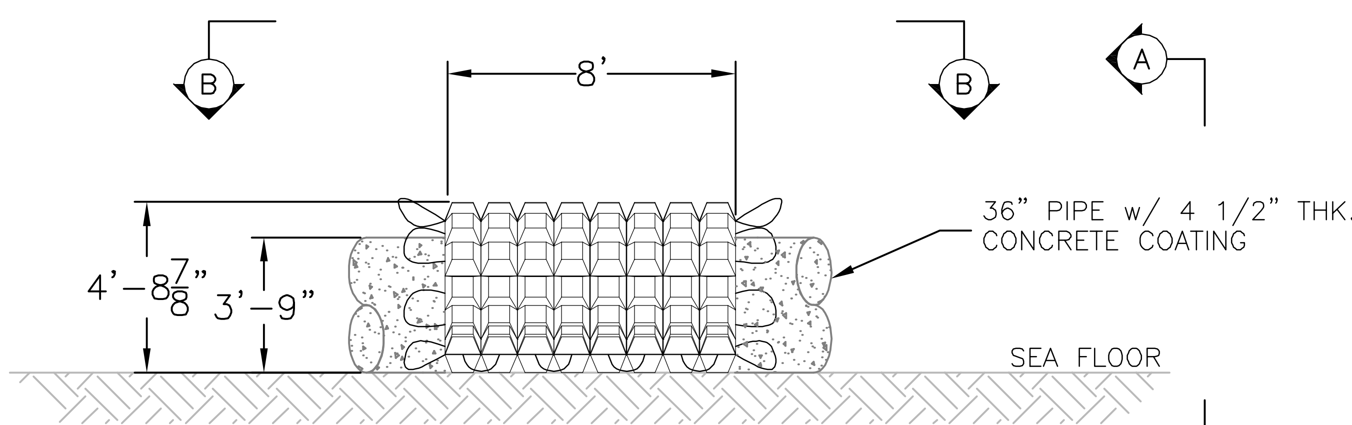
SCALE – 3/8"=1'-0"



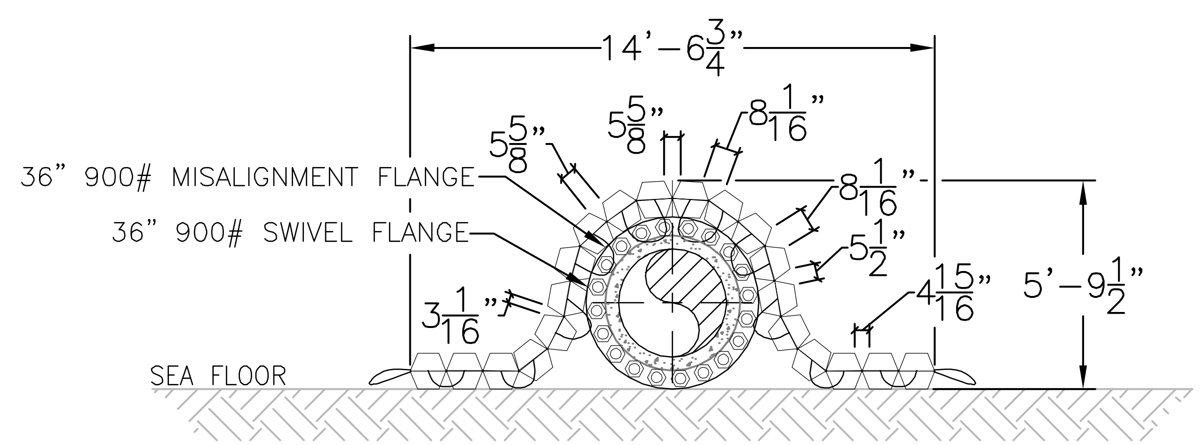
SECTION B–B



SECTION A–A



PROFILE



SECTION A–A

(w/ MISALIGNMENT & SWIVEL FLANGES)

NOTE:

THIS IS NOT THE FINAL DESIGN.
ALL DIMENSIONS ARE ESTIMATED.

REFERENCE DRAWINGS	
DWG. NO.	DESCRIPTION
26017–A–4333	EXIT PIT w/ MATTRESS DETAIL–@ WEST CROSSING
26017–A–4334	EXIT PIT w/ MATTRESS DETAIL–@ EAST CROSSING
26017–A–4335	ENTRY PIT w/ MATTRESS DETAIL–@ EAST CROSSING
26017–A–4336	EXIT PIT w/ MATTRESS DETAIL–@ SHORE APPROACH

REVISIONS		
NO	DATE	DESCRIPTION
A	10/07/08	ISSUED FOR REVIEW
0	10/30/08	ISSUED FOR ERP DRAFT APPLICATION
1	12/08/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690–9111
FAX: (713) 690–0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS–BUILT		

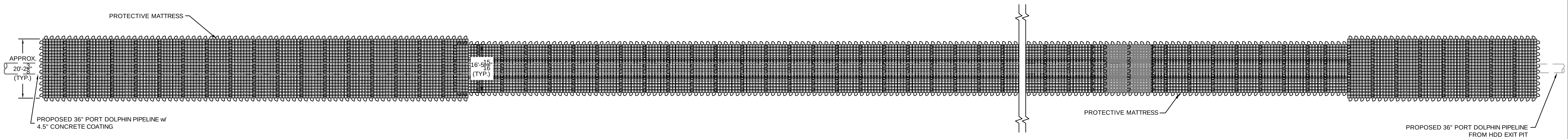
SCALE 3/16"=1'-0"
DRAWN HEW DATE 10/07/08
CHK'D DJR DATE 10/30/08
APPROVED MM DATE 12/10/08
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017–4331–1

PortDolphin

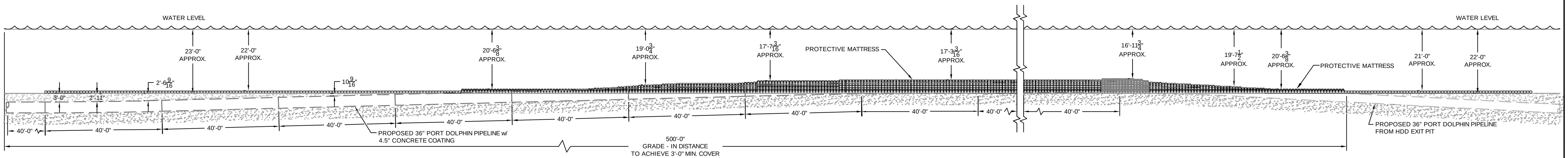
TITLE TYPICAL CONCRETE MATTRESS INSTALLATION
SECTIONS & DETAILS
PORT DOLPHIN PIPELINE
FEDERAL/STATE WATERS, FLORIDA

NO. 26017–B–4331 REV. 1

TRANSITION DETAIL WITH MATTRESSES
HDD EXIT @ WEST GULFSTREAM CROSSING



PLAN



PROFILE

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
	26017-B-4326	HDD ENTRY/EXIT PIT AREA - WEST GULFSTREAM PIPELINE			A	12/09/08	ISSUED FOR REVIEW			
		CROSSING			0	12/12/08	ISSUED FOR USCG ADDENDUM II FILING			
	26017-B-4331	TYP. CONCRETE MATTRESS INSTALL. - SECTIONS & DETAILS								
	26017-A-4333	MATTRESS DETAIL FOR HDD ENTRY/EXIT PIT TRANSITION								
		@ WEST GULFSTREAM PIPELINE CROSSING								

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1/16"=1'-0"
DRAWN HEW DATE 12/09/08
CHK'D DJR DATE 12/12/08
APPROVED GOB DATE 12/12/08
PESI JOB NO. 26017
AFE/P.O.NO.
CLIENT FILE NO. 1088
PESI FILE NO. 26017-4339-0

PortDolphin

TITLE TRANSITION DETAIL WITH MATTRESSES
HDD EXIT AT WEST GULFSTREAM CROSSING
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-D-4339 REV. 0

TRANSITION DETAIL WITH MATTRESSES
HDD ENTRY @ WEST GULFSTREAM CROSSING

PLAN

PROFILE

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
	26017-B-4326	HDD ENTRY/EXIT PIT AREA - WEST GULFSTREAM PIPELINE			A	12/09/08	ISSUED FOR REVIEW			
		CROSSING			0	12/12/08	ISSUED FOR USCG ADDENDUM II FILING			
	26017-B-4331	TYP. CONCRETE MATTRESS INSTALL. - SECTIONS & DETAILS								
	26017-A-4333	MATTRESS DETAIL FOR HDD ENTRY/EXIT PIT TRANSITION								
		@ WEST GULFSTREAM PIPELINE CROSSING								

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1/16"=1'-0"	
DRAWN HEW	DATE 12/09/08
CHK'D DJR	DATE 12/12/08
APPROVED GOB	DATE 12/12/08
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-4340-0	

PortDolphin

TITLE
TRANSITION DETAIL WITH MATTRESSES
HDD ENTRY AT WEST GULFSTREAM CROSSING
PORT DOLPHIN PIPELINE
HILSBOROUGH COUNTY, FLORIDA

NO. 26017-D-4340 REV. 0

TRANSITION DETAIL WITH MATTRESSES
HDD EXIT @ EAST GULFSTREAM CROSSING

PLAN

PROFILE

GENERAL NOTES

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION
26017-B-4330	HDD EXIT PIT AREA - EAST GULFSTREAM PIPELINE CROSSING
26017-B-4331	TYP. CONCRETE MATTRESS INSTALL. - SECTIONS & DETAILS
26017-A-4334	MATTRESS DETAIL FOR HDD EXIT PIT TRANSITION
	@ EAST GULFSTREAM PIPELINE CROSSING

REFERENCE DRAWINGS

DWG.NO.	DESCRIPTION

REVISIONS

NO.	DATE	DESCRIPTION
A	12/09/08	ISSUED FOR REVIEW
0	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

REVISIONS

NO.	DATE	DESCRIPTION

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
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FAX: (713) 690-0060

DRAWING STATUS

ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE	1/16"=1'-0"		
DRAWN	HEW	DATE	12/09/08
CHK'D	DJR	DATE	12/12/08
APPROVED	GOB	DATE	12/12/08
PESI JOB NO.	26017		
AFE/P.O.NO.			
CLIENT FILE NO.	1088		
PESI FILE NO.	26017-4341-0		

PortDolphin

TITLE
TRANSITIONS DETAIL WITH MATTRESSES
HDD EXIT AT WEST GULFSTREAM CROSSING
PORT DOLPHIN PIPELINE
HILSBOROUGH COUNTY, FLORIDA

NO. 26017-D-4341 REV. 0

TRANSITION DETAIL WITH MATTRESSES
HDD ENTRY@ EAST GULFSTREAM CROSSING

PLAN

PROFILE

GENERAL NOTES	REFERENCE DRAWINGS		REFERENCE DRAWINGS		REVISIONS			REVISIONS		
	DWG.NO.	DESCRIPTION	DWG.NO.	DESCRIPTION	NO.	DATE	DESCRIPTION	NO.	DATE	DESCRIPTION
	26017-B-4331	TYP. CONCRETE MATTRESS INSTALL. - SECTIONS & DETAILS			A	12/09/08	ISSUED FOR REVIEW			
	26017-B-4332	HDD EXIT PIT AREA - EAST GULFSTREAM PIPELINE CROSSING			0	12/12/08	ISSUED FOR USCG ADDENDUM II FILING			
	26017-A-4335	MATTRESS DETAIL FOR HDD ENTRY PIT TRANSITION								
		@ EAST GULFSTREAM PIPELINE CROSSING								

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE 1/16"=1'-0"	
DRAWN HEW	DATE 12/09/08
CHK'D DJR	DATE 12/12/08
APPROVED GOB	DATE 12/12/08
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-4342-0	

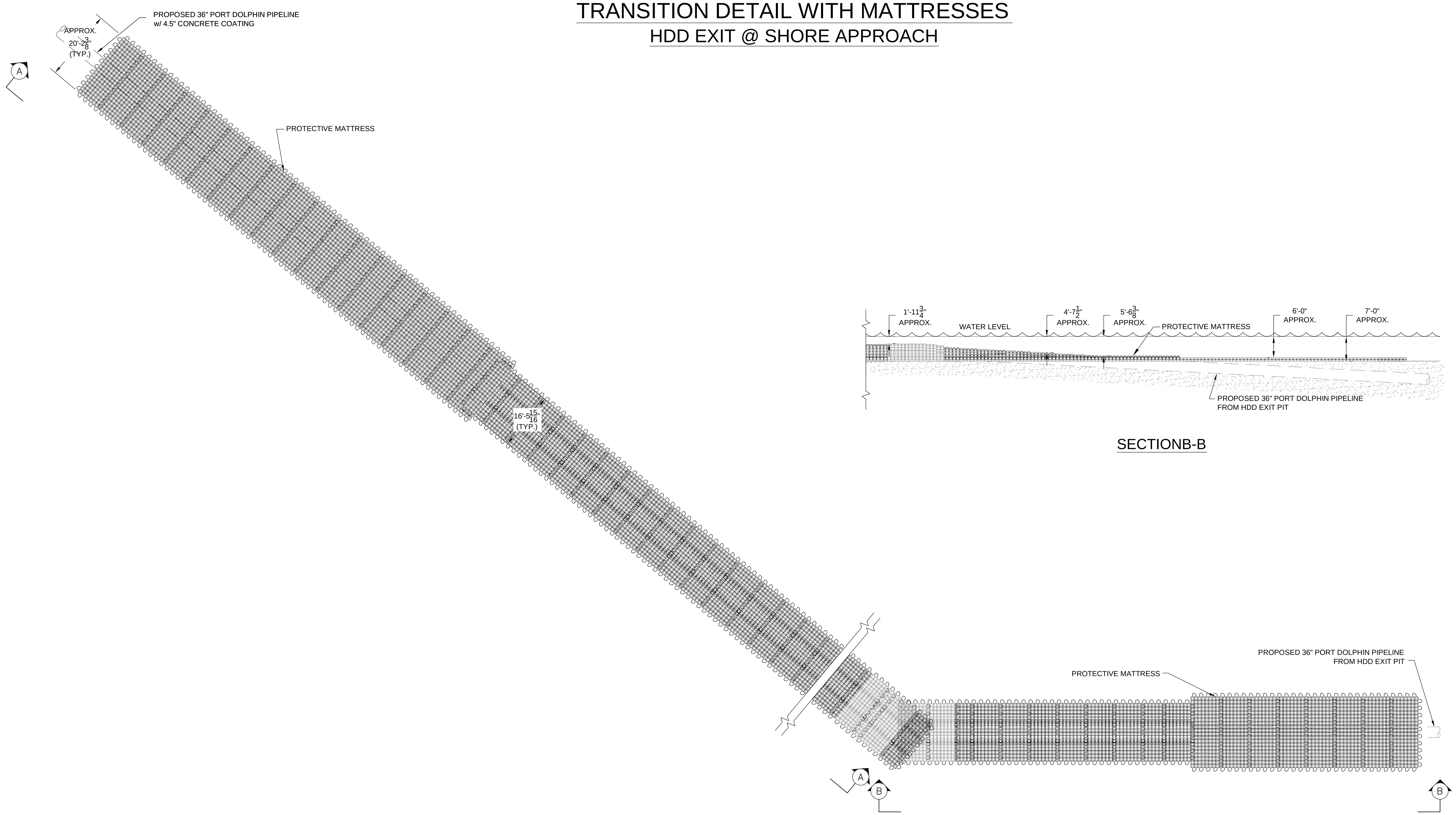
PortDolphin

TITLE
TRANSITION DETAIL WITH MATTRESSES
HDD ENTRY AT EAST GULFSTREAM CROSSING
PORT DOLPHIN PIPELINE
HILSBOROUGH COUNTY, FLORIDA

NO. 26017-D-4342 REV. 0

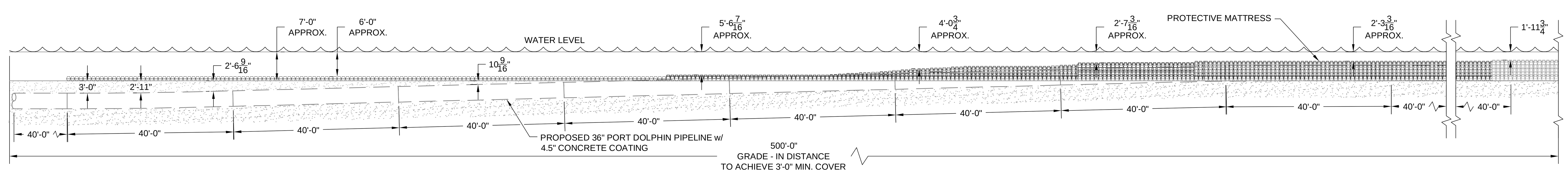
TRANSITION DETAIL WITH MATTRESSES

HDD EXIT @ SHORE APPROACH



SECTIONB-B

PLAN



SECTION A-A

GENERAL NOTES

REFERENCE DRAWINGS	
DWG.NO.	DESCRIPTION
26017-B-4327	HDD EXIT PIT PIPING AREA - SHORE APPROACH
26017-B-4331	TYP. CONCRETE MATTRESS INSTALL. - SECTIONS & DETAILS
26017-A-4336	MATTRESS DETAIL FOR HDD EXIT PIT TRANSITION
	@ SHORE APPROACH

REFERENCE DRAWINGS	
DWG.NO.	DESCRIPTION

REVISIONS		
NO.	DATE	DESCRIPTION
A	12/09/08	ISSUED FOR REVIEW
0	12/12/08	ISSUED FOR USCG ADDENDUM II FILING

REVISIONS		
NO.	DATE	DESCRIPTION

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

DRAWING STATUS		
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

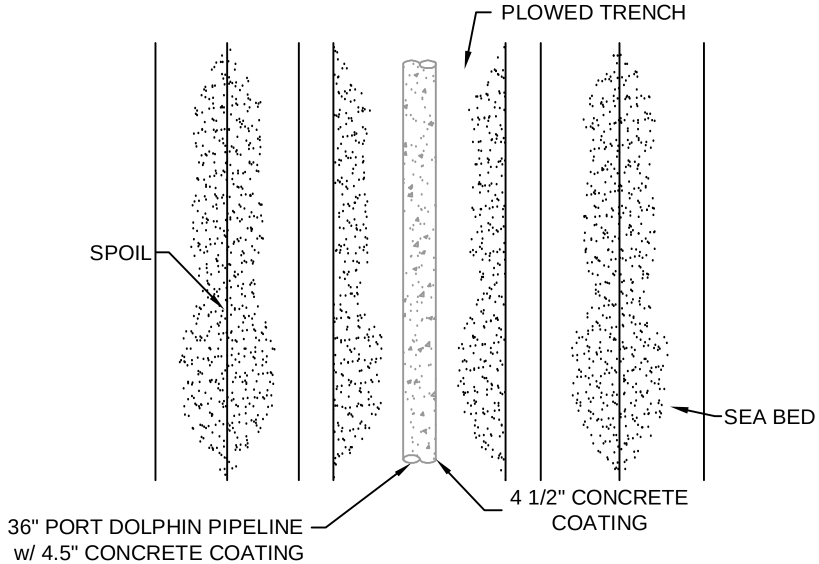
SCALE 1/16"=1'-0"	
DRAWN HEW	DATE 12/09/08
CHK'D DJR	DATE 12/12/08
APPROVED GOB	DATE 12/12/08
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017-4343-0	

PortDolphin

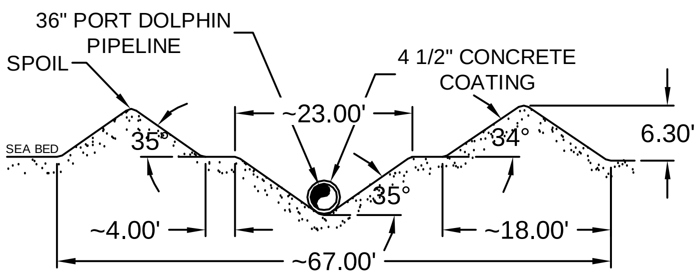
TITLE
TRANSITION DETAIL WITH MATTRESSES
HDD EXIT AT SHORE APPROACH
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-D-4343 REV. 0

TYPICAL DETAIL OF PIPELINE DITCH FOLLOWING PLOWING PASS

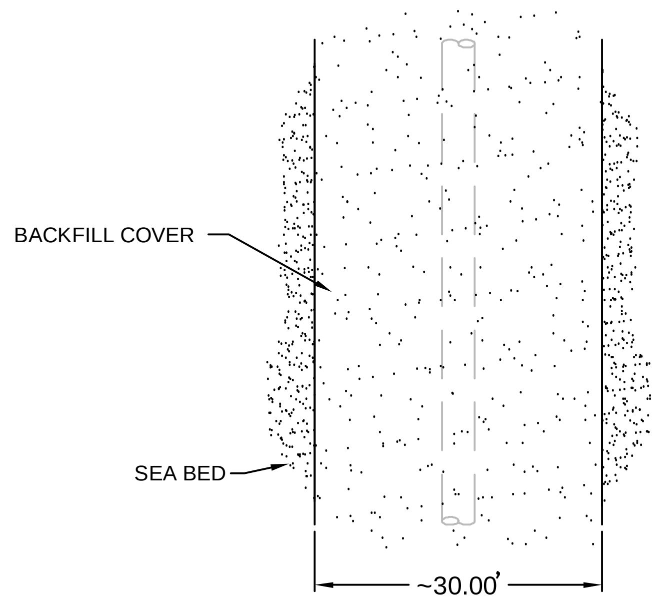


PLAN

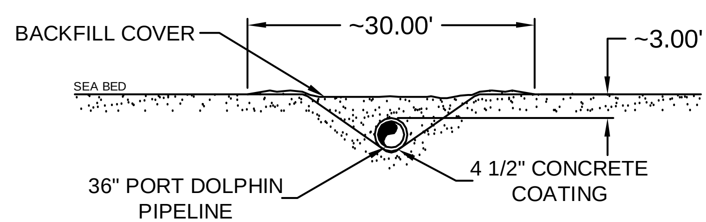


PROFILE

TYPICAL DETAIL OF BURIAL PROFILE FOLLOWING BACKFILL PASS



PLAN



PROFILE

REVISION

NO	DATE	DESCRIPTION
A	09/30/08	ISSUE FOR REVIEW
0	10/30/08	ISSUED FOR ERP DRAFT APPLICATION
1	12/08/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.

13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

SCALE NTS	
DRAWN HEW	DATE 09/23/08
CHK'D DJR	DATE 10/30/08
APPROVED	DATE
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PESI FILE NO. 26017–7723–1	

PortDolphin

TITLE
TYPICAL OFFSHORE PLOWED DITCH
AND BACKFILLED DETAIL
PORT DOLPHIN PIPELINE
FEDERAL / STATE WATERS, FLORIDA

NO. 26017-A-7723 REV. 1

ATTACHMENT A.4

INSTALLATIONS CONSTRUCTED WITH HORIZONTAL DIRECTIONAL DRILLING

Port Dolphin Energy LLC

INSTALLATIONS CONSTRUCTED WITH HORIZONTAL DIRECTIONAL DRILLING

ERIC R. SKONBERG, P.E.

TRENCHLESS ENGINEERING CORP.
15015 INVERRARY DRIVE
HOUSTON, TEXAS 77095 (USA)
TEL: 713-303-3319
WWW.TRENCHLESSENGINEERING.COM

OCTOBER 2008

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BACKGROUND

Port Dolphin Energy LLC is proposing to construct and operate an offshore liquefied natural gas (LNG) deepwater port (DWP) including regasification facilities on LNG vessels and a pipeline to shore, west of Tampa Bay, Florida. The natural gas will be transported from the LNG regasification facility across Tampa Bay to a point onshore at Port Manatee via a 42-mi., 36-in. pipeline. An overview of the pipeline system is depicted in **Figure 1**. The project is more fully described in the Federal Energy Regulatory Commission (FERC) Docket CP07-191-000 and the Port Dolphin DWP application.

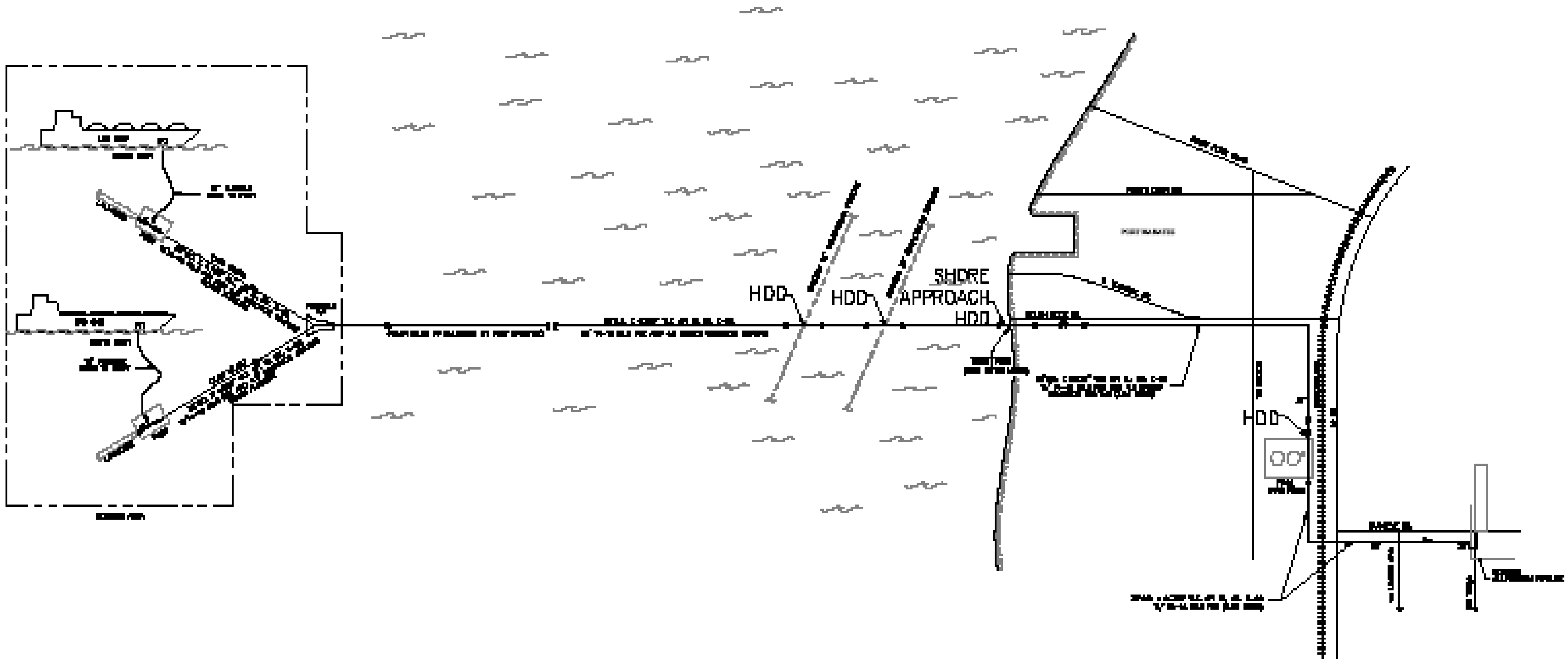
Trenchless Engineering Corporation has been retained by Port Dolphin to analyze and describe the feasibility and methodologies to be implemented for the proposed horizontal directional drilling (HDD) installations. The principal of Trenchless Engineering, Mr. Eric R. Skonberg, P.E., prepared this report; his curriculum vitae is included in **Attachment A**.

Port Dolphin proposes to employ HDD at four locations to install the Port Dolphin pipeline under man-made obstacles, specifically the Gulfstream pipeline, Port Manatee's bulkhead, and the Florida Power & Light (FPL) tank farm, as well as the environmentally sensitive nearshore seagrass areas. Specifically:

- **At the West HDD Crossing at Sta. 1648+86 to 1662+21,** the Port Dolphin pipeline will cross the Gulfstream pipeline in a water depth of 21 ft. The drilled length will be approximately 1,335 ft, and this will be a "water-to-water" HDD installation;
- **At the East HDD Crossing at Sta. 1980+98 to 2010+45**, the Port Dolphin pipeline will cross the Gulfstream pipeline in a water depth of 21 ft. The drilled length will be approximately 2,947 ft, and this will be a "water-to-water" HDD installation;
- **Shore approach from Sta. 2183+84 (water) to Sta. 1330 (land)** is planned from onshore to offshore at Port Manatee. This HDD will allow Port Dolphin to safely clear Port Manatee's bulkhead and the Gulfstream pipeline as well as seagrass areas that have been identified in the vicinity of Manbirdtee Key. The drilled length will be approximately 4,900 ft, and this will be a "land-to-water" HDD installation; and
- **Onshore, from Sta. 7386+08 to Sta. 8633+00**, the Port Dolphin pipeline will cross under the FPL oil storage tank farm. The drilled length is planned to be 1,247 ft, and this will be a conventional "land-to-land" HDD installation.

At this time, Port Dolphin also is considering a "water-to-water" HDD installation to cross under the Sunshine Skyway Bridge. If HDD is used to cross under the bridge, the construction method would be very similar to both the West and East HDD crossings.

Figure 1
Port Dolphin Pipeline System Overview

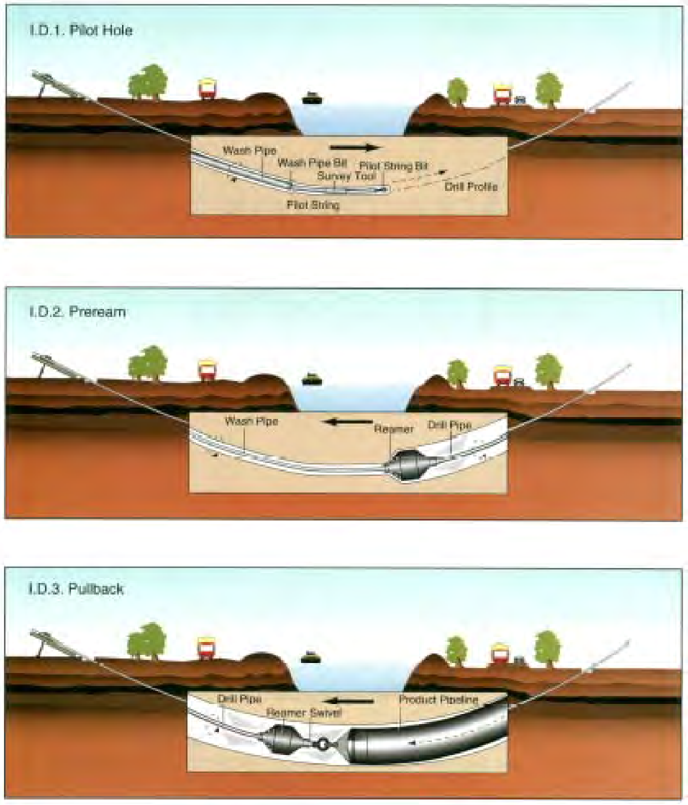


THE HDD PROCESS

Originally developed in the 1970's, HDD is now the preferred method of construction of pipelines under waterways, shore lines, environmentally sensitive wetlands or marine habitats, and other obstacles. Because the construction footprint of HDD is generally limited to work areas on either side of the obstacle, HDD avoids disturbance to the sensitive areas along the drilled alignment. A far greater depth of cover is afforded by HDD, promoting pipeline security. Marine traffic is not disrupted on active waterways. Turbidity limits and monitoring requirements of conventional "open cut & cover" techniques can be avoided. This typically allows the regulatory permitting process to proceed in a more expeditious manner, as HDD is often considered the Least Damaging Practicable Alternative. The longest HDD crossing to date has exceeded 8,000 ft (i.e., Janco Directional Drilling, Houston Ship Channel, Texas – 8,300 ft X 10 in.). Pipe with diameters of up to 60 in. have been installed.

The HDD process begins with a pilot hole drilled at a prescribed angle from horizontal and continues under and across the obstacle along a design profile made up of straight tangents and long radius arcs. A schematic of the technique is shown as **Figure 2.** The directional control is brought about by a small bend in the drill string just behind the cutting head. The pilot drill string is not rotated except to orient the bend. If the bend is oriented to the right, the drill path then proceeds in a smooth radius bend to the right. The drill path is monitored by an electronic package housed in the pilot drill string near the cutting head. The electronic package detects the relation of the drill string to the earth's magnetic field and its inclination. These data are transmitted in real-time back to the surface, where calculations are made as to the location of the cutting head. Surface location of the drill head also can be used for directional monitoring.

Figure 2
The HDD Process



The methodologies, techniques, and electronic technology currently applied to the HDD process in the pipeline industry results in accurate determinations of where the pilot hole will exit. The pipe size and HDD lengths and configurations that are planned by Port Dolphin are all considered to be well within the accuracy of the current HDD process.

After the pilot hole is complete, the hole must be enlarged to a suitable diameter for the gas or liquid pipeline. Generally, a reamer is attached to the drill string and then pulled and rotated into the pilot hole. Joints of drill pipe are added as the reamer makes its way across the obstacle. Bentonite slurry is pumped into the hole to maintain the integrity of the hole and to flush out cuttings.

Once the drilled hole is enlarged, the pipeline can be pulled through. The pipeline is prefabricated, and a reamer is attached to the drill string and then connected to the pipeline pull head via a swivel. The swivel prevents any translation of the reamer's rotation into the pipeline string, allowing for a smooth pull into the reamed hole. The drilling rig then begins the pullback operation, rotating and pulling on the drill string and once again circulating high volumes of drilling slurry. The pullback continues until the reamer and pipeline break ground at the HDD rig.

CURRENT HDD CAPABILITY

Industry experience confirms that the drilled length and diameters of the pipelines considered for the Port Dolphin project are within the current HDD state-of-the-art. Details of industry experience include the following:

MARINE HDD INSTALLATIONS

Maritimes & Northeast – Hubline Project – Boston Bay, Massachusetts.

- Weymouth Landfall Crossing – 3,065 ft X 30 in.
- Salem Landfall Crossing – 4,829 ft X 30 in.
- Beverly Harbor "Water-to-Water" – 4,386 ft X 30 in.
- Georges Island "Water-to-Water" – 4,232 ft X 30 in.

Iroquois – Eastchester Extension Project – Long Island Sound, New York.

- Hunt's Point Shore Approach – 3,050 ft X 24 in.
- Throgs Neck "Water-to-Water" – 4,500 ft X 24 in.

Gulfstream **–** Tampa Bay, Florida; Coden, Alabama; and Pascagoula, Mississippi.

- Spoil Island Shore Approach (Florida) – 4,000 ft X 36 in.
- Pascagoula Shore Approach (Mississippi) – 2,670 ft X 36 in.
- Coden Shore Approach (Alabama) – 4,500 ft X 36 in.

SIGNIFICANT CONVENTIONAL LAND-TO-LAND HDD INSTALLATIONS

- Golden Pass Pipeline, Sabine River near Orange, Texas – 6,000 ft X 42 in.
- Transsierra SA, Rio Grande, Bolivia – 6,575 ft X 32 in.
- Duke, Tasmanian Gas Pipeline – 6,710 ft X 27 in.
- Williams Cardinal Pipeline, Lake Jackson, North Carolina – 6,041 ft X 24 in.
- Janco Directional Drilling, Houston Ship Channel, Texas – 8,300 ft X 10 in.

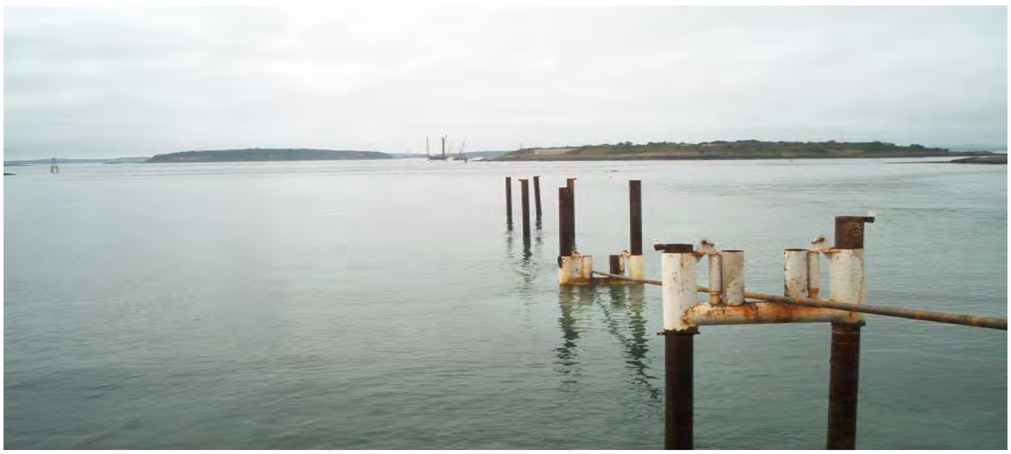
WATER-TO-WATER HDD INSTALLATIONS

The Port Dolphin pipeline will have two water-to-water HDD installations crossing the Gulfstream pipeline in Tampa Bay and possibly a third crossing under the Sunshine Skyway Bridge. For the water-to-water installations, a lift boat unit with support barges and vessels will be located at the HDD entry point. A Class 200 lift boat is recommended; it provides sufficient deck space for the drill unit, and the Class 200 lift boat can accept the deck loading and drilling forces during drilling operations. Flat top barges will be moored to driven caissons aside the lift boat for other HDD equipment. Hopper barges will be used for collection of drilling slurry and cuttings that are limited to those that return to the drill rig location. **Figure 3** illustrates a Class 200 lift boat during HDD operations.

Figure 3
HDD Entry Side Operations from a 200 Class Lift Boat

Depending on the hard bottom seafloor conditions, a temporary steel casing pipe/riser will be inserted into the seabed prior to pilot hole drilling operations. The casing/riser will support the drill string between the lift boat and the seafloor. The steel casing will be supported by H-pile structures from the seabed up to the lift boat at spacing of approximately 75 to 125 ft. Assuming a 3-degree entry/exit angle, the overall length of the riser assembly from the seafloor to the lift boat would be approximately 350 ft. Once the drilling assembly exits, it will be lifted from the seafloor to another lift boat and supported over another array of temporary H-pile structures, as shown in **Figure 4**. An inland derrick barge or other marine support equipment (material barges, crew boats, tug, etc.) would be used to erect the structures.

Figure 4
HDD Exit Side Operation – Riser Structure



The HDD entry and exit points will likely require excavation to provide a smooth transition from the entry and exit angles selected to a horizontal position fully supported by the seabed. Depending on the angles chosen, the deepest part of the excavation could be approximately 10 to 20 ft deep, and transition to horizontal through a length of approximately 150 to 200 ft long.

Once the hole has been reamed to the final diameter, the lift boat will be removed on the exit side. The 36-in. pipeline, already fabricated and hydrostatically tested, will be pulled through the drilled hole by the HDD equipment on the entry side of the crossing.

Installation of the temporary steel casings/risers at each location is estimated to take 2 to 3 weeks. Actual drilling duration, depending on geotechnical conditions, is planned to be less than 3 weeks at the West crossing and approximately 2 weeks on the East crossing. Another 1 to 2 weeks would be necessary at each installation to remove the temporary steel casings/risers.

This water-to-water methodology is a proven technique and technically feasible. An American Society of Civil Engineers (ASCE) publication about the Hubline Project (cited above) is included in **Attachment B**.

LAND-TO-WATER HDD INSTALLATION (SHORE APPROACH AT PORT MANATEE)

For the shore approach at Port Manatee, an HDD rig spread will be set up onshore. The pilot hole will be drilled from onshore to offshore. Once the drilling assembly exits, it will be lifted from the seafloor to an HDD support vessel and supported by H-pile structures. Due to the shallow water depth, the HDD support vessel will most likely be a flat-top spud barge. Other marine support will include a material barge, tug, and crew boat. Caissons are likely to be driven behind the barge to provide stable and robust anchorage during the pullback.

During HDD operations, the 36-in. pipeline will be prefabricated onshore. After the hole is opened to its final planned diameter of 48 in., the pipeline will be pulled through the reamed hole from onshore to offshore. It is expected for drilling operations to take approximately 3 to 4 weeks.

While most HDD land-to-water installations prefabricate the pipeline offshore and are then pulled onshore, the concept of pulling from onshore to offshore minimizes any construction activities in the adjacent aquatic preserve. This proposed method is technically feasible.

CONVENTIONAL LAND-TO-LAND HDD INSTALLATION

The HDD installation at Sta. 7386+08 to 8633+00 under the FPL storage tank farm is a straightforward land-to-land HDD application and well within current HDD capabilities. The HDD operations for this installation are estimated to take less than 2 weeks.

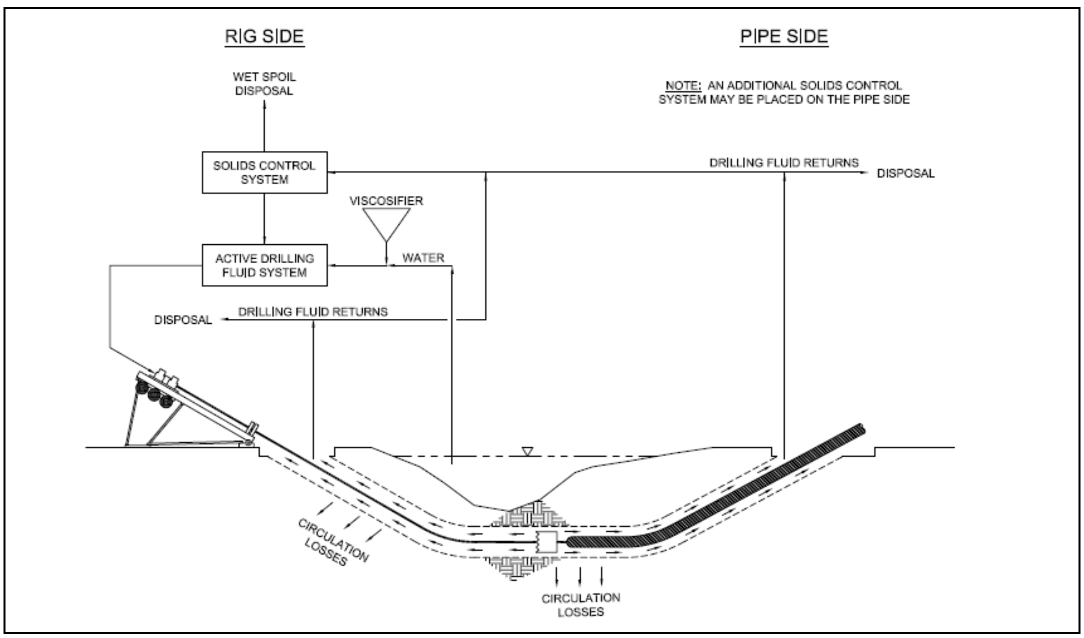
DRILL SLURRY MANAGEMENT

The HDD process uses bentonite slurry. The slurry is an engineered fluid and a key component to successful HDD installations. The slurry is usually a mixture of fresh water, bentonite (sodium montmorillonite), and benign polymers. The volume of bentonite slurry necessary for a specific HDD operation is a direct function of the drill length, pipe diameter, and other site-specific considerations. The primary reasons for the careful selection and design of the slurry are to:

- stabilize the reamed hole against collapse;
- lubricate, cool, and clean the cutters;
- transport cuttings and spoil by suspension and flow to entry and exit points; and
- reduce soil friction, thus reducing required pull loads.

A schematic of the HDD slurry circuit is depicted in **Figure 5**.

Figure 5
Drill Slurry Circulation



During the marine installations, a mixture of drilling fluid and drill cuttings will continuously circulate within the borehole from the drill bit back to the transition excavation. During reaming operations, the drill cuttings and drilling fluid will be contained within the HDD bore and transition excavation. As the pipeline string is being pulled into the drilled hole, it will displace drill mud into the excavation for the transition. Normally, this remaining mud will be mixed with the native materials during backfill (note – this same method was also used during the Gulfstream HDD installation at Spoil Island).

Onshore, the drill slurry will flow to excavated pits where the slurry will be cleaned and reused. Any slurry remaining and collected after the pullback will be disposed at an approved location.

INADVERTENT RELEASE OF DRILLING SLURRY (FRAC-OUTS)

Another potential impact associated with HDD installations is the possible inadvertent release of drilling slurry along the drill alignment. The drill fluid follows a path of least resistance, and there may be occasions when some of the drilling slurry may not return to the entry or exit locations but instead may discharge to other areas along the HDD alignment. The following can cause inadvertent returns:

- Highly permeable soils;
- Soils with very low permeability but jointed, such as slickensided clays (stiff clays with natural fissures) or rock fractures;
- Considerable elevation differences from either the entry/exit point and ground elevations along the HDD alignment;
- Disturbed soils such as piling or fill; and
- Areas along the HDD alignment where there is little depth of cover.

In 2001, the Gas Research Institute (GRI) sponsored a detailed survey of large (>750 ft) HDD installations to gather data concerning the frequency, locations, and possible causes of inadvertent returns. Data from 54 separate HDD crossings with drilled lengths ranging from 750 to 5,500 ft and pipeline diameters up to 41 in. were analyzed. The empirical evidence from the GRI report showed that inadvertent return events were not uncommon and occurred on approximately half the HDD installations (Skonberg et al., 2001).

During HDD operations, fluid pressures may build up within the borehole, potentially resulting in hydraulic fracturing and subsequent migration of drilling fluids to the surface. The two primary factors affecting hydraulic fracturing in soil are borehole pressure and depth of cover (Staheli et al., 1998). When the pressure in the borehole exceeds the strength of the surrounding strata, a potential frac-out condition occurs. However, this risk decreases with increasing depth of cover. Methods have been developed to predict hydraulic fracturing in HDD installations; however, these methods have had limited success in providing a reliable prediction method (American Society of Civil Engineers, 2005).

Downhole electronic tools are available that allow the driller to monitor annular borehole pressures during pilot hole operations (pressure while drilling [PWD] tools). Pilot hole drilling is when theoretical annular pressures should be highest. These tools have been used effectively on many environmentally sensitive HDD installations to maintain slurry flow to the entry point.

Once it is indicated to the driller that annular pressures are abnormally high, the driller has the following options (or any combination of these options) to stop or minimize the frac-out condition:

- Decrease pump pressure;
- Decrease penetration rate;
- Retract the drill string a distance to restore circulation (“swab” the hole);
- Introduce additional flow along the borehole using “weeper” subs; and
- Modify the drilling mud with lost circulation additives or certain polymers.

In the un-anticipated event that a frac-out occurs the following actions will be implemented:

- Cease drilling operations;
- Investigate the circumstances of the potential loss of drilling slurry;
- Notify FDEP immediately of suspected loss of drilling slurry; and
- Work with FDEP to assess if any impacts to resources have occurred and quantify impact area.

LITERATURE CITED

American Society of Civil Engineers. 2005. Pipeline design for installation by horizontal directional drilling – ASCE MOP 108. ISBN 0-7844-0804-1.

Skonberg, E.R., C.E. Tammi, D.J. Cameron, and A.M. Desilets. 2001. Evaluating the effects of muds on wetlands from horizontal directional drilling: The relationship of subsurface and geophysical conditions to inadvertent returns. Prepared for the Gas Research Institute (GRI). Contract No. 5097-250-4046.

Staheli, K., D. Bennett, and T.J. Hurley. 1998. Installation of pipelines beneath levees using horizontal directional drilling. Prepared for the Construction Productivity Advancement Research Program, U.S. Army Corps of Engineers, Waterways Experiment Station. Technical Report CPAR-GL-98-1.

ATTACHMENTS

ATTACHMENT A

CURRICULUM VITAE OF ERIC R. SKONBERG, P.E.

Trenchless Engineering Corp. *15015 Inverrary Dr.* *Houston, Texas 77095* *Tel: (713) 303 3319* *www.trenchlessengineering.com*	*Curriculum Vitae* **Eric R. Skonberg, P.E.**

Professional experience

2001-Present

Trenchless Engineering Corp. *President*

Providing professional consulting services including construction management and engineering support for major HDD installations. Recent project experience includes Golden Pass, Freeport LNG, the HubLine Project, Ocean Express, Mardi Gras, and Gulfstream.

1996-2000

Horizontal Drilling International, Inc. *President*

HDI is a specialist construction company offering (HDD) to both domestic and international markets. The company offers services to the energy, telecommunications, and municipal sectors. HDI operates slant-drilling units from 250 ton down to 19-ton capacities. Several landmark projects completed with industry recognition as a leader in its field. This included the first HDD application in the Arctic, the longest large-diameter hard rock crossing, and many marine applications of HDD. Over 150 major crossings were completed during this period.

1986-1996

Land & Marine, Inc. *Regional Director*

Land & Marine, based in the UK, is an established international near-shore pipeline contractor. Recruited to initiate its HDD capability, operations were set up from Houston. During the start-up, equipment was designed/fabricated. From Houston, HDD projects were undertaken domestically, and in Latin America (Colombia, Venezuela, and Mexico). Over 200 major HDD crossings were completed during this period.

1982-1986

Drilled Crossings, Inc. *Director of Engineering*

Attracted investment capital for start-up operations of the company, during a time when HDD was in its infancy. Responsibilities included rig design and engineering liaison during projects. The company completed 43 crossings during this period.

1981-1982

Baker Energy Resources Corp. *Project Engineer*

Worked as engineering liaison for this second competitor to the HDD industry. Responsibilities included crossing design, cost estimating, and supervision of rig fabrication. The company completed 25 major river crossings during this time.

1978-1981

Santa Fe International Corp. *Project Engineer*

Recruited to provide engineering services for this major international offshore contractor. Rotated through the Specialized Drilling, Marine Construction, Estimating, and Engineering Services groups. Involved in several large-diameter drilling projects for offshore jacket piling and for mineshaft drilling.

Professional Activities

- Directional Crossing Contractors Association – First President – 1991
- Chairman of DCCA committees overseeing the writing and publication of "Guidelines for a Successful Bid Package" and "Survey Standards". Member of DCCA committee for "Midsize Guidelines"
- Member of the ASCE "HDD Design Guideline Task Committee"
- Licensed Professional Engineer – State of California M21014
- Technical Advisory Group member to the Gas Research Institute's Construction and Maintenance Committee. This included advisory input on many issues dealing with HDD and its construction impact.
- External Advisory Board, Department of Mechanical Engineering, College of Engineering, University of Kentucky (2007-2009)

Education

1974-1978

University of Kentucky *Lexington, Kentucky*

BS – Mechanical Engineering

Publications and Presentations

1. Center for Underground Infrastructure Research & Education (CUIRE), Speaker at the Professional Level Continuing Education Program "Horizontal Directional Drilling School". 2006, 2007 at the Underground Construction Technology Conference.
2. "Short Course – Manual of Practice for Horizontal Directional Drilling", co-presented with J.D. Hair, H.W. O'Donnell, T. Stinson, and L. Petroff. ASCE Pipelines 2005. August 21, 2005. Houston, Texas.
3. "Inadvertent Slurry Returns during Horizontal Directional Drilling: Understanding the Frequency and Causes", co-authored with C.E. Tammi, A.M. Desilets, and V. Srivastava. Right-Of-Way 8 Congress. September, 2004. Saratoga, New York.
4. "A Bridge Under Troubled Waters: We Have Found the Way", co-authored with T.C. McGuire. Proceedings of the ASCE International Conference on Pipeline Engineering and Construction - 2004. August 2, 2004. San Diego, California.
5. "Determining the Future of HDD - Quality Assurance/Quality Control", Underground Construction Technology (UCT) Conference, January 13, 2004. Houston, Texas.
6. "Kick in the Tail Saves HDD Shore Approach", co-authored with H.W. O'Donnell. Proceedings of the ASCE International Conference on Pipeline Engineering and Construction - 2003. Presented at the "New Pipeline Technologies, Security, and Safety Conference", July 14, 2003. Baltimore, Maryland.
7. "Merging Pipe Ramming and HDD", co-presented with C. Braher, M. Laney. Underground Construction Technology (UCT) Conference, January 15, 2003. Houston, Texas.
8. "Horizontal Directional Drilling Best Practices Manual", co-authored with C.E. Tammi, D.J. Cameron, A.M. Desilets for the Gas Research Institute (GRI Contract No. 5097-250-4046). May 2002.
9. "Evaluating the Effects of Muds on Wetlands from Horizontal Directional Drilling: The Relationship of Subsurface and Geophysical Conditions to Inadvertent Returns", co-authored with C.E. Tammi, D.J. Cameron, A.M. Desilets for the Gas Research Institute (GRI Contract No. 5097-250-4046. November 2001.
10. "Directional Crossing Survey Standards", Directional Crossing Contractors Association (DCCA), Dallas, Texas; October 12, 1998; Chairman of the Committee which drafted and published the work in various trade magazines
11. "Directionally Drilled Crossing Constructed Under River Levee", co-authored with C.W. Berry, *Pipeline & Gas Journal*, June 1996
12. "Guidelines for a Successful Directional Crossing Bid Package", the Directional Crossing Contractors Association (DCCA), Dallas, Texas; April 21, 1995, Chairman of the Committee which drafted and published the work in various trade magazines
13. "Directional Contractors Should Review Contracts*", Pipeline & Gas Journal*; June, 1995
14. "Directional Crossings for Municipal Projects". Presentation to the Gulf Coast Trenchless Association. Houston, Texas. June 9, 1995.
15. "Environmental Concerns Contribute to Growth Of Directional Crossings". *Pipeline Digest*. Hart Publications. March, 1995.
16. "Directional Crossings". Presentation to the Pipeliner's Club. Atlanta, Georgia. February 13, 1995.
17. "Directional Crossings - Design Considerations". Presentation on Trenchless Pipeline Installation Methods organized by Baltimore Gas & Electric. Baltimore, Maryland. March 15, 1995.
18. "Water to Water Directional Crossings". Presentation to the Pipeliner's Club. Houston, Texas. December 5, 1994.
19. "Environmental Liabilities - A Directional Crossing Contractor's Perspective". *Pipeline Digest*. Hart Publications. August, 1994. Also presented at the Directional Crossing Contractors Association Third Spring Symposium. April Sound, Texas. April 9, 1994
20. "Directionally Drilled Crossings Require Mutual Responsibility". *Pipeline & Gas Journal.* Oildom Publishing. June, 1994.
21. "Drilled Crossing Technology - Pipelining's Cutting Edge". *Pipeline Digest*. Hart Publications. August, 1993.
22. "Directional Pipeline Crossings: A Growing Market". National Utility Contractors Association Magazine. July, 1993.

23. "Directional Crossings: What Contractors Need". Co-authored with R.N. Smith. *Pipeline & Gas Journal*. Oildom Publishing. June, 1993.
24. "An Overview of Directional Crossings". Directional Crossing Contractors Association Second Annual Spring Symposium. Rancho Viejo, Texas. April 16, 1993.
25. "Legal Aspects of Directional Drilling Contracts". Presentation at the Symposium on Directional Drilling organized by R.A. Hamilton. East Brunswick, New Jersey. March 29, 1993.
26. "Design Considerations for Pipeline Installations by Horizontal Directional Drilling". Co-authored with R.N. Smith. ASME - Energy Sources Technology Conference. Houston, Texas. February 3, 1993.
27. "Educational Forum on Horizontal Directional Drilling". Presentation sponsored by the DCCA. Houston, Texas. November 4, 1992 and New Orleans, Louisiana. June 23, 1993.
28. "Directional Contractors Seek Separate Identity". A Contractor's Roundtable in *Pipeline & Gas Journal*. Oildom Publishing June, 1992.
29. "Land & Marine Installs Rio Apure Crossing in Venezuela". *Pipeline & Utilities Construction.* Oildom Publishing. September, 1987.
30. "Horizontal Drilling for Coal Gasification". Eighth Underground Coal Conversion Symposium. Keystone, Colorado. August 6, 1982.
31. "Precast Concrete Liners for Blind Drilled Shafts". Fifth Canadian Institute of Mining & Metallurgy Meeting. Institute Paper 4712. Flin Flon, Manitoba. September 20, 1980.

ATTACHMENT B

AMERICAN SOCIETY OF CIVIL ENGINEERS PAPER
ON WATER-TO-WATER HDD INSTALLATIONS:
"A BRIDGE UNDER TROUBLED WATERS: WE HAVE FOUND THE WAY"

A Bridge Under Troubled Waters: We Have Found the Way

Eric R. Skonberg, P.E.[1] and Tim C. McGuire[2]

Abstract

The HubLine Pipeline project included the marine construction of approximately 46.7 km of 762 mm diameter pipeline in Massachusetts Bay from Beverly to Weymouth. At two critical segments, Horizontal Directional Drilling (HDD) was employed to avoid conventional construction in scenic Beverly Harbor and near historic Georges Island under a busy shipping channel.

Past HDD projects have faced hard rock, large diameters, and long lengths. Several have been installed from barges into the seafloor. However, no two crossings have ever had such a challenging combination of these factors. The bores exceeded 1,280 m. Water depths were over 13.7 m with 3.7 m tidal fluctuations and exposure to the North Atlantic Ocean. The compressive strength of the rock ranged from 58,610 kPa (8,500 psi) to greater than 275,800 kPa (40,000 psi) These HDD installations have set a new standard for "state of the art" in a marine environment.

Several innovative techniques were employed to achieve success:

- Adaptation of Lift Boat vessels to support HDD operations;
- The installation of temporary marine risers to ensure fluid recirculation and transition of large diameter hole-opener assemblies;
- Pioneering pilot hole drilling techniques to overcome difficult downhole conditions; and,
- Controlled handling of the pull-back string in open waters.

The Hubline Pipeline Project

The HubLine Pipeline project connected the 1,046 km Maritimes & Northeast pipeline with the 1,609 km Algonquin system. The project included the marine construction of approximately 46.7 km of 762 mm diameter pipeline from Salem, MA to a termination near Weymouth, MA. Extensive engineering and environmental studies were conducted to determine the route of the pipeline. Final permits were received in May, 2002. The HDD construction option was considered necessary to avoid environmentally sensitive areas and busy marine traffic.

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[2] Michels Corporation, 817 Main Street, Brownsville, Wisconsin 53006; PH (920) 583 3132; e-mail tmcguire@michels-usa.com

The offshore route originated at Salem where a 1,486 m shore approach was drilled under shallow waters and US Hwy. 1A near Beverly, MA. At a place very near the Salem Landfall, a 1,308 m water-to-water drill was made under and across scenic Beverly Harbor. The pipeline proceeded east out of Salem Sound and southeast across Massachusetts Bay. The pipeline then progressed to a point outside of Boston Harbor near Georges Island, one of several islands that are part of the Bay Islands National Park. At Georges Island, another water-to-water crossing was drilled with a 1,290 m length. The pipeline made landfall at Weymouth where a HDD shore approach of 931 m was installed.

In addition to the marine HDD work, there were three HDD river crossings, at Emerson Brook (618 m), the Merrimack River (456 m), and the Waters River (1,101 m).

Marine Equipment and Risers – Minimal Discharge to the Sea Floor

The marine drilling operations required static and stable platforms not prone to shut-down from adverse weather or sea conditions. Four Class 200 Lift Boats, with legs 60 m long, were mobilized from the Gulf of Mexico. These self propelled, three-leg vessels provided 288 sq. m of usable deck space, and up to 181 tonnes of deck loading. The Lift Boats were positioned at both the entry and exit locations of the Beverly Harbor and Georges Island crossings. Each Lift Boat was equipped with a HDD Rig and supplemented with mud circulation and recycling capability. Having a Lift Boat/drill rig on each side of the crossing facilitated tripping operations of the downhole tools.

The HDD operations were complemented at each location with drill slurry mixing and recycling equipment on deck barges moored next to the Lift Boats. Hopper barges were also moored to collect slurry and cuttings, along with water barges to provide fresh water for slurry make-up. Numerous other vessels were chartered to provide crew transport and refreshment of fuel and consumables. A typical HDD Marine spread is shown in Figure 1.

Figure 1 - Typical HDD Marine Spread

The strict project environmental permits dictated that any slurry discharges to the sea floor be minimized. The hard rock conditions would require frequent tripping for refurbishment of large diameter hole-opener tools to the working decks of the Lift Boats. The design and installation of marine risers, or casings, from the sea floor to the decks of the Lift Boats would allow minimal slurry discharge and facilitate tool trips.

Large diameter casing (1,219 mm) was needed to accommodate the hole-opener tools. At the water depths and drilling angles encountered, up to 460 m of casing would be necessary to transition from the deck of the Lift Boat through the sea floor and then to drive through the overburden to the bed rock. Support legs, or "goal posts," were driven into the sea floor along the drilling alignment on centers of approximately 25 m. A typical marine riser structure is shown in Figure 2. At Georges Island, outcrops of bedrock near the sea floor precluded driving of the goal posts; and batter piled structures were installed (shown in Figure 3). Once the goal posts were installed, joints of 1,219 mm casing were welded on the drill rig and pushed off the Lift Boats and over the goal posts. After the casing reached the sea floor, a large pneumatic pipe rammer, rated at 39.3 kJ (29,000 ft.-lbs.) of impact energy at 180 strokes per minute, drove the casing through the overburden and to the bed rock interface. With the marine riser in place, drilling could commence.

Figure 2 – Typical Marine Riser Structure

Figure 3 - Marine Riser at Georges Island

Pilot Hole Drilling – Threading the Needle

Directional pilot hole operations were conducted using conventional mud motors and wire line survey tools. Precise punch-out positioning was not critical, as the marine risers on the exit side were designed to be installed after punch-out.

Pilot hole drilling at Georges Island proved very difficult. Although the marine riser had been driven to refusal, it had not sealed against the bedrock. As the pilot hole advanced; unconsolidated soils, cobbles and boulders sloughed into the drilled hole. Large pieces of fractured bedrock fell into the drilled hole. Also, fractures in the bedrock impeded the slurry circulation back through the marine riser, and allowed salt-water infiltration to the bentonite slurry. With this combination of adverse conditions, the drill pipe advancing the pilot hole began to seize more frequently. The pilot hole could only be advanced approximately 975 m.

In what was its first use in the United States, a Rotating Magnet Ranging (RMR) system was employed. The RMR system employs a Rotating Magnet which is placed in a drill sub, and the alternating signal is detected by wire line survey tools in an approaching hole. This signal provides steering information to the driller up to 50 m from the target.

To thread the needle, pilot hole drilling commenced from what was the "exit side", and drilled approximately 335 m to intersect with the partially completed pilot hole from the entry side of the crossing. The intersect was successfully completed on the first attempt. It is believed that, the ability to intersect pilot holes will have a profound effect on the capabilities of the HDD industry.

Hole Opening – Innovative Tool Designs

A 1,067 mm diameter reamed hole was necessary for the 762 mm diameter pipeline. The compressive strength of the rock in the area was often greater than 275,800 kPa (40,000 psi). Prior to construction, coordinated development took place with downhole tool manufacturers for more productive and robust hole-openers.

Traditionally, large diameter holes have been reamed by running numerous "stepped-up" hole-openers. The new hole-openers combined with specialty fabricated high-capacity drilling equipment allowed the 1,067 mm hole to be achieved in fewer passes. These newly designed hole-openers and specialized HDD equipment allowed more efficient reaming operations than have ever been achieved in comparable conditions. The hole-openers were fitted with tungsten carbide inserts for the hard drilling conditions. At several times during the hole-opening operations, penetration rates for the final 1,067 mm diameter hole-opener exceeded that of the smaller passes.

Pull-back

A single string of 762 mm pipeline was prefabricated, filled with water, and hydrostatically tested prior to pull-back at each location. When flooded, the line pipe had a submerged weight suitable to provide on-bottom stability for the local tidal currents. However, when dewatered, the pipeline strings had a submerged weight of only 48 kg/m. This low weight allowed easy handling of the pipe prior to and during pull-back.

The Class 200 Lift Boats had been structurally checked for side-loading. Normal well-servicing operations conducted from the Lift Boats only apply vertical loads. It was determined that the 544 tonne pull-capacity HDD rig pulling at shallow horizontal angles could topple a single Lift Boat. Therefore, prior to each pull-back, two Lift Boats were joined in-line to double the toppling resistance, as shown in Figure 4.

The pull-back drilling assemblies were tied into the pipeline string above water. The pull-back drilling assembly, attached to drill pipe through the drilled hole back to the drill rig, was lifted above water and along side the Lift Boat. Simultaneously, the pipeline string was lifted. The pull-back drilling assembly was maneuvered towards the pipeline string, and the connection was made. The pipeline string was then slowly lowered to the sea floor as the pull-back drilling assembly was pulled into the drilled hole.

Figure 4 - Lift Boats Ready for Pull-back

Beverly Harbor proved the biggest challenge in preparation for pull-back. The pipeline string had been laid at a location approximately 1.6 km from the HDD exit point, requiring it to be floated and towed to the HDD exit location. The pipeline string was lifted from the sea floor and bridled just below the surface from flotation units. Once the string was completely off bottom, it was slowly towed along a pre-planned route through Beverly Harbor. The pipeline tow was conducted in close coordination with the Coast Guard and harbor authorities. Once the pipeline string reached the exit location, it was tied-into the pull-back assembly and allowed to float during the pull-back operation.

A unique pull-back sequence was employed at Beverly Harbor for eventual tie-in to other sub sea pipeline sections. A spool piece had been designed to tie between the Beverly Harbor crossing and where the Salem landfall had been drilled. This required a flanged connection at the Beverly Harbor entry location. Following the pull-back of the HDD string to the entry location, the pipe string was actually pulled beyond that point and above water, where a flange was welded. After attaching the flange, the Lift Boats were moved to the exit side, and the pipeline string was retracted to the original entry point. This operation took less than 24 hours to complete.

Conclusion

The marine pipeline industry is increasingly using the HDD option for landfalls and obstructions offshore. The HubLine HDD installations proved that HDD can be adapted to significant water depths, difficult drilling conditions, and large diameter pipe. The HDD installations at Beverly Harbor and Georges Island have set a new standard for "state of the art" HDD pipeline construction in a marine environment.

ATTACHMENT A.5

DRAFT STATE WATERS COMPENSATORY MITIGATION PLAN TO OFFSET UNAVOIDABLE IMPACTS TO LIVE BOTTOM HABITAT FROM IMPLEMENTING THE PORT DOLPHIN DEEPWATER PORT PROJECT

Port Dolphin Energy LLC

STATE WATERS COMPENSATORY MITIGATION PLAN TO OFFSET UNAVOIDABLE IMPACTS TO LIVE BOTTOM HABITAT FROM IMPLEMENTING THE PORT DOLPHIN DEEPWATER PORT PROJECT

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1.0 INTRODUCTION

This mitigation plan was prepared as a tool for use during the Port Dolphin Deepwater Port project (Port Dolphin) permitting process to evaluate options and select specific strategies to compensate for unavoidable impacts to live bottom habitats in Florida state waters from implementation of the project. Live bottom is defined as hard seafloor substrate that supports attached (epibenthic) biological communities. The Florida Department of Environmental Protection (FDEP) will evaluate and comment on the plan while reviewing the Florida Environmental Resource Permit (ERP) application and as part of its Coastal Zone Consistency process. The ERP consolidates the State of Florida environmental permitting process, allowing all interested agencies to comment and add appropriate conditions. A separate mitigation plan is being prepared for similar unavoidable impacts within federal waters. In addition, mitigation plans for state and federal waters will be provided to the U.S. Coast Guard (USCG) for use in the National Environmental Policy Act (NEPA) process environmental impact statement preparation.

1.1 PURPOSE OF PLAN

The purpose of this mitigation plan is threefold:

1. to identify live bottom habitats within the area of the proposed Port Dolphin pipeline;
2. to assess the relative sensitivity of identified live bottom habitats to potential impacts associated with the construction of the project (the nature of the impacts will be assessed as well as the size of affected areas); and
3. to recommend specific mitigation measures to offset these impacts. Monitoring plans for each mitigation scenario are proposed, as well as a long-term monitoring strategy designed to assess relative success of mitigation actions and document recovery of project-related impacts.

This plan describes the following:

- the affected environment, based on previously conducted environmental surveys;
- anticipated additional pre- and post-construction environmental surveys;
- habitat impact scaling and mitigation analysis;
- mitigation scenarios and designs;
- implementation of optional mitigation approaches;
- a proposed 5-year post-construction monitoring approach; and
- contingency considerations.

This mitigation plan was developed using field-tested mitigation methods that will minimize impacts through relocation of colonized hard substrate and biota, and the direct offset of impacted hard bottom through the construction and/or installation of habitat replacement structures (limestone boulders, reef modules, concrete mats). Detailed mitigation strategies will be prepared upon final determination of impacts and compensatory requirements.

1.2 AGENCY CONSULTATION

The mitigation plan is being developed in consultation with the regulatory agencies, including federal, state, and local entities and will be based on agreements between personnel from Port Dolphin and the regulatory agencies.

2.0 PROJECT DESCRIPTION

Port Dolphin Energy LLC has filed for a license pursuant to the Deepwater Port Act of 1974, as amended, and the USCG's regulations, 33 Code of Federal Regulations Part 148 (2006), to construct, own, and operate a deepwater port. The offshore unloading portion (mooring area) of the Port Dolphin deepwater port (DWP) would be located in federal waters approximately 28 miles (45 kilometers) offshore of Tampa Bay, Florida in approximately 100 feet (30 meters) of water (**Figure 1**) and located within St. Petersburg lease area of the U.S. Department of the Interior, Minerals Management Service's Eastern Gulf of Mexico Outer Continental Shelf Planning Area. The unloading portion of the DWP would consist of two unloading buoys that would be separated by a distance of approximately 3.1 miles (5 kilometers). Each unloading buoy would have eight mooring lines consisting of wire rope and chain. The mooring lines would connect each unloading buoy to eight anchor points, most likely consisting of driven piles on the seabed. When not connected to a shuttle regasification vessel (SRV), the unloading buoy would be submerged 60 to 70 feet (18 to 21 meters) below the sea surface. In this position, the buoy would be held in position by the mooring lines and would be resting on the submerged turret loading buoy landing pad. A 16-inch flexible riser from each buoy would connect to two 36-inch subsea flowlines through a piggable-Y to a 36-inch gas transmission line that comes ashore at Port Manatee. The gas transmission line continues east onshore to an interconnection station located approximately 3.9 miles (6.28 kilometers) inland in Manatee County, Florida to connect with the Gulfstream Natural Gas System, L.L.C. and Tampa Electric Company.

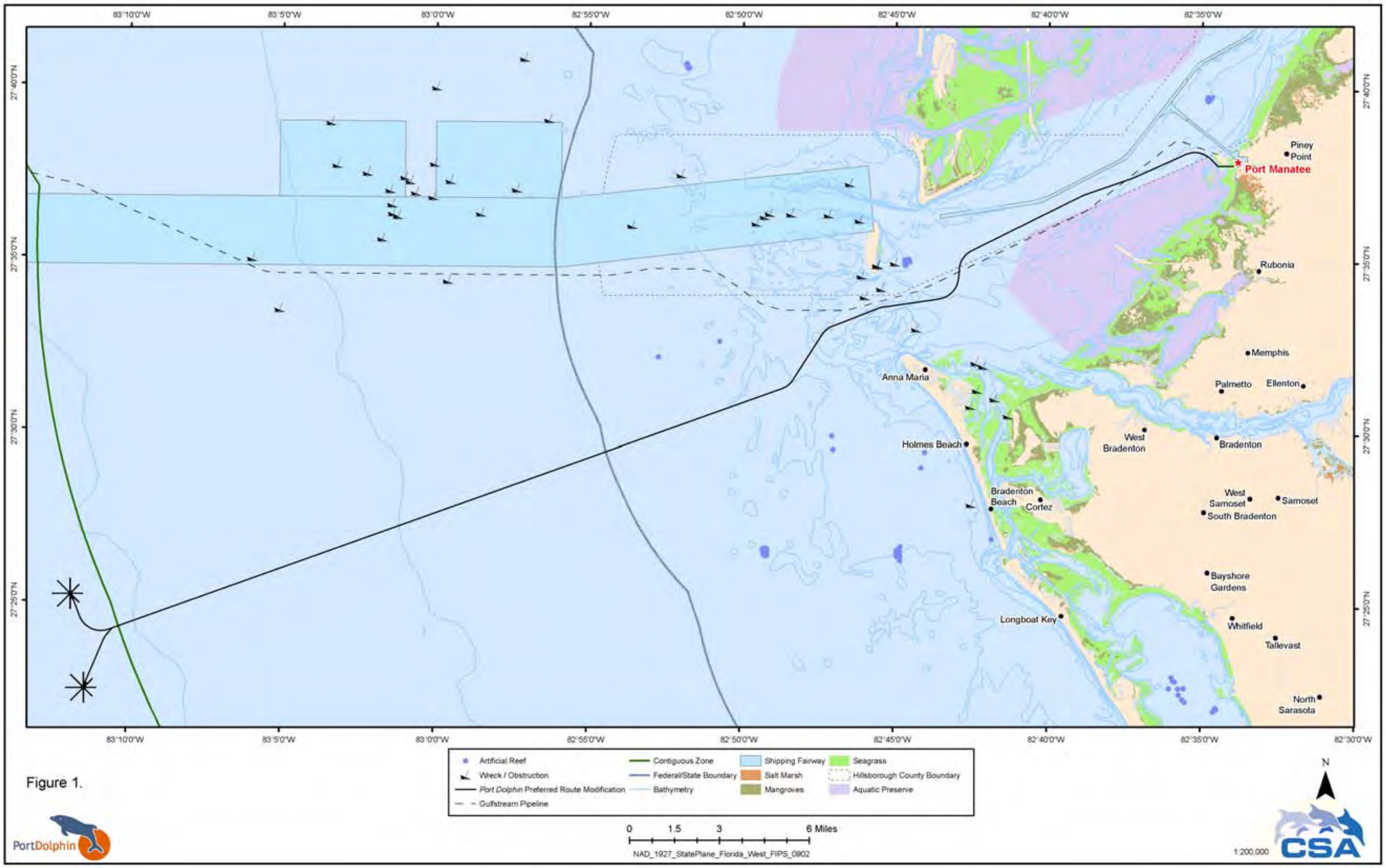
As presented in the **Deepwater Port Application**, **Volume II,** three alternative offshore pipeline routes corresponding to alternative terminal locations were originally proposed for consideration. These three routes (Northern, Southern, and Preferred) converged within Tampa Bay at 82°41'45" W longitude, 27°31'44"N latitude, northeast of Anna Maria Island and just outside of the Terra Ceia Aquatic Preserve. The routes then followed a common corridor passing through the northern edge of the Terra Ceia Aquatic Preserve for a distance of 3.0 miles (4.8 kilometers). Of the three offshore routes under consideration, the Preferred Route was ultimately chosen.

Based on subsequent discussions with the State of Florida, three new alternative nearshore pipeline routes (Alternatives A, B, and C) were developed within Tampa Bay to avoid passing through the Terra Ceia Aquatic Preserve. An analysis of the alternative routes led to the selection of Alternative A. Once beyond the Aquatic Preserve, the pipeline turns southeast to the landing at Port Manatee. The Revised Preferred Route consists of the offshore Preferred Route, plus nearshore Alternative A. Details of the selection process can be found in **Addendum II to the Deepwater Port License Application**, **Section 1**. **Figure 1** represents this revised preferred route.

2.1 CONSTRUCTION SCHEDULE

Construction of Port Dolphin would be a multi-phase project and will take approximately 22 months. This time period includes detailed design, procurement, and construction. In general, the Port Dolphin pipeline would be constructed in an onshore to offshore direction. The construction phases may be conducted concurrently, or in several cases, in parallel. Once mobilized, the construction activity would be 24 hours per day, 7 days per week. The port would be expected to commence operations in the second quarter of 2011.

Figure 1
Port Dolphin Location and Pipeline Route



2.2 CONSTRUCTION METHODS

Base-case construction methods have been selected based on best available data (i.e., geophysical survey data) and are subject to adjustment pending the results of the geotechnical survey and detailed engineering. The four base-case construction methods planned for use within Tampa Bay and state waters include the following:

- plow trench system (PTS);
- clam shell dredging;
- horizontal directional drilling (HDD); and
- external protection technologies.

Plowing is the preferred methodology for pipeline burial, and the baseline installation methods presented include 87.8% (113,671 feet [34,646.9 meters]) of the pipeline to be laid on the seafloor by a pipelaying barge, and then buried within state waters. It is expected that in some plowed areas, the plow may not achieve burial to the design depth, in which case these areas would subsequently be covered by concrete mattresses or rock armoring. Those areas where full burial is anticipated accounts for 83.5% (108,171 feet [32,970.5 meters]) within state waters and those areas where full burial is not anticipated accounts for 4.2% (5,500 feet [1,676 meters]) of the pipeline route within state waters. However, for direct disturbance determination, these areas are simply assumed to be plowed, since the impact width for plowing is greater than that for mattress placement. Although plowing is the preferred methodology for pipeline burial, other techniques, such as dredging and HDD, will be used in certain areas. External protection with concrete mattresses or other armoring will be used in transition areas and accounts for 5.3% (6,884 feet [2,098 meters]) of the pipeline route within state waters.

2.2.1 Plow Burial—PTS

In the plowing technique, the pipeline is lowered below seabed level by shearing a "V"-shaped ditch in the soil below the pipeline. The plow is towed along the pipeline directly behind the burial barge (**Figure 2**). As the ditch is cut, spoil is removed and passively pushed to the side by specially-shaped moldboards fitted to the main plowshare.

Figure 2
A Typical Pipeline Burial Plow
(Courtesy of Horizon Offshore)

Use of a "conventionally moored" barge is planned, which means that the position of the pipeline installation will be maintained through the use of anchors, associated anchor chains, and/or cables. The anchor reset distance for each mile of offshore pipeline burial route will be a function of the size of the lay/bury barge, weather conditions, water depth, seabed type, and the amount of anchor line that can be stored, deployed, and retrieved by the barge. Based on previous experience and accepted practice in similar conditions, as well as discussions with an experienced pipelay/bury contractor, it is currently assumed that each anchor will be reset approximately every 2,000 feet (2,400 meters) along the pipeline route.

Figure 3
Lowering Plow with Share Open

The barge will first position directly over the burial initiation point on the pipeline. The plow is then launched with its share in the open position and lowered towards the burial initiation point (**Figure 3**). The plow will be fitted with cameras, sonar, and sensor instruments, which will assist with final positioning. Divers or robotic submersibles also will be deployed as necessary to monitor the plow as it is located and placed astride the pipeline.

When it is confirmed that the plow safely straddles the pipeline and all in-water system checks have indicated that it is safe to proceed, the plow's pipeline lifters are activated. The pipeline is raised into the plowshare, which is then closed around it (**Figure 4**). At this point, the barge would recover the plow's main lifting line and advance forward along the pipeline route in order to establish a proper tow catenary. Barge advancement is achieved by winching-in/paying-out anchor cable while "walking" and relocating the anchor array as required.

Once a proper tow catenary is established, the plow is pulled forward under tension while operators monitor and adjust the depth of the ditch being cut. The latest generation of burial plow is fitted with sophisticated computer control systems and instrumentation, enabling the operators to select and continuously monitor the depth of the ditch as it is formed in real time (**Figure 5**). The process continues as the barge simultaneously advances along the pipeline route and lowers the pipeline into the ditch cut by the plow.

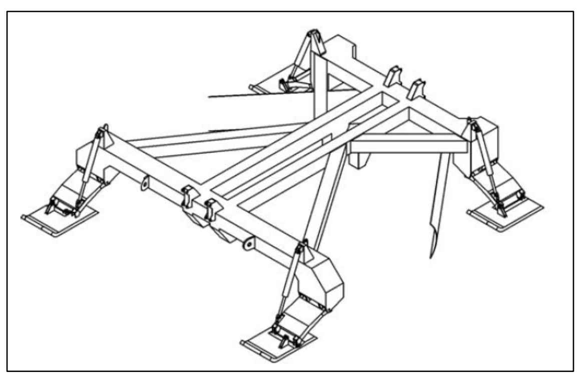
Figure 4
Pipeline Raised into Plowshare

Figure 5
Monitoring and Adjustment of Ditch Being Cut

Once the end of the pipeline route is reached, the procedure above is reversed in order to lift and recover the plow back onto the deck of the barge. The pipeline route is then surveyed either by the barge itself, or by a separate survey vessel, to determine where full pipeline lowering has been achieved.

Finally, one further pass will be made along the pipeline route to backfill the pipeline lying in the ditch. For this purpose, the plow blades are reversed for scraping the spoils back into the ditch (**Figure 6**). As the backfill plow is advanced, the spoil is simultaneously pushed back into the ditch and on top of the pipeline. Upon completion, a final survey is run to confirm and document the conclusion of all burial operations.

Figure 6
Backfill Plow Configuration
(Courtesy of Horizon Offshore)



2.2.2 Clam Shell Dredging (Sunshine Skyway Bridge Section)

The section of the route that passes beneath the Sunshine Skyway Bridge is anticipated to be buried by means of bucket dredging. In this section, dredging of the pipeline ditch would be carried out “pre-lay” prior to passage of the pipelay barge. An inshore dredge barge would be accurately located at all times along the proposed pipeline corridor, using a satellite-deployed differential global positioning system operated and supervised by suitably qualified professional surveyors. The barge will be moored in position using either temporary spudded legs or anchors.

Depending on any access restrictions for the anchor handling support vessels in the shallowest water zones, it may be temporarily required to operate the barge with a reduced number of anchors. In such a case it may be necessary to use the anchor handling support vessels as tugs to aid barge positioning.

A clamshell dredge grab would be deployed to seabed from a crane on the barge, and an acoustic sonar system would be used to accurately monitor the depth of the ditch dredged. Excavated spoil will be carefully placed adjacent to the ditch formed, and its location will be recorded. Following passage of the pipelay barge, the spoil will be relocated back into the ditch in order to backfill the laid pipeline.

2.2.3 Horizontal Directional Drilling

2.2.3.1 Port Manatee HDD Shore Approach

The HDD operation on the Port Dolphin shore approach would involve drilling from onshore to offshore, ultimately pulling the carrier pipe into the drill bore from the offshore exit site. Employing HDD for the bay to shore transition at Port Manatee offers three distinct advantages over an “open trench” approach, such as:

1) it is not environmentally intrusive, as the entry and exit construction sites are temporary in nature and will be restored to pre-construction condition;
2) it offers excellent protection for the pipeline from mechanical and/or storm damage; and
3) it avoids active industrial areas present on the shore approach.

A drill rig would be located inside the Port Manatee industrial complex. The exit point would be 3,573 feet (1,089 meters) away, bearing northwest into Tampa Bay, located in a water depth of 7 feet (2 meters) mean low low water (MLLW). The apex of the drill bore curve would be 120 feet (37 meters) below MLLW.

The drilling operation consists of progressively larger drill strings to be inserted into the hole, ultimately producing a drill bore 48 inches (121 centimeters) in diameter. As the drilling operation is underway, a jack-up barge would be positioned offshore at the exit station to excavate an “exit” hole. This excavation would be accomplished by either the use of a long-boom backhoe or bucket dredging (refer to description of trenching method to be utilized under the Sunshine Skyway Bridge).

Simultaneously, or even in advance of onshore drilling at Port Manatee, the 36-inch (91 centimeter) carrier pipe would be constructed onshore in close proximity to the entry point. The carrier pipe would be constructed in several long sections to be welded together once the pull is started.

Once the exit pit is constructed, a jack-up barge would be positioned near the pit for the pulling operation. The drilling commences at shore and proceeds until the drill string is punched through at the exit pit. The exit angle would be between 3 and 10 degrees. The definitive exit angle would be determined during detailed design engineering.

A shallow water diving operation would connect the drill string to the pulling winch on the jack-up barge. The pull wire is retrieved to the entry point, the sections of pipe are positioned in alignment with the entry hole, and the pipeline is pulled offshore to the exit point. At this point, the HDD operation is complete.

2.2.3.2 East and West HDD Crossings of the Gulfstream Pipeline

In order to avoid construction activity in the Aquatic Preserve, the Port Dolphin pipeline route would now follow a northerly direction after passing through Passage Key. This new route would require crossing the existing Gulfstream pipeline in two locations.

The first crossing would be east of the causeway in a water depth of 21 feet (6.4 meters). This crossing would be 2,950 feet (899 meters) in length. The second crossing would be west of the causeway, also in a water depth of 21 feet (6.4 meters). This crossing would be 1,335 feet (407 meters) in length. Other than the difference in total length (due to a difference in crossing angles), the crossing construction requirements are the same for each crossing.

The results of an acoustic bathymetric survey conducted in October 2007 by Port Dolphin, confirm that the Gulfstream pipeline, as located in the Tampa Bay complex, is below or at minimum flush with the natural bottom. For all practical purposes, the water-to-water HDD crossings would be identical to the water-to-land HDD, as would be conducted for the final approach into Port Manatee, with two basic exceptions:

- the crossing would require two jack-up barges in the 200-class range; and
- the depth of the drill below the Gulfstream pipeline would be approximately 20 feet (6 meters).

For construction continuity and economy, the two crossings can be drilled while other segments of the pipeline are under construction. To achieve this, the two pull-in strings (or carrier pipes) are constructed by the lay barge and wet-stored on the seafloor. Both strings would be wet-stored on the north side of the pipeline route, as the pull-in would be from the south side. The strings would not be concrete-coated, but would be flooded with filtered and treated seawater. Flooding is required in order to provide stability on the seafloor. The south end of the west string will be wet-stored approximately 650 feet (198 meters) north of the Gulfstream pipeline within the surveyed corridor. The south end of the east string will be wet-stored approximately 1,500 feet (457 meters) east of the Gulfstream pipeline within the surveyed corridor. Each string would be hydrostatically-tested after installation on the seafloor, prior to tie-in.

The two jack-up barges work in unison during the drilling operation. A teardrop-shaped exit pit would be excavated on both ends of each crossing, using either the backhoe or bucket dredge methods described previously. The spoil from the pit(s) would be side-cast and reused later for backfill after the HDD string will be tied in to the pipeline. The exit pits are constructed as an elevation transition to facilitate the pull-in of the string and the final tie-in to the pipeline. The fluids and muds (i.e., water and Super Gel-X® or equivalent) utilized are environmentally benign and pose no danger to the environment if lost and not recovered. The exit pits are not constructed or intended for containment and recovery of drilling fluids or muds. All drilling fluids and muds would be collected and recycled during the HDD operation.

2.2.4 External Pipeline Protection Technologies

In order to provide equivalent protection and stabilization in areas where pipeline burial is not achieved; the use of placement of concrete mattresses is planned. The final burial survey will identify any zones where full burial has not been achieved. In such zones, an alternative protection technology would be installed; the primary technique planned is the placement of flexible concrete mattresses. These concrete mattresses will be selected to conform to applicable regulatory requirements and designed to provide an equivalent level of stabilization and protection of the pipeline.

The concrete mattresses would be installed from a specialist diving support or construction barge that will be moored in position with an anchoring system similar to that of the burial barge. The mattresses will be lifted and located on top of the pipeline using the barge crane and a special deployment frame (**Figure 7**). Divers or a robotic submersible vehicle would assist with the final positioning and attachment of the mattresses to the pipeline.

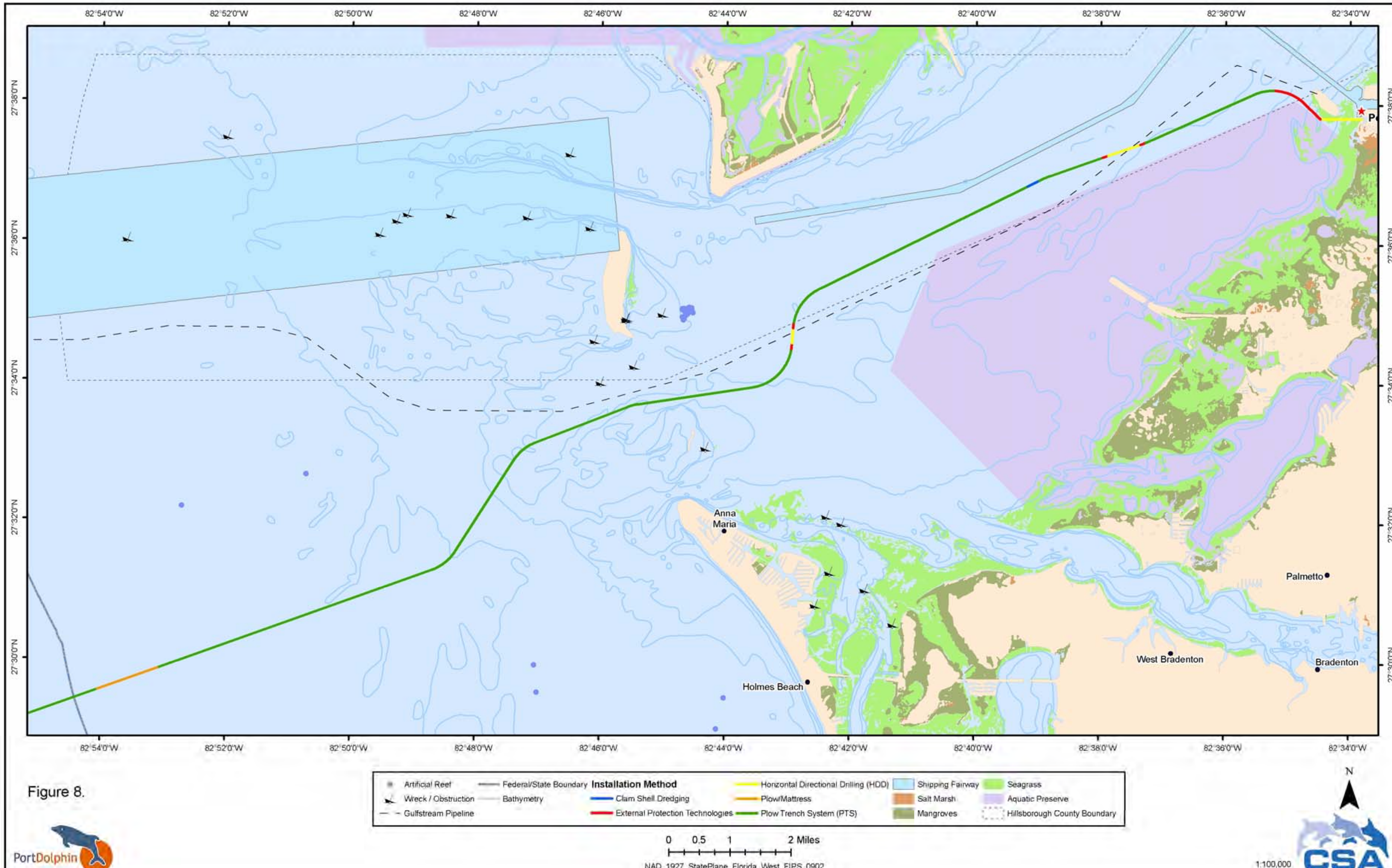
Figure 7
Concrete Mattress on Deployment Frame

A typical example of a proprietary concrete mattress product widely used for protection of large-diameter pipelines in the Gulf of Mexico is 20 feet (6 meters) wide, 8 feet (2.4 meters) long, and 9 inches (23 centimeters) thick. It weighs 10,500 pounds in air (6,000 pounds submerged). Such mattresses are normally laid together to provide continuous protective cover over the pipeline. However, the concrete mattresses anticipated to be used for the Port Dolphin pipeline will be 20 feet (6 meters) wide, 8 feet (2.4 meters) long, and 12 inches (31 centimeters) thick.

An optional construction method for external protection that is not part of Port Dolphin's base-case construction plan but could still be considered during future discussions with permitting agencies (FDEP, U.S. Army Corps of Engineers, etc.) includes the use of rock armoring. Rock armoring is a common and proven methodology to externally protect pipelines that cannot be buried and backfilled due to extreme soil substrates. A conventional anchor barge is mobilized with hoppers, shakers, and a Tremie chute and a natural material (procured locally) is sized to withstand existing ambient current conditions with consideration for storm surge. This material is placed over and around the pipeline through the Tremie chute from the barge. The operation is monitored by subsurface sonar mounted on the chute. Once the operation is complete, an as-built survey is conducted with side-scan or multi-beam sonar to ensure the engineered cover has been achieved.

Figure 8 illustrates pipeline installation methods along the proposed route.

Figure 8
Pipeline Installation Methods Along the Proposed Route Within State Waters



3.0 AFFECTED ENVIRONMENT

Numerous offshore surveys were performed to collect qualitative and quantitative data to characterize and delineate the marine benthic habitats (including seagrass) within the Port Dolphin project area that may be impacted by construction of this project. In order to meet requirements for both the State of Florida and federal requirements, survey methods incorporated guidelines from both state and federal regulatory agencies.

Survey types included a geophysical, photodocumentation survey using towed video and still cameras, and diver surveys. The geophysical survey was conducted to acoustically identify any hard bottom within the pipeline corridor, as well as to locate and identify any hazards (such as shipwrecks) or potential archaeological sites. Descriptive and qualitative video and still photographic data were collected to characterize hard/live bottom, seagrass, and soft bottom habitats. Diver surveys were conducted to collect *in situ* quantitative still photographic data on representative hard bottom habitats offshore Tampa Bay and within shallow waters of Tampa Bay.

3.1 GEOPHYSICAL SURVEY RESULTS

The seafloor slope of the project area is variable, but decreases notably to the east into Tampa Bay. From about the 60-foot (18-meter) contour eastward, the seafloor is depicted by an irregular surface characterized by hard bottom conditions and the accumulation of sandy sediments, sometimes extending over the hard bottom zones. The possible remnant shoal exhibits heights from 2 to 3 feet (6.6 to 10 meters), with broad sheets extending over large areas, up to 1,000 feet (305 meters). Low relief outcrops occur over uplifted areas, which may represent calcareous bioherms formed during lower sea levels. From the 60-foot (18-meter) contour eastward, the route is crossed by minor relief migrating sand waves. At the entrance to Tampa Bay, hard bottom exposure due to tidal flow scouring was recorded. Complete results of the geophysical surveys can be found in the archaeological and hazard survey reports produced by T. Baker Smith, Inc. for Hoegh LNG (T. Baker Smith, Inc., 2007a,b, 2008).

3.2 PHOTODOCUMENTATION SURVEY RESULTS

Following the FDEP protocol, four distinct marine benthic habitat types were identified within the survey area (**Table 1**). Habitats included live bottom (Type A, Type B, and Type D) and soft substrate/sand. Survey area classifications were based on a review of video data collected from the survey transects within the proposed offshore project area.

Table 1
Florida Department of Environmental Protection (FDEP) Habitat Type Classifications

FDEP Habitat Type	Habitat Type Description
Type A	20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 feet (0.25 m) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).
Type B	5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 feet (0.25 m) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.
Type D	Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.
Soft substrate/Sand	Soft substrate/sedimentary habitats not associated with hard bottom ecotones.

Surveys indicated soft substrate/sand is the dominant habitat type in the offshore project area. Types A, B, and D live bottom habitats observed within the project area were characterized as relatively small with patchy distribution. The areal extent of the various habitat types along the proposed project corridor is provided in **Table 2** (CSA International, Inc., 2007b,c). The areas included in **Table 2** reflect the currently proposed pipeline configuration including the current pipeline re-route currently underway by Port Dolphin to avoid potential sand resources. **Figure 9** shows the distribution of live bottom habitat types along the Preferred Route Modification. .

Table 2
Area of Florida Department of Environmental Protection (FDEP) Habitat Types Within the Project Corridor Based on Surveys Conducted in Florida State Waters

FDEP Habitat Type	Acres	Hectares	Percent of Total Area (%)
Type A	655.93	265.45	5.6
Type B	255.13	103.25	2.2
Type D	714.85	289.29	6.1
Soft substrate/Sand	10,071.58	4,075.82	86.1
Total	11,697.49	4,733.80	100.0

3.3 DIVER SURVEY RESULTS

3.3.1 Live Bottom Habitat Survey

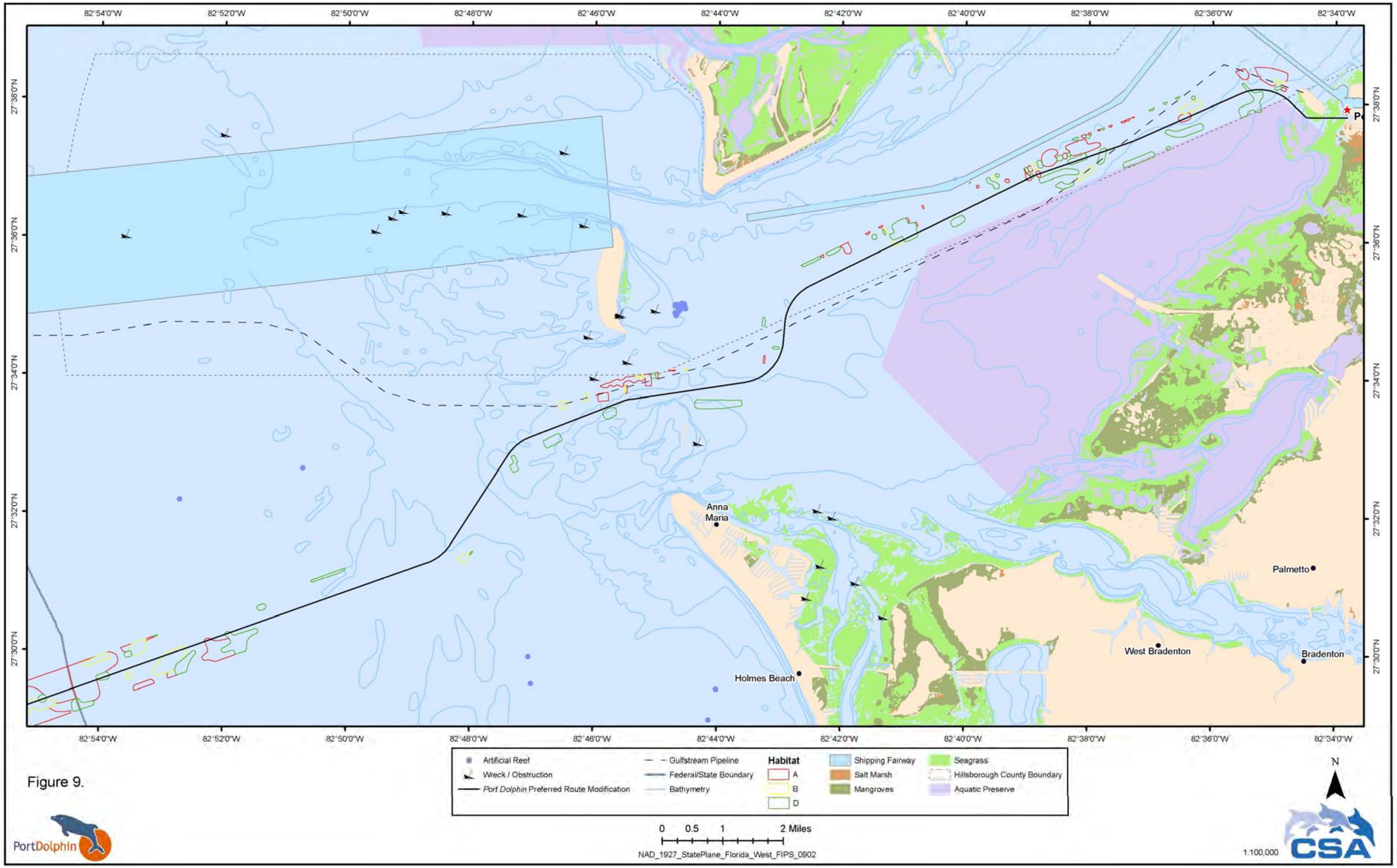
A total of 15 live bottom sites was surveyed within Florida state waters. These included 13 sites along the original pipeline corridor and two sites within the rerouted section of corridor around the Terra Ceia Aquatic Preserve. Of the 15 live bottom sites, 11 Type A habitats were confirmed, mostly based on structural relief (greater than 10 inches [25 centimeters]). Two Type B and two Type D habitats were documented and classified based on their relative lack of structure and percent cover of non-algal epibiotic cover (**Table 3**) (CSA International, Inc., 2007b,c).

Table 3
Florida Department of Environmental Protection Habitat Classifications of Live Bottom Sites Visited During Diver Surveys

Site	Dive Site Number	Depth (feet)	Habitat Classification	Non-algal Cover (%)	Macroalgal Cover (%)
1	17	41	D	4.9	40.2
2	18	41	A*	5.5	35.8
3	19	41	A*	5.3	34.5
4	21	32	D	4.8	16.7
5	26	17	A	34.4	10.6
6	27	11	A	26.4	20.9
7	28	12	B	15.4	1.3
8	29	16	A	21.6	3.7
9	30	23	A*	13.7	5.0
10	31	25	A	20.0	5.8
11	32	23	A	32.3	10.6
12	33	22	A*	15.0	5.0
13	35	16	B	12.1	2.7
14	A-1	15	A	24.3	2.7
15	A-2	22	A	22.2	2.1

* Classified as Type A based on structural relief.

Figure 9
Mapped Habitats by Florida Department of Environmental Protection Classification Type



3.3.2 Quantitative Seagrass Survey

Seagrass communities are found in the shallower waters (up to 6 to 8 feet [1.8 to 2.4 meters]) of Tampa Bay (Southwest Florida Water Management District, 1999) and are composed of five species: turtle grass (*Thalassia testudinum*), manatee grass (*Syringodium filiforme*), shoal grass (*Halodule wrightii*), widgeon grass (*Ruppia maritima*), and star grass (*Halophila englemannii*).

Within the pipeline corridor, seagrass was observed predominantly near Manbirtee Island, the spoil island near Port Manatee, in water depths shallower than 7 feet (2 meters). A total of 195 acres (79 hectares) of seagrass habitat, illustrated as 24 separate polygons, was identified, all offshore of Port Manatee (**Figure 10**).

Seagrasses do not currently exist in the HDD Area but do occur within 75 feet (23 meters) to the southwest and more than 194 feet (60 meters) to the northeast (**Figure 10**). Since seagrass beds are a dynamic habitat, a thorough seagrass survey will be performed prior to construction to determine the current status and location of seagrass in the area of the HDD exit location.

Figure 10
Seagrass Polygons off of Port Manatee

4.0 POTENTIAL ENVIRONMENTAL IMPACTS

4.1 IMPACT-PRODUCING FACTORS

Environmental impacts associated with the proposed project include disturbance or alteration of seafloor habitats. Potential impact-producing factors include the following:

- pipeline burial (plowing) activities;
- placement of concrete mattresses;
- pipelaying barge anchor placement; and
- pipelaying barge anchor cable sweep.

4.2 ESTIMATIONS OF ENVIRONMENTAL IMPACTS

4.2.1 Pipeline Plowing and Concrete Mattress Placement

The area of seafloor impact from pipeline plowing and concrete mattress placement activities was calculated using a geographic information system (GIS) to overlay mapped benthic communities onto pipeline segments that are expected to be plowed, covered with mattresses, or buried using dragline and mattresses. The majority of the area expected to be impacted by plowing and mattress placement will be soft bottom, but small areas of hard/live bottom habitat also will be affected. The total area of seafloor impact within state waters was estimated at 179 acres (72.65 hectares), approximately 11% (20.27 acres [8.2 hectares]) of which would be live bottom habitats (Types A, B, and D). Impacts associated with direct physical seafloor disturbances in state waters during the construction phases are summarized in **Table 4**. The areas included in **Table 4** reflect the currently proposed pipeline configuration and do not reflect the current pipeline re-route currently underway by Port Dolphin to avoid potential sand resources. These areas will be updated once the final pipeline alignment is determined.

Table 4
Extent of Live Bottom Impacts from Pipeline Installation in Florida State Waters

Activity	Area Affected acres (hectares)			
	Type A Habitat	Type B Habitat	Type D Habitat	Total
Plowing	7.09 (2.87)	4.85 (1.96)	8.09 (3.28)	20.03 (8.11)
Mattress placement	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Clamshell	0.24 (0.1)			0.24 (0.1)
Anchoring	0.84 (0.34)	2.44 (0.99)	1.45 (0.59)	4.73 (1.92)
Anchor cable sweep	279.92 (113.28)	806.54 (326.4)	476.94 (193.01)	1,563.40 (632.69)
Total	288.09 (116.59)	813.83 (329.35)	486.48 (196.88)	1,588.4 (642.82)

Impacts due to plowing and mattress placement represent permanent loss of live bottom habitat, as hard bottom substrate will be destroyed by plowing or permanently covered by mattress placement. Impacts due to anchoring and cable sweep represent a temporary decrease of live bottom function, as these impacts will be primarily to the epibenthic organisms and not to the to the structural habitat (i.e., substrate).

Plowing and Mattress Placement: The analysis predicts that a total of 20.03 acres (8.11 hectares) of live bottom habitat would be affected by plowing including areas where the required 3 feet (0.9 meter) of burial is not achieved and mattresses will be used for protection. Additionally, the analysis predicts that no live bottom would be affected by concrete mattress placement only.

Anchoring: The analysis predicts that 4.73 acres (1.92 hectares) of live bottom habitat would be affected by anchoring.

Anchor Cable Sweep: In addition to the direct impacts, each anchor cable also will contact (sweep) the seafloor. A range of anchor wire catenary analyses was performed using a standard static catenary program to calculate the extent of anchor sweep impacts for a 10-anchor array. The area per reset was adjusted to account for the use of mid-line buoys to reduce cable sweep. A detailed analysis of mid-line buoys has not been undertaken at this stage. However, an initial assessment suggests that mid-line buoys could reduce anchor wire weight by about 50%, with a corresponding reduction in seabed contact area of 25% or greater, yielding an impact area of 1,199,162 square feet (111,395 square meters) per anchor reset..

The area of live bottom habitat expected to be impacted by cable sweep is predicted to be 1,563.4 acres (632.68 hectares) of live bottom habitat, making this the largest source of seafloor impacts during the pipeline installation.

4.2.2 Impacts from Pipelaying Barge Anchoring

The following assumptions were used in order to calculate impacts:

- The pipelaying barge will make four passes along the route for the following: pipelaying, plowing, backfilling, and mattress placement.
- During the first three passes, the barge will use 10 anchors, which will be reset every 610 meters (2,000 feet). Each anchor contact with the seafloor would directly affect an area of 360 square feet (33.4 square meters).
- The fourth pass (mattress placement) will be done by a smaller barge with four smaller anchors that would be reset every 1,000 feet (305 meters). The anchors would affect a smaller area of 90 square feet (8.4 square meters).
- Hard and soft bottom areas will be affected in direct proportion to the percentage of these areas along the portion of the pipeline route in Florida state waters.

The actual sequence of events involved in pipelaying will be more complicated than indicated by these assumptions, particularly in Tampa Bay, where three HDD operations would be conducted. However, the assumptions were reasonable for estimating the number and extent of anchor impacts. **Table 5** categorizes impacts from anchoring related to specific operations of the pipeline installation.

Table 5

Areal Extent of Seafloor Impacts from Anchoring During Pipeline Installation (Preferred Route Modification – State Waters only)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	No. of Anchor Impacts	Direct Impact Area[b]			
					Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)
1st	Pipelaying	121,659	60	600	3.34 (1.35)	0.29 (0.12)	0.83 (0.34)	0.50 (0.20)
2nd	Plowing	113,671	57	570	3.17 (1.28)	0.27 (0.11)	0.79 (0.32)	0.47 (0.19)
3rd	Backfilling	113,671	57	570	3.17 (1.28)	0.27 (0.11)	0.79 (0.32)	0.47 (0.19)
4th	Mattress placement	12,384	13	52	0.07 (0.03)	0.01 (0.00)	0.02 (0.01)	0.01 (0.00)
				Total	9.76 (3.95)	0.84 (0.34)	2.44 (0.99)	1.45 (0.59)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each would affect an area of 360 square feet (33.4 meters^2). For the fourth pass, assumed four smaller anchors would be reset every 1,000 feet (305 meters) and each would affect an area of 90 square feet (8.4 meters^2).

[b] Assumed anchors would contact habitats in proportion to their occurrence during the video surveys (5.84% Type A, 16.84%, Type B, 9.96 Type D, and 67.36% soft bottom).

4.2.3 Impacts from Pipelaying Barge Anchor Cable Sweep

In addition to the direct impacts from the placement of the pipelaying barge anchors, each anchor cable also will contact (sweep) the seafloor. The impact area associated with cable sweep was estimated to be 1,199,162 square feet (111,395 square meters) per anchor reset. The total anchor wire sweep per reset was estimated to be 1,598,882 square feet (148,526 square meters), which equals 36.71 acres (14.85 hectares). This estimate is considered to be very conservative for Florida state waters because of the water depth and anchor scope assumptions. Benthic habitats will be affected in direct proportion to the percentage of these areas within the project area in Florida state waters.

There are two types of injuries that occur to live bottom communities associated with the installation of the Port Dolphin Project, structural and biological. Anchor sweep impacts to live bottom habitat differ from direct impact from pipeline installation (i.e., plowing, mattress placement, dredging, or direct anchor placement). The direct impacts from installation of the pipeline create injuries to the structure (live bottom/hard bottom substrate) as well as the biological component (organisms growing on the substrate), whereas the impacts from anchor sweep are typically injurious to the biological component (living organisms growing on the structure) and not the structure. Impacts from anchor sweep typically recover much more quickly than the types of injuries that will be caused from direct impact from pipeline installation.

5.0 MITIGATION

Methods for scaling mitigation requirements to offset the impact will be different for state and federal waters. This document only addresses mitigation for potential impacts in state waters.

5.1 UNIFORM MITIGATION ASSESSMENT METHOD (UMAM)

Using the data collected during the field surveys (**Section 3.0**), the Uniform Mitigation Assessment Method (UMAM) will be implemented to determine the necessary mitigation within state waters. UMAM is a standard impact assessment procedure used by the state of Florida for assessing the function of the habitat, the amount of habitat functions reduced by proposed impacts, and the amount of mitigation necessary to offset that loss (Chapter 62-345, Florida Administrative Code).

5.2 TIME LAG AND RISK

Time lag will be addressed in the mitigation plan to assess the length of time it would take for the mitigation implementation to reach the relative productivity level of pre-construction conditions. Risks associated with the mitigation implementation will be analyzed in the mitigation plan and will be considered as factors during the selection of the mitigation option. The information obtained from the time lag and risk assessments would be included as inputs for the UMAM process

5.3 MITIGATION OBJECTIVE

The objective of the proposed mitigation options is to compensate for unavoidable and recognized impacts to marine live bottom habitat associated with the construction of the Port Dolphin DWP project. Mitigation is intended to reduce loss of habitat and ecological function by creating biological and structural enhancements that provide and maintain features similar to the impacted habitat. An effective strategy for meeting the stated objective is to use a combination of the presented mitigation options.

5.4 MITIGATION OPTIONS

Mitigation options include biological enhancement and structural enhancement methods. Each method is discussed separately.

5.4.1 Biological Enhancement

Biological enhancement will consist of two components:

1) resource translocation, and
2) resource reattachment.

The biological enhancement option would be implemented primarily to rescue hard coral colonies, octocorals, and/or large sponges. Rescue of these resources is considered a priority since they are the most visible and slowest growing components of the impacted epibiotal community. The rescue of larger individuals of corals and sponges would significantly reduce recovery time following construction. Biological enhancement can be conducted prior to and following construction activities; although, the primary focus would be on resource translocation from pre-construction impact areas.

5.4.1.1 Resource Translocation

Pre-Construction Translocation

It is recommended to conduct translocation operations at live bottom areas that have been identified during pre-construction as impact areas that support the highest densities of the target biota. This approach will help maximize biological benefit for a relatively time-sensitive program. It is estimated that removed epibiota could be cached pending reattachment for up to 3 months with minimal tissue loss.

Hard corals, and large octocorals and sponges would be removed from live bottom areas by chipping the living portion of the colony from the point of attachment, or by removing a portion of the substrate along with the attached organism(s). Biota/substrate suitable for reattachment will be transported and securely cached away from potential impacts of construction activities. Cache locations will be in similar water depths as the donor sites. Cached biota/substrate will be secured using fabricated holding bins and/or natural topographic features (i.e., depressions). This method for caching biota has been successfully utilized for recent biota reattachment and transplantation projects (Marine Resources Inc., 2003; Continental Shelf Associates, Inc., 2006a; CSA International, Inc., 2007a).

To reduce relative productivity time lag for mitigation, cached biota will be reattached to suitable prepared substrate and mitigation structures. Colonies would be reattached onto prepared surfaces, utilizing either cement or marine-grade epoxy as a bonding agent. A sufficient amount of the selected bonding agent will be placed directly on the reattachment substrate; biota to be reattached will be pressed firmly into the bonding agent and held in position or propped until stable. Reattached biota will be checked intermittently during reattachment operations to ensure their stability and to address (enhance) the aesthetic quality of the reattachment matrix. Reattached biota will be spatially distributed in a manner that would mimic natural conditions as closely as possible.

Post-Construction Translocation

Pipeline construction activities, particularly plowing, will very likely displace carbonate substrate and associated epibiota. Although individual epibiotic resources will be addressed, the primary concern with post-construction translocation will be the displaced substrate/biota boulders. Boulders and attached epibiota identified during post-construction mitigation operations will be handled as described for pre-construction mitigation. The boulders displaced during construction could be translocated and utilized as mitigation substrate. This mitigation option has the potential to preserve epibiotic resources and will maximize the use of natural substrates to provide faunal refuge and suitable naturally-occurring settling substrate for subsequent epibenthic recruitment. Additionally, the utilization of these naturally-occurring substrate/biota boulders will minimize potential substrate mobility, when compared with that of quarried boulders, which may impede recovery and/or possibly cause additional collateral damage to the habitat. Salvaged substrate/biota boulders will be stabilized by utilizing bonding agents in conjunction with deployment strategies discussed in **Section 5.4.2.1**.

Recovery of displaced substrate/biota boulders will include localized containment, transport, and deployment at the selected mitigation site(s). Displaced boulders could be safely handled by a two-person dive team and transported to selected mitigation sites. Multiple mesh cargo nets, each accommodating the containment of about 1 cubic yard of rubble, would be utilized for the boulder recovery operations. The method of transport will depend on the distance between the recovery site and the deployment (mitigation) site. It is recommended to utilize these displaced substrate/biota boulders relatively close to the recovery site so they can be moved by divers utilizing lift bags; long-distance deployment will require work vessel and specialized equipment. These methods for recovery of displaced substrate/biota boulders have been successfully utilized during restoration activities conducted offshore Florida (Marine Resources Inc., 2006) and Hawaii (Continental Shelf Associates, Inc. [CSA], written communication to Fowler Rodriquez and Chalos, 2006).

5.4.1.2 Resource Reattachment

Translocation of corals and other biota has been conducted in different parts of the world and is recommended as a good option for corals threatened by marine construction (Harriot and Fisk, 1988). Successful coral translocation has been performed for a wide variety of marine construction projects throughout the world by a wide variety of contractors and governmental agencies. CSA has conducted coral reattachment on over 35 programs associated with marine construction, ship groundings, anchor damage, and habitat enhancement. These programs collectively involved the reattachment of over 25,000 corals with hundreds of tons of cement. Some of these programs were monitored by an outside party to determine the relative success of the reattachment technique. Outside parties that have monitored CSA reattachment programs (primarily hard coral) include the National Oceanic and Atmospheric Administration, National Coral Reef Institute, and Florida Marine Research Institute.

CSA coral reattachment has been proved to be very successful, and monitoring reports assessing the relative success of these programs are summarized below.

- A ship grounding program completed by CSA and monitored by an independent third party reported 100% survivorship and coral colony stability after 2 years following restoration in the Florida Keys National Marine Sanctuary (FKNMS). The program included coral reattachment, reef structural repair, and placement of artificial reef structure (Franklin et al., 2005).
- CSA reattached over 400 corals in restoration modules in the southern portion of the FKNMS. Monitoring of the site 3 years after the restoration found all modules were stable, with elevated coral coverage due to growth of reattached corals (Schittone et al., 2006).
- Over 1,000 coral colonies were removed from an offshore construction site in Broward County Florida, temporarily cached for the construction period, and reattached to a submerged structure following construction activities. Monitoring of the coral stability and health was conducted at the reattachment site over a 3-year period and showed a 97% success rate (National Coral Reef Institute, 2004).

All of the aforementioned reattachment programs were conducted utilizing the same techniques proposed for Port Dolphin mitigation component of biological enhancement.

5.4.2 Structural Enhancement

Structural enhancement would include preparation and deployment of mitigation structures, which would increase rugose hard substrate surface area and complexity for epibenthic settlement. Potential mitigation structures for this project include the following:

- limestone boulders;
- habitat replacement modules; and
- low-relief articulating mats.

Substrate surface area and the relative abundance of sessile macroinvertebrates are variables that influence the abundance and diversity of fishes (Ferriera et al., 2001). Mitigation structures can serve as recipient sites for translocated epibenthic resources from within the impact area and additionally may be used to stabilize fractured substrate associated with pipeline construction, particularly hard bottom habitat within pipelaying barge anchor scars. Structural mitigation, as presented, is intended to mimic natural hard bottom habitat to the greatest extent possible. However, studies based on monitoring development of benthic and fish assemblages on mitigation structure suggest that physical differences between the mitigation structures and naturally-occurring substrate (such as shape, rugosity, and relief) may limit the potential of the convergence of similarity with the natural habitat (Thanner et al., 2006).

The specific configuration of the mitigation structure placement will be determined by considerations of marine construction equipment, water depth, and overall required mitigation area. The spacing of structures within mitigation sites will create a natural patch-structure similar to that of the natural hard bottom habitat. Patchy configuration of mitigation structures has proven effective off Florida's west and east coasts (Continental Shelf Associates, Inc., 2006a,b; Lindberg et al., 2006; Thanner et al., 2006; Schmidt et al., 2007a).

5.4.2.1 Limestone Boulder Mitigation Structures

Limestone boulders are probably the most common structure utilized for offshore mitigation in Florida. Benefits of utilizing limestone boulders for marine impact mitigation include the following:

- their composition is similar to natural substrate;
- they are readily available;
- they are suitable for remote deployment;
- they allow spatial conformity;
- they provide adequate mitigative services; and
- they are cost-effective.

Limestone boulders are mined from local quarries and require little or no preparation for deployment readiness. Boulders of appropriate size can be remotely deployed from a vessel or barge and eliminate the need for large-scale marine construction equipment (e.g., crane system) and commercial dive operations. Boulder size and weight can be specified to accommodate site-specific requirements, including amount of vertical relief and mitigation site footprint. The boulders can be configured and stabilized on the seafloor using SCUBA operations to mimic habitat structure impacted by project construction. Additionally, limestone boulders have been shown to provide similar mitigation services concerning epibiotal coverage and fish, as other mitigation structures, such as habitat replacement modules (Schmidt et al., 2007a,b). Overall, the benefits of limestone boulders as mitigation structures include efficiency, with field-tested relative productivity, and cost-effectiveness.

Both natural substrates from post-construction translocation (see **Section 5.4.1.1**) and quarried limestone boulders will be utilized during structural enhancement and will be located at identified mitigation sites. Limestone boulders should have an estimated diameter of 1 to 1.5 feet (0.3 to 0.5 meters) and a correlative weight that is safely maneuvered by a one or two-person dive team (**Figure 11**). This size range for boulder used in the mitigation will allow settling within a sand veneer while providing minimal vertical relief similar to the impacted habitat. Boulder groupings will cover an area of approximately 1,076 square feet (100 m^2) and will be configured on bottom to facilitate stability, utilizing natural features (i.e., topography and sand veneer). Largest boulders will be placed along the perimeter of the grouping. The outer two layers of boulders will be stabilized boulder to boulder and boulder to underlying substrate using Portland cement. The smaller boulders within the grouping will be tightly packed within the secured perimeter boulders. Additional stabilization of boulders within the internal grouping will be provided with reattachment of transplanted biota associated with biological enhancement options (see **Section 5.4.1**). This general approach for boulder stabilization has been previously utilized during relatively shallow-water vessel grounding restoration (Marine Resources Inc., 2004, 2006).

Figure 11
Limestone Boulders (Size Range of 1 to 1.5 feet [0.3 to 0.5 meters]) Representative of Those Suggested for Mitigation to be Used to Mimic the Low-relief Structure of the Natural Hard Bottom Habitat

Limestone boulders independent of, or in conjunction with, other mitigation structures could be positioned on the seafloor within designated mitigation sites and in close proximity to impact areas to offset loss of natural hard bottom substrate. Limestone boulders are composed of the same material as the impacted reef substrate (calcium carbonate) and should provide a similar surface texture, with micro-habitats such as ledges and crevices, and mimic the low-relief structure of the natural hard bottom habitat.

5.4.2.2 Reef Module Mitigation Structures

Habitat replacement modules are a common form of mitigation structure and were used as partial mitigation during the Gulfstream project directly north of the Port Dolphin project (Schmidt et al., 2007a,b). This general design also has been used in mitigation/restoration projects in the FKNMS (http://sanctuaries.noaa.gov/special/wellwood/restoration.html) and off Miami-Dade County (Thanner et al., 2006). Typically, modules are composed primarily of concrete that is modified or augmented to provide surficial rugosity and complexity. Modules are often high profile and intended to provide vertical structure that is in contrast with the natural hard bottom habitat. A drawback of high profile modules is that they would have to be modified accordingly to replicate the structure of natural hard bottom features. It is important to realize that, in some cases, perceived benefits of artificial reefs actually conflict with particular project goals. For example, a potential detrimental effect on local fish populations could occur if fishes are drawn from surrounding natural hard bottom areas and concentrated around the modules, making them more vulnerable to fishing. This is a standard argument of the negative effects of artificial reef deployments (Bohnsack, 1989).

Modules are a high-cost option relative to the substrate area provided for mitigation. The high cost is driven by the requirement of an extensive front end design and fabrication, and the need for commercial dive operations and heavy equipment for their deployment (**Figure 12**). Heavy equipment marine operations potentially include a tug, barge, crane, and an extensive on-bottom mooring system. It is noted these services may be required for operations-associated pipeline protection but would prolong their programmatic requirement and subsequently add additional costs. Overall, the relatively high-cost and dissimilarity of modules to natural habitat would suggest they would be best suited on a small scale in specific applications, if greater structural complexity associated with vertical relief is required for mitigation.

Figure 12
Habitat Replacement Module Deployment Requiring
Commercial Dive Operations and Marine Operation Heavy Equipment

5.4.2.3 Low-relief Articulating Mat Mitigation Structures

Low-relief articulating mats are proposed as external protection at locations where full burial of the Port Dolphin pipeline is not achieved in Florida state waters. A large number of these articulating mats will be used as pipeline covering, and subsequently are considered as a cost-effective option for mitigative structural enhancement (**Figure 13**). These mats closely mimic the low-relief profile of the natural hard bottom habitat observed in the project area. Similar structures have been proposed for low-relief hard bottom mitigation associated with beach renourishment along the east coast of Florida (Continental Shelf Associates, Inc., 2006a) and used during restoration of hard bottom habitats following vessel groundings in the FKNMS. Mats could be layered to provide more topographic features to emulate the physical relief of low ledges and inverted relief (i.e., holes) within the natural habitat.

Figure 13
Articulating Mats Similar to Those Being Considered for Mitigation for the Port Dolphin Project for Use as Protective Structures

Typical concrete articulating mats used for protection of large-diameter pipelines in the Gulf of Mexico are 20 feet wide (6 meters), 8 feet (2.4 meters) long, 9 inches (23 centimeters) thick, and weigh approximately 5 tons (3 tons submerged in seawater). The mattresses anticipated to be used for the protecting the Port Dolphin project pipeline are 20 feet (6 meters) wide, 8 feet (2.4 meters) long, and 12 inches (31 centimeters) thick. The overall dimensions of the mats can be modified to suit the application and conform to specific footprints. The articulating mats are a web of cement blocks connected with steel/Kevlar® cables that conform to the shape of the underlying structure. Deployment of articulating mats will have the same requirements as previously discussed for habitat replacement modules (see **Section 5.4.2.2**). Mats can be connected together in order to add stability during subsidence into the sand veneer as a result of scouring. The articulating mats of standard size have proven stability able to withstand currents ranging from 20 to 24 feet per second. The mattresses that would be used for mitigation would be the same size as those used for pipeline protection (i.e., 12-inches [30.5 centimeters] thick) and are therefore heavier and more stable than the typical 9-inch (22.9 centimeter) thick mattresses. Cementing would be conducted in conjunction with reattachment of transplanted biota associated with biological enhancement options (see **Section 5.4.1**). Biological transplantation onto articulating mats has been successfully conducted by Marine Resources Inc. (2002), when over 1,000 hard corals were reattached and cemented onto articulating mats in a water depth of approximately 33 feet (10 meters) (**Figure 13**).

6.0 MITIGATION MONITORING

Currently, the strategy and methodology for mitigating potential impacts from the pipeline in state waters have not been resolved. Consequently, this section provides a general overview of the structure of a monitoring plan, recognizing that the specifics of the actual monitoring program, e.g., sampling methodology, will be determined after the actual mitigation strategy has been developed. This proposed monitoring strategy can be used for monitoring in federal waters, so that the two programs are complementary.

6.1 MITIGATION MONITORING OBJECTIVES

The objectives of the mitigation monitoring plan are as follows:

- assess recovery of the live bottom communities impacted during pipeline construction;
- determine the colonization/recruitment rates of the mitigation sites by sessile invertebrate species and algae;
- compare the live bottom communities of the impacted sites, mitigation sites, and reference sites;
- determine the survivorship of transplanted benthic organisms;
- determine if the colonization rates for these communities are depth-related; and
- assess the performance of mitigation structures as replacement habitat.

6.2 MONITORING STRATEGY

The experimental design is based on the concept of testing equivalence. The usual approach to evaluating environment impacts is testing point-null hypotheses that there are no differences among the treatments. If the null hypothesis is rejected by statistical testing at a specified probability level, then the conclusion is that the treatments are in fact different (Cole and McBride, 2004). For the purpose of evaluating the success of mitigation; however, the problem with using this approach is that the null hypothesis is the hypothesis of interest. To “prove” or “accept” a null hypothesis requires very high power (probability of rejecting a false null hypothesis) for the statistical testing, which in turn commonly requires very large samples sizes. Obviously, the additional effort needed to collect the samples makes a monitoring program more expensive and time consuming.

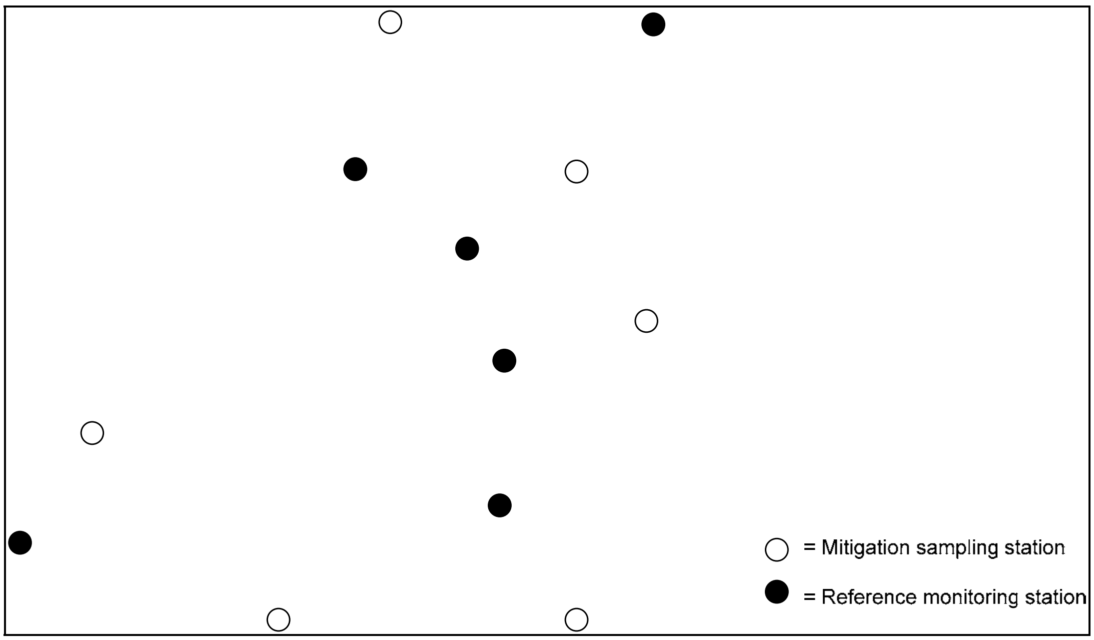
For a study of mitigation, the actual null hypothesis is alternative hypothesis of the point-null hypothesis described above. This null hypothesis is that the mitigation sites are different from the reference sites, and the alternative hypothesis is that the mitigation sites are not significantly different from the reference sites, i.e., they are bioequivalent (Downes et al., 2002). To illustrate, consider an artificial reef that is constructed as mitigation for impacts to nearshore hard bottom habitat associated with a human activity such as beach nourishment. The null hypothesis for equivalence analysis is that the artificial reef and natural hard bottom are different. If this null hypothesis is rejected, the interpretation of the statistical analysis results is the mitigation reef is equivalent to the natural hard bottom. Use of this monitoring strategy should reduce the required sampling effort.

6.3 EXPERIMENTAL DESIGN

The overall experimental design for the mitigation monitoring may require stratification for several variables; among these are water depth and location relative to (inside versus outside of) Tampa Bay. A preliminary experimental design at an individual study site for the monitoring program is presented in

Figure 14. A series of mitigation sites are established for sample collection. In addition, an appropriate number of reference sites are to be established. Sampling should occur prior to and after installation of the mitigation at an appropriate frequency. Measurements of biological assemblages (e.g., fishes, macroinvertebrates, macroalgae) would be collected at the mitigation and reference sampling sites. Addition measurements that could be useful in interpretation of results, e.g., temperature, dissolved oxygen, currents, photosynthetically active radiation, and turbidity also should be collected, preferably continuously.

Figure 14
Hypothetical Arrangement of Mitigation/Reference Monitoring Stations



Monitoring will be conducted on both a large scale: areas impacted by pipeline construction, associated reference areas, and areas of structural mitigation; as well as on a small scale: transplanted organisms, transplanted live rock/substrate, and controls for both transplanted organisms and live rock. Monitoring methods employed will be appropriate to the scale of the monitoring being conducted.

The following survey methods may be employed for mitigation monitoring:

- qualitative remotely operated vehicle (ROV) surveys;
- quantitative photographic surveys;
- in-field assessment of transplanted organisms/live rock; and
- qualitative video surveys of transplanted organisms/live rock.

6.3.1 Qualitative ROV Surveys

Initial, post-construction assessment of impacts resulting from pipeline trenching and burial will consist of continuous video data collection by ROV along the pipeline route to document the appearance of the pipeline trench, the spoil mounds on either side of the pipeline trench, anchor strikes, and cable sweep areas, as well as to assess the areal extent of impacts. These surveys will be initiated as soon as practicable after construction is complete.

6.3.2 Quantitative Photographic Surveys

Baseline monitoring and all further post-construction monitoring of impact, structural enhancement, and reference sites will consist of the random collection of photographic images using diver-operated still camera. Quantitative photographic surveys will begin as soon as possible following the ROV survey.

6.3.3 In-Field Assessment of Transplanted Organisms/Live Rock

Sampling of transplanted and control organisms/live rock will be conducted during each field survey and include visual observations, firmness of bond, and qualitative videography. Monitoring stations will be established within the transplantation site. Each monitoring station will be marked with a geo-referenced station marker. A minimum of 100 transplanted benthic organisms/live rock will be tagged using uniquely numbered plastic tags. Tagged organisms will be mapped using distance and bearing relative to the monitoring station marker. A minimum of 30 control organisms will be selected at each relocation site. Control organisms will be tagged and location recorded in the same manner as transplanted organisms.

Monitoring stations for live rock relocation will be selected separately from monitoring stations for transplanted organisms. A minimum of 100 transplanted sections of live rock will be selected for monitoring. A minimum of 30 sections of live rock, with characteristics similar to those of the transplanted specimens, will be selected within the relocation site to serve as controls. Individual organisms on each section of transplanted live rock, or control live rock, will be selected for detailed observation at the time of tagging. The condition of each of these organisms will be observed and recorded on each subsequent survey. Sections of live rock selected for study will be marked in the same manner as described for transplanted/control organisms.

Direct observations concerning attachment status and relative health of transplanted organisms will be made by an experienced scientist at each of the monitoring stations. Relative health of transplanted organisms will be based primarily on assessment of color (e.g., normal, pale, bleached), tissue condition (e.g., degree of accretion/regression, presence of disease), interspecific events (e.g., clionid intrusion) and algal overgrowth. Stability and relative health of experimental and control groups will be compared between groups and between monitoring surveys. Transplanted organisms/live rock will be monitored *in situ* for stability of cement bond by gently pulling on the colony edge (i.e., tactile census). Any loose organisms/live rock will be reattached at the monitoring site during monitoring activities. If individual organisms/live rock cannot be relocated because of the loss of a tag, measurements from the geo-referenced station marker will be taken to relocate the organism/live rock, and any missing tags will be replaced. Comparisons will be made between relocated and control organisms/live rock, in order to assess the success of relocation efforts.

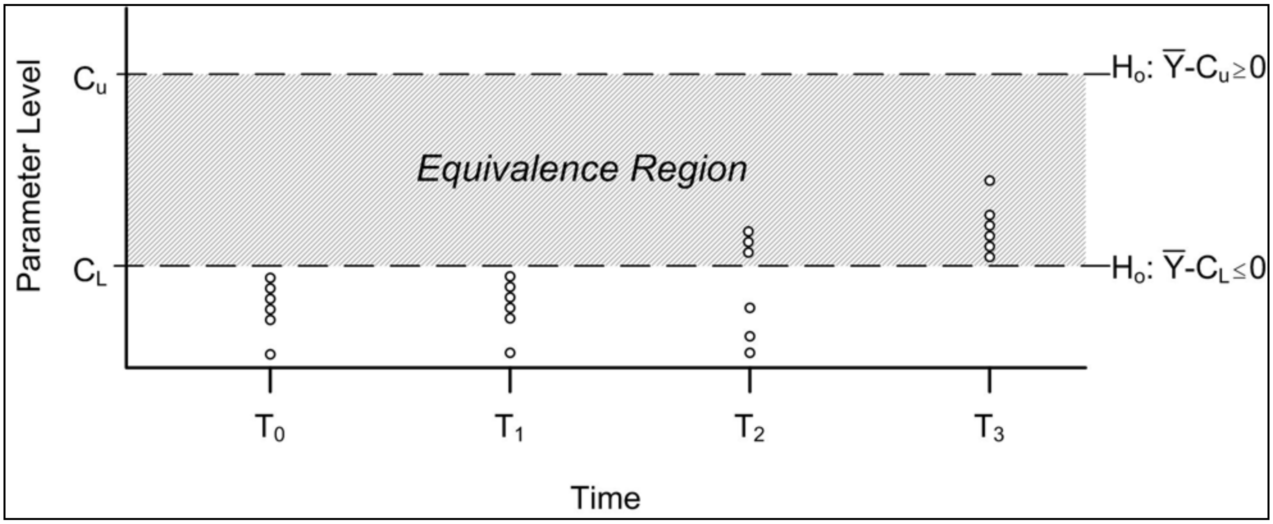
6.3.4 Qualitative Video Surveys of Transplanted Organisms/Live Rock

Qualitative imaging will be utilized to augment direct observations of transplanted organisms/live rock. Use of video as opposed to still photography will allow views of the organism/live rock from varying perspectives, providing greater opportunity to assess condition. In addition to collection of video data, assessments of stability and relative health will be made in the field.

6.4 STATISTICAL TESTING

If stratification related to depth and/or geography is incorporated into the final monitoring design, then the statistical analysis will be applied to each monitoring effort for each individual stratum independently. The first step in conducting the statistical testing will be to define the criteria for bounds of the equivalence region (**Figure 15**). These criteria can be set *a priori* based on existing data, but it is more likely that they will be set based on what is observed at the reference stations. For example, the upper and lower bounds of the equivalence region could be based on 95% confidence limits for the mean value of a parameter at the reference stations.

Figure 15
Example of Hypothetical Testing for Equivalence Analysis



Separate statistical tests would be conducted for the upper and lower bounds. If the null hypotheses are rejected, then the interpretation would be that the mitigation and references sites are equivalent. This approach also can be used with similarity statistics, such as the Bray-Curtis similarity index; however, testing only the lower bound would be appropriate.

7.0 LITERATURE CITED

Bohnsack, J.A. 1989. Are high densities of fishes at artificial reefs the result of habitat limitation or behavioral preference? Bull. Mar. Sci. 55:796-823.

Cole, R. and G. McBride. 2004. Assessing impacts of dredge spoil disposal using equivalence tests: implications of a precautionary (proof of safety) approach. Mar. Ecol Prog. Ser. 279: 63-72.

Continental Shelf Associates, Inc. 2006a. Brevard County Mid Reach Shore Protection Project: Mitigation Assessment Analysis. 36 pp. + apps.

Continental Shelf Associates, Inc. 2006b. Habitat restoration: M/V *SPAR ORION* grounding, Broward County, Florida. A report submitted to Independent Maritime Consulting, Ltd. 10 pp. + app.

CSA International, Inc. 2007a. Hard coral relocation as mitigation for three pipeline corridors, nearshore Ras Laffan Industrial City, State of Qatar. A report submitted to Qatar Liquefied Gas Company Limited (II) and Qatargas3 & 4 Joint Asset Development Team. 20 pp.

CSA International, Inc. 2007b. Survey of marine benthic habitats within the proposed *Port Dolphin* deepwater port and pipeline corridor offshore and within Tampa Bay, Florida. Prepared for Höegh LNG Affiliate. January 2007. 37 pp.

CSA International, Inc. 2007c. Terra Ceia re-route survey of marine benthic habitats within the proposed *Port Dolphin* pipeline corridor within Tampa Bay, Florida. Attachment A.1, Deepwater Port License Application, *Port Dolphin Project*. Prepared for Port Dolphin LLC. December 2007. 20 pp.

Downes, B.J., L.A. Barmuta, P.G. Fairweather, and D.P. Faith. 2002. Monitoring Ecological Impacts: Concepts and Practice in Flowing Waters. Cambridge University Press. 446 pp.

Ferreira, C.E.L., J.E.A. Goncalves, and R. Coutinho. 2001. Community structure of fishes and habitat complexity on tropical rocky shores. Environ. Biol. Fish. 61:353-369.

Franklin, E.C., J.H. Hudson, and J. Anderson. 2005. M/V *WAVE WALKER*. Coral reef restoration baseline monitoring report—2004 Florida Keys National Marine Sanctuary, Monroe County, Florida. Marine Sanctuaries Conservation Series NMSP-0608. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Spring, MD. 15 pp.

Harriot, V.J. and D.A. Fisk. 1988. Coral transplantation as a reef management option. In: Proceedings of the 6th International Coral Reef Symposium 2:375-379.

Lindberg, W.J., T.K. Frazer, K.M. Portier, F. Vose, J. Loftin, D.J. Murie, D.M. Mason, B. Nagy, and M.K. Hart. 2006. Density-dependent habitat selection and performance by a large mobile reef fish. Ecol. App. 16(2):731-746

Marine Resources Inc. 2002. Hollywood Florida Outfall, Hard Coral Mitigation. Prepared for Underwater Engineering Services Inc.

Marine Resources Inc. 2003. M/V *ALAM SENANG* grounding, Broward County Florida: assessment and restoration. Report for Scandinavian Underwriters Agency. 12 pp.

Marine Resources Inc. 2004. Habitat restoration conducted at *ADARO* grounding site: Florida Keys National Marine Sanctuary. Prepared for Houck, Hamilton, & Anderson, P.A. 11 pp. + app.

Marine Resources Inc. 2006. Biological survey at boulder reattachment sites for the M/V *EASTWIND* grounding, Broward County, Florida. Prepared for Houck, Hamilton, & Anderson, P.A. 10 pp.

National Coral Reef Institute. 2004. Hollywood ocean outfall stony coral transplantation monitoring final monitoring event. Draft Report. Nova Southeastern Oceanographic Center, Dania Beach, Florida. 14 pp.

Schittone, J., E.C. Franklin, J.H. Hudson, and J. Anderson. 2006. M/V *Connected* Coral Reef Restoration Monitoring Report, Monitoring Events 2004-2005. Florida Keys National Marine Sanctuary Monroe County, Florida. Marine Sanctuaries Conservation Series NMSP-06-10. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Spring, MD. 25 pp.

Schmidt, J.A., S.W. Ellsworth, R.A. Brooks, D.F. Bishop, M. C. Aubele, and H.E. Watkins. 2007a. Environmental Mitigation-1: Monitoring, analysis show rapid Gulf of Mexico seafloor recovery. Oil & Gas Journal 105(2).

Schmidt, J.A., S.W. Ellsworth, R.A. Brooks, D.F. Bishop, M.C. Aubele, and H.E. Watkins. 2007b. Environmental Mitigation-2: ROV, diver-collected data show post construction epifaunal health. Oil & Gas Journal 105(2).

Southwest Florida Water Management District. 1999. Tampa Bay Surface Water Improvement (SWIM) Plan. Tampa, FL: SWIM section. 108 pp.

T. Baker Smith, Inc. 2007a. Archaeological, Engineering, and Hazard Study, Proposed 36-inch Gas Pipeline, Proposed LNG Facility, Block 545 St. Petersburg Area Offshore Florida to Tampa Bay, Florida. Report for Hoegh LNG. January 2007. 3 vols.

T. Baker Smith, Inc. 2007b. Archaeological, Engineering, and Hazard Study, Proposed 36-inch Gas Pipeline Reroute, Tampa Bay, Florida. Report for Hoegh LNG. October 2007. 3 vols.

T. Baker Smith, Inc. 2008. Archaeological, Engineering, and Hazard Study, Proposed 36-inch Gas Pipeline Sand Resource Avoidance Reroute, Tampa Bay, Florida. Report for Hoegh LNG. December 2008.

Thanner, S.E., T.L. Mcintosh, and S.M. Blair. 2006. Development of benthic and fish assemblages on artificial reef materials compared to adjacent natural reef assemblages in Miami-Dade County, Florida. Bull. Mar. Sci. 78(1):57-70.

ATTACHMENT A.6

DRAFT FEDERAL WATER COMPENSATORY MITIGATION PLAN TO OFFSET UNAVOIDABLE IMPACTS FROM IMPLEMENTING THE PORT DOLPHIN DEEPWATER PORT PROJECT

PORT DOLPHIN ENERGY LLC

DRAFT FEDERAL WATERS COMPENSATORY MITIGATION PLAN TO OFFSET UNAVOIDABLE IMPACTS FROM IMPLEMENTING THE PORT DOLPHIN DEEPWATER PORT PROJECT

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1.0 INTRODUCTION

This mitigation plan was prepared as a tool for use during the Port Dolphin Deepwater Port project (Port Dolphin) permitting process to evaluate options and select specific strategies to compensate for unavoidable impacts to live bottom habitats and fisheries resources in Federal waters from implementation of the project. Live bottom is defined as hard seafloor substrate that supports attached (epibenthic) biological communities. A separate mitigation plan has been prepared for similar unavoidable impacts within State waters. In addition, mitigation plans for State and Federal waters will be provided to the U.S. Coast Guard (USCG) for use in the National Environmental Policy Act (NEPA) process Environmental Impact Statement (EIS) preparation.

1.1 PURPOSE OF PLAN

The purpose of this mitigation plan is to

1) identify live bottom habitats within the area of the proposed Port Dolphin pipeline within Federal Waters;
2) assess the relative sensitivity of identified live bottom habitats to potential impacts associated with project construction (both the nature of the impacts and the size of the affected areas will be assessed);
3) recommend specific mitigation measures to offset these impacts. Monitoring plans for each mitigation scenario are proposed, as well as a long-term monitoring strategy designed to assess relative success of mitigation actions and document recovery of project-related impacts.
4) evaluate the density and taxonomic composition of the ichthyoplankton expected to be present around the structure that might be entrained into the discharge plume;
5) estimate potential impacts of the project on fish eggs and larvae in and around the deepwater port; and
6) modify, where possible, operational procedures in order to reduce impacts, recommend specific mitigation measures to offset these impacts, and define monitoring plans for each proposed mitigation measure.

This plan describes the following:

- Affected environment, based on previously conducted environmental surveys;
- Anticipated additional pre- and post-construction environmental surveys;
- Habitat impact scaling and mitigation analysis;
- Mitigation scenarios and designs;
- Implementation of optional mitigation approaches;
- Proposed 5-year post-construction monitoring approach; and
- Contingency considerations.

This mitigation plan for impacts to the benthic environment was developed using field-tested mitigation methods that will minimize impacts through relocation of colonized hard substrate and biota, and the direct offset of impacted hard bottom through the construction and/or installation of habitat replacement structures (limestone boulders, reef modules, concrete mats). Detailed mitigation strategies will be prepared upon final determination of impacts and compensatory requirements.

1.2 AGENCY CONSULTATION

The mitigation plan is being developed in consultation with the regulatory agencies, including Federal, State, and local entities and will be based on agreements between personnel from Port Dolphin and the regulatory agencies.

2.0 PROJECT DESCRIPTION

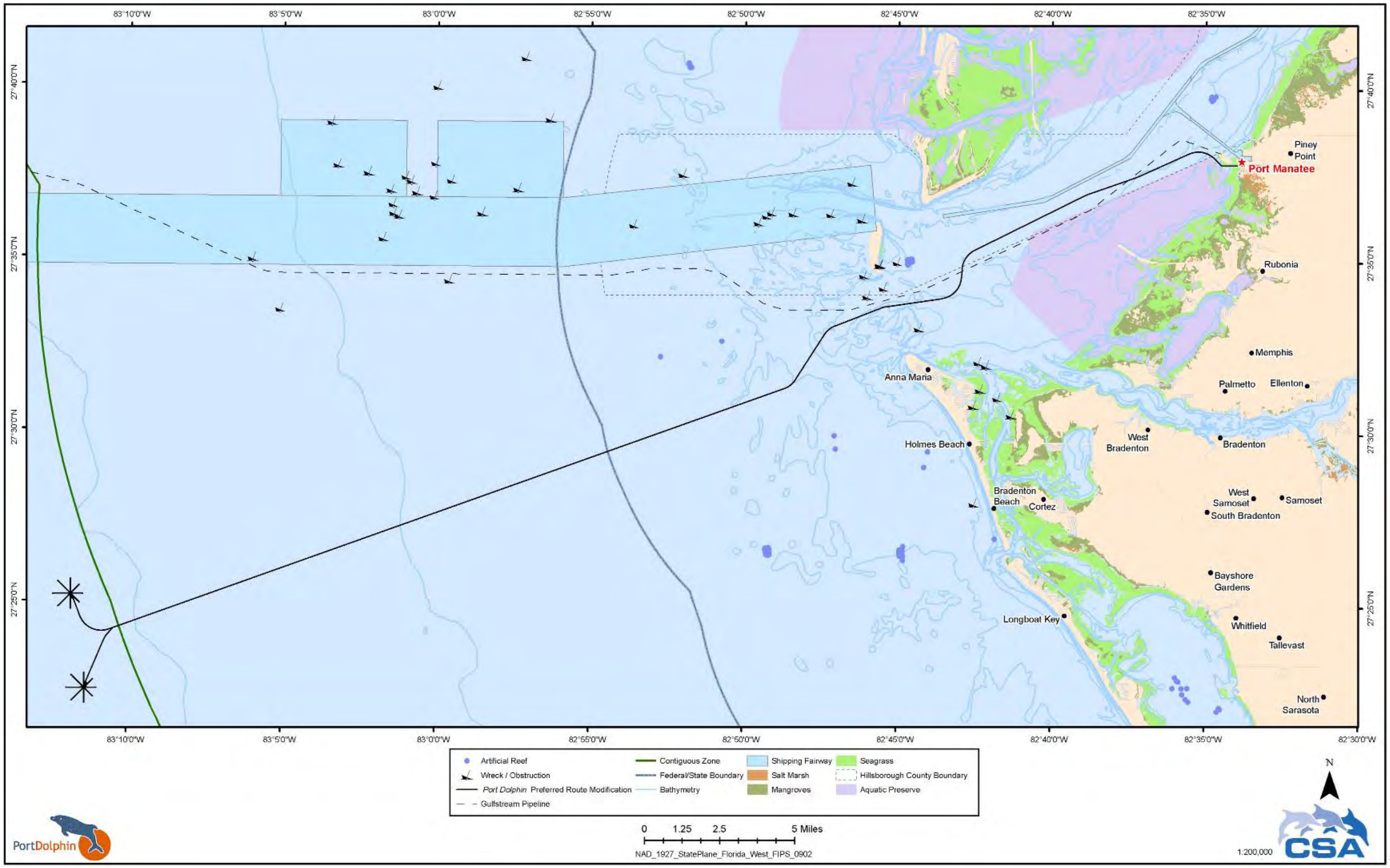
Port Dolphin Energy LLC has filed for a license pursuant to the Deepwater Port Act of 1974, as amended, and the USCG's regulations, 33 Code of Federal Regulations Part 148 (2006), to construct, own, and operate a deepwater port. The offshore unloading portion (mooring area) of the Port Dolphin deepwater port would be located in Federal waters approximately 28 miles (45 kilometers) offshore of Tampa Bay, Florida in approximately 100 feet (30 meters) of water (**Figure 1**) and located within St. Petersburg lease area of the U.S. Department of the Interior, Minerals Management Service's Eastern Gulf of Mexico Outer Continental Shelf Planning Area. The unloading portion of the deepwater port would consist of two unloading buoys that would be separated by a distance of approximately 3.1 miles (5 kilometers). Each unloading buoy would have eight mooring lines consisting of wire rope and chain. The mooring lines would connect each unloading buoy to eight anchor points, most likely consisting of driven piles on the seabed. When not connected to a shuttle regasification vessel (SRV), the unloading buoy would be submerged 60 to 70 feet (18 to 21 meters) below the sea surface. In this position, the buoy would be held in position by the mooring lines and would be resting on the submerged turret loading buoy landing pad. A 16-inch. flexible riser from each buoy would connect to two 36-inch subsea flowlines through a piggable wye (Y) to a 36-inch gas transmission line that comes ashore at Port Manatee. The gas transmission line continues east onshore to an interconnection station located approximately 3.9 miles (6.28 kilometers) inland in Manatee County, Florida to connect with the Gulfstream Natural Gas System, L.L.C. and Tampa Electric Company.

As presented in the **Deepwater Port Application**, **Volume II,** three alternative offshore pipeline routes corresponding to alternative terminal locations were originally proposed for consideration. These three routes (Northern, Southern, and Preferred) converged within Tampa Bay at 82°41'45" W longitude, 27°31'44"N latitude, northeast of Anna Maria Island and just outside of the Terra Ceia Aquatic Preserve. The routes then followed a common corridor passing through the northern edge of the Terra Ceia Aquatic Preserve for a distance of 3.0 miles (4.8 kilometers). Of the three offshore routes under consideration, the Preferred Route was ultimately chosen.

Based on subsequent discussions with the State of Florida, three new alternative nearshore pipeline routes (Alternatives A, B, and C) were developed within Tampa Bay to avoid passing through the Terra Ceia Aquatic Preserve. An analysis of the alternative routes led to the selection of Alternative A. Once beyond the Aquatic Preserve, the pipeline turns southeast to the landing at Port Manatee. Details of the selection process can be found in the **Addendum I** to the **Deepwater Port Application**, **Section 1**.

Consultation with Manatee County and the Town of Longboat Key resulted in the development of three pipeline re-routes to avoid permitted borrow areas and to reduce impacts to identified potential sand sources. An analysis of these re-routes led to the selection of Option A, as it eliminated impacts to permitted borrow areas, and minimized impacts to potential sand sources. The Preferred Route Modification consists of the original preferred route, nearshore Alternative A, plus sand source re-route Option A. **Figure 1** represents this Preferred Route Modification.

Figure 1
Port Dolphin Preferred Route Modification



2.1 CONSTRUCTION SCHEDULE

Construction of Port Dolphin would be a multi-phase project and will take approximately 22 months. This time period includes detailed design, procurement, and construction. In general, the Port Dolphin pipeline would be constructed in an onshore to offshore direction. The construction phases may be conducted concurrently, or in several cases, in parallel. Once mobilized, the construction activity would be 24 hours per day, 7 days per week. The port would be expected to commence operations in the second quarter of 2011.

2.2 CONSTRUCTION METHODS

Base-case construction methods have been selected based on best available data (i.e., geophysical survey data) and are subject to adjustment pending the results of the geotechnical survey and detailed engineering. The two base-case construction methods planned for use within Federal waters include the following:

- plow trench system (PTS); and
- external protection technologies (concrete mattressing and rock armoring).

Plowing is the preferred methodology for pipeline burial, and the baseline installation methods presented include 81.1% (92,326.02 feet [28,148 meters]) of the pipeline to be laid on the seafloor by a pipelaying barge, and then buried within Federal waters. Plowing is the preferred methodology for pipeline burial. It is expected that in some plowed areas, the plow may not achieve burial to the design depth, in which case these areas would subsequently be covered by concrete mattresses or rock armoring. Those areas where full burial is anticipated accounts for 18.73% (21,326.02 feet) within Federal waters and those areas where full burial is not anticipated accounts for 62.4% (71,000 feet) of the pipeline route within Federal waters. However, for direct disturbance determination, these areas are simply assumed to be plowed, since the impact width for plowing is greater than that for mattress placement.

2.2.1 Plow Burial – PTS

In the plowing technique, the pipeline is lowered below seabed level by shearing a “V”-shaped ditch in the soil below the pipeline. The plow is towed along the pipeline directly behind the burial barge (**Figure 2**). As the ditch is cut, spoil is removed and passively pushed to the side by specially-shaped moldboards fitted to the main plowshare.

Use of a “conventionally moored” barge is planned, which means that the position of the pipeline installation will be maintained through the use of anchors, associated anchor chains, and/or cables. The anchor reset distance for each mile of offshore pipeline burial route will be a function of the size of the lay/bury barge, weather conditions, water depth, seabed type, and the amount of anchor line that can be stored, deployed, and retrieved by the barge. Based on previous experience and accepted practice in similar conditions, as well as discussions with an experienced pipelay/bury contractor, it is currently assumed that each anchor will be reset approximately every 2,000 feet (2,400 meters) along the pipeline route.

The barge will first position directly over the burial initiation point on the pipeline. The plow is then launched with its share in the open position and lowered towards the burial initiation point (**Figure 3**). The plow will be fitted with cameras, sonar, and sensor instruments, which will assist with final positioning. Divers or robotic submersibles also will be deployed as necessary to monitor the plow as it is located and placed astride the pipeline.

Figure 2
A Typical Pipeline Burial Plow
(Courtesy of Horizon Offshore)

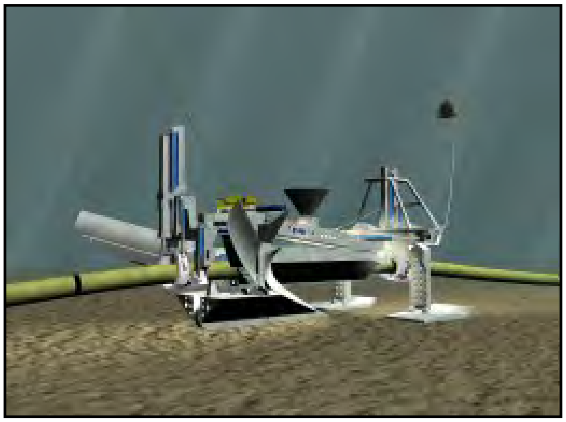
Figure 3
Lowering Plow with Share Open

When it is confirmed that the plow safely straddles the pipeline and all in-water system checks have indicated that it is safe to proceed, the plow's pipeline lifters are activated. The pipeline is raised into the plowshare, which is then closed around it (**Figure 4**). At this point, the barge would recover the plow's main lifting line and advance forward along the pipeline route in order to establish a proper tow catenary. Barge advancement is achieved by winching-in/paying-out anchor cable while "walking" and relocating the anchor array as required.

Once a proper tow catenary is established, the plow is pulled forward under tension while operators monitor and adjust the depth of the ditch being cut. The latest generation of burial plow is fitted with sophisticated computer control systems and instrumentation, enabling the operators to select and continuously monitor the depth of the ditch as it is formed in real time (**Figure 5**). The process continues as the barge simultaneously advances along the pipeline route and lowers the pipeline into the ditch cut by the plow.

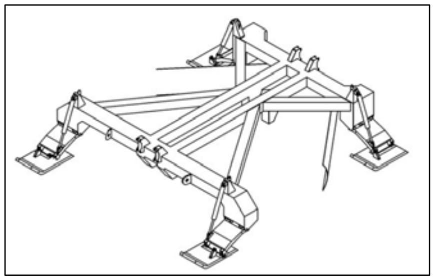
Figure 4
Pipeline Raised into Plowshare

Figure 5
Monitoring and Adjustment
of Ditch Being Cut



Once the end of the pipeline route is reached, the procedure above is reversed in order to lift and recover the plow back onto the deck of the barge. The pipeline route is then surveyed either by the barge itself, or by a separate survey vessel, to determine where full pipeline lowering has been achieved.

Figure 6
Backfill Plow Configuration
(Courtesy of Horizon Offshore)



Finally, one further pass will be made along the pipeline route to backfill the pipeline lying in the ditch. For this purpose, the plow blades are reversed for scraping the spoils back into the ditch (**Figure 6**). As the backfill plow is advanced, the spoil is simultaneously pushed back into the ditch and on top of the pipeline. Upon completion, a final survey is run to confirm and document the conclusion of all burial operations.

2.2.2 External Pipeline Protection Technologies

In order to provide equivalent protection and stabilization in areas where pipeline burial is not achieved; the use of placement of concrete mattresses is planned. The final burial survey will identify any zones where full burial has not been achieved. In such zones, an alternative protection technology would be installed; the primary technique planned is the placement of flexible concrete mattresses. These concrete mattresses will be selected to conform to applicable regulatory requirements and designed to provide an equivalent level of stabilization and protection of the pipeline.

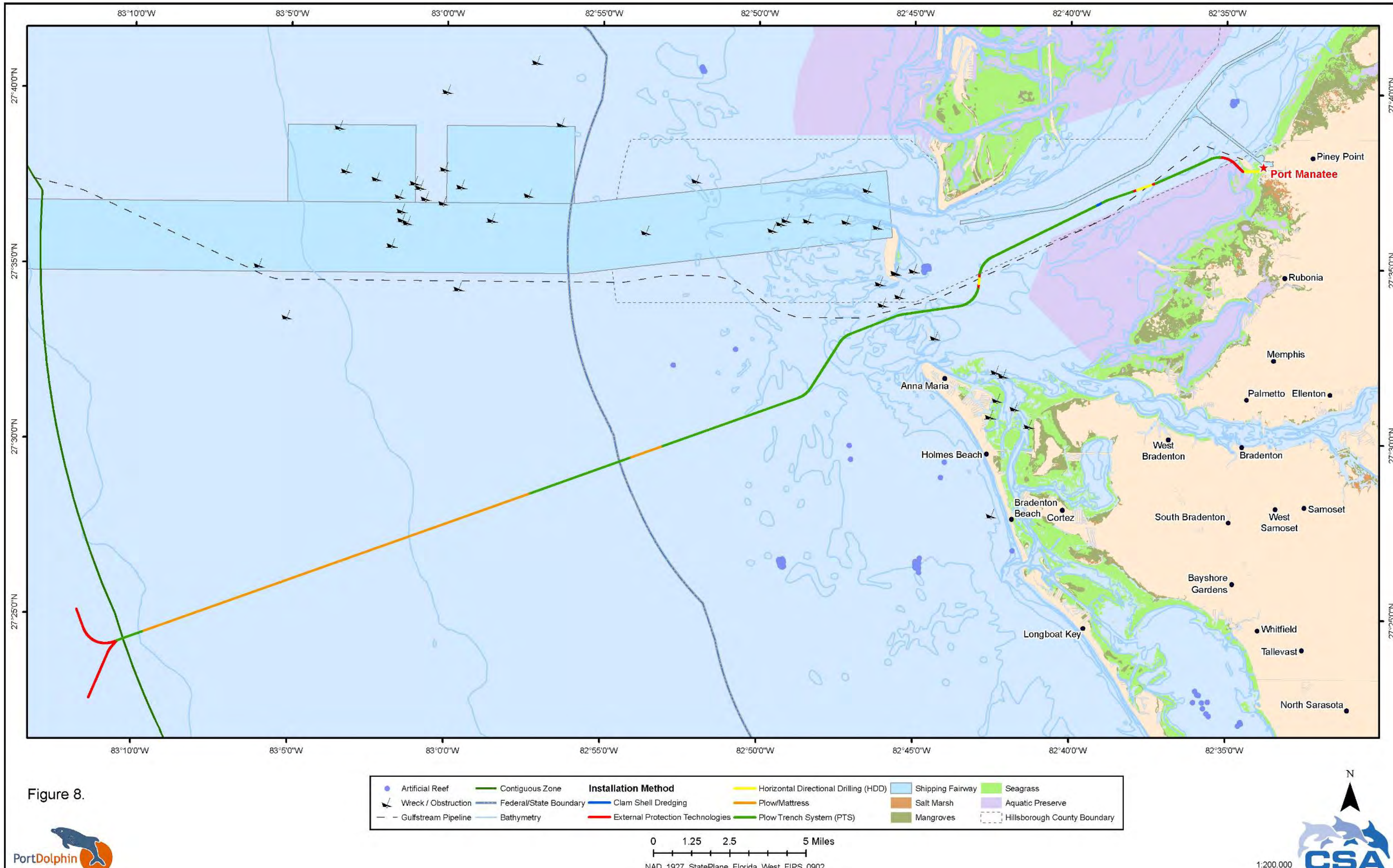
Figure 7
Concrete Mattress on
Deployment Frame

The concrete mattresses would be installed from a specialist diving support or construction barge that will be moored in position with an anchoring system similar to that of the burial barge. The mattresses will be lifted and located on top of the pipeline using the barge crane and a special deployment frame (**Figure 7**). Divers or a robotic submersible vehicle would assist with the final positioning and attachment of the mattresses to the pipeline.

A typical example of a proprietary concrete mattress product widely used for protection of large-diameter pipelines in the Gulf of Mexico is 20 feet (6 meters) wide, 8 feet (2.4 meters) long, and 9 inches (23 centimeters) thick. It weighs 10,500 pounds in air (6,000 pounds submerged). Such mattresses are normally laid together to provide continuous protective cover over the pipeline. However, the concrete mattresses anticipated to be used for the Port Dolphin pipeline will be 20 feet (6 meters) wide, 8 feet (2.4 meters) long, and 12 inches (31 centimeters) thick.

An optional construction method for external protection that is not part of Port Dolphin's base-case construction plan but could still be considered during future discussions with permitting agencies (FDEP, U.S. Army Corps of Engineers, etc.) includes the use of rock armoring. Rock armoring is a common and proven methodology to externally protect pipelines that cannot be buried and backfilled due to extreme soil substrates. A conventional anchor barge is mobilized with hoppers, shakers, and a Tremie chute and a natural material (procured locally) is sized to withstand existing ambient current conditions with consideration for storm surge. This material is placed over and around the pipeline through the Tremie chute from the barge. The operation is monitored by subsurface sonar mounted on the chute. Once the operation is complete, an as-built survey is conducted with side-scan or multi-beam sonar to ensure the engineered cover has been achieved. **Figure 8** illustrates pipeline installation methods along the Federal portion of the proposed route.

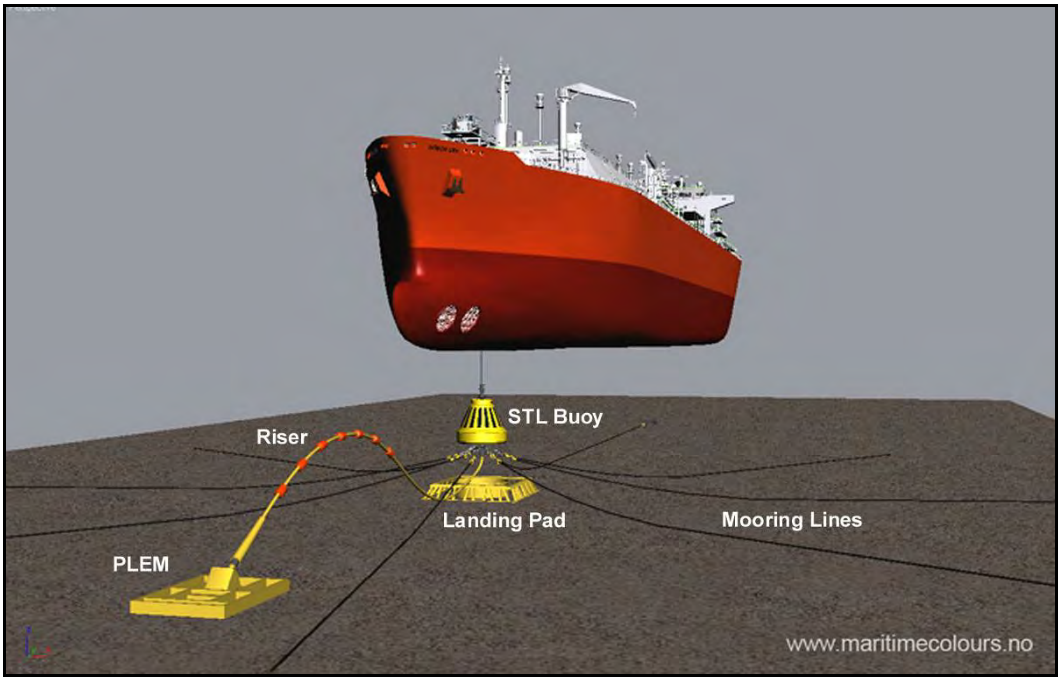
Figure 8
Port Dolphin Pipeline Installation Methods Along the Preferred Route Modification



2.2.3 STL Subsea System

In addition to the pipeline, installation of the STL subsea system will impact the seafloor. The STL subsea system consists of the STL buoy and pipeline end manifold (PLEM), as well as associated moorings, risers, and umbilicals (**Figure 9**). Installation will disturb sediments due to placement of components on the seabed, as well as anchoring of construction vessels. Port Dolphin would be capable of simultaneously mooring two liquefied natural gas (LNG) carriers. These LNG carriers would be moored at two separate mooring buoys that would allow for overlap in the arrival and departure of two vessels, thereby providing uninterrupted flow of natural gas into a pipeline system.

Figure 9
Artist's Rendering of STL Subsea System Components



The STL subsea system (**Figure 9**), provides mooring for the SRV as well as allowing weather vaning of the SRV. It also provides the connection between the shipboard swivel arrangement and the flexible riser and umbilical, which is in turn connected to a pipeline end manifold (PLEM). This system consists of dual sets of the following:

- STL buoy;
- STL buoy pick-up assembly;
- STL buoy landing pad;
- Mooring lines with anchor piles;
- Flexible riser and umbilical;
- Pipeline end manifold (PLEM); and
- Flowlines and piggable wye.

2.2.3.1 STL Buoy Landing Pad

The STL buoy landing pad, depicted in **Figure 9**, provides the resting point for the STL buoy while the latter is in the idle position at a depth of 60 to 70 feet (18 to 21 meters) measured to the top of the buoy. The STL buoy landing pad will measure approximately 49-feet (15-meters) in diameter and consist of a rubber fender set on a foundation. The fender will absorb the impact loads of the STL buoy. Additionally, fenders may be fitted below the turret tank on the STL buoy for cushioning. The landing pad will be fixed to the seafloor by a skirted mud mat (base case) or alternatively with a suction pile. This will be at a depth of approximately 100 feet (30 meters) of water for the north buoy and 111 feet (33 meters) of water for the south buoy.

2.2.3.2 Anchor Piles and Mooring lines

As depicted in **Figure 9**, eight mooring lines and anchor piles will be connected at their upper ends to the bottom of each STL buoy. These mooring lines are designed to allow the SRV to remain moored in the event of 100-year storm conditions. The lines are arrayed at 45º intervals beginning at North (Mooring Line No. 1) and proceeding clockwise. Coordinates for the anchors of the northern and southern buoys are shown in **Table 1**.

Table 1
Mooring Anchor Locations

Anchor	Latitude* (ºN)	Longitude* (ºW)	Distance from Turret Center to Mooring Anchor (meters)
Northern 1	27°25’38.70”	83°11’50.40”	800
Northern 2	27°25’27.17”	83°11’33.58”	650
Northern 3	27°25’12.32”	83°11’26.50”	650
Northern 4	27°24’57.36”	83°11’33.26”	650
Northern 5	27°24’54.16”	83°11’49.84”	800
Northern 6	27°24’50.11”	83°11’14.31”	950
Northern 7	27°25’11.82”	83°11’24.66”	950
Northern 8	27°25’33.71”	83°11’14.78”	950
Southern 1	27°22’54.66”	83°11’22.78”	800
Southern 2	27°22’43.76”	83°11’05.96”	650
Southern 3	27°22’28.91”	83°11’58.88”	650
Southern 4	27°22’13.94”	83°11’05.64”	650
Southern 5	27°22’02.75”	83°11’22.22”	800
Southern 6	27°22’06.74”	83°11’46.68”	950
Southern 7	27°22’08.42”	83°11’57.03”	950
Southern 8	27°22’50.30”	83°11’47.15”	950

*NAD 27 coordinates.

As a base case, driven pile anchors will be used with a final determination being based on collected soil data. A typical driven pile is made of steel and will have a diameter of approximately 70-inches and length of 65 to 98 feet (20 to 30 meters). The anchors will weigh 40 to 50 tons each. The mooring chain will be terminated with an anchor shackle to a padeye at the anchor skirt. The location of the padeye will be optimized with respect to the moment capacity of the soil.

If the alternative suction pile type anchor is pursued, the diameter will be 14 to 16 feet (4 to 5 meters) with a corresponding weight of 50 to 70 tons.

Length of the mooring lines will vary from 1,800 to 4,000 feet (548.6 to 1,219.2 meters) for the northern buoy, and 2,500 to 3,600 feet (762 to 1,097.3 meters) for the southern buoy. The chain and wire segments of the mooring lines will be designed with sufficient strength for 40 years of service life.

2.2.3.3 Flexible Riser and Umbilical

The flexible riser consists of a 16-inch flexible hose-like device that is approximately 270-feet (82-meters) in length and acts as the pipeline between the STL buoy and PLEM as depicted in **Figure 9**. The umbilical provides hydraulic control connections and signals between the vessel and ESD valve and pressure transmitters in the PLEM. Overall, the flexible riser and umbilical configuration is designed to counteract the dynamic forces caused by the environment and vessel-related motion that will be acting on it. The flexible riser is routed in a steep wave configuration between the STL buoy and PLEM via buoyancy elements at its lower end. The buoyancy equivalent section is approximately 138-feet (42 meters) long and the length between the buoyancy section and turret is approximately 131-feet (40 meters).

The umbilical will incorporate:

- Two hydraulic lines for the ESD valve (supply and return);
- Control lines for two pressure transmitters; and
- Signals for ESD valve status.

The umbilical will piggyback on the riser through the buoyancy modules. Instead of a vertical connection at the PLEM, however, the umbilical will be configured as a catenary from the lowest buoyancy module down to the horizontal connection at the deck of the PLEM. Guide tubes for connection to the STL buoy will be provided for the riser and umbilical. At the PLEM end, the hydraulic and signal lines will be routed to the ESD valve and to the pressure transmitter by wet matable connectors.

2.2.3.4 Pipeline End Manifold (PLEM)

The north and south PLEMs are the structures that provide the base for the flexible riser and umbilical and form the beginning point of the subsea pipeline. They are positioned approximately 246-feet (75 meters) from the landing pad. The PLEMs function as the interconnection between the flexible risers and flowlines. Additionally, the PLEMs have valve assemblies and pressure transmitters as well as the actuated valves and piping necessary to connect a removable pig launcher to facilitate launching inspection pigs. The pigs are devices that that are propelled along the pipeline while being pushed by the natural gas and are used in their different configurations for operations, maintenance, and integrity assessment. A foundation for a pig launcher skid is also provided.

Valves contained within the PLEM include an ESD valve of a fail-safe close type that is remotely controlled through the umbilical, a check valve to prevent back flow from the flowline, and an isolation valve located upstream of the connecting flange between the flexible riser and PLEM in order to isolate the PLEM for maintenance purposes. Two pressure transmitters isolated by double sets of valves are included in the main line and are connected to the SRV through the umbilical.

The PLEMs will be fixed to the seafloor by skirted mud mats (base case) or alternatively, with a suction anchor. This form of fixture will counteract the forces of pipeline expansion and pressure on the landward end and the forces of riser and umbilical flex on the other end. If a suction anchor is used as a foundation, each PLEM structure will serve as the top lid for the suction skirt. In this circumstance, a suction pipe with flange for connection to a ROV mounted pump skid will be arranged on top of each PLEM.

2.2.3.5 Flowlines and Piggable Wye

The flowlines will consist of two 36-inch pipelines, each approximately 2 miles (3.2 kilometers) long, one connecting the northern PLEM and the other the southern PLEM to a wye-connection. From the wye connection, a single 36-inch gas transmission line approximately 46 miles (73.9 kilometers) long will carry gas from the unloading buoys to onshore interconnections with the Gulfstream and TECO pipeline systems.

2.3 OPERATIONS

2.3.1 Cooling and Ballast Seawater

Seawater would be used primarily for engine cooling, ballast, and quarterly fire-protection system tests. The intake rate of cooling water would be up to 9.51 million gallons per day per SRV at a velocity of 0.5 feet per second. The volume of ballast water will depend on the size of the vessel, with either 14 million or 19 million gallons of ballast water being taken aboard during the 8.18 day regasification period, corresponding to intake rates of 1.71 or 2.32 MGD. Approximately 4 times per year the firewater system will be tested, using 79,251 gallons during each 15-minute test.

In order to provide consistent throughput of natural gas, it is planned that two SRVs would be operating at once for only a 9 hour overlap period, assuming that these would be the larger volume vessels they would draw a total maximum of 23.62 MGD. Because the firewater testing is so infrequent and the volume of water used negligible, it is not included in this calculation. The simultaneous operation of two SRVs would represent cooling water intake at design maximum. The planned operational schedule calls for round the clock operations with one vessel departing approximately 9 hours after the second has arrived at the port. To maximize natural gas throughput, two SRVs could undertake simultaneous vaporization activities. The impacts analysis was conducted assuming 24 hour simultaneous operations of 2 SRVs.

Seawater intake systems on the SRVs will draw water into their cooling systems via two sea chests located 14.8 and 24.6 feet (4.5 and 7.5 meters) below the water line. Water would be pumped aboard through one high and one low sea chest. Sea chest dimensions are approximately 6.1 feet x 4.6 feet x 4.6 feet (2 meters x 1.5 meters x 1.5 meters) and flow to a 4 inch x 6 inch (100-millimeter x 150-millimeter) strainer screen assembly fabricated from stainless steel lattice screen. These screens are similar to wedge wire screens in terms of some performance characteristics, but provide structural support within sea chests on SRVs. The seawater intake velocity will not exceed the U.S. Environmental Protection Agency (EPA)-mandated maximum (i.e., 0.5 feet per second).

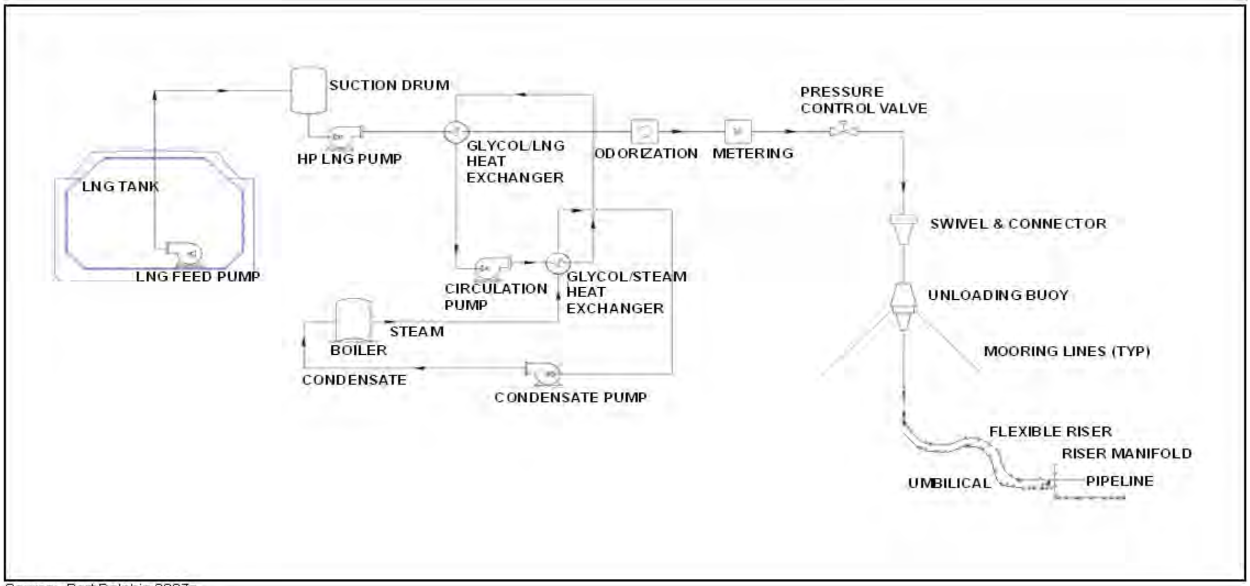
Cooling water discharges will be made at points removed from the intake sea chests to avoid recirculating warmed water through the cooling system. All cooling water will be discharged at a temperature not exceeding 18°F (10°C) above ambient water temperature.

Although the seawater system will be equipped with a chlorination system to prevent biofouling of heat transfer surfaces and system components, the chlorination system will not be used while the SRVs are approaching the Port or moored at the buoys. Ballast water discharges will be made as the SRV takes on its next cargo of LNG. International and local regulations will apply to the discharge of ballast water.

2.3.2 Regasification System

The SRVs will employ a closed-loop system vaporization system consisting of two high-pressure cryogenic LNG pumps, two heating glycol/water-brine circulating pumps, one steam/brine heat exchanger, one brine/LNG heat exchanger, and one control module. The closed-loop LNG vaporizer process flow diagram is shown in **Figure 10**.

Figure 10
Closed-Loop LNG Vaporizer Process Flow Diagram



Source: Port Dolphin 2007a.

LNG at -160 °C (-256 °F) and approximately 72 psi would be pressurized in multistage centrifugal pumps to a pressure up to 1,740 psi. The LNG would then be evaporated and heated as gas ranging in temperature between 0 to 10 °C (32 to 50 °F). Heating would be accomplished in a shell-and-tube heat exchanger, where LNG would be evaporated and heated in the tubes, and a glycol/water-brine solution would flow through the shell and around the tubes that contain the LNG, heating the LNG in tubes.

The glycol/water-brine solution would be heated by steam generated in an auxiliary boiler and pumped into the LNG heat exchanger. The glycol/water-brine will enter the LNG heat exchanger at 194°F (90°C) and leave at 68°F (20°C). The glycol/water-brine will then return to the steam heat exchanger where it will be reheated and pumped back to the LNG heat exchanger to continue the cycle. Because a closed-loop system is being employed, the intake of seawater will be greatly reduced as compared to seawater intake of open-loop systems. In addition, there would not be a large discharge of cooled seawater typical of an open-loop system.

3.0 AFFECTED ENVIRONMENT

Numerous offshore surveys were performed to collect qualitative and quantitative data to characterize and delineate the marine benthic habitats (including seagrass) within the Port Dolphin project area that may be impacted by construction of this project. In order to meet both the State of Florida and Federal requirements, survey methods incorporated guidelines from both State and Federal regulatory agencies.

Survey types included a geophysical, photo documentation survey using towed video and still cameras, and diver surveys. The geophysical survey was conducted to acoustically identify any hard bottom within the pipeline corridor, as well as to locate and identify any hazards (such as shipwrecks) or potential archaeological sites. Descriptive and qualitative video and still photographic data were collected to characterize hard/live bottom, seagrass, and soft bottom habitats. Diver surveys were conducted to collect *in situ* quantitative still photographic data on representative hard bottom habitats offshore Tampa Bay and within shallow waters of Tampa Bay.

3.1 GEOPHYSICAL SURVEY RESULTS

The seafloor slope of the project area is variable, but decreases notably to the east into Tampa Bay. From about the 60-foot (18-meter) contour eastward, the seafloor is depicted by an irregular surface characterized by hard bottom conditions and the accumulation of sandy sediments, sometimes extending over the hard bottom zones. The possible remnant shoal exhibits heights from 2 to 3 feet (6.6 to 10 meters), with broad sheets extending over large areas, up to 1,000 feet (305 meters). Low relief outcrops occur over uplifted areas, which may represent calcareous bioherms formed during lower sea levels. From the 60 foot (18 meter) contour eastward, the route is crossed by minor relief migrating sand waves. At the entrance to Tampa Bay, hard bottom exposure due to tidal flow scouring was recorded. Complete results of the geophysical surveys can be found in the archaeological and hazard survey reports produced by T. Baker Smith, Inc. for Höegh LNG (T. Baker Smith, Inc., 2007a, b, 2008).

3.2 PHOTODOCUMENTATION SURVEY RESULTS

Following the FDEP protocol, four distinct marine benthic habitat types were identified within the survey area (**Table 2**). Habitats included live bottom (Type A, Type B, and Type D) and soft substrate/sand. Survey area classifications were based on a review of video data collected from the survey transects within the proposed offshore project area.

Table 2
Florida Department of Environmental Protection (FDEP) Habitat Type Classifications

FDEP Habitat Type	Habitat Type Description
Type A	20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8 feet (0.25 meter) in relief, inclusive of sand components integral to these habitats. Essential Fish Habitat (EFH) and Habitat Area of Particular Concern (HAPC).
Type B	5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8 feet (0.25 meter) in relief, inclusive of sand components integral to these habitats. EFH, HAPC.
Type D	Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage. EFH.
Soft substrate/Sand	Soft substrate/sedimentary habitats not associated with hard bottom ecotones.

Surveys indicated soft substrate/sand is the dominant habitat type in the offshore project area. Types A, B, and D live bottom habitats observed within the project area were characterized as relatively small with patchy distribution. The areal extent of the various habitat types along the proposed project corridor is provided in **Table 3**. **Figure 11** shows the distribution of live bottom habitat types and geophysically mapped hard bottom along the Preferred Route Modification.

Table 3
Area of Florida Department of Environmental Protection (FDEP) Habitat Types Within the Project Corridor Based on Surveys Conducted in Federal Waters

FDEP Habitat Type	Acres	Hectares	Percent of Total Area
Type A	979.45	396.37	6.01
Type B	4,456.97	1,803.67	27.36
Type D	2,071.59	838.34	12.72
Soft substrate/Sand	8,779.65	3,553.00	53.91
Total	16,287.66	6,591.38	100.00

3.3 DIVER LIVE BOTTOM SURVEY RESULTS

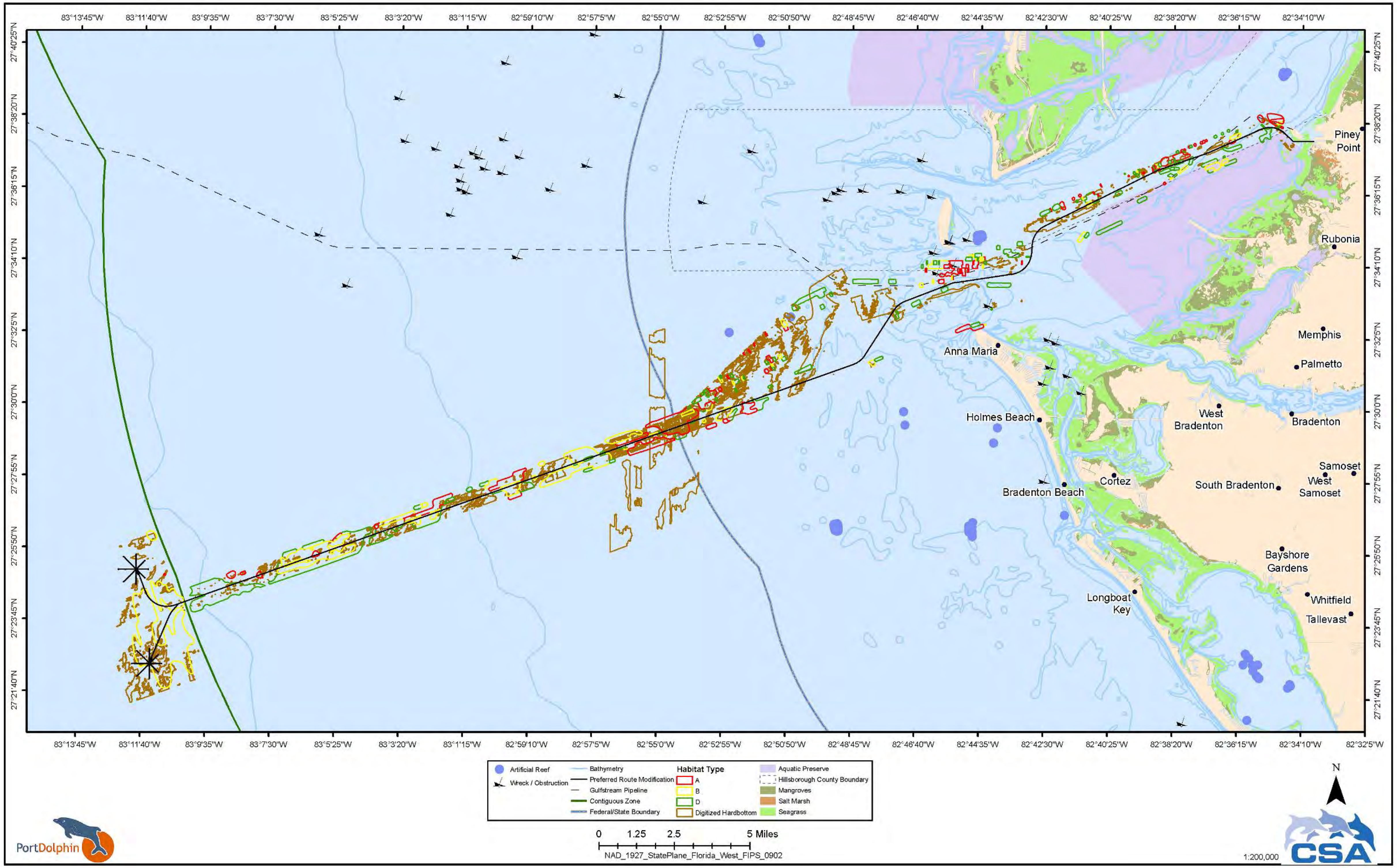
A total of 12 live bottom sites was surveyed within Federal waters. All of these were along the original pipeline corridor. Of these, six Type A habitats were confirmed; classification of these sites was based on structural relief due to sparse non-algal biotic cover. Six sites were classified as Type B, and none were classified as Type D. These habitats were documented and classified based on their relative structure and percent cover of non-algal epibiotic cover (**Table 4**).

Table 4
Florida Department of Environmental Protection Habitat Classifications of Live Bottom Sites Visited During Diver Surveys

Dive Site	Depth (feet)	Preliminary Habitat Classifications		Quantitative Analysis: Percent Coverage (Non-algal)	Percent Macroalgal Coverage	Final Habitat Classification
		Video Review	Diver Survey			
1	104	D	B	14.6	12.0	B
2	104	D	D	7.2*	11.0	B
3a	108	D	D	6.5*	19.6	B
4	108	D	D	11.7*	7.2	B
7	90	A	A	13.7	6.6	A**
8	81	A	A	10.3	19.3	A**
9	74	B	None	8.1	14.6	B
10	72	A	B	5.0	14.4	A**
12	49	B	B	11.7*	52.9	B
13	48	A	A	3.1	67.6	A**
14	45	B	A	1.2	57.1	A**
22	44	A	A	2.7	48.5	A**

* Confirmed during quality control analysis.
** Classified as Type A based on structural relief.

Figure 11
Mapped Habitats by Florida Department of Environmental Protection Classification Type and Geophysically Mapped Hard Bottom



The West Florida Shelf harbors some deepwater seagrass beds (*Halophila decipiens*), which occur commonly out to 100 feet (30.5 meters) (Phillips et al. 1990; Dawes et al. 2004) but rarely cover significant areas. Some small deepwater seagrass patches (*Halophila decipiens*) were intermittently observed offshore as part of the video survey but were not quantified as they were uncommon and sporadic (**Figure 12**).

3.4 FISHERIES RESOURCES

The northern Gulf of Mexico supports one of the most productive fisheries in North America (Gunter, 1967). Marine habitats in the Gulf of Mexico range from coastal marshes to the deep-sea abyssal plain and support an abundant and diverse fish fauna. Coastal pelagic and demersal fish assemblages are recognized within broad habitat classes for the continental shelf and oceanic waters of the Gulf of Mexico. Many species within these two groups require estuarine habitat during at least some part of their life cycle.

Coastal pelagic fish inhabit the continental shelf waters of the Gulf of Mexico throughout the year. Coastal pelagic fish can be divided into two ecological groups: predators and planktivores. Predators include species such as king and Spanish mackerels, bluefish, cobia, dolphin, jacks, and little tunny. These species typically undergo migrations, grow rapidly, mature early, and exhibit high fecundity. Some large predator species might be attracted to large concentrations of anchovies, herrings, and silversides that congregate in nearshore areas. Planktivores have similar life history characteristics, but are smaller in size. Species of planktivores include Gulf menhaden, Atlantic thread herring, Spanish sardine, round scad, and anchovies.

Demersal or bottom-oriented fish, as well as other demersal fauna of the Gulf of Mexico, inhabit hard bottom habitats, soft sediments, and seagrass beds. Typical fish species within this assemblage on the western Florida shelf include left eye flounders, grunts, eagle rays, drums, sea basses, and porgies.

Commercially important shellfish species found on the western Florida shelf include pink shrimp (*Farfantepenaeus duorarum*), rock shrimp (*Sicyonia brevirostris*), spiny lobster (*Panulirus argus*), stone crab (*Menippe mercenaria*), blue crab (*Callinectes sapidus*), calico scallop (*Argopecten gibbus*), and squid (*Loligo brevis*).

Many species of ecologically, commercially, and recreationally important fish and invertebrates begin their life cycle as planktonic eggs and larvae (i.e., meroplankton). Eggs and yolk-sac larvae only spend a few days in the planktonic phase after being spawned, with the exact duration depending on the species. The presence of meroplankton is indicative of spawning areas and seasonal spawning migrations of adults (Ditty et al., 1988). Spawning is often triggered by water temperature, therefore the distribution of larval fish is significantly influenced by water temperature (MMS, 2002a). Larval densities tend to peak during the summer and fall off in the winter as illustrated by **Table 5**.

Currents facilitate ichthyoplankton transport, influencing its distribution. Other factors influencing ichthyoplankton distribution include tidal transport, duration of the pelagic period, larval behavior (e.g. diel migration), and larval mortality and growth. Two of the most important hydrographic features in the Gulf of Mexico are the Mississippi River discharge plume and the Loop Current. Researchers hypothesize that ichthyoplankton aggregate at the frontal zone of the Mississippi River, and that the discharge plume might indicate that frontal waters provide feeding and growth opportunities for larvae (MMS, 2002b). Evidence indicates that eddies that spin off the loop current transport deepwater fish larvae onto the Florida shelf (Houde et al,. 1979). Ichthyoplankton monitoring to be conducted following issuance of a license may be incorporated into an oceanographic modeling effort in order to assess what affect these currents may have on larval transport and entrainment within the project area.

Figure 12
Presence of the Seagrass *Halophila decipiens* Relative to the Preferred Route Modification in Federal Waters

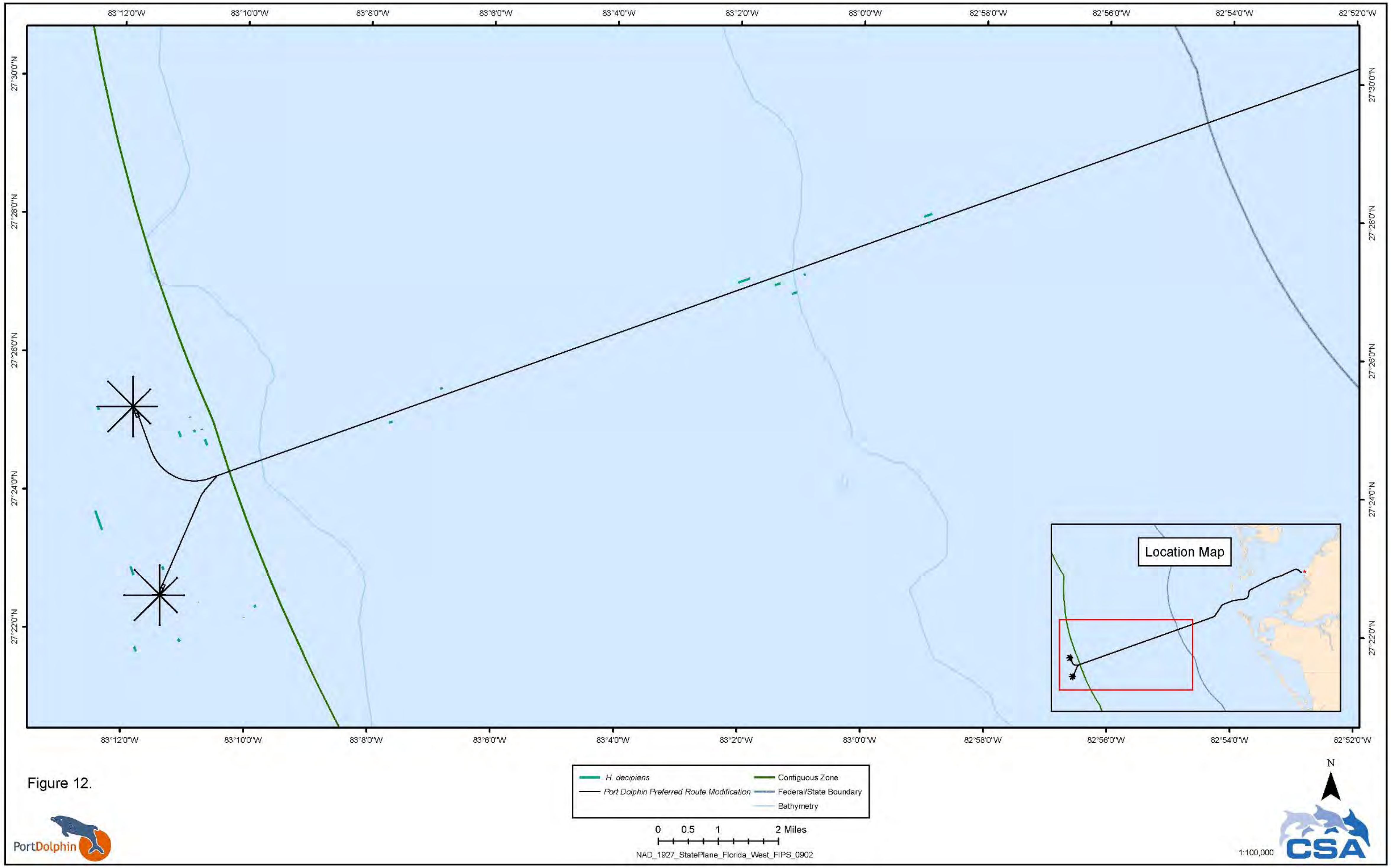


Table 5
Monthly and Peak Seasonal Occurrence of Larval Fishes
(< 10-mm standard length) in the North-Central Gulf of Mexico

Family (common name)	Taxa (common name)	Scientific Name	J	F	M	A	M	J	J	A	S	O	N	D
Herring and Menhaden	Gulf menhaden	*Brevoortia patronus*	*	*	X	X	-	-	-	-	X	X	X	*
	Round herring	*Etrumeus teres*	*	*	*	X	X	X					X	X
	Atlantic thread herring	*Opisthonema oglinum*			X	X	*	*	*	*	X	X	X	
Anchovy	Striped	*Anchoa hepsetus*	X	X	*	*	*	*	*	*	*	X	X	X
	Bay	*Anchoa mitchilli*	X	X	*	*	*	*	*	*	*	X	X	X
	Longnose	*Anchoa nasuta*	X	X	*	*	*	*	*	*	*	X	X	X
Sea Bass and Grouper	Sand perch	*Diplectrum formosum*	X	X	X	X	*	*	*	*	X	X	X	X
	Pygmy sea bass	*Serraniculus pumilio*	-	-	-	-	X	*	*	*	*	X	X	-
Jacks, Scads, Pompanos, and relatives	Blue runner	*Caranx crysos*	-	-	X	X	X	*	*	*	X	X	X	-
	Atlantic bumper	*Chloroscombrus chrysurus*	-	-	-	X	X	*	*	*	*	X	-	-
	Round scad	*Decapterus punctatus*	-	-	X	*	*	*	*	*	*	X	X	-
	Rough scad	*Trachurus lathami*	*	*	X	X	X	-	-	-	-	-	X	X
	Dolphin	*Coryphaena hippurus Linnaeus*	-	-	-	-	X	X	X	X	X	X	X	-
Snapper	Red	*Lutjanus campechanus*	-	-	-	X	X	*	*	*	X	X	X	-
	Gray	*Lutjanus griseus*	-	-	-	X	X	*	*	*	X	X	X	-
	Lane	*Lutjanus synagris*	-	-	-	X	X	*	*	*	X	X	X	-
Mojarras	Pigfish	*Orthopristis chrysoptera*	X	X	*	X	X	-	-	-	-	-	-	-
Porgies	Sheepshead	*Archosargus probatocephalus*	X	*	*	*	X	-	-	-	-	-	-	-
	Pinfish	*Lagodon rhomboides*	*	*	X	X	-	-	-	-	-	X	X	*
Drums, Croakers, Sea Trout	Spotted sea trout	*Cynoscion nebulosus*	-	X	X	*	*	*	*	*	X	X	-	-
	Spot	*Leiostomus xanthurus*	*	X	X	X	-	-	-	-	-	X	X	*
	Atlantic croaker	*Micropogon undulates*	*	X	X	X	-	-	-	-	X	*	*	*
	Red drum	*Sciaenops ocellatus*	-	-	-	-	-	-	-	X	*	*	X	-
Spadefish	Atlantic spadefish	*Chaetodipterus faber*	-	-	-	X	X	*	*	*	X	-	-	-
Mackerels, Tunas, Wahoo	Bullet mackerel	*Auxis rochei*	X	X	X	X	*	*	*	*	*	X	X	-
	Little tunny	*Euthynnus alletteratus*	-	-	-	X	*	*	*	*	*	X	X	-
	Skipjack tuna	*Euthynnus pelamis*	-	-	-	X	X	X	X	X	X	X	-	-
	King mackerel	*Scomberomorus cavalla*	-	-	-	-	X	X	X	*	*	X	X	-
	Spanish mackerel	*Scomberomorus maculates*	-	-	-	X	X	X	X	*	*	X	-	-
	Bluefin tuna	*Thunnus thynnus*	-	-	-	X	X	X	-	-	-	-	-	-
Butterfish	Gulf butterfish	*Peprilus burti*	*	*	*	X	X	X	X	X	X	X	*	*

Source: Ditty et al. 1988
Notes: X = Seasonality, * = Peak Seasonal occurrence

Many species of ichthyoplankton are found within specific depth contours. Larval depth distribution of some of the more abundant fish taxa found in the northern Gulf of Mexico are shown in **Table 6**. Species most likely to be found in the project area are those that are distributed in water depths of less than 100 feet (30 meters).

Table 6
Primary Depth Distribution of Larval Fish
(< 10 mm standard length) in the Gulf of Mexico, North of 26º N Latitude

Common Name	Scientific Name	<82 feet (<25 meters)[a]	<164 feet (<50 meters)[a]	<328 feet (<100 meters)[a]	164-656 feet (50–200 meters)[a]	>492 feet (>150 meters)[a]
Sheepshead	*Archosargus probatocephalus*[b]	X				
Atlantic spadefish	*Chaetodipterus faber*	X				
Atlantic bumper	*Chloroscombrus chrysurus*	X				
Sand sea trout	*Cynoscion arenarius*	X				
Spotted sea trout	*C. nebulosus*[b]	X				
Pigfish	*Orthopristis chrysoptera*	X				
Northern harvestfish	*Peprilus paru*	X				
Black drum	*Pogonias cromis*[b]	X				
Anchovies	*Anchoa* spp.	X	X			
Gulf menhaden	*Brevoortia patronus*[b]	X	X			
Black sea bass	*Centropristis striata*	X	X			
Sand perch	*Diplectrum formosum*	X	X			
Scaled herring	*Harengula jaguana*	X	X			
Pinfish	*Lagodon rhomboides*[b]	X	X			
Spot	*Leiostomus xanthurus*[b]	X	X			
Atlantic croaker	*Micropogonias undulatus*[b]	X	X			
Atlantic thread herring	*Opisthonema oglinum*	X	X			
Round sardine	*Sardinella aurita*	X	X			
Spanish mackerel	*Scomberomorus maculatus*	X	X			
Pygmy sea bass	*Serraniculus pumilio*	X	X			
Round scad	*Decapterus punctatus*	X	X	X		
Gulf butterfish	*Peprilus burti*	X	X	X		
Mackerel	*Auxis* spp.				X	
Blue runner	*Caranx crysos*				X	
Round herring	*Etrumeus teres*				X	
Little tunny	*Euthynnus alletteratus*				X	
Red barbier	*Hemanthias vivanus*				X	
Red snapper	*Lutjanus campechanus*				X	
King mackerel	*Scomberomorus cavalla*				X	
Rough scad	*Trachurus lathami*				X	
Skipjack tuna	*Euthynnus pelamis*					X
Sailfish	*Istiophorus* spp.					X
Swordfish	*Xiphias gladius*					X

Source: MMS 2002b
Notes: [a] Depth ranges are those at which more than 75 percent of larvae were collected
[b] Estuarine-dependent species

4.0 POTENTIAL ENVIRONMENTAL IMPACTS

4.1 IMPACT-PRODUCING FACTORS

Impact-producing factors include those caused by construction of the project and those incurred during routine operation of Port Dolphin. Environmental impacts associated with the proposed project include disturbance or alteration of seafloor habitats. Potential factors impacting seafloor habitat include the following:

- Pipeline burial (plowing) activities;
- Placement of concrete mattresses;
- Pipelaying barge anchor placement;
- Pipelaying barge anchor cable sweep;
- Installation of the STL subsea system; and
- Mooring line sweep during routine operation of the Port.

In addition to impacts to benthic habitat, operation of the Port will potentially impact fisheries resources due to the following:

- Entrainment or impingement during cooling water intake; and
- Discharge of cooling water.

4.2 ESTIMATIONS OF ENVIRONMENTAL IMPACTS

Benthic live bottom habitat as well as fisheries resources (larvae and eggs of fish and invertebrates) will be impacted by the construction and operation of this project. Impacts to benthic habitat and fisheries will be discussed separately.

4.2.1 Live Bottom Impacts

4.2.1.1 Pipeline Plowing and Concrete Mattress Placement

The area of seafloor impact from pipeline plowing and concrete mattress placement activities was calculated using a geographic information system (GIS) to overlay mapped benthic communities onto pipeline segments that are expected to be plowed, plowed and covered with mattresses where the necessary 3 feet of burial depth is not achieved, covered with mattresses, or buried using dragline and mattresses. The majority of the area expected to be impacted by plowing and mattress placement will be soft bottom, but areas of hard/live bottom habitat also will be affected. The total area of seafloor impact was estimated at 151.87 acres (61.46 hectares), approximately 62% (94.11 acres [38.08 hectares]) of which would be live bottom habitats (Types A, B, and D). Impacts associated with physical seafloor disturbances in Federal waters during the construction phases are summarized in **Table 7**.

Table 7
Areal Extent of Seafloor Impacts from Pipeline Installation
(Preferred Route Modification – Federal Waters only)

Activity	Area Affected Acres (Hectares)			
	Soft Bottom	Type A	Type B	Type D
STL subsea system installation	0.19 (0.50)	0	0.04 (0.10)	0
Plowing	52.32 (21.17)	8.39 (3.39)	33.68 (13.63)	47.62 (19.27)
Mattress placement	5.44 (2.2)	0.0 (0.0)	4.43 (1.79)	0.0 (0.0)
Anchoring	8.81 (3.57)	0.76 (0.31)	2.19 (0.89)	1.30 (0.53)
Anchor cable sweep	2,763.05 (1,118.17)	239.7 (97.0)	690.66 (279.5)	408.41 (165.28)
Total	2,829.81 (1,145.61)	248.85 (100.70)	731.00 (295.91)	457.33 (185.08)

Impacts due to plowing and mattress placement represent permanent loss of live bottom habitat, as hard bottom substrate will be destroyed by plowing or permanently covered by mattress placement. Impacts due to anchoring and cable sweep represent a temporary decrease of live bottom function, as these impacts will be primarily to the epibenthic organisms and not to the to the structural habitat (i.e., substrate).

Plowing and Mattress Placement: The analysis predicts that a total of 89.69 acres (36.83 hectares) of live bottom habitat would be affected by plowing including areas where the required 3 feet of burial is not achieved and mattresses will be used for protection. Additionally, the analysis predicts that 4.43 acres (0.1.79 hectares) would be affected by concrete mattresses.

Anchoring: The analysis predicts that 4.25 acres (0.1.73 hectares) of live bottom habitat would be affected by anchoring.

Anchor Cable Sweep: In addition to the direct impacts, each anchor cable also will contact (sweep) the seafloor. A range of anchor wire catenary analyses was performed using a standard static catenary program to calculate the extent of anchor sweep impacts for a 10-anchor array. The area per reset was adjusted to account for the use of mid-line buoys to reduce cable sweep. A detailed analysis of mid-line buoys has not been undertaken at this stage. However, an initial assessment suggests that mid-line buoys could reduce anchor wire weight by about 50%, with a corresponding reduction in seabed contact area of 25% or greater, yielding an impact area of 1,199,162 square feet (111,395 square meters) per anchor reset.

The area of live bottom habitat expected to be impacted by cable sweep is predicted to be 1,338.77 acres (541.78 hectares) of live bottom habitat, making this the largest source of seafloor impacts during the pipeline installation.

4.2.1.2 Impacts from Pipelaying Barge Anchoring

The following assumptions were used in order to calculate impacts:

- The pipelaying barge will make four passes along the route for the following: pipelaying, plowing, backfilling, and mattress placement.

- During the first three passes, the barge will use 10 anchors, which will be reset every 2,000 feet (610 meters). Each anchor contact with the seafloor would directly affect an area of 360 square feet (33.4 square meters).
- The fourth pass (mattress placement) will be done by a smaller barge with four smaller anchors that would be reset every 1,000 feet (305 meters). The anchors would affect a smaller area of 90 square feet (8.4 square meters).
- Hard and soft bottom areas will be affected in direct proportion to the percentage of these areas along the portion of the pipeline route in Federal waters.

The actual sequence of events involved in pipelaying will be more complicated than indicated by these assumptions. However, the assumptions were reasonable for estimating the number and extent of anchor impacts. **Table 8** categorizes impacts from anchoring related to specific operations of the pipeline installation.

Table 8
Areal Extent of Seafloor Impacts from Anchoring During Pipeline Installation
(Preferred Route Modification – Federal Waters only)

Pass[a]	Activity	Length (feet)	No. of Anchor Resets	No. of Anchor Impacts	Direct Impact Area[b]			
					Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)
1st	Pipelaying	113,840	56	560	3.17 (1.28)	0.27 (0.11)	0.79 (0.32)	0.46 (0.19)
2nd	Plowing	92,326	47	470	2.56 (1.04)	0.22 (0.09)	0.64 (0.26)	0.38 (0.15)
3rd	Backfilling	92,326	47	470	2.56 (1.04)	0.22 (0.09)	0.64 (0.26)	0.38 (0.15)
4th	Mattress placement	92,514	93	372	0.51 (0.21)	0.05 (0.02)	0.13 (0.05)	0.08 (0.03)
				Total	8.81 (3.57)	0.76 (0.31)	2.19 (0.89)	1.30 (0.53)

[a] For first three passes, assumed a barge would use 10 anchors that would be reset every 2,000 feet (610 meters) and each would affect an area of 360 square feet (33.4 meters^2). For the fourth pass, assumed four smaller anchors would be reset every 1,000 feet (305 meters) and each would affect an area of 90 square feet (8.4 meters^2).
[b] Assumed anchors would contact habitats in proportion to their occurrence during the video surveys (5.84% Type A, 16.84%, Type B, 9.96 Type D, and 67.36% soft bottom).

4.2.1.3 Impacts from Pipelaying Barge Anchor Cable Sweep

In addition to the direct impacts from the placement of the pipelaying barge anchors, each anchor cable also will contact (sweep) the seafloor. The impact area associated with cable sweep was estimated to be 1,199,162 square feet (111,395 square meters) per anchor reset. The total anchor wire sweep per reset was estimated to be 1,598,882 square feet (148,526 square meters), which equals 36.71 acres (14.85 hectares). This estimate is considered to be very conservative for Florida State waters because of the water depth and anchor scope assumptions. Benthic habitats will be affected in direct proportion to the percentage of these areas within the project area in Federal waters.

There are two types of injuries that occur to live bottom communities associated with the installation of the Port Dolphin Project, structural and biological. Anchor sweep impacts to live bottom habitat differ from direct impact from pipeline installation (i.e., plowing, mattress placement, dredging, or direct anchor placement). The direct impacts from installation of the pipeline create injuries to the structure (live bottom/hard bottom substrate) as well as the biological component (organisms growing on the substrate), whereas the impacts from anchor sweep are typically injurious to the biological component (living organisms growing on the structure) and not the structure. Impacts from anchor sweep typically recover much more quickly than the types of injuries that will be caused from direct impact from pipeline installation.

4.2.1.4 Impacts from Installation of STL Subsea System

The seafloor within the North and South buoy areas is a mix of hard and soft substrates, and although the layout has been planned to avoid hard/live bottom to the extent possible, some contact with anchors and/or mooring lines is considered likely. It is expected that only Type B habitat would be affected by installation of the STL subsea system. There is a small patch of Type A habitat in the North Buoy area but the anchor positions have been planned to avoid contacting it (**Figure 13**).

Installation of the STL subsea system is assumed to be conducted by a barge with 10 anchors, each affecting an area of 360 square feet (33.4 m^2). Anchor positions will be adjusted to contact primarily soft bottom, but it is assumed that one of the anchors will be placed on hard/live bottom. The area affected would be 0.107 acres (0.033 hectares) of soft bottom and 0.058 acres (0.023 hectares) of hard/live bottom (Type B habitat). However, it may be determined during detailed design that a Dynamic Positioning (DP) vessel could install the STL buoy system. In that event, the impacts from barge anchor placement would not occur.

The landing pad and PLEM will be fixed to the seafloor, either by means of a skirted mud mat or with a suction pile. These components will be placed on soft bottom. The area affected would be 0.02 acres (0.01 hectares) for the PLEM and 0.13 acres (0.05 hectares) for the STL landing pad.

The STL subsea system includes eight anchors or suction piles in both the North Buoy and South Buoy areas. Each anchor or suction pile is assumed to affect an area of 360 square feet (33.4 square meters). Although anchor positions have been adjusted to minimize contact with hard bottom, it is assumed that one location will be in a hard/live bottom area. The area affected would be 0.091 acres (0.037 hectares) of soft bottom and 0.041 acres (0.017 hectares) of hard/live bottom (Type B habitat).

Each barge anchor cable may also contact (sweep) the seafloor. During detailed design, an anchoring plan will be developed that will provide specific procedures for anchor deployment to minimize impacts on hard/live bottom. Midline buoys will be used to the extent practicable to reduce the amount of anchor chain sweep.

Table 9 summarizes impacts resulting from installation of the STL subsea system. The seafloor within the North and South buoy areas is a mix of hard and soft substrates, and although the layout has been planned to avoid hard/live bottom to the extent possible, some contact with anchors and/or mooring lines is considered likely. Of the hard/live bottom habitats, it is expected that only Type B habitat would be affected. There is a small patch of Type A habitat in the North Buoy area but the anchor positions have been planned to avoid contacting it.

Figure 13
Distribution of Hard/Live Bottom Habitat in Buoy Placement Areas

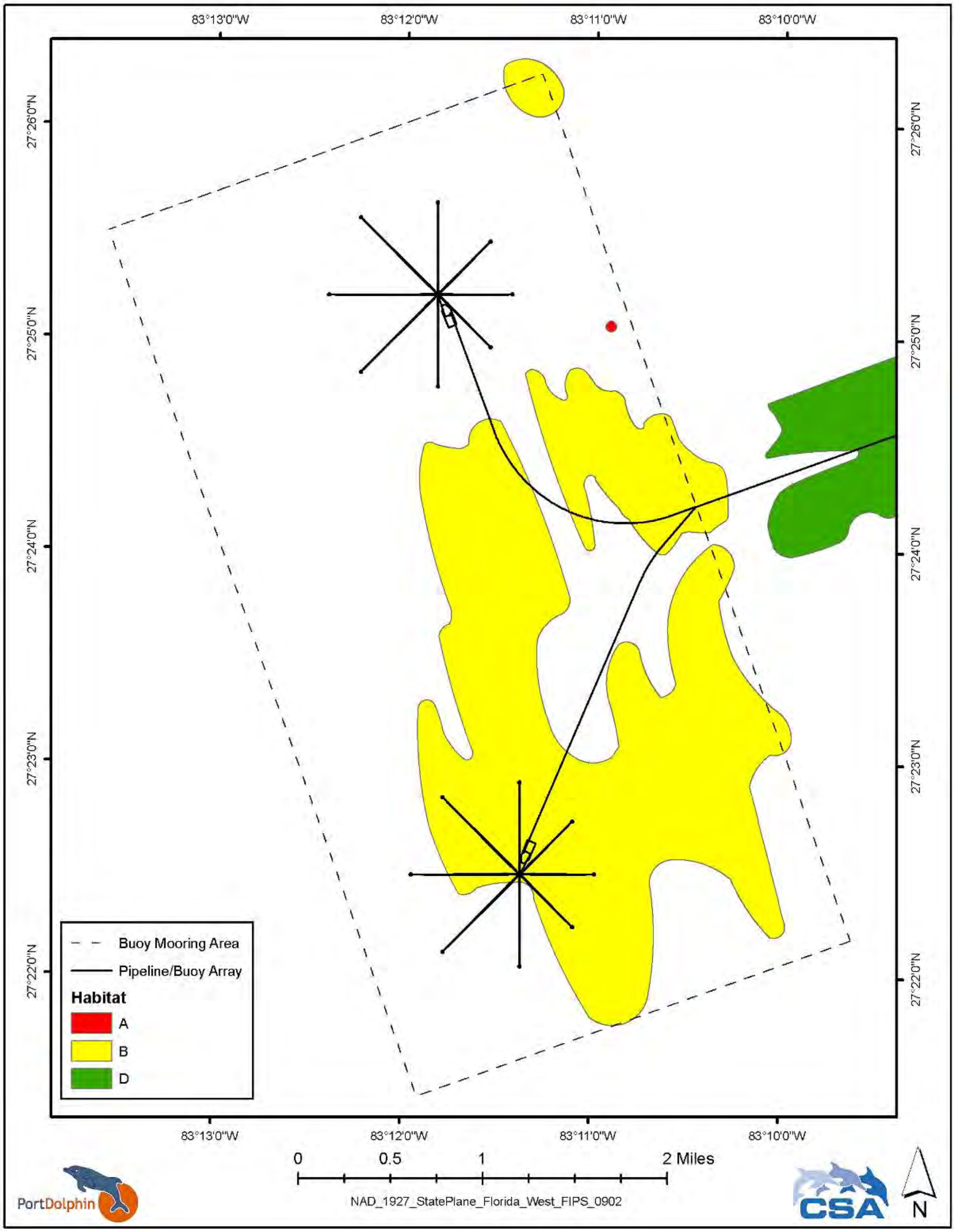


Table 9
Area of Benthic Habitats Affected by Installation of the STL Subsea System

Impact Source	North Buoy				South Buoy				Total			
	Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)	Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)	Soft Bottom acres (hectares)	Type A acres (hectares)	Type B acres (hectares)	Type D acres (hectares)
Placement of STL landing pad	0.13 (0.05)	0	0	0	0.13 (0.05)	0	0	0	0.26 (0.10)	0	0	0
Placement of PLEM	0.02 (0.01)	0	0	0	0.02 (0.01)	0	0	0	0.04 (0.02)	0	0	0
Placement of anchors/piles (8 anchors total)[a]	0.066 (0.027)	0	0	0	0.025 (0.010)	0	0.041 (0.017)	0	0.091 (0.037)	0	0.041 (0.017)	0
Barge anchoring (10 anchors total)[b]	0.074 (0.030)	0	0.008 (0.003)	0	0.033 (0.013)	0	0.050 (0.020)	0	0.107 (0.033)	0	0.058 (0.023)	0
Total	0.29 (0.12)	0	0.01 (0.003)	0	0.21 (0.08)	0	0.09 (0.04)	0	0.50 (0.19)	0	0.10 (0.04)	0

[a] Each mooring assumed to affect 360 square feet (33.4 meters^2). For North Buoy area, assumed all 8 moorings would be in soft bottom. For South Buoy area, assumed 3 of 8 moorings would be in soft bottom, the rest in Type B habitat.

[b] Each barge anchor assumed to affect 360 square feet (33.4 meters^2). For North Buoy area, assumed 9 of 10 barge anchors would be in soft bottom and the other in Type B habitat. For South Buoy area, assumed 4 of 10 barge anchors would be in soft bottom, the rest in Type B habitat.

4.2.1.5 Impacts from Mooring Line Sweep

During operations, the anchor chains/cables from the STL buoys will chafe the seafloor and may physically damage benthic communities. The two unloading buoys each will have eight mooring lines consisting of wire rope and chain, connecting to anchors or driven piles on the seabed. When not connected to an LNG carrier, the unloading buoy would be submerged below the sea surface. When an LNG carrier arrives, the unloading buoy would be retrieved from its submerged position by means of a winch and recovery line. As the STL buoy moves up and down, some lateral movement of the mooring lines will occur, contacting the seabed. The total seafloor area affected by anchor sweep at both North and South buoys combined is estimated to be approximately 22 acres (8.94 hectares).

The anchor layouts have been planned to minimize the amount of hard bottom habitat contacted. **Table 10** summarizes the estimated area of hard/live bottom that would be contacted by anchor sweep. Hard/live bottom will be impacted only at the north buoy location. It is estimated that 6.39 acres (2.58 hectares) of hard/live bottom habitat would be affected. Only Type B habitat would be affected. There is a small patch of Type A habitat in the North Buoy area but it would not be affected because it has been avoided in the anchor layout.

Table 10
Area of Benthic Habitat Estimated to be Affected by Mooring Line Sweep During Routine Operationsa

Impact Source	North Buoy		South Buoy		Total	
	Soft Bottom acres (hectares)	Type B acres (hectares)	Soft Bottom acres (hectares)	Type B acres (hectares)	Soft Bottom acres (hectares)	Type B acres (hectares)
Cable sweep (STL buoy)	11.05 (4.47)	0	4.66 (1.89)	6.39 (2.58)	15.71 (6.36)	6.39 (2.58)

[a] In North buoy area, assumed all 8 moorings would sweep soft bottom areas; in South Buoy area, assumed mooring lines 5, 6, and 7 would sweep soft bottom and the rest would sweep Type B habitat.

4.2.2 Fisheries Impacts

4.2.2.1 Impacts from Entrainment and Impingement

During routine operations SRVs moored at the Port will draw seawater into their cooling systems via sea chests. Direct, adverse impacts on biological organisms by seawater intake would primarily involve the entrainment of marine organisms. Entrainment involves the drawing of small marine organisms (e.g., ichthyoplankton) into the seawater intake system. Mortality of entrained organisms is conservatively assumed to be 100 percent. Impingement is a lesser potential impact involving the trapping of organisms against the seawater intake screens. Entrainment mortality of early life stages of fishes and invertebrates as a result seawater uses may affect the adult population by decreasing the number of developing stages able to survive to reproduce as adults. The combined impacts of entrainment and impingement and subsequent mortality of eggs, larvae, phytoplankton, and zooplankton would be expected to have long-term, minor, adverse impacts on the ecology of the area.

The SRVs used for Port Dolphin use a closed looped system, however; intake of cooling water and ballast water is still required for operations. The maximum combined cooling/ballast water intake of two 217,000 m^3 SRVs is 23.62 MGD and does not reflect the standard operating scenario, but has been used as the worst case scenario for determining impacts from water intake. The maximum intake volume still represents a small rate compared with other water intake rates from power plants in the Tampa Bay area. For example, the Bartow Plant uses approximately 475 MGD, the Big Bend Plant uses approximately 1,275 MGD, and the F.J. Gannon Power Station (renamed H.L. Culbreath Bayside Power Station when repowered in 2003) uses approximately 950 MGD (based on annual averages). These facilities also draw water directly from nearshore areas in Tampa Bay, where there is typically a higher abundance of early life stages of fishes and invertebrates as compared to the waters surrounding the proposed Port Dolphin deepwater port. Within the Tampa Bay region, cumulative or synergistic effects between the power plant intakes and Port Dolphin would not be expected due to the nearshore versus offshore locations of the water uses.

Monitoring to be conducted following issuance of a license will include at least one year of pre-construction data collection which will allow an assessment of baseline abundances of the eggs and larvae of both fish and invertebrates. These data may be incorporated into an oceanographic modeling project to better assess entrainment impacts on specific taxa.

4.2.2.2 Impacts from Cooling Water Discharge

Because the regasification process proposed for Port Dolphin is a closed loop system, with water being used primarily for engine cooling, there will be no large cold water discharge associated with this project as would be typical of an open-loop system. Water used for engine cooling in the SRVs will be discharged at a slightly higher temperature than ambient water temperatures. The intensity of impacts would vary within the impacted area depending on seasonality, prevailing currents, operational activities, the location and conditions within the impacted zone where larvae are exposed, and the sensitivity of the organisms to changes in temperature. Water would be released from a discharge 11.5 feet (3.5 meters) below the SRV waterline and rise rapidly to the surface due to buoyancy. The discharge would be less than 18ºF (10ºC) above ambient water temperature; modeling shows that it would typically mix to within 1.8ºF (1ºC) of ambient water temperature within 66 feet (20 meters) of the discharge. The discharge would extend further during summer months, but mix to within 1.8ºF (1ºC) of ambient water temperature within the 328 feet (100 meters) mixing zone of the SRV discharge. The cooling water discharge is not expected to reach the seafloor. Most mobile organisms would be expected to avoid the cooling water discharge plume during the summer and attracted to it in the winter. Because the plume of cooling water will be of relatively small volume, any impacts would be expected to be minor.

5.0 MITIGATION

Methods for scaling mitigation requirements to offset the impact will be different for State and Federal waters. This document only addresses mitigation for potential impacts in Federal waters.

5.1 HARD/LIVE BOTTOM HABITAT IMPACTS

5.1.1 Habitat Equivalency Analysis

Habitat Equivalency Analysis (HEA) is a method used to determine compensation for damaged resources. The goal of HEA is to mitigate loss of ecological function resulting from damage to natural resources. Restoration can be either primary, in which a permanent loss of function is mitigated, or compensatory, in which temporary loss of function is mitigated until the impacted resource returns to its pre-impact level of function. Data collected during field surveys (**Section 3.0**) will be used in the HEA process to assess impacts due to project construction, calculate functional loss, and determine the amount and type of mitigation necessary.

5.1.2 Time Lag and Risk

Time lag will be addressed in the mitigation plan to assess the length of time it would take for the mitigation implementation to reach the relative productivity level of pre-construction conditions. Risks associated with the mitigation implementation will be analyzed in the mitigation plan and will be considered as factors during the selection of the mitigation option. The information obtained from the time lag and risk assessments would be included as inputs for the HEA process.

5.1.3 Mitigation Objective

The objective of the proposed mitigation options is to compensate for unavoidable and recognized impacts to marine live bottom habitat associated with the construction of the Port Dolphin project. Mitigation is intended to reduce loss of habitat and ecological function by creating biological and structural enhancements that provide and maintain features similar to the impacted habitat. An effective strategy for meeting the stated objective is to use a combination of the presented mitigation options.

5.1.4 Mitigation Options

Mitigation options include biological enhancement and structural enhancement methods. Each method is discussed separately.

5.1.4.1 Biological Enhancement

Biological enhancement will consist of two components:

1) resource translocation, and
2) resource reattachment.

The biological enhancement option would be implemented primarily to rescue hard coral colonies, octocorals, and/or large sponges. Rescue of these resources is considered a priority since they are the most visible and slowest growing components of the impacted epibiotal community. The rescue of larger individuals of corals and sponges would significantly reduce recovery time following construction. Biological enhancement can be conducted prior to and following construction activities; although, the primary focus would be on resource translocation from pre-construction impact areas.

5.1.4.1.1 Resource Translocation

Pre-Construction Translocation
It is recommended to conduct translocation operations at live bottom areas that have been identified during pre-construction as impact areas that support the highest densities of the target biota. This approach will help maximize biological benefit for a relatively time-sensitive program. It is estimated that removed epibiota could be cached pending reattachment for up to 3 months with minimal tissue loss.

Hard corals, and large octocorals and sponges would be removed from live bottom areas by chipping the living portion of the colony from the point of attachment, or by removing a portion of the substrate along with the attached organism(s). Biota/substrate suitable for reattachment will be transported and securely cached away from potential impacts of construction activities. Cache locations will be in similar water depths as the donor sites. Cached biota/substrate will be secured using fabricated holding bins and/or natural topographic features (i.e., depressions). This method for caching biota has been successfully utilized for recent biota reattachment and transplantation projects (Marine Resources Inc., 2003; Continental Shelf Associates, Inc. (CSA), 2006a; CSA International, Inc. (CSA), 2007c).

To reduce relative productivity time lag for mitigation, cached biota will be reattached to suitable prepared substrate and mitigation structures. Colonies would be reattached onto prepared surfaces, utilizing either cement or marine-grade epoxy as a bonding agent. A sufficient amount of the selected bonding agent will be placed directly on the reattachment substrate; biota to be reattached will be pressed firmly into the bonding agent and held in position or propped until stable. Reattached biota will be checked intermittently during reattachment operations to ensure their stability and to address (enhance) the aesthetic quality of the reattachment matrix. Reattached biota will be spatially distributed in a manner that would mimic natural conditions as closely as possible.

Post-Construction Translocation
Pipeline construction activities, particularly plowing, will very likely displace carbonate substrate and associated epibiota. Although individual epibiotic resources will be addressed, the primary concern with post-construction translocation will be the displaced substrate/biota boulders. Boulders and attached epibiota identified during post-construction mitigation operations will be handled as described for pre-construction mitigation. The boulders displaced during construction could be translocated and utilized as mitigation substrate. This mitigation option has the potential to preserve epibiotic resources and will maximize the use of natural substrates to provide faunal refuge and suitable naturally-occurring settling substrate for subsequent epibenthic recruitment. Additionally, the utilization of these naturally-occurring substrate/biota boulders will minimize potential substrate mobility, which may impede recovery and/or possibly cause additional collateral damage to the habitat. Salvaged substrate/biota boulders will be stabilized by utilizing bonding agents in conjunction with deployment strategies discussed in **Section 5.1.4.2**.

Recovery of displaced substrate/biota boulders will include localized containment, transport, and deployment at the selected mitigation site(s). Displaced boulders could be safely handled by a two-person dive team and transported to selected mitigation sites. Multiple mesh cargo nets, each accommodating the containment of about 1 cubic yard of rubble, would be utilized for the boulder recovery operations. The method of transport will depend on the distance between the recovery site and the deployment (mitigation) site. It is recommended to utilize these displaced substrate/biota boulders relatively close to the recovery site so they can be moved by divers utilizing lift bags; long-distance deployment will require work vessel and specialized equipment. These methods for recovery of displaced substrate/biota boulders have been successfully utilized during restoration activities conducted offshore Florida (Marine Resources Inc., 2006) and Hawaii (Continental Shelf Associates, Inc., written communication to Fowler Rodriquez and Chalos, 2006).

In deeper waters, relocation of substrate prior to construction would prove more problematic. Therefore it is proposed that during the course of the post-construction survey displaced substrate with substantial biotic growth is identified and mapped, then to return to these sites for stabilization of these boulders *in-situ*.

5.1.4.1.2 Resource Reattachment

Translocation of corals and other biota has been conducted in different parts of the world and is recommended as a good option for corals threatened by marine construction (Harriot and Fisk, 1988). Successful coral translocation has been performed for a wide variety of marine construction projects throughout the world by a wide variety of contractors and governmental agencies. CSA has conducted coral reattachment on over 35 programs associated with marine construction, ship groundings, anchor damage, and habitat enhancement. These programs collectively involved the reattachment of over 25,000 corals with hundreds of tons of cement. Some of these programs were monitored by an outside party to determine the relative success of the reattachment technique. Outside parties that have monitored CSA reattachment programs (primarily hard coral) include the National Oceanic and Atmospheric Administration, National Coral Reef Institute, and Florida Marine Research Institute.

CSA coral reattachment has been proved to be very successful, and monitoring reports assessing the relative success of these programs are summarized below.

- A ship grounding program completed by CSA and monitored by an independent third party reported 100% survivorship and coral colony stability after 2 years following restoration in the Florida Keys National Marine Sanctuary (FKNMS). The program included coral reattachment, reef structural repair, and placement of artificial reef structure (Franklin et al., 2005).
- CSA reattached over 400 corals in restoration modules in the southern portion of the FKNMS. Monitoring of the site 3 years after the restoration found all modules were stable, with elevated coral coverage due to growth of reattached corals (Schittone et al., 2006).
- Over 1,000 coral colonies were removed from an offshore construction site in Broward County Florida, temporarily cached for the construction period, and reattached to a submerged structure following construction activities. Monitoring of the coral stability and health was conducted at the reattachment site over a 3-year period and showed a 97% success rate (National Coral Reef Institute, 2004).

All of the aforementioned reattachment programs were conducted utilizing the same techniques proposed for Port Dolphin mitigation component of biological enhancement.

5.1.4.2 Structural Enhancement

Structural enhancement would include preparation and deployment of mitigation structures, which would increase rugose hard substrate surface area and complexity for epibenthic settlement. Potential mitigation structures for this project include the following:

- Limestone boulders;
- Habitat replacement modules; and
- Low-relief articulating mats.

Substrate surface area and the relative abundance of sessile macroinvertebrates are variables that influence the abundance and diversity of fishes (Ferriera et al., 2001). Mitigation structures can serve as recipient sites for translocated epibenthic resources from within the impact area and additionally may be used to stabilize fractured substrate associated with pipeline construction, particularly hard bottom habitat within pipelaying barge anchor scars. Structural mitigation, as presented, is intended to mimic natural hard bottom habitat to the greatest extent possible. However, studies based on monitoring development of benthic and fish assemblages on mitigation structure suggest that physical differences between the mitigation structures and naturally-occurring substrate (such as shape, rugosity, and relief) may limit the potential of the convergence of similarity with the natural habitat (Thanner et al., 2006).

The specific configuration of the mitigation structure placement will be determined by considerations of marine construction equipment, water depth, and overall required mitigation area. The spacing of structures within mitigation sites will create a natural patch-structure similar to that of the natural hard bottom habitat. Patchy configuration of mitigation structures has proven effective off Florida's west and east coasts (Continental Shelf Associates, Inc., 2006a,b; Lindberg et al., 2006; Thanner et al., 2006; Schmidt et al., 2007a).

5.1.4.2.1 Limestone Boulder Mitigation Structures

Limestone boulders are probably the most common structure utilized for offshore mitigation in Florida. Benefits of utilizing limestone boulders for marine impact mitigation include the following:

- Composition is similar to natural substrate;
- Readily available;
- Suitable for remote deployment;
- Allow spatial conformity;
- Provide adequate mitigative services; and
- Cost-effective.

Limestone boulders are mined from local quarries and require little or no preparation for deployment readiness. Boulders of appropriate size can be remotely deployed from a vessel or barge and eliminate the need for large-scale marine construction equipment (e.g., crane system) and commercial dive operations. Boulder size and weight can be specified to accommodate site-specific requirements, including amount of vertical relief and mitigation site footprint. The boulders can be configured and stabilized on the seafloor using SCUBA operations to mimic habitat structure impacted by project construction. Additionally, limestone boulders have been shown to provide similar mitigation services concerning epibiotal coverage and fish, as other mitigation structures, such as habitat replacement modules (Schmidt et al., 2007a, b). Overall, the benefits of limestone boulders as mitigation structures include efficiency, with field-tested relative productivity, and cost-effectiveness.

Both natural substrates from post-construction translocation (see **Section 5.1.4.1.1**) and quarried limestone boulders will be utilized during structural enhancement and will be located at identified mitigation sites. Limestone boulders should have an estimated diameter of 1 to 1.5 feet (0.3 to 0.5 meters) and a correlative weight that is safely maneuvered by a one or two-person dive team (**Figure 14**). This size range for boulder used in the mitigation will allow settling within a sand veneer while providing minimal vertical relief similar to the impacted habitat. Boulder groupings will cover an area of approximately 1,076 square feet (100 square meters) and will be configured on bottom to facilitate stability, utilizing natural features (i.e., topography and sand veneer). Largest boulders will be placed along the perimeter of the grouping. The outer two layers of boulders will be stabilized boulder to boulder and boulder to underlying substrate using Portland cement. The smaller boulders within the grouping will be tightly packed within the secured perimeter boulders. Additional stabilization of boulders within the internal grouping will be provided with reattachment of transplanted biota associated with biological enhancement options (see **Section 5.1.4.1**). This general approach for boulder stabilization has been previously utilized during relatively shallow-water vessel grounding restoration (Marine Resources Inc., 2004, 2006).

Figure 14
Limestone Boulders (Size Range of 1 to 1.5 feet [0.3 to 0.5 meters]) Representative of Those Suggested for Mitigation to be Used to Mimic the Low-relief Structure of the Natural Hard Bottom Habitat

Limestone boulders independent of, or in conjunction with, other mitigation structures could be positioned on the seafloor within designated mitigation sites and in close proximity to impact areas to offset loss of natural hard bottom substrate. Limestone boulders are composed of the same material as the impacted reef substrate (calcium carbonate) and should provide a similar surface texture, with micro-habitats such as ledges and crevices, and mimic the low-relief structure of the natural hard bottom habitat.

5.1.4.2.2 Reef Module Mitigation Structures

Habitat replacement modules are a common form of mitigation structure and were used as partial mitigation during the Gulfstream project directly north of the Port Dolphin project (Schmidt et al., 2007a,b). This general design also has been used in mitigation/restoration projects in the FKNMS (http://sanctuaries.noaa.gov/special/wellwood/restoration.html) and off Miami-Dade County (Thanner et al., 2006). Typically, modules are composed primarily of concrete that is modified or augmented to provide surficial rugosity and complexity. Modules are often high profile and intended to provide vertical structure that is in contrast with the natural hard bottom habitat. A drawback of high profile modules is that they would have to be modified accordingly to replicate the structure of natural hard bottom features.

It is important to realize that, in some cases, perceived benefits of artificial reefs actually conflict with particular project goals. For example, a potential detrimental effect on local fish populations could occur if fishes are drawn from surrounding natural hard bottom areas and concentrated around the modules, making them more vulnerable to fishing. This is a standard argument of the negative effects of artificial reef deployments (Bohnsack, 1989).

Modules are a high-cost option relative to the substrate area provided for mitigation. The high cost is driven by the requirement of an extensive front end design and fabrication, and the need for commercial dive operations and heavy equipment for their deployment (**Figure 15**). Heavy equipment marine operations potentially include a tug, barge, crane, and an extensive on-bottom mooring system. It is noted these services may be required for operations-associated pipeline protection but would prolong their programmatic requirement and subsequently add additional costs. Overall, the relatively high-cost and dissimilarity of modules to natural habitat would suggest they would be best suited on a small scale in specific applications, if greater structural complexity associated with vertical relief is required for mitigation.

Figure 15
Habitat Replacement Module Deployment Requiring
Commercial Dive Operations and Marine Operation Heavy Equipment

5.1.4.2.3 Low-relief Articulating Mat Mitigation Structures

Low-relief articulating mats are proposed as external protection at locations where full burial of the Port Dolphin pipeline is not achieved in Federal waters. A large number of these articulating mats will be used as pipeline covering, and subsequently are considered as a cost-effective option for mitigative structural enhancement (**Figure 16**). These mats closely mimic the low-relief profile of the natural hard bottom habitat observed in the project area. Similar structures have been proposed for low-relief hard bottom mitigation associated with beach renourishment along the east coast of Florida (Continental Shelf Associates, Inc., 2006a) and used during restoration of hard bottom habitats following vessel groundings in the FKNMS. Mats could be layered to provide more topographic features to emulate the physical relief of low ledges and inverted relief (i.e., holes) within the natural habitat.

Typical concrete articulating mats used for protection of large-diameter pipelines in the Gulf of Mexico are 20 feet wide (6 meters), 8 feet (2.4 meters) long, 9 inches (23 centimeters) thick, and weigh approximately 5 tons (3 tons submerged in seawater). The mattresses anticipated to be used for the protecting the Port Dolphin project pipeline are 20 feet (6 meters) wide, 8 feet (2.4 meters) long, and 12 inches (31 centimeters) thick. The overall dimensions of the mats can be modified to suit the application and conform to specific footprints. The articulating mats are a web of cement blocks connected with steel/Kevlar® cables that conform to the shape of the underlying structure. Deployment of articulating mats will have the same requirements as previously discussed for habitat replacement modules (see **Section 5.1.4.2.2**). Mats can be connected together in order to add stability during subsidence into the sand veneer as a result of scouring. The articulating mats of standard size have proven stability able to withstand currents ranging from 20 to 24 feet per second. The mattresses that would be used for mitigation would be the same size as those used for pipeline protection (i.e., 12 inches thick) and are therefore heavier and more stable than the typical 9 inches thick mattresses. Cementing would be conducted in conjunction with reattachment of transplanted biota associated with biological enhancement options (see **Section 5.1.4.1**). Biological transplantation onto articulating mats has been successfully conducted by Marine Resources Inc. (2002), when over 1,000 hard corals were reattached and cemented onto articulating mats in a water depth of approximately 33 feet (10 meters) (**Figure 16**).

Figure 16
Articulating Mats Similar to Those Being Considered for Mitigation for the Port Dolphin Project for Use as Protective Structures

5.2 FISHERIES IMPACTS

Port Dolphin has been designed to keep the impacts to the environment low through design of the deepwater port components and the construction methods to be employed. The potential impacts from the operation of Port Dolphin are kept to a minimum through the selection of its location and through the use of best management practices for design of equipment and systems onboard the SRVs including but not limited to the intake water velocity of 0.5 feet per second, the use of a closed-loop re-gasification system, and not using sodium hypochlorite to treat any waters released while the SRV is on the buoy..

5.2.1 Seawater Intake, Usage, and Discharge

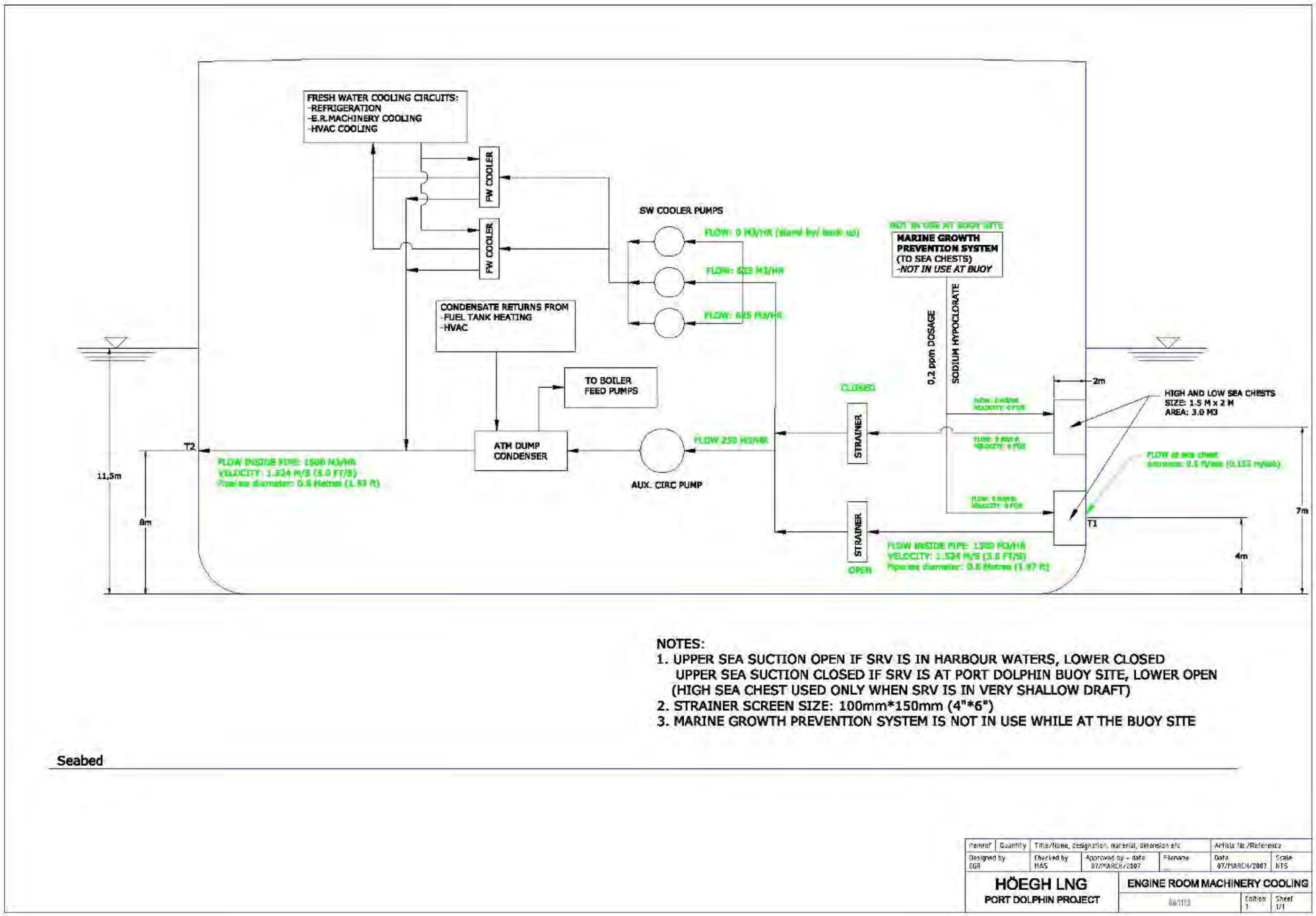
Seawater would be used primarily for engine cooling, ballast, and for quarterly fire protection system tests. For usage calculations, it is assumed that two 217,000 m^3 SRVs would be operating at once, each with a cooling water intake of 9.51 MGD, which is not the anticipated standard operating scenario, but rather the most conservative operating scenario. It is assumed that both SRVs would be the larger type (217,000 m^3 with a ballast intake of 2.3 MGD. The firewater system intake is omitted from the calculations because it is a small quantity and occurs four times annually. The combined maximum cooling/ballast water intake of 23.62 MGD represents a small rate compared with other water intake rates from power plants in the Tampa Bay area. For example, the Bartow Plant uses approximately 475 MGD, the F.J. Gannon Power Station (renamed H.L. Culbreath Bayside Power Station when repowered in 2003) uses approximately 950 MGD, and the Big Bend Plant approximately 1,275 MGD (based on annual averages). These facilities also draw water directly from Tampa Bay, where one would expect to have higher abundance of early life stages of fishes and invertebrates compared to the waters surrounding Port Dolphin.

The SRVs will employ a closed-loop system, so the intake of seawater will be greatly reduced compared to open-loop systems, and there would not be a large discharge of cooled seawater. Water discharges would be released from a discharge 11.5 feet (3.5 meters) below the SRV waterline and rise rapidly to the surface due to buoyancy (**Figure 17**). The discharge would be 18ºF (10ºC) above ambient water temperature, typically mix to within 1.8ºF (1ºC) of ambient within 66 feet of the discharge (20 meters). The discharge would extend further during summer months, but mixing to within 1.8ºF (1ºC) of ambient within 328 feet (100 meters) of the SRV discharge.

5.2.2 Intake Ports' Design and Configuration

Seawater intake systems on the SRVs will draw water into their cooling systems via two sea chests located 14.8 feet (4.5 meters) and 24.6 feet (7.5 meters) below the water line (**Figure 17**). The SRVs are capable of changing seasonally which intake port (shallow or deep) is used for drawing in cooling water to help minimize impacts to ichthyoplankton. Sea chest dimensions are a 6.1 feet x 4.6 feet x 4.6 feet (2 meters x 1.5 meters x 1.5 meters) and flow through a strainer screen assembly fabricated from stainless steel lattice screen. These screens are similar in some performance characteristics to wedge wire screens but are self cleaning and provide structural support within sea chests on SRVs. This type of screen excludes larger mobile organisms (fishes and invertebrates) from entrainment into the ships' water systems. The seawater intake velocity will not exceed the U.S. Environmental Protection Agency (EPA)-mandated maximum (i.e., 0.5 feet per second).

Figure 17
Engine Room Machinery Cooling Diagram



6.0 MITIGATION MONITORING

6.1 MITIGATION MONITORING – LIVE/HARD BOTTOM IMPACTS

Currently, the strategy and methodology for mitigating potential impacts from the pipeline in State and Federal waters have not been resolved. Consequently, this section provides a general overview of the structure of a monitoring plan, recognizing that the specifics of the actual monitoring program, e.g., sampling methodology, will be determined after the actual mitigation strategy has been developed. This proposed monitoring strategy was adopted from that proposed for monitoring in State waters, so that the two programs are complementary.

6.1.1 Mitigation Monitoring Objectives

The objectives of the mitigation monitoring plan for live bottom habitat are as follows:

- Assess recovery of the live bottom communities impacted during pipeline construction;
- Determine the colonization/recruitment rates of the mitigation sites by sessile invertebrate species and algae;
- Compare the live bottom communities of the impacted sites, mitigation sites, and reference sites;
- Determine the survivorship of transplanted benthic organisms;
- Determine if the colonization rates for these communities are depth-related; and
- Assess the performance of mitigation structures as replacement habitat.

6.1.2 Monitoring Strategy

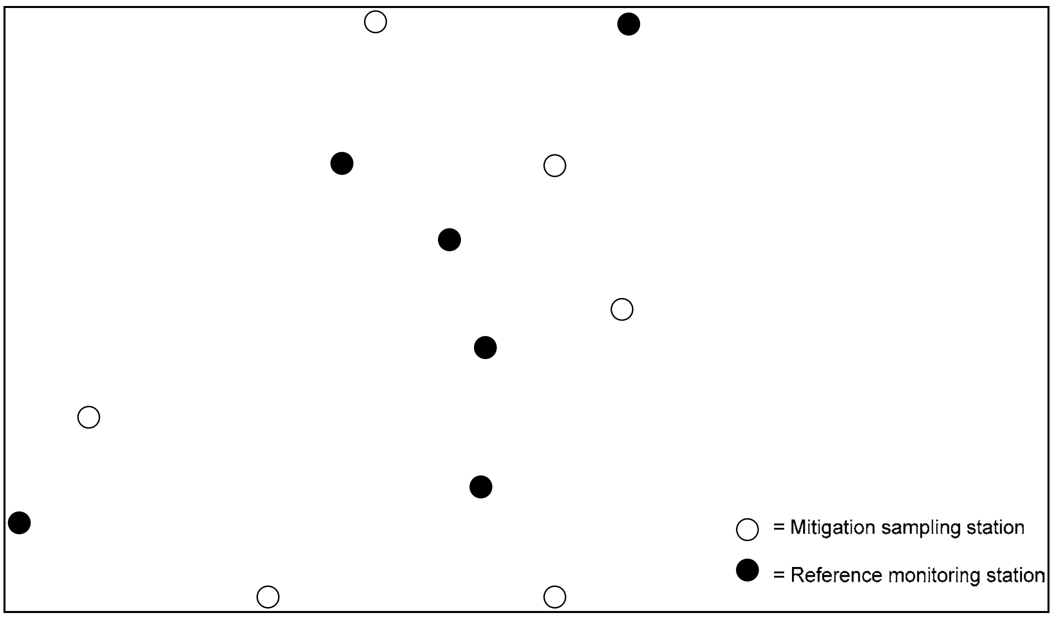
The experimental design is based on the concept of testing equivalence. The usual approach to evaluating environment impacts is testing point-null hypotheses that there are no differences among the treatments. If the null hypothesis is rejected by statistical testing at a specified probability level, then the conclusion is that the treatments are in fact different (Cole and McBride, 2004). For the purpose of evaluating the success of mitigation; however, the problem with using this approach is that the null hypothesis is the hypothesis of interest. To “prove” or “accept” a null hypothesis requires very high power (probability of rejecting a false null hypothesis) for the statistical testing, which in turn commonly requires very large samples sizes. Obviously, the additional effort needed to collect the samples makes a monitoring program more expensive and time consuming.

For a study of mitigation, the actual null hypothesis is alternative hypothesis of the point-null hypothesis described above. This null hypothesis is that the mitigation sites are different from the reference sites, and the alternative hypothesis is that the mitigation sites are not significantly different from the reference sites, i.e., they are bioequivalent (Downes et al., 2002). To illustrate, consider an artificial reef that is constructed as mitigation for impacts to nearshore hard bottom habitat associated with a human activity such as beach nourishment. The null hypothesis for equivalence analysis is that the artificial reef and natural hard bottom are different. If this null hypothesis is rejected, the interpretation of the statistical analysis results is the mitigation reef is equivalent to the natural hard bottom. Use of this monitoring strategy should reduce the required sampling effort.

6.1.3 Experimental Design

The overall experimental design for the mitigation monitoring may require stratification for several variables; among these are water depth and location relative to (inside versus outside of) Tampa Bay. A preliminary experimental design at an individual study site for the monitoring program is presented in **Figure 18**. A series of mitigation sites are established for sample collection. In addition, an appropriate number of reference sites are to be established. Sampling should occur prior to and after installation of the mitigation at an appropriate frequency. Measurements of biological assemblages (e.g., fishes, macroinvertebrates, macroalgae) would be collected at the mitigation and reference sampling sites. Addition measurements that could be useful in interpretation of results, e.g., temperature, dissolved oxygen, currents, photosynthetically active radiation, and turbidity also should be collected, preferably continuously.

Figure 18
Hypothetical Arrangement of Mitigation/Reference Monitoring Station



Monitoring will be conducted on both a large scale: areas impacted by pipeline construction, associated reference areas, and areas of structural mitigation; as well as on a small scale: transplanted organisms, transplanted live rock/substrate, and controls for both transplanted organisms and live rock. Monitoring methods employed will be appropriate to the scale of the monitoring being conducted.

The following survey methods may be employed for mitigation monitoring:

- Qualitative remotely operated vehicle (ROV) surveys;
- Quantitative photographic surveys;
- In-field assessment of transplanted organisms/live rock; and
- Qualitative video surveys of transplanted organisms/live rock.

6.1.3.1 Qualitative ROV Surveys

Initial, post-construction assessment of impacts resulting from pipeline trenching and burial will consist of continuous video data collection by ROV along the pipeline route to document the appearance of the pipeline trench, the spoil mounds on either side of the pipeline trench, anchor strikes, and cable sweep areas, as well as to assess the areal extent of impacts. These surveys will be initiated as soon as practicable after construction is complete.

6.1.3.2 Quantitative Photographic Surveys

Baseline monitoring and all further post-construction monitoring of impact, structural enhancement, and reference sites will consist of the random collection of photographic images using diver-operated still camera. Quantitative photographic surveys will begin as soon as possible following the ROV survey.

6.1.3.3 In-Field Assessment of Transplanted Organisms/Live Rock

Sampling of transplanted and control organisms/live rock will be conducted during each field survey and include visual observations, firmness of bond, and qualitative videography. Monitoring stations will be established within the transplantation site. Each monitoring station will be marked with a geo-referenced station marker. A minimum of 100 transplanted benthic organisms/live rock will be tagged using uniquely numbered plastic tags. Tagged organisms will be mapped using distance and bearing relative to the monitoring station marker. A minimum of 30 control organisms will be selected at each relocation site. Control organisms will be tagged and location recorded in the same manner as transplanted organisms.

Monitoring stations for live rock relocation will be selected separately from monitoring stations for transplanted organisms. A minimum of 100 transplanted sections of live rock will be selected for monitoring. A minimum of 30 sections of live rock, with characteristics similar to those of the transplanted specimens, will be selected within the relocation site to serve as controls. Individual organisms on each section of transplanted live rock, or control live rock, will be selected for detailed observation at the time of tagging. The condition of each of these organisms will be observed and recorded on each subsequent survey. Sections of live rock selected for study will be marked in the same manner as described for transplanted/control organisms.

Direct observations concerning attachment status and relative health of transplanted organisms will be made by an experienced scientist at each of the monitoring stations. Relative health of transplanted organisms will be based primarily on assessment of color (e.g., normal, pale, bleached), tissue condition (e.g., degree of accretion/regression, presence of disease), interspecific events (e.g., clionid intrusion) and algal overgrowth. Stability and relative health of experimental and control groups will be compared between groups and between monitoring surveys. Transplanted organisms/live rock will be monitored *in situ* for stability of cement bond by gently pulling on the colony edge (i.e., tactile census). Any loose organisms/live rock will be reattached at the monitoring site during monitoring activities. If individual organisms/live rock cannot be relocated because of the loss of a tag, measurements from the geo-referenced station marker will be taken to relocate the organism/live rock, and any missing tags will be replaced. Comparisons will be made between relocated and control organisms/live rock, in order to assess the success of relocation efforts.

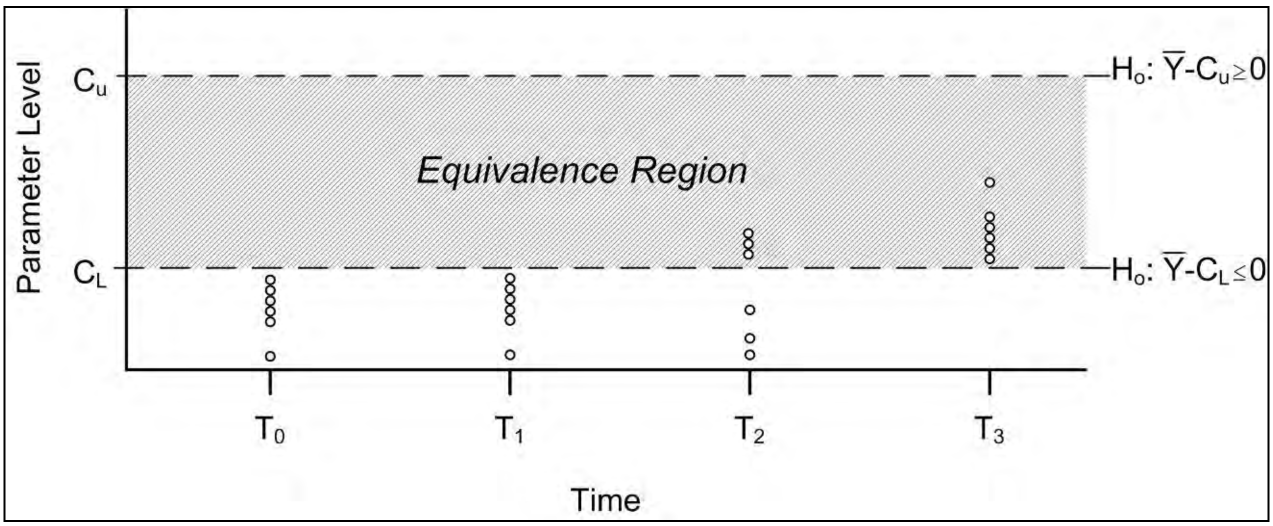
6.1.3.4 Qualitative Video Surveys of Transplanted Organisms/Live Rock

Qualitative imaging will be utilized to augment direct observations of transplanted organisms/live rock. Use of video as opposed to still photography will allow views of the organism/live rock from varying perspectives, providing greater opportunity to assess condition. In addition to collection of video data, assessments of stability and relative health will be made in the field.

6.1.4 Statistical Testing

If stratification related to depth and/or geography is incorporated into the final monitoring design, then the statistical analysis will be applied to each monitoring effort for each individual stratum independently. The first step in conducting the statistical testing will be to define the criteria for bounds of the equivalence region (**Figure 19**). These criteria can be set *a priori* based on existing data, but it is more likely that they will be set based on what is observed at the reference stations. For example, the upper and lower bounds of the equivalence region could be based on 95% confidence limits for the mean value of a parameter at the reference stations.

Figure 19
Example of Hypothetical Testing for Equivalence Analysis



Separate statistical tests would be conducted for the upper and lower bounds. If the null hypotheses are rejected, then the interpretation would be that the mitigation and references sites are equivalent. This approach also can be used with similarity statistics, such as the Bray-Curtis similarity index; however, testing only the lower bound would be appropriate.

6.2 MITIGATION MONITORING – FISHERIES IMPACTS

A detailed Monitoring Plan for ichthyoplankton will be developed by Port Dolphin in coordination with the Florida Fish and Wildlife Conservation Commission (FWC) and the Florida Department of Environmental Protection (FDEP). This plan would generally follow the sampling approach provided to Port Dolphin by FWC in the memo dated August 27, 2007, enhanced with applicable requirements based on concerns raised by both agencies in subsequent correspondence, and other items identified by the Port Dolphin. Specific plan details (i.e., species to be sampled, sample collection methodology, sampling location/frequency, format and frequency of reports, etc.) would be thoroughly discussed and coordinated with FWC and FDEP to develop the final plan.

The Port Dolphin is committed to conducting 3 years of post MARAD license ichthyoplankton monitoring in accordance with the approved Monitoring Plan. This sampling would be conducted by the permittee in accordance with the approved Monitoring Plan as a condition of the FDEP Environmental Resource Permit and the Coastal Zone Management consistency determination, should they be issued, and would consist of 1 year of monitoring pre-construction and 2 years of monitoring during operation of the deepwater port. The data collected during the first sampling year (pre-construction) (for total eggs, total fish larvae, and larvae of selected commercial and recreational important species) would be used to supplement baseline data, and would be input into an empirical transport model to confirm the accuracy of the level of impacts stated in the Final EIS (FEIS) from this closed-loop system. In the event that the levels of impacts derived from the empirical transport model from the pre-construction year of sampling are not consistent with (or less than) the level of impacts included in the FEIS, adaptive management techniques would be provided, as appropriate. The data collected during the second/third sampling years (for total eggs, total fish larvae, and larvae of selected commercial and recreational important species) would be used to confirm that the actual level of ichthyoplankton impacts are consistent with (or less than) the level of impacts forecasted with the empirical transport model. Monitoring reports completed by the applicant would be provided to the FWC and FDEP as well as the USCG, MARAD, and NOAA-NMFS for review at regular intervals during the monitoring period.

7.0 LITERATURE CITED

Bohnsack, J.A. 1989. Are high densities of fishes at artificial reefs the result of habitat limitation or behavioral preference? Bull. Mar. Sci. 55:796-823.

Cole, R. and G. McBride. 2004. Assessing impacts of dredge spoil disposal using equivalence tests: implications of a precautionary (proof of safety) approach. Mar. Ecol Prog. Ser. 279: 63-72.

Continental Shelf Associates, Inc. 2006a. Brevard County Mid Reach Shore Protection Project: Mitigation Assessment Analysis. 36 pp. + apps.

Continental Shelf Associates, Inc. 2006b. Habitat restoration: M/V *SPAR ORION* grounding, Broward County, Florida. A report submitted to Independent Maritime Consulting, Ltd. 10 pp. + app.

CSA International, Inc. 2007a. Hard coral relocation as mitigation for three pipeline corridors, nearshore Ras Laffan Industrial City, State of Qatar. A report submitted to Qatar Liquefied Gas Company Limited (II) and Qatargas3 & 4 Joint Asset Development Team. 20 pp.

CSA International, Inc. 2007b. Survey of marine benthic habitats within the proposed Port Dolphin deepwater port and pipeline corridor offshore and within Tampa Bay, Florida. Prepared for Höegh LNG Affiliate. January 2007. 37 pp.

CSA International, Inc. 2007c. Terra Ceia re-route survey of marine benthic habitats within the proposed Port Dolphin pipeline corridor within Tampa Bay, Florida. Attachment A.1, Deepwater Port License Application, Port Dolphin Project. Prepared for Port Dolphin LLC. December 2007. 20 pp.

Ditty, J.G., G.G. Zieke, and R.F. Shaw. 1988. Seasonality and DepthDistribution of Larval Fishes in the Northern Gulf of Mexico Above 26º00'N". Fishery Bulletin 86:811–823.

Downes, B.J., L.A. Barmuta, P.G. Fairweather, and D.P. Faith. 2002. Monitoring Ecological Impacts: Concepts and Practice in Flowing Waters. Cambridge University Press. 446 pp.

Ferreira, C.E.L., J.E.A. Goncalves, and R. Coutinho. 2001. Community structure of fishes and habitat complexity on tropical rocky shores. Environ. Biol. Fish. 61:353-369.

Franklin, E.C., J.H. Hudson, and J. Anderson. 2005. M/V *WAVE WALKER*. Coral reef restoration baseline monitoring report—2004 Florida Keys National Marine Sanctuary, Monroe County, Florida. Marine Sanctuaries Conservation Series NMSP-0608. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Spring, MD. 15 pp.

Gunter, G. 1967. Some relationships of estuaries to the fisheries of the Gulf of Mexico. In Estuaries [papers] edited by G. Lauff. Conference on Estuaries, Jekyll Island, 1964. Washington, DC: American Association for the Advancement of Science.

Harriot, V.J. and D.A. Fisk. 1988. Coral transplantation as a reef management option. In: Proceedings of the 6th International Coral Reef Symposium 2:375-379.

Helfman, G. S., B.B. Collette, and D.E. Facey. 1997. Cycles of Activity and Behavior: Vertical Migrations. In The Diversity of Fishes. Malden, MA: Blackwell Science, Inc. 1997.

Houde, E.D., J.L. Leak, C.E. Dowd, and S.A. Berkeley. 1979. Ichthyoplankton Abundance and Diversity in the Eastern Gulf of Mexico. A Report to the Bureau of Land Management.

Jenkins, G. P., D.C. Welsford, M.J. Keough, and P.A Hamer. 1998. Diurnal and tidal vertical migration of pre-settlement King George whiting Sillaginodes punctata in relation to feeding and vertical distribution of prey in a temperate bay. Marine Ecology Progress Series 170:239–248.

Lindberg, W.J., T.K. Frazer, K.M. Portier, F. Vose, J. Loftin, D.J. Murie, D.M. Mason, B. Nagy, and M.K. Hart. 2006. Density-dependent habitat selection and performance by a large mobile reef fish. Ecol. App. 16(2):731-746

Marine Resources Inc. 2002. Hollywood Florida Outfall, Hard Coral Mitigation. Prepared for Underwater Engineering Services, Inc.

Marine Resources Inc. 2003. M/V *ALAM SENANG* grounding, Broward County Florida: assessment and restoration. Report for Scandinavian Underwriters Agency. 12 pp.

Marine Resources Inc. 2004. Habitat restoration conducted at *ADARO* grounding site: Florida Keys National Marine Sanctuary. Prepared for Houck, Hamilton, & Anderson, P.A. 11 pp. + app.

Marine Resources Inc. 2006. Biological survey at boulder reattachment sites for the M/V *EASTWIND* grounding, Broward County, Florida. Prepared for Houck, Hamilton, & Anderson, P.A. 10 pp.

Minerals Management Service (MMS). 2002a. Outer Continental Shelf Oil and Gas Leasing Program: 2002-2007, Final Environmental Impact Statement: Volume I. OCS EIS/EA MMS 2002-006. Available online: http://www.mms.gov/5-year/. Accessed May 2003.

Minerals Management Service (MMS). 2002b. Gulf of Mexico OCS Oil and Gas Lease Sales: 2003–2007, Central and Western, Final Environmental Impact Statement: Volume I. OCS EIS/EA MMS 2002-052. New Orleans, LA: USDOI, MMS, Gulf of Mexico OCS Region.

National Coral Reef Institute. 2004. Hollywood ocean outfall stony coral transplantation monitoring final monitoring event. Draft Report. Nova Southeastern Oceanographic Center, Dania Beach, Florida. 14 pp.

Nybakken, J.W. 1997. Plankton and plankton communities: vertical migration. In Marine Biology: An Ecological Approach, 4th edition, edited by C. Pusateri et al. Reading, MA: Addison-Wesley Educational Publishers, Inc.

Schittone, J., E.C. Franklin, J.H. Hudson, and J. Anderson. 2006. M/V *Connected* Coral Reef Restoration Monitoring Report, Monitoring Events 2004-2005. Florida Keys National Marine Sanctuary Monroe County, Florida. Marine Sanctuaries Conservation Series NMSP-06-10. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Sanctuary Program, Silver Spring, MD. 25 pp.

Schmidt, J.A., S.W. Ellsworth, R.A. Brooks, D.F. Bishop, M. C. Aubele, and H.E. Watkins. 2007a. Environmental Mitigation-1: Monitoring, analysis show rapid Gulf of Mexico seafloor recovery. Oil & Gas Journal 105(2).

Schmidt, J.A., S.W. Ellsworth, R.A. Brooks, D.F. Bishop, M.C. Aubele, and H.E. Watkins. 2007b. Environmental Mitigation-2: ROV, diver-collected data show post construction epifaunal health. Oil & Gas Journal 105(2).

Schultz, E. T., K. M. M. Lwiza, M. C. Fencil, and J. M. Martin. 2003. Mechanisms promoting upriver transport of larvae of two fish species in the Hudson River estuary. Marine Ecology Progress Series 251:263–277.

Southwest Florida Water Management District. 1999. Tampa Bay Surface Water Improvement (SWIM) Plan. Tampa, FL: SWIM section. 108 pp.

T. Baker Smith, Inc. 2007a. Archaeological, Engineering, and Hazard Study, Proposed 36-inch Gas Pipeline, Proposed LNG Facility, Block 545 St. Petersburg Area Offshore Florida to Tampa Bay, Florida. Report for Hoegh LNG. January 2007. 3 vols.

T. Baker Smith, Inc. 2007b. Archaeological, Engineering, and Hazard Study, Proposed 36-inch Gas Pipeline Reroute, Tampa Bay, Florida. Report for Hoegh LNG. October 2007. 3 vols.

T. Baker Smith, Inc. 2008. Archaeological, Engineering, and Hazard Study, Proposed 36-inch Gas Pipeline Sand Resource Avoidance Reroute, Tampa Bay, Florida. Report for Hoegh LNG. December 2008.

Thanner, S.E., T.L. Mcintosh, and S.M. Blair. 2006. Development of benthic and fish assemblages on artificial reef materials compared to adjacent natural reef assemblages in Miami-Dade County, Florida. Bull. Mar. Sci. 78(1):57-70.

Thompson, N.B. 2004. Letter from Ms. Nancy B. Thompson (Science Administrator, NMFS) to Mr. Roy Crabtree (Regional Administrator, NMFS) regarding the potential impacts of liquid natural gas processing facilities on fishery resources in the Gulf of Mexico. June 3, 2004.

ATTACHMENT A.7

POTENTIAL IMPACTS TO FISHING ACTIVITIES AND LOSS OF FISHING GROUNDS

PORT DOLPHIN ENERGY LLC

POTENTIAL IMPACTS TO FISHING ACTIVITIES AND LOSS OF FISHING GROUNDS

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1.0 INTRODUCTION

Port Dolphin Energy LLC (Applicant) is filing for a license pursuant to the Deepwater Port Act of 1974, as amended, and the United States Coast Guard's (USCG's) regulations, 33 CFR Part 148 (2006), to construct, own and operate a deepwater port. The unloading portion of the deepwater port, named Port Dolphin, would be located in Federal waters approximately 28 mi (45 km) offshore of the Tampa Bay area of Florida in approximately 100-ft (30-m) of water. This area lies within the St. Petersburg block of the Outer Continental Shelf.

The following sections discuss impacts to commercial and recreational fisheries, fish resources, and essential fish habitat (EFH). **Volume II, Appendix D of the Deepwater Port Application** (Hoegh LNG, 2007a) presents additional information and impact analysis for EFH and managed species (including invertebrates) from soft bottom, hard bottom, and pelagic assemblages. Impact producing factors relevant to commercial and recreational fisheries resources and activity include space-use, the "Fish Attracting Device" (FAD) effect, seafloor disturbance, turbidity, and noise during pipeline installation and decommissioning; and the FAD effect and entrainment of fish eggs and larvae through operational seawater intake during routine operations.

2.0 COMMERCIAL AND RECREATIONAL FISHERIES

The primary socioeconomic activities of concern in the project area are commercial and recreational fishing. Commercial landings for Florida's west coast exceeded 82 million pounds valued at over 146 million dollars in 2004 (Van Voorhees and Pritchard, 2005). The port of Tampa/St. Petersburg ranked 34th nationally in terms of landings value (21.6 million dollars) and second in the state behind Key West (43.2 million dollars; ranked 10th nationally) in 2004. Recreational fishing is directly linked to Florida's vital and valuable tourist industry. In 2004, over six million recreational fishers, roughly half of which were out-of-state visitors, made more than 27 million fishing trips in Florida (Van Voorhees and Pritchard, 2005). The following sections describe commercial and recreational fishing as they relate to the general project area.

2.1 COMMERCIAL FISHERIES

Florida's west coast supports productive commercial fisheries that target a variety of invertebrate and finfish species. Commercial fisheries of the project area are described using landings data obtained from the Florida Wildlife and Conservation Commission (FWC, 2006). For each Florida County, FWC records weight landed in pounds and fishing effort expressed as number of trips (by species) made during the year. Annual landings reports categorize fishery species broadly as finfish, shrimps, and other invertebrates. For this evaluation, annual landings data for the years 2002 to 2005 from Hillsborough, Pinellas, and Manatee counties were used to provide a representative account of commercial fishing for the project area. In addition to catch and effort data, FWC keeps records of permits and licenses required by State and Federal regulatory agencies for commercial fishers and seafood dealers. When used in concert, landings, effort, and permit data provide the basis for a characterization of fishery activity in the general vicinity of the proposed pipeline route.

The data used here do not have an explicit spatial component other than county of record; therefore, landings, trips, and permits will not reveal where particular species were caught in relation to the proposed pipeline route. Thus, many species landed in the three coastal counties may have been caught at locations well outside of the project area. Nevertheless, examination of catch composition coupled with known information on individual species distributions does allow reasonable inferences to be made about which fisheries may be directly or indirectly affected by the proposed pipeline along both inshore and offshore segments.

2.1.1 Landings

Combined landings of finfishes, shrimps, and other invertebrates for the three counties from 2002 to 2005 averaged 18,823,274 pounds (**Table 1**). Fishes represented 70% of the average weight landed; whereas shrimps and other invertebrates (primarily blue and stone crabs) accounted for 23% and 7%, respectively, of the average weight landed over the 2002 to 2005 period. Fish species contributing most to the landings of the three counties combined were red grouper, striped mullet, thread herring, gag grouper, and ladyfish. Shrimp landings were dominated by pink shrimp, followed by rock shrimp and bait shrimp, which are pink shrimp caught in inshore waters. Dominant under the other invertebrate category were blue crab, stone crab, and to a lesser extent, sponges.

Table 1
Commercial landing data (pounds) showing top ranked finfish, shrimp, and other invertebrate species from Pinellas, Manatee, and Hillsborough counties averaged from 2002 to 2005. Finfish, shrimp, and other invertebrates are ranked (R) by the grand mean landings for each county

Species	Pinellas	R	Manatee	R	Hillsborough	R	Grand Mean	R
Finfish								
Red grouper	2,996,270	1	430,988	3	22,579	5	1,149,946	1
Striped mullet	1,155,281	2	489,916	2	226,661	2	623,953	2
Thread herring	319,808	6	977,400	1	11		432,406	3
Gag grouper	1,008,605	3	51,594	7	10,803	8	357,000	4
Ladyfish	553,510	5	378,203	4	10,389	9	314,034	5
Shark	595,435	4	1,119		4,315		200,290	6
Total finfish (unclassified)					394,770	1	131,590	7
Bait fish	16,724		369,514	5	774		129,004	8
Yellow edge grouper	274,088	7	63,925	6	14,338	6	117,451	9
Amberjacks	230,019	8	5,751		1,684		79,151	10
Crevalle jack	134,380		27,383	8	12,470	7	58,078	
Black grouper	140,942	9	3,280		1,460		48,561	
Scamp grouper	134,901	10	6,691		859		47,484	
Tilapia (Nile perch)	32,340		482		65,005	3	32,609	
Mojarra	33,549		13,509	10	23,672	4	23,577	
Sheepshead	34,990		11,235		8,923	10	18,383	
Pompano	28,015		14,170	9	1,408		14,531	
Shrimp								
Pink	1,163,039	1	15,138	3	1,360,698	1	846,292	1
Rock	181,144	2	430	4	450,605	3	210,726	2
Bait	96,354	3	15,632	2	442,980	4	184,989	3
Total food (unclassified)					490,326	2	163,442	4
Royal red	26,684	4			76,714	5	34,466	5
Brown	8,305	5			9,763	6	6,023	6
Total bait			16,179	1	190	9	5,456	7
Other	572	6			407	7	326	8
White	190	7			373	8	188	9
Other Invertebrates								
Blue crab (hard)	394,462	1	109,512	1	185,782	2	229,918	1
Stone crab (claws)	180,952	2	68,416	2	2,418	4	83,929	2
Total invertebrates (unclassified)					213,974	1	71,325	3
Sponge (pieces)	113,217	3			82	5	37,766	4
Blue crab (soft)	175	5	51	4	42,779	3	14,335	5
Octopus	2,422	4	4,769	3	18	6	2,403	6

R = top 10 species ranked in terms of landing for the county.
Source: Florida Fish and Wildlife Conservation Commission, 2006.

When viewed by individual county, the landings differed in catch composition and total weight reported annually. Pinellas County was the highest producer averaging 12,031,422 pounds landed annually from 2002 to 2005. Manatee and Hillsborough each averaged over 3 million pounds annually during the same time period. The Pinellas County landings comprised 80% finfish, 14% shrimp, and 6% other invertebrates. Top ranked finfish species in the landings included red grouper, striped mullet, gag grouper, and shark. Shrimp catches from this county consisted of pink shrimp, rock shrimp, and bait shrimp (**Table 1**). Blue crab and stone crab represented highest landings among other invertebrates.

In Manatee County, the major landings components were 93% finfish, 6% other invertebrates, and 1% shrimp. Finfish landings in this county were represented by thread herring, striped mullet, red grouper, ladyfish, and baitfish. Shrimp landings were mostly bait shrimp and pink shrimp. The other invertebrate category included predominantly blue crab and stone crab (**Table 1**).

Hillsborough County landings were dominated by shrimp (80%) followed by finfish (13%) and other invertebrates (7%). Pink shrimp accounted for most of the shrimp landings; total finfish (unclassified), striped mullet, tilapia, and mojarra were the top finfish species landed; and blue crab topped the invertebrate category (**Table 1**).

2.1.2 Types of Activity

Effort (number of trips) expended to produce landings reported above for the various species in the three counties (collectively and individually) provide additional information on commercial fishing activity in the project area. The average number of trips for all species groups and for the three counties combined was 39,197. For the three counties collectively, 75% of the trips made during the 2002 to 2005 period were for finfish, 18% for other invertebrates, and 7% for shrimp.

As with the landings statistics, Pinellas leads the three counties with the highest average number of trips (29,115) per year during 2002 to 2005. Pinellas trips consisted of 80% finfish, 15% other invertebrates, and 5% shrimp. Most of the finfish effort was for striped mullet, followed by red grouper, gag grouper, and gray snapper. For other invertebrates, the primary effort was for blue crab and stone crab. Bait shrimp accounted for most of the effort under the shrimp category (**Table 2**).

Manatee County averaged 6,016 trips per year from 2002 to 2005. These trips were apportioned into 66% finfish, 28% other invertebrates, and 6% shrimp. Most of the effort was expended on finfish in Manatee County, which targeted striped mullet, sheepshead, ladyfish, and red grouper. Under the other invertebrate category, effort was largely expended for stone crab and blue crab. Shrimping effort in Manatee County was directed predominantly towards bait shrimp (**Table 2**).

Hillsborough County averaged 4,066 trips during the same period. Hillsborough County's effort was subdivided into 59% finfish, 26% other invertebrates, and 15% shrimp. Finfish trips were made primarily for striped mullet, followed by mojarra and sheepshead. Blue crab dominated the average number trips recorded under the other invertebrate category. Pink shrimp and rock shrimp accounted for most of the shrimping effort in Hillsborough County (**Table 2**).

High levels of effort shown for striped mullet, blue crab, and bait shrimp reflect the inshore nature of these fisheries. Most of the trips recorded were likely of short duration because travel to fishing areas is short. Bait shrimping occurs in the inshore waters of Tampa Bay, primarily over shallow seagrass meadows (Meyer et al., 1999).

Table 2
Commercial effort showing top ranked average number of trips from Pinellas, Manatee, and Hillsborough counties averaged from 2002 to 2005. Finfish, shrimp, and other invertebrates are ranked (R) by the grand mean landings for each county

Species	Pinellas	R	Manatee	R	Hillsborough	R	Grand Mean	R
Finfish								
Striped mullet	3,013	1	874	1	811	2	1566	1
Red grouper	2,131	2	178	4	36	10	782	3
Gag grouper	1,971	3	150	7	39	9	720	4
Sheepshead	1,115	5	310	2	200	4	542	5
Total finfish					1,511	1	504	2
Gray snapper	1,233	4	124	9	36		464	6
Scamp grouper	1,109	6	87		8		401	7
Grunts	1,103	7	33		49	8	395	8
Mojarra	592	10	155	5	258	3	335	9
Crevalle jack	671	8	139	8	88	7	300	10
Ladyfish	569		205	3	18		264	
Pinfish	449		155	6	165	5	256	
Porgies	649	9	49		13		237	
Tilapia (Nile perch)	195		5		142	6	114	
Bait fish	33		94	10	14		47	
Shrimp								
Bait	1,009	1	317	2	78	3	468	1
Pink	194	2	8	3	233	1	145	2
Total bait			353	1	2	6	118	3
Rock	98	3	5	4	197	2	100	4
Total food					64	4	21	5
Royal red	4	4			46	5	17	6
Invertebrates								
Blue crab (hard)	2,111	1	710	2	839	2	1,220	1
Stone crab (claws)	1,779	2	737	1	41	4	852	2
Total invertebrates					1,037	1	346	3
Blue crab (soft)	6	6	3	5	215	3	75	4
Octopus	41	4	52	3	1	7	31	5
Sponge (pieces)	78	3			1	6	26	6
Spanish lobster	22	5	4	4	8	5	11	7

R = top 10 species ranked in terms of trips for the county.
Source: Florida Fish and Wildlife Conservation Commission, 2006.

In addition to the effort data, **Table 3** shows the types of permits and licenses held by fishers residing in Hillsborough, Manatee, and Pinellas counties. The numbers of commercial fishers in the three-county area may be estimated from these statistics, especially Saltwater Products Licenses and Restricted Species Permits. Saltwater Products Licenses, required by anyone selling seafood products in Florida, averaged 1,341 from 2002 to 2005 in the three counties combined. Federally-issued Restricted Species Permits averaged 1,098 over the same period. Individually, the three counties differed in levels of commercial fishing activity. Of the three, Pinellas County supported most of the commercial fishing activity in the project area, averaging 779 Saltwater Products Licenses and 640 Restricted Species Permits. Pinellas also has 272 Retail and 90 Wholesale Dealers Licenses. Manatee County was second, with 294 Saltwater Products Licenses and 255 Restricted Species Permits. Hillsborough followed closely, with 268 Saltwater Products Licenses and 203 Restricted Species Permits.

Table 3
Number of licenses and permits held by residents of Hillsborough, Manatee, and Pinellas counties from 2002 to 2005

License-Permit Type	County			
	Hillsborough	Manatee	Pinellas	Combined Average
Saltwater Products	267.8	294.3	778.5	1,340.5
Restricted Species	203.0	255.3	639.5	1,097.8
Retail Dealer	129.8	50.0	271.8	451.5
Blue Crab	44.5	63.0	149.3	256.8
Stone Crab	23.3	53.5	136.8	213.5
Wholesale Dealer	53.5	25.5	89.8	168.8
Incidental Take	21.8	20.5	42.8	85.0
Sponge	10.3	3.0	50.5	63.8
Crawfish/Lobster	16.5	9.8	35.5	61.8
Marine Life	14.3	3.3	24.3	42.0
Purse Seine	6.8	24.0	10.8	41.5
Special Recreational Crawfish	11.0	3.0	15.0	29.0
Marine Life Transferable Dive	8.0	0.0	6.0	14.0
Pompano	0.0	5.5	8.3	13.8
Commercial Dive Permit	5.0	3.0	5.5	13.5
Tampa Bay Dead Shrimp	5.5		1.3	6.8
Marine Life Bycatch			2.0	2.0
Marine Life Non-Transfer Dive			2.0	2.0
Special Activity	1.5		0.5	2.0
Lampara Net		1.0		1.0
Other Permits		1.0		1.0

Source: Florida Fish and Wildlife Conservation Commission, 2006.

Impact Analysis, Inc. (2005a, b) examined the types of commercial fishing permits and licenses used in the coastal counties of Florida in detail for the year 2001 (2003 for shrimp). They reported licenses and permits for key fishing communities within each county for the year 2001. This perspective mirrored the county level analysis presented above. A total of 14 fishing communities were studied in Pinellas County (Impact Analysis, Inc., 2005a). Four of these, St. Petersburg, Tarpon Springs, Clearwater, and Madeira held over 60% of the permits in the County. Largo and Seminole were next in order of total number of permits held.

For Manatee County, permit data for the communities of Anna Maria, Bradenton, Cortez, Holmes Beach, Palmetto, and Terra Ceia were assessed. Of these, Bradenton (76 total permits) and Cortez (54 total permits) accounted for 130 (79%) of the 164 permit holders in 2000. The types of permits held in these communities indicated that reef fishes were the most commonly held (67 permits for red snapper and gulf reef fish combined) followed by Spanish and king mackerel, with 17 and 18 total permits, respectively (Impact Analysis, Inc., 2005b).

In Hillsborough County fishing communities profiled by Impact Analysis, Inc. (2005b) were Apollo Beach, Gibsonton, Lutz, Riverview, Ruskin, and Tampa. Most permit holders (116 of the 136) from Hillsborough County resided in Tampa. Reef fish permits accounted for 63 of the 136 total permits for Hillsborough.

2.1.3 Commercial Fisheries Summary

The combined data sets (landings, effort, permits, and licenses) indicate that key fisheries exist for shelf and inshore Tampa Bay waters of the region. For shelf waters of the project area, the key fisheries in order of importance are reef fishes, pink shrimp, coastal pelagic fishes, and stone crab. Reef fishing for red grouper, gag, and scamp, generally occurs in water depths ranging from 66 to 394 ft (20 to 120 m). Pink shrimp are caught in shelf waters using bottom trawls. Primary water depths for pink shrimp are 66 to 197 ft (20 to 60 m). The Sanibel shrimp grounds (west of Ft. Myers) and the Tortugas grounds (north of Dry Tortugas) are the primary pink shrimping areas in the region. Trawling can only take place on level sandy bottoms as hard bottom or other obstructions will snag and damage nets. Many members of the shrimp fleet are nomadic and only appear during peak seasons then move on to other ports. Tampa is one of the primary ports for shrimpers in the eastern Gulf of Mexico. Coastal pelagic species are caught by gillnetting or purse netting. Both of these activities are banned from State waters and can only occur in Federal waters. Pompano, Spanish mackerel, and sharks are main targets of gillnet fisheries in the region. Spanish sardine, thread herring, and ladyfish are the quarry of purse net fisheries.

In the inshore waters of Tampa Bay, the primary fisheries are striped mullet, bait shrimp, and blue crab. Striped mullet were historically fished in shallow waters with gillnets; however, since 1995 when Florida banned the use of gillnets in its territorial waters, the primary fishing mode has been the castnet. Bait shrimp are caught over shallow seagrass meadows with specialized roller frame trawl nets (Meyer et al., 1999). Blue crabs are harvested with bottom tending traps throughout the bay.

2.2 RECREATIONAL FISHERIES

Marine recreational fisheries in the project area were characterized using data from the National Oceanic and Atmospheric Administration (NOAA) Fisheries sponsored surveys, specifically the Marine Recreational Fisheries Statistical Survey (MRFSS). In this survey, marine recreational fisheries are grouped to reflect primary fishing modes such as shore, private/rental boat, and charter boat. Data on numbers of fishes caught by species are generated through random telephone interviews and dockside intercept surveys of private/rental, and charter boat operators made throughout the Gulf of Mexico (excluding Texas). Data presented here were obtained from the MRFSS website (NMFS, 2006) and include estimated numbers of fish caught and trips made by recreational anglers fishing from shore, private/rental boats, and charter boats. To include areas traversed by the proposed pipeline route, recreational catches and trips from west Florida were examined from three spatial subdivisions: (1) inland waters, (2) ocean waters less than or equal to 10 mi (16 km) from shore, and (3) ocean waters greater than 10 mi (16 km) from shore. Data extracted were total catch (A+B1+B2), where A are numbers estimated from fish actually seen and identified by observers, B1 are numbers of fish not observed whole by observers (i.e., filleted), and B2 are fish released or discarded at sea. These data are compiled for the entire western coast of Florida and are meant to provide a general picture of recreational fishing that is expected for the project area, not a site-specific account.

2.2.1 Target Species and Estimated Catches

Species ranking highest in estimated total catches for charter vessels operating in oceanic waters greater than 10 mi (16 km) from shore off west Florida during 1995 to 2005 included red snapper, *Mycteroperca* (e.g., gag and scamp) groupers, *Epinephelus* (e.g., red grouper, snowy grouper, goliath grouper) groupers, white grunt, vermilion snapper, triggerfishes/filefishes, and yellowtail snapper, all reef species (**Table 4**). With the exception of the other fish category, the remainder of the top ten species caught greater than 10 mi (16 km) offshore were pelagic species (dolphin, king mackerel, and other tunas/mackerels) (**Table 4**). Top ranked fish caught by charter vessels fishing in waters less than or equal to 10 mi (16 km) from shore also included reef fishes such as red snapper, *Mycteroperca* groupers, white grunt, dolphins, and gray snapper. Spanish and king mackerel were both important in this sub-area, as were spotted seatrout. Charter vessels fishing in inland waters caught spotted seatrout, herrings, red drum, sheepshead, pinfishes, and crevalle jack (**Table 4**). The catch composition indicates that charter vessels fishing in shelf waters target reef species and coastal pelagic species. Charter vessels fishing in inland waters target spotted seatrout, red drum, sheepshead, and gray snapper.

Table 4
Top 10 average numbers of fish caught by charter vessels operating off the west coast of Florida inland waters, ocean waters less than or equal to 10 mi (16 km) from shore, and ocean waters greater than 10 mi (16 km) from shore from 1995 to 2005

Species Name	Inland	R	Ocean (≤10 mi [16 km])	R	Ocean (>10 mi [16 km])	R	Total	R
Red snapper	102		151,335	1	518,276	1	3,348,158	1
Groupers (*Mycteroperca* spp.)	9,653		71,326	5	329,847	2	2,054,128	2
Other fishes	246,235	2	80,405	4	76,294	10	2,014,668	3
Groupers (*Epinephelus* spp.)	3,623		46,063	9	304,239	3	1,769,622	4
Spotted seatrout	229,042	3	104,727	2	14,405		1,740,866	5
White grunt	8,886		67,646	6	245,398	4	1,609,648	6
Herrings	335,719	1	38,720	10	75,176		1,576,640	7
Dolphins			15,090		222,837	5	1,189,634	8
Gray snapper	34,702	7	55,392	7	82,171	9	861,326	9
Spanish mackerel	22,962	10	101,006	3	30,209		770,885	10
Vermilion snapper	241		21,097		123,354	6	722,498	
Other jacks	1,557		22,435		114,192	7	690,920	
Red drum	93,106	4	25,099		4,144		611,745	
Yellowtail snapper	185		32,916		89,119	8	610,363	
King mackerel	144		48,388	8	56,549		524,971	
Crevalle jack	40,026	6	22,843		6,775		348,219	
Saltwater catfishes	49,790	5	12,983		2,784		327,786	
Pinfishes	27,618	8	8,025		9,989		228,161	
Sheepshead	25,982	9	14,009		732		203,614	

R = top 10 species ranked in terms of abundance in each area category.
Source: National Oceanic and Atmospheric Administration Fisheries and Marine Recreational Fisheries Statistical Survey (NMFS, 2006).

Species most commonly caught by private/rental vessels in ocean waters greater than 10 mi (16 km) offshore of west Florida were *Mycteroperca* groupers, *Epinephelus* groupers, black sea bass, herrings, pinfishes, and white grunt (**Table 5**). In waters less than or equal to 10 mi (16 km) from shore, private/rental vessels caught herrings, spotted seatrout, pinfishes, groupers (*Epinephelus* spp.), catfishes, black sea bass, and red drum (**Table 5**). Catches from inland waters also included herrings, spotted seatrout, pinfishes, catfishes, and red drum.

Table 5
Top 10 average numbers of fish caught by private/rental vessels operating off the west coast of Florida inland waters, ocean waters less than or equal to 10 mi (16 km) from shore, and ocean waters greater than 10 mi (16 km) from shore from 1995 to 2005

Species Name	Inland	R	Ocean (≤10 mi [16 km])	R	Ocean (≤10 mi [16 km])	R	Total	R
Herrings	22,838,897	1	2,417,678	2	810,068	5	130,333,218	1
Spotted seatrout	6,223,850	2	4,214,196	1	150,430		52,942,379	2
Pinfishes	3,783,297	4	1,885,751	3	655,533	6	31,622,903	3
Other fishes	4,288,204	3	1,263,898	6	241,285		28,966,935	4
White grunt	515,077		1,480,614	4	2,494,150	1	22,449,203	5
Saltwater catfishes	2,200,041	5	1,393,385	5	55,982		18,247,038	6
Gray snapper	1,838,608	6	712,088	9	263,081	9	14,068,886	7
Groupers (*Mycteroperca* spp.)	552,677		723,425	8	1,509,262	3	13,926,819	8
Black sea bass	143,982		1,120,042	7	821,822	4	10,429,229	9
Groupers (*Epinephelus* spp.)	66,438		276,159		1,729,170	2	10,358,832	10
Red drum	1,198,052	7	686,80	10	26,192		9,555,245	
Sheepshead	1,139,241	8	228,728		37,468		7,027,185	
Other sea basses	252,778		478,638		476,096	8	6,037,561	
Crevalle jack	794,829	10	342,259		28,052		5,825,696	
Mullets	896,780	9	206,964		21,953		5,628,484	
Red snapper	13,865		346,900		477,964	7	4,193,643	
Lane snapper	14,089		113,940		260,050	10	1,940,397	

R = top 10 species ranked in terms of abundance in each area category.
Source: National Oceanic and Atmospheric Administration Fisheries and Marine Recreational Fisheries Statistical Survey (NMFS, 2006).

Anglers fishing from shore on the Gulf coast and in inland waters caught a similar suite of species consisting of coastal pelagic (herrings, blue runner, Spanish mackerel, mullets, and crevalle jack), soft bottom (pinfishes, sand seatrout, silver perch, and pigfish), and hard bottom (gray snapper) species (**Table 6**).

Table 6
Top 10 average numbers of fish caught from shore along the west coast of Florida inland waters and ocean waters less than or equal to 10 mi (16 km) from shore from 2001 to 2005

Species Name	Inland	R	Ocean (≤10 mi [16 km])	R	Total	R
Herrings	5,527,183	1	3,430,070	1	44,786,264	1
Pinfishes	3,058,344	2	1,425,903	3	22,421,237	2
Other fishes	1,079,315	3	1,265,456	4	11,723,855	3
Blue runner	279,195		2,026,116	2	11,526,559	4
Spanish mackerel	793,818	5	1,212,620	5	10,032,190	5
Gray snapper	919,461	4	656,618	8	7,880,391	6
Other jacks	140,289		1,196,189	6	6,682,391	7
Saltwater catfishes	597,466	7	725,394	7	6,614,297	8
Mullets	602,431	6	121,232		3,618,313	9
Crevalle jack	322,551		400,922	10	3,617,365	10
Sheepshead	414,650	10	205,786		3,102,180	
Kingfishes	157,061		420,964	9	2,890,126	
Sand seatrout	477,927	8	47,223		2,625,751	
Pigfish	420,568	9	8,3097		2,518,326	

R = top 10 species ranked in terms of abundance in each area category.
Source: National Oceanic and Atmospheric Administration Fisheries and Marine Recreational Fisheries Statistical Survey (NMFS, 2006).

2.2.2 Fishing Effort

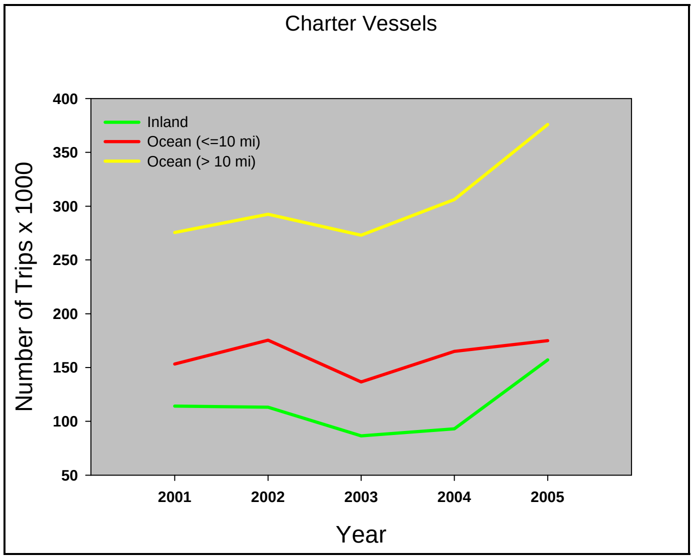
Private/rental vessels accounted for most of the estimated recreational trips made in shelf waters off west Florida during the 2001 to 2005 period (**Table 7**). The average number of recreational trips made by private vessels decreased from inland waters out to greater than 10 mi (16 km) from shore. The number of trips made by recreational anglers fishing from shore in inland waters including bridges, piers, and beaches was the second highest average number of trips during the period. Of the three fishing modes, charter vessels accounted for the fewest average trips per year (**Table 7**). However, **Figure 1** shows that charter vessels spend most of their time in waters greater than 10 mi (16 km) from shore, and conversely, the fewest number of charter trips was made in inland waters.

Table 7
Average number of recreational trips made in inland, ocean waters less than or equal to 10 mi (16 km) from shore, and ocean waters greater than 10 mi (16 km) from shore off Florida's west coast from 2001 to 2005

Area	Private/Rental	Shore	Charter
Inland	4,442,220	3,590,683	112,782
Ocean (≤10 mi [16 km])	3,121,339	2,935,211	161,100
Ocean (>10 mi [16 km])	1,164,752	---	304,629

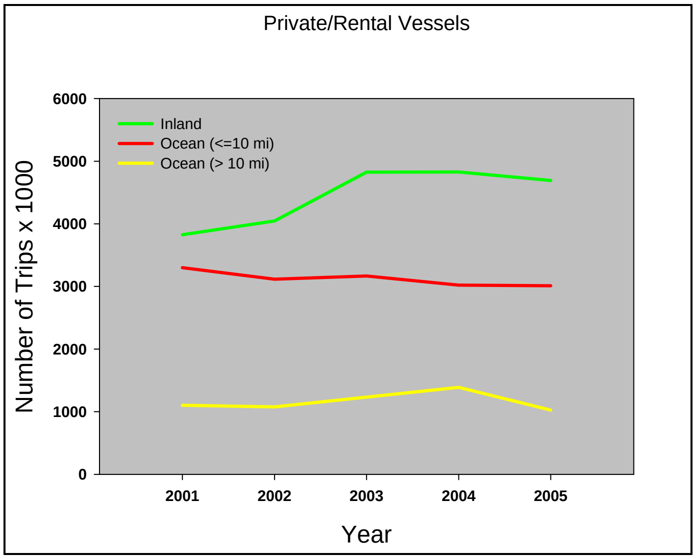
Source: National Oceanic and Atmospheric Administration Fisheries and Marine Recreational Fisheries Statistical Survey (NMFS, 2006).

Figure 1
Number of trips made by charter boats operating off the west coast of Florida in inland waters, ocean waters less than or equal to 10 mi (16 km) from shore, and ocean water greater than 10 mi (16 km) from shore from 2001 to 2005



Private/rental vessels accounted for an average of 8.7 million trips per year from all fishing areas combined, but unlike charter vessels that spend most of their time in waters greater 10 mi (16 km) from shore, the bulk of their effort was concentrated in inland and coastal waters (**Figure 2**).

Figure 2
Number of trips made by private/rental vessels operating off the west coast of Florida in inland waters, ocean waters less than or equal to 10 mi (16 km) from shore, and ocean waters greater than 10 mi (16 km) from shore from 2001 to 2005



2.2.3 Recreational Fisheries Summary

Although the MRFSS data represented the entire coast of west Florida and not the specific project area, it appears that most of the general patterns and trends in the data should broadly reflect the situation in the project area. General patterns that emerged from the analysis of the west Florida shelf, as a whole, were that offshore fishers target reef fish and, to a lesser extent, coastal pelagic species. Species caught by charter vessels were mostly reef fish (snappers and groupers). Charter vessels contributed fewer overall trips. Most trips went greater than 10 mi (16 km) offshore, whereas the private/rental vessels accounted for many more trips, but fished mostly in inland or coastal waters. Most trips were made by anglers fishing from shore either inland or along the Gulf beaches.

Additional support for the importance of reef fishing comes from the Impact Analysis, Inc. (2005a, b) studies that reported reef fishing charter permits in fishing communities of Pinellas, Hillsborough, and Manatee counties combined exceed the number of pelagic charter permits. The MRFSS data showed that inshore fishers (charter and private/rental vessels) catch pinfish, spotted seatrout, and red drum, all of which occur in Tampa Bay. This list should be expanded to include snook, tarpon, and ladyfish, especially for the charter fleet.

3.0 ENVIRONMENTAL CONSEQUENCES

Commercial fisheries occurring in the shelf waters of the project area were previously identified as bottom trawling for pink shrimp, trapping for stone crab, bottom longlining for reef fishes, and hook and line fishing for reef and coastal pelagic species. Commercial fishing occurring in Tampa Bay includes cast netting for mullet and trapping for blue and stone crabs. Recreational fisheries occurring in shelf waters involve a suite of species similar to what was found for commercial fisheries: reef and coastal pelagic fishes. Inside Tampa Bay, recreational fishers sought herrings, pinfish, red drum, spotted seatrout, snook, and tarpon.

The primary impact to commercial and recreational fisheries from construction, routine operations, and decommissioning is space-use: the preclusion of fishers from viable fishing grounds over time. During construction, commercial and recreational fishers will be temporarily precluded from areas immediately occupied by construction vessels installing the Port Dolphin Project. During routine operations, no anchoring zones imposed for safety reasons around the submerged turret loading (STL) buoys and the entire pipeline route will mostly affect fishers that use bottom-tending gear. Decommissioning effects would be similar to construction effects but last for a shorter time and cover less area.

Impacts other than space-use expected from this project are environmental disturbances and the artificial reef or FAD effect. Trenching and installing the pipeline, as well as emplacement of the buoys will disturb the seafloor, causing turbidity, creating noise, and possibly driving fishes away from affected areas. These activities are temporary and are expected to minimally affect commercial or recreational fisheries. The presence of structures including pipelines, buoys, mooring lines, and concrete armoring will add hard substrate to the local environment and therefore have a FAD effect on reef-associated and coastal pelagic species that also would be attractive to commercial and recreational fishers. On the other hand, trawlers, bottom longliners, and crab trappers would be precluded from areas with bottom structures or no-anchoring stipulations.

3.1 CONSTRUCTION

During construction, all transiting vessels would be required to maintain a Clearance Zone from all project construction vessels. The Clearance Zone will only be in effect during construction and will be established by the USCG; it is expected to be a radius of approximately 500 m in size. As construction proceeds, the precluded area will vary as the vessels move along the pipeline route from Port Manatee across the shelf to the STL buoys. Estimated time to install the pipeline is approximately 6 months, but the rate of movement across the shelf will vary. According to statistics presented in **Section 2.2.2,** most private/rental boats in the region operate in inland waters. Therefore, potential for impacts with construction barges are most likely inside Tampa Bay. However, the area occupied by these construction vessels is very small relative to the areal extent of navigable waters in Tampa Bay (about 210,467 acres [85,173 ha]). Most commercial and recreational fishing vessels, particularly those using mobile gear (e.g., hook and line), would have to temporarily avoid the construction barges and attendant vessels while they are on site. Stationary gear such as crab traps, or in deeper water, bottom longlines, would be susceptible to damage or loss during construction if they were deployed along the proposed route or at the buoy area.

Disturbances generated from the pipeline construction will create turbidity and noise that may repel fishes and motile invertebrates. Turbidity can cause mortality and feeding impairment in early life stages, avoidance and attraction movements, and physiological changes in adult pelagic fishes. Some species will actively avoid or be attracted to turbid water. The spatial and temporal extents of turbidity plumes from trenching and other construction activities are expected to be limited. Therefore, impacts to fisheries are not expected to be significant.

3.2 OPERATIONS

Once the pipeline and STL buoys are installed and operating, a No Anchoring (Precautionary) Zone will be established around the entire pipeline route and STL buoys. This zone is designed to lessen potential impacts, collisions, or other interactions with vessel traffic. The spatial extent of these sites is given in **Table 8**.

Table 8
Estimated areal extent of no anchoring (precautionary) zones for the pipeline segments in State and Federal waters and the buoy area (also in Federal waters) for the preferred location and route

Location	No Anchoring (Precautionary) Zone	
	Acres	Ha
State Waters	3,901.0	1,578.8
Federal Waters	2,856.6	1,155.1
Buoy Area	5,516.4	2,232.6
Total	12,274.0	4,966.5

The total area precluded by the No Anchoring (Precautionary) Zone was estimated to be 12,274 acres (4,966.5 ha). State waters accounted for 3,901 acres (1578.8 ha) or 31.7% of this area and Federal waters accounted for 2856.6 acres (1,155.1 ha) or 23.3% of the area. The portion of the State water estimate contributed by the route through Tampa Bay was estimated to be 2,177.2 acres (881.1 ha). This portion of Tampa Bay, which represents less than 1% of the surface area of Tampa Bay proper (see above), would be precluded from anchoring, trapping, or trawling by commercial or recreation fishers. On the adjacent shelf, an even smaller fraction of the available area would be precluded to anchoring, trawling, trapping, and bottom longlining. Around the STL buoy, commercial and recreational fishers would be precluded from 5,516.4 acres (2,232.6 ha).

During routine operations, the precluded areas represent small fractions of either Tampa Bay or particular depth strata on the adjacent shelf. Space-use effects to commercial or recreational fishers will only be significant if particularly productive areas are encompassed by any of the no anchoring zones.

3.3 DECOMMISSIONING

Fishery impacts during decommissioning are expected to be similar to those for installation of the STL subsea system. The duration and spatial extent of preclusion would, however, be less than that of construction activities.

3.4 ACCIDENTS AND UPSETS

Potential accidents and upsets that could result in impacts on marine fisheries include minor hydrocarbon spills, liquefied natural gas (LNG) releases, and natural gas releases. Demersal (bottom) fisheries would not be expected to be affected by a spill or LNG release, which are assumed to float on the surface and quickly dissipate.

A minor hydrocarbon spill would result in elevated hydrocarbon concentrations in the water and a sheen on the water surface. The surface area temporarily affected by the elevated hydrocarbon concentrations would depend on the characteristics of the spilled product and the oceanographic conditions (winds, currents, waves) at the time. Effects on fisheries would most likely be short term. Impacts are considered minor.

An LNG release would be vaporized quickly into the atmosphere. The effects of an LNG spill could include localized rapid temperature reductions in the vicinity of the spill, which would dissipate quickly with mixing due to current and wave action. Because LNG is not toxic and it evaporates rapidly into the atmosphere, impacts on fisheries would be negligible. Similarly, a subsea release of natural gas would rise to the surface and dissipate.

3.5 OFFSHORE POTENTIAL IMPACTS AND MITIGATION

Impacts to commercial and recreational fisheries during construction, routine operations, and decommissioning include the following:

- space-use conflicts;
- seafloor disturbance; and
- artificial reef or FAD effect.

For construction and decommissioning, space preclusion will be negligible. The area affected is small relative to the surrounding shelf and bay waters, and duration of each activity is short. During routine operations, space preclusion is permanent; however, the relative area remains small. Therefore, the impacts are minor. If the precluded areas are productive fishing grounds, then impacts would be considered significant. Currently, the fishery productivity of the pipeline corridor and the STL buoy areas is unknown. Nevertheless, the area encompassed by the pipeline corridor and STL buoys represent a small fraction of the seafloor/surface along the cross-shelf gradient. Most of the areal preclusion will occur during routine operations when the No Anchoring (Precautionary) Zone around the STL buoys and the pipeline corridor will be in effect. For the Preferred Location and Route, it is estimated that 12,274 acres (4,966.5 ha) will be precluded from use.

Table 9 summarizes the space-use impacts expected for commercial and recreation fisheries. Potential impacts to commercial and recreational fishing are rated as significant, minor, or negligible using the following criteria:

- Significant—impacts that disturb a particular fishery to the extent that production and/or revenue are permanently and negatively affected.
- Minor—changes that can be monitored and/or noticed but do not meet the definition of a significant impact (above).
- Negligible—impacts are short duration.

Table 9
Summary of impacts to offshore economic conditions with commercial and recreational fishing methods

Fishing Method	Shelf Waters			Tampa Bay		
	Installation	Routine Operations	Decommissioning	Installation	Routine Operation	Decommissioning
Bottom trawl[1]	Minor	Minor	Minor	Negligible	Negligible	Negligible
Purse net[1]	Negligible	Negligible	Negligible	n/a	n/a	n/a
Gill net[1]	Negligible	Negligible	Negligible	n/a	n/a	n/a
Hook-and-lining[1,2] (bottom fishing and trolling)	Negligible	Negligible	Negligible	Negligible	Negligible	Negligible
Bottom longline[1]	Minor	Minor	Negligible	n/a	n/a	n/a
Trap (Stone Crab)	Minor	Minor	Minor	Minor	Minor	Minor
Trap (Blue Crab)	n/a	n/a	n/a	Minor	Minor	Minor

[1] Commercial.
[2] Recreational.

None of the fishing methods listed in **Table 9** were significantly affected, mostly due to the very small relative space that is being precluded. Minor impacts may occur with bottom tending fisheries such as trawling, bottom longlining, and crab trapping. Within Tampa Bay, productive shallow-water habitats such as seagrass meadows, oyster reefs, and mangrove fringe are for the most part avoided. Although hard bottom habitat is being impacted in shelf waters, it is not evident that any uniquely productive fishing grounds are within the area encompassed by the pipeline corridor and STL buoy area. Impacts to hard bottom will require that lost habitat is replaced, most likely by artificial reefs. The details of this mitigation have yet to be determined but will be established, during the permitting process.

Seafloor disturbance during construction and decommissioning will generate turbidity that will drive fishery species from the immediate area of activity. Turbidity will dissipate rapidly. Fish or motile invertebrates should return, or other individuals will recolonize vacated areas. These impacts are expected to be negligible.

The FAD effect of the STL buoys and their mooring lines will possibly create problems, as fishers will try to get near the installation to take advantage of fishes attracted to the facility. Reef fishes such as red grouper, gag grouper, red snapper, gray snapper along with king mackerel, cobia, blackfin tuna, will likely congregate around the STL facility. It is likely also that fishers trolling or drifting in the buoy area will be attracted to the facility. The artificial reef or FAD effect will persist as long as the structure remains. This effect can be significant and will persist until decommissioning or physical removal of structures that attract fish in the first place.

4.0 IMPACTS TO ESSENTIAL FISH HABITAT (EFH)

Federally and State managed species from the following groups have been identified as having EFH within the proposed project region:

- penaeid shrimps;
- stone and blue crab;
- spiny lobster;
- coastal pelagic fishes;
- red drum;
- reef fishes;
- highly migratory species; and
- coastal sharks.

Species within these groups occur in the project area for a portion, if not all, of their life cycle and are also commercially and recreationally valuable species. The EFH for these species and their life stages relative to the proposed project area are summarized in **Table 10**. EFHs for all species occurring with the project area are discussed in **Volume II, Appendix D of the Deepwater Port License Applicat**ion (Hoegh LNG, 2007a).

Table 10
Federally managed species and associated
Essential Fish Habitat (EFH) within the project area

Commercially and Recreationally Valuable EFHs		
Species Group	Managed Species	EFH
Penaeid Shrimps	Two species and their life stages: pink shrimp (*Penaus duorarum*), rock shrimp (*Sicyonia brevirostris*)	Found in inshore waters and estuaries
Stone and Blue Crabs	Stone crab (*Menippe mercenaria*) and its life stages Blue crab (*Callinectes sapidus*) and its life stages	Found in intertidal zone, seagrass beds, rocky or soft bottoms Found in inshore waters and estuaries
Spiny Lobster	Spiny lobster (*Panulirus argus*) and its life stages	Found in shallow subtidal bottoms, seagrass beds, soft bottoms, coral reefs, and mangroves
Coastal Pelagic Fishes	Florida Pompano (*Trachinotus carolinus*), Spanish mackerel (*Scomberomorus maculates*), king mackerel (*Scomberomorus cavalla*), stripped mullet (*Mugil cephalus*), snook (*Centropomus undecimalis*), tarpon (*Megalops atlanticus*), and flounder (*Paralichthys* spp.) and life stages	Some found offshore, sandy shoals, beaches, estuaries, and inlets
Red Drum	Red drum (*Sciaenops ocellatus*) and life stages	Found in coastal inlets, sounds, bays, seagrass beds, shallow estuarine rivers, and mainland shores

Commercially and Recreationally Valuable EFHs		
Species Group	Managed Species	EFH
Reef Fishes	Young stages of multiple species including red grouper (*Epinephelus morio*), gag grouper (*Mycteroperca microlepis*), red snapper (*Lutjanus campechanus*), gray snapper (*L. griseus*), vermilion snapper (*Rhomboplites aurorubens*), greater amberjack (*Seriola dumerili*), seabass (*Centropristis* spp.), and two grunts (*Haemulon* spp. and *Orthopristis chrysoptera*)	Some found in shallow nearshore waters, mangroves, salt marshes, seagrass beds, coral reefs, algal mats, and estuaries
Highly Migratory Species	Spawning, eggs, and larvae of bluefin tuna (*Thunnus thynnus*)	Some found in pelagic and near coastal surface waters
Coastal Sharks	Blacknose shark (*Carcharhinus acronotus*), spinner shark (*C. brevipinna*), bull shark (*C. leucas*), sandbar shark (*C. plumbeus*), tiger shark (*Gaelocerdo cuvier*), bonnetheard shark (*Sphyrna tiburo*), and lemon shark (*Negaprion brevirostris*)	Found in shallow coastal waters and estuaries

4.1 IMPACTS TO PELAGIC HABITAT

Effects of the Port Dolphin project on EFHs for managed species will result from construction, decommissioning, and routine operations are summarized in **Table 11**. Impacts to the EFH of commercial and recreational fish species can be separated into pelagic, soft bottom, and hard bottom categories. Impacts to the pelagic habitat result from operations that draw in seawater or discharge heated water, and impacts to benthic habitats result from installation and construction of the pipeline.

Table 11
Summary of impact-producing factors and potential effects on commercially and recreationally valuable members of managed species groups and their habitats (Essential Fish Habitat) expected from construction, decommissioning, and routine operations

Species Group	Construction/Decommissioning			Routine Operations	
	Turbidity	Noise	Seafloor Disturbance	Entrainment	Attraction
Penaeid Shrimps	Mortality of early life stages	None expected	Adult habitat loss	Planktonic larvae	Adults will use structures inshore
Stone Crab	Mortality of early life stages	None expected	Adult habitat loss	Planktonic larvae	Adults will use structures inshore
Spiny Lobster	Mortality of early life stages	None expected	Adult habitat loss	Planktonic larvae	Adults will use structures offshore
Coastal Pelagic Fishes	Mortality/feeding impairment of early life stages	Temporary alteration of acoustic environment	None expected	Planktonic larvae	Adults will use structures
Red Drum	Mortality/feeding impairment of early life stages	None expected	None expected	Planktonic larvae	Adults will use structures
Reef Fishes	Mortality/feeding impairment of early life stages	Impairment of auditory abilities in late stage larvae	Adult and juvenile habitat loss	Planktonic larvae	Adults and Juveniles will use structures

Species Group	Construction/Decommissioning			Routine Operations	
	Turbidity	Noise	Seafloor Disturbance	Entrainment	Attraction
Highly Migratory Species	Mortality/feeding impairment of early life stages	Temporary alteration of acoustic environment	None expected	Planktonic larvae	Adults will use structures
Coastal Sharks	None expected	Temporary alteration of acoustic environment	Adult and juvenile habitat loss (nurse sharks)	None expected	Adults will use structures

The cooling water intake velocity is low (0.5 ft/s), which should allow most strong-swimming juvenile fishes and smaller adults to escape entrainment into the sea chests. At the maximum design intake velocity, however, drifting plankton would not be able to escape entrainment, with the exception of a few fast-swimming larvae of certain taxonomic groups.

Presence and abundance of larvae of Federal and State managed fish species in the vicinity of the Port Dolphin project were assessed using data collected by the Southeast Monitoring and Assessment Program (SEAMAP). SEAMAP data extracted for this project included all samples collected by bongo nets (0.5 m in diameter) with 0.333-mm mesh from four stations. These include SEAMAP Stations B111 (27.5000 Lat 83.000 Long), B110 (27.0000 Lat 83.0000 Long), B119 (27.5000 Lat 83.5000 Long), and B120 (27.0000 Lat 83.5000 Long), which approximately bracket the proposed project location. A total of 49 bongo net samples were collected from these stations between 1982 and 2002. These samples were represented by 134 taxa from a wide range of families with varying ecological affinities. Larvae of taxa associated with hard bottom, soft bottom, and the water column of the shelf as adults were most common. In addition, larvae of some deepwater meso-pelagic forms such as lanternfishes and bristlemouths were also collected. The most abundant (numbers/m^3) taxa collected in the area were Spanish sardine (*Sardinella aurita*), gobies (Gobiidae), thread herring (*Opisthonema oglinum*), herrings (Clupeidae), Atlantic bumper (*Chloroscombrus chrysurus*), round scad (*Decapterus punctatus*), and snappers (Lutjanidae). The number of fish larvae (all taxa combined) averaged 4.6/$m^3$and ranged from 0.4 to 23.3/m^3 across all stations. Fish eggs were not extracted from the above data set; however, general estimates of fish egg density (Rettig and Snyder, 2005) were used (6.6/m^3).

Entrainment of fish eggs and larvae for three additional groups (*Mugil* sp., Haemulidae, and Bothidae) was adapted from an impact assessment conducted by engineering-environmental Management, Inc. (e^2M) for the Port Dolphin Project (e^2M, 2008). The evaluation conducted by e^2M focused on the expected impacts on six fish species with varying commercial and recreational value that are thought to be representative of other species in the project area. Species evaluated were red drum (*Sciaenops ocellatus*), red snapper (*Lutjanus campechanus*), Gulf menhaden (*Brevoortai patronus*), bay anchovy (*Anchoa* spp.), gag grouper (*Mycteroperca microlepis*), and sheepshead (*Archosargus probatocephalus*). SEAMAP data from 1984 through 2002, representing 143 samples collected within a study area centered on the proposed location of the Port Dolphin deepwater port, were used to estimate losses due to entrainment for each of these species. Estimated losses of the age-1 fish of these species were then compared to harvest records from 1990 to 2006 to estimate the impact of entrainment losses relative to the take from commercial and recreational fisheries. Mortality estimates considered to reflect likely losses to the fishery averaged <0.01% of the harvest for red drum, red snapper, sheepshead, and bay anchovy, and 0/04% for gag grouper. No Gulf menhaden were captured in any of the samples in the study area, so no age-1 fishery impact was assessed for this species.

Accurate entrainment rates for certain species of concern (e.g., crustaceans of commercial or recreational importance such as stone crab [*Menippe mercenaria*] and pink shrimp [*Farfantepenaeus duorarum*]) and some reef fishes (e.g., Gulf flounder [*Paralichthys albigutta*], gag grouper [*Mycteroperca microlepis*], and red grouper [*Epinephelus morio*]) are presented as family estimates since those species primarily spawn outside the SEAMAP sampling periods.

Table 12 summarizes estimated entrainment of fish larvae and eggs (all species combined) by seawater intake for cooling and ballast water. For calculations, it is assumed that two shuttle and regasification vessels would be operating at once, each with a cooling water intake of 9.5 million gallons per day.

Table 12
Estimated entrainment rates of fish larvae and eggs due to intake of cooling water and ballast water during regasification

Life Stage	Number per m^3	Number per Million Gallons	Intake Rate (Million Gallons per Day [MGD])	Entrainment		
				Per Day (millions)	Per Week (millions)	Per Year (millions)
Eggs	6.6	24,984	23.62	0.59	4.13	215.40
Larvae	4.6	17,413	23.62	0.41	2.88	150.12
Larvae (3x)[a]	13.8	52,239	23.62	1.23	8.64	450.36

Intake rate based on two shuttle and regasification vessels, each drawing 9.5 MGD cooling water, and an maximum of 2.3 MGD ballast water.
[a] Larval densities in this row were multiplied by three to account for extrusion during plankton sampling, which can result in underestimated densities.

Occurrence and density of larvae of federally managed fishes from the samples are shown in **Table 13**. Representatives of several managed groups or taxa including coastal pelagic, red drum, reef fishes, and highly migratory were collected. Reef fishes accounted for the most taxa and in the case of snappers, the most frequently occurring. Larval densities ranged from $0.1483/m^3$ for snappers (Lutjanidae) to $0.0002/m^3$ for tarpon (*Mugil* sp.).

Table 13
Estimated entrainment rates of larvae of managed fish species due to intake of cooling water and ballast water during regasification

Management Unit	Taxon	Number per m^3	Number per Million Gallons	Entrainment[1]		
				Per Day (thousands)	Per Week (thousands)	Per Year (thousands)
Coastal pelagic	*Scomberomorus cavalla*	0.0016	6.12	0.14457	1.0120	52.77
	Scomberomorus maculatus	0.0065	24.66	0.58257	4.0780	212.64
	Mugil sp.[2]	0.0002	0.58	0.01370	0.096	5.00
Red drum	*Sciaenops ocellatus*	0.0024	8.93	0.21082	1.4758	76.95
Highly migratory	*Thunnus thynnus*	0.0016	6.06	0.14320	1.0024	52.27

Management Unit	Taxon	Number per m³	Number per Million Gallons	Entrainment[1]		
				Per Day (thousands)	Per Week (thousands)	Per Year (thousands)
Reef fishes	Lutjanidae	0.1483	561.35	13.25903	92.8132	4839.55
	Lutjanus	0.0015	5.82	0.13748	0.9624	50.18
	Lutjanus campechanus	0.0028	10.60	0.25040	1.7528	91.40
	Lutjanus griseus	0.0008	3.14	0.07424	0.5197	27.10
	Rhomboplites aurorubens	0.0184	69.74	1.64731	11.5312	601.27
	Centropristis	0.0098	37.17	0.87801	6.1461	320.47
	Epinephelinae	0.0006	2.46	0.05810	0.4067	21.21
	Serranidae	0.0827	313.17	7.39715	51.7800	2699.96
	Haemulidae[2]	0.0083	31.51	0.74427	5.2099	271.66
	Carangidae	0.0098	36.94	0.87258	6.1081	318.49
	Bothidae[2]	0.0486	183.89	4.34348	30.4044	1585.37

[1] Calculations based on daily intake rate of 23.62 million gallons/day.
[2] Data are average estimates taken from engineering-environmental Management, Inc., 2008.

Another potential impact of routine operations is attraction of pelagic fishes to the structures that comprise the STL subsea system, pipelines, and mooring buoys. Not only will these structures potentially attract small forage species such as round scad, Spanish sardine, and thread herring, but they also will attract managed coastal pelagic species (e.g., cobia, king mackerel, and little tunny). Lights on the facility will likely attract ichthyoplankton and adult fishes after dark.

4.1.1 Construction

Plowing and trenching of the pipeline will increase turbidity along the cross-shelf corridor and around the STL installation. Turbidity can cause mortality (by clogging or abrading the respiratory surfaces on gill filaments) and feeding impairment for visually feeding individuals of the early life stages of the managed species in the project area

Noise created during construction may cause temporary changes in the acoustic environment possibly resulting in fish being temporarily driven away from the immediate construction area.

4.1.2 Routine Operations

Routine operations will impact the pelagic habitat through the entrainment of individuals into the cooling water intake aboard the SRVs. The Port Dolphin regasification process is a closed system; however, seawater is drawn in to cool the engines aboard an SRV. The eggs and larvae of managed species entrained into this system will be stressed from physical impacts in the pumps and condenser tubing, pressure changes caused by diversion of the cooling water into the ships' systems and the hydraulic effects of the condensers, shear stress, as well as chemical toxic effects from cooling system antifouling agents (paints, chlorine). Death from entrainment of larval stages of managed species can occur during entrainment or at some time after the entrainment and return of entrained organisms to the sea. An additional impact involves entrainment of organisms in the waters around the SRVs into the discharge plume which may be elevated as much as 1° C as far as 60 m away from the SRV (Applied Science Associates, Inc. 2007) during some summer high current conditions. The mortality of early life stages of all members of the zooplankton community including early life stages of managed species would be most sensitive and therefore vulnerable to this thermal discharge stress.

4.1.3 Decommissioning

As with construction, decommissioning will have minimal effects on the pelagic habitat other than the local effects of increased turbidity, and potential resuspension of contaminated sediments when the docking system is removed. Sediment resuspension and contaminant release are expected to be localized, of minimal impact to plankton, and reversible. This impact will be limited to the shelf area surrounding Port Dolphin and should have no effect on waters surrounding the pipeline route to the inshore Tampa Bay system.

4.2 IMPACTS TO SOFT BOTTOM BENTHIC HABITAT

Photographic and geophysical surveys indicated that 67.4% of the seafloor along the preferred route modification and including the STL areas was soft/sedimentary substrate (CSA International, Inc., 2008). The primary impacts to soft bottom EFH are sediment disturbance, crushing of benthos (prey for bottom feeding fishes), and increased turbidity.

4.2.1 Construction

Installation of the STL buoys will disrupt 0.50 acres (0.19 ha) of soft bottom (**Table 14**). Impacts to soft bottom from plowing along the pipeline route are estimated to be 207.13 acres (83.82 ha) and from installation of mattresses are 8.6 acres (3.48 ha). Additional impacts due to anchoring are estimated to be 18.57 acres (7.51 ha). A small area of 1.28 acres (0.52 ha) would be affected by dragline burial and concrete mattresses at one location in Tampa Bay. All of the area would be soft bottom.

4.2.2 Routine Operations

Anchor sweep at the STL buoys represents the only impacts expected to soft bottom during routine operations. Anchor sweep for the all 8 anchors will affect 15.71 acres (6.36 ha) of soft bottom around the STL subsea systems.

4.2.3 Decommissioning

Decommissioning effects to soft bottom will be similar to those described for construction. Anchoring by barges and attendant vessels will destroy or displace infauna in soft bottom areas. Removal of seafloor components of the STL installation will create turbidity and side-cast sedimentary material that will alter the soft bottom environment in small areas.

Table 14
Estimated areal extent of impacts to the benthic habitats for the preferred location and route

Phase/Activity	Area Affected acres (ha)			
	Soft Bottom	Type A	Type B	Type D
Construction				
STL subsea system installation	0.50 (0.19)	0	0.10 (0.04)	0
Pipeline installation—plowing	207.13 (83.82)	15.49 (6.26)	38.52 (15.59)	55.72 (22.55)
Pipeline installation—mattresses	8.60 (3.48)	0	4.43 (1.79)	0
Dragline/mattress	1.28 (0.52)	0.24 (0.10)	0	0
Pipeline installation—anchoring	18.57 (7.51)	1.61 (0.65)	4.63 (1.88)	2.75 (1.11)
Routine Operations				
Anchor sweep (STL buoy)	15.71 (6.36)	0	6.39 (2.58)	0
Decommissioning				
STL subsea system removal[a]	0.50 (0.19)	0	0.10 (0.04)	0
Accidents or Upsets				
No impact on seafloor	0	0	0	0
Total	252.29 (102.10)	17.34 (7.02)	54.17 21.92)	58.47 (23.66)

[a] Decommissioning is assumed to affect the same area as STL subsea system installation.

4.3 IMPACTS TO HARD BOTTOM BENTHIC HABITAT

On the west Florida shelf, hard bottom habitat represents important EFH for corals, stone crab, spiny lobster, reef fishes, and in some cases, coastal pelagic species. Hard bottom habitats of the region occur as a mosaic of patches that vary in relief, exposure/burial, and epibiotal development. The distribution of benthic habitats within the preferred location and preferred route modification was mapped during video surveys conducted during 2006, 2007, and 2008 (CSA International, Inc., 2008). Most of the survey area (67.4%) consisted of soft bottom/sand substrate. However, 32.6% of the seafloor area was classified as hard/live bottom, which includes three Florida Department of Environmental Protection (FDEP)-defined habitat types:

- Type A (5.8% of survey area). Areas with 20% to 100% cover by attached epibenthic biota and/or hard bottom with greater than or equal to 0.8-ft (0.25-m) relief, inclusive of sand components integral to these habitats.

- Type B (16.8% of survey area). Areas with 5% to 20% cover by attached epibenthic biota and/or hard bottom with less than 0.8-ft (0.25-m) relief, inclusive of sand components integral to these habitats.

- Type D (10% of survey area). Sand (soft substrate/sedimentary habitat) in proximity to reef/hard bottom resources, a sandy veneer over hard substrate with less than 5% epibenthic coverage.

Most of the remaining seafloor was classified as soft substrate/sedimentary habitat. In addition to the hard/live bottom habitats, there are seagrass beds along a small portion of the pipeline route. Seagrass was observed only near Manbirdtee Island, the Spoil Island near Port Manatee, in water depths shallower than 7 ft (2 m).

Geophysical surveys (Hoegh LNG, 2007b, and **Addendum II, *Confidential* Attachment B.1**) of the buoy areas and along the 3,000-ft survey corridor centered on the preferred route modification produced a different estimate of hard bottom percentages (14.6%), based solely on seafloor geophysical signatures. This estimate is lower than from the video surveys, in part because areas of thin sand veneer over hard substrate (e.g., Habitat Type D) might not be detected geophysically as hard bottom. Another reason for the difference is that video surveys characterize the seafloor based on a relatively narrow field-of-view, as compared with the wide swaths of seafloor characterized geophysically. For this analysis, only the habitat classifications based on the video surveys are used. An analysis using only the geophysically defined hard bottom is presented in **Section 7** of the **Deepwater Port License Application, Addendum II**.

Findings from both the video and geophysical surveys were used to plan anchor positions for the STL subsea system at the two buoy locations. All of the hard/live bottom calculations presented in **Table 14** were made using the combined coverage of FDEP-defined habitat types.

4.3.1 Construction

Construction activities that affect hard/live bottom habitat in the project area include installation of (1) the STL subsea system, and (2) the pipeline, which includes plowing, deploying concrete mattresses, clamshell dredging, and anchoring. A summary of hard/live bottom area impacted by these activities is provided in **Table 14**. Installation of the STL subsea system will impact estimated 0.10 acres (0.04 ha) of hard/live bottom. Impacts to hard/live bottom resulting from pipeline installation are estimated to be 109.72 acres (44.4 ha) and from mattress placement to be 4.43 acres (1.79 ha). In addition, it is estimated that anchor placement will result in 8.99 acres (3.64 ha) of impacts to hard/live bottom.

4.3.2 Routine Operations

Impacts to hard/live bottom during routine operations are attributed only to the anchor sweep associated with cables attached to the eight anchors that secure each of the two buoys. Hard/live bottom impacts were estimated to be 6.39 acres (2.58 ha) during routine operations. In addition, the presence of the STL subsea system, pipelines, concrete armoring, and other subsea structures placed during routine operations will attract federally managed invertebrates and reef fishes. For example, adult stone crab and spiny lobster will likely seek shelter around the concrete armoring and other structures, as will snapper and grouper species. Noise generated during routine operations will affect managed species in a species-specific fashion.

4.3.3 Decommissioning

Effects of decommissioning on hard/live bottom will be similar to the effects described for construction. The total acreage of hard/live bottom impacted is estimated at 0.10 acres (0.04 ha). Decommissioning activities also are expected to generate noise that may temporarily affect managed fishes.

4.4 IMPACTS TO MIGRATORY BENTHIC INVERTEBRATES

Several species of highly mobile benthic invertebrates inhabit the seafloor within the project area. These species include the horseshoe crab (*Limulus polyphemus*), and the economically important spiny lobster (*Panulirus argus*) and stone crab (*Menippe mercenaria* and *Menippe adina*). There is concern that a pipeline in the project area may impede the onshore/offshore migrations of these species. A study conducted off Nova Scotia, Canada, in 2004 (Martec Limited, 2004) investigated the potential effects of natural gas pipelines on the behavior of American lobsters (*Homarus americanus*). The study assessed the ability of lobsters and crabs to scale exposed pipelines of 32-in. and 48-in. diameter. The results demonstrated that a 32-in. pipe with half its height exposed above the seafloor, presented no barrier to lobsters, regardless of whether it had a rough or smooth coating. An ROV inspection found over 700 crabs of several species on the pipeline, revealing that the 32-in. diameter pipeline posed no apparent barrier to a variety of crab species. The proposed Port Dolphin pipeline will be 36-in. diameter and will not be left exposed anywhere along the route. In areas where the pipeline cannot be trenched and buried, it will be covered with concrete mattresses. These mattresses will provide a sloped, rough textured incline, allowing easy crossing of the pipeline by lobsters and crabs. No literature was found regarding the scaling/climbing ability of a horseshoe crab with respect to exposed pipelines and mattressing; however, based on the anatomy and preferred habitat (sand flats) of the horseshoe crab, it would not be expected to be as agile a climber as either spiny lobster or crabs. Articulating concrete mattresses used to cover the pipeline are 9-in. thick. This abrupt edge may present an obstacle to horseshoe crabs attempting to cross the pipeline. Tapering the edges of the concrete mattresses may make it easier for horseshoe crabs to cross the pipeline in these areas. Most of the mattress-covered pipeline is over 4 mi off the coast and runs perpendicular to the shoreline, so it would not be expected to obstruct the shoreward migration of horseshoe crabs during the mating season. Mattress-covered pipeline within Tampa Bay consists of several short segments (generally less than half a mile long). None of these segments are in a position to block horseshoe crabs from their preferred, low-energy nesting beaches. Because of the location, extent, and orientation of unburied, mattress-covered pipeline, it should not present a significant obstacle to migrating horseshoe crabs, and no obstacle at all to spiny lobster or stone crabs.

4.5 CONCLUSIONS

Based on the analysis in the preceding sections, with appropriate mitigation for damages to hard bottom habitat, the proposed action is not expected to have adverse effects on EFH areas for Federal and State managed species. Although SEAMAP data used to estimate entrainment impacts do not provide complete seasonal or spatial (vertical) coverage of the distribution and abundance of ichthyoplankton, they do provide representative taxonomic composition, including managed species from which to estimate general effects of entrainment. The outer west Florida Shelf is a spawning area for managed species such as groupers and snappers (e.g., Coleman et al., 1996). Unless the facility has been located in the immediate vicinity of a spawning site, the variability in dispersal, high natural mortality of eggs and larvae, and high fecundity of marine fishes should prevent the seawater intake from adversely affecting adult fish populations of the region. There is presently no evidence indicating that the project is located at or near any spawning areas. Disturbance of soft bottom areas will occur, but no adverse effects on soft bottom benthic habitats are expected due to the limited area relative to the expansive West Florida shelf.

5.0 LITERATURE CITED

Applied Science Associates, Inc. 2007. Appendix C: Discharge Modeling and Analysis of Effluent Dilution, In: Port Dolphin LLC Deepwater Port License Application Volume II. I did not see this cited in text.

Coleman, F.C., C.C. Koenig, and L.A. Collins. 1996. Reproductive styles of shallow-water groupers (Pisces: Serranidae) in the eastern Gulf of Mexico and the consequences of fishing spawning aggregations. Env. Biol. Fish. 47:129-141.

CSA International, Inc. 2008. Revised Sand Source Re-Route Survey of Marine Benthic Habitats within the Proposed Port Dolphin Pipeline Corridor within Tampa Bay, Florida. Prepared for Port Dolphin LLC. 18 pp. + app.

engineering-environmental Management, Inc. 2008. Appendix E: Ichthyoplankton Assessment, In: USCG Draft Environment Impact Statement for Port Dolphin LLC Liquefied Natural Gas Deepwater Port License Application. No. USCG-2007-28532.

Florida Fish and Wildlife Conservation Commission. 2006. www.floridamarine.org.

Hoegh LNG. 2007a. Appendix D: Essential Fish Habitat, In: Port Dolphin Energy LLC Deepwater Port License Application Volume II.

Hoegh LNG. 2007b. Section 2: Geophysical Survey, In: Port Dolphin Energy LLC Deepwater Port License Application Volume III.

Impact Analysis, Inc. 2005a. Identifying Communities Associated with the Fishing Industry along the Florida Gulf Coast. Volume II: Archer to Treasure Island. A report prepared for U.S. Department of Commerce, NOAA Fisheries, Southeast Regional Office, St. Petersburg, Florida. 161 pp.

Impact Analysis, Inc. 2005b. Identifying Communities Associated with the Fishing Industry along the Florida Gulf Coast. Volume III: Apollo Beach to Royal Palm Hammock. A report prepared for U.S. Department of Commerce, NOAA Fisheries, Southeast Regional Office, St. Petersburg, Florida. 240 pp.

Martec Limited. 2004. Effects of Pipelines/Gathering Lines on Snow Crabs and Lobster. Martec Technical Report #TR-04-53 prepared for Environmental Studies Research Funds. Calgary, Alberta. 46 pp. + app.

Meyer, D.L., M.S. Fonseca, P.L. Murphey, R.H. McMichael, M.M. Byerly, M.W. LaCroix, P.E. Whitfield, and G.W. Thayer. 1999. Effects of live-bait shrimp trawling on seagrass beds and fish bycatch in Tampa Bay, Florida. Fish. Bull. (97)1:193:199.

National Marine Fisheries Service. 2006. Marine Recreational Fisheries Statistics Survey, Landings www.st.nmfs.noaa.gov.

Rettig, A. and B. Snyder. 2005. A summary of fish egg presence and abundance in the Gulf of Mexico, as part of an assessment of the potential for entrainment by offshore oil and gas facilities. Unpublished memorandum. Tetra Tech, Inc., Owings Mills, MD.

Van Voorhees, D. and E. Pritchard (eds). 2005. Fisheries of the United States 2004, Current Fisheries Statistics No. 2004. National Marine Fisheries Service, Office of Marine Technology, Silver Spring, MD. 124 pp.

ATTACHMENT A.8

PORT DOLPHIN PROJECT-SPECIFIC WETLAND AND WATERBODY CONSTRUCTION AND MITIGATION PROCEDURES

PORT DOLPHIN ENERGY LLC

PORT DOLPHIN PROJECT-SPECIFIC

WETLAND AND WATERBODY CONSTRUCTION

AND MITIGATION PROCEDURES

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I. APPLICABILITY

A. The intent of these Wetland and Waterbody Construction and Mitigation Procedures (Procedures) is to assist applicants by identifying baseline mitigation measures for minimizing the extent and duration of project-related disturbance on wetlands and waterbodies. Port Dolphin should specify in its applications for a Federal Energy Regulation Commission (FERC) Certificate (Certificate) any individual measures in these Procedures they consider unnecessary, technically infeasible, or unsuitable due to local conditions and fully describe any alternative measures they would use. Applicants should also explain how those alternative measures would achieve a comparable level of mitigation.

Once a project is certificated, further changes can be approved. Any such changes from the measures in these Procedures (or the applicant's approved procedures) will be approved by the Director of the Office of Energy Projects (Director), upon the applicant's written request, if the Director agrees that an alternative measure:

1. provides equal or better environmental protection;

2. is necessary because a portion of these Procedures is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Any requirements in these Procedures to file material with the Secretary of the FERC (Secretary) do not apply to projects undertaken under the provisions of the blanket certificate program. This exemption does not apply to a request for alternative measures.

Project-related impacts on nonwetland areas are addressed in the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**).

B. DEFINITIONS

1. "Waterbody" includes any natural or artificial stream, river, or drainage with perceptible flow at the time of crossing, and other permanent waterbodies such as ponds and lakes:

   a. "minor waterbody" includes all waterbodies less than or equal to 10 feet wide at the water's edge at the time of crossing;
   b. "intermediate waterbody" includes all waterbodies greater than 10 feet wide but less than or equal to 100 feet wide at the water's edge at the time of crossing; and
   c. "major waterbody" includes all waterbodies greater than 100 feet wide at the water's edge at the time of crossing.

2. "Wetland" includes any area that is not an actively cultivated or rotated cropland and that satisfies the requirements of the current federal methodology for identifying and delineating wetlands.

II. PRECONSTRUCTION FILING

A. The following information shall be filed with the Secretary prior to the beginning of construction:

1. hydrostatic testing information specified in **Section VII.B.3** and a wetland delineation report as described in **Section VI.A.1**, if applicable; and

2. a schedule identifying when trenching or blasting would occur within each waterbody greater than 10 feet wide, or within any designated coldwater fishery. Port Dolphin shall revise the schedule as necessary to provide FERC staff at least 14-days advance notice. Changes within this last 14-day period must provide for at least 48 hours advance notice.

B. The following site-specific construction plans required by these Procedures must be filed with the Secretary for the review and written approval by the Director:

1. plans for extra work areas that would be closer than 50 feet from a waterbody or wetland;

2. plans for major waterbody crossings;

3. plans for the use of a construction right-of-way (ROW) greater than 75 feet wide in wetlands; and

4. plans for horizontal directional drill (HDD) "crossings" of wetlands or waterbodies.

III. ENVIRONMENTAL INSPECTORS

A. At least one Environmental Inspector having knowledge of the wetland and waterbody conditions in the project area is required for each construction spread. The number and experience of Environmental Inspectors assigned to each construction spread should be appropriate for the length of the construction spread and the number/significance of resources affected.

B. The Environmental Inspector's responsibilities are outlined in the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**).

IV. PRECONSTRUCTION PLANNING

A. A copy of the Stormwater Pollution Prevention Plan (SWPPP) prepared for compliance with the U.S. Environmental Protection Agency's (EPA) National Stormwater Program General Permit requirements must be available in the field on each construction spread. The SWPPP shall contain Spill Prevention and Response Procedures that meet the requirements of state and federal agencies.

1. It shall be the responsibility of Port Dolphin and its contractors to structure their operations in a manner that reduces the risk of spills or the accidental exposure of fuels or hazardous materials to waterbodies or wetlands. Port Dolphin and its contractors must, at a minimum, ensure that:

a. all employees handling fuels and other hazardous materials are properly trained;
b. all equipment is in good operating order and inspected on a regular basis;
c. fuel trucks transporting fuel to on-site equipment travel only on approved access roads;
d. equipment travel is only on approved access roads;
e. all equipment is parked overnight and/or fueled at least 100 feet from a waterbody or in an upland area at least 100 feet from a wetland boundary. These activities can occur closer only if the Environmental Inspector finds, in advance, no reasonable alternative and Port Dolphin and its contractors have taken appropriate steps (including secondary containment structures) to prevent spills and provide for prompt cleanup in the event of a spill;
f. hazardous materials, including chemicals, fuels, and lubricating oils, are not stored within 100 feet of a wetland, waterbody, or designated municipal watershed area, unless the location is designated for such use by an appropriate governmental authority. This applies to storage of these materials and does not apply to normal operation or use of equipment in these areas; and
g. concrete coating activities are not performed within 100 feet of a wetland or waterbody boundary, unless the location is an existing industrial site designated for such use.

2. Port Dolphin and its contractors must structure their operations in a manner that provides for the prompt and effective cleanup of spills of fuel and other hazardous materials. At a minimum, Port Dolphin and its contractors must:

   a. ensure that each construction crew (including cleanup crews) has on hand sufficient supplies of absorbent and barrier materials to allow the rapid containment and recovery of spilled materials and knows the procedure for reporting spills;
   b. ensure that each construction crew has on hand sufficient tools and material to stop leaks;
   c. know the contact names and telephone numbers for all local, state, and federal agencies (including, if necessary, the U.S. Coast Guard and the National Response Center) that must be notified of a spill; and
   d. follow the requirements of those agencies in cleaning up the spill, in excavating and disposing of soils or other materials contaminated by a spill, and in collecting and disposing of waste generated during spill cleanup.

B. AGENCY COORDINATION

Port Dolphin must coordinate with the appropriate local, state, and federal agencies as outlined in these Procedures and in the Certificate.

V. <u>WATERBODY CROSSINGS</u>

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply to the U.S. Army Corps of Engineers (COE), or its delegated agency, for the appropriate wetland and waterbody crossing permits.

2. Provide written notification to authorities responsible for potable surface water supply intakes located within 3 miles downstream of the crossing at least 1 week before beginning work in the waterbody, or as otherwise specified by that authority.

3. Apply for state-issued waterbody crossing permits and obtain individual or generic Section 401 water quality certification or waiver.

4. Notify appropriate state authorities at least 48 hours before beginning trenching or blasting within the waterbody, or as specified in state permits.

B. INSTALLATION

1. Time Window for Construction

   Unless expressly permitted or further restricted by the appropriate state agency in writing on a site-specific basis, instream work, except that required to install or remove equipment bridges, must occur during the following time windows:

   a. coldwater fisheries – June 1 through September 30; and
   b. coolwater and warmwater fisheries – June 1 through November 30.

2. Extra Work Areas

   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from water's edge, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land.
   b. Port Dolphin shall file with the Secretary for review and written approval by the Director, a site-specific construction plan for each extra work area with a less than 50-foot setback from the water's edge (except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land), and a site-specific explanation of the conditions that will not permit a 50-foot setback.
   c. Limit clearing of vegetation between extra work areas and the edge of the waterbody to the certificated construction ROW.
   d. Limit the size of extra work areas to the minimum needed to construct the waterbody crossing.

3. General Crossing Procedures

   a. Comply with the COE, or its delegated agency, permit terms and conditions.
   b. Construct crossings as close to perpendicular to the axis of the waterbody channel as engineering and routing conditions permit.
   c. If the pipeline parallels a waterbody, attempt to maintain at least 15 feet of undisturbed vegetation between the waterbody (and any adjacent wetland) and the construction ROW.
   d. Where waterbodies meander or have multiple channels, route the pipeline to minimize the number of waterbody crossings.
   e. Maintain adequate flow rates to protect aquatic life, and prevent the interruption of existing downstream uses.

f. Waterbody buffers (extra work area setbacks, refueling restrictions, etc.) must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

4. Spoil Pile Placement and Control

   a. All spoil from minor and intermediate waterbody crossings, and upland spoil from major waterbody crossings, must be placed in the construction ROW at least 10 feet from the water's edge or in additional extra work areas as described in **Section V.B.2**.
   b. Use sediment barriers to prevent the flow of spoil or heavily silt-laden water into any waterbody.

5. Equipment Bridges

   a. Only clearing equipment and equipment necessary for installation of equipment bridges may cross waterbodies prior to bridge installation. Limit the number of such crossings of each waterbody to one per piece of clearing equipment.
   b. Construct equipment bridges to maintain unrestricted flow and to prevent soil from entering the waterbody. Examples of such bridges include:

      (1) equipment pads and culvert(s);
      (2) equipment pads or railroad car bridges without culverts;
      (3) clean rock fill and culvert(s); and
      (4) flexi-float or portable bridges.

      Additional options for equipment bridges may be utilized that achieve the performance objectives noted above. Do not use soil to construct or stabilize equipment bridges.

   c. Design and maintain each equipment bridge to withstand and pass the highest flow expected to occur while the bridge is in place. Align culverts to prevent bank erosion or streambed scour. If necessary, install energy-dissipating devices downstream of the culverts.
   d. Design and maintain equipment bridges to prevent soil from entering the waterbody.
   e. Remove equipment bridges as soon as possible after permanent seeding unless the COE, or its delegated agency, authorizes it as a permanent bridge.
   f. If there will be more than 1 month between final cleanup and the beginning of permanent seeding and reasonable alternative access to the ROW is available, remove equipment bridges as soon as possible after final cleanup.

6. Dry-Ditch Crossing Methods

   a. Unless approved otherwise by the appropriate state agency, install the pipeline using one of the dry-ditch methods outlined below for crossings of waterbodies up to 30 feet wide (at the water's edge at the time of construction) that are state-designated as either coldwater or significant coolwater or warmwater fisheries.

b. Dam and Pump

(1) The dam-and-pump method may be used without prior approval for crossings of waterbodies where pumps can adequately transfer streamflow volumes around the work area, and there are no concerns about sensitive species passage.
(2) Implementation of the dam-and-pump crossing method must meet the following performance criteria:

(i) use sufficient pumps, including on-site backup pumps, to maintain downstream flows;
(ii) construct dams with materials that prevent sediment and other pollutants from entering the waterbody (e.g., sandbags or clean gravel with plastic liner);
(iii) screen pump intakes;
(iv) prevent streambed scour at pump discharge; and
(v) monitor the dam and pumps to ensure proper operation throughout the waterbody crossing.

7. Flume Crossing

The flume crossing method requires implementation of the following steps:

(1) install flume pipe after blasting (if necessary), but before any trenching;
(2) use sand bag or sand bag and plastic sheeting diversion structure or equivalent to develop an effective seal and to divert stream flow through the flume pipe (some modifications to the stream bottom may be required to achieve an effective seal);
(3) properly align flume pipe(s) to prevent bank erosion and streambed scour;
(4) do not remove flume pipe during trenching, pipelaying, or backfilling activities, or initial streambed restoration efforts; and
(5) remove all flume pipes and dams that are not also part of the equipment bridge as soon as final cleanup of the stream bed and bank is complete.

8. Horizontal Directional Drill (HDD)

To the extent they were not provided as part of the pre-certification process, for each waterbody or wetland that would be crossed using the HDD method, provide a plan that includes:

(1) site-specific construction diagrams that show the location of mud pits, pipe assembly areas, and all areas to be disturbed or cleared for construction;
(2) a description of how an inadvertent release of drilling mud would be contained and cleaned up; and
(3) a contingency plan for crossing the waterbody or wetland in the event the directional drill is unsuccessful and how the abandoned drill hole would be sealed, if necessary.

9. Crossings of Minor Waterbodies

   Where a dry-ditch crossing is not required, minor waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

   a. except for blasting and other rock breaking measures, complete instream construction activities (including trenching, pipe installation, backfill, and restoration of the streambed contours) within 24 hours. Streambanks and unconsolidated streambeds may require additional restoration after this period;
   b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and
   c. equipment bridges are not required at minor waterbodies that do not have a state-designated fishery classification (e.g., agricultural or intermittent drainage ditches). However, if an equipment bridge is used it must be constructed as described in **Section V.B.5**.

10. Crossings of Intermediate Waterbodies

   Where a dry-ditch crossing is not required, intermediate waterbodies may be crossed using the open-cut crossing method, with the following restrictions:

   a. complete instream construction activities (not including blasting and other rock breaking measures) within 48 hours, unless site-specific conditions make completion within 48 hours infeasible;
   b. limit use of equipment operating in the waterbody to that needed to construct the crossing; and
   c. all other construction equipment must cross on an equipment bridge as specified in **Section V.B.5**.

11. Crossings of Major Waterbodies

   Before construction, Port Dolphin shall file with the Secretary for the review and written approval by the Director a detailed, site-specific construction plan and scaled drawings identifying all areas to be disturbed by construction for each major waterbody crossing (the scaled drawings are not required for any offshore portions of pipeline projects). This plan should be developed in consultation with the appropriate state and federal agencies and should include extra work areas, spoil storage areas, sediment control structures, etc., as well as mitigation for navigational issues. The Environmental Inspector may adjust the final placement of the erosion and sediment control.

12. Temporary Erosion and Sediment Control

   Install sediment barriers (as defined in **Section IV.F.2.a** of the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan [**Attachment A.9**]) immediately after initial disturbance of the waterbody or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration of adjacent upland areas is complete.

Temporary erosion and sediment control measures are addressed in more detail in the Plan; however, the following specific measures must be implemented at stream crossings:

a. install sediment barriers across the entire construction ROW at all waterbody crossings, where necessary, to prevent the flow of sediments into the waterbody. In the travel lane, these may consist of removable sediment barriers or driveable berms. Removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent;
b. where waterbodies are adjacent to the construction ROW, install sediment barriers along the edge of the construction ROW, as necessary, to contain spoil and sediment within the construction ROW; and
c. use trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody.

13. Trench Dewatering

Dewater the trench (either on or off the construction ROW) in a manner that does not cause erosion and does not result in heavily silt-laden water flowing into any waterbody. Remove the dewatering structures as soon as possible after the completion of dewatering activities.

C. RESTORATION

1. Use clean gravel or native cobbles for the upper 1-foot fisheries.

2. For open-cut crossings, stabilize waterbody banks and instream construction activities. For dry-ditch crossings, complete streambed and bank stabilization before returning flow to the waterbody channel.

3. Return all waterbody banks to preconstruction contours or to a stable angle of repose as approved by the Environmental Inspector.

4. Application of riprap for bank stabilization must comply with the COE, or its delegated agency, permit terms and conditions.

5. Unless otherwise specified by state permit, limit the use of riprap to areas where flow conditions preclude effective vegetative stabilization techniques such as seeding and erosion control fabric.

6. Revegetate disturbed riparian areas with conservation grasses and legumes or native plant species, preferably woody species.

7. Install a permanent slope breaker across the construction ROW at the base of slopes greater than 5% that are less than 50 feet from the waterbody, or as needed to prevent sediment transport into the waterbody. In addition, install sediment barriers as outlined in the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and

Maintenance Plan (**Attachment A.9**). In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the waterbody.

8. **Sections V.C.3** through **V.C.6** above also apply to those perennial or intermittent streams not flowing at the time of construction.

D. POST-CONSTRUCTION MAINTENANCE

1. Limit vegetation maintenance adjacent to waterbodies to allow a riparian strip at least 25 feet wide, as measured from the waterbody's mean high water mark, to permanently revegetate with native plant species across the entire construction ROW. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be maintained in a herbaceous state. In addition, trees that are located within 15 feet of the pipeline that are greater than 15 feet in height may be cut and removed from the permanent ROW.

2. Do not use herbicides or pesticides in or within 100 feet of a waterbody except as allowed by the appropriate land management or state agency.

VI. WETLAND CROSSINGS

A. GENERAL

1. Port Dolphin shall conduct a wetland delineation using the current federal methodology and file a wetland delineation report with the Secretary before construction. This report shall identify:

    a. by milepost all wetlands that would be affected;
    b. the National Wetlands Inventory (NWI) classification for each wetland;
    c. the crossing length of each wetland in feet; and
    d. the area of permanent and temporary disturbance that would occur in each wetland by NWI classification type.

The requirements outlined in this section do not apply to wetlands in actively cultivated or rotated cropland. Standard upland protective measures, including workspace and topsoiling requirements, apply to these agricultural wetlands.

1. Route the pipeline to avoid wetland areas to the maximum extent possible. If a wetland cannot be avoided or crossed by following an existing ROW, route the new pipeline in a manner that minimizes disturbance to wetlands. Where looping an existing pipeline, overlap the existing pipeline ROW with the new construction ROW. In addition, locate the loop line no more than 25 feet away from the existing pipeline unless site-specific constraints would adversely affect the stability of the existing pipeline.

2. Limit the width of the construction ROW to 75 feet or less. Prior written approval of the Director is required where topographic conditions or soil limitations require that the construction ROW width within the boundaries of a federally delineated wetland

be expanded beyond 75 feet. Early in the planning process Port Dolphin is encouraged to identify site-specific areas where existing soils lack adequate unconfined compressive strength that would result in excessively wide ditches and/or difficult to contain spoil piles.

3. Wetland boundaries and buffers must be clearly marked in the field with signs and/or highly visible flagging until construction-related ground disturbing activities are complete.

4. Implement the measures of **Sections V** and **VI** in the event a waterbody crossing is located within or adjacent to a wetland crossing. If all measures of **Sections V** and **VI** cannot be met, Port Dolphin must file with the Secretary a site-specific crossing plan for review and written approval by the Director before construction. This crossing plan shall address at a minimum:

   a. spoil control;
   b. equipment bridges;
   c. restoration of waterbody banks and wetland hydrology;
   d. timing of the waterbody crossing;
   e. method of crossing; and
   f. size and location of all extra work areas.

5. Do not locate aboveground facilities in any wetland, except where the location of such facilities outside of wetlands would prohibit compliance with U.S. Department of Transportation regulations.

B. INSTALLATION

1. Extra Work Areas and Access Roads

   a. Locate all extra work areas (such as staging areas and additional spoil storage areas) at least 50 feet away from wetland boundaries, except where the adjacent upland consists of actively cultivated or rotated cropland or other disturbed land.
   b. Port Dolphin shall file with the Secretary for review and written approval by the Director, a site-specific construction plan for each extra work area with a less than 50-foot setback from wetland boundaries (except where adjacent upland consists of actively cultivated or rotated cropland or other disturbed land) and a site-specific explanation of the conditions that will not permit a 50-foot setback.
   c. Limit clearing of vegetation between extra work areas and the edge of the wetland to the certificated construction ROW.
   d. The construction ROW may be used for access when the wetland soil is firm enough to avoid rutting or the construction ROW has been appropriately stabilized to avoid rutting (e.g., with timber riprap, prefabricated equipment mats, or terra mats).

      In wetlands that cannot be appropriately stabilized, all construction equipment, other than that needed to install the wetland crossing, shall use access roads located in upland areas. Where access roads in upland areas do not provide reasonable access, all other construction equipment will be limited to one pass through the wetland using the construction ROW.

e. The only access roads, other than the construction ROW, that can be used in wetlands without Director approval are those existing roads that can be used with no modification and no impact on the wetland.

2. Crossing Procedures

a. Comply with COE, or its delegated agency, permit terms, and conditions.
b. Assemble the pipeline in an upland area unless the wetland is dry enough to adequately support skids and pipe.
c. Use "push-pull" or "float" techniques to place the pipe in the trench where water and other site conditions allow.
d. Minimize the length of time that topsoil is segregated and the trench is open.
e. Limit construction equipment operating in wetland areas to that needed to clear the construction ROW, dig the trench, fabricate and install the pipeline, backfill the trench, and restore the construction ROW.
f. Cut vegetation just above ground level, leaving existing root systems in place, and remove it from the wetland for disposal.
g. Limit pulling of tree stumps and grading activities to directly over the trenchline. Do not grade or remove stumps or root systems from the rest of the construction ROW in wetlands unless the Chief Inspector and Environmental Inspector determine that safety-related construction constraints require grading or the removal of tree stumps from under the working side of the construction ROW.
h. Segregate the top 1 foot of topsoil from the area disturbed by trenching, except in areas where standing water is present or soils are saturated or frozen. Immediately after backfilling is complete, restore the segregated topsoil to its original location.
i. Do not use rock, soil imported from outside the wetland, tree stumps, or brush riprap to support equipment on the construction ROW.
j. If standing water or saturated soils are present, or if construction equipment causes ruts or mixing of the topsoil and subsoil in wetlands, use low-ground-weight construction equipment, or operate normal equipment on timber riprap, prefabricated equipment mats, or terra mats.
k. Do not cut trees outside of the approved construction work area to obtain timber for riprap or equipment mats.
l. Attempt to use no more than two layers of timber riprap to support equipment on the construction ROW.
m. Remove all project-related material used to support equipment on the construction ROW upon completion of construction.

3. Temporary Sediment Control

Install sediment barriers (as defined in **Section IV.F.2.a** of the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan [**Attachment A.9**]) immediately after initial disturbance of the wetland or adjacent upland. Sediment barriers must be properly maintained throughout construction and reinstalled as necessary (such as after backfilling of the trench). Except as noted below in **Section VI.B.3.c**, maintain sediment barriers until replaced by permanent erosion controls or restoration of adjacent upland areas is complete. Temporary erosion and sediment control measures are addressed in more detail in the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**).

a. Install sediment barriers across the entire construction ROW at all wetland crossings where necessary to prevent sediment flow into the wetland. In the travel lane, these may consist of removable sediment barriers or driveable berms. Removable sediment barriers can be removed during the construction day, but must be re-installed after construction has stopped for the day and/or when heavy precipitation is imminent.
b. Where wetlands are adjacent to the construction ROW and the ROW slopes toward the wetland, install sediment barriers along the edge of the construction ROW as necessary to prevent sediment flow into the wetland.
c. Install sediment barriers along the edge of the construction ROW as necessary to contain spoil and sediment within the construction ROW through wetlands. Remove these sediment barriers during ROW cleanup.

4. Trench Dewatering

Dewater the trench (either on or off the construction ROW) in a manner that does not cause erosion and does not result in heavily silt-laden water flowing into any wetland. Remove dewatering structures as soon as possible after the completion of dewatering activities.

C. RESTORATION

1. Where the pipeline trench may drain a wetland, construct trench breakers and/or seal the trench bottom as necessary to maintain the original wetland hydrology.

2. For each wetland crossed, install a trench breaker at the base of slopes near the boundary between the wetland and adjacent upland areas. Install a permanent slope breaker across the construction ROW at the base of a slope greater than 5% where the base of the slope is less than 50 feet from the wetland, or as needed to prevent sediment transport into the wetland. In addition, install sediment barriers as outlined in the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**). In some areas, with the approval of the Environmental Inspector, an earthen berm may be suitable as a sediment barrier adjacent to the wetland.

3. Do not use fertilizer, lime, or mulch unless required in writing by the appropriate land management or state agency.

4. Consult with the appropriate land management or state agency to develop a project-specific wetland restoration plan. The restoration plan should include measures for re-establishing herbaceous and/or woody species, controlling the invasion and spread of undesirable exotic species (e.g., purple loosestrife and phragmites), and monitoring the success of the revegetation and weed control efforts. Provide this plan to the FERC staff upon request.

5. Until a project-specific wetland restoration plan is developed and/or implemented, temporarily revegetate the construction ROW with annual ryegrass at a rate of 40 pounds/acre (unless standing water is present).

6. Ensure that all disturbed areas successfully revegetate with wetland herbaceous and/or woody plant species.

7. Remove temporary sediment barriers located at the boundary between wetland and adjacent upland areas after upland revegetation and stabilization of adjacent upland areas are judged to be successful as specified in **Section VII.A.2** of the Port Dolphin Project-specific Upland Erosion Control, Revegetation, and Maintenance Plan (**Attachment A.9**).

D. POST-CONSTRUCTION MAINTENANCE

1. Do not conduct vegetation maintenance over the full width of the permanent ROW in wetlands. However, to facilitate periodic pipeline corrosion/leak surveys, a corridor centered on the pipeline and up to 10 feet wide may be maintained in a herbaceous state. In addition, trees within 15 feet of the pipeline that are greater than 15 feet in height may be selectively cut and removed from the permanent ROW.

2. Do not use herbicides or pesticides in or within 100 feet of a wetland, except as allowed by the appropriate land management agency or state agency.

3. Monitor and record the success of wetland revegetation annually for the first 3 years after construction or until wetland revegetation is successful. At the end of 3 years after construction, file a report with the Secretary identifying the status of the wetland revegetation efforts. Include the percent cover achieved and problem areas (weed invasion issues, poor revegetation, etc.). Continue to file a report annually until wetland revegetation is successful.

4. Wetland revegetation shall be considered successful if the cover of herbaceous and/or woody species is at least 80% of the type, density, and distribution of the vegetation in adjacent wetland areas that were not disturbed by construction. If revegetation is not successful at the end of 3 years, develop and implement (in consultation with a professional wetland ecologist) a remedial revegetation plan to actively revegetate the wetland. Continue revegetation efforts until wetland revegetation is successful.

VII. HYDROSTATIC TESTING

A. NOTIFICATION PROCEDURES AND PERMITS

1. Apply for state-issued water withdrawal permits, as required.

2. Apply for National Pollutant Discharge Elimination System (NPDES) or state-issued discharge permits, as required.

3. Notify appropriate state agencies of intent to use specific sources at least 48 hours before testing activities unless this requirement is waived in writing.

B. GENERAL

1. Perform nondestructive testing of all pipeline section welds or hydrotest the pipeline sections, before installation under waterbodies or wetlands.

2. If pumps used for hydrostatic testing are within 100 feet of any waterbody or wetland, address the operation and refueling of these pumps in the project's Spill Prevention and Response Procedures.

3. Port Dolphin shall file with the Secretary before construction a list identifying the location of all waterbodies proposed for use as a hydrostatic test water source or discharge location.

C. INTAKE SOURCE AND RATE

1. Screen the intake hose to prevent entrainment of fishes.

2. Do not use state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and/or local permitting agencies grant written permission.

3. Maintain adequate flow rates to protect aquatic life, provide for all waterbody uses, and provide for downstream withdrawals of water by existing users.

4. Locate hydrostatic test manifolds outside wetlands and riparian areas to the maximum extent practicable.

D. DISCHARGE LOCATION, METHOD, AND RATE

1. Regulate discharge rate, use energy dissipation device(s), and install sediment barriers, as necessary, to prevent erosion, streambed scour, suspension of sediments, or excessive streamflow.

2. Do not discharge into state-designated exceptional value waters, waterbodies which provide habitat for federally listed threatened or endangered species, or waterbodies designated as public water supplies, unless appropriate federal, state, and local permitting agencies grant written permission.

ATTACHMENT A.9

PORT DOLPHIN PROJECT-SPECIFIC
UPLAND EROSION CONTROL, REVEGETATION,
AND MAINTENANCE PLAN

PORT DOLPHIN ENERGY LLC

PORT DOLPHIN PROJECT-SPECIFIC

UPLAND EROSION CONTROL, REVEGETATION,

AND MAINTENANCE PLAN

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1. provides equal or better environmental protection;

2. is necessary because a portion of this Plan is infeasible or unworkable based on project-specific conditions; or

3. is specifically required in writing by another federal, state, or Native American land management agency for the portion of the project on its land or under its jurisdiction.

Any requirements in this Plan to file material with the Secretary of the FERC (Secretary) do not apply to projects undertaken under the provisions of the blanket certificate program. This exemption does not apply to a request for alternative measures.

Project-related impacts on wetland and waterbody systems are addressed in the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**).

II. SUPERVISION AND INSPECTION

A. ENVIRONMENTAL INSPECTION

1. At least one Environmental Inspector is required for each construction spread during construction and restoration (as defined by **Section V**). The number and experience of Environmental Inspectors assigned to each construction spread should be appropriate for the length of the construction spread and the number/significance of resources affected.

2. Environmental Inspectors shall have peer status with all other activity inspectors.

3. Environmental Inspectors shall have the authority to stop activities that violate the environmental conditions of the Certificate, state, and federal environmental permit conditions, or landowner requirements; and to order appropriate corrective action.

B. RESPONSIBILITIES OF ENVIRONMENTAL INSPECTORS

At a minimum, the Environmental Inspector(s) shall be responsible for:

1. Ensuring compliance with the requirements of this Plan, the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**), the environmental conditions of the Certificate authorization, the mitigation measures proposed by Port Dolphin (as approved and/or modified by the Certificate), other environmental permits and approvals, and environmental requirements in landowner easement agreements;

2. Identifying, documenting, and overseeing corrective actions, as necessary, to bring an activity back into compliance;

3. Verifying that the limits of authorized construction work areas and locations of access roads are properly marked before clearing;

4. Verifying the location of signs and highly visible flagging marking the boundaries of sensitive resource areas, waterbodies, wetlands, or areas with special requirements along the construction work area;

5. Identifying erosion/sediment control and soil stabilization needs in all areas;

6. Ensuring that the location of dewatering structures and slope breakers will not direct water into known cultural resources sites or locations of sensitive species;

7. Verifying that trench dewatering activities do not result in the deposition of sand, silt, and/or sediment near the point of discharge into a wetland or waterbody. If such deposition is occurring, the dewatering activity shall be stopped and the design of the discharge shall be changed to prevent reoccurrence;

8. Ensuring that subsoil and topsoil are tested in agricultural and residential areas to measure compaction and determine the need for corrective action;

9. Advising the Chief Construction Inspector when conditions (such as wet weather) make it advisable to restrict construction activities to avoid excessive rutting;

10. Ensuring restoration of contours and topsoil;

11. Verifying that the soils imported for agricultural or residential use have been certified as free of noxious weeds and soil pests, unless otherwise approved by the landowner;

12. Determining the need for and ensuring that erosion controls are properly installed, as necessary, to prevent sediment flow into wetlands, waterbodies, sensitive areas, and onto roads;

13. Inspecting and ensuring the maintenance of temporary erosion control measures at least:

    a. on a daily basis in areas of active construction or equipment operation;
    b. on a weekly basis in areas with no construction or equipment operation; and
    c. within 24 hours of each 0.5 inches of rainfall.

14. Ensuring the repair of all ineffective temporary erosion control measures within 24 hours of identification;

15 Keeping records of compliance during active construction and restoration that document adherence to environmental conditions specified in the Certificate as well as mitigation measures proposed by Port Dolphin in the FERC application and other federal or state environmental permits; and

16. Identifying areas that should be given special attention to ensure stabilization and restoration after the construction phase.

III. PRECONSTRUCTION PLANNING

Port Dolphin shall do the following before construction:

A. CONSTRUCTION WORK AREAS

1. Identify all construction work areas (e.g., construction right-of-way [ROW], extra work space areas, pipe storage and contractor yards, borrow and disposal areas, access roads, etc.) that would be needed for safe construction. Port Dolphin must ensure that appropriate cultural resources and biological surveys have been conducted.

2. Port Dolphin is encouraged to consider expanding any required cultural resources and endangered species surveys in anticipation of the need for activities outside of certificated work areas.

B. DRAIN TILE AND IRRIGATION SYSTEMS

1. Attempt to locate existing drain tiles and irrigation systems.

2. Contact landowners and local soil conservation authorities to determine the locations of future drain tiles that are likely to be installed within 3 years of authorized construction.

3. Develop procedures for constructing through drain-tiled areas, maintain irrigation systems during construction, and repair drain tiles and irrigation systems after construction.

4. Engage qualified drain tile specialists, as needed, to conduct or monitor repairs to drain tile systems affected by construction. Use drain tile specialists from the project area, if available.

C. GRAZING DEFERMENT

Develop grazing deferment plans with willing landowners, grazing permittees, and land management agencies to minimize grazing disturbance of revegetation efforts.

D. ROAD CROSSINGS AND ACCESS POINTS

Plan for safe and accessible conditions at all roadway crossings and access points during construction and restoration.

E. DISPOSAL PLANNING

Determine methods and locations for the disposal of construction debris (e.g., timber, slash, mats, garbage, drilling fluids, excess rock, etc). Off-site disposal in other than commercially operated disposal locations is subject to compliance with all applicable survey, landowner permission, and mitigation requirements.

F. AGENCY COORDINATION

Port Dolphin must coordinate with the appropriate local, state, and federal agencies as outlined in this Plan and in the Certificate.

1. Obtain written recommendations from the local soil conservation authorities or land management agencies regarding permanent erosion control and revegetation specifications.

2. Develop specific procedures in coordination with the appropriate agency to prevent the introduction or spread of noxious weeds and soil pests resulting from construction and restoration activities.

G. STORMWATER POLLUTION PREVENTION PLAN

Make available on each construction spread the Stormwater Pollution Prevention Plan prepared for compliance with the U.S. Environmental Protection Agency's National Stormwater Program General Permit requirements.

IV. INSTALLATION

A. APPROVED AREAS OF DISTURBANCE

1. Project-related ground disturbance shall be limited to the construction ROW, extra work space areas, pipe storage yards, borrow and disposal areas, access roads, and other areas approved in the Certificate. Any project-related ground disturbing activities outside these Certificated areas, except those needed to comply with this Plan and the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**) (e.g., slope breakers, energy-dissipating devices, dewatering structures, and drain tile system repairs) will require prior Director approval. All construction or restoration activities outside of the Certificated areas are subject to all applicable survey and mitigation requirements.

2. The construction ROW width for a project shall not exceed 75 feet, or that described in the FERC application, unless otherwise modified by a Certificate condition. However, in limited, nonwetland areas, this construction ROW width may be expanded by up to 25 feet without Director approval to accommodate full construction ROW topsoil

segregation and to ensure safe construction where topographic conditions (such as side-slopes) or soil limitations require it. Twenty-five feet of extra construction ROW width may also be used in limited, non-wetland or non-forested areas for truck turn-arounds where no reasonable alternative access exists.

Project use of these additional limited areas is subject to landowner approval and compliance with all applicable survey and mitigation requirements. When such additional areas are used, each one should be identified and the need explained in the weekly or biweekly construction reports to the FERC, if required. The following material should be included in the reports:

a. the location of each additional area by station number and reference to a previously filed alignment sheet, or updated alignment sheets showing the additional areas;
b. identification of where the Commission's records contain evidence that the additional areas were previously surveyed; and
c. a statement that landowner approval has been obtained and is available in project files.

Prior written approval of the Director is required when the Certificated construction ROW width would be expanded by more than 25 feet.

B. TOPSOIL SEGREGATION

1. Unless the landowner or land management agency specifically approves otherwise, prevent the mixing of topsoil with subsoil by stripping topsoil from either the full work area or from the trench and subsoil storage area (ditch plus spoil side method) in:

   a. actively cultivated or rotated croplands and pastures;
   b. residential areas;
   c. hayfields; and
   d. other areas at the landowner's or land managing agency’s request.

2. In residential areas, importation of topsoil is an acceptable alternative to topsoil segregation.

3. In deep soils (more than 12 inches of topsoil), segregate at least 12 inches of topsoil. In soils with less than 12 inches of topsoil make every effort to segregate the entire topsoil layer.

4. Where topsoil segregation is required, maintain separation of salvaged topsoil and subsoil throughout all construction activities.

5. Segregated topsoil may not be used for padding the pipe.

C. DRAIN TILES

1. Mark locations of drain tiles damaged during construction.

2. Probe all drainage tile systems within the area of disturbance to check for damage.

3. Repair damaged drain tiles to their original or better condition. Do not use filter-covered drain tiles unless the local soil conservation authorities and the landowner agree. Use qualified specialists for testing and repairs.

4. For new pipelines in areas where drain tiles exist or are planned, ensure that the depth of cover over the pipeline is sufficient to avoid interference with drain tile systems. For adjacent pipeline loops in agricultural areas, install the new pipeline with at least the same depth of cover as the existing pipeline(s).

D. IRRIGATION

Maintain water flow in crop irrigation systems, unless shutoff is coordinated with affected parties.

E. ROAD CROSSINGS AND ACCESS POINTS

1. Maintain safe and accessible conditions at all road crossings and access points during construction.

2. If crushed stone access pads are used in residential or active agricultural areas, place the stone on synthetic fabric to facilitate removal.

F. TEMPORARY EROSION CONTROL

Install temporary erosion controls immediately after initial disturbance of the soil. Temporary erosion controls must be properly maintained throughout construction (on a daily basis) and reinstalled as necessary (such as after backfilling of the trench) until replaced by permanent erosion controls or restoration is complete.

1. Temporary Slope Breakers

a. Temporary slope breakers are intended to reduce runoff velocity and divert water off the construction ROW. Temporary slope breakers may be constructed of materials such as soil, silt fence, staked hay or straw bales, or sand bags.

b. Install temporary slope breakers on all disturbed areas, as necessary, to avoid excessive erosion. Temporary slope breakers must be installed on slopes greater than 5% where the base of the slope is less than 50 feet from waterbodies, wetlands, or road crossings at the following spacing (closer spacing should be used if necessary):

Temporary Slope Breaker	
Slope (%)	Spacing (ft)
5-15	300
>15-30	200
>30	100

c. Direct the outfall of each temporary slope breaker to a stable, well vegetated area or construct an energy-dissipating device at the end of the slope breaker and off the construction ROW.

d. Position the outfall of each temporary slope breaker to prevent sediment discharge into wetlands, waterbodies, or other sensitive resources.

2. Sediment Barriers

a. Sediment barriers are intended to stop the flow of sediments and prevent the deposition of sediments into sensitive resources. They may be constructed of materials such as silt fence, staked hay or straw bales, compacted earth (e.g., driveable berms across travelways), sand bags, or other appropriate materials.
b. At a minimum, install and maintain temporary sediment barriers across the entire construction ROW at the base of slopes greater than 5% where the base of the slope is less than 50 feet from a waterbody, wetland, or road crossing until revegetation is successful as defined in this Plan. Leave adequate room between the base of the slope and the sediment barrier to accommodate ponding of water and sediment deposition.
c. Where wetlands or waterbodies are adjacent to and downslope of construction work areas, install sediment barriers along the edge of these areas, as necessary, to prevent sediment flow into the wetland or waterbody.

3. Mulch

a. Apply mulch on all slopes (except in actively cultivated cropland) concurrent with or immediately after seeding, where necessary to stabilize the soil surface and to reduce wind and water erosion. Spread mulch uniformly over the area to cover at least 75 percent of the ground surface at a rate of 2 tons/acre of straw or its equivalent, unless the local soil conservation authority, landowner, or land managing agency approves otherwise in writing.
b. Mulch can consist of weed-free straw or hay, wood fiber hydromulch, erosion control fabric, or some functional equivalent.
c. Mulch <u>before</u> seeding if:

(1) final grading and installation of permanent erosion control measures will not be completed in an area within 20 days after the trench in that area is backfilled (10 days in residential areas), as required in **Section V.A.1**; or
(2) construction or restoration activity is interrupted for extended periods, such as when seeding cannot be completed due to seeding period restrictions.

d. If mulching <u>before</u> seeding, increase mulch application on all slopes within 100 feet of waterbodies and wetlands to a rate of 3 tons/acre of straw or equivalent.
e. If wood chips are used as mulch, do not use more than 1 ton/acre and add the equivalent of 11 lbs/acre available nitrogen (at least 50% of which is slow release).
f. Ensure that mulch is adequately anchored to minimize loss due to wind and water.
g. When anchoring with liquid mulch binders, use rates recommended by the manufacturer. Do not use liquid mulch binders within 100 feet of wetlands or waterbodies.
h. Install erosion control fabric on waterbody banks at the time of final bank recontouring. Anchor the erosion control fabric with staples or other appropriate devices.

V. RESTORATION

A. CLEANUP

1. Commence cleanup operations immediately following backfill operations. Complete final grading, topsoil replacement, and installation of permanent erosion control structures within 20 days after backfilling the trench (10 days in residential areas). If seasonal or other weather conditions prevent compliance with these time frames, maintain temporary erosion controls (temporary slope breakers and sediment barriers) until conditions allow completion of cleanup.

   Port Dolphin should file with the Secretary for the review and written approval of the Director, a winterization plan if construction will continue into the winter season when conditions could delay successful decompaction, topsoil replacement, or seeding until the following spring.

2. A travel lane may be temporarily left open to allow access by construction traffic if the temporary erosion control structures are installed (as specified in **Section IV.F**), inspected, and maintained (as specified in **Sections II.B.12** through **14**). When access is no longer required, the travel lane must be removed and the ROW restored.

3. Rock excavated from the trench may be used to backfill the trench only to the top of the existing bedrock profile. Rock that is not returned to the trench should be considered construction debris, unless approved for use as mulch or for some other use on the construction work areas by the landowner or land managing agency.

4. Remove excess rock from at least the top 12 inches of soil in all actively cultivated or rotated cropland and pastures, hayfields, and residential areas, as well as other areas at the landowner's request. The size, density, and distribution of rock on the construction work area should be similar to adjacent areas not disturbed by construction. The landowner may approve other provisions in writing.

5. Grade the construction ROW to restore preconstruction contours and leave the soil in the proper condition for planting.

6. Remove construction debris from all construction work areas unless the landowner or land managing agency approves otherwise.

7. Remove temporary sediment barriers when replaced by permanent erosion control measures or when revegetation is successful.

B. PERMANENT EROSION CONTROL DEVICES

1. Trench Breakers

   a. Trench breakers are intended to slow the flow of subsurface water along the trench. Trench breakers may be constructed of materials such as sand bags or polyurethane foam. Do not use topsoil in trench breakers.
   b. An engineer or similarly qualified professional shall determine the need for and spacing of trench breakers. Otherwise, trench breakers shall be installed at the same spacing as and upslope of permanent slope breakers.
   c. In agricultural fields and residential areas where slope breakers are not typically required, install trench breakers at the same spacing as if permanent slope breakers were required.
   d. At a minimum, install a trench breaker at the base of slopes greater than 5% where the base of the slope is less than 50 feet from a waterbody or wetland and where needed to avoid draining a waterbody or wetland.

2. Permanent Slope Breakers

   a. Permanent slope breakers are intended to reduce runoff velocity, divert water off the construction ROW, and prevent sediment deposition into sensitive resources. Permanent slope breakers may be constructed of materials such as soil, sand bags, or some functional equivalent.
   b. Construct and maintain permanent slope breakers in all areas, except cultivated areas and lawns, using spacing recommendations obtained from the local soil conservation authority or land managing agency.

   In the absence of written recommendations, use the following spacing unless closer spacing is necessary to avoid excessive erosion on the construction ROW:

Permanent Slope Breaker	
Slope (%)	Spacing (ft)
5-15	300
>15-30	200
>30	100

   c. Construct slope breakers to divert surface flow to a stable area without causing water to pool or erode behind the breaker. In the absence of a stable area, construct appropriate energy-dissipating devices at the end of the breaker.
   d. Slope breakers may extend slightly (about 4 feet) beyond the edge of the construction ROW to effectively drain water off the disturbed area. Where slope breakers extend beyond the edge of the construction ROW, they are subject to compliance with all applicable survey requirements.

C. SOIL COMPACTION MITIGATION

1. Test topsoil and subsoil for compaction at regular intervals in agricultural and residential areas disturbed by construction activities. Conduct tests on the same soil type under

similar moisture conditions in undisturbed areas to approximate preconstruction conditions. Use penetrometers or other appropriate devices to conduct tests.

2. Plow severely compacted agricultural areas with a paraplow or other deep tillage implement. In areas where topsoil has been segregated, plow the subsoil before replacing the segregated topsoil.

   Alternatively, make arrangements with the landowner to plant and plow under a "green manure" crop, such as alfalfa, to decrease soil bulk density and improve soil structure. If subsequent construction and cleanup activities result in further compaction, conduct additional tilling.

3. Perform appropriate soil compaction mitigation in severely compacted residential areas.

D. REVEGETATION

1. General

   Port Dolphin is responsible for the following:

   a. Ensure successful revegetation of soils disturbed by project-related activities, except as noted in **Section V.D.1.b**; and
   b. Restore all turf, ornamental shrubs, and specialized landscaping in accordance with the landowner's request, or compensate the landowner. Restoration work must be performed by personnel familiar with local horticultural and turf establishment practices.

2. Soil Additives

   Fertilize and add soil pH modifiers in accordance with written recommendations obtained from the local soil conservation authority, land management agencies, or landowner. Incorporate recommended soil pH modifier and fertilizer into the top 2 inches of soil as soon as possible after application.

3. Seeding Requirements

   a. Prepare a seedbed in disturbed areas to a depth of 3 to 4 inches using appropriate equipment to provide a firm seedbed. When hydroseeding, scarify the seedbed to facilitate lodging and germination of seed.
   b. Seed disturbed areas in accordance with written recommendations for seed mixes, rates, and dates obtained from the local soil conservation authority or as requested by the landowner or land management agency. Seeding is not required in actively cultivated croplands unless requested by the landowner.
   c. Perform seeding of permanent vegetation within the recommended seeding dates. If seeding cannot be done within those dates, use appropriate temporary erosion control measures discussed in **Section IV.F** and perform seeding of permanent vegetation at the beginning of the next recommended seeding season. Lawns may be seeded on a schedule established with the landowner.

d. In the absence of written recommendations from the local soil conservation authorities, seed all disturbed soils within 6 working days of final grading, weather and soil conditions permitting, subject to the specifications in **Section V.D.3.a-c**.
e. Base seeding rates on Pure Live Seed. Use seed within 12 months of seed testing.
f. Treat legume seed with an inoculant specific to the species using the manufacturer's recommended rate of inoculant appropriate for the seeding method (broadcast, drill, or hydro).
g. In the absence of written recommendations from the local soil conservation authorities, landowner, or land managing agency to the contrary, a seed drill equipped with a cultipacker is preferred for seed application.

Broadcast or hydroseeding can be used in lieu of drilling at double the recommended seeding rates. Where seed is broadcast, firm the seedbed with a cultipacker or imprinter after seeding. In rocky soils or where site conditions may limit the effectiveness of this equipment, other alternatives may be appropriate (e.g., use of a chain drag) to lightly cover seed after application, as approved by the Environmental Inspector.

VI. OFF-ROAD VEHICLE CONTROL

Port Dolphin shall offer to install and maintain measures to control unauthorized vehicle access to the ROW for each owner or manager of forested lands. These measures may include:

a. Signs;
b. Fences with locking gates;
c. Slash and timber barriers, pipe barriers, or a line of boulders across the ROW; and
d. Conifers or other appropriate trees or shrubs across the ROW.

VII. POST-CONSTRUCTION ACTIVITIES

A. MONITORING AND MAINTENANCE

1. Conduct follow-up inspections of all disturbed areas after the first and second growing season to determine the success of revegetation.

2. Revegetation in nonagricultural areas shall be considered successful if, upon visual survey, the density and cover of nonnuisance vegetation are similar in density and cover to adjacent undisturbed lands. In agricultural areas, revegetation shall be considered successful if crop yields are similar to adjacent undisturbed portions of the same field. Continue revegetation efforts until revegetation is successful.

3. Monitor and correct problems with drainage and irrigation systems resulting from pipeline construction in active agricultural areas until restoration is successful.

4. Restoration shall be considered successful if the ROW surface condition is similar to adjacent undisturbed lands, construction debris is removed (unless requested otherwise by the land owner or land managing agency), revegetation is successful, and proper drainage has been restored.

5. Routine vegetation maintenance clearing shall not be done more frequently than every 3 years. However, to facilitate periodic corrosion and leak surveys, a corridor not exceeding 10 feet in width centered on the pipeline may be maintained annually in a herbaceous state. In no case shall routine vegetation maintenance clearing occur between April 15 and August 1 of any year.

6. Efforts to control unauthorized off-road vehicle use, in cooperation with the landowner, shall continue throughout the life of the project. Signs, gates, and vehicle trails will be maintained, as necessary.

B. REPORTING

1. Port Dolphin shall maintain the following records that identify by milepost:

   a. method of application, application rate, and type of fertilizer, pH modifying agent, seed, and mulch used;
   b. acreage treated;
   c. dates of backfilling and seeding;
   d. names of landowners requesting special seeding treatment and a description of the follow-up actions; and
   e. any problem areas and how they were addressed.

2. Port Dolphin shall file with the Secretary quarterly activity reports documenting problems, including those identified by the landowner, and corrective actions taken for at least 2 years following construction.

ATTACHMENT A.10

DEWATERING PLAN

CLIENT:

PortDolphin

PROJECT:

PORT DOLPHIN'S 46-MILE, 36-INCH NATURAL GAS PIPELINE FLORIDA

DOCUMENT:

Dewatering Plan

Contents

1 Introduction

Hoegh LNG has requested Pipeline Engineering Solutions, Inc. (PESI) to draft a Dewatering Plan for the terrestrial portion of the Port Dolphin Deepwater Port pipeline. The Dewatering Plan describes the methods proposed to remove or prevent the encroachment of ground water, storm water, and surface water into the pipeline construction ditch/area in order to facilitate a dry environment for installing the pipeline. A typical arrangement of dewatering equipment is shown in **Drawing 26017-A-7018**.

This Dewatering Plan divides the pipeline into a number of sections in order to allow a more effective way to describe the different and unique methods used for the dewatering process. Each section of the pipeline is described by using the "Foot Markers" (FM) to define the beginning and end point of each section.

2 Construct Zone C Areas

The project proposes to construct two storm water ponds as shown on **Drawing 26017-D-3503**.

The storm water pond east of the coating area will be abandoned after construction of the pipeline while the other pond will be a permanent change.

3 From the Bulkhead to the Offshore HDD Tie-in, Approximately FM 0 – FM 1330

The intended plan for the pipeline construction is that it shall be completed as quickly as is safe and reasonable so the excavation sites can be backfilled and restored soon after the pipe is installed.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pit will have a silt fence around its perimeter. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

Discharges from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

Outflow from this dewatering operation will discharge to the south conveyance ditch through a filter bag system.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of the Florida Department of Environmental Protection (FDEP) 62-302 F.A.C. Dissolved oxygen concentrations shall be maintained at a minimum of 5 mg/L and turbidity shall be maintained at a maximum of 25 nephelometric turbidity units (NTU). Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

4 From the Point where the Pipeline Enters the South Conveyance Ditch to West of the Mangroves, Approximately FM 1330 – FM 2250

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

A sheet pile fence will be installed near the radio tower, close to FM 1500 - FM 1600, to prevent soil movement around the tower's foundation.

The port areas to the north of the south drainage ditch drain to the south and enter the south conveyance ditch at approximately FM 500, FM 700, and FM 2300. The project intends to not block off the culverts at FM 500 and FM 700 during construction. The project expects the culvert at FM 2300 to be blocked off less than 5 days.

Plug #1 will be set west of where the pipeline enters the south conveyance ditch, at approximately FM 1200, to limit tidal waters entering the excavation site.

Plug #2A will be set west of the outfall to the mangroves, at approximately FM 2250, to divert storm water runoff into that outfall. A diversion channel will convey surface waters from the mangrove outfall channel into the existing storm water pond south of Warehouse 11. Details of the diversion system are provided in **Figure E-III-K(2)**.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

Outflow from this dewatering operation will discharge to the south conveyance ditch to the west of Plug #1 through a filter bag system.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be maintained at a minimum of 5 mg/L and turbidity shall be maintained at a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

Before excavation for the pipeline begins, the new East Bridge will be built, the old East Bridge will be demolished, and the old East Bridge rubble will be removed.

The dewatering plan for this section of the project will apply to the new East Bridge construction, the old East Bridge demolition, the old East Bridge removal, and the pipeline construction.

5 From West of the Mangroves to East of the Mangroves Outfall, Approximately FM 2250 – FM 2550

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

Plug #1 will be removed.

Plug #2B, at approximately FM 2200, will be set west of Plug #2A at a distance sufficient to allow tie-in of the next string of pipe to the string of pipe already laid in the excavation trench.

Plug #2A will be removed.

The port areas to the north of the south drainage ditch drain to the south and enter the south conveyance ditch at approximately FM 500, FM 700, and FM 2300. The project intends to not block off culverts at FM 500 and FM 700 during construction. The project expects the culvert at FM 2300 to be blocked off less than 5 days.

Plug #3A will be set at approximately FM 2550.

A 3,000-gpm pump will be placed near Plug #3A to pump upstream storm runoff through temporary low-pressure, above-ground 10-inch diameter or greater collapsible hoses from east of Plug #3A to west of Plug #2B. A second 3,000-gpm pump will also be maintained on location, as a backup pump.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

Outflow from this dewatering operation will discharge to the south conveyance ditch west of Plug #2B through a filter bag system.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be maintained at a minimum of 5 mg/L and turbidity shall be maintained at a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

6 From East of the Mangroves Outfall to the Reeder Road Slick Bore Tie-in, Approximately FM 2550 – FM 4970

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

Plug #3B, at approximately FM 2500, will be set west of Plug #3A at a distance sufficient to allow tie-in of the next string of pipe to the string of pipe already laid in the excavation trench.

Plug #3A will be removed.

Plug #4, at approximately FM 5060, will be set north of South Dock Road and West of Reeder Road to block the culvert that crosses South Dock Road.

Just north of Plug #4 a culvert crosses Reeder Road. In that general area, a small water gathering pit will be excavated and lined with matting (see **Drawing 26017-A-7012**). This will be the primary draw area for one of the 3,000-gpm storm water pumps.

Plug #5, at approximately FM 5424, will be set north of South Dock Road and east of Reeder Road to block the culvert that crosses South Dock Road.

Plug #6 will be set in the south conveyance ditch south of South Dock Road and east of the culvert that crosses South Dock Road, at approximately FM 5425.

Plug #7 will be set in the ditch north of South Dock Road at approximately FM 3800, to block the north-south culvert in the area.

Plug #8, at approximately FM 5050, will be set in the south conveyance ditch west of Reeder Road and east of the proposed Reeder Road slick bore pit.

In the general area of Plug #8, a small water gathering pit will be excavated and lined with matting (see **Drawing 26017-A-7012**). This will be the primary draw area for one of the 3,000-gpm storm water pumps.

A 3,000-gpm storm water pump will be placed near Plug #4 to pump storm water runoff through temporary low-pressure, above-ground 10-inch diameter or greater collapsible hoses to west of Plug #2B. The water that collects upstream of Plug #6 and Plug #8 will be part of the suction header hose system of the 3,000-gpm storm water pump near Plug #4. A second 3,000-gpm pump will be placed near Plug #7 to pump storm water into the common header hose and then conveyed to west of Plug #2B. A third 3,000-gpm pump will also be maintained on location as a backup pump.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

Outflow from this dewatering operation will discharge to the south conveyance ditch west of Plug #1B through a filter bag system.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be maintained at a minimum of 5 mg/L and turbidity shall be maintained at a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

7 From the West Reeder Road Slick Bore Tie-in to the East Reeder Road Slick Bore Tie-in, Approximately FM 4970 – FM 5460

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters (see **Drawing 26017-A-7014**). If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

Plug #4 will be set north of South Dock Road and West of Reeder Road to block the culvert that crosses South Dock Road.

Just north of Plug #4 a culvert crosses Reeder Road. In that general area, a small water gathering pit will be excavated and lined with matting (see **Drawing 26017-A-7012**). This will be the primary draw area for the 3,000-gpm storm water pump.

Plug #5, at approximately FM 5424, will be set north of South Dock Road and east of Reeder Road to block the culvert that crosses South Dock Road.

Plug #6 will be set in the ditch south of South Dock Road and east of the culvert that crosses South Dock Road, at approximately FM 5425.

Plug #8, at approximately FM 5050, will be set in the south conveyance ditch west of Reeder Road and east of the proposed Reeder Road slick bore pit.

A 3,000-gpm pump will be placed near Plug #4 to pump storm water runoff through temporary low-pressure, above-ground 10-inch diameter or greater collapsible hoses to west of the Reeder Road slick bore construction area. The water that collects upstream of Plug #6 and Plug #8 will be part of the suction header hose system of the 3,000-gpm storm water pump near Plug #4. A second 3,000-gpm pump will also be maintained on location as a backup pump.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to west of the Reeder Road slick bore construction area. Temporary low-pressure, above-ground 10-inch diameter or greater collapsible hoses may be used to move the discharge a sufficient distance away from the construction area.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be maintained at a minimum of 5 mg/L and turbidity shall be maintained at a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

8 From the East Reeder Road Slick Bore Tie-in to the North Tank Farm HDD Tie-in, Approximately FM 5460 – FM 7390

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

Remove all plugs.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch west of the CSX railroad and east of the proposed pipeline corridor.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

9 From the North Tank Farm HDD Tie-in to the South Tank Farm HDD Tie-in, Approximately FM 7390 – FM 8630

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

Outflow from this dewatering operation will discharge to the ditch west of the CSX railroad and east of the proposed pipeline corridor railroad through a filter bag system.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be maintained at a minimum of 5 mg/L and turbidity shall be maintained at a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

10 From the South Tank Farm HDD Tie-in to the West CSX Railroad Dry Jack and Bore Tie-in, Approximately FM 8630 – FM 9910

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

Outflow from this dewatering operation will discharge to the ditch west of the CSX railroad and east of the proposed pipeline corridor through a filter bag system.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

11 From the West CSX Railroad Dry Jack and Bore Tie-in to the East CSX Railroad Dry Jack and Bore Tie-in, Approximately FM 9910 – FM 10130

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from dewatering operations west of the CSX railroad will discharge to the ditch west of the CSX railroad and east of the proposed pipeline corridor. Outflow from dewatering operations east of the CSX railroad will discharge to the ditch east of the CSX railroad.

There will be two sample points for this portion of the project, i.e. the east side and the west side of the CSX railroad. The sample points shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated. For the purposes of this section, the water samples will be tracked and treated as independent. Out of spec samples from the east side will not affect dewatering operations on the west side of the CSX railroad.

12 From the East CSX Railroad Dry Jack and Bore Tie-in to the West Highway 41 Slick Bore Tie-in, Approximately FM 10130 – FM 11070

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch east of the CSX railroad or the ditch west of Highway 41, whichever is most practical.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

13 From the West State Highway 41 Slick Bore Tie-in to the East Highway 41 Slick Bore Tie-in, Approximately FM 11070 – FM 11300

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters (see **Drawing 26017-A-7014)**. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from dewatering operations west of Highway 41 will discharge to the ditch west of Highway 41. Outflow from dewatering operations east of Highway 41 will discharge to the ditch east of State Highway 41.

There will be two sample points for this portion of the project, i.e. the east side and the west side of Highway 41. The sample points shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated. For the purposes of this section, the water samples will be tracked and treated as independent. Out of spec samples from the east side will not affect dewatering operations on the west side of Highway 41.

14 From the East Highway 41 Slick Bore Tie-in to West of the Florida Power and Light Company Borrow Pit (the Borrow Pit), Approximately FM 11300 – FM 11800

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch east of Highway 41 or the borrow pit, whichever is most practical.

Care should be taken to not fill the borrow pit to the point of overflow. If continued discharge of water to the borrow pit would cause it to overflow, then discharge should shift to the ditch east of Highway 41.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

15 From West of the Florida Power and Light Company Borrow Pit (the Borrow Pit) to East of the Borrow Pit, Approximately FM 11800 – FM 13000

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

During the course of construction, excess fill dirt may be produced by the project. Some of the fill dirt, if suitable for the application, may be used to fill in portions of the borrow pit required for construction work space.

Fill dirt may be taken from the borrow pit, if suitable for the application, and laid out on the temporary easement to windrow and dry. Once the fill dirt is dry it can be used to fill in portions of the borrow pit required for construction work space.

If excess fill dirt produced by the project and/or fill dirt taken from the borrow pit is not suitable for this use or not available in sufficient quantity, then suitable fill dirt from another source may be used to fill in portions of the borrow pit required for construction work space.

The partial fill of the borrow pit would be a permanent change.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch east of Highway 41, the borrow pit, or the ditch south of Buckeye Road, whichever is most practical.

Care should be taken to not fill the borrow pit to the point of overflow. If continued discharge of water to the borrow pit would cause it to overflow, then discharge should shift to the ditch east of Highway 41 or the ditch south of Buckeye Road.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

16 From East of the Florida Power and Light Company Borrow Pit to the West 31st Terrace East Slick Bore Tie-in, Approximately FM 13000 – FM 13840

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the borrow pit or the ditch south of Buckeye Road, whichever is most practical.

Care should be taken to not fill the borrow pit to the point of overflow. If continued discharge of water to the borrow pit would cause it to overflow, then discharge should shift to the ditch south of Buckeye Road.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every two hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

17 From the West 31st Terrace East Slick Bore Tie-in to the East 31st Terrace East Slick Bore Tie-in, Approximately FM 13840 – FM 13940

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters (see **Drawing 26017-A-7014**). If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from dewatering operations west and east of 31st Terrace East will discharge to the ditch south of Buckeye Road.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every two hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

18 From the East 31st Terrace East Slick Bore Tie-in to East of Bud Rhoden Road, Approximately FM 13940 – FM 15800

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

Bud Rhoden Road, a field gravel road, will be crossed using the open trench and backfill method (see **Drawing 26017-A-7013**). After backfilling the crossing, it will be compacted with road base material and given a final cover of gravel.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch south of Buckeye Road.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every two hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

19 From East of Bud Rhoden Road to the West Oneil Road Slick Bore Tie-in, Approximately FM 15800 – FM 19660

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

During the course of construction, excess fill dirt may be produced by the project. Some of the fill dirt, if suitable for the application, may be used to fill in the low lying areas of the Tami Sola wetlands required for construction work space.

If excess fill dirt produced by the project is not suitable for this use or not available in sufficient quantity, then suitable fill dirt from another source may be used to fill in the low lying areas of the Tami Sola wetlands required for construction work space.

The partial fill of the Tami Sola wetlands would be a permanent change.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch south of Buckeye Road or the ditch west of Oneil Road, whichever is most practical.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

20 From the West Oneil Road Slick Bore Tie-in to the East Oneil Road Slick Bore Tie-in, Approximately FM 19660 – FM 19930

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters (see **Drawing 26017-A-7014**). If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from dewatering operations west of Oneil Road will discharge to the ditch west of Oneil Road. Outflow from dewatering operations east of Oneil Road will discharge to the ditch east of Oneil Road.

There will be two sample points for this portion of the project, i.e., the east side and the west side of Oneil Road. The sample points shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated. For the purposes of this section, the water samples will be tracked and treated as independent. Out of spec samples from the east side will not affect dewatering operations on the west side of Oneil Road.

21 From the East Oneil Road Slick Bore Tie-in to the South Buckeye Road Slick Bore Tie-in, Approximately FM 19930 – FM 20130

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the ditch east of Oneil Road.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

22 From the South Buckeye Road Slick Bore Tie-in to the North Buckeye Road Slick Bore Tie-in, Approximately FM 20130 – 20500

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. Specifically, at a minimum, the bore pits will have a silt fence around their perimeters (see **Drawing 26017-A-7014**). If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

The water from dewatering operations south of Buckeye Road will discharge to the ditch east of Oneil Road. The water from dewatering operations north of Buckeye Road will discharge to the north-south running ditch to the west of the temporary easement.

There will be two sample points for this portion of the project, i.e. the south side and the north side of Buckeye Road. The sample points shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated. For the purposes of this section, the water samples will be tracked and treated as independent. Out of spec samples from the south side will not affect dewatering operations on the north side of Buckeye Road.

23 From the North Buckeye Road Slick Bore to the End of Line, Approximately FM 20500 – FM 20700

The construction shall be completed as quickly as is safe and reasonable so the excavation site can be backfilled and the site restored.

A silt fence (see **Drawing 26017-A-7002**) will be installed along the excavation site to help limit soil movement. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

If needed, a well point system of adequate size will be installed to a minimum depth of 3 feet below the planned bottom of the excavation site for dewatering of the excavation site. If well pointing is not required, water will be pumped out of the excavation ditch to the dewatering system, frac tanks, filter bag system, etc.

The discharge from any possible dewatering operation will be sent through as many frac tanks as required to achieve the water quality standards required at the sample point. The discharge referred to in this paragraph includes storm water, ground water, surface water, and all other water that enters the areas to be dewatered.

The dewatering operation water will discharge through a filter bag system.

Outflow from this dewatering operation will discharge to the north-south running ditch to the west of the temporary easement.

The sample point shall be where the water leaves the filter bag system.

Water quality shall satisfy the water quality standards of FDEP 62-302 F.A.C. Dissolved oxygen concentrations shall be a minimum of 5 mg/L and turbidity shall be a maximum of 25 NTU. Dissolved oxygen and turbidity shall be monitored with calibrated meters. Water samples shall be tested and results recorded every 2 hours during periods of discharge. If water samples do not satisfy water quality standard requirements, discharge shall be discontinued until water quality violations can be eliminated.

24 The Interconnection Station

The interconnection station property south of the topographic high point near the middle of the site will be graded to drain toward a permanent storm water pond that will be constructed on the property as a part of the project.

This storm water pond will be permanent, see **Figure 26017-A-3502**.

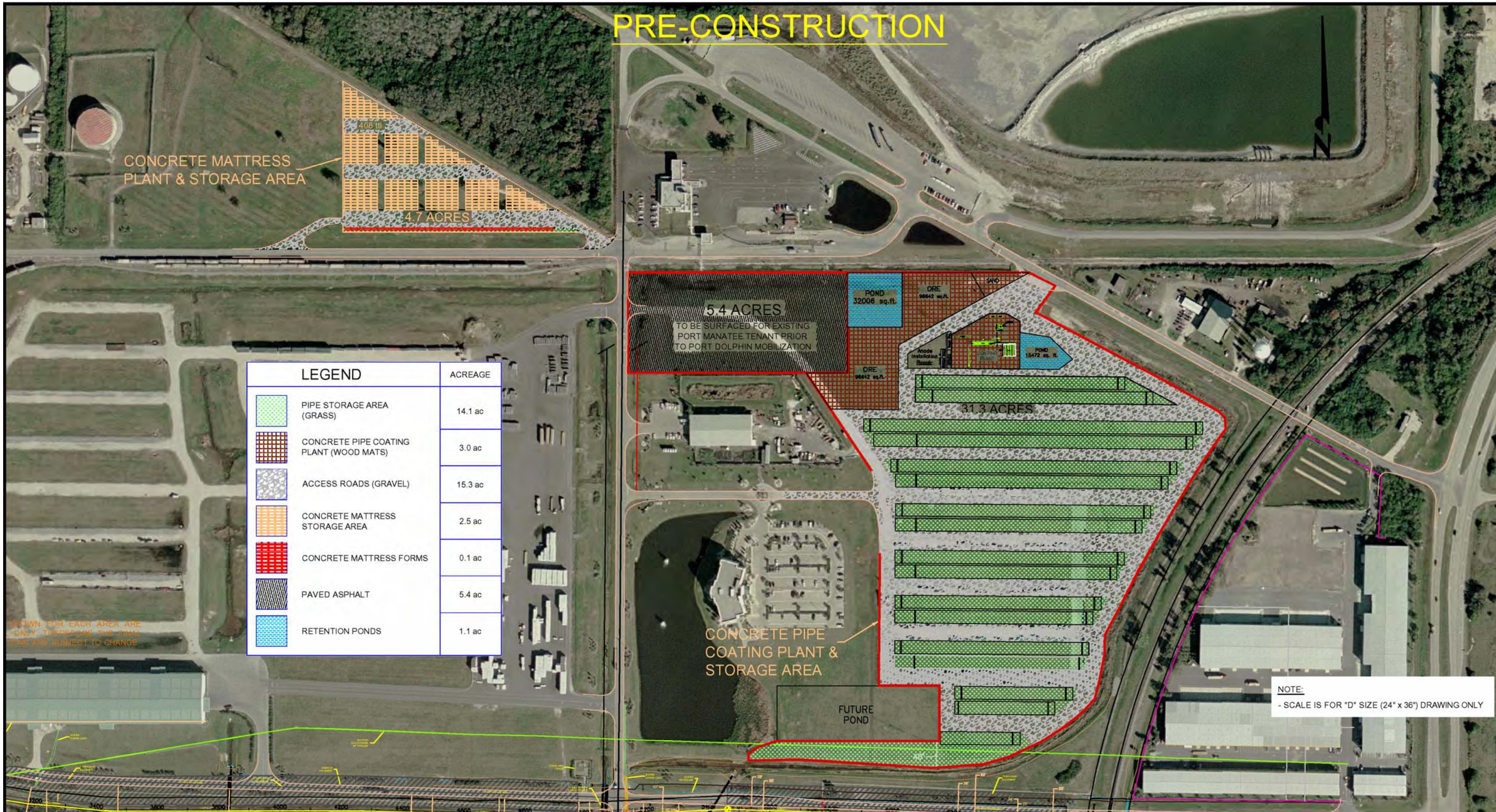
Some areas of the interconnection station will have temporary matting placed on it during construction.

A temporary road will be built along the east side of the temporary easement running north-south.

A silt fence (see **Drawing 26017-A-7002**) will be installed around the work areas. If required, erosion control fabric (see **Drawing 26017-A-7012**) and/or timber equipment mats (see **Drawing 26017-A-7001**) will be temporarily installed to help control soil stability and erosion during construction.

APPENDIX

DRAWINGS AND FIGURES



LEGEND	ACREAGE
PIPE STORAGE AREA (GRASS)	14.1 ac
CONCRETE PIPE COATING PLANT (WOOD MATS)	3.0 ac
ACCESS ROADS (GRAVEL)	15.3 ac
CONCRETE MATTRESS STORAGE AREA	2.5 ac
CONCRETE MATTRESS FORMS	0.1 ac
PAVED ASPHALT	5.4 ac
RETENTION PONDS	1.1 ac

REFERENCE DRAWINGS

DWG. NO.	DESCRIPTION

REVISIONS

NO	DATE	DESCRIPTION
A	3/17/08	FOR INFORMATION ONLY
B	4/10/08	NEW LAYOUT FOR ZONE "C"
C	6/17/08	RETENTION PONDS ADDED
0	12/05/08	ISSUED FOR USCG ADDENDUM II FILING

PIPELINE ENGINEERING SOLUTIONS, INC.
13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
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DRAWING STATUS

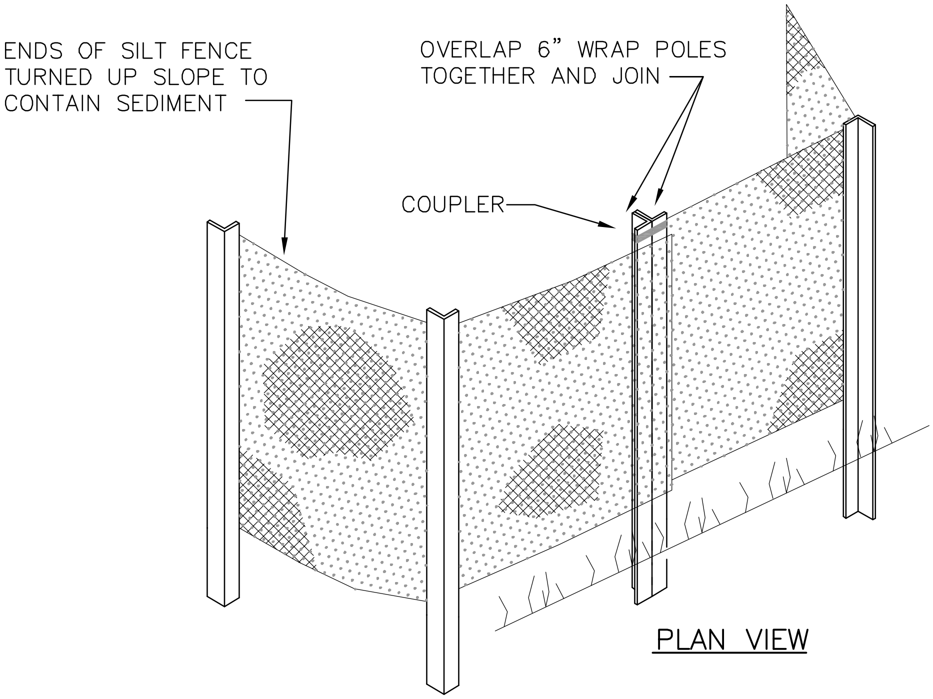
ISSUED FOR	DATE	BY
BID		
CONST.		
AS-BUILT		

SCALE	1"=100'
DRAWN	EHF
DATE	2/18/08
CHK'D	DJR
DATE	3/17/08
APPROVED	
DATE	
PESI JOB NO.	26017
AFE/P.O.NO.	
CLIENT FILE NO.	1088
PESI FILE NO.	26017-3503-0

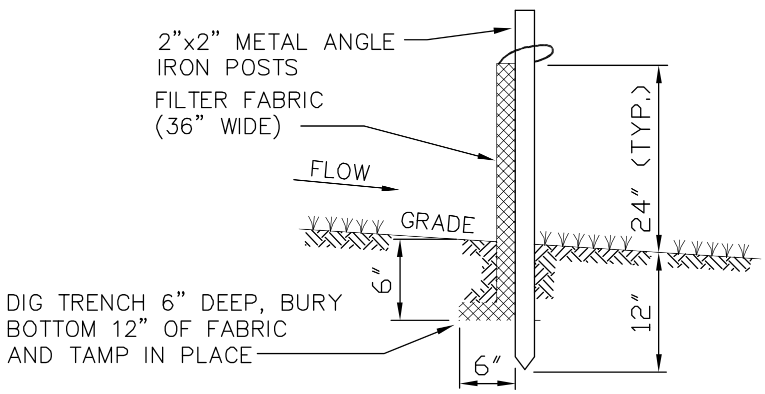
PortDolphin

TITLE: PROPOSED CONCRETE PLANT LAYOUT
PORT MANATEE
PORT DOLPHIN PIPELINE
MANATEE COUNTY, FLORIDA

NO. 26017-D-3503 REV. 0



PLAN VIEW



INSTALLATION REQUIREMENTS

- WHEN USING SILT FENCE PLACE IT:
  - BETWEEN DISTURBED AREAS AND DOWN-SLOPE ENVIRONMENTAL RESOURCE AREAS
  - AT THE BASE OF ALL SLOPES NEXT TO WETLANDS, WATERBODIES, AND ROAD CROSSING
  - AT THE INLET AND OUTLET OF OPEN DRAINAGE STRUCTURES
  - APPROXIMATELY 6 FEET BEYOND THE TOE OF THE SLOPE TO GIVE THE SEDIMENT ROOM TO COLLECT
- USE SANDBAGS OR BACKFILLING TO KEY IN THE BOTTOM OF THE FABRIC WHERE IT IS NOT FEASIBLE TO TRENCH IT IN (LEDGES, ROCKY SOIL, LARGE ROOTS, ETC.)

MAINTENANCE REQUIREMENTS:

- INSPECT SILT FENCE:
  - DAILY IN AREAS OF ACTIVE CONSTRUCTION
  - WEEKLY IN AREAS WITH NO CONSTRUCTION
  - WITHIN 24 HOURS FOLLOWING EACH MAJOR STORM EVENT.
- REPAIR OR REPLACE SILT FENCE AS NEEDED
- REMOVE ACCUMULATED SEDIMENTS TO AN UPLAND AREA AS NEEDED

PLOTTED BY: HEW DATE: 05/08/08 TIME:11:00A.M.

REVISION		
NO	DATE	DESCRIPTION
A	2/5/07	ISSUED FOR REVIEW
0	07/25/08	ISSUED FOR ERP DRAFT APPLICATION

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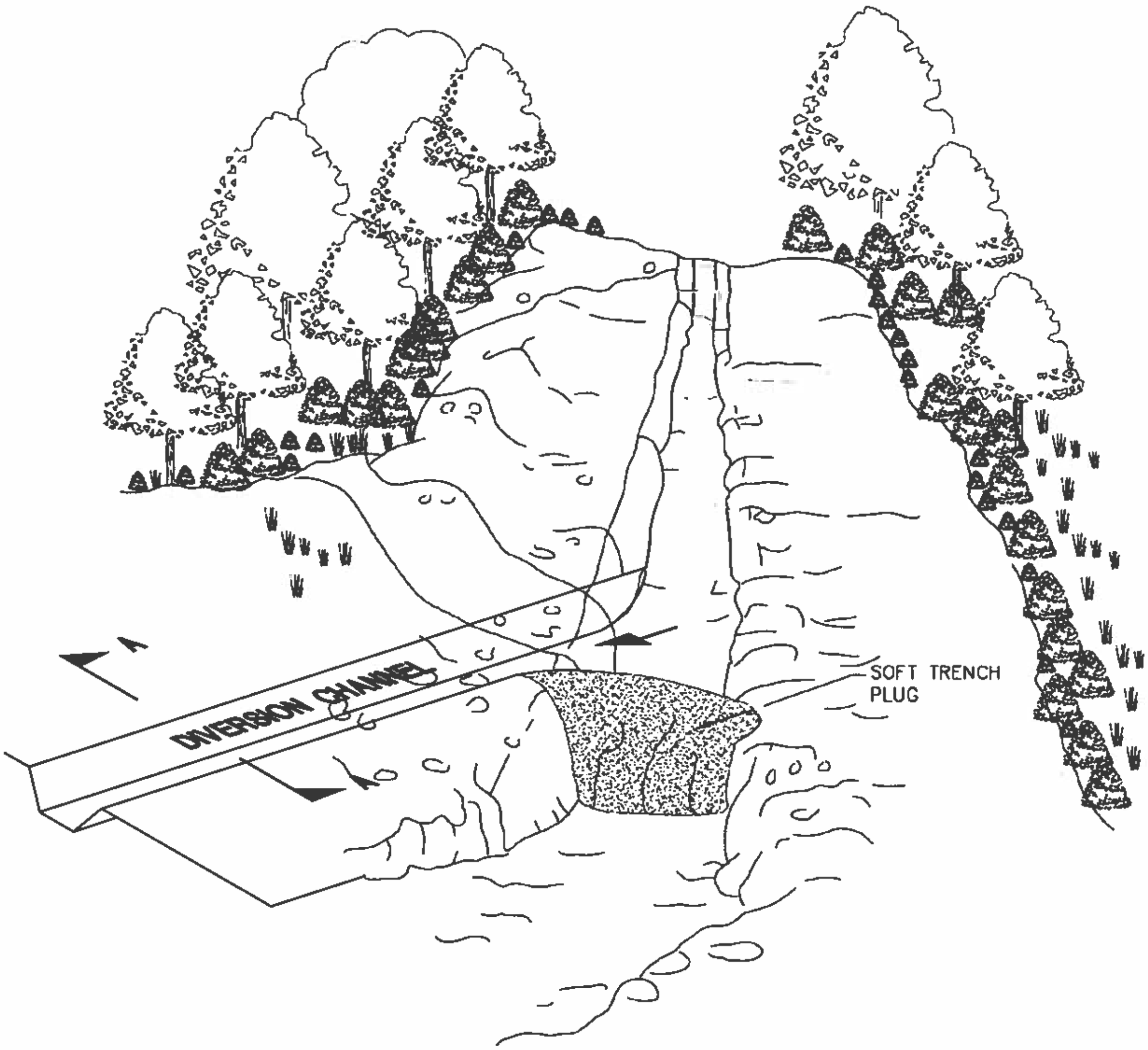
SCALE NTS	
DRAWN DJR	DATE 2/5/07
CHK'D RT	DATE
APPROVED	DATE
PESI JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO.	
PESI FILE NO. 26017-7002-0	

PortDolphin

TITLE
SILT FENCE INSTALLATION AND MAINTENANCE
FIGURE #2

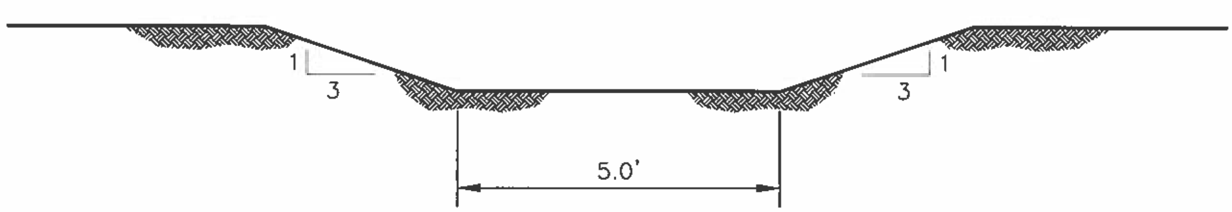
NO. 26017-A-7002 REV. 0

FILE PATH: 26017-7002-0



DIVERSION CHANNEL LAYOUT

N.T.S.



A TYPICAL CROSS SECTION

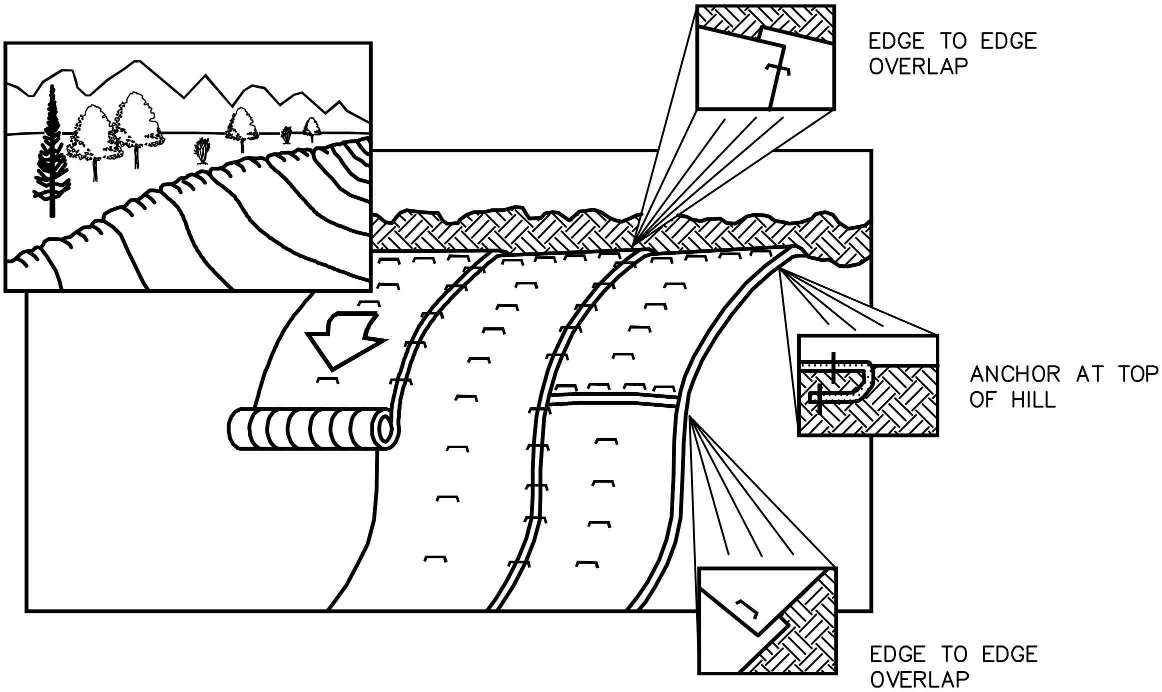
N.T.S.

NOTES:

1. TEMPORARY TRENCH PLUG WILL BE USED TO PREVENT WATER FROM OVERFLOWING INTO SENSITIVE RESOURCE AREA.
2. DIVERSION TRENCH BYPASS CHANNEL DIMENSIONS SECTION A.

ARDAMAN AND ASSOCIATES, INC.

FIGURE E-III-K(2)



NOTES:

1. EROSION CONTROL MATTING (BLANKETS) SHALL BE USED AT THE LOCATIONS IDENTIFIED IN THE PLAN AND OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
2. EROSION CONTROL MATTING SHALL MEET THE REQUIREMENTS SPECIFIED IN THE PLAN AND OR AS DIRECTED BY THE ENVIRONMENTAL INSPECTOR.
3. STAPLES SHALL BE MADE OF 11 GAUGE WIRE, U-SHAPED WITH 6" LEGS AND A 1" SQUARE CROWN. STAPLES SHALL BE DRIVEN INTO THE GROUND FOR THE FULL LENGTH OF THE STAPLE LEGS.
4. MATTING SHALL BE INSTALLED ACCORDING TO MANUFACTURER SPECIFICATIONS OR AS STATED BELOW:
   * EXTEND TOP OF BLANKET 3 FEET PAST THE UPPER EDGE OF THE SLOPE.
   * ANCHOR ("KEY") THE UPPER EDGE OF THE BLANKET INTO THE SLOPE USING A 6" DEEP TRENCH AND ROLL THE BLANKET DOWN THE HILL. DOUBLE STAPLE EVERY 12" BEFORE BACKFILLING AND COMPACTING TRENCH.
   * AVOID STRETCHING EROSION CONTROL MATTING (LOOSELY) DURING INSTALLATION.
   * BRING MAT ROLL BACK OVER THE TOP OF THE TRENCH AND CONTINUE TO ROLL DOWN SLOPE. STAPLE EVERY 12" WHERE MAT EXITS THE TRENCH AT THE TOP OF THE SLOPE.
   * WHEN BLANKETS ARE SPLICED DOWN-SLOPE TO ADJOINING MATS (SLOPE OR STREAM BANK MATS), THE UPPER BLANKET SHALL BE PLACED OVER THE LOWER MAT (SHINGLE STYLE) WITH APPROXIMATELY 6" OF OVERLAP. STAPLE THROUGH THE OVERLAPPED AREA EVERY 12".
   * OVERLAP ADJACENT BLANKETS 6". STAPLE EDGES OF BLANKETS AND CENTER EVERY 36".
5. IN LIVESTOCK AREAS WHERE EROSION CONTROL MATTING IS APPLIED TO THE SLOPES, FENCING WILL BE USED IF NECESSARY TO EXCLUDE LIVESTOCK, WITH PERMISSION OF THE LANDOWNER.
6. MONITOR WASHOUTS, STAPLE INTEGRITY, OR MAT MOVEMENT. REPLACE OR REPAIR AS NECESSARY.

REVISION

NO	DATE	DESCRIPTION
A	2/5/07	ISSUED FOR REVIEW
0	9/9/08	ISSUED DEWATERING PLAN

PIPELINE ENGINEERING SOLUTIONS, INC.

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SCALE NTS	
DRAWN DJR	DATE 2/5/07
CHK'D RT	DATE
APPROVED	DATE
PETC JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO.	
PETC FILE NO. 26017-7011-A	

PortDolphin

TITLE

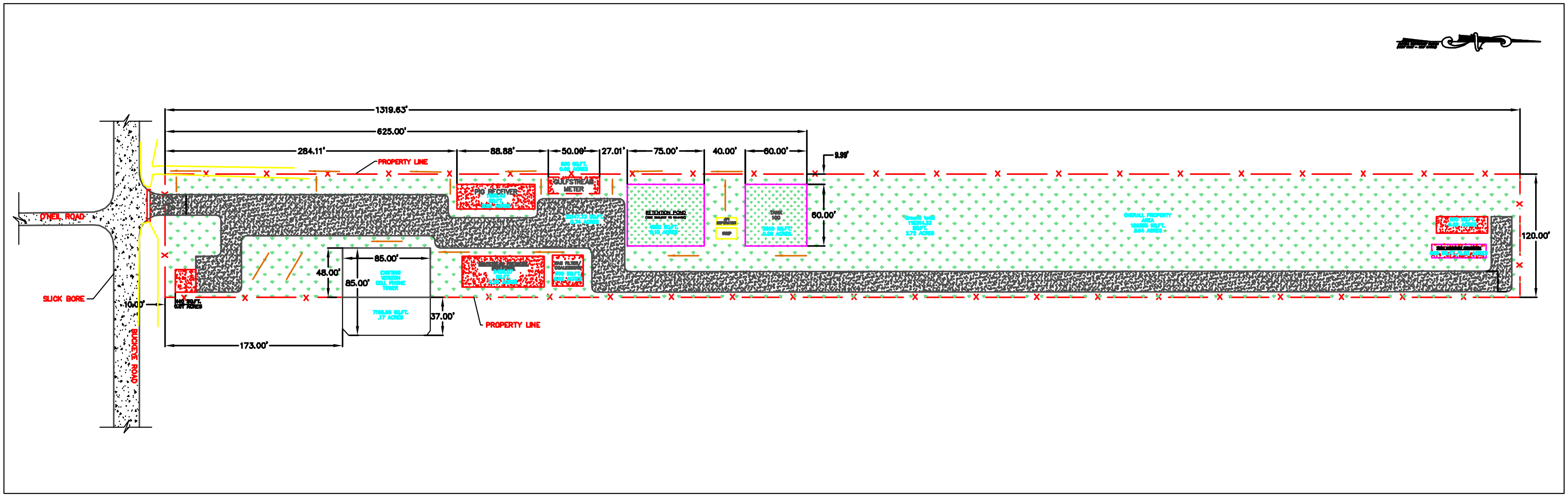
TYPICAL MATTING ON SLOPES

NO.	REV.
26017-A-7011	0

PLOTTED BY: HEW DATE: 05/08/08 TIME: 4:00 P.M.

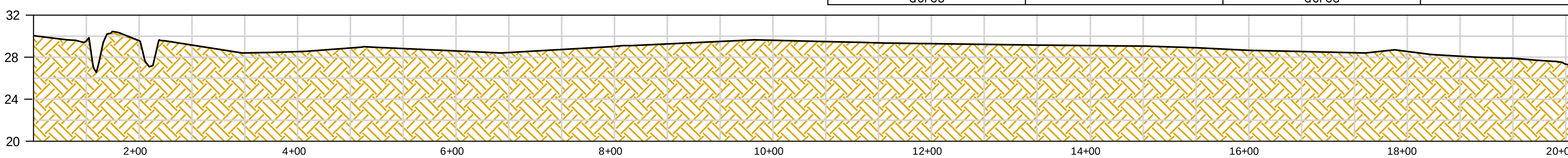
FILE PATH: 26017-7011-0

POST-CONSTRUCTION



PLAN
1" = 150'

SQUARE FEET & ACREAGE			
ASPHALT	CONCRETE	GRASS	OVERALL
32147.73 sq.ft. / 0.74 acres	7892.5 sq-ft / 0.18 acres	114234.33 sq.ft. / 2.62 acres	154275 sq.ft. / 3.54 acres



PROFILE
1" = 150'

REVISION		
NO	DATE	DESCRIPTION
A	7/24/08	ISSUED FOR REVIEW
0	8/28/08	ISSUED FOR ERP DRAFT APP.

PIPELINE ENGINEERING SOLUTIONS, INC.

13831 NORTHWEST FRWY. #312
HOUSTON, TEXAS 77040
BUS: (713) 690-9111
FAX: (713) 690-0060

SCALE 1" = 150'	
DRAWN NBG	DATE 7/24/08
CHK'D DJR	DATE 8/28/08
APPROVED	DATE
PETC JOB NO. 26017	
AFE/P.O.NO.	
CLIENT FILE NO. 1088	
PETC FILE NO. 26017-3502-0	

PortDolphin

TITLE
POST -GRADING PLAN WITH FLOW ARROWS
PROPOSED PORT DOLHIN
INTERCONNECTION STATIONS
MANATEE COUNTY, FLORIDA

NO. 26017-A-3502 REV. 0

ATTACHMENT A.11

ONSHORE POST-CONSTRUCTION RECOVERY AND MITIGATION PLAN

PORT DOLPHIN ENERGY LLC

ONSHORE POST-CONSTRUCTION

RECOVERY AND MITIGATION PLAN

TABLE OF CONTENTS

Page

1.0 INTRODUCTION

This plan describes the onshore recovery plan and proposed mitigation to off-set wetland impacts (forested and shrubby) that will result from constructing the proposed Port Dolphin pipeline project located in northwestern Manatee County, Florida (**Figure 1** – Location Map). Refer to flux maps in **Volume 3** for depiction of Project Area with Habitat Types (Florida Land Use and Cover Classification System [FLUCCS]).

Recovery activities will restore the impacted areas in accordance with the requirements outlined in the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**). Mitigation for wetland impacts within the Port Dolphin pipeline project area will be provided through a mitigation bank to off-set those impacts associated with the loss of forested and shrubby wetland components. The recovery and mitigation details are provided below.

2.0 PROJECT IMPACTS AND UMAM ASSESSMENT

A natural gas pipeline and construction activities associated with the placement of the pipeline underground are planned within the project area. Project impacts to forested, shrubby, and herbaceous wetlands will occur from placement of fill and excavation associated with the pipeline construction, horizontal directional drill staging, construction areas, and an interconnection station.

2.1 Project Impacts

Refer to **Volume I**, **Section 7.0** for a description of proposed conditions and anticipated project impacts. A summary of the temporary and permanent project impacts is provided below in **Table 1**. Wetlands account for a total of approximately 22.56% of the onshore portion of the pipeline project. The majority of impacts will be temporary in nature. Only the forested and shrubby habitats will be permanently impacted. In total, approximately 1.19 acres of wetland habitat (2.3%) will be permanently impacted. Approximately 10.71 acres of wetland habitats (20.3%) will be temporarily impacted.

Table 1
Summary of Project Impacts

Wetland	NWI Code	NWI Classification Type	Temporary Impact (Acres)	Permanent Impacts (Acres)	Length of Crossing (Feet)	Percent of Onshore Portion	Functional Loss
W-1	EOW/SS (3)	Estuarine Open Water/Scrub-Shrub	1.88	0.0	2,769.4	3.6	N/A
W-2	PFO/SS	Freshwater Forested/ Scrub-Shrub	0.60	0.35	505.2	1.8	0.10
W-3	PSS	Freshwater Scrub-Shrub	1.91	0.84	1,224.5	5.2	0.03
W-6	PEM/SS	Freshwater Emergent/ Scrub-Shrub	0.07	0.00	120.6	0.1	N/A
W-7	PSS	Freshwater Scrub-Shrub	0.03	0.00	22.3	0.06	N/A
W-8	PSS/EM	Freshwater Scrub-Shrub/ Emergent	0.15	0.00	168.7	0.3	N/A
W-9	PEM/L1OW(x)	Freshwater Emergent/ Lacustrine Limnetic Open Water (excavated)	5.46	0.00	3,533.2	10.4	N/A
W-10	PEM	Freshwater Emergent	0.37	0.00	137.9	0.7	N/A
W-11	POW	Freshwater Open Water	0.24	0.00	34.0	0.4	N/A
TOTAL			**10.71**	**1.19**	**8,515.8**	**22.56**	**0.13**

NWI = National Wetlands Inventory.

Figure 1
Port Dolphin Onshore Location

Temporary impacts will consist of clearing in the construction areas. All construction areas will be returned to preconstruction conditions. Therefore, impacts in herbaceous wetlands are temporary and do not require mitigation. Permanent impacts are proposed for maintaining the 30-foot permanent right-of-way (ROW). The wetlands will be cleared and allowed to naturally recruit. The ROW will be periodically mowed for maintaining the area and access. Refer to the Proposed Wetland Recovery Activities (**Section 3.2**) for a description of the temporary and permanent impacts associated with each wetland.

2.2 UMAM Assessment

Assessment of the project impacts and the extent of mitigation proposed are based on the Uniform Mitigation Assessment Method (UMAM), Chapter 62-345, Florida Administrative Code (F.A.C.). The UMAM analysis was conducted to evaluate the functional loss of wetlands associated with the project construction. The UMAM assessments demonstrate that there will be no net functional loss of wetlands associated with the construction of the project.

UMAM has been utilized to assess the function of two (2) of the nine (9) wetlands that are proposed for permanent impacts from the proposed project. Wetlands 2 and 3 will be impacted as a result of the loss of their forested and/or shrubby wetland component due to the clearing activities and maintaining the 30-foot permanent ROW for the proposed pipeline project.

The remaining seven (7) wetlands are proposed to have only temporary impacts and will be restored to preconstruction conditions. The recovery activities required by the Florida Energy Regulation Commission (FERC) will assure no loss of function in temporarily impacted herbaceous wetlands. Therefore, no mitigation or UMAM is required for Wetlands 1, 8, 9, 10, or 11.

Additionally, Wetlands 6 and 7 are ditches constructed in uplands and, according to the Southwest Florida Water Management District (SWFWMD) Basis of Review, will not require mitigation. UMAM forms have not been provided for Wetlands 6 and 7.

The total functional loss for forested/shrubby wetland impacts is 0.13 functional units (refer to UMAM documents provided at the end of **Attachment A.11**).

3.0 PROPOSED RECOVERY PLAN

3.1 Port Dolphin Project-specific Wetland and Waterbodies Construction and Mitigation Procedures

Port Dolphin will follow the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**). Construction methods outlined in this document include: complying with all state and federal permit conditions, using sediment barriers for spoil piles adjacent to waterbodies, and minimizing the time that the pipeline excavation trench is open. Any steps required to minimize impacts to the surface water sites will be followed, as appropriate, on a site-specific basis.

The recovery procedures planned for each wetland in the document include

- returning the wetlands to preconstruction grade and contours;
- returning the hydrology to preconstruction conditions;
- replacing top soil;

- revegetating forested and shrubby temporary construction areas with appropriate wetland species; and
- allowing natural recruitment of herbaceous species.

Refer to **Section 2.2** below for details on the specific recovery plan for each wetland.

3.2 Proposed Wetland Recovery Activities

The following outlines the specific recovery activities for each of the wetlands affected by the proposed pipeline project. Each wetland will be returned to preconstruction conditions and, in some cases, replanting of native vegetation is proposed to provide additional benefit to the area. If replanting is proposed, the species type, spacing, and number are provided below in tabular form.

3.2.1 Wetland 1

Wetland 1 is a tidally-influenced stormwater conveyance ditch that serves Port Manatee. The ditch, after construction, will be regraded and returned to original preconstruction conditions, and native estuarine species will recruit naturally into the temporarily impacted areas.

3.2.2 Wetland 2

Wetland 2 is a forested wetland dominated by Brazilian pepper. Approximately 0.57 acres of the wetland is classified as natural forested wetland. The remaining habitat is predominantly Brazilian pepper. The Brazilian pepper will be removed from the project area during construction. Areas utilized as temporary construction areas, outside of the 30-foot permanent ROW, will be replanted with native forested wetland species (0.60 acres). Both areas will be monitored and maintained with exotic/nuisance species removal for 6 months to allow wetland vegetation to become established and aid in erosion control. The 30-foot ROW will be periodically mowed throughout the operation of this pipeline. **Tables 2** and **3** list those species proposed for replanting in the temporary construction areas and 30-foot ROW.

Table 2
Recovery Area Planting for Wetland 2 – Temporary Construction Areas

Forested Species		DEP Status	Spacing	Impact Area (Acres)	Total Number of Plants
Common Name	Scientific Name				
Red maple	*Acer rubrum*	FACW	10-ft centers	0.60	87
Swamp dogwood	*Cornus foemina*	FACW	10-ft centers	0.60	87
Laurel oak	*Quercus laurifolia*	OBL	10-ft centers	0.60	87

DEP = Department of Environmental Protection.
FACW = Facultative Wet.
OBL = Obligate.

Table 3
Recovery Area Planting for Wetland 3 – Temporary Construction Areas

Shrub Species		DEP Status	Spacing	Impact Area (Acres)	Total Number of Plants
Common name	Scientific Name				
Buttonbush	*Cephalanthus occidentalis*	OBL	8-ft centers	1.90	431
Swamp dogwood	*Cornus foemina*	FACW	8-ft centers	1.90	431
Fetterbush	*Lyonia lucida*	FACW	8-ft centers	1.90	431

DEP = Department of Environmental Protection.
FACW = Facultative Wet.
OBL = Obligate.

3.2.3 Wetland 3

Wetland 3 is a scrub-shrub wetland dominated by Brazilian pepper. The wetland will be returned to its preconstruction grade and replanted with native wetland shrub species in those areas utilized for temporary construction (1.91 acres). Both areas will be monitored and maintained for 6 months to allow for the wetland vegetation to become established. **Table 3** lists those species proposed for replanting in the temporary construction areas.

3.2.4 Wetland 6

Wetland 6 is an agricultural drainage ditch that connects the project area to the swale system on the south side of Buckeye Road. This ditch has a pump that creates flow into the ditch system, which then connects to a large agricultural field. The ditch contains limited desirable wetland vegetation and Brazilian pepper. After construction, the ditch will be returned to its previous grade and allowed to recruit vegetation naturally. It is expected that the ditch will return to its previous condition shortly after construction.

3.2.5 Wetland 7

Wetland 7 is an agricultural drainage ditch that is dominated by wetland grasses and Brazilian pepper. The ditch provides a water source to the agricultural field located to the southeast of the project area. This ditch will be returned to its preconstruction grade, and natural recruitment will occur in both the temporary construction (0.02 acres) and permanent ROW (0.01 acres). Both areas will be monitored and maintained for 6 months to allow for the wetland vegetation to become established and for soil control.

3.2.6 Wetland 8

Wetland 8 will be returned to its previous grade after construction activities are completed. Brazilian pepper, which dominates the wetland, will be removed, and the wetland will be replanted with native shrub species. The wetland will be allowed to naturally recruit vegetation in both the temporary construction areas and permanent 30-foot ROW. Both areas will be monitored and maintained for 6 months to allow for the wetland vegetation to become established and for soil control.

3.2.7 Wetland 9

Wetland 9, a borrow pit, will be returned to its preconstruction grade after construction is completed. The cattails, which dominate the borrow pit, will be removed during construction. The habitat, in both the temporary construction areas and the 30-foot permanent ROW, will be allowed to naturally revegetate.

3.2.8 Wetland 10

Wetland 10 is a herbaceous system dominated by pasture grasses, *Juncus effusus*, and wetland grasses. The site did not exhibit the required hydrology component for either the U.S. Army Corps of Engineers (USACE) or the Florida Department of Environmental Protection (FDEP), and the soils were marginally hydric with minimal streaking in sandy soils. This site will not be directly impacted by the pipeline but will be temporarily impacted by construction activities. The site will be returned to its original grade, and vegetation will recruit naturally.

3.2.9 Wetland 11

Wetland 11 is a pond that serves the adjacent orange groves and is culverted to connect across Buckeye Road. The pond will be temporarily filled to provide an additional area for construction activities and storage. The pond itself will not be directly impacted by the pipeline and will be returned to its original grade after construction is completed. The pond will be allowed to naturally recruit and is expected to return to its original condition in a short period of time.

3.3 Monitoring, Maintenance, and Management

Invasive exotic plant species heavily dominate the project site and surrounding areas. Monitoring will occur after the work has been completed and the site has been restored to preconstruction elevations and revegetation as proposed. Monitoring will occur for 6 months immediately following the project. During this time the site will be reviewed for recruitment of vegetation, establishment of planted vegetation where appropriate, erosion control, and presence of invasive exotic plant species. Any invasive exotic plant species will be removed or treated to allow effective recovery by native wetland species. Monitoring, maintenance, and management will comply with the guidelines outlined in the Port Dolphin Project-specific Wetland and Waterbody Construction and Mitigation Procedures (**Attachment A.8**).

3.4 Mitigation

For this project, off-site mitigation in the form of a mitigation bank will be used to offset the loss of the forested and shrubby wetland component in the project area. The functional loss of wetland habitat on site will be offset by the required number of credits purchased from the bank. The use of a mitigation bank was chosen as the appropriate onshore mitigation option. Any on-site mitigation opportunities are not expected to have comparable long-term viability due to the large exotic/nuisance seed source present. The mitigation bank(s) will provide greater improvement in ecological value than any on-site mitigation option.

The Braden River Mitigation Bank is located in proximity to the project area and provides mitigation within the same watershed (Little Manatee River). The bank also has the types of credits needed to offset the potential impacts from the proposed project (forested and shrubby). The Braden River Mitigation Bank offers forested credits at a cost of $150,000 per credit and herbaceous credits at a cost of $125,000 per credit. This project will require a total of 0.13 credits for forested/shrubby wetland impacts.

UNIFORM MITIGATION ASSESSMENT METHOD (UMAM) DOCUMENTS

PART I – Qualitative Description
(See Section 62-345.400, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Port Dolphin		Wetland 2

FLUCCs code	Further classification (optional)	Impact or Mitigation Site?	Assessment Area Size
619/630		Impact	0.95

Basin/Watershed Name/Number	Affected Waterbody (Class)	Special Classification (i.e.OFW, AP, other local/state/federal designation of importance)
Lower Tampa Bay Watershed		None

Geographic relationship to and hydrologic connection with wetlands, other surface water, uplands

There appears to be a slight hydrologic connection via a swale system to adjacent wetlands. The wetland is surrounded by development and commercial areas.

Assessment area description

The assessment area is a forested/shrub scrub wetland dominated by Brazilian pepper. A few native trees are present along the eastern edge of the wetland. Leather fern and other fern species are present in the understory. Approximately 0.57 acres of forested wetlands are proposed for permanent impact.

Significant nearby features	Uniqueness (considering the relative rarity in relation to the regional landscape.)
South Dock Street to the north, FPL tank farm to the south, orange groves to the west, and commercial and railroad to the east.	Not unique, dominated by Brazilian Pepper.

Functions	Mitigation for previous permit/other historic use
Minimal functions; habitat for wildlife	N/A

Anticipated Wildlife Utilization Based on Literature Review (List of species that are representative of the assessment area and reasonably expected to be found)	Anticipated Utilization by Listed Species (List species, their legal classification (E, T, SSC), type of use, and intensity of use of the assessment area)
racoons, song birds, armadillo	-

Observed Evidence of Wildlife Utilization (List species directly observed, or other signs such as tracks, droppings, casings, nests, etc.):

racoons and armadillo

Additional relevant factors:

Area is dominated by Brazilian pepper in the wetland and in adjacent areas.

Assessment conducted by:	Assessment date(s):
Birkitt Environmental Services, Inc	11-01-07; 05-28-08

PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Port Dolphin		Wetland 2
Impact or Mitigation	**Assessment conducted by:**	**Assessment date:**
Impact (Temporary)	Birkitt Environmental Services, Inc.	11-01-07; 05-28-08

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

Indicator	w/o pres or current	with	Description
.500(6)(a) Location and Landscape Support	4	4	**Existing Conditions:** Wetland 2 is a forested/scrub shrub wetland dominated by Brazilian pepper. Brazilian pepper and several other exotic species (caster bean, elephant grass, etc) are located within and directly adjacent to the wetland habitat. Agricultural fields, South dock road, the railroad, a ROW, and the FPL tank farm all provide barriers for wildlife to and from the area. The wetland is only seasonally connected to a swale system that may provide a nexus to the adjacent wetlands which are hydrologically connected to Tampa Bay. **With:** The temporary construction areas (0.60 acres) will recover to pre-construction conditions. However, these areas will be re-planted with forested vegetation after construction is complete to facilitate recovery. Hydrologic conditions and wildlife are not anticipated to be altered. Brazilian pepper will be removed from the project area. However, the adjacent exotic/nuisance species seed source will still remain. No impact to location and landscape is expected because the activities will not change the degree to which this site provides functions to and from the surrounding areas.
.500(6)(b)Water Environment (n/a for uplands)	3	3	**Existing Conditions:** No standing water was observed within Wetland 2. Saturated soils were observed in places as well as hydrologic indicators such as stain lines. Leather fern was present as well as a dominance by Brazilian pepper. **With:** The proposed project will return the area to the original grade and the habitat will be replanted with native wetland forested vegetation in the temporary construction areas. The hydrology of the area is not expected to be impacted. In fact, the removal of the Brazilian pepper may increase the water flow and levels in the wetland. Brazilian pepper will be removed from the project area. However, the adjacent exotic/nuisance species seed source will still remain.
.500(6)(c)Community structure 1. Vegetation and/or 2. Benthic Community	4	3	**Existing Conditions:** Wetland 2 is dominated by Brazilian pepper. The edge of the wetland does contain some red maple, willow, swamp dogwood, and laurel oaks. Some leather and royal fern were present in the understory. The vegetation appeared to be older with little new recruitment visible. Some plants do appear stressed from lack of water. **With:** The proposed project will return the area to the original grade. The construction areas will be replanted with native forested wetland vegetation. This will provide a native community structure which was lacking previously due to the Brazilian pepper dominance. The removal of Brazilian pepper is anticipated to temporarily improve native recruitment and the overall health of the wetland. However, the adjacent seed source of Brazilian pepper will still remain.

Score = sum of above scores/30 (if uplands, divide by 20)	
current or w/o pres	**with**
0.433	0.333

If preservation as mitigation,
Preservation adjustment factor =
Adjusted mitigation delta =

For impact assessment areas
FL = delta x acres 0.10 x 0.60 = **0.06**

Delta = [with-current]
0.1

If mitigation
Time lag (t-factor) =
Risk factor =

For mitigation assessment areas
RFG = delta/(t-factor x risk) =

PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Port Dolphin		Wetland 2
Impact or Mitigation	**Assessment conducted by:**	**Assessment date:**
Impact (Permanent)	Birkitt Environmental Services, Inc.	11-01-07; 05-28-08

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

Indicator	w/o pres or current	with	Description
.500(6)(a) Location and Landscape Support	4	4	**Existing Conditions:** Wetland 2 is a forested/scrub shrub wetland dominated by Brazilian pepper. Brazilian pepper and several other exotic species (caster bean, elephant grass, etc) are located within and directly adjacent to the wetland habitat. Agricultural fields, South dock road, the railroad, a ROW, and the FPL tank farm all provide barriers for wildlife to and from the area. The wetland is only seasonally connected to a swale system that may provide a nexus to the adjacent wetlands which are hydrologically connected to Tampa Bay. **With:** Permanent impacts to the native forested vegetation will occur from the proposed project. Approximately 0.35 acres of forested wetlands will be impacted by clearing activities from the pipeline permanent ROW construction. The habitat will be regraded to pre-construction conditions. As a result, hydrologic conditions, wildlife, and location and landscape support is not anticipated to be altered. Additionally, Brazilian pepper will be removed from the project area. The wetland will be restored in the permanent ROW to pre-construction conditions. The adjacent areas will be re-planted with native forested vegetation. The wetland will still provide quality for fish and wildlife.
.500(6)(b)Water Environment (n/a for uplands)	3	3	**Existing Conditions:** No standing water was observed within Wetland 2. Saturated soils were observed in places as well as hydrologic indicators such as stain lines. Leather fern was present as well as a dominance by Brazilian pepper. **With:** The proposed project will return the area to the original grade and replant the habitat with native herbaceous vegetation, removing Brazilian pepper and other exotic species from the project area. The hydrology of the area is not expected to be impacted. In fact, the removal of the Brazilian pepper may increase the water flow and levels in the wetland. Please refer to the post-construction recovery plan for the benefit to the area from re-planing of native herbaceous vegetation in the permanent ROW as well as the removal of the exotic/nuisance species and planting of native forested and herbaceous vegetation in adjacent areas.
.500(6)(c)Community structure 1. Vegetation and/or 2. Benthic Community	4	3	**Existing Conditions:** Wetland 2 is dominated by Brazilian pepper. The edge of the wetland does contain some red maple, willow, swamp dogwood, and laurel oaks. Some leather and royal fern were present in the understory. The vegetation appeared to be older with little new recruitment visible. Some plants do appear stressed from lack of water. **With:** The proposed project will return the area to the original grade. However, the forested component in the permanent 30 ft ROW will not be replaced as the ROW will be maintained. The surrounding construction areas will be replanted with both native forested wetland vegetation. The removal of Brazilian pepper is anticipated to improve native recruitment and the overall health of the wetland.

Score = sum of above scores/30 (if uplands, divide by 20)	
current or w/o pres	with
0.433	0.333

If preservation as mitigation,
Preservation adjustment factor =
Adjusted mitigation delta =

For impact assessment areas
FL = delta x acres 0.1 x 0.35 = **0.04**

Delta = [with-current]
0.1

If mitigation
Time lag (t-factor) =
Risk factor =

For mitigation assessment areas
RFG = delta/(t-factor x risk) =

Form 62-345.900(2), F.A.C. [effective date 02-04-2004]

PART I – Qualitative Description
(See Section 62-345.400, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Port Dolphin		Wetland 3

FLUCCs code	Further classification (optional)	Impact or Mitigation Site?	Assessment Area Size
619/631		Impact	2.75

Basin/Watershed Name/Number	Affected Waterbody (Class)	Special Classification (i.e.OFW, AP, other local/state/federal designation of importance)
Lower Tampa Bay Watershed		None

Geographic relationship to and hydrologic connection with wetlands, other surface water, uplands

Through culverts and ditches, Wetland 3 is hydrologically connected to estuarine wetlands to the west.

Assessment area description

The assessment area is a shrub scrub wetland dominated by Brazilian pepper. The center of the wetland contains some native shrub wetlands. Some leather ferns are present in the understory. Approximately 0.94 acres of scrub shrub freshwater wetlands are anticipated to be impacted by the proposed project.

Significant nearby features	Uniqueness (considering the relative rarity in relation to the regional landscape.)
FPL tank farm to the north, agricultural fields to west and south, and industrial to the east.	Not very unique as dominated by Brazilian pepper, minimal native vegetation.

Functions	Mitigation for previous permit/other historic use
Some water filtration to downstream habitats; habitat for wildlife	N/A

Anticipated Wildlife Utilization Based on Literature Review (List of species that are representative of the assessment area and reasonably expected to be found)	Anticipated Utilization by Listed Species (List species, their legal classification (E, T, SSC), type of use, and intensity of use of the assessment area)
racoons, song birds, armadillo	None

Observed Evidence of Wildlife Utilization (List species directly observed, or other signs such as tracks, droppings, casings, nests, etc.):

racoons and armadillo

Additional relevant factors:

Area is dominated by Brazilian pepper in the wetland and in adjacent areas.

Assessment conducted by:	Assessment date(s):
Birkitt Environmental Services, Inc	11-01-07; 05-28-08

PART II – Quantification of Assessment Area (impact or mitigation)
(See Sections 62-345.500 and .600, F.A.C.)

Site/Project Name	Application Number	Assessment Area Name or Number
Port Dolphin		Wetland 3
Impact or Mitigation	**Assessment conducted by:**	**Assessment date:**
Impact (Permanent)	Birkitt Environmental Services, Inc.	11-01-07; 05-28-08

Scoring Guidance	Optimal (10)	Moderate(7)	Minimal (4)	Not Present (0)
The scoring of each indicator is based on what would be suitable for the type of wetland or surface water assessed	Condition is optimal and fully supports wetland/surface water functions	Condition is less than optimal, but sufficient to maintain most wetland/surface waterfunctions	Minimal level of support of wetland/surface water functions	Condition is insufficient to provide wetland/surface water functions

Indicator	w/o pres or current	with	Description
.500(6)(a) Location and Landscape Support	3	3	**Existing Conditions:** Wetland 3 is scrub shrub wetland dominated by Brazilian pepper. A ditch runs along the eastern edge of the wetland which connects via a culvert to outside areas. Leather fern and other herbaceous and scrubby wetland species are present in the ground cover. Some upland species such as live oak and other oak species are present. Adjacent habitats include a citrus field, railroad, FPL tank farm, and industrial areas. **With:** The wetland, within the 30ft ROW, will be returned to pre-construction grade and planted with herbaceous vegetation. The adjacent areas outside of the permanent ROW will be replanted with native shrubby vegetation. The permanent ROW area will not be replanted with shrub wetland vegetation. Hydrologic conditions and wildlife access is not anticipated to be altered. The Brazilian pepper will be completely removed from the project area and native vegetation will be planted in its place. However, the adjacent exotic/nuisance species seed source will still exist.
.500(6)(b)Water Environment (n/a for uplands)	4	4	**Existing Conditions:** The water environment within Wetland 3 includes standing water in a culverted ditch that runs along the eastern border of the wetland. Saturated soils were observed in places as well as hydrologic indicators such as stain lines. Leather fern was present as well as a dominance by Brazilian pepper. Community zonation included a shrubby wetland habitat with some Brazilian pepper surrounded by predominantly Brazilian pepper and other exotic species. **With:** The proposed project will return the area to the original grade. Brazilian pepper and other exotic species will be removed from the project area during construction. The hydrology of the area is not expected to be impacted, in fact, the removal of the Brazilian pepper may increase the water flow and levels in the wetland.
.500(6)(c)Community structure 1. Vegetation and/or 2. Benthic Community	4	3	**Existing Conditions:** Wetland 3 is dominated by Brazilian pepper. Leather fern and shrubby wetland species are present in the groundcover. The vegetation appears to be older with little new recruitment visible. Little to no benthic species were observed in the ditched areas that contained standing water. **With:** The proposed project will return the area to the original pre-construction grade. However, the shrubby wetland component in the permanent 30 ft ROW will not be replaced. The removal of Brazilian pepper is anticipated to temporarily improve native recruitment and the overall health of the wetland. However, the remaining exotic/nuisance seed source will still remain. The wetland will be maintained and monitored to help the native wetland vegetation become established.

Score = sum of above scores/30 (if uplands, divide by 20)	
current or w/o pres	with
0.367	0.333

If preservation as mitigation,
Preservation adjustment factor =
Adjusted mitigation delta =

For impact assessment areas
FL = delta x acres = 0.034 X 0.84 = **0.03**

Delta = [with-current]
0.034

If mitigation
Time lag (t-factor) =
Risk factor =

For mitigation assessment areas
RFG = delta/(t-factor x risk) =

APPENDIX 5

MEMORANDUM OF AGREEMENT

**MEMORANDUM OF AGREEMENT
BETWEEN THE STATE OF FLORIDA,
DEPARTMENT OF ENVIRONMENTAL PROTECTION AND
FISH AND WILDLIFE CONSERVATION COMMISSION, AND
PORT DOLPHIN ENERGY, LLC**

THIS AGREEMENT is entered into by the State of Florida, Department of Environmental Protection ("FDEP") and Fish and Wildlife Conservation Commission ("FWCC"), and Port Dolphin Energy, LLC ("Port Dolphin") (collectively referred to as the "Parties") concerning Port Dolphin's proposal to construct and operate a deepwater port and infrastructure to receive natural gas for transport as reflected in the Application to the U.S. Maritime Administration ("MARAD"), docketed as USCG-2007-28532, and the Environmental Resource Permit ("ERP") Application number 286121-005 dated July, 2009, submitted to FDEP (the "Project").

WHEREAS, reports indicate that additional supplies of natural gas are or will be needed in Florida, and

WHEREAS, the delivery of new gas supplies will result in economic, energy, reliability, and clean air benefits to the citizens of Florida, and

WHEREAS, after twice relocating the proposed route of the subaqueous portion of the pipeline connecting the deepwater port to the mainland of Florida it has been determined that the pipeline corridor will impact sand resources of a quality that could be used for beach restoration or nourishment projects, and

WHEREAS, the Town of Longboat Key and Manatee County have identified needs for such beach restoration or nourishment sand in the near future, and

WHEREAS, FDEP and Port Dolphin have reached agreement on all known issues associated with avoidance, minimization and mitigation for impacts to restoration or nourishment sand resources. This Agreement also addresses other requirements including (1) the assessment of impacts of the Project on marine fisheries, (2) the support of renewable energy in Florida, (3) the implementation of vessel construction and operation technology requirements to reduce impacts, and (4) the support of local cultural, marine education or recreational activities, and

WHEREAS, Port Dolphin recognizes that mitigative measures, other than those for restoration or nourishment sand resources, are also appropriate to address impacts from the construction and operation of the Project,

NOW, THEREFORE, the Parties agree to the following:

1. Port Dolphin will continue its efforts to obtain necessary federal, state and local permits and authorizations required to construct and operate the Project.

2. FDEP will use its best efforts to expedite decision-making on all state permits and authorizations within its jurisdiction required for the Project and for the extraction and utilization of sand consistent with applicable legal requirements contained in the Florida Administrative Code and the Florida Statutes, including requirements for public participation.

3. After the issuance of all permits and authorizations required for the construction of the Project[1], should they be issued, and subject to any additional specific timing considerations related to each item, Port Dolphin will provide for the mitigation of or compensation for non-sand related Project impacts as follows:

[1] For purposes of this Agreement, the issuance of all permits and authorizations required for construction of the Project shall be deemed to have occurred when the permits are issued in final form and not subject to further judicial or administrative review.

a. Port Dolphin shall develop and implement a program to assess the impacts of the Project's operational water intake on marine fisheries through a Population Connectivity Study (Study). Development and implementation of the assessment Study, including adaptive management, shall require the coordination with and approval of the State of Florida (Florida Fish and Wildlife Conservation Commission) and the National Oceanographic Atmospheric Administration (NOAA Fisheries Service), also in concurrence with the U.S. Coast Guard and the Maritime Administration. If needed to assess impacts to marine fisheries, the approved Study may include one metocean buoy that is consistent with the University of South Florida's Coastal Ocean Monitoring and Prediction System. The Study shall include data collection. The study shall be required as part of the Port Operations Manual. The Study budget is $8.5 million.

b. Prior to the commencement of construction of the Project, Port Dolphin will provide $1 million to be used to support activities associated with development of renewable energy. Port Dolphin will provide two additional payments of $1 million each not later than the third and the fifth anniversary of the first $1 million payment for the same purpose. The payments will be made to the Florida Energy Systems Consortium or to an alternate entity as agreed by the Parties.

c. Prior to the commencement of construction of the Project, Port Dolphin will provide $500,000 to support cultural, marine education and recreational activities in the local communities adjacent to the Project. The recipients will be determined by Port Dolphin after consultation with interested parties and FDEP.

d. Each shuttle and regasification vessel ("SRV") utilized to transport liquid natural gas to the deepwater port will be equipped with a closed loop regasification system and have a comprehensive ballast and cooling water management system for minimizing sea water use and the intake design velocity will be 0.5 feet per second or lower. The estimated cost of these features per SRV is $9 million.

e. To facilitate the use of natural gas during residence at the deepwater port buoys, the propulsion/power generation engines and the auxiliary marine boilers will have dual fuel capability. The estimated engine redesign cost per SRV is $12 million.

f. The propulsion/power generation dual fuel engines on each ship will be equipped with selective catalytic reduction equipment for the control of nitrogen oxide ("NOx") emissions and will utilize a carbon monoxide (CO) catalyst to reduce emissions of CO. The marine auxiliary boilers which produce steam for the regasification equipment will include low NOx burners and be equipped with selective catalytic reduction for control of NOx emissions. Total emissions control equipment cost per SRV is estimated to be $3.4 million.

g. Port Dolphin shall participate in and support MARAD's manning/crew program providing job opportunities for United States Cadets on board the Project's fleet and funding training initiatives to prepare qualified mariners.

4. To mitigate and compensate for potential impacts to restoration or nourishment sand resources within the vicinity of the pipeline the Parties agree to the following:

a. Escrow Account

(1) An Escrow Account shall be established with the Florida Department of Financial Services to receive, invest, administer and distribute funds associated with development, permitting and Sand Extraction Activities[2] required for sand extraction within an 800 foot wide corridor centered on the centerline of the proposed pipeline (the "Sand Recovery Area").

[2] Sand Extraction Activities means collectively the activities necessary to remove sand from the Sand Recovery Area and utilize that sand which has been removed from the Sand Recovery Area for beach nourishment or restoration projects.

(2) The Escrow Agent shall distribute funds at the direction of the FDEP to the Town of Longboat Key and Manatee County (each referred to individually herein as a "Local Government") in accordance with Section 4 of this Agreement. Neither the Escrow Agent nor FDEP shall have any obligation to Local Governments to direct or make payments in excess of sums deposited by Port Dolphin into the Escrow Account.

(3) All interest earned shall accrue to the benefit of Port Dolphin.

b. Sand Development and Permitting

(1) Not later than 30 days after the Project ERP is issued and the submerged lands easements have been authorized by the State of Florida and the time for administrative challenges by interested parties or appeals for the ERP and the submerged land authorizations has expired, Port Dolphin will deposit $1 million into the Escrow Account to be used solely for development and permitting of borrow areas within and adjacent to the Sand Recovery Area from which the sand will be extracted.

(2) Each local government may request reimbursement from the Escrow Account up to a maximum of $500,000.00 for costs associated with sand development and permitting. Requests for reimbursement shall be made to FDEP in accordance with paragraph 4.d. of this Agreement. Any funds remaining in the Escrow Account after completion of development and permitting of the borrow areas shall remain in the Escrow Account to be used to fund in full or in part the items described in paragraph 4.c.

(3) FDEP shall ensure that Port Dolphin is kept fully advised and provided copies of permit applications and other documents relating to the development of the borrow areas and the borrow area design to ensure that the borrow area design minimizes impacts to pipeline construction.

c. Sand Extraction

(1) Not later than 30 days after the date of issuance of the permits necessary to authorize the extraction and utilization of sand from the Sand Recovery Area the Parties shall meet with appropriate officials from the Local Governments proposing to extract sand from the Sand Recovery Area for the purpose of examining and confirming the schedule for pipeline construction and sand extraction and to determine whether significant changes have occurred in the Project development that would necessitate any schedule changes.

(2) After issuance of all permits and authorizations necessary for the construction of the Project, Port Dolphin shall deposit $10 million to the Escrow Account established in Subsection 4.a. This $10 million, combined with any funds remaining from sand development and permitting in accordance with paragraph 4.b.(2) (hereinafter the "Sand Extraction Funds") is the total amount committed for sand extraction from the Sand Recovery Area. The $10 million may be paid in installments with the first installment of $1 million deposited within 30 days of issuance of all permits and authorizations necessary for construction of the Project. A $1 million balance shall be maintained in the Escrow Account by Port Dolphin until FDEP provides the notice required by paragraph 4.d.(3). If funds in the Escrow Account are insufficient to reimburse pending, approved invoices, Port Dolphin shall transmit the necessary funds to the Escrow Account by wire transfer executed within 72 hours of notification of the amount of the invoices. Sand Extraction Funds shall be used solely to reimburse the Local Governments for funds expended in Sand Extraction Activities or pursuant to paragraph 4.e.(2)(b) if elected by Port Dolphin, or to compensate the State of Florida in accordance with paragraph 4.c.(7).

(3) Each local government shall be eligible for not less than $5 million for reimbursement of funds expended for Sand Extraction Activities after the initial funding of the Escrow Account pursuant to paragraph 4.c.(2) or 4.e.(1)(a), subject to paragraphs 4.c.(4), 4.e.(2), and 4.e.(3) of this Agreement. Except as provided in paragraph 4.b.(1) and (2) and 4.e.(3), if the Project is cancelled no payments are due from Port Dolphin.

(4) Subject to paragraphs 4.c.(1), 4.c.(4) and 4.c.(5) of this Agreement, the FDEP shall authorize and direct the Escrow Agent to distribute funds from the Escrow Account in accordance with paragraph 4.d. of this Agreement provided that all sand extraction from the Sand Recovery Area is completed no later than June 30, 2012. The June 30, 2012 date may be extended at the discretion of Port Dolphin.

(5) If either Local Government determines that it will not pursue extraction of the sand from the Sand Recovery Area or challenges any of the permits for the Project, that Local Government(s) will forfeit their opportunity to seek reimbursement from the Escrow Account. In the event either Local Government forfeits their opportunity to seek reimbursement, all funds remaining in the Escrow Account will be available to pay for activities required for sand extraction carried out on behalf of the Local Government pursuing such extraction in the Sand Recovery Area and not filing a challenge to a Project permit or to FDEP in accordance with paragraph 4.c.(7).

(6) If, despite using best efforts, the Town of Longboat Key is unable to obtain the federal authorizations necessary to extract sand from the area known as F2 on a schedule that will allow the extraction of the sand from the construction area by June 30, 2012, and Port Dolphin in its sole judgment determines that it is unable to adjust the construction schedule to accommodate the delay, FDEP may request the Escrow Agent to release funds to the

Town of Longboat Key in an amount not to exceed the permitted volume expressed in cubic yards of extractable beach compatible sand contained within area F2 within a 400 foot wide corridor centered on the centerline of the pipeline location multiplied by $15.00. For purposes of this paragraph, "best efforts" shall mean that the Town of Longboat Key is diligently and continuously pursuing federal authorizations with monthly updates to FDEP on its progress and that it has not and will not engage in any efforts to delay or impede the issuance of the authorizations. If any of the authorizations are denied, no payment shall be due under this paragraph. In no event shall the total amount of Sand Extraction Funds provided for in this Agreement be exceeded.

(7) Any or all funds remaining in the Escrow Account after the completion of Sand Extraction Activities and payment of approved invoices submitted by the Local Government not filing any permit challenges, shall be assessed by FDEP as a fee for the preemption of any unrecovered beach restoration or nourishment sand within the jurisdiction of the State of Florida at a rate of $2.25 per cubic yard. FDEP will request a release of funds from the Escrow Account to the State of Florida to be deposited into the Minerals Trust Fund. Any excess funds remaining will be returned to Port Dolphin.

d. Distribution of Funds.

(1) Each Local Government requesting reimbursement of funds from the Escrow Account shall provide copies of invoices or other appropriate documentation to the Escrow Agent and the Parties prior to the release of funds. FDEP shall have 10 business days to review the documentation and request a release of funds or disapprove the request and notify the Local Government. If disapproval is based upon deficient documentation, FDEP shall afford the Local Government the opportunity to provide sufficient documentation.

(2) FDEP may request a release of funds from the Escrow Account as provided in paragraph 4.c.(7).

(3) When the remaining balance of the Escrow Account approaches the final $1 million, FDEP shall notify the Local Governments of the balance and how the remaining funds will be apportioned.

e. Sand - General Conditions

(1) If all permits and authorizations necessary for construction of the Project have not been issued by March 1, 2011, Port Dolphin, at its sole and exclusive option, shall be required to take one of the following actions:

(a) Deposit $10 million to the Escrow Account to be distributed by FDEP to the Town of Longboat Key and Manatee County for Sand Extraction Activities associated with restoration and nourishment sand extraction within the Sand Recovery Area in accordance with paragraphs 4.c.(2) and 4.d.(1);

(b) Extend the schedule for commencement of construction of the Project by at least one year. The anticipated schedule shall be provided to all parties. All time requirements included in this Agreement for the extraction of restoration and nourishment sand from the Sand Recovery Area will be extended by the amount of time equal to the extension for commencement of construction, or

(c) Notify FDEP that the Project will be cancelled.

If Port Dolphin elects to extend the schedule for the commencement of construction of the Project by at least one year, Port Dolphin shall, not later than twelve months prior to the revised date for commencement of construction, take one of the actions set forth in subsections (a), (b), or (c) if all permits and authorizations necessary for construction of the Project have not yet been issued. If Port Dolphin elects to proceed under subsection (a) the payment is part of the total described in paragraph 4.c.(2)

(2) If either or both of the Local Governments are proceeding in good faith with plans to complete the sand extraction activities required to extract the sand from the Sand Recovery Area by not later than June 30, 2012 and are prevented from doing so due to an unforeseeable catastrophic event, including extreme weather, natural disaster or war, Port Dolphin shall either:

(a) Extend the schedule for the commencement of construction of the Project by the time necessary to extract the sand from the Sand Recovery Area taking into account turtle habitat requirements, or

(b) Authorize FDEP to request payments from the Escrow Account of the remaining funds to the Town of Longboat Key and Manatee County in an amount not to exceed the Sand Extraction Funds; Funds provided pursuant to paragraph 4.e.(2) shall be used for sand extraction and use activities only, and shall be subject to the provisions of paragraph 4.d., or

(c) Cancel the Project in which case the Local Governments shall be entitled to reimbursement of documented expenses incurred for the development, permitting or sand extraction in the Sand Recovery Area up to the occurrence of the force majeure event, not to exceed the amount of the Sand Extraction Funds.

(3) If either or both of the Local Governments are proceeding in good faith with plans to complete the sand extraction activities required to extract the sand from the Sand Recovery Area by not later than June 30, 2012 and Port Dolphin cancels the Project for any reason, Port Dolphin shall authorize the FDEP to request payment from the Escrow Account to

the Local Governments for the reimbursement of expenses incurred and documented in accordance with paragraph 4.d. for the development, permitting or Sand Extraction Activities up to the date when the Project was cancelled, not to exceed the amount of the Sand Extraction Funds.

(4) Port Dolphin agrees not to challenge any state or federal permitting of borrow areas within the Sand Recovery Area.

5. Unless the Project schedule is extended as provided in paragraphs 4.e.(1) or 4.e.(2) sand extraction activities shall cease not later than June 30, 2012 and any remaining sand within a 400 foot dredging buffer area corridor centered on the centerline of the pipeline location shall remain unrecovered and Port Dolphin shall be permitted to begin construction related activities.

6. Recognizing that there are issues other than those addressed in this Agreement for the Governor of the State of Florida (Governor) to approve or disapprove the Port Dolphin Permit Application, the FDEP shall recommend to the Governor prior to September 11, 2009, that the Deepwater Port Application be approved subject to the conditions contained in this Agreement and the completion of necessary permitting and authorizations. FDEP shall request that the Town of Longboat Key and Manatee County also notify the Governor prior to September 11, 2009 that the Deepwater Port Application for the Project should be approved subject to the conditions set forth in this Agreement.

7. The Agreement of Port Dolphin to the terms set forth herein is contingent upon permits and authorizations being issued for construction of the Project as currently proposed. Any material changes to the pipeline route as a result of permit requirements shall result in suspension of the provisions of paragraphs 4. and 5. pending an assessment of whether

mitigation or compensation for sand related impacts is required and if so at what levels. Any changes to the construction techniques related to the burial of the pipeline in the Sand Recovery Area as currently set forth in permit applications under review by FDEP shall be coordinated with the FDEP Southwest District Office, and reflected in the post construction filing of as built surveys and drawings.

8. Each of the persons signing this Agreement represents and warrants that he or she is duly authorized to sign this Agreement. This Agreement may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall be deemed one and the same instrument. This Agreement shall be effective as of the date the last required signature is affixed hereto.

9. Except for additional mitigation to address adverse impacts to hard and live-bottom habitats in the Gulf of Mexico, to address any loss of fishing grounds found to result from the Safety Zone established around the deepwater port, or any impacts that are not currently known as of the effective date of this Agreement, not addressed in this Agreement and/or will be addressed during the permit process, FDEP agrees that compliance with this Agreement by Port Dolphin constitutes full and complete mitigation and compensation for the impact of waterward activities for the Project relating to the issues addressed in this Agreement.

10. If questions arise concerning the appropriateness or propriety of the use of the funds provided by Port Dolphin pursuant to paragraph 4 an audit of the approval and distribution process may be conducted at the request of either Port Dolphin or FDEP. Any such audit will be funded by the requesting Party.

11. This Agreement has been delivered in the State of Florida and shall be construed in accordance with the laws of Florida. Wherever possible, each provision of this Agreement

shall be interpreted in such manner as to be effective and valid under applicable law. If any provision of this Agreement shall be prohibited or invalid under applicable law, such provision shall be ineffective to the extent of such prohibition or invalidity, without invalidating the remainder of such provision or the remaining provisions of this Agreement. Any action hereon or in connection herewith shall be brought in Leon County, Florida. In any such action each Party shall be responsible for its own attorney's fees.

12. This Agreement represents the entire agreement of the parties. Any alterations, variations, changes, modifications or waivers of provisions of this Agreement shall only be valid when they have been reduced to writing, duly signed by each of the parties hereto, and attached to the original of this Agreement, unless otherwise provided herein. Each Local Government shall be provided notice by FDEP of any modifications to this Agreement.

Sept. 17, 2009
Date:

Michael W. Sole, Secretary
Florida Department of
Environmental Protection

Sept 17, 2009
Date:

Kenneth D. Haddad
Executive Director
Florida Fish & Wildlife
Conservation Commission

Sept 16, 2009
Date:

James E. Butcher
Chairman and C.E.O.
Port Dolphin Energy, LLC

APPENDIX 6

CULTURAL RESOURCES REPORT

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

July 26, 2011

Mr. Brian Jordan, Ph.D.
Bureau of Ocean Energy Management,
Regulation, and Enforcement
Branch of Environmental Assessment
381 Elder St., MS 4042
Herndon, VA 20170

Re: DHR Project File No.: 2011-02802 (2011-2596)
Received by DHR: July 14, 2011 and June 20, 2011
Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida

Dear Dr. Jordan:

Our office received and reviewed the above referenced survey report in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992, and *36 C.F.R., Part 800: Protection of Historic Properties*, and Chapter 267, *Florida Statutes,* for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

Between August and October 2010, Tidewater Atlantic Research, Inc. (TAR) conducted an underwater remote sensing survey of the proposed F-2 borrow area on behalf of Coastal Planning & Engineering, Inc.. TAR identified seven magnetic anomalies buildings within the project area during the investigation.

TAR determined that all anomalies appear to represent modern debris. TAR recommends no further investigation of the anomalies in the F-2 investigation area.

However, TAR found that one line of magnetometer data was corrupt. Therefore, TAR recommends that dredging avoid this portion of the borrow area.

The Bureau of Ocean Energy Management, Regulation, and Enforcement (BOEMRE) determined that the proposed undertaking will have no effect on cultural resources listed, or eligible for listing, on the NRHP.

Based on the information provided, our office concurs with the determinations of BOEMRE and finds the submitted report complete and sufficient in accordance with Chapter 1A-46, *Florida Administrative Code.*

For any questions concerning our comments, please contact Rudy Westerman, Historic Preservationist, by electronic mail at rjwesterman@dos.state.fl.us, or by phone at 850.245.6333. We appreciate your continued interest in protecting Florida's historic properties.

Sincerely,

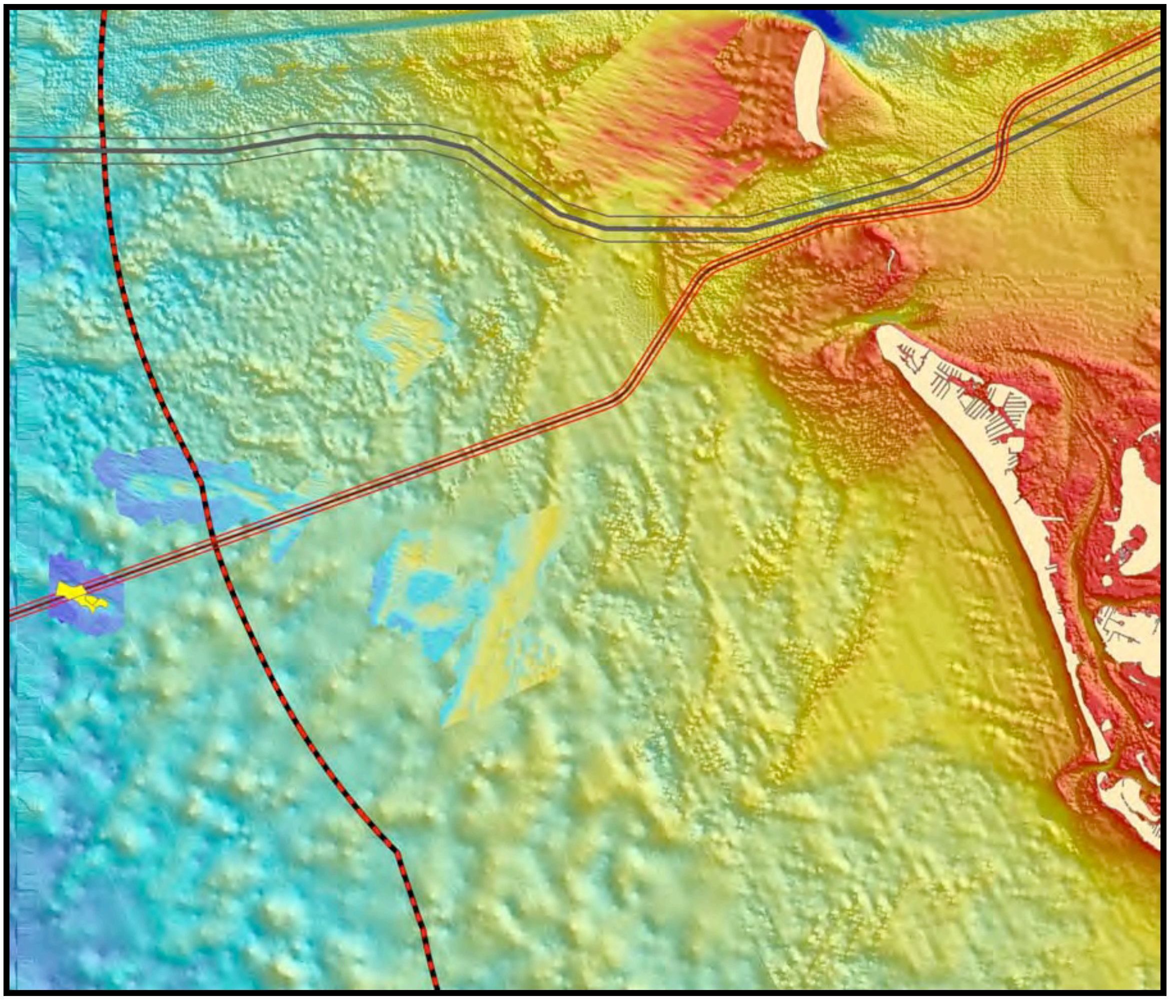
Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

Pc: Dr. Gordon Watts, Jr. – Tidewater Atlantic Research, Inc.

Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida

BOEMRE Geophysical Survey Authorization #M09-004



Coastal Planning & Engineering, Inc.
2481 N.W. Boca Raton Boulevard
Boca Raton, Florida 33431

14 April 2011

Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida

BOEMRE Geophysical Survey Authorization #M09-004

Submitted to:
Coastal Planning & Engineering, Inc.
2481 N.W. Boca Raton Boulevard
Boca Raton, Florida 33431

Submitted by:

Tidewater Atlantic Research, Inc.
P. O. Box 2494
Washington, North Carolina 27889

____
Gordon P. Watts, Jr.
Principal Investigator

14 April 2011

Abstract

Coastal Planning and Engineering, Inc. (CPE) is the consulting engineer for a beach nourishment project for Longboat Key in Manatee and Sarasota counties, Florida. A source material for this nourishment will be a borrow site, designated F-2, offshore of Longboat Key. The Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) Geological and Geophysical Survey Authorization number is M09-004. In order to determine the project's effects on potentially significant submerged cultural resources, CPE contracted with Tidewater Atlantic Research, Inc. (TAR) of Washington, North Carolina to supervise the conduct of a submerged cultural resource remote-sensing survey of the borrow site. Analysis of the F-2 investigation area remote-sensing data identified a total of seven magnetic anomalies. None of those signatures are considered to represent shipwreck remains or other potentially significant submerged cultural resources. Sonar identified no bottom surface contacts in the area and no evidence of relict land forms or other potentially significant features are apparent in the sub-bottom profiler data. A previous survey carried out in 2006 by Laura A. Landry & Associates, Inc. for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay pipeline covered most of the F-2 investigation area. That survey identified four magnetic anomalies in the F-2 investigation area. Only one of those corresponded approximately to one of the seven anomalies identified during the current survey and none of the 2006 anomalies were considered to be potentially significant. Based on the acoustic and magnetic data from both the 2006 and 2010 surveys, dredging material from F-2 will not impact any potentially significant submerged cultural resources. No additional investigation of the area is recommended in conjunction with the proposed project. However, in the event that shipwreck remains or other cultural material is encountered during dredging, CPE and BOEMRE should be notified and on-site activity shifted until an assessment of the archaeological significance of the disturbed material can be assessed.

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List of Figures

Introduction

Coastal Planning and Engineering, Inc. (CPE) is the consulting engineer for a beach nourishment project for Longboat Key in Manatee and Sarasota counties, Florida. A source material for this nourishment will be a borrow site, designated F-2, in Federal waters offshore of Anna Maria Island. In order to determine the project's effects on potentially significant submerged cultural resources, CPE contracted with Tidewater Atlantic Research, Inc. (TAR) of Washington, North Carolina to supervise the conduct of a pre-lease remote-sensing survey of the borrow area authorized under a BOEMRE Geological and Geophysical Survey Authorization M09-004.

The remote-sensing survey conducted by CPE was designed to identify magnetic and/or acoustic anomalies that might be generated by shipwreck resources and relict landforms that could be associated with prehistoric habitation. Analysis of the data was designed to identify and assess the potential significance of anomalies and determine the necessity for additional investigation designed to generate data to support a determination of National Register of Historic Places (NRHP) eligibility. The investigation complies with federal mandates established in the National Historic Preservation Act of 1966, as amended; the Archaeological and Historic Preservation Act of 1979, as amended; the Abandoned Shipwreck Act of 1987, the Advisory Council on Historic Preservation revised 36 CFR, Part 800, Regulations and the BOEMRE Guidelines for Archaeological Resource Field Surveys. The results of the investigation furnished CPE with the archaeological data essential to comply with submerged cultural resource legislation and regulations.

Analysis of the remote-sensing data revealed seven magnetic anomalies in the F-2 investigation area. No acoustic targets were identified in the sonar records and no evidence of relict landforms were apparent in the subbottom profiler data. All of the magnetic anomalies have signature characteristics indicative of modern debris such as fish and crab traps, pipes, small diameter rods, cable, wire rope, chain, small boat anchors or other small ferrous objects. No additional investigation of those anomalies is recommended in conjunction with the proposed project.

A previous survey carried out in 2006 by Laura A. Landry & Associates, Inc., for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay pipeline covered most of the F-2 investigation area. That survey identified 4 magnetic anomalies in the F-2 investigation area. Only one of those corresponded approximately to one of the seven anomalies identified during the current survey. The remaining 3 are located between survey lines run in 2010 and were not of sufficient intensity or duration to be identified in the current data. None of the 2006 anomalies were considered to be potentially significant (Landry 2008).

The fieldwork consisted of a survey of the investigation area employing a cesium vapor magnetometer, sidescan sonar and sub-bottom profiler. Survey planning was carried out by archaeological principal investigator Gordon Watts and CPE project manager Beau Suthard. Fieldwork activities were carried out between 20 and 23 October 2009 and on 20 October 2010. Project field personnel consisted of Dr. Gordon Watts, TAR archaeological principal investigator and remote-sensing operators from CPE. CPE personnel included navigator Chris Dougherty, geophysicist Cesar Felix, and geologist John Rose. Data analysis and illustrations were prepared by Dr. Watts and Joshua Daniel. Historical and cartographical research was carried out by Dr. Watts and historian Robin Arnold. Dr. Watts, Mr. Daniel and Ms. Arnold prepared this report.

Project Location

One sand source for the Longboat Key beach nourishment project is an area offshore of Anna Maria Island. The F-2 investigation area is located approximately 10.5 nautical miles west-southwest of the northern extremity of Anna Maria Island and is a polygon measuring 3,825 feet in width, 5,350 feet in length and covers an area of 375.57 acres (Figure 1 and Figure 2).

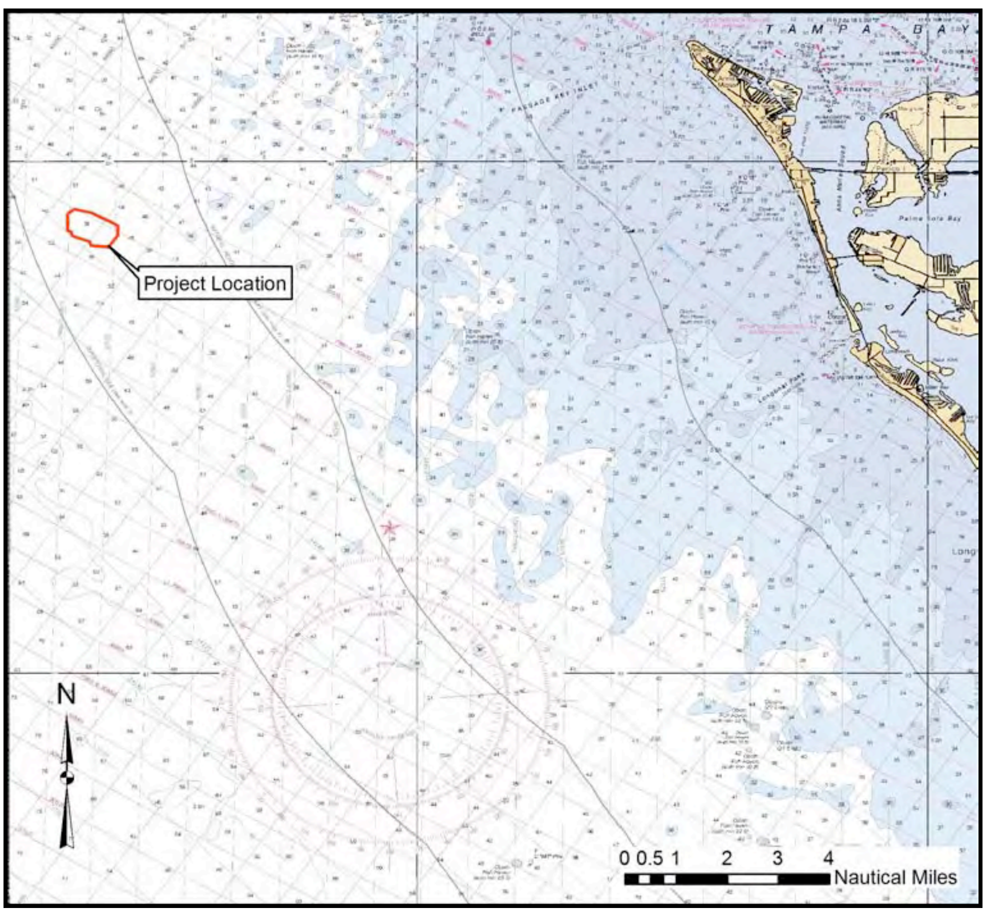

Figure 1. The F-2 investigation area project location (NOAA Chart No. 11424).

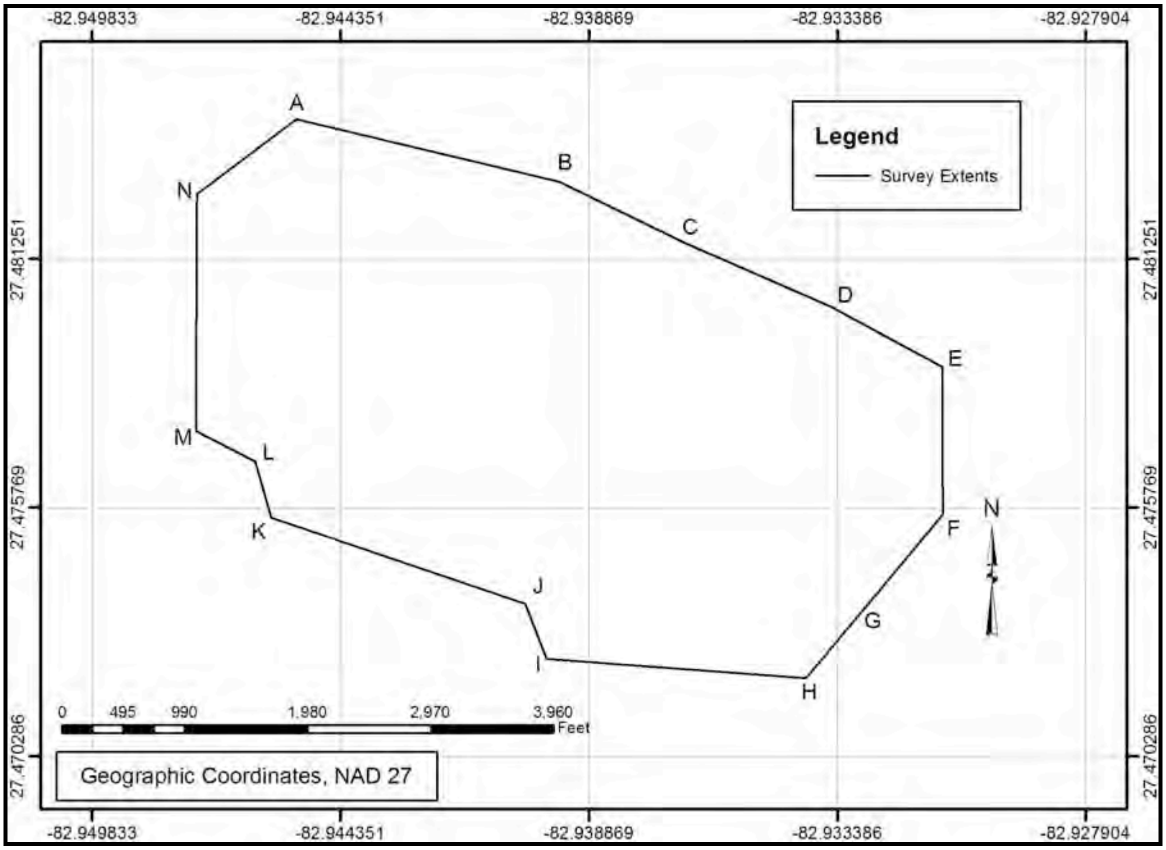

Figure 2. The F-2 investigation area configuration and border coordinate locations.

The Latitude/Longitude NAD 27 coordinates for the F-2 investigation area are:

Survey Border (NAD 27)		
Point	**Latitude**	**Longitude**
A	27.48433781	-82.94532184
B	27.48295193	-82.93951819
C	27.48159200	-82.93675187
D	27.48019728	-82.93351656
E	27.47887295	-82.93107094
F	27.47562087	-82.93106054
G	27.47376926	-82.93260042
H	27.47200689	-82.93407933
I	27.47243581	-82.93979558
J	27.47364754	-82.94027768
K	27.47554890	-82.94587586
L	27.47678488	-82.94622688
M	27.47745344	-82.94754293
N	27.48268740	-82.94750942

Lease block information for the F-2 investigation area is:

OCS Lease Area	Block Number	Water Depth Range (NAVD 88)
PB	506	-41 to -57
PB	507	-42 to -51

Research Methodology

Literature and Historical Research

TAR conducted a literature search of primary and secondary sources to assess the potential to find significant historic and/or cultural resources in the proposed study area. Research in Florida repositories was previously carried out in libraries and archives in St. Petersburg, Tampa, Gainesville and Tallahassee. Maps in the collections of the Bureau of Archaeological Research in Tallahassee and at archives and libraries in the St. Petersburg/Tampa area were previously examined.

Preliminary wreck-specific information was collected from secondary sources that include: *The Encyclopedia of American Shipwrecks* (Berman 1972), *Merchant Steam Vessels of the United States 1790 - 1868* (Lytle and Holdcamper 1975), *Disasters to American Vessels, Sail and Steam, 1841-1846* (Lockhead 1954), *Shipwrecks of the Civil War: The Encyclopedia of Union and Confederate Naval Losses* (Shomette 1973), *A Guide to Sunken Ships In American Waters* (Lonsdale and Kaplan 1964), *Shipwrecks in the Americas* (Marx 1983), *Shipwrecks of Florida* (Singer 1998) and *Shipwrecks in Florida Waters* (Marx 1985). Additional information was generated by a survey of maritime records associated with Manatee and Sarasota counties, the annual reports of the U.S. Army Corps of Engineers-Jacksonville District, and the U.S. Department of Commerce Automated Wreck and Obstruction Information System (AWOIS). Previously acquired data on historic maps and charts preserved in the collections of the Florida Archives and University of Florida were reviewed for submerged cultural resources data applicable to the proposed project area. Additional maps and charts were examined on the NOAA Historical Map and Chart Collection, online database.

Dr. Roger Smith (Smith pers. comm. 2010) and Mr. Louis Tesar (Tesar pers. comm. 2010) from the Florida State Historic Preservation Office, and Ms. Celeste Ivory (Ivory pers. comm. 2010) from the Florida Master Site File office were contacted to determine if any previously reported sites were located in the project areas and if any were listed on the NRHP. In addition, professional archaeologists Ms. Marion M. Almy (Almy elec. comm. 2010) and Mr. Bill Burger (Burger pers. comm. 2010) were interviewed to collect data concerning unreported sites in the proposed project area.

Regional Prehistoric Overview

The fluctuation of sea level during and following the Wisconsin Glaciation is an important factor for reconstructing the paleoenvironment and determining the potential for Native American sites on drowned continental shelf surfaces. Goggin postulated sea level fluctuation and its archaeological interpretation in 1948 and in 1960 proposed that for "some periods of man's cultural history there may well be far more data under the sea than on the land" (Goggin 1960:352). In 1966, Emery and Edwards established a relative sea level curve and noted its implications to archaeological sites (Emery and Edwards 1966:733-736). Paleoindian and Archaic sites were most likely submerged offshore and sites of particular periods could be located at specific depths (Murphy 1990:17; Milanich 1994:38-39).

Because the survey area lies in this offshore environment any prehistoric material in the area should be related to either the Paleoindian or Early Archaic Period. It is possible that sites dating from the Middle Archaic and more recent cultural phases may be located closer inshore (Ruppé 1978:119). For that reason the focus of this prehistoric background is on the Paleoindian and Early Archaic periods and the sites and cultural evidence that characterize each. A table based on data from prominent Florida prehistoric archaeologists for the Ancient Native Village Living History Museum has been included to provide insight into the nature of subsequent prehistoric cultural periods that have been identified in the Tampa Bay area, but date later than the relative stabilization of sea level well inshore of the project area (Table 1). Detailed descriptions of later prehistoric cultural phases in the Tampa Bay project vicinity can be found in Milanich (1994, 1998), Hann (2003), and Hutchinson (2004).

The earliest period of human occupation in Florida is identified as the Paleoindian Period (12,000-8000 B.P.). It is characterized by small groups of nomads who hunted animals, some of which are now extinct, and collected plant and other food resources. Paleoindian peoples were known for making lanceolate-shaped stone projectile points, one of the few surviving diagnostic artifacts of the period (Milanich 1994:47-50). In Florida, these types of projectile points have come primarily from inundated sites, sinkholes and rivers in the northern and west-central coastal areas of the state (Dunbar and Waller 1983:19-30; Dunbar 1991:192-193). During the Paleoindian period, the Floridian peninsula was much larger than it is today due to lower sea level stands (Milanich 1994:18, 1998:4). Because of the arid conditions and the fact that "inland rivers, lakes, springs, and other extensive surface water such as marshes and wet prairies were virtually nonexistent" (Milanich 1994:18), the greatest Paleoindian populations probably existed in areas of the Atlantic and Gulf of Mexico coasts that are now inundated (Goggin 1960: 352).

Based on archaeological evidence, Paleoindian groups initially appeared in Florida around 12,000 B.P. (Milanich 1994:38). During this period sea level was some 90 to 300 feet lower than the present. Pollen and paleontological studies indicate that the environment of the central peninsula at that time was

FLORIDA'S NATIVE CULTURES

TIME SPAN	CULTURE PERIOD	VILLAGE TRAIT	NATURAL ENVIRONMENT	ANIMALS	TOOLS
12,000-8,000 B.P.	PaleoIndian	Migratory camps of hunter gatherers.	World emerging from an Ice Age; drier and cooler than today; Gulf Coast 40-70 miles farther west than today; Hillsborough River forming	Mammoth, mastodon, tapir species of box turtle, deer diamondback rattlesnake, opossum, and raccoon.	Bifacial points used as knives, adzes, bolas, and flake tools
8,000-7,000 B.P.	Early Archaic	Less migratory; canoes, shell fishing by 3,000 B.P.	Sea levels rising, oak & hardwood areas cover most of "Florida", prickly pear & gourds, sabal palms & saw palmettos.	Alligator, deer, amphibious turtles; opossum, rat, rabbit, squirrel, frog, fish, snake several types of aquatic birds, panther & bobcat	Hafted end-scrapper, bifacial knives & scrappers hafted drills, flake knives, woven fiber objects.
7,000-4,500 B.P.	Middle Archaic	Increasingly sedentary population using a greater variety of tools.	Sea level stabilized to about present-day level; oaks, pines, and mixed forests; dryer than present-day.	Continuation of the changes which began in the Early Archaic -3,200	Pitch used to attach knives to handles.
4,500-3,200 B.P.	Late Archaic	Small villages and middens; crude fiber-tempered pottery; increased contact with other southeastern cultures.	Increase of moisture in environment; oaks giving way to pines and mixed forests.	See above	Matting, cordage, bone pins, antler ornaments, scrapers, wood carving; projectile points.
3,200-2,500	Florida Transitional	Sand and limestone tempered pottery; cultural identity Developing; evidence of circular shelters, twelve feet in diameter	Continuation of environ-mental changes started during the Late Archaic period.	Appearance and proliferation of animals that still inhabit Florida--owls, sharks, barracuda, alligators	Fiber-tempered pottery and ornaments made of steatite; ovate and hafted knives end scrapers, and cleavers
2,500 B.P. 700 A.D.	Manasota	Burial ceremonies begin; black drink ceremony begins; large, thick check stamped and plain pottery emerges; evidence of trade with other southeastern People; trade with mid-western people.	Coastal hammocks, salt and fresh water marshes.	Florida panther, Bear, gopher tortoise, racoon, salt marsh terrapins, many varieties of fish and marine life.	use of mortars and pestals, wood and stone tools; emergence of simple bone tools.
700-1000 A. D.	Weeden Island	Painted Pots; kill holes; secondary bundle burials; burial mounds mortuary pottery; highly decorated designs; incised and punctuated pottery; effigy pots charnel houses, extensive trading.	First widespread instances of human changes to Florida's natural environment; circular shell middens, some 20 - 30 feet in	Spread of species (see above); plus other species, like turkey and mosquitoes	Woven basketry; stone atlatal weights; hammerstones; netting; stone and shell celts.
1000-1500 AD.	Safety Harbor	Large towns with chiefs; temple mounds; pottery similar to Weeden Island, but poorly made and decorated; social ceremonialism; temple	Introduction of corn, beans and squash to Florida; dense, high trees; marshes.		Ceremonial pottery, utilitarian pottery; whelk shell hammers, pendants, chisels, etc.; hook and lines, nets
1513	European Contact	Widespread disease brought by Europeans; beginning of acculturation, including conversion to Christianity; changes in clothing styles; massive depopulation.	Introduction of foreign plants, citrus, etc. from European explorers.	Introduction of European draft animals, horses, pigs, cattle, sheep	

Table 1. Table of prehistoric cultural periods in the project region (Ancient Native Village Living History Museum 2009).

considerably drier than today. The region was characterized by xeric scrub vegetation. Areas where rivers or springs provided additional moisture supported forests of oak and pine (Borremans 1990:2). These wetter environments also sustained a host of animal life and would have attracted Paleoindian groups arriving from the north.

Paleoindians have traditionally been identified as nomads moving seasonally as sources of game and wild plant foods changed with the seasons. However, research by Daniel and Wisenbaker (1987) and others indicates that Paleoindians were not as nomadic as previously believed. More refined concepts of Florida Paleoindian lifeways include consideration of physiography, climate, vegetation, and animal populations in assessing the potentials for food and raw material resources. While late Pleistocene Florida savannahs supported transient grazing herds analogous to those found on the North American plains, many other types of game animals lived in the hammocks surrounding the rivers, lakes, and sinkholes that were important locations of Paleoindian activities (Martin and Webb 1974).

Initial reconstructions of Paleoindian subsistence emphasized the role of Pleistocene megafauna but archaeologists now suggest that Paleoindian diets included smaller game including fish, shellfish, turtles and plant foods. Evidence from spring and sinkhole sites by Carl Clausen (Clausen et al. 1979), Wilburn Cockrell (Cockrell 1988) and others lends support for revising the earlier perception. Although aquatic resources are not generally included in reconstructions of Paleoindian lifeways, the fact that sites of the period are most frequently found in association with sources of water suggests that fish, turtles, alligators, and shellfish may have been as important for Paleoindian subsistence as those resources were for later inhabitants of Florida (Florida Heritage Site 2010).

The archaeological evidence suggests that most utilitarian artifacts recovered in areas where chert was readily accessible were made from local materials. That could also support the hypothesis that the lifestyle of early Floridians may not have been quite as nomadic (Goodyear et al. 1983). Yet archaeological evidence of interaction with other Paleoindian groups can be found in the uniformity of artifact types. Paleoindian projectile points indicate only minor regional variations in form across the continent. Occasional artifacts fashioned from exotic raw materials found at Florida Paleoindian sites suggests some degree of both interregional travel and trade (Florida Heritage Site 2010).

Prehistoric habitation in what Milanich identifies as the central peninsula Gulf coast region of Florida (Milanich 1994:xix), dates to the Paleoindian period from 12,000 B.P. to 8000 B.P. Archaeological evidence of the presence of Paleoindians in the central peninsula Gulf coast region of Florida has been identified at several locations. Amateur and professional investigations in the Tampa Bay area have produced a considerable amount of Paleoindian lithic material (Figure 3). That distribution is likely associated with both the availability of raw materials for weapons and tools and the Paleoenvironment at the headwaters of a major

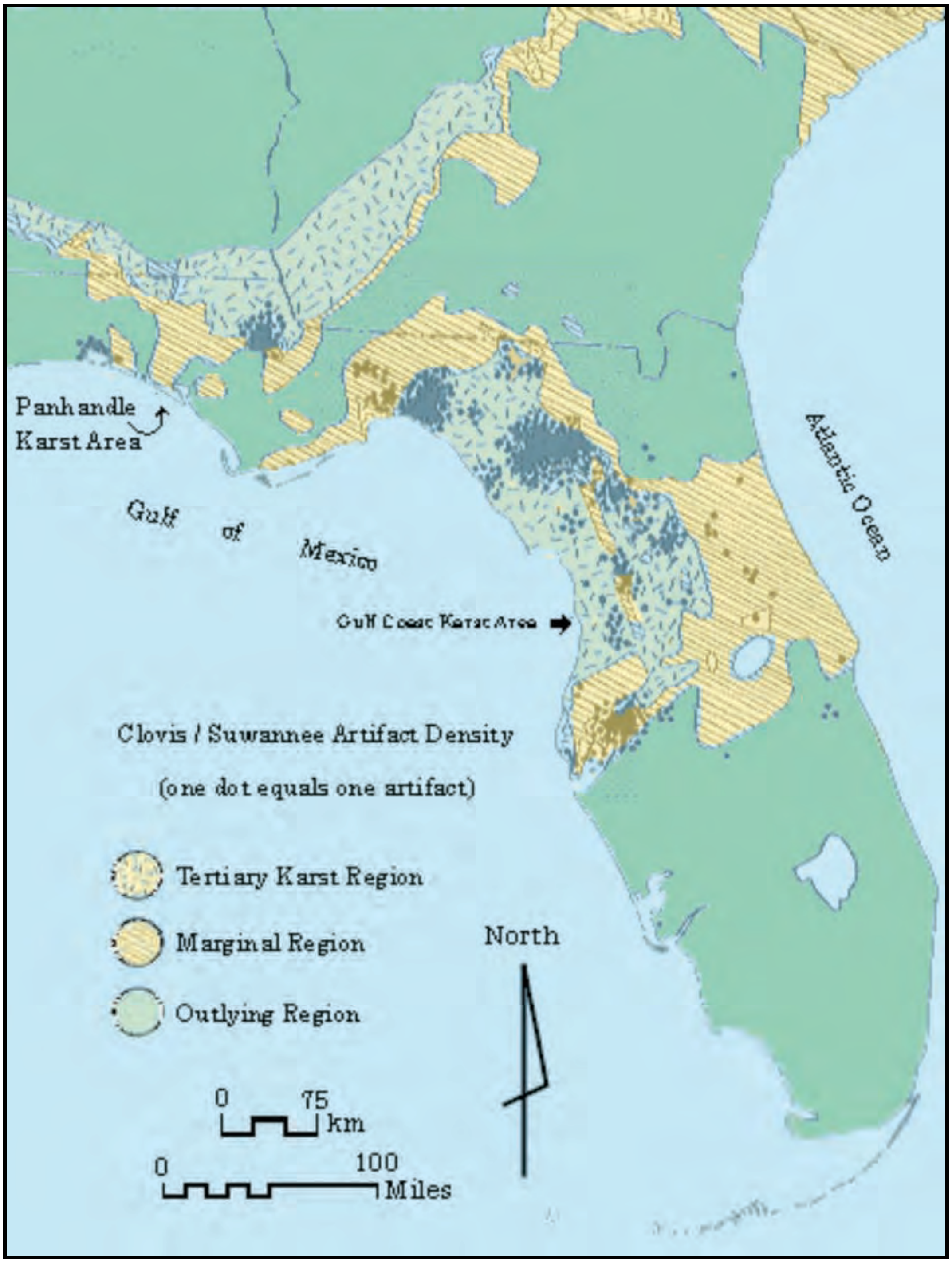

Figure 3. Distribution of Clovis and Suwannee points illustrates a concentration in the Tampa Bay vicinity (Florida Heritage Site 2010).

drainage system (Goodyear et al. 1983:62). The availability of potable water was critical and attracted the game that provided the major element of subsistence for hunters (Milanich 1994:41).

Paleoindian sites in Florida fall into at least five basic categories. Base camps or village locations have been identified in the vicinity of fresh water and chert outcrops. They are complex multicomponent sites like Harney Flats (8HI507). Quarry sites are located in association with sources of the chert that provided the primary raw material for tools and weapons. Hillsborough County is the location for a number of quarry sites. Lithic scatters have been identified as the location of short term camps that were possibly occupied while hunting and gathering. Artifacts that identify short term camps include tools and the debitage associated with their modification. Kill sites are characterized by Paleoindian artifacts in association with animal remains. Lithic material is similar to that identified at short term camps and includes projectile points, flakes that could be used for cutting and scraping, and flakes produced by tool use or modification. Where single lithic points are found the site is identified as the location of an isolated find (Florida Heritage Site 2010).

Distinctive projectile points are considered to be the most reliable diagnostic evidence of Paleoindian sites.

> Large, lanceolate projectile points have been recognized by archaeologists as the hallmark of the Paleoindian period. Some of these points may have been used as hafted knives. The Suwannee point is the most commonly reported lanceolate in Florida, but several other types and varieties have been defined to incorporate the stylistic and temporal variations in form. Common traits include lateral rather than basal thinning, basal grinding, and straight to slightly waisted lower sides. Based on technological and stratigraphic investigations, some temporal trends in projectile point shape have been documented. Point length and thickness appear to decrease in time, while waisting increases (Florida Heritage Site 2010).

In 1983, Albert Goodyear, Sam Upchurch, Mark Brooks and Nancy Goodyear published an article in *The Florida Anthropologist* that identified documented Paleoindian artifacts and sites, and formed basic conclusions about their distribution and significance (Goodyear et al. 1983). Perhaps the earliest identified Suwannee points in the area were documented by Gordon Willey. Two came from Parrish Mound 2 (8MA0002) near the Little Manatee River and a third from Safety Harbor Site (8PI0002) on Old Tampa Bay. All three had been redeposited in later Safety Harbor context, likely having been found and reused (Willey 1949:113; Goodyear et al. 1983:41). The inventory included artifacts from sites near the Sunshine Skyway Bridge in southern Pinellas County and the Safety Harbor site reported by Frank Bushnell (Bushnell 1962:89-101). Their report included Lyman Warren's 1966 article that identified Suwannee and other lanceolate Paleopoint types from Boot Ranch (8PI0063) in Pinellas County (Warren 1966:39-41) and a 1968 article that documented Paleoindian material dredged to make the Caladesi Causeway from Dunedin to Dunedin Beach (Warren 1968:92-94). Additional Paleopoints from the Fish Creek Site (8HI00105) on the eastern shore of Old Tampa Bay were reported by Karlis Karklins (Karklins 1970:62-80).

Additional examples of Paleopoints were reported in association with dredging activity in Tampa Bay and likely came from the immediate area of the inundated channels of the Alafia River and/or Little Manatee River (Goodyear and Warren 1972:52-66). In 1980, Goodyear, Upchurch and Brooks reported Bolen and Greenbriar points at the inundated Turtlecrawl Point Site (8PI0881) on Boca Ciega Bay near St. Petersburg (Goodyear et al. 1980:24-33). Northeast of Tampa Bay in the Hillsborough River drainage system, Daniel and Wisenbaker identified evidence of manufacturing Suwannee points at the Harney Flats site (8H1507) in Hillsborough County (Daniel and Wisenbaker 1981; Daniel and Wisenbaker 1987). Both a considerable number of Bolen beveled and Bolen plain Paleoindian points were also recovered at the Harney Flats Site (Daniel and Wisenbaker 1987:55). Unfortunately, the archaeological context of many of the Paleoindian point examples was impossible to establish and any associated material was lost.

During the drier conditions of the Paleo and Late Archaic Periods, sinkholes and the broken landform of the Karst region provided ready access to water sources. These oasis-like areas contained abundant wildlife and other resources that were exploited by early Native Americans. Perhaps the most revealing and comprehensively documented evidence of Paleoindians in the southern extremity of the central peninsula Gulf coast region is associated with investigations at Little Salt Spring (8SO18) and Warm Mineral Springs (8SO19) in Sarasota County. The most important aspects of investigation at the spring sites were the high level of organic preservation and the volume of human remains and associated cultural material. Both sites were explored by retired Lieutenant Colonel William R. Royal in 1958 and 1959. Initial archaeological investigation of both springs was carried out by Carl J. Clausen, State of Florida underwater archaeologist with the Division of Archives, History and Records Management. Work at Little Salt Spring (8SO18) was initiated in 1972 and focused first on exploration and mapping of the spring. Excavations in 1972 and again in 1975 in the basin and a ledge 27 meters deep produced a variety of Paleoindian material (Clausen et al. 1979:609).

Remains of a giant land tortoise were found on the 27-meter ledge where it had been killed with sharpened stakes and literally cooked in its shell. Radiocarbon dating of samples from the stakes found inside the shell indicated that activity on the ledge occurred 12,030 years B.P. and a fragment of tortoise bone dated 13,450 B.P. Excavation of a trench extending from the shoreline to the lip of the basin at 10 to 11 meters of depth and test squares in the basin produced both human skeletal material and additional cultural material. Material from the basin included food refuse, animal remains and artifacts of wood, gourd, shell, stone, and bone in association with shallow fire pits. One of the most unusual was the remains of a non-returning boomerang (Clausen et al. 1979:610-611).

In addition to Paleoindian evidence in Little Salt Spring, the site proved to have been the location of a large Archaic village. Between 8500 and 8000 years B.P. water levels at the site had increased to fill the spring basin and Paleoindian habitation appears to have ceased. As the climate changed to a more arid environment around 6000 B.P. the water level fell again (Milanich 1994:63) and the site was reoccupied (Clausen et al. 1979:612). The site of Middle Archaic habitation along higher elevations adjacent to a slough covered an area of 10,000 to 20,000 square meters and contained well-preserved vertebrate remains and tools made of stone, shell, and bone. Excavated Middle Archaic burials around the spring and inside the basin suggest that as many as 1,000 individuals may have been interred at the site. Because of subsequently high water levels and an anaerobic environment, organic preservation associated with the burials is high and tools, decorated carvings, and other organic material has survived. The remains of an almost intact brain were discovered inside the skull in one burial (Clausen et al. 1979:612).

At Warm Mineral Springs, Clausen's initial 1972 investigation (Clausen et al. 1975:192) was followed up by research carried out under the direction of Wilburn Cockrell. While Clausen found the site extensively disturbed by Royal's earlier recovery of skeletal material, his excavations recovered organic material that contributed significantly to Paleoenvironmental reconstruction. Samples of human bone were radiocarbon dated 10,000 B.P. (Clausen et al. 1975:204). Cockrell's research at the spring included mapping and definition of the hydrology of the site. Excavation on the 13-meter ledge identified a flexed human burial with an associated carved shell spearthrower spur. Radiocarbon dating of the skeletal remains produced a date of 10,300 years B.P. (Cockrell 1988:22).

Organic samples recovered by Cockrell dated as early as 11,000 years B.P. and established that the oldest human remains at Warm Mineral Springs existed chronologically with giant ground sloth, saber-toothed cat and North American horse and camel (Cockrell 1981:178). Although Middle Archaic habitation may have also been associated with Warm Mineral Springs, development of the site appears to have destroyed or obscured the kind of evidence found at Little Salt Spring.

By 10,000 B.P., the environment of Florida began to change. Additional rainfall allowed forests to expand farther south. These environmental changes coincide with the introduction of Archaic culture into Florida. Sea level was still low during this period; the present coastlines were not established until around 2000 and 4000 B.P. As a consequence, many Early Archaic sites likely lie inundated in association with their Paleo predecessors (Ruppé 1980:33-80; Milanich 1994:39-40, 62-63). Evidence from Venice Beach indicates that some Middle Archaic and later prehistoric sites may be inundated inshore along the present Gulf of Mexico coastline (Ruppé 1978:119-121).

The end of the Paleoindian Period and the beginning of the Early Archaic Period (8000-7000 B.P.) is marked by a gradual warming trend, sea level rise, and extinction of megafauna. In response to these environmental changes, early groups adopted new subsistence strategies, as indicated by different and more diverse tool types and more varied food resources recorded at archaeological sites (Milanich 1994:63; Russo and Quitmyer 2008:235-237). Data from Early Archaic period sites are similar to that from Paleoindian sites and suggests little change in subsistence patterns. Around 8000 B.P., the environment became wetter, which opened up new regions suitable for habitation. Exploitation of these new environments led to a corresponding expansion of the toolkit. Perhaps the most distinctive change seen archaeologically is the abandonment of the lanceolate-shaped projectile points like Clovis, Suwannee and Simpson. In the Early Archaic, notched, stemmed points appear almost exclusively. This change in point styles is the primary criteria for the division of the Paleoindian and Early Archaic time periods (White 1985:169; Milanich 1994:62-70, 75-87).

The Middle Archaic period spans the period from 7000-4500 B.P. During the Middle Archaic, sea levels began to stabilize and a modern coastal ecosystem developed. Sea levels were much lower; the shoreline was as much as 200 miles further west than its present position. By around 6500 B.P., mesic conditions began to prevail. With the warmer and wetter environment, cypress swamps and hardwood sub-tropical forests became established. As sea levels began to rise, interior areas shifted to an estuary system, offering potential inhabitants a more diverse subsistence base. By the late Middle or early Late Archaic a number of significant shell mounds and middens began appearing along the southwest coast. The introduction of these mounds suggest that a stable estuary system had been established by the Middle Archaic and that shellfish resources were utilized in the support of denser and more semi-sedentary populations (Beriault et al. 2003:15).

Middle Archaic sites in Florida are almost always identified on the basis of point typologies (Milanich 1998:12-13). Perhaps the most prolific of these point types is Newnan. These points have been recovered from intact contexts yielding carbon dates that consistently cluster around 4000 B.C. (Milanich 1994:76). The Middle Archaic environment in northwest Florida was a continuation of the wetter than normal conditions of the Early Archaic, however, as the period progressed, conditions became drier with more available surface water than in previous times with modern conditions stabilizing around 3000 B.C. (Milanich 1994:75). The environmental setting for Middle Archaic sites continued to diversify with freshwater shellfish middens appearing for the first time (Russo and Quitmeyer 2008:239). While the archaeological record indicates a shift to inland settlement along the ridges of the recently formed watersheds, the Venice Beach Site (8SO26) investigated by Ruppé identified Middle Archaic lithic artifacts in -5.5 meters of water offshore of a shell midden (Ruppé 1980:43).

Archaic Period sites in the Tampa Bay area include representative elements of the Early, Middle and Late Archaic. Turtlecrawl Point (8PI881) on Boca Ciega Bay was formed by dredge spoil deposition in the 1960s. The spoil was determined to have come from a complex inundated habitation site in the drowned stream valley of Long Bayou. Investigations in 1980 by Goodyear, Upchurch and Brooks identified cultural material dating from all three phases of the Archaic Period. Bolen points and tools representative of the Early Archaic confirmed the earliest period of activity at the site. Additional projectile points including a Hardee Beveled stemmed point, two Newnan points and eight other stemmed points indicate activity spanning the Middle and Late Archaic Period (Goodyear et al. 1980:24-33). The Crystal Beach Site in Pinellas County (8PI66) , identified as an Early Archaic Period coastal workshop, consisted of three upland areas of habitation and several shell middens located on the beach. Several projectile points dating to the Late Archaic Period were associated with extensive debitage indicative of quarry activity (Wolf 1975).

The Upper Tampa Bay Archaeological District (8HI2271) includes the peninsula area occupied by Upper Tampa Bay Park. Material at the site identified during a survey in 1979 included five linear middens associated with a salt water environment, six shell scatters associated with freshwater sinkholes and one lithic scatter. The sites all have been dated to the Late Archaic Period and are included on the National Register of Historic Places (NRHP n.d.). Northeast of Tampa Bay in the Hillsborough River drainage system, Daniel and Wisenbaker identified Archaic components at the Harney Flats Site (Daniel and Wisenbaker 1987:55).

Based on the archaeological evidence available today the Tampa Bay area has a rich potential for terrestrial and submerged Paleo and Archaic Period archaeological sites. Archaeological research has identified a total of 14 Paleoindian sites in Hillsborough County, 8 in Pinellas County, 1 in Manatee County and 3 in Sarasota County (Celeste Ivory, pers. comm. 10 March 2010). A total of 221 Archaic Period sites have been identified in Hillsborough County, 102 in Pinellas County, 38 in Manatee County and 53 in Sarasota County (Celeste Ivory, pers. comm. 10 March 2010).

Those numbers and the process of inundation suggests that Karst and other relict landform features offshore of Manatee County should be considered a high priority for association with both Paleo and Archaic Period submerged cultural resources. Those sites are most likely to consist of lithic material and possibly bone. However, evidence from terrestrial springs and sinkholes indicates that under some environmental circumstances and in conjunction with those types of submerged landforms a much more complex archaeological assemblages could be identified.

As the inundation process for the Florida coast isolated virtually all of the Gulf of Mexico Continental Shelf by roughly 5,000 B.P. (Thomas 2010:130), the survey area could not have been accessible after the Middle Archaic Period when the coastline stabilized at roughly the current elevation. For that reason the more recent prehistory of the Tampa Bay area has not been treated in this report. However, the timetable for prehistoric cultural change, period diagnostic cultural attributes, environmental conditions, fauna and tools are identified in Table 1.

Prehistoric Resource Potential

Wisconsin Period glacial advances produced world wide lower sea levels. From 60,000 to 50,000 and 24,000 to 20,000 years ago, the bottomlands of the Gulf of Mexico were exposed almost to the edge of the Continental Shelf. During this period, sea level was some 90 to 300 feet lower than present. The development of vegetation and adaptation of natural resources would have made the exposed continental shelf attractive to human populations (Fisk and McFarlan 1955).

The fluctuation of sea level during and following the Wisconsin Glaciation is an important factor for reconstructing the paleoenvironment and determining the potential for Native American sites on drowned continental shelf surfaces. Sea level fluctuation and its role in archaeological interpretation was postulated by Goggin in 1960 (Goggin 1960:352). The bands of Paleo-Indian groups that moved onto the exposed Continental Shelf as early as 12,000 B.P. occupied areas adjacent to streams and rivers (Fisk and McFarlan 1955). Confluences of streams and rivers, river levees and river and coastal terraces have proven to be high probability areas for terrestrial Paleoindian sites (Coastal Environments 1986).

On the Continental Shelf, those inundated geomorphological features are considered prime indicators for submerged prehistoric archaeological sites. In 1966, Emery and Edwards established a relative sea level curve and noted its implications for archaeological sites. Paleoindian and Archaic sites were most likely submerged offshore and sites of particular periods could be located at specific depths. Those authors also speculated "that little might remain offshore beyond some tools, because of the advancing seas and the scattering of materials produced by the passage of the surf zone over the sites" (Emery and Edwards 1966:735). Others postulate that estuarine sediment deposition associated with rising sea level possibly protected sites from erosion associated with the Holocene transgression (Belknap 1983). Research along the west coast of Florida suggests that the rise of sea level in low energy environments served to preserve sites during the inundation process.

The first physical evidence of prehistoric activity on the Florida continental shelf appeared inadvertently. Dredging along coastal margin zones to support increasing development and demands for shore protection occasionally disturbed prehistoric deposits. At Turtlecrawl Point, material dredged for the construction of an artificial peninsula contained cultural material that included Greenbriar and Bolen (Early Archaic) lithic material, unifacial tools, a Dalton adze, as well as Middle Archaic Morrow Mountain and Newnan points (Goodyear et al. 1980). At Terra Ceia Bay, materials dredged for beach nourishment contained artifacts including Dalton and Greenbriar points, a turtle back scraper, lithic tools, ceramics, and extinct faunal remains (Bullen 1951). Suwannee (Paleoindian) and Bolen (Early Archaic) points were uncovered during dredging at Caladesi Causeway (Warren 1968). Off the Gulf of Mexico coast of Venice Beach, Florida a complex of mounds and middens were investigated under the direction of Reynold J. Ruppé. That investigation documented inundated middens and recovered Archaic stone tools (Ruppé 1980:35-45; Murphy 1993). This evidence contradicts Emery and Edwards hypothesis and suggests that more complex archaeological deposits could well survive the inundation process intact (Murphy 1990:17-18).

Recent research on submerged sites along the northeastern Gulf of Mexico has been carried out by researchers at Florida State University (FSU). Under the direction of Dr. Michael Faught, FSU investigators actively searched for prehistoric sites along the margins of the drowned Aucilla River. Employing models used for locating Paleo and Archaic period sites in terrestrial settings, Faught identified submerged features that could be associated with prehistoric habitation (Faught and Latvis 2000; Faught 2001). Terrestrial analogs from the local karst terrestrial archaeological record have proved effective in identifying 39 sites on inshore areas of the continental shelf. More than 4,500 stone artifacts, including diagnostic projectile points, formal chipped stone tools and abundant debitage have been recovered. Abundant artifacts in dense arrays have been found at sites located between 3.5 to 9 miles offshore in water depths of 10–20 feet. Ancillary geoarchaeological data includes faunal bone, wood, mollusks, and sediment samples (Florida State University 1998). This research supports theories that submerged sites, like their terrestrial counterparts, are usually found on relict ridges near relict river and creek channels and inundated karst features like sinkholes (Faught 2003). As data from submerged prehistoric sites increases based on survey and testing, models for offshore site distribution may need to be refined.

Historical Background

Discovery and Exploration

The discovery of the New World in 1492 precipitated rapid colonization of the islands in the Caribbean. With European settlements and agricultural enterprises flourishing and the slave trade becoming more lucrative than efforts to find gold, a labor shortage began to develop in the Caribbean region (Helps 1900:114; Thomas 2004:256-257, 385-386). As the Caribbean native population was being depleted by harsh labor practices, disease, and the exportation of aboriginal slaves to Spain, slave traders received permission and incentives to explore a wider geographical area in search of other exploitable ethnic groups (Thomas 2004:291, 303).

Deagan (1988:189) suggests that "Florida proper has been considered as part of the circum-Caribbean area during early historic times, particularly from the prospective of colonial administration … [and that the] initial Spanish presence in Florida was a direct result of circumstances in the Columbus-era Caribbean, in that the first 50 years of Spanish activity in Florida was dominated by exploratory expeditions originating in the Caribbean". While no documents record the specific voyages of these slavers, the earliest extant maps indicate the Florida peninsula was known by about 1500.

The Cantino Map, ca. 1502, and the Juan de la Cosa Map, possibly produced two years earlier, depicted a landmass north of Cuba. The coastline detail suggests that the mass could represent Florida and some scholars speculate that these maps were prepared for Spanish slave traders (Helps 1900:xxiv, 58; Peterson 1975:12). La Cosa was the master of the celebrated *Santa Maria*, and was appointed as the official cartographer by Columbus during their second New World voyage. The La Cosa map "indicates the results of discovery up to 1500—those of Columbus, the Cabots, Ojeda, and Pinzon … and brings out more clearly than written description the very respectable amount of work in the way of exploration that had been performed in eight years, from Cuba through the Islands, down to the Main" (Helps 1900:xxiv-xxv, 69).

Europeans first explored the western coast of Florida during the early sixteenth century. Spanish documents generated during the sixteenth century, which described modern Florida appointed the phrase "Costa de Caracoles" [coast of the shells] to the central Gulf coast (Mulder 1991:2). In 1513, Juan Ponce de León sailed northward from Puerto Rico along the Atlantic coast of the Bahamas. That course took his ships to the coast of Florida somewhere north of Cape Canaveral. After navigating the straits between Cuba and the Florida Keys, he sailed up the west coast, perhaps as far north as Charlotte Harbor before returning to the Caribbean (Thomas 2004:282-284). Ponce de León returned to the west coast of Florida in 1521 intent on establishing a colony. Sand hills described in his pilot's logbook may have been those located at Caxambas (modern Marco Island) (Collier County Historical Society [CCHS] 1981:3). After encountering hostile natives in Florida and suffering from a mortal arrow wound, De León returned to Cuba (Peterson 1975:14-19; Milanich and Milbrath 1991:13).

Some sources suggest that Juan Ponce de León reconnoitered modern Anna Maria Island before his final departure, naming the small island Ana Maria Cay in honor of the Virgin Mary and her mother, Saint Anne. Alternate theories surmised that the appellation flattered one or more early-sixteenth-century Spanish princesses (Magrin 1980:B-1; Copeland 2005a).

Governor Pánfilo de Narváez (sixth royal administrator of La Florida) explored West Central Florida in 1528 with 400-armed men and 10 women. Landing near present-day Tampa Bay on Good Friday, he discovered European corpses in a local village laid out in boxes that had been constructed in Spain. The Indians, under questioning and physical abuse, said that the deceased individuals had come ashore as the result of a shipwreck (Adorno and Pautz 2003:175). Due to the Spaniards mistreatment of the natives, the Narváez expedition was continuously harassed as it reconnoitered the region. Eight years later and without success, four survivors of the original party, including Álvar Núñez Cabaza de Vaca, reached Mexico (Milanich and Milbrath 1991:16-17).

Although the survey ended in disaster, Narváez's treasurer wrote the first documented description of Tampa Bay. Cabeza de Vaca's account of the exploration reflects the actual contemporary distance between their landing site and Old Tampa Bay. Most historians agree that the large embayment observed by Cabaza de Vaca was Tampa Bay. De Vaca reported:

> This port is the best in the world, and it enters inland seven or eight leagues. And its bottom is of soft, fine sand. And there is no tide nor any fierce storm that enters it, and thus many ships will fit in it. It has a great quantity of fish. It lies one hundred leagues from Havana, which is a settlement of Christians in Cuba, and it lies in a line north to south with

> this town. And here breezes are always blowing. And ships come and go from one place to the other in four days, because they come and go a quarter of the crew always (Adorno and Pautz 2003:175).

In 1539, a similar expedition under Hernando de Soto arrived in the Tampa area to establish a colony and search for gold. The explorer named the bay "Espiritu Santo" or spirit of the saint. De Soto's fleet of nine ships, manned with over 700 men, sailed from Havana on 18 May 1539. The vessels carried several hundred fighting dogs and horses, swine, building supplies and a vast array of weapons (Gannon 2003:6). De Soto arrived in the Tampa Bay region on 25 May, settling in the abandoned Indian village of Ocita (Milanich and Milbrath 1991:84). Quickly recognizing the futility of finding gold in the area, de Soto and his men abandoned the settlement and marched northward. The conquistador left a legacy of destruction and violence in his quest for gold that ended in May 1543 upon his death near the Mississippi River (Milanich and Milbrath 1991:17-18, 77).

In 1549, a third Spanish expedition landed in the Tampa area, which included six priests who intended to set up a mission in Florida. The members were unarmed and intended to accomplish their objectives through gifts and the Word of God. Five priests were captured and killed by local Indians when they discovered that the group was not part of a larger force. The surviving priest was forced to flee with the expedition's ships back to Mexico and reported the group's failure to convert the Indians by peaceful methods (Matthews 1985:28-29).

Colonial Period

Pedro Menéndez de Avilés led yet another expedition of six vessels to the Tampa area in 1567. Menéndez employed Hernando de Escalante Fontaneda, who had lived with the natives for nearly 17 years after being shipwrecked in the area in 1545, as an interpreter. Fontaneda wrote about his Florida travels after returning to Spain in 1575. During his stay at a Calusa village, Menéndez negotiated with the Calusa chieftain Carlos and was granted permission to establish a small settlement and fort subsequently called San Antonio de Padua. In addition to establishing Spanish colonies on the west coast of Florida, Menéndez searched for an inland passage that would connect with the St. Johns River. That search led to an expedition to Tampa Bay and negotiations with the Tocobaga. A connection with the St. Johns was never identified and efforts to establish a peace between the Tocobaga and the Calusa failed. After Pedro Menéndez departed an outpost at Tocobaga and the San Antonio de Padua settlement were abandoned in the face of increasing hostility (Milanich and Milbrath 1991:156; Matthews 1993:53-59).

For the next 200 years, Spanish interest in Florida concentrated on settlements in St. Augustine and Pensacola. With the exception of seasonal fishing stations (ranchos) along the southern gulf coast, the Tampa region received little attention. Historian Walter Fuller described the typical West Florida rancho as a "peculiar Cuban-Spanish institution that was the great civilizing force of the lower Gulf Coast of Florida and the most dependable way to make a living for perhaps two centuries of Spanish rule of Florida" (Fuller 1969:47).

A late-nineteenth-century resident of Anna Maria Island named John R. Jones related that the Spanish recorded the island as "Ana-Maria-Cay" on ancient charts, and more importantly suggested that "three Spanish settlements-one at north point in Anna Maria, one in Holmes Beach near 52nd Street and one in Bradenton Beach-were established at a very early date" (Copeland 2005a).

An excerpt published by *The Anna Maria Island Sun* from Captain Jones's 1927 narrative stated:

> Traces of these early settlements could be found when the government turned over the Island for homesteaders; and in the early 1880s, when part of the island was taken pre-exemption, the remains of houses and broken cooking utensils were in evidence (John R. Jones quoted in: Copeland 2005a).

West Florida ranchos usually operated from November through April, and the fishermen lived in crude huts constructed of palmetto thatch. Despite the primitive housing, they enjoyed an abundant choice of fresh fish supplemented by "good gardens and considerable fruit trees, notably mangoes, limes, oranges, guavas and pineapples" (Fuller 1969:47). The rich fishing grounds near the entrance to Tampa Bay were an enviable condition for Cubans who faced a severe shortage of fish. Deep water on the northern end of Cuba precluded dependable fishing, while the southern end of the island was sparsely populated and surrounded by shallow waters. Therefore, the "poor of Cuba depended on the Florida Gulf Coast" for much of their protein supply, especially mullet. The Cuban government did possess the advantage to license the ranchos due to its monopoly of salt. This control was critical because salted mullet remained edible far longer than smoked mullet, which of course advanced the importance of the commodity (Fuller 1969:47)

Cuba also could not produce suitable timber and naval stores for critical vessel construction. Consequently, Spanish shipbuilders lobbied for expeditions to assess those resources in West Florida. In 1756, Ferdinand VI decreed that timber there could be harvested for masts and spars. Consequently, Havana's Royal Armada shipyard sponsored Juan Baptista Franco to visit the region. The navy draftsman's expedition around Tampa Bay lasted some 22 days with only the rewards of several specimen logs. Franco did return to Havana with the impression that Spain should settle Tampa Bay (Weddle 1995:204-205).

In the following year, Havana navy officials sponsored another voyage to Tampa Bay under the command of Franco. Royal Armada pilot Don Francisco María Celi accompanied Franco on this occasion and departed on 10 April 1757 aboard the xebec *San Francisco de Asís*. While Celi was responsible for surveying operations, Lt. José Jiménez commanded the shallow-draft, three-masted vessel and its crew of thirty-four sailors. On 13 April, the crew could observe the islands flanking the mouth of Tampa Bay. Later that day, they arrived at San Juan y Navarro [Southwest Channel] and commenced to measure San Blas y Barreda [Egmont Key] (Weddle 1995:205-206).

After sounding around several keys at the bay entrance, the Celi-Franco party explored numerous coastal sites in modern Hillsborough, Pinellas, and Manatee counties. Near the end of their undertaking, the Spanish reconnoitered the southeast side of Tampa Bay but perhaps "failed to take notice of the Manatee and Little rivers, Terra Ceia Bay, or Sarasota Pass." On 6 May 1757, Celi and the other Spanish "erected a cross on the southern point of Egmont Key". On the following day, the *San Francisco de Asís* passed through Southwest Pass to return to Cuba by 12 May (Weddle 1995:207-208). Although their survey and hearty recommendations for utilization of Florida's resources failed to generate results, a remarkable map attributed to Celi provides early documentation of the area (Arnade 1965:86-88; Holmes and Ware 1968:91-97; Weddle 1995:208).

England took control of Florida in 1763, and within two years Scotsman George Gauld conducted a survey of Tampa Bay for the British Admiralty. On 13 June 1765, the exceptional cartographer and 22 sailors left Pensacola aboard HMS *Alarm*. Piloted by Captain Rowland Cotton, the 32-gun man-of-war was accompanied by the schooner *Betsey*. Taking intermittent soundings along the way, the vessels reached the three small islands at the entrance to Tampa Bay by late June. After the two-day challenge of navigating the *Alarm* up the channel north of Egmont Key, the ship was safely anchored in lower Tampa Bay. The crew, however, was subjected to an unknown sickness there. Over the course of their stay, 14 sailors died (Weddle 1995:208).

HMS *Alarm* would remain at that anchorage for nearly 70 days. In the interim, Gauld and his retinue began to survey "the adjacent islands, most of them shrouded in mangrove and blackwood bushes" (Weddle 1995:209). They sounded the three major channels, charted their shoals and described individual characteristics such as directions of currents and tidal ranges. Eventually, the Gauld party "examined John's Pass to the north and Longboat Pass to the south and proceeded thence into Sarasota Pass and Boca Ciega Bay, sketching the islets within" (Weddle 1995:209).

At the conclusion of the momentous project, Gauld noted several important details about contemporary Tampa Bay. Large vessels could seek refuge in the bay, and for their sustenance there was "an abundance of fish, oysters, clams, and waterfowl, with turkey and deer plentiful on shore" (Weddle 1995:209). In regard to the indigenous population, Gauld and the Royal Marines saw no Indians but confirmed that there were empty Indian huts (Weddle 1995:209).

Gauld suggested that the east side of the Pinellas Peninsula could sustain a healthy settlement site, noted the evidence of Spanish fishing camps on the "Mullet Kays", and observed that the English were well aware of the bay (Matthews 1993:66-67; Weddle 1995:209). This last observation was made on 14 August 1765, when a "schooner bound from Virginia to Pensacola hove into view, sailed confidently into the bay, and dropped anchor to take on water and firewood" (Weddle 1995:210).

After carefully assessing the high ground of Egmont Key, Captain Gauld prophetically observed that a minor fortification on the northern end of the small island could effortlessly control the entrance of the "Harbour" (Weddle 1995:209). The cartographer's contribution to the region's modern toponymy is evident. Gauld's written descriptions and the accompanying chart utilized the names Egmont, Hillsborough and Mullet, and he "also brought forth the Indian name Tampa, which to that point had been obscured by the Spanish name Espiritu Santo" (Weddle 1995:210).

A six-week survey of Tampa Bay was included in a larger Florida project conducted by Bernard Romans during 1769. Romans infiltrated some areas that Celi and Gauld did not explore, and mentioned the "Captain Braddock" chart as one of his possible guides. Romans suggested that two keys that defined Tampa Bay's mouth were called "Castor and Pollux". These names, he attributed to "Braddock's ship and another privateer that sailed with him" (Weddle 1995:210).

In the course of his investigations, Romans "sank his boat in the Manatee River" (Weddle 1995:210). This event apparently caused little concern, as he continued his expedition to remark on the many advantages that Tampa Bay afforded mariners and commercial fishermen. Indeed, at this time, Cuban fishing fleets visited Tampa Bay during several months of the year to catch "drum, mullet, and bass" (Weddle 1995:210).

By 1779, 30 ships were fishing off the south Florida Gulf coast (Glasser 1976:11). In 1783, Spanish naval officer Joseph Antonio de Evia arrived at Tampa Bay to also conduct a royal survey. Evia mentioned that 12 to 14 boats regularly transported dried fish from Tampa Bay to Havana. Natives living near the bay continued to travel by their efficient cypress-log canoes in the same manner, as observed by the Spanish during the sixteenth century (Hammond 1973:356-357; Weddle 1995:211).

Vicente Folch y Juan [stationed at Mobile Bay] was commissioned by Governor Esteban Miró to survey Tampa Bay in September 1793. Miró chose well because the Catalonian engineer was experienced in topographical as well as marine operations. Upon reaching West Florida, Folch first anchored 30 leagues south of the bay [Pine Island Sound] to weather a storm. Shortly after his arrival at the mouth of Tampa Bay, Folch's vessel grounded there during a squall. Unable to "right the vessel", Folch and a small landing party boarded a launch to investigate the bay paying close attention to the mouths of four rivers and outlying barrier islands (Weddle 1995:214-216).

The Spanish survey revealed that vessels drawing 15 to 16 feet could enter the Acachy [Millian] and that even a war frigate could be brought up the river "by warping or sailing." Abundant timber growing along its shores was well suited for ship construction. Folch observed that the mouth of the Manatee River could accommodate vessels drawing six to seven feet and was navigable upriver for six leagues by canoes. Although the Nattasy [Río de los Ojos de Agua] was shallow at its mouth and impeded navigation, Folch related that the trees that grew along the waterway were superior species for shipbuilding. Another river flowing into Tampa Bay, Tala Cahkp [Río de Ostiones], presented the best location for a European settlement according to Folch (Weddle 1995:216-217).

At this time, Folch observed two Indian villages in the Tampa Bay area. Cascavela, 30 leagues east, supported Savacolas and "Hechityses" and their "many slaves and large herds of cattle". The village of Anattylaica, 10 leagues to the northwest, was comprised of 80 families that also owned slaves and cattle. These local Indians cultivated "corn, rice, potatoes, pumpkins, and various kinds of vegetables and had a profitable trade in skins with San Augstín, Apalache, and Pensacola" (Weddle 1995:217).

Arriving in Havana on 27 November 1793, Folch prepared a report for the captain-general of Cuba and the Floridas Luis de las Casas. Folch suggested that the Tampa Bay region could be initially settled with a small complement of officers and garrison of 50 soldiers. He also proposed that the barrier islands should be colonized with 50 American families, which would develop commercial interests and deter foreign intrusion. Folch envisioned that after recruiting these Americans by newspaper advertisement, "Spain would have no vacant coast on the entire Gulf of Mexico". In the event of war with King George III, control of Tampa Bay "would put an end to the English of Providence coming to fish, cut wood, or trade with the Indians; [and] his Majesty [Charles IV] would be lord of the entire Gulf" (Weddle 1995:218).

Despite Folch's assignment to patrol the route from Cuba to the Mississippi passes with the galley *Leal* and schooner *Fina* for the next few years, he remained somewhat obsessed with the West Florida coast. In 1799, while acting as the military and civil commandant at Pensacola, Folch declared that the "English have kept themselves in full possession of a considerable part of the coasts of both Floridas" (Weddle 1995:219-220). In particular, Lieutenant Colonel Folch was convinced that the English Crown was determined to build a fortification at some site on Tampa Bay. This perception was based on George Gauld's survey of Egmont Key (1765), when the Scottish cartographer had noted the high ground there; and the 1783 Crown plan to send two high-ranking British officers to Tampa Bay to choose the site for a fort (Weddle 1995:209, 221).

Seminole Wars and American Development

The strategic value of the Tampa Bay region was widely acknowledged at the onset of the First Seminole War in 1818. The Seminoles were a tribe composed of various displaced native groups and escaped black slaves that had migrated into central Florida in the late eighteenth and early nineteenth centuries. The Seminoles harbored some resentment towards the United States, perhaps as a consequence of the Creeks and Muscogee that had been driven out of Georgia and Alabama by American settlers and attacks led by General Andrew Jackson during the War of 1812. That sentiment was manifested in frequent attacks on Georgia settlements across the border from Spanish Florida (Matthews 1993:66; Knetsch 2003:12-13).

In March 1818, General Andrew Jackson and a force of 3,500 soldiers marched into Spanish Florida to retaliate against the Indians. Jackson captured the Spanish fort at St. Marks and then marched on Pensacola where he forced the surrender of Spanish fortifications protecting the city. The attack into Florida resulted in destroyed villages, massive quantities of confiscated grain and hundreds of cattle, and brought the raids to a temporary halt (Gannon 2003:27; Knetsch 2003:28-35).

During the invasion, former British Royal Marine officer, Robert C. Ambrister and Peter Cook were captured near their vessel anchored near the Suwannee River bar. Documents aboard the vessel tied Ambrister and Cook to a Scottish trader named Alexander Arbuthnot. While Cook proved to be an uninvolved clerk, it was clear that Arbuthnot and Ambrister had conspired with Indian allies to take over the Florida peninsula and were also accused by Americans with conspiring with the British. Arbuthnot was arrested and he and Ambrister were tried and convicted for giving aid and comfort to enemies of the United States. Arbuthnot was hanged and Ambrister was executed by firing squad on 29 April 1818 (Knetsch 2003:34-35; O'Brien 2005:215-216). The incident compounded an already complex international diplomatic crisis. In spite of Jackson's gross exercise of his authority, the invasion of Florida led to the Adams-Onis Treaty that ceded Florida to the United States (Knetsch 2003:40). In 1821, the United States assumed control of Florida after purchasing the territory from Spain for $5,000,000. Settlement of the region increased following American control of the peninsula.

After the war, General Andrew Jackson ordered Captain James Gadsden to survey the west coast for prime locales for fortifications to thwart sea-based assaults. Gadsden reported on the strategic position that a fort based on Tampa Bay would provide against foreign aggression in the region. He noted that:

> The Bay of Tampa, in latitude 27 degrees 36 minutes, is esteemed one of the finest harbors in the Gulf. Its entrance is bold, admitting of four fathoms at low water and from its peculiar situation must at no distant period become valuable as a maritime depot for Florida. As such it must be embraced within any chain of seacoast defenses which may be constructed and its occupancy is all important at this period. It is the last rallying point of the disaffected Negroes and Indians and the only favorable point from whence communication can be had with Spanish and European emissaries (Grismer 1950:46).

In 1819, New York solicitor Richard S. Hackley purchased 11 million acres that had been granted to the Duke of Aragon by Ferdinand VII in February 1818. Though the Florida treaty between Spain and the United States nullified all grants made by the Spanish monarch after 24 January 1818, the attorney's claim was eventually recognized and included the Tampa Bay region in its entirety (Burnett 1991:109; Matthews 1993:71). Hackley, no doubt, was aware of contemporary news articles that predicted the future importance of the bay area. One published in the *Niles' Weekly Register* in March 1821 reported:

> Florida, in every respect, is a valuable acquisition to us. It *may* cause a considerable revolution in things, domestic and foreign. It opens to us a large tract of country, capable of furnishing immense supplies of cotton, sugar, rice and perhaps coffee and cocoa, and the olive, all of which, it may be exposed, will be fully tried on an extensive scale, by new adventurers in those, at present, rich commodities. The product of these will have a domestic effect, as well as that which may be caused by considerable disbursements by the government at Pensacola and probably at Hillsborough Bay, or Tampa Bay, or Espiritu Santo Bay, as a place on the west coast of the peninsula is called, which will, most likely, become the seat of government (*Niles' Weekly Register* 1821a:49).

Another *Niles' Weekly Register* story, published three months later, touted the significance of Espiritu Santo Bay stating,

> From what we hear of Tampa Bay, though its shores are not now inhabited, it will probably contest with Pensacola the honor of being ultimately fixed upon as the site for the southern naval depot of the United States. The bay is said to be easier of access and to have more water than that of Pensacola; the neighboring country is fertile and abounds with live oak--and a short canal will unite the bay with the great river St. Johns (*Niles' Weekly Register* 1821b).

While Hackley's business commitments prevented him from traveling to Florida, he sent his 21-year old son Robert to Tampa Bay in November 1823. Robert established a plantation on the east bank of the Hillsborough River a year later. It would be the first on Florida's west coast (Burnett 1991:109). Relations with the Seminoles deteriorated after Spain's cession of Florida. Land speculators advocated the seizure of Indian lands and supported General Jackson's desire to move the Indians to western reservations. Indian leaders agreed to a treaty that was signed at Moultrie Creek, south of St. Augustine, in September 1823. The Moultrie Creek Treaty created one reservation on the upper Apalachicola River and one in south Florida (Covington 1958:319; Knetsch 2003:44-45).

In return for their consent to move on to reservations, the United States promised protection from encroachment by American citizens and funding for an annual annuity, schools, blacksmith shops, agricultural implements, and livestock were included. Meat, corn, and salt would be supplied for the first year and funds were promised for moving. The terms of the treaty were never met by the United States and the Seminoles were justifiably dissatisfied and disgruntled (Knetsch 2003:45-49). Left without the support and protection identified in the treaty, many Seminoles left the reservations and raids on the settlements amplified in the absence of military protection (Knetsch 2003:52-60).

On 5 November 1823, a military fortification for Tampa Bay was funded by the U.S. War Department. Colonel George Mercer Brooke and four companies of the 4th Infantry traveled from Pensacola to Tampa Bay in January 1824 to identify a suitable location and to construct a fortification (Covington 1953:273-274, 1958:320). Brooke reported:

> On the 22nd met with Colonel Gadsden who had arrived some days previous and who made a partial reconnaissance of the country but had not selected any particular spot. On visiting several places, and after a consultation, we determined upon this place as the most eligible regarding the objects of the expedition, health and the convenience of getting supplies. We were also influenced by the quantity of cleared land which was at once adapted to gardens for the officers and men. We are situated on the northeast bank of the Hillsborough River immediately on its entrance into the Bay of the same name. Colonel G. did me the honor of insisting that the cantonment should be called Brooke but it will be known as that of Hillsborough till the pleasure of the War Department shall be ascertained (Brooke to Brown, 5 February 1824, O.A.G., 97-B-1824; Grismer 1950:56-58).

Brooke's report omitted that the site's cultivated land and existing buildings were due to the efforts of Robert Hackley. Despite valid protests and legal action by the Hackley family, the federal government seized the plantation and its surrounding lands (*Scott v. Carew*, 196 U.S. 100 (1905); Covington 1958:319; Burnett 1991:111). Cantonment Brooke, later renamed Fort Brooke, was isolated as the nearest army post was located across the peninsula at St. Augustine (Figure 4). The army post at Pensacola was over 300 miles away by water. The army transport *Florida* called on Fort Brooke periodically from Fort Barrancas [Pensacola] with provisions, correspondence, and news (Covington 1958:323). U.S. Navy warships that were requested to deter Indian trouble arrived in the bay infrequently.

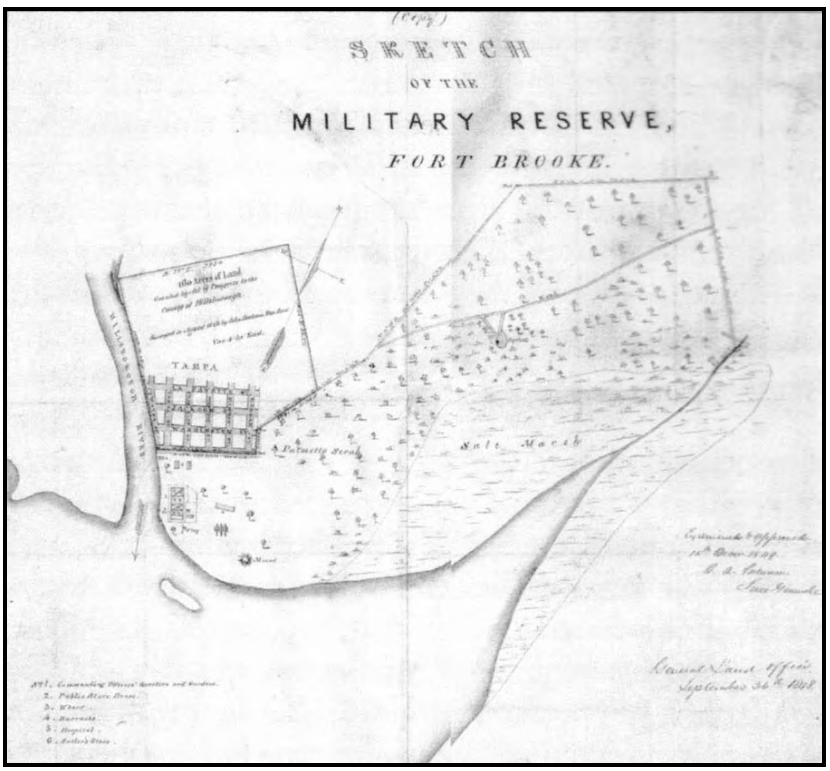

Figure 4. A sketch of Fort Brooke (Knetsch 2003:64).

In July 1832, newcomer Augustus Steele was appointed deputy collector of customs at Fort Brooke and was later designated postmaster of the Tampa Bay post office by President Jackson. Steele immediately recognized that in order to prosper, the area should be removed from Alachua County. After intense lobbying by Steele and other prominent settlers, the Legislative Council of the Territory of Florida passed and approved the creation of Hillsborough County in January 1834. The "village of Tampa" was elected as the interim county capital, "until the permanent seat of Justice" was established. Hillsborough County was bounded as follows:

> On the north by Alacuua [*sic*] County, by a line running East and West from the Indian village of Toachatka, forty miles from Tampa, East by Mosquito County, South by Munroe [*sic*] County, and West by the Gulf of Mexico, shall constitute a County to be called Hillsborough (Legislative Council of the Territory of Florida, Sessions Laws 1834, 12th Session, 22 January/25 January 1834).

The Pinellas Peninsula formed the western boundary of the county, which extended from Hernando County in the north to Fort Myers in the south and to the Kissimmee River in the east (McCarthy 2007:18; Hillsborough Board of County Commissioners 2009). The first known permanent white resident on the Pinellas Peninsula was Count Odette Phillipe, who settled near Safety Harbor in ca. 1836. Phillipe is largely credited with the introduction of grapefruit (*citrus paradisi* Macf.) into Florida in 1823 (Williamson 1997:1).

Despite the massive geographical size of the new county, the 1840 *Sixth Census* reported only 452 residents, all of which were associated with military posts (U.S. Department of State 1840:96-98, 334-344). Within two years of the new county's inception, the region once again became embroiled in Indian unrest. During the late 1820s, scarcity of food among the Seminoles had reached near famine conditions. As early as April 1824, Colonel Brooke reported that the "Indians appear to me, to be more and more displeased at the treaty … and I am not unapprehensive [*sic*] of some difficulty" (Covington 1953:276).

An Indian raid in 1826 had prompted the United States government to discontinue the annual annuities and to seize all firearms from the Seminoles. In anticipation of more serious problems with the Seminoles in the south Florida reservation, Colonel Duncan L. Clinch and General Edmund P. Gaines made an inspection of Fort Brooke in January 1827 (Covington 1958:323). Under extreme pressure to move the Seminoles in Florida to territories west of the Mississippi River following the Indian Removal Act of 1830, James Gadsden met with representatives of the Seminole tribes at Payne's Landing on the Ocklawaha River in May 1832. There seven of the Seminole chiefs signed the Fort Gibson Treaty agreeing to move the tribes to new reservations the trans-Mississippi West within three years (Gannon 2003:32; Knetsch 2003:60).

The immediate reaction of the younger Seminole chiefs, warriors and blacks living with the tribes was open resistance. Without the approval of the tribal council the Fort Gibson Treaty was not binding. Given the miserable failure of U.S. officials to adhere to the terms of the treaty signed at Moultrie Creek, there was understandably meager support to approve the Fort Gibson Treaty (Knetsch 2003:61). In April 1835, U.S. Superintendent of Indian Relations Wiley Thompson outlined conditions for those who insisted on remaining in Florida. Those Seminoles who would not voluntarily leave Florida would be subject to a moratorium on the purchase of gunpowder. Indians including Chief As-sin Yahole, known by Americans as Osceola [or Powell], defiantly refused to submit to any American orders (Figure 5). As a defensive measure in response to increasing Indian raids, Hillsborough County residents called for the secretary of war to reinforce Fort Brooke (Knetsch 2003:69).

Figure 5. Chief As-sin Yahole, also known as Osceola or Powell (Gannon 2003:33).

Open warfare erupted on 28 December 1835 when Seminoles ambushed a 108-man column commanded by U.S. Army Brevet Major Francis L. Dade, in which the War of 1812 hero and most of his soldiers were massacred. At the time, Major Dade was marching from Fort Brooke to reinforce Fort King [near present-day Ocala] on a punitive mission. Dade and 39 soldiers from Company B, 4th Infantry first arrived at Tampa Bay on 21 December aboard the transport *Motto*, and were reinforced by other Florida peninsular forces (Roberts 1927:124). The calculated attack on Dade's unit corresponded with the assassinations of General Wiley Thompson and Lieutenant Constantine Smith at Fort King on the afternoon of 28 December. In addition to the murders of the army officers, "the Mickasookee tribe of forty or sixty strong, under the traitor Powell" killed the post's sutler and his two clerks (Cubberly 1927:148-149; Knetsch 2003:671-72).

By the end of January 1836, Fort Brooke was reinforced with two detachments of infantry. Joint military and civilian efforts in 1837 supported construction of a number of forts and roads in the Tampa Bay area. The ultimate result of this network of strategic outposts and roadways was to facilitate constant offensive and defensive operations against the Seminoles. The revenue cutters *Dallas* and *Washington* sailed from Key West with arms, ammunition, and supplies (Matthews 1993:86-87). In response to urgent requests for support at Fort Brooke, Commodore Alexander J. Dallas dispatched a company of U.S. Marines and the armed schooner *Grampus*. Commandant William C. Bolton provided arms and three field pieces, which were brought into Tampa Bay aboard the USS *Vandalia* (Knetsch 2003:671-74).

While the major engagements of the Second Seminole War were fought outside the Tampa Bay area, Fort Brooke served as a major link in the chain of supply and reinforcement for military operations. Following a series of engagements near the Cove of the Withlacoochee, General Winfield Scott and General Edmund Gaines were dispatched to conduct the Florida Campaign (Knetsch 2003:86). General Scott devised and initiated a three-pronged attack to force the Seminoles into the Cove of the Withlacoochee. In the face of considerable odds and without an avenue of escape, the Seminoles were expected to surrender. The strategy was confounded from the start by weather, sickness, the difficult terrain, poor coordination, and communication problems (Knetsch 2003:89-91). The Seminoles carried out attacks against the columns and, after a highly mobile engagement at Wahoo Swamp, used their superior knowledge of the area to escape.

Although the somewhat grandiose plans of General Winfield Scott failed to produce results, and battles like that fought at Lake Okeechobee on Christmas Day 1837 proved costly and without significant consequences for the Seminoles, the combined strength of United States forces ultimately prevailed (Knetsch 2003:105). With Tampa Bay as a forward base, naval vessels prevented the Seminoles from receiving supplies and provided transport, supplies, and protection for U.S. Army units along the West Florida coast (Matthews 1993:86-93). The capture of King Philip, Holata Micco [Billy Bowlegs], Coa Hadjo and Osceola significantly reduced the Seminole leadership (Figure 6) (Knetsch 2003:104-105). While battles like that at Loxahatchee were singly indecisive, each one reduced the number of Seminoles warriors. Although Congress was not disposed to increase resources for the war when Brevet General Zachary Taylor took command in May 1838, he continued to fight isolated and inconclusive engagements where the Seminoles generally chose the location. Although being slowly pushed into the swamps, the Seminoles launched highly successful guerilla attacks on army outposts like one on the Caloosahatchee River established by Colonel William S. Harney (Knetsch 2003:118-119). Under a series of new commanders, the guerilla war continued until the spring of 1842 when Colonel William J. Worth fought the last organized engagement with the Seminoles near Lake Apopka (Knetsch 2003:131).

Figure 6. Billy Bowlegs (Knetsch 2003:144).

The Second Seminole War provided the impetus for the passage of the Armed Occupation Act in August of 1842. The act provided anyone who settled certain parts of Florida with title to 160 acres of land. If armed settlers moved into the area in considerable numbers, their presence would combat the Seminole threat and possibly push them towards extinction. Within a year, the General Land Office had granted numerous homestead sites throughout the Tampa Bay region (Matthews 1993:127-128).

On the lower Pinellas Peninsula, Antonio Maximo Hernandez established a fish camp circa 1835 at the tip of Fishermen's Point, later known as Maximo Point. William Bunce developed his first camp at Shaw's Point [south side of Manatee

River] around that time and perhaps started other fish camps on Cabbage Key [Terra Verde] and Hospital Key. Bunce has the distinction of being the "only United States citizen to ever head a Rancho" (Fuller 1969:47).

Following the conclusion of the Second Seminole War, Florida was admitted into the Union (Matthews 1993:181). Civilians settled around Fort Brooke as Tampa became a thriving commercial center. The city was incorporated in 1855, and Manatee County was also established that year by the Florida legislature. Agricultural products from small farms and large plantations east of Tampa Bay produced vegetables, livestock, and cash crops such as sugar cane, cotton, and tobacco. Fish continued to be an integral source of revenue and now was also processed for shipment to both domestic and foreign markets (Pizzo 1968:12; Matthews 1993:157-158, 211).

A significant 1846 hurricane had destroyed crops, buildings, and vessels that supported those industries but the storm's aftermath presented only a temporary economic setback (Matthews 1993:165). However, the 23-25 September 1848 hurricane that swept the Tampa Bay region destroyed most ranchos, including that of veteran Antonio Maximo Hernandez [died 15 August], "thus putting an end to the fishing business for the Cuban market in this section until 1859" (Bethell 1914:7; Fuller 1969:47-48, 50).

Although the economic impact of the hurricanes was significant, Holata Micco and his 30 warriors presented a more serious threat to the farmers and plantation owners east and south of Tampa. Holata Micco's initial attack killed four militiamen under the command of Captain John Casey near Ft. Myers (Matthews 1993:214). The subsequent call to arms and additional hostilities disrupted critical harvests and set the population on edge. Many in newly formed Manatee County withdrew to Tampa (Matthews 1993:218-219). Although the scale was limited, the Third Seminole War was characterized by guerilla attacks and retaliation that continued until the spring of 1858 (Matthews 1993:249).

Tampa and Key West business interests began to lobby for the construction of a lighthouse near the entrance to Tampa Bay during the early 1830s. Their political campaign was strengthened by the lucrative cotton trade conducted by New Orleans and Mobile vessels navigating along the coast and up to Tampa. Due to the strategic location of Egmont Key, the U.S. Treasury strongly encouraged the construction of a lighthouse on the small island ca. 1837 (Cipra 1997:34).

A lighthouse was finally erected there and became operational by April 1848. Francis Gibbons of Baltimore, Maryland built the octagonal brick structure and keeper's house for $6,250. Unfortunately, the edifice was severely damaged during the aforementioned September 1848 hurricane. At the time, Keeper Edwards and his family "took refuge in a rowboat tied to a palm tree as water rose over the island" (Young 2009:E105).

Due to the increased volume of vessel traffic navigating through the mouth of Tampa Bay, the U.S. Navy reconnoitered Egmont Channel and the other Tampa entrance channels during 1854. At this time, U.S. army corps of engineers interviewed local pilots concerning the condition of the entrance to Tampa Bay. No obstructions to navigation were described in this report (U.S. Coast Survey 1855:66-67). To promote maritime safety and commercial activities, a taller and larger replacement lighthouse was constructed in 1857 near the northern end of Egmont Key, some 90 feet inland from the site of the original structure (Young 2009:E105).

War Between the States

By the time that hostilities with the Seminoles were finally concluded a more serious threat loomed on the horizon. Southern states were posturing to secede from the Union. While one issue was slavery, the most irresolvable was the rights of individual states (Calhoun 1961:1-10). The matter came to an abrupt head when the Union garrison at Fort Sumter in Charleston Harbor refused to evacuate the fortification. In April 1861, artillery of the newly established Confederate States of America shelled the garrison into submission and a state of war was declared (Vandiver 1962:21-22).

On 10 January 1861, Florida seceded from the United States and became the third state to join the Confederacy (Work Projects Administration 1939:57; Wynne and Taylor 2001:19). By late spring 1861, U.S. Navy captain William Mervine was promoted to command the newly established Gulf Blockading Squadron (GBS), which encompassed the west coast of Florida by order of Secretary of the Navy Gideon Welles (The National Historical Society [TNHS] ser. I, vol. 16, 1987a:523-524). The 17 May 1861 executive order identified 18 naval vessels assigned to Mervine's command that included: the *Brooklyn*, *St. Louis*, *Powhatan*, *Water Witch*, *Wyandotte*, *Crusader*, *Mohawk*, *Mount Vernon*, *Colorado*, *Mississippi*, and the *R.R. Cuyler* (TNHS ser. I, vol. 16, 1987a:523).

Another confidential order issued by Secretary Welles to Mervine on 8 June regarded the strict enforcement of the Federal blockade in the Gulf of Mexico. Welles stressed that while Mervine could not "stop every outlet with an armed vessel", he must demonstrate "unceasing vigilance", and should:

> [E]mbarrass the insurgents, relieve your own cares, and make the embargo more strict by sinking hulks across some of the harbors or on the bars. Doubtless you will capture some prizes, and perhaps this may be the best disposition you can make of them. There must be, so far as is possible, a perfect nonintercourse [*sic*] established. Foreign nations are allowed a reasonable time to leave the ports, but after that has expired there should be no relaxing the rule. Vessels coming on the coast should be once warned off before seizure. These are privileges extended by courtesy to those who are not aware that the ports of the States in insurrection are closed. To foreign nations and to our own citizens they are as if they had never been ports of entry (TNHS ser. I, vol. 16, 1987a:529).

On this date, Mervine was stationed off Key West aboard the *Mississippi* and advised Secretary Welles that a steamer [*Salvor*] entered the harbor on the previous evening "under suspicious circumstances" and was thus intercepted. In the case of this detained vessel, Mervine remarked that:

> Lieutenant Commanding Craven informs me that he permitted this vessel to make a trip from this place to Tampa Bay and from thence to Havana with a load of cattle, in order to fulfill an important contract with a firm there. She touched here and was to sail on the same destination this morning, when I stopped her until further orders (TNHS ser. I, vol. 16, 1987a:530).

On 12 June, Mervine reported to the U.S. Navy department that the *R. R. Cuyler* arrived at Key West with "a case of smallpox on board" but was scheduled to proceed to Tampa Bay "to blockade that port" after coaling (TNHS ser. I, vol. 16, 1987a:545).

In early August 1861, Captain Francis Ellison of the USS *Cuyler* reported to GBS command that the British ship-of-war *Jason* had recently surveyed Tampa Bay "evidently for the purpose of ascertaining the state of the blockade". Ellison informed superiors that contact was made with the foreign vessel. Due to the lack of development there, the *Cuyler* and other Federal ships relied heavily on supply vessels to deliver rations, water, and coal. In his 2 August letter to Commander Mervine now stationed off Fort Pickens [near Pensacola], Ellison complained that he was unable to communicate with "my sick men ashore" due to the unfit nature of boats attached to his ship (TNHS ser. I, vol. 16, 1987a:603).

Despite his troubles, the *Cuyler*'s commander was able to land "thirty or forty men, with three eighteen-pounders" on Egmont Key some two weeks earlier, with instructions to erect a battery on the east side of the island. A news account first published by the *Florida Peninsular* on 21 July suggested that crew associated with the local smack *Wilbur* transported these cannon to Egmont Key, leading the original correspondent to wonder if they were "volunteers in the Lincoln service, or … prisoners" (*The New York Times* [*TNYT*] 1861a).

By mid-September, Captain Ellison reported that there was "no trade or commerce from Tampa worth speaking of", and that "[n]othing whatever of interest occurred there" since his arrival (*TNYT* 1861b). In the interim, the *Cuyler* was assigned to blockade the northeast pass at Apalachicola. Prior to proceeding to that station, Ellison chose to replenish his vessel's water supply at Egmont Key with assistance from the *J. Appleton*. A 17 September letter sent to GBS headquarters described the untimely loss of this U.S. revenue service schooner at that location as such:

> To facilitate this movement [taking on of water], as well as to clean the boilers…I came into the bay and anchored near the watering place on Egmont Key. After obtaining a sufficient supply for present purposes…I was about to proceed to sea in execution of your orders (on the 15th instant) when it came to blow very heavily from northward and eastward and in a few hours increased to a gale of great violence. The *Appleton* parted her cables and went ashore near the light-house before I was able to render her any assistance. She was driven on the beach some 30 feet

> above low-water mark. After the gale abated, finding myself without means to get her afloat, which, under any circumstances, would have been exceedingly doubtful, having only my two bower anchors to depend on, the schooner's anchors being lost, and deeming her of too little value to incur the delay of making what I considered a futile attempt at best, I directed her to be burned, after saving from her everything of any value, sails, spars, etc., and she was totally destroyed to prevent her falling into the hands of the rebels (TNHS ser. I, vol. 16, 1987a:668).

Before ending his correspondence addressed to Commander Mervine, Captain Ellison suggested that the *Cuyler* was unsuited for "war purposes" and mentioned that a 1,500-pound anchor from the schooner was previously lost near Tampa bar in about four fathoms of water (TNHS ser. I, vol. 16, 1987a:668). In regard to the recent activities of the *J. Appleton*, Commander Mervine consigned the revenue schooner to Ellison in mid-June 1861 at which time the former provided Midshipman Adam C. Alexander and 10 extra crewmen for its service as a blockade tender. Just prior to its destruction at Egmont Key, the *J. Appleton* had sheltered smallpox victims that were not allowed to disembark at *any* Florida port (TNHS ser. I, vol. 16, 1987a:547-548, 598).

By mid-autumn 1861, Confederate forces under the command of Major W. L. L. Bowen [Fort Brooke] captured two Key West sloops in fisheries off Tampa Bay. On 16 October, Bowen informed Brigadier-General John B. Grayson that:

> [P]ermit me to report for your orders 13 prisoners of war, captured under my command on the 10th and 11th of this month, being the crew of the sloops *William Batty* and *Lyman Dudley*, sailing under the American colors (stars and stripes), with papers from Key West, with license to engage in the fishery on the Florida coast and supply Key West market with the same. The sloops are of the first class, well rigged, and in good order. One measures 65 tons; the other, 56 tons. The sloops have been duly turned over to the prize commissioner as legal prizes to the Confederate States, and the prisoners are detained in safe custody for your disposal; and in consequence of the inconvenience and difficulty of subsisting troops at this post, I hope you will order the prisoners to be sent to some other place or disposed of in some other manner as soon as practicable (TNHS ser. I, vol. 16, 1987a:845).

The first tangible effect of the Federal blockade on the economies of Tampa Bay and Manatee County took place shortly after the captures of the *William Batty* and *Lyman Dudley*. On 16 October, James McKay's steamer *Salvor* [or *M.S. Perry*] was captured by the USS *Keystone State* some 20 miles south of the Tortugas. Captain McKay was a wealthy Scotsman who arrived at Tampa in late 1846, and now supplied Federal officers with beef cattle until this lucrative activity was prohibited. The blockade-runner *Salvor* was confiscated by the U.S. Government, and was sent to Philadelphia for adjudication as a war prize. Afterwards, the Federals used the *Salvor* for three months before it was returned to Captain McKay. In the interim, McKay and his young son Donald were imprisoned. After his release and return to maritime activities, Captain McKay ultimately sold the steamer in Havana (U.S. War Department [USWD] 1897:956-957, 960). Other blockade-runners successfully eluded the Federal blockaders, and Tampa Bay remained open to shipping until late autumn 1861.

On 12 November, a small Union force of barks and schooners including the USS *Ethan Allen* arrived to blockade the port after taking on water and provisions at Fort Pickens (Figure 7). GBS Flag-Officer William McKean ordered Lieutenant William B. Eaton's bark to the Tampa station after finding the vessel "in perfect order, and her crew remarkably well drilled" (TNHS ser. I, vol. 16, 1987a:766). Egmont Key's lighthouse and its support buildings served as a base for Union forces as well as a refuge for escaped slaves and Northern sympathizers (Figure 8). Confederate prisoners were also detained on the island. A "light of some sort" assisted the Federal blockaders to some degree (Zerfas n.d:4-5; Cipra 1997:34, 36; Young 2009:E105).

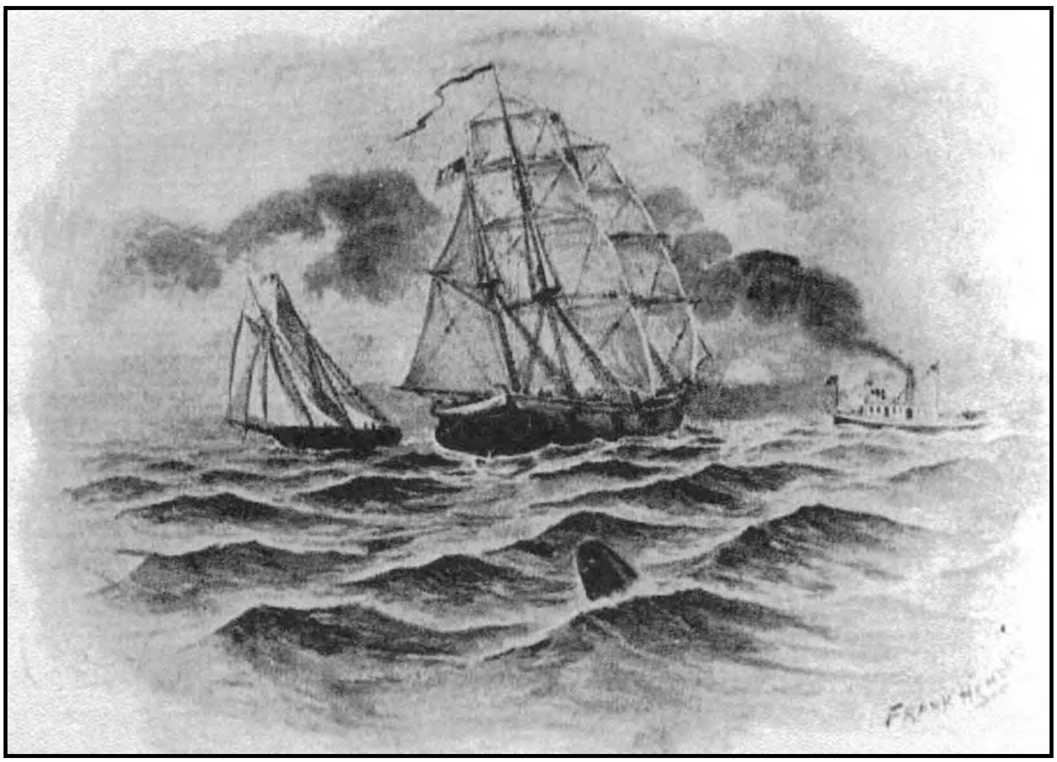

Figure 7. Union vessels blockading Tampa Bay (Wynne and Taylor 2001:77).

Confederate salt-making also induced the Federal armed forces to control all points of entry along the west coast of Florida. During 1861, salt works were established there "particularly on the western coast between Choctawhachee bay and Tampa". Because the Confederacy exempted salt-makers from military service, the industry employed several thousand men to produce the valuable

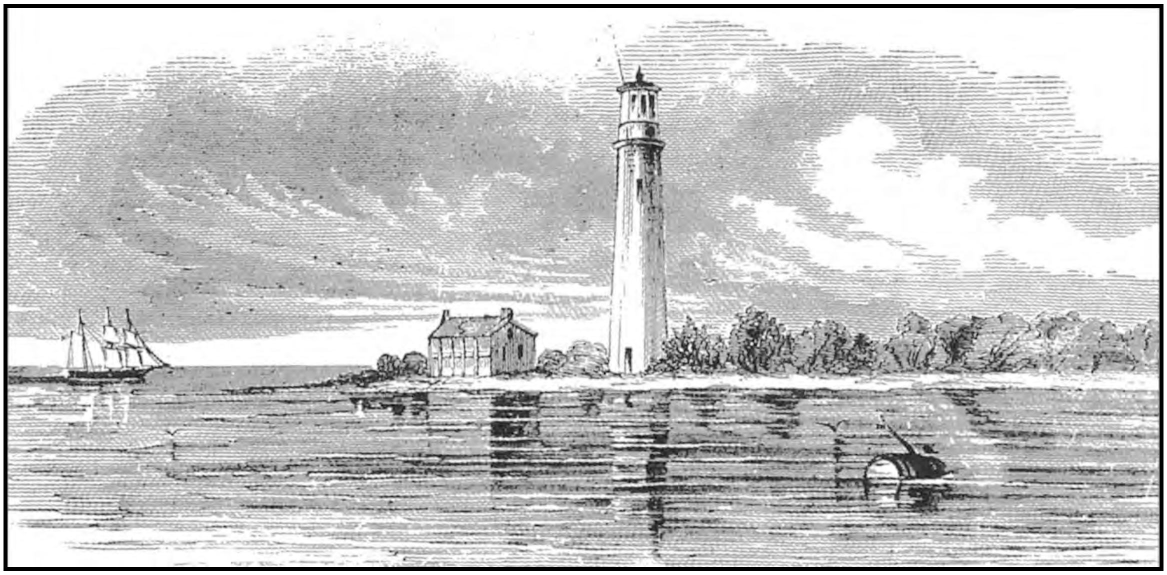

Figure 8. Civil War era engraving of Egmont Key Lighthouse (Cipra 1997:35).

commodity. By autumn 1862, "thousands of bushels of salt were being manufactured daily and scores of teams were hauling it into the more populous interior—most of it, out of state", (especially to Georgia and Alabama). As the war progressed, "salt-boiling complexes sprang up using large custom-designed boilers and ceramic-lined drying pans" (Figure 9). However, old sugar kettles

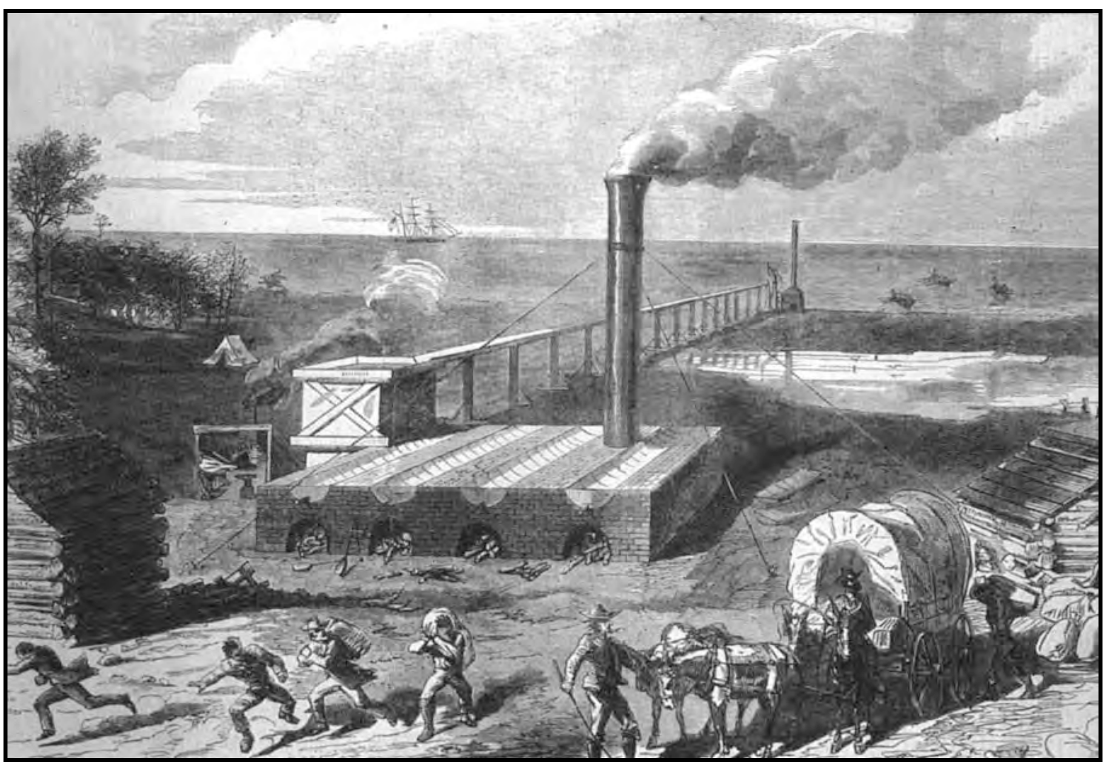

Figure 9. Contemporary illustration of Confederate salt works in Florida (Wynne and Taylor 2001:78).

and metal harbor buoys were still converted into boilers along the coastline. In July 1864 and December 1864, extensive salt works at Tampa Bay were destroyed by the Federal fleet (Davis 1913:203, 209; McCarthy 2007:27; Wynne and Taylor 2001:78-79).

In early October 1863, Tampa's defenses and waterfront were described by the Northern press as such:

> The town is defended on the water side by a battery of five guns, built on one end of the United States parade-ground, and formerly called Fort Brooke, used during the war with the Indians. To the right of this are the United States docks and warehouses, now occupied by the rebels as barracks. Behind these are some blacksmith and machine shops, used by the rebel army, and also for fitting out blockade-runners (*TNYT* 1863).

At this time, Captain James McKay had resumed blockade-running activities at the port, and was making preparations to elude Federal blockaders in mid-October utilizing his vessels, the *Scottish Chief* and *Kate Dale*. On 16 October, crews aboard the gunboat USS *Tahoma* and steamer USS *Adela* opened raking fire on Tampa and Fort Brooke as a diversionary tactic after receiving intelligence regarding McKay's subterfuge. The bombardment was successful, as the shell from both vessels made "dirt and splinters fly driving the men from the [Confederate] works and the people from the town" (*TNYT* 1863). In the aftermath of the surprise attack, Federal landing-squads converged at the location where McKay's vessels were *still* anchored on the early morning of 17 October. A witness remarked:

> Acting Ensign Balch and men were the first to reach the river, where, near the opposite bank, lay the steamer *Scottish Chief*, loaded with 156 bales of cotton, and also the sloop *Kate Dale*, with 11 bales. He hailed some men moving about the steamer, and ordered his men to cover them with their rifles, gave them three minutes to lower their boat to come over after him, which they immediately did. Turning them out, and leaving them prisoners under a guard ashore, he took possession of the boat, taking six men with him, boarded the steamer, capturing all on board, and informing the captain that he took possession in the name of the United States Government. When the rest of the party arrived, the vessel was ready for firing. The order having been given he started a fire in her fore hold. The sloop was served in the same way, and in a few minutes they both were a mass of flames. Ten minutes from the time of first seeing the vessels, the whole expedition was accomplished, and the party started on their way back by a more direct route to the bay (*TNYT* 1863).

Small squads of Confederate infantry opened fire on these men but scattered as the main Union body advanced to the shoreline. Sailors aboard the nearby *Adela* fired its lee gun at the Rebels, and signaled the *Tahoma* to dispatch its boats for the rescue effort. Confederate Cavalry was then seen "flying about through the woods", and as the Union sailers attempted to reach small boats their efforts were hampered by the rapid fire of riflemen and by "light artillery masked among the bushes". The *Adela*'s gunner now returned fire, "bursting shell among the horsemen, compelling most of them to put back and go around through the woods" (*TNYT* 1863). Before the *Tahoma* and *Adela* left Tampa Bay, sources related that Captain's McKay's large saltwork factory [at modern Frazier Beach] was razed by another Union sortie (Zerfas n.d.:3-5).

Official EGBS records relate that fifteen steamers, eleven schooners, five barks, two sloops, and one ordnance-storeship were assigned to West Florida stations during mid-December 1863. Of these, the steamers *Sunflower* and *Tahoma* were specifically tasked to monitor Tampa Bay. The schooner *Sea Bird* was under orders to regularly cruise along the coast from the mouth of Crystal River to Tampa Bay (TNHS ser. I, vol. 17, 1987b:603-604).

Soldiers from the Second Colored Infantry, meeting no resistance, occupied Fort Brooke and the City of Tampa on 6 May 1864. This Federal occupation ended by 12 May. At that time, the fort and Tampa Bay were assessed by the U.S. War Department to be of minimal strategic importance. No further actions of consequence were conducted at Fort Brooke for the remainder of the Civil War (De Quesada 2006:63).

Reconstruction and Nineteenth-Century Development

After the war ended Tampa Bay was used as a familiar harbor of refuge by government vessels that included the steam tug *Narcissus*. On 1 January 1866, the *Narcissus* (ex-*Mary Cook)* and the U.S. tug *Althea* left Pensacola in route for New York. While anchored near the mouth of Tampa Bay on the following evening, the *Narcissus* encountered a violent storm and wrecked on a shoal at Egmont Key. While attempting to power off the shoal, the ship's boiler exploded. A contemporary account reported that "about thirty souls" perished, and that one "body was washed ashore from the *Narcissus*, but could not be recognized". The *Althea* weathered the storm and arrived safely at Key West according to reports (*TNYT* 1866; Watts 1999:2).

The United States military presence in the Tampa Bay vicinity dwindled in the decades that followed the Civil War. Although Egmont Key was designated as a permanent military reservation in 1882 development of the facility was virtually ignored by the Board of Ordnance and Fortification created by the U.S. Congress in 1888. The board's major objective was to implement the "Endicott Plan", in which the U.S. Army would design, construct, and garrison modern forts in some 30-seaport locations. Despite the strategic location of Tampa Bay and its neighboring keys, the area was not considered a high priority in the Endicott defense system (De Quesada 2006:177; Panamerican Consultants 2007:18).

While peacetime priorities shifted military assets and personnel away from the Tampa Bay area in the decades following the Civil War, homesteaders began to move into Manatee County and other points along the southwest Florida coast. Manatee and the Manatee River area formed the principal area of settlement in the northern part of the county. Sarasota, located at the southern end of Sarasota Bay and part of Manatee County until 1921, constituted the county's second area of population growth. Efforts were made to promote the region to potential settlers with particular attention being given to attract Europeans. The most well-known European group was known as the Scottish Ormiston Colony. In 1885, the Florida Mortgage and Investment Company received the deed to a tract of land of approximately 21,000 acres and sold the property in 40-acre lots for £100 in Scotland to promote immigration. Upon arriving in Sarasota the new colonists were discouraged by an unusually harsh winter and unfulfilled promises by the land company. The majority of the new settlers returned to Scotland at the end of the winter (Firestone 1977:17-20).

Shortly before the Ormiston colony materialized, *New York Times* correspondent William Drysdale traveled to the region in February 1884 and regaled the charms of Manatee County. Entertained readers learned that Drysdale found the town of Palma Sola to be especially charming, which he reached by way of the yacht *Mallory*. The New Yorker found a thriving maritime economy centering around W. S. Warner's wharf that serviced the "good-sized" steamboat *Erie*, the excursion yacht *Mischief*, Tampa Steam-Ship Company vessels, the "opposition line", and numerous oyster and fishing sloops. In addition to transporting tourists, resident passengers, and abundant catches of shellfish and finfish, these vessels conveyed local citrus, tomatoes, potatoes, watermelon and other fresh produce. In summing up his trip to balmy Manatee County, while New Yorkers faced miserably cold temperatures Drysdale remarked that the local cuisine eclipsed the finest New York City meal. A typical *winter* supper included:

> All the luxuries of Southern Florida…great big clams, beautifully fried; the sweetest of oysters from Sarasota, served raw; an abundance of fresh vegetable just out the garden; fresh, ripe Florida oranges, and a great dish of guava jelly, home made, from Manatee County guavas" (*TNYT* 1884a).

A May 1884 assignment required Drysdale to return to Tampa in order to take evening passage on the old black steamer *Cochran*, which was scheduled to meet another steamer the following morning near the mouth of the Manatee River. Drysdale retired but was jarred from sleep when the steamer bumped against an abandoned hulk in lower Tampa Bay. His recollection of the encounter with the unknown shipwreck follows:

> We were to run down as far as Palma Sola, there meet the *Alabama*, of the same line, take aboard her passengers and mails, and proceed on the journey to Key West. But we were not to go into harbor at Palma Sola; simply to meet the other boat out in the bay, lie by her side a few minutes, and then go on about our business….I had slept for two or three hours, when I was awakened by the stopping of the machinery….While I was feeling in the dark for my hat the boat came up against something solid with a bump....The *Cochran* had swung up against the wreck of an old cattle ship, and was tied there to wait for the other boat [*Alabama*] whose lights were then in sight. This cattle ship must have been an immense vessel, three or four times the size of the *Cochran*. As she lay there in the water, careened (or listed, as we sailors say) till her deck was on a steep slant, she was a perfect picture of a wreck. She looked, as she lay, bigger than an ocean steam-ship. Her main cabin seemed longer than

> our vessel, and much of her upper works were still complete. Great rents in her deck disclosed the dark and ghostly hold, long since emptied….Palma Sola was hidden by a projecting point, and there was no familiar object in sight but the Egmont Light-house….The *Alabama* came up alongside and a few trunks and mail-bags and two or three passengers were transferred, the latter done so done up in cloaks and great-coats they looked like a lot of pirates. One of the passengers brought enough guns and fishing tackle to capture all the game and fish in Florida. The excitement of the midnight transfer over, we all went to bed, and the next morning we were far down the coast, almost but not quite, out o sight of land (*TNYT* 1884b).

In addition to journalists, tourists and sportsmen, scientists of varied disciplines visited lower Tampa Bay and reconnoitered many of the barrier islands. A significant geological expedition was conducted on the west coast of Florida in 1886, and this pioneering survey included parts of Manatee and Sarasota counties. Traveling aboard the schooner *Rambler* and a smaller vessel, Professor Angelo Heilprin and other scientists took samples of fossils and other geologic materials near the entrance to Tampa Bay [Egmont Key and Passage Key], and at various sites along the Manatee River, Perico Island, and Sarasota Bay (Heilprin 1887:1-3, 12-15).

In late autumn 1889, William Drysdale returned to Manatee County and published his latest observations:

> It is only five years since all the Gulf coast of Florida, from Cedar Keys down to the end of the peninsula, was largely under the control of Miller & Henderson, merchants of Tampa. They owned the steamers running between Cedar Keys, Tampa, and Key West, and none of the west-coast towns could do any business without paying tribute to them. In those days the railroad from Jacksonville to Cedar Keys was the only way of reaching the Gulf by land, and a very slow and uncomfortable way it was. Gradually the railroads spread westward and southward, and Miller & Henderson's monopoly was destroyed. I have no doubt that this firm retarded the development of the Gulf coast for some years….First came the railroad to Tampa, and that was practically the end of the coastwise steamboat line. Then the Orange Belt Railroad Company extended its road down through the peninsula formed by Old Tampa Bay and the Gulf of Mexico, running along the Gulf shore for some miles, and ending on the shore of Tampa Bay, and starting there a new town called St. Petersburg (Drysdale 1889:17).

Drysdale commenced his journey at Port Tampa, which he noted was "a place not in existence five years ago", and descended Tampa Bay in the steamboat *Kissimmee.* Steaming southwest toward his destination of Palma Sola, Drysdale commented that the new town of St. Petersburg was impressive not only for its refreshing non-generic Florida name [conversely "Rural, Tropic, Eden, Citrus, Winter Garden"] but also for the hotel that "towers up in the air four or five stories" (Drysdale 1889:17).

Under normal circumstances, the proposed trip to the mouth of the Manatee River would take approximately fours hours by steamer. The *Kissimmee* left Port Tampa at 6 am, and by 9 am the Egmont Key lighthouse was in sight. From this vantage point, the steamer changed course and Drysdale later remarked:

> Half an hour later the broad and placid Gulf of Mexico was before us, and the steamer swept to the southward into the mouth of the Manatee River. The Manatee is great highway of Manatee County, and on its shores are the only towns, with the single exception of Sarasota. It is for twenty miles a wide arm of Tampa Bay, and into the upper end of the arm empties the real river, a muddy and narrow fresh-water stream nearly fifty miles long; but the whole stream, to the mouth of Tampa Bay is known as the Manatee River. Once manatees, or sea cows, were plenty in it, and even yet they are sometimes taken, but seldom. Here on the south bank of the river are Palma Sola, Braidentown [*sic*], and Manatee, the latter the county seat; and on the north shore are Atwater, Palmetto, Ellenton, Erie, and Rye, the last named not being the "pure old" so familiar in the North, for Manatee is a temperance county, which means that the inhabitants have to send up to Tampa for their whisky. On our left as we swing into the mile-wide river is Snead's Island…about two miles long and half a mile wide, fronting on the Manatee River and Tampa Bay, and backed by Terra Ceia Bay (Drysdale 1889:17).

The barrier islands that Drysdale and his companions could observe before entering the Manatee River aboard the *Kissimmee* were now being settled and developed. In 1891, Thomas Mann and his large family relocated from the Manatee River region to the north end of Longboat Key and became the area's first permanent residents. Mann was issued a homesteader's certificate for approximately 145 acres in June 1891, which included Longbeach Village and waterfront property on the Gulf (*The Longboat Observer* 7 October 1999). Anna Maria Island was settled within a few years by George Emerson Bean (Norwood 2003:15).

Nearby Passage Key was a favorite site for small local fishing craft as well as "larger" steamers hailing from the Florida panhandle and Mobile, Alabama. In 1895, the U.S. War Department reported that a shipwreck obstructed Passage Key Inlet, and that this obstruction hindered navigation at that location. Historical sources indicate that during December 1884 [or January 1885], the 85-ton *Millie Wales* burned while anchored in Passage Key Channel. According to the *Eleventh Annual List of Merchant Vessels of the United States*, the steamer was registered prior to 30 June 1879 [81.10 tons-55 hp] and was officially berthed at Boston, Massachusetts (U.S. Department of Commerce and Labor 1879:245, 274). The U.S. Bureau of Navigation related that by June 1883, the *Millie Wales*'s homeport was at Pensacola, Florida and that its tonnage had increased to 85. (U.S. Department of Commerce 1883:272; U.S. War Department [USWD] 1895a:221; 1895b:1560; 1896a:198; 1896b:1337-1338).

At the time of the shipwreck event, Pensacola Fish and Ice Company owned the former "sponge fishing" steamer. A report published by U.S. Commission of Fish and Fisheries in 1887 related that the Pensacola firm purchased the *Minnie*

Wales in 1881. After the wreck was declared as an obstruction to navigation in 1895, the U.S. War Department entertained four bids to remove the stricken vessel. Roderick G. Ross of Jacksonville, Florida was awarded the contract for the sum of $1,907. In its consideration of selecting Ross, the U.S. War Department reported that "the contract was awarded to him for the reason that he had a plant in the vicinity well adapted for the removal of the wreck" (U.S. Commission of Fish and Fisheries 1887:284, 297; USWD 1895a:221; 1895b:1560; 1896a:198; 1896b:1337-1338).

According to the official government report:

> The work of removing this wreck was begun by the contractor on August 2, and it was reported as entirely removed on August 7. Nothing of value being recovered from the wreck, the removed portions were destroyed and abandoned. The main portion of the wreck was carried outside the harbor and sunk in deep water in the Gulf of Mexico (USWD 1896b:1338).

As of 1896, Tampa was recognized as the principal receiving port for mullet on the west coast with a large supply taken from the waters of Manatee, Hillsboro, De Soto, and Lee counties. Fishing centers located there also collected large numbers of "sheepshead, redfish, squeteague, Spanish mackerel, pompano, bluefish, ladyfish, and crevallé " from West Florida, and West Gulf fishermen who operated in shallow waters (U.S. Bureau of Fisheries 1897:24).

When the USS *Maine* was destroyed in Havana harbor on 15 February 1898, the sensational event inspired Henry B. Plant and other prominent Tampa citizens to lobby for the re-fortification of Tampa Bay. In light of its close proximity to Cuba and the swift onset of the Spanish-American War, the U.S. Congress immediately allotted federal money to construct modern batteries at Egmont Key. Construction commenced on Egmont Key in April 1898, and a 12-inch mortar battery was completed on Mullet Key by early 1900. In the interim, the eastern two-thirds of Mullet Key was transferred by the War Department to the U.S. Treasury to be used for a quarantine station. The rest of the island was designated as the Fort De Soto Military Reservation. The same federal order designated the name Fort Dade to the new installation on Egmont Key. At this time, both posts were placed under the control of the Fort Dade commander and were regulated as a single operating unit (*TNYT* 1900; De Quesada 2006:177-178).

A U.S. Army lieutenant general conducted an inspection of the Tampa Bay forts during 1901, and remarked on their status:

> *Fort Dade, Fla.*—There has been no change in the barracks and officers' quarters at this point. … A new wharf should be constructed at a point nearly opposite the barracks, which site, from all I can learn, would be a great improvement over the one where the wharf now is, in the channel between Egmont and Mullet keys. On my recent visit to Fort Dade it was impossible to land at that wharf, owing to its exposure to the high sea that was then running, though there was no difficulty in landing at Mullet Key, nor at the little wharf on Egmont Key, used by the pilots. At this pilot wharf, however, there is not sufficient water for any thing larger

> than a small launch. At the site near the barracks, I am informed, deep water may be reached within a reasonable distance. *Fort De Soto, Mullet Key, Florida.*—At this point the mortar battery has been completed, but the guns have not been received. Barracks and quarters have been built. These buildings are located too close to the water on the shore fronting the main channel. This location is, in my opinion, an exceedingly objectionable one (USWD 1901:16).

A series of reports published by *The New York Times* in April 1902 questioned the nature of a foreign survey of the Egmont Key fortifications and the entrance to Tampa Bay. The newspaper's Washington D.C. correspondent reported on 25 and 26 April that a "Captain Bayly" hired a tug at Tampa, and then "thoroughly examined the Egmont Key fortifications and the undefended channels from the entrance of the bay up to the pier at Port Tampa". Apparently, the British naval attaché possessed a U.S. Coast survey map and proceeded to take soundings on certain 20-mile courses in the bay to verify the chart's accuracy. Onlookers surmised that the "foreigner's purpose was to see if any of the courses he had marked out could safely be taken by a torpedo boat bent on attacking vessels at anchor within the harbor". Despite wide speculation about the motivation of the British survey, the U.S. War Department and U.S. Secretary of State issued no details (*TNYT* 1902a, 1902b).

By March 1906, over $700,000 had been expended for the Tampa Bay defenses, and over 70 structures were erected on Egmont Key by the federal government. One building housed the Navy's wireless telegraph station (est. 1905), which used the lighthouse tower to support its antenna. Egmont Key lighthouse keeper Charles Moore hailed passing vessels during this period with the assistance of a "melodious" sounding conch shell. In 1908, the Fort Dade quartermaster issued a formal request for bids to civil engineers to repair wharves located at Fort De Soto. Army supply boats like the *General Timothy Pickering* regularly navigated between the Egmont Key and Mullet Key wharves (Figure 10). Built at Philadelphia in 1905, the 280-ton, 110-foot steel steamer was frequently seen along Pinellas Peninsula and in Tampa Bay. The U.S. Treasury gas screw *Catherine* was stationed at the Fort De Soto quarantine post according to 1909 Department of Commerce records. Built in New York, the "boarding launch" was sister ship to the *Gannet*, *Sea Gull*, *Vidette*, *Genevieve*, and *Osprey*. Ranging in size from 30 to 42 feet, these wooden vessels were operated by the Marine-Hospital Service off the Florida Gulf Coast (*TNYT* 1906; *Engineering-Contracting* 1908:37; U.S. Department of Commerce and Labor 1909:404,419; *TNYT* 1910; Cipra 1997:37).

In April 1910, a local newspaper reported that the War Department planned to transfer a significant part of the Fort De Soto garrison to Fort Morgan [Alabama] by early summer. Military sources advised the public that 12 soldiers would remain at the Florida fort to superintend its guns and equipment, and to facilitate a "re-occupancy at any time" should the region be threatened by hostile forces. The federal government asserted that Fort Dade "at present, is amply strong to defend the harbor against any ordinary attack" (Figure 11) (*The Evening Independent* [*TEI*] 1910:1).

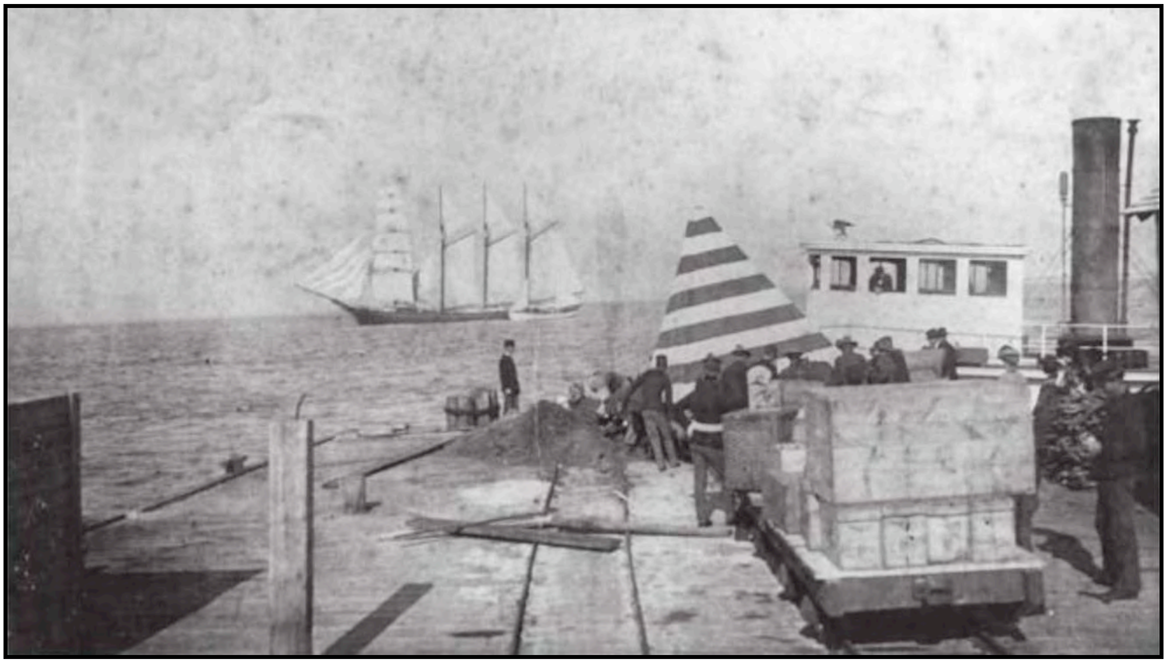

Figure 10. Photograph of Fort Dade Engineer's Wharf (De Quesada 2006:185).

Figure 11. Fort Dade, Egmont Key ca. 1909 (University of South Florida 2002).

Government camps at Mullet and Egmont keys were jeopardized later that year by a powerful fall storm. During October 1910, a hurricane developed in the West Indies and moved toward Tampa after first striking Key West. On 17 October, West Florida weather forecasters predicted the storm's track and warned Hillsborough County citizens of imminent danger. Marine reports issued that day advised area residents that the *General Timothy Pickering* returned to Tampa after the government supply boat failed to discharge its cargo at Forts Dade and De Soto. The *Pickering* reported that several encampments on Egmont Key were wrecked, and that soldiers from the Plant City First Company of Artillery [Florida State Guard] and U.S. Coast Artillery were without shelter. In his report, the captain of the *Pickering* also remarked that "a number of small sailing vessels" were struggling near the forts on account of the "exceedingly heavy seas" and winds. The army boat could not render assistance as it was "blown out of the channel several times and nearly went aground." A related story commented that the Mallory steamer *Alamo* departed Tampa on 17 October "but encountered such heavy seas and high winds", it was forced to return to the city (*TNYT* 1910).

A protective detachment was assigned to Fort De Soto in 1917, when half of its mortars were shipped overseas to assist the WWI effort. In August 1921, Fort Dade was deactivated and by May 1923, both forts (Dade and De Soto) were "officially abandoned". Ownership of Fort Dade would be eventually transferred to the Commerce and Treasury departments, while Fort De Soto would be sold to Pinellas County ca. 1938 (De Quesada 2006:179-180).

By the early 1900s, the region had developed into an agricultural and fishing center. For much of the last half of the nineteenth century cattle ranches dominated the countryside in south Florida, but with the abolishment of open ranging the agricultural potential of the region could be finally realized. A variety of crops were grown in the area for export including celery, tomatoes, beans, potatoes, sweat potatoes, peppers, eggplant, cabbage, peas, cucumbers and spinach (Wilpon 1999:17).

By the second decade of the twentieth century, celery had become the biggest cash crop for the area and there soon developed a sort of "Celery Wars" with each grower touting the superiority of his products. Citrus, and other fruits, constituted additional sources of revenue and though no longer a major factor in the economy, sugar cane was still an important crop around the Manatee River. In 1918, the Manatee County Grower's Association was established. Composed of approximately 200 growers, the organization maintained "packing houses" in Bradenton, Palmetto and other towns and developed financing and marketing strategies to better promote the region's products (Wilpon 1999:17).

The development of Manatee County was greatly enhanced by steamer service. In 1909, the St. Petersburg Transportation Company, known popularly as the Favorite Line, began service carrying freight and passengers between Tampa, St. Petersburg, Manatee River stops, Sarasota and Fort Myers. The line employed a number of vessels including: *Favorite, Manatee, H. B. Plant, Terasia, Terra Ceia, Hanover, Vandalia* and *Pokonoket* (Wilpon 1999:55-56). Steamers departed St.

Petersburg in the morning, and also dropped passengers off at the Anna Maria Island pier for a day of swimming, sunning, fishing and boating (Wilpon 1999:55, 57). The line commenced service to the northern end of Anna Maria Island during summer 1911, when the village of Anna Maria completed its municipal pier (University of South Florida Libraries n.d.a).

The steamboat era ended with the extension of rail lines along the southern gulf coast and the introduction of the automobile. In 1902, the Seaboard Air Line Railway reached the Manatee River and would eventually provide service as far south as Naples (Wilpon 1999:34). Rail service stimulated industrial development. Citrus and fishing industries expanded as railroads allowed goods to reach markets more quickly to decrease spoilage. However, West Florida's shellfish industry declined sharply during this same period.

In 1913, the state legislature finally passed an act "to encourage, protect and regulate" oysters and clams. State Shellfish Commissioner Hodges proclaimed that there were practically no oyster beds from Cedar Key to Old Tampa Bay "and territory south of there except some planted beds on grants or leases, taken under the provisions of the [1913] law in Hillsboro and Manatee counties" (Hodges 1913:11).

While Commissioner Hodges applauded that legislation, he remarked that the "beautiful shell-paved streets" of many Florida towns and some country roads "constructed of oyster shells, are tomb stones to the departed oyster industry of the state of Florida" (Hodges 1913:11). Though most roads in the region were still primitive dirt trails, increased automobile traffic spurred efforts to improve the peninsula's system of roads. In 1915, the Tamiami Trail, connecting Tampa to Miami, was begun. By 1928, the entire length of the Tamiami Trail was accessible to automobile traffic (Burnett 1986, vol. II:41-45) Auto travel between Manatee and St Petersburg was also facilitated by the establishment of ferry service. The Bee Line and the St. Petersburg Port Authority Ferries operated boats across the mouth of the bay until 1954, when the Sunshine Skyway was completed.

Tourism became a major industry along the coast during the first half of the twentieth century. To support this influx of visitors, a number of hotels were constructed, including the Manavista Hotel, Dixie Grande and Manatee River Hotel in Bradenton and the New Bay Haven Hotel, Hotel Sara Sota and El Vernona Hotel in nearby Sarasota. Many of the more luxurious structures catering to the wealthy and more prominent members of society supported such amenities as fine restaurants, air conditioning, tennis courts, pools and excellent views of the water. The popularity of the automobile allowed families of even modest income to make the trip to Florida which resulted in the construction of many small beach cottages and "Mom and Pop" motels during the 1940 and 1950s (Wilpon 1999:76). For those making extended or seasonal visits both Bradenton and Sarasota sported extensive trailer parks, many of which contained electricity, running water, paved streets and entertainment areas.

Plans to build Port Manatee were seriously considered in 1965 to relieve rail congestion through the City of Tampa. Shipments from the booming phosphate industry created endless delays through the city's center that resulted in numerous complaints from area citizens. To ease these problems, the Atlantic Coast Line Railroad (ACLRR) announced plans to relocate its phosphate loading facilities to Piney Point in Manatee County (Hall 2001:10). This prospect incited conflict between the Tampa Port Authority, local businessmen and city officials and resulted in lengthy litigation. Ultimately, ACLRR agreed to allow the city to construct a new phosphate handling facility on Hillsborough Bay.

In 1967, the Florida legislature enacted a bill to create Port Manatee (Verdier 2009:14). The facility opened for business in August 1970 with the arrival of the 576-foot-long M/V *Fermland* that carried 2,000 tons of Korean plywood (Hall 2001:11; Verdier 2009:14). In June 1986, the massive (849-foot long) M/V *Chandos* delivered 246,387 barrels of Rumanian petroleum that was consigned to Florida Power & Light (FP&L) (Verdier 2009:14). By 1998, the port could handle approximately 4.2 tons of cargo each year, which made it the fifth largest in Florida. The M/V *Vicki I* entered Port Manatee that year with over 400,000 barrels of oil for FP&L and was distinctive due to its 139-foot breadth (Cronan 1998; Verdier 2009:14).

By May 2003, a $115 million dollar seven-year improvement project was nearing its final phase. The impressive modernization included the expansion of the port warehouse by over 500,000 square feet, the addition of 2,800 feet of ship berths (2004), and a 1,600 feet ship berth on the south side to attract cruise lines like Carnival and Royal Caribbean (Meadows 2003). During the port's mid-1960s construction, a 60-acre bird sanctuary was integrated into the landscape but deteriorated over time. During the 2003 port renovation, the sanctuary was restored and now serves as a habitat for over 120 species of birds. Several other beneficial ecology-related projects are conducted at Port Manatee to promote popular "green" principles (Verdier 2009:14).

According to the port's website, the facility and "its partners move approximately 9 million tons of containerized break-bulk and project cargo each year including fresh produce, forestry products, petroleum products, citrus juice products, fertilizer, steel, aluminum, automobiles, cement, aggregate and more" (Manatee County Port Authority [MCPA] 2009). Significant clients include Martin Marietta, Tropicana and Del Monte. Del Monte's tenancy represents the international produce firm's second, largest U.S. port facility. Recognized as one of the state's principal deepwater ports, the facility also has the advantage of its close proximity to the Panama Canal. This geographical benefit enables vessels to reach Pacific Rim markets more rapidly than competitors. In respect to commercial and tax issues, Port Manatee employs over 20,000 employees and provides some $2.3 billion dollars into the regional economy (MCPA 2009). The port is also home to a thriving cruise industry. Although the Port of Miami is called the "Cruise Capital of the World", the Manatee facility services approximately 60,000 cruise enthusiasts annually (Miami Beach 411 2009).

Contemporary Manatee County is comprised of six municipalities identified as: Anna Maria City, Bradenton, Bradenton Beach, Holmes Beach, Longboat Key and Palmetto. The towns of Bradenton Beach, Holmes Beach and Anna Maria City are located on Anna Maria Island. Each island community offers residents and tourists the opportunity to experience several public beaches, water sports, nature activities and other leisure pursuits (Anna Maria Island Chamber of Commerce n.d.).

Development of Anna Maria Island commenced in the late nineteenth century. By many accounts, George Emerson Bean arrived at uninhabited Anna Maria Island in 1892/1893 to homestead on the northern end. The Bean tract comprised some 160 acres, and was the site of the first permanent home on the island. This section of Anna Maria Island is still known as Bean Point. In 1901, chemist William Berg (and inventor of a waterproof glue) settled on a tract of land located at contemporary Magnolia Avenue on Anna Maria Island. Bean's dreams for development failed to materialize until German immigrant John Roser, developer of the original Fig Newton cookie, retired to St. Petersburg, where he met George Bean son (Hunt 2003:126; Norwood 2003:15; Copeland 2005b).

Around 1911, George Wilhelm Bean and Roser organized the Anna Maria Development Company. The shrewd businessmen successfully negotiated with William Berg to purchase his homestead at the northern extremity of the still undeveloped island. Within the year, a pier was constructed to service steamboats plying between the island and Tampa. The widowed Roser built a small chapel [contemporary Roser Memorial Community Church] in 1913 to honor his wife Caroline, which hosted non-denominational services. Mainland pastors would arrive by boat each weekend on a rotating schedule to preach there. In order to promote full-time residency there, Bean and Roser conveyed two lots (Magnolia Avenue) to the Manatee County School Board in 1913, where the latter party built a modest school. Over the next 15 years, enrollment reached 40 students. Due to economic conditions associated with the Great Depression, enrollment dropped sharply. During the pre-World War I period, real estate speculation sales increased and was reflected by corresponding enrollment of school age children on the island (Hunt 2003:126; Norwood 2003:15-16; Copeland 2005b).

A marketing brochure produced circa 1913 remarked that 60 "beautiful cottages and bungalows" were "already built" on Anna Maria Island. The advertisement included photographs of: "Lotus Cottage" (home of Colonel John Trice), "Royal Palms" (home of Professor B. C. Nichols), "Notnomis Villa" (home of Mrs. F. M. Simonton), and "Cozy Corner" (home of G. W. Bean) (University of South Florida Libraries n.d.b).

A primitive building known as "the hall" was transported to Anna Maria Island from the town of Parrish during the early 1900s by barge. Over the next several decades, it was used as a tourist center, church and theater. Through preservation efforts, the vernacular structure was rehabilitated, and currently operates as a venue for the Island Players repertoire company (Copeland 2009).

By 1914, the Angler's Lodge was constructed at the southern end of the island. This popular structure served as a retreat for visitors after they arrived from the mainland via steamer and ferry (Krosney 2009).

In 1921, a bridge was built to span Anna Maria Sound from the fishing village of Cortez to Anna Maria Island at modern Bradenton Beach. A segment of the original bridge still exists and functions as the Bradenton Beach City Pier. In February 1925, Manatee citizens voted overwhelmingly to support a bond issue for 73 miles of hard-surfaced highways, and for the construction of a bridge to link Anna Maria Island and Longboat Key. This bridge was included in the $1.5 million project that would eventually be part of the overall link with St. Armand's Key. From that point, a bridge was scheduled for construction to connect the island to the mainland (Sarasota County) (*St. Petersburg Times* 25 January 1925:7; Krosney 2009).

A late September 1926 hurricane caused considerable damage to the barrier islands of Anna Maria and Longboat. This destructive storm was responsible for perhaps four shipwrecks in the vicinity of Passage Key and Anna Maria Island. On 24 September, *The Evening Independent* report these details:

> Mute evidences of a tragedy at sea, two schooners and three bodies were found on the beach at Egmont Key, the first wrecks reported from the sorm [*sic*] of last week on the gulf. The dead men and the upturned boats showed that the wind took its toll on the gulf as well as on land. The bodies of three unidentified sailors were picked up off Egmont key by members of the Tampa Bay Pilots' association….when Captain Bert [or Bart] of the pilot boat Egmont put in for repairs. The bodies were picked up and delivered to the quarantine station at Egmont key for possible identification….Captain Bart also reported two two-masted schooners bottom side up in the Gulf of Mexico, one off Passage key and the other off Anna Maria. Identification of the boats was impossible at the time of sighting the craft, which were evidently fishing schooners. No other wreckage was reported off shore in this territory. No damage was reported at Egmont key except high water and minor roof damage. Pilot boats *Egmont* and *Pilot* were taken to Palmetto in lee of the storm and neither boat suffered any damage (*The Evening Independent* 24 September 1926:1).

Despite the threat and occurrence of significant hurricanes, coastal Manatee County continued to attract developers, full-time residents and tourists. After completing the General Electric Building in New York City during 1934, developer Jack Holmes visited Anna Maria Island and was impressed with its pristine beauty. Holmes returned to West Florida during World War II to construct Army Air Corps camps and eventually purchased 300 acres on the island. In concert with some full-time residents, the town of Holmes Beach was incorporated on the island in March 1950. By 1962, Jack Holmes had built an airstrip, an innovative apartment complex named Seaside Gardens, a shopping center, yacht club and marina. About 1980, the airstrip Holmes built was converted to serve commercial aviation (Magrin 1980:17). With access to Anna Maria Island by land, water and air established the development George

Emerson Bean envisioned became a reality. Today, the Manatee County barrier islands are home to retirees, a winter haven for visitors and a summer destination for tourists.

Previous Investigations in the Project Vicinity

1978
Jones, Edmunds and Associates

The U.S. Army Corps of Engineers, Jacksonville District (USACE-J) requested that an archaeological survey of proposed beach material borrow areas for Anna Maria Island be conducted (Jones, Edmunds and Associates 1978). That investigation was performed by Jones, Edmunds and Associates, Inc. of Gainesville, Florida. Forty magnetic anomalies were recorded. Nine of those were associated with the 'Molasses Wreck' (the wreck of the SS *Regina* [NRHP# 05001355]) and were recommended for avoidance by the creation of a 2,000-foot diameter buffer.

1988
Espey, Huston and Associates

The Pinellas County Board of Commissioners authorized the use of a proposed borrow area on the north side of Egmont Channel as a source of nourishment for the Indian Rocks Beach shore protection project in Pinellas County, Florida. In order to identify any proposed project impacts on potentially significant submerged cultural resources, a remote-sensing survey was required to locate, identify and assess the significance of any shipwrecks in the proposed study area. Espey, Huston and Associates, Inc. (EH&A) of Austin, Texas carried out that investigation. Analysis of the remote-sensing data identified a total of 34 magnetic targets. Nine target clusters consisting of 20 of the anomalies generated signature characteristics that were considered indicative of potentially significant submerged cultural resources. Those targets were recommended for additional investigation (Espey, Huston and Associates 1988).

1999
C&C Technologies

In December 1999, C&C Technologies, Inc. and Coastal Planning & Engineering, Inc. conducted a remote-sensing survey of two proposed borrow areas off Anna Maria Island (Warren 2000). Analysis of the magnetic data revealed 67 anomalies in the south borrow area. Three anomaly clusters were recommended for avoidance. In the north borrow area 118 magnetic anomalies were recorded. Nine clusters in this borrow area were recommended for avoidance.

1999
R. Christopher Goodwin & Associates

R. Christopher Goodwin & Associates, Inc. conducted a remote-sensing survey of the Gulfstream Gas System, L.L.C. Pipelines route (Goodwin 1999). This survey extended from Port Manatee, Florida, through Tampa Bay to the edge of State waters. Results of this investigation identified a total of 668 magnetic anomalies. Of these, 602 were considered to be associated with modern ferrous debris. Sixty-six anomalies were divided into 17 more complex magnetic targets. Of these, three may represent significant submerged cultural resources and were recommended for avoidance. Fifty-one geomorphic features were considered to have a high probability for prehistoric occupation. Nineteen of these were located in the pipeline corridor and consisted of 17 relict channels and 2 sinkholes. Both sinkholes and 50% of the relict channels were recommended for additional investigation. That investigation was conducted in 2000 and none of the features that were investigated yielded cultural material or terrestrial sediment (Goodwin 2000). The Gulfstream pipeline project was determined to have no effect on potentially significant cultural resources.

1999
Institute for International Maritime Research

In an effort to locate and identify U. S. Navy and U. S. Navy-managed shipwrecks in Florida waters, Florida Underwater Archaeologist Roger C. Smith, Ph.D. and the Florida Division of Historical Resources contracted with the Institute for International Maritime Research, Inc. of Washington, North Carolina to conduct a remote-sensing survey and an anomaly identification assessment in an area off Egmont Key, Florida. The Egmont Key survey was designed to locate, identify and document the wreck of the Civil War steam tug USS *Narcissus* (8PI05369). A wreck believed to be the *Narcissus* was located using a magnetometer and sidescan sonar on the shoals north of Egmont Channel. Underwater investigation revealed the wreck to be almost entirely covered in deep sand with only a small portion of the steam engine exposed. Additional investigation was recommended to confirm the vessel's identity and determine the extent and condition of remaining wreckage (Watts 1999).

2001
Tidewater Atlantic Research

In 2001, the USACE-J was considering the use of a proposed borrow area on the north side of the Egmont Channel as a source of nourishment for a shore protection project in Pinellas County, Florida. In order to identify any proposed project impacts on potentially significant submerged cultural resources, a remote-sensing survey was required to locate, identify and assess the significance of any shipwrecks in the proposed study area. TAR carried out that investigation. The research was designed to provide accurate and reliable identification, assessment and remote-sensing documentation of submerged cultural resources located within the study area. Analysis of the remote-sensing data identified a total of 11 magnetic and no acoustic targets. While eight of the anomalies generated signature characteristics that are not indicative of potentially significant shipwreck resources, three targets, EC-06, EC-08 and EC-11, should be considered potentially significant, as their more complex signature characteristics correspond with those of previously identified NRHP eligible submerged cultural resources. In the event that proposed dredging could not be designed to avoid those anomalies, additional investigation was recommended to identify and assess the significance of the material generating the signatures. No additional investigation of the remaining eight anomalies was recommended in conjunction with the proposed dredging operations (Watts 2001).

2003
Tidewater Atlantic Research

CPE was the consulting engineer for the Town of Longboat Key for a beach renourishment project on Longboat Key, Manatee County, Florida. In 1999 and 2002, CPE conducted hydrographic surveys between Egmont and Lido keys to identify potential "white sand" deposits suitable for use as beach material. The results of those surveys determined that two areas, one approximately 1.5 miles off the north end of Anna Maria Island and a second approximately 4.5 miles west of Longboat Pass contained suitable sand deposits to serve as borrow areas for the proposed project. In order to determine the project's affect on potentially significant submerged cultural resources, CPE contracted with TAR to conduct a remote-sensing survey of the two selected borrow areas. The research was designed to provide accurate and reliable identification, assessment and remote-sensing documentation of submerged cultural resources located within the study areas. Analysis of the remote-sensing data identified a total of two magnetic and/or acoustic targets. Both were located within Borrow Area IX. One of the targets, IX-02, contained an associated sonar signature which indicated cable and other modern debris. Though the other anomaly, IX-01, did not contain an associated acoustic signature, its magnetic signature and proximity to the first suggested similar buried material. No magnetic or acoustic anomalies were identified in Borrow Area VIII. No additional investigation of the anomalies was recommended in conjunction with the proposed beach nourishment project (Watts 2003).

2005
Panamerican Consultants

The USACE-J investigated improvements to the Tampa Harbor Project in a general re-evaluation study, focusing on the need to develop a deep draft anchorage area (Lydecker 2005). The investigation area was situated in Tampa Bay and included the main ship channel from the Sunshine Skyway Bridge to the entrance to Port Sutton and the existing ship channel into the port of St. Petersburg, proposed bypass, three possible deep-water anchorage areas along the main channel, and a proposed new channel south of the Port Tampa channel. The remote-sensing survey identified a total of 475 magnetic anomalies and 539 sidescan sonar targets. Thirty-one targets were identified for diver investigation. That phase of the project proved that none of those 31 targets represented significant historical resources and no further investigation was required.

2005
Panamerican Consultants

The same year, Panamerican contracted with the USACE-J to investigate 34 magnetic anomalies recommended for avoidance by EH&A in 1988 (Krivor 2005). Of those 34, 26 were identified as modern debris, too small or isolated to warrant further investigation, or were no longer located within the borrow area. Eight targets were recommended for avoidance by revised buffer zones. Those anomalies were associated with the wreck of the USS *Narcissus*, a modern wreck, and the remains of a nineteenth-century wooden-hulled vessel (Shake's Wreck (8PI10001).

2006
Panamerican Consultants

The USACE-J proposed several stabilization and renourishment projects around Fort Dade (James, Pearson and Krivor 2006). As part of that project, Panamerican Consultants, Inc. conducted an intensive remote-sensing and diver investigation at Egmont Key (8HI00117C), which was added to the NRHP in 1978. In addition to a developing a more complete historic context of the island, the investigation included surveys of both terrestrial and submerged portions of Fort Dade. Terrestrial investigations, in addition to informant interviews, identified nine cultural resource features within the Area of Potential Effects (APE). A Ground Penetrating Radar Survey identified three features of which none were indicative of human graves. The offshore remote-sensing survey identified 107 magnetic and 66 sidescan targets. Diver investigation of those targets revealed many features associated with historic Fort Dade remain in situ offshore of Egmont Key. Panamerican recommended no further investigation of the area .

2007
The Florida Aquarium

The Florida Aquarium initiated a study of submerged cultural resources in the Tampa Bay area (Morris et al. 2007). Based on predictive models generated through archival and cartographic research, a number of areas were identified for remote-sensing investigation. Areas off Egmont Key included four NOAA charted shipwreck sites: the Egmont Wreck Site, the Nineteen Foot Wreck Site, the West Egmont Wreck Site and the Southwest Passage Shipwreck Site. All four sites contained magnetic signatures that could be considered suggestive of shipwrecks. In addition, two sites were reevaluated: Shake's Wreck and the remains of the USS *Narcissus*.

2008
The Florida Aquarium

This study continued in 2008 with a remote-sensing survey of additional areas in Tampa Bay, diver assessment of three targets around Egmont Channel (8HI11474), and sonar imaging of Fort Dade's southern gun batteries (8HI11473) (Morris et al. 2008). Remote-sensing work was also conducted in partnership with Scripps Research Institute, who provided multi-beam sonar and a subbottom profiler. An area northeast of Egmont Key was survey as part of the search for the *John Appleton*, a U.S. Navy tender lost in August 1861. In addition, the multi-beam sonar was used to obtain detailed three-dimensional imagery of the USS *Narcissus*.

2008
Laura A. Landry & Associates

Laura A. Landry & Associates, Inc. conducted assessments of two high-resolution marine geophysical remote-sensing surveys for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay (Landry 2008a). The project consisted of a survey of a proposed mooring area, pipeline route, and alternate mooring and pipeline routes. In the primary mooring area and pipeline route, 1,146 magnetic anomalies and 11 sonar targets were identified. Buried relict fluvial channels were also identified in the mooring area and were recommended for avoidance. Three of the sonar contacts and 15 magnetic anomalies were recommended for avoidance. In the alternate mooring area and pipeline route, 76 magnetic anomalies and two sonar targets were recorded. Relict channel segments were also identified in Federal waters and recommended for avoidance. One sonar contact and five magnetic anomalies were recommended for avoidance in the alternate mooring and pipeline areas.

2008
Laura A. Landry & Associates

A second survey was conducted the same year for the Port Dolphin Project to identify potential cultural resources in a re-routed pipeline (Landry 2008b). That survey identified 920 magnetic anomalies and 15 sonar contacts. One sonar contact and three associated magnetic anomalies were recommended for avoidance by project activities.

2009
Tidewater Atlantic Research

CPE was the consulting engineer for Manatee County for a beach renourishment project on Anna Maria Island, Manatee County, Florida. The potential source material for this renourishment was identified as a borrow site in the coastal waters off Anna Maria Island. To facilitate placement of material on the south end of Anna Maria Island a corridor for a temporary material transfer pipeline was also identified. In order to determine the proposed project's impact on potentially significant submerged cultural resources, CPE contracted with TAR to supervise the conduct of a systematic magnetometer, sidescan sonar and Subbottom survey of the borrow site, a reassessment of previously identified anomalies and a magnetometer and sidescan sonar survey of the pipeline corridor. The Anna Maria remote-sensing surveys were designed to locate and identify submerged cultural resources in the study areas and to generate sufficient data to make an initial assessment of each target's potential significance. Survey data provided insight into the necessity for avoidance and/or additional investigation of anomalies in both areas. Fieldwork for the borrow site survey was carried out between 5 and 9 June 2008 and fieldwork for the pipeline alignment survey was carried out between 11 and 14 November 2008. Two clusters of magnetic anomalies in the borrow area were determined to contain signature characteristics suggestive of shipwreck material and/or other potentially significant submerged cultural resources. To protect material generating those signatures a 250-foot radius buffer was recommended for both target clusters AMICR-1 and AMICR-2. Based on a reevaluation, targets identified for avoidance following a 2004 survey of the borrow area were determined to be small isolated single objects and not representative of more complex shipwreck material. Analysis of the remote-sensing data from the pipeline alignment survey revealed two clusters of anomalies determined to be suggestive of shipwreck material. The most complex is associated with the remains of the steamer *Regina* that was designated as a Florida Underwater Archaeological Preserve. To protect the exposed remains of *Regina* from the temporary material transfer pipeline a 400-foot radius buffer was recommended. Although nothing is exposed on the bottom surface, the cluster of anomalies identified as AMIP-1 was also recommended for avoidance by the creation of a 150-foot radius buffer. The remainder of the pipeline corridor anomalies appeared to be associated with modern debris such as fish haven debris, crab traps, small diameter rods, cable, wire rope, chain or small boat anchors. No additional investigation of those sites was recommended in conjunction with the deployment of the proposed pipeline (Watts 2009a).

Remote-Sensing Survey

The remote-sensing survey of the F-2 investigation area was designed to identify potentially significant submerged cultural resources that could be impacted by proposed dredging. The survey methodology and equipment was based on standards identified by BOEMRE. A combination of state-of-the-art magnetic, acoustic and seismic remote-sensing equipment was employed to generate sufficient data to reliably identify cultural material such as shipwreck sites. Remote-sensing data collection was controlled by an onboard computer running precision survey software and connected to a Real Time Kinematic (RTK) Global Positioning System (GPS). Data were collected on survey lanes spaced 30 meters (98 feet) apart. That lane spacing was designed to provide complete lateral coverage with the sonar system and a representative sampling with the seismic and magnetometer systems. Survey line crossings verified the accuracy of the collected data; all data quality was more than adequate for geological/archaeological interpretation.

Magnetometer

Magnetometers measure the earth's magnetic field in gammas and identify anomalies that represent both geological features and cultural material associated with human activity. Because of the association of ferrous material and material having thermoremnant magnetism with shipwrecks and other submerged cultural resources, magnetometers have been adopted by archaeologists as one of the principal tools employed in submerged cultural resource surveys.

State-of-the-art magnetometers use cesium vapor or hydrogen to measure the magnetic field and virtually all have processing components in the sensor for high sensitivity and very low noise (Geometrics 2003; Marine Magnetics 2003). All utilize digital technology, even the low-end proton precession magnetometers that remain on the market (Geometrics 2003). Both the cesium vapor and Overhauser sensor instruments are advertised to have much greater sensitivity than proton precession instruments (Marine Magnetics 2003). Multiple sensor instruments have been developed to operate as gradiometers providing amplified data that include target direction, size, and distance (Geometrics 2003; Marine Magnetics 2003; Michel et al. 2004).

Although all of the new generation magnetometers can be connected via a computer to a printer, data are almost universally computer displayed in real time. Data display can be achieved by a computer dedicated to the magnetometer, or the magnetometer can be connected directly to the navigation computer for both real time display and data storage. Targets can be filed and represented on the navigation display by a keystroke. All of the magnetometers can be fitted with depth and/or height over bottom sensors to facilitate maintaining survey altitude requirements (Geometrics 2003; Marine Magnetics 2003; Michel et al. 2004).

An EG&G Geometrics G-882 marine cesium magnetometer capable of plus or minus 0.001 gamma resolution was employed to collect magnetic data in the survey areas (Figure 12). The cesium magnetometer provides a scalar measurement of the earth's magnetic field intensity expressed in gammas. To produce the most comprehensive magnetic record, data were collected at five samples per second. The tow height of the magnetometer sensor was maintained between 26 feet (7.9 meters) and 37 feet (11.3 meters) below the water surface at a speed of approximately 3 to 4 knots and generally remained less than 20 feet from the bottom surface. Background noise level did not exceed a total of 2.5 gammas peak to peak. Magnetic data were recorded as a data file associated with the computer navigation system and were monitored on a 100-gamma scale chart as they were recorded. Data from the survey were contour plotted using QUICKSURF computer software to facilitate anomaly location and definition of target signature characteristics.

Figure 12. Deploying the EG&G Geometrics G-882 magnetometer.

Sidescan Sonar

Side scan sonars utilize sound to generate images of bottom surface geological features and cultural material such as shipwrecks. Transducers located on the sides of a towfish generate sound that travels through the water column at a known speed. The towfish transducers also record sound returning from the bottom surface and other exposed material. By processing the strength and variable time of returning sound, a highly detailed image of the bottom and any other exposed material can be generated. Today high resolution sonar can produce images that are almost photographic in quality and detail (Mazel 1985).

While most sidescan sonar systems are equipped to interface with recorders that generate paper records, they are designed to present and store data electronically. Virtually all sonar units available today operate on computer-based systems. Computer-based systems have advanced high-speed signal processing and most sensors are equipped with much improved transducers that provide better control over beam transmission and reception. In addition, computer-based systems are programmed to connect record processing with real world geographical coordinates permitting the computer to correct for speed and eliminate slant range error in real time by program functions (Michel et al. 2004). Computer-generated resolution is higher and tow speeds can be significantly increased. Most new systems are designed to operate at dual frequencies such as 100kHz/500 kHz or 500kHz/900kHz (Klein Associates

2003; EdgeTech 2003; Benthos 2003). All of those improvements contribute to higher resolution images. The higher the resolution of the sonar data, the more diagnostic the image.

An EdgeTech 4200-HFL sidescan sonar system was employed to collect acoustic data in the investigation area (Figure 13). The 4200-HFL uses full-spectrum chirp technology to deliver wideband, high-energy pulses coupled with high-resolution and superb signal to noise ratio echo data. The sonar package included a portable laptop configuration running DISCOVER acquisition software and a 300/600 kHz dual frequency, dual channel towfish running in high definition mode. Dual frequency provided a differential aid to interpretation. The sidescan sonar transducer was deployed and maintained between 8 and 10 feet below the water surface. Acoustic data were collected on 30 meter (98-foot) lines using a range scale of 75 meters (246 feet). The survey was conducted in such a manner to achieve total bottom coverage of over 300% within the survey area. The digital sidescan data was merged with positioning data via the computer navigation system and logged to disk for post-processing.

Figure 13. Launching the EdgeTech 4200-HFL sidescan sonar.

Sub-Bottom Profiler

Subbottom profilers also use sound to generate images. Unlike high resolution side scan sonars, subbottom profilers employ low frequency sound to penetrate and identify bottom sediments. CHIRP systems generally operate in frequencies between 3.5 to 40 kHz and are capable of resolution on the order of 10 cm (6 in.). While penetration and resolution depend on sediment type, data can identify relict landforms that could be associated with prehistoric human activity and, under the right circumstances, contribute to assessment of shipwreck or other buried submerged cultural resources (Kongsberg Simrad AS 2003; Benthos 2003; Ocean Data Equipment Corporation 2003).

A variety of subbottom profilers can be used to map the subsurface of the ocean floor. These include sparkers, boomers, pingers, and Chirp systems (Technical Committee 1 2005:22-23). A range of frequencies with differing penetration depths and resolutions characterizes each. Sparkers emit the lowest frequencies, between 800 Hz to 200 Hz, and can penetrate soils and rocks to over 1000m, but provide the lowest resolution and have unstable waveforms. Boomers generally operate between 500 Hz to 5kHz and can typically penetrate the seabed between 30 m and 100m, with resolutions between 0.3 m to 1.0 m. Pingers operate in frequencies between 3.5 kHz and 7 kHz and can penetrate the bottom to more than 50 m, depending on sediment consolidation. Chirp systems are designed to sweep across a range of frequencies (i.e. chirp). These systems can operate between 3 kHz and 40 kHz and, depending on sediment type, can attain vertical resolutions of 10 cm and is the most useful for defining sediment features, such as relict channels. Because of the resolution and frequency, this system was chosen for the survey.

Digital technology also has improved subbottom profilers. Like sidescan sonars, virtually all of today's high-resolution subbottom profilers operate on computer-based systems. Computer data processing has improved resolution greatly. Advances in the design of transducers have also contributed to improved stratigraphic definition. New transducers produce narrower beam widths with reduced side lobes and have a higher frequency range. Most produce a short sound pulse without ringing and have higher pulse rates. Many systems are compatible with heave, pitch, and roll compensators for much improved record detail. Positioning can be integrated with the data to facilitate feature location and three-dimensional projection. The primary result of these improvements is better stratigraphic definition (Kongsberg Simrad AS 2003; Benthos 2003; Ocean Data Equipment Corporation 2003; Michel et al. 2004).

An EdgeTech 512i towfish (Figure 14) was employed with a Full Spectrum Sub-Bottom Topside Unit to collect seismic data. The sub-bottom profiler sends an acoustic signal through the ocean bottom to record surface and subsurface geological features. Each distinct layer in the bottom sediment is indicated as a surficial trace, which is recorded in an electronic format onboard the survey vessel. The chart shows the presence of the sediment surface and other distinct layers or features within the sediment, such as buried river channels. The topside unit was utilized to control the 512i towfish and to display and archive the data, which was merged with positioning data via the computer navigation system. The area was surveyed using the 0.7 KHz to 12 KHz 20ms FM pulse setting. The transducer was deployed between 8 and 12 feet below the water surface. The pulse repetition rate was typically twelve pulses per second.

Figure 14. Launching the EdgeTech 512i sub-bottom profiler.

Fathometer

Fathometers employ sound to determine and record water depths. While the depth recorder or precision survey fathometer is perhaps the most elementary of the acoustic remote-sensing instruments, it can present an accurate profile of the water depth and bottom surface under the survey vessel. Highly sensitive survey depth recorders can provide insight into bottom surface sediments, surface geological features, and exposed cultural resources (Ocean Data Equipment Corporation 2003; Kongsberg Simrad AS 2003; Reson 2003).

An Odom Hydrographic Systems Hydrotrac was used to perform the bathymetric survey. The Hydrotrac is a digital, survey-grade, single frequency portable hydrographic echo sounder which operates at frequencies of 24, 33, 40, 200, 210 or 340 kHz. A 210 kHz transducer was used for the bathymetric survey and was maintained at 2.9 feet below the water surface. Sounder calibration was performed twice daily via bar-checks and a sound velocity probe. A Digibar Pro sound velocity meter offered a quick, additional calibration for sound velocity as compared to the traditional bar-check. Bar-checks were also performed at 5-foot intervals from a depth of 5 feet to a depth just beyond the maximum survey depths. A TSS model DMS-25 Motion Compensator, interfaced to Hypack, was used onboard the survey vessel to provide instantaneous heave corrections. All bathymetric data were recorded in HYPACK at 10 samples per second.

Positioning and Data Collection

The navigation and positioning systems employed during the surveys were a TRIMBLE RTK Global Positioning System (GPS) interfaced with HYPACK hydrographic survey software. RTK GPS relies on a base station/transmitter placed on a survey point of known elevation and horizontal position. The receiver on the survey vessel applies carrier phase and Doppler shift corrections received from the transmitter to the position of the vessel resulting in a determination of vessel position within several centimeters, both vertically and horizontally. The TRIMBLE RTK GPS base station transmits data once per second to a receiver up to 25 kilometers away.

HYPACK is a state-of-the-art navigation and hydrographic surveying system. On-line screen graphic displays include the pre-plotted survey lines, the updated boat track across the survey area, adjustable left/right indicator, as well as other positioning information such as boat speed, quality of fix and line bearing (Figure 15).

Figure 15. Computer navigation system located at the research vessel helm.

Position fixes were digitally recorded five times a second (approximately 1 position fix every two feet) along all survey lanes and were annotated on all records every 100 feet. All data obtained is recorded on the computer's hard disk and is transferred to an external hard drive to provide a backup of the raw survey data. Data generated was correlated to remote-sensing records by RTK GPS to facilitate target location and anomaly analysis. All data were plotted to Florida West State Plane coordinates, NAD 83, U.S. Survey Foot.

Survey Vessel

Data acquisition was carried out from the survey vessel R/V *Aqua Quest*. *Aqua Quest* is a steel-hulled trawler measuring 60 feet in length and 22 feet in breadth. Vessel speed averaged 3.5 knots during the course of the survey. All instrumentation was referenced relative to the GPS antenna, which was located 41.3 feet forward of the stern and 2 feet to starboard of the vessel's centerline. The Hydrotrac fathometer was set up at a position -10.5 feet to starboard and -6.8 feet forward. The magnetometer was towed at a position 12.0 feet to starboard and -195.4 feet forward. The subbottom profiler was towed at a position 1.7 feet to starboard and –57 feet forward. The sidescan sonar was towed at a position 13 feet to starboard and 0 feet forward. All survey lanes were run on a 36/216 azimuth.

Limitations of Magnetic and Acoustic Remote-Sensing

Magnetic Remote-Sensing

The magnetometer represents one of the most valuable tools available for locating submerged cultural material. One distinct advantage associated with magnetic detection is that material can be buried and still generate an identifiable signature. However, magnetic remote-sensing has limitations that should be acknowledged. Since disturbances in the earth's magnetic field are relative to both the mass and physical characteristics of ferrous and thermo-remnant material, a number of factors influence detectable signatures. One of the most critical is survey lane spacing. Acceptable lane spacing must be determined based on the anticipated nature of submerged cultural resources in the survey area. For example the signature of a large iron ship would be detectable over a considerably longer distance than a small wooden vessel. Thus the lane spacing adopted to reliably locate a large ship could be considerably greater than that employed for a small wooden vessel.

The proximity of the sensor to material generating the anomaly is one of the most important factors. As the magnetometer is not range specific, the size and composition of material generating an anomaly in the earth's magnetic field combine to establish the distance at which magnetic material creates the detectable disturbance. For example a small anchor will be detectable for a much more limited distance than the iron hull of a vessel. Therefore, sensor elevation in the water column and line spacing have a great deal to do with the size and characteristics of an anomaly that will be identifiable. Vessel speed and the cyclical rate of data collection will also have a bearing on the detectable characteristics of an anomaly. Higher speed and/or a slower cyclical rate can turn the subtle characteristics of a multi-component signature into one of the other three signature types; negative monopolar, positive monopolar or dipolar.

Currently, a 100-foot (30.42m) lane spacing is considered acceptable for most offshore areas. In inshore areas or offshore areas where historical sources confirm that vessel traffic and losses have been high, a 50-foot (15.21m) lane spacing is considered acceptable. However, neither of those line spacings will ensure 100% likelihood of identification. Vessel signatures vary significantly. Even at a 50-foot (15.21m) lane spacing, identifying the remains of small vessels could be a factor of the chance position of a single survey line in relationship to the wreck. Several examples of detectable limitations can be found in a report on "State-of-the-Art Remote-sensing Equipment, Software and Survey Methodology in Submerged Cultural Resource Identification, Protection and Management" incorporated in a Minerals Management Service publication titled: *Archaeological Damage from Offshore Dredging: Recommendations for Pre-Operational Surveys and Mitigation During Dredging to Avoid Adverse Impacts* (OCS Report MMS2004-005) (Michel et al. 2004).

In addition to lane spacing, background noise also plays a role in isolating small signatures. When small vessel remains and other cultural resources create limited disturbances in the earth's magnetic field, background noise can obscure the signature. Fortunately modern magnetometer systems are highly stable and background noise is limited unless there are significant geological features, solar activity and vessel-generated noise. In addition to background noise, modern debris, cables, pipelines and structures such as offshore rigs, bridges, docks and bulkheads can mask subtle signatures. An excellent example can be found in the remains of two vessels located adjacent to the Jordan Point Bridge on the Southern Branch of the Elizabeth River in Chesapeake, Virginia. Neither vessel, both large wooden ships over 150 feet in length (Figure 16), was magnetically detectable (Figure 17) due to the massive magnetic disturbance created by adjacent bridge and pier structures, cables and bulkheads (Watts 2009b).

Unfortunately, shipwreck sites have been demonstrated to produce each signature type under certain circumstances. Some shipwreck signatures are more apparent than others. Large vessels, whether iron or wood produce signatures that can be reliably identified. Smaller vessels, or disarticulated vessel remains, are more difficult to identify. Their signatures are frequently difficult, if not impossible, to distinguish from single objects and/or modern debris. In fact, some small vessels produce little or no magnetic signature. Unless ordnance, ground tackle or cargo associated with the hull produces a detectable signature, some sites are impossible to identify magnetically. For example, the remains of the Mepkin Abby vessel in the Cooper River near Charleston, South Carolina produced no magnetic signature. Instead the site was identified solely by sonar (Figure 18). It is also difficult to magnetically distinguish some small wrecks from modern debris. As a consequence, magnetic targets must be subjectively assessed according to intensity, duration and signature characteristics. The final

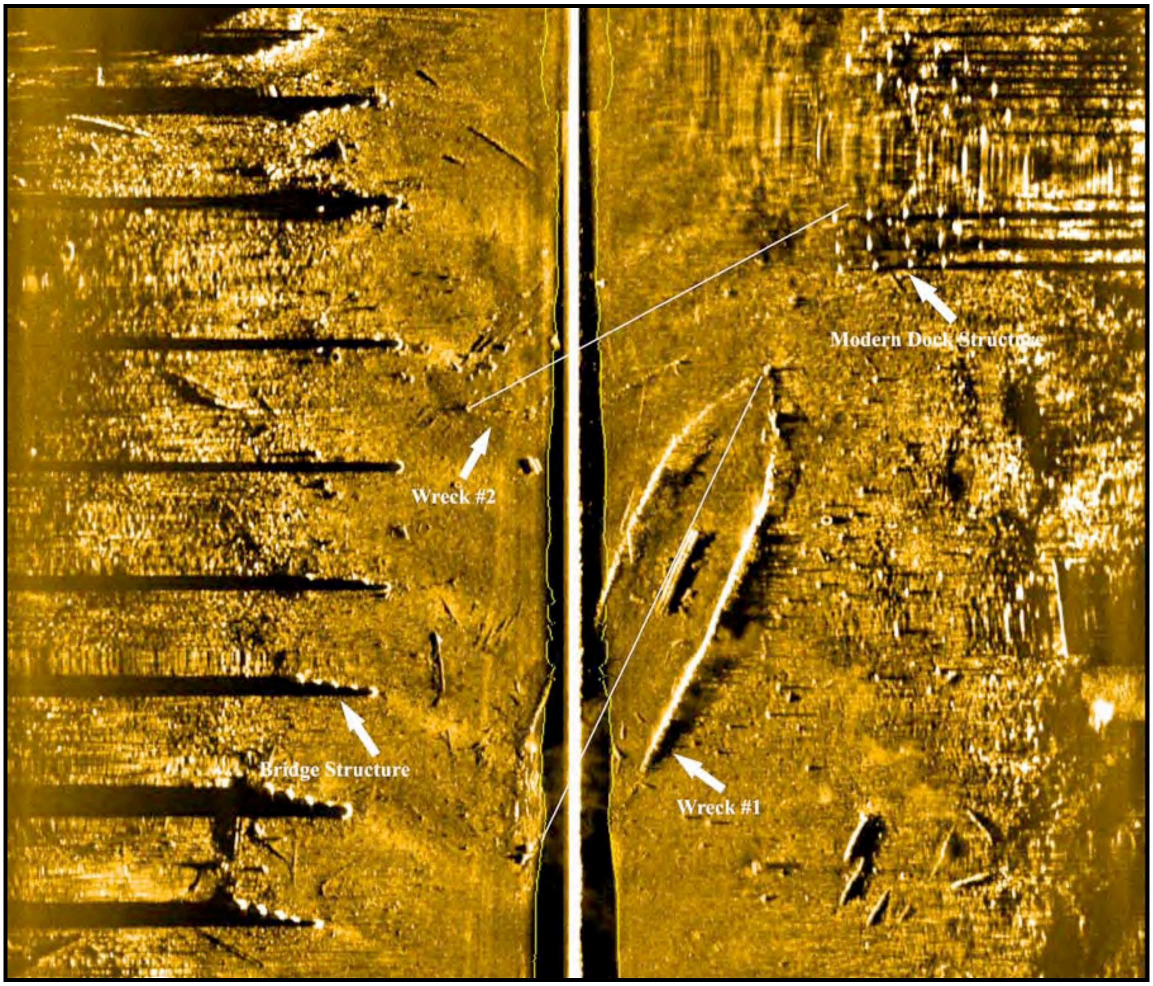

Figure 16. Sonar image of the Jordan Bridge shipwrecks.

decision concerning potential significance must be made on the basis of anomaly attributes, historical patterns of navigation in the project area and a responsible balance between historical and economic priorities.

Sonar Remote-Sensing

Used in conjunction with magnetometers, sidescan sonar can generate valuable diagnostic insight into the nature of material generating magnetic anomalies. In addition, sonar can identify the exposed remains of vessels and other cultural material that does not create a ferrous or thermoremnant magnetic signature. Because sonar generates highly valuable diagnostic data, side scan sonars have also been adopted by archaeologists and submerged cultural resource managers to locate and identify shipwrecks and other submerged cultural resources.

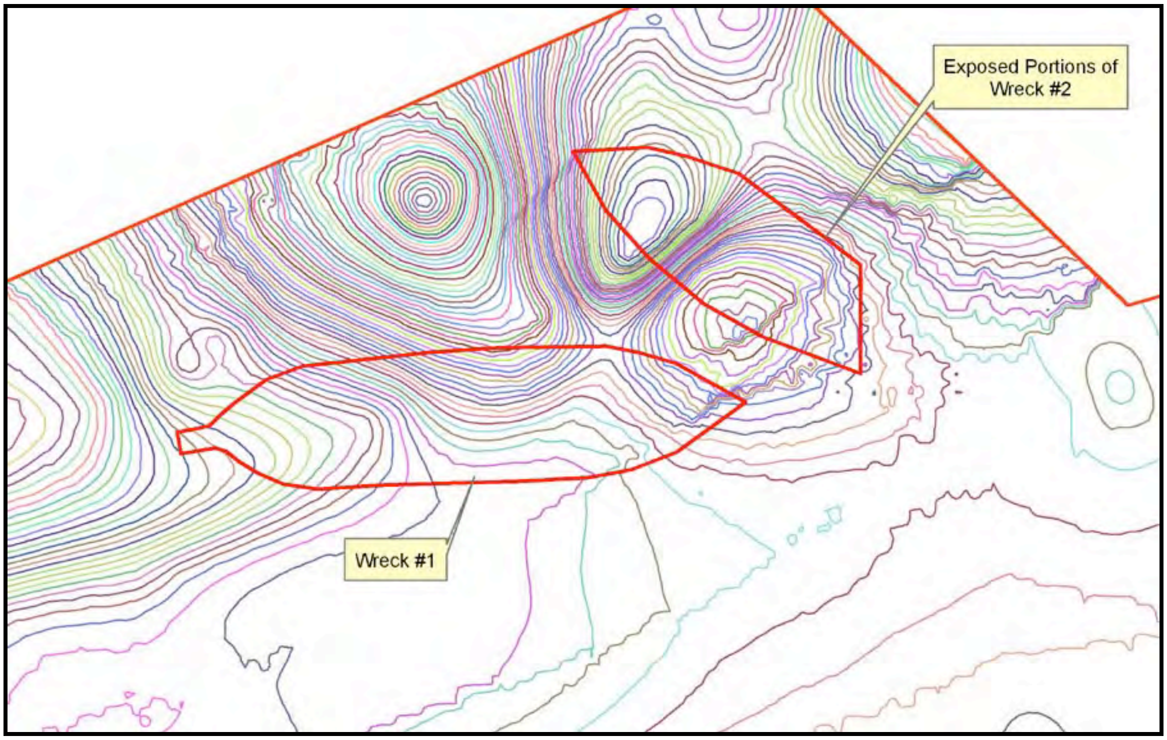

Figure 17. Magnetic contour map illustrating the masking of vessel signatures by bridge and pier structures, cables and bulkheads.

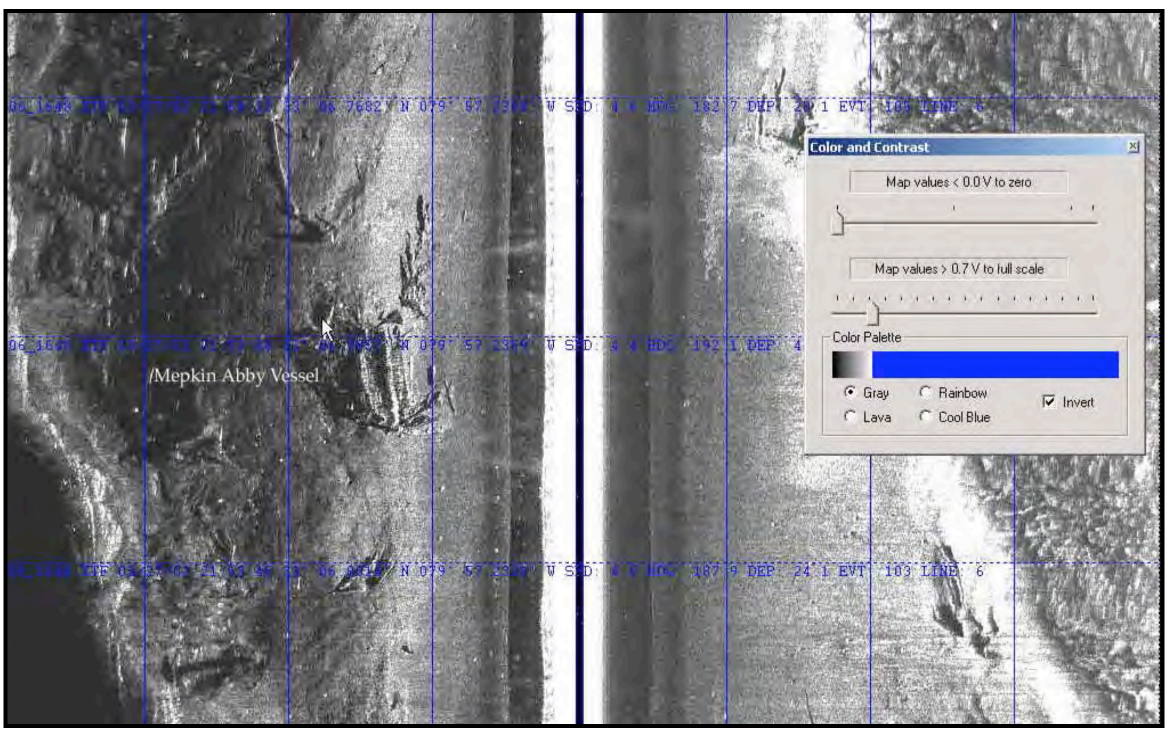

Figure 18. High resolution sonar image of the Mepkin Abby wreck in the Cooper River near Charleston, South Carolina (image courtesy of Ralph Wilbanks).

Unfortunately, shipwreck sites have been demonstrated to produce a variety of signature characteristics under different circumstances. Like magnetic signatures, some acoustic shipwreck signatures are more apparent than others. Large vessels, whether iron or wood, produce signatures that can be reliably identified. Smaller vessels, or disarticulated vessel remains are inevitably more difficult. Their signatures are frequently difficult, if not impossible, to distinguish from concentrations of snags and/or modern debris. In fact, some small vessels produce little or no acoustic signature. As a consequence, acoustic targets must be subjectively assessed according to intensity of return over background, elevation above bottom and geometric image characteristics. The final decision concerning potential significance of less readily identifiable targets must be made on the basis of anomaly attributes, historical patterns of navigation in the project area and a responsible balance between historical and economic priorities.

Like magnetic remote-sensing, sidescan sonar also has limitations to be considered. For different reasons, sensor to target distance is also critical. Again, the size of anticipated vessel remains or other submerged cultural material is a significant issue in survey line spacing. For targets such as the remains of large vessels, a broad survey pattern may generate acceptable results. For smaller and less distinctive targets such as the remains of small, disarticulated or partially exposed vessels, a much closer line spacing may be required to produce acceptable results.

Another consideration associated with line spacing is operational frequency and range selection. The lower the frequency the more extended the range but the lower the resolution. The higher the frequency the better the resolution but the more limited the range. Where larger targets are anticipated the lower frequency and higher range will produce reliable results. Where more subtle targets are anticipated, and that must generally be the case with submerged cultural resource surveys, a higher frequency and closer line spacing is essential. The 30 meter (98-foot) and 15 meter (49-foot) line spacing generally adopted for magnetometer surveys produces excellent high frequency sonar images on a 50 meter (164-foot) range scale. That range scale and line spacing also provides excellent overlap in coverage and multiple images of each target.

High quality diagnostic sonar image production can also be impacted by both environmental and survey conditions. Under certain conditions the water surface can produce a deceptive return that could be construed to represent real targets. Rough water conditions, particularly in shallower water where the transducer cannot be lowered sufficiently, can distort images. Biological and marine animal activity can also impact record quality as floating vegetation, shrimp, fish, dolphin and other marine organisms can create deceptive imagery. On more than one occasion schools of fish have been identified as ballast piles in submerged cultural resource reports (Figure 19). Vessel course and speed can also have an impact on sonar record quality. With the exception of sidescan sonars designed for high speed operations, vessel speed over ground has a direct bearing on target resolution as the number of pings on a target relates directly to resolution. Finally, noise generated by vessel power sources and other acoustic equipment can also degrade record quality.

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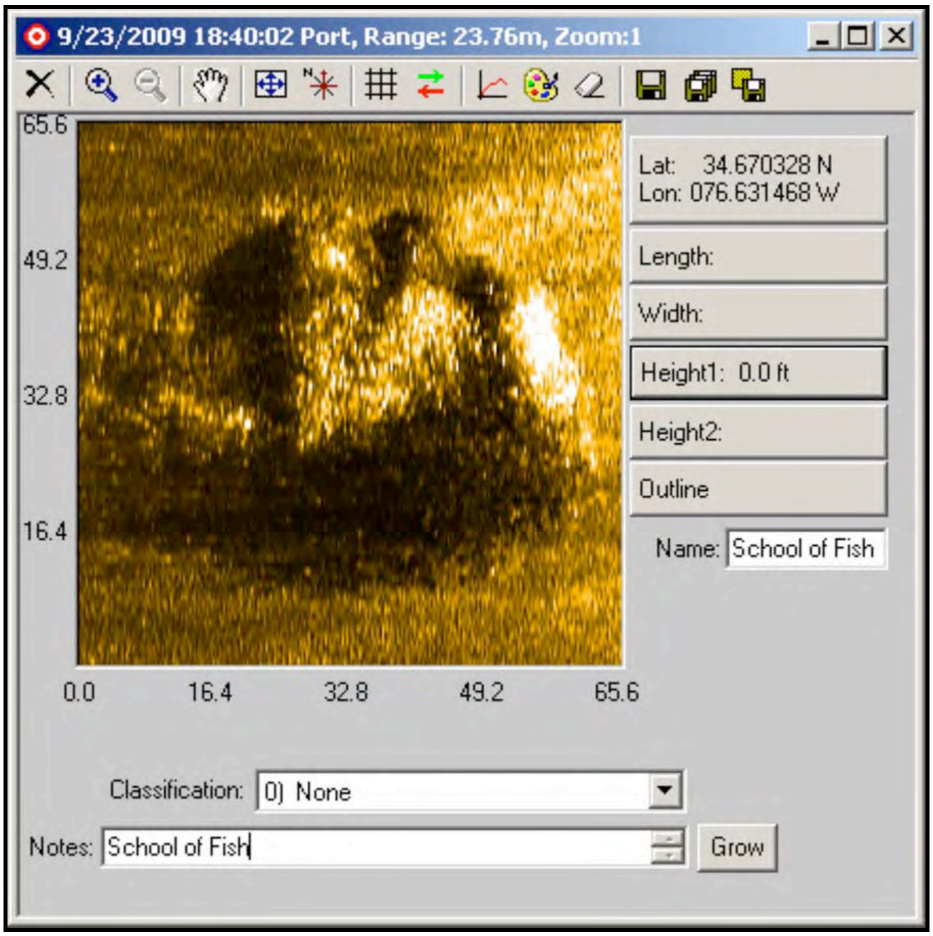


Figure 19. A school of fish generating the appearance of a ballast pile.

Subbottom Profiler Remote-Sensing

On most submerged cultural resource surveys, subbottom profilers are an integral part of the remote-sensing array. Like sidescan sonars, virtually all high-resolution subbottom profilers operate on computer-based systems. Computer data processing has improved resolution greatly. Advances in the design of transducers have also contributed to improved stratigraphic definition. New transducers produce narrower beam widths with reduced side lobes and have a higher frequency range. Most produce a short sound pulse without ringing and have higher pulse rates. Many systems are compatible with heave, pitch, and roll compensators for much improved record detail (Michel et al. 2004).

Used in conjunction with magnetometers and sidescan sonars, subbottom profilers can generate insight into the nature of subbottom stratigraphy. On occasion, subbottom profiler data can provide insight into the location and nature of buried material such as shipwrecks, cables and pipelines generating magnetic anomalies. While subbottom data has, on occasion, been useful in characterizing and evaluating subbottom anomalies, it has rarely been useful in identifying vessel remains without magnetic anomalies on which to focus. The subbottom image associated with the remains of the Civil War steamer CSS *Waterwitch* (Figure 20) confirms the marginal diagnostic value of the data even under virtually ideal conditions. The CSS *Waterwitch* wreck site is located in the upper reaches of the Vernon River near Savannah, Georgia and is completely covered by the type of mud and light sediment that is conducive to excellent low frequency penetration (Watts 2008).

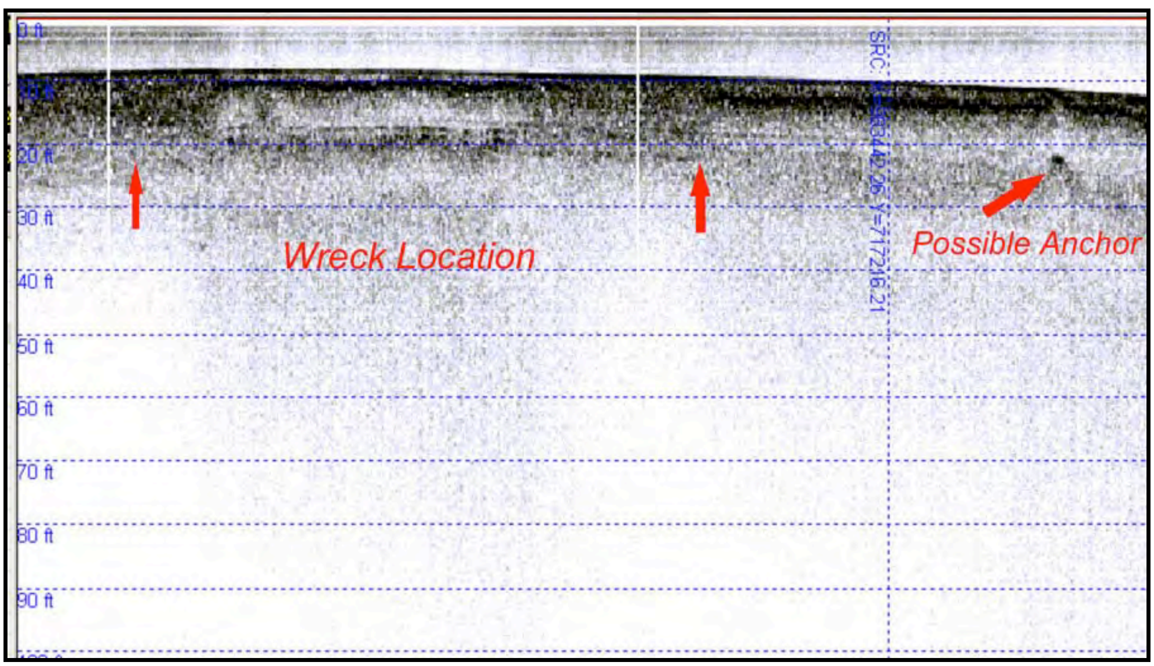


Figure 20. Subbottom profiler image of the CSS *Waterwitch* in the Vernon River near Savannah, Georgia.

On occasion data can reflect the influence of external elements that produce spurious images. There are five different types of false signal returns that must be identified during analysis: direct arrival, reflection multiple, water surface reflection, side echoes, and point source reflections (Applied Acoustic

Engineering Limited 1998:8-11). Side echoes can be clearly seen in subbottom records generated during a survey in Naples Bay, Collier County, Florida (Figure 21).

Although subbottom profilers have not generally produced a high degree of diagnostic insight into submerged cultural resources such as shipwrecks, the data they produce is extremely beneficial in locating, identifying and mapping relict landforms. Karst features like sink holes (Figure 22) and Paleo river channels (Figure 23) previously identified off Cape Romano, Florida provide excellent examples.

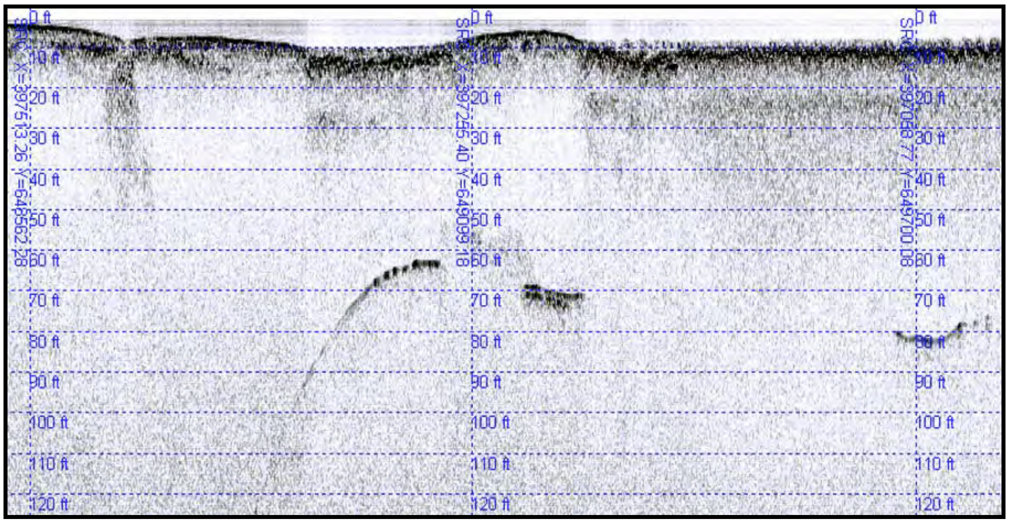


Figure 21. Example of side echoes created by an adjacent bulkhead in Naples Bay, Collier County, Florida.

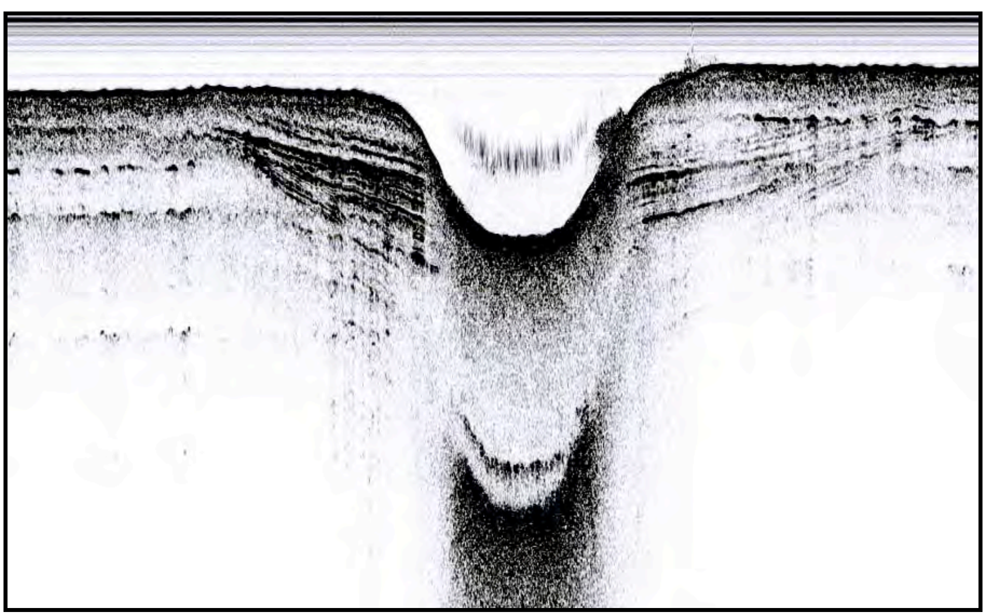


Figure 22. Subbottom profile of a sink hole off Cape Romano, Collier County, Florida (Courtesy Coastal Planning and Engineering, Boca Raton, Florida).

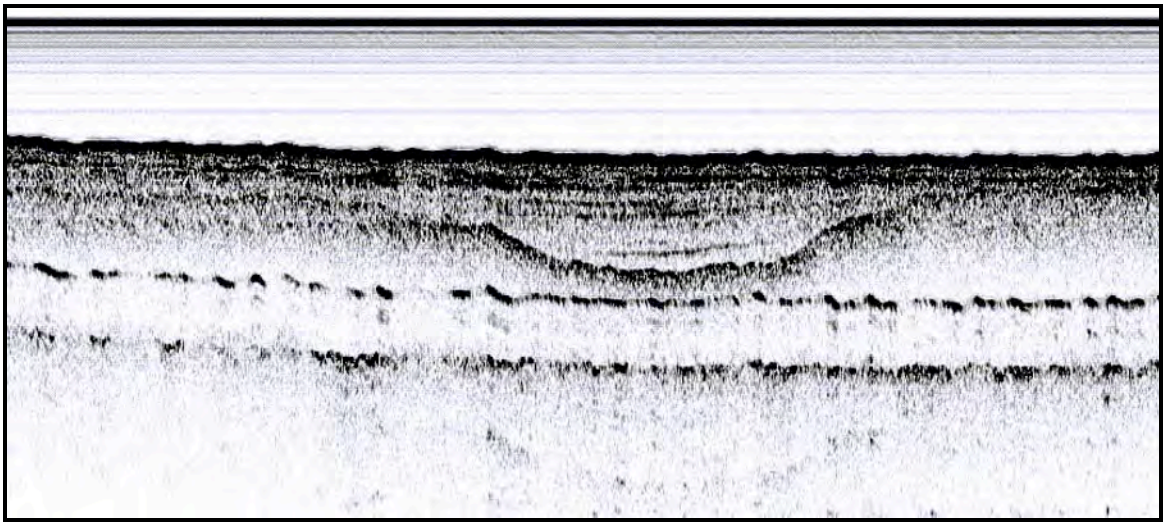


Figure 23. Subbottom profile of a relict channel off Cape Romano, Collier County, Florida (Courtesy Coastal Planning and Engineering, Boca Raton, Florida).

However like all forms of remote-sensing, subbottom profilers have limitations that must be considered. Unlike sonar, the subbottom profiler provides insight into bottom sediments along each survey line. Large geological features can be extrapolated between lines, however smaller localized features that lie between lines may not be detected. For example, a shell midden or small karst feature could lie entirely between survey lines on 100-foot (30.42m) or greater centers.

As the analytical potential of data generated is relative to line spacing, decreasing the line spacing increases the likelihood of identifying and characterizing both localized features such as relict landforms, shell middens, or buried non-magnetic shipwreck remains. To effectively characterize a localized buried geological feature or wreck using a Subbottom profiler would require an exercise similar to that employed to generate a high-resolution sonar image. Additional lines run across all anomalies recommended for additional investigation or avoidance would generate more diagnostic data (Michel et al. 2004).

Where there are salt and fresh water inversions or mixing, such as associated with offshore springs, record quality can be compromised. Gas generated by biological activity can also degrade record quality and obscure features. While consolidated sand and even rock can be penetrated by high power systems, too much power can obscure more subtle targets in the less consolidated sediments that preserve evidence of the type of features that are accepted to be associated with prehistoric habitation. In the vicinity of objects such as bulkheads, passing vessels, vertical channel shoulders cut into hard sediments, sound bouncing laterally back from such an object can create a spurious anomaly that appears well below the actual depth of penetration. Like sidescan sonar, water depth, surface conditions and vessel speed can also degrade data.

Fathometers

Survey fathometers also have operational limitations to consider. As accurate sounding is based on the speed of sound, the composition of water in the survey area must be checked for sound speed. That can be established with instruments like the Odom Digibar Pro®. The Digibar Pro® is a velocimeter that profiles water column sound velocity and generates speed of sound data that can be used to calibrate acoustic systems. The speed of sound established in this manner is corrected for pressure, salinity and temperature (Odom 2010). Calibration can also be made using the traditional "bar check" method of systematically lowering a target under the fathometer transducer and correcting for known depths.

Fathometer data can also be degraded by salt and fresh water inversions or mixing, such as associated with offshore springs. Vessel wake and gas generated by biological activity can also degrade record quality and obscure bottom features. Like sonar, fathometer data can also be compromised by both environmental and survey conditions. Rough water conditions, particularly in shallower water, can distort images. Without heave, pitch and roll compensation surface motion can produce distorted bottom surface records. Biological and marine mammal activity can also impact record quality as floating vegetation, shrimp, fish, dolphin and other marine organisms can create spurious data.

Survey Conditions

During the F-2 investigation area survey, weather was warm with temperatures ranging from approximately 78 degrees early in the morning to about 89 degrees by mid-afternoon. Winds were from out of the southeast 5 to 15 mph. Sea state was approximately two feet during operations. Visibility exceeded 10 miles.

Environmental Setting

Anna Maria Island and Longboat Key lie on the western portion of the Floridan Plateau. The plateau, which includes the Florida peninsula and the adjacent continental shelf, is a large carbonate platform composed of approximately 22,000 feet of marine sediments (National Oceanic and Atmospheric Administration [NOAA] 1995:10). Underneath that structure lies the south Florida Basin, a crystalline and sedimentary basement of rock. The basin is a block-faulted feature that is associated with the breakup of the North American and African plates during the Mesozoic era.

Sea level fluctuation from the last period of glaciation is largely responsible for the region's current morphology. During the Wisconsin Glaciation, sea level dropped significantly exposing the entire Floridan Plateau to marine and subaerial erosion (NOAA 1995:10). Approximately 6,000 years ago sea level rose again, flooding the plateau to present levels. The west central plateau consists mainly of a karst topography composed of porous Eocene limestone strata approximately 2,000 feet thick (Holt et al. 1982:120). A thin layer of unconsolidated sediments covers the limestone throughout much of the region. This landform is characterized by sinkholes formed as the result of solution of surface limestone or the collapse of underlying caverns.

Data Analysis

To ensure reliable target identification and assessment, analysis of the magnetic and acoustic data was carried out as it was generated. No problems were encountered during data collection. Using QUICKSURF contouring software, magnetic data generated during the survey was contour plotted at 5-gamma intervals for analysis and accurate location of the material generating each magnetic anomaly. Magnetic targets were isolated and analyzed in accordance with intensity, duration, areal extent and other signature characteristics. Sonogram signatures associated with magnetic targets were analyzed on the basis of configuration, areal extent, elevation, target intensity and contrast with background and shadow image.

Data generated by the remote-sensing equipment was developed to support an assessment of each magnetic and acoustic signature. Analysis of each target signature included consideration of magnetic and sonar signature characteristics previously demonstrated to be reliable indicators of historically significant submerged cultural resources. Sub-bottom data was also assessed for relict channels and the potential for prehistoric resources. Assessment of each target included recommendations for additional investigation to determine the exact nature of the cultural material generating the signature and its potential NRHP significance. Historical evidence was developed into a background context and an inventory of shipwreck sites (Appendix A). These data were then used to identify possible correlations with magnetic targets. A magnetic contour map of the survey area was produced to aid in the analysis of each target.

Signature Analysis and Target Assessment

No absolute criteria for identification of potentially significant magnetic and/or acoustic target signatures exists. However, available literature confirms that reliable analysis must be made on the basis of certain characteristics. The most reliable signature analysis can be made by comparative analysis of both magnetic and acoustic data. Data analysis should also be carried out with consideration of the limitations of each instrument and the environment in which survey operations are conducted.

Magnetometer Data Collection and Analysis

Data from the magnetometer is collected using HYPACK and stored as *.RAW files by line, time, and day. Raw data files are opened and reviewed in HYPACK Single Beam Editor and layback parameters are set (Figure 24). The location, strength, duration, and type of anomaly are then transcribed to a spreadsheet along with comments. Contour maps of the magnetic data are produced with QuickSurf, a proprietary AutoCAD extension. The *.DWG file is saved and exported into an ArcMap project. The contour maps provide a graphic illustration of anomaly locations, spatial extent, and association with other anomalies.

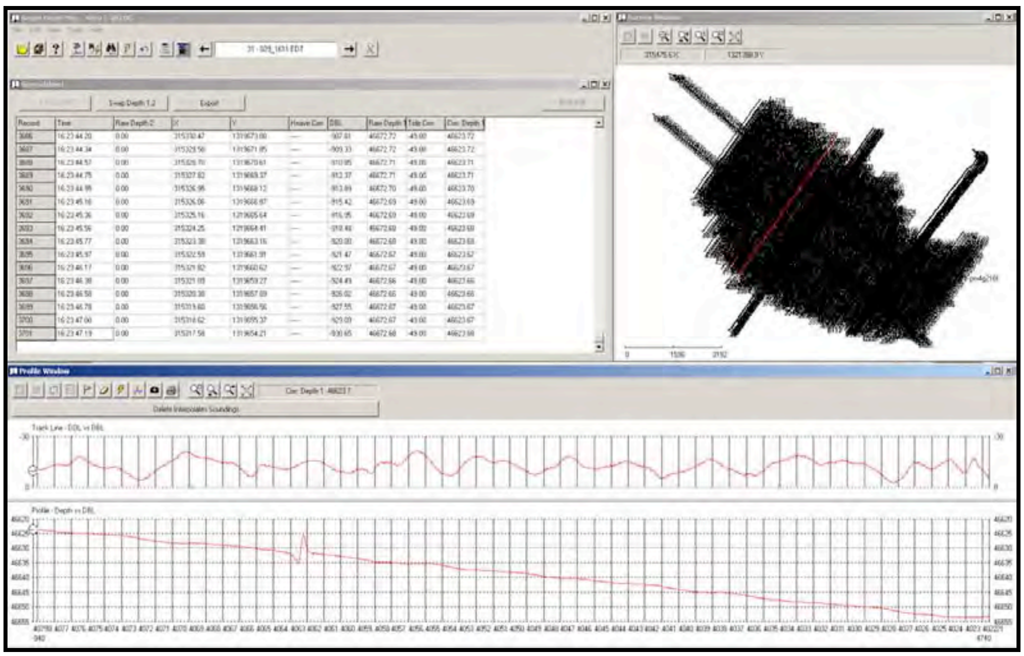


Figure 24. HYPACK's Single Beam Editor.

Magnetic signatures are evaluated on the basis of three basic factors. The first factor is intensity and the second is duration. The third consideration is the nature of the signature; e.g., positive monopolar, negative monopolar, dipolar or multi-component. In conjunction with signature intensity in gammas and duration in feet, those four signature configurations are used to characterize virtually all magnetic anomalies.

Sidescan Sonar Data Collection and Analysis

Sidescan sonar data was collected using EdgeTech's Discover data acquisition software. Data correlated with RTK GPS positioning coordinates were recorded as *.JSF files and stored by project, area designation, line and line direction. The dual frequency system recorded data at both 300 and 600kHz frequencies. The sonar towfish was towed approximately 20 feet off the bottom and operated at a range scale of 75 meters per channel. On a 30 meter (98-foot) line spacing that range scale generated over 300 percent overlapping data.

Post processing of sidescan sonar is accomplished using SonarWiz.MAP, a product that enables the user to view the sidescan data in digitizer waterfall format, record targets and enter target parameters including length, width, height, material and other characterizations into a database of contacts. In addition, SonarWiz.MAP mosaics the sidescan data by associating each pixel (equivalent to about .3 feet) of the sidescan image with its geographic location determined from the distance from the RTK GPS position. SonarWiz.MAP is the industry standard for creating sonar mosaics, and the results are exported as geo-referenced TIFFs and imported into the GIS project. SonarWiz.MAP also generates target reports in PDF, Word, or Excel format. TAR utilizes the Word format for reports (Figure 25 and Figure 26).

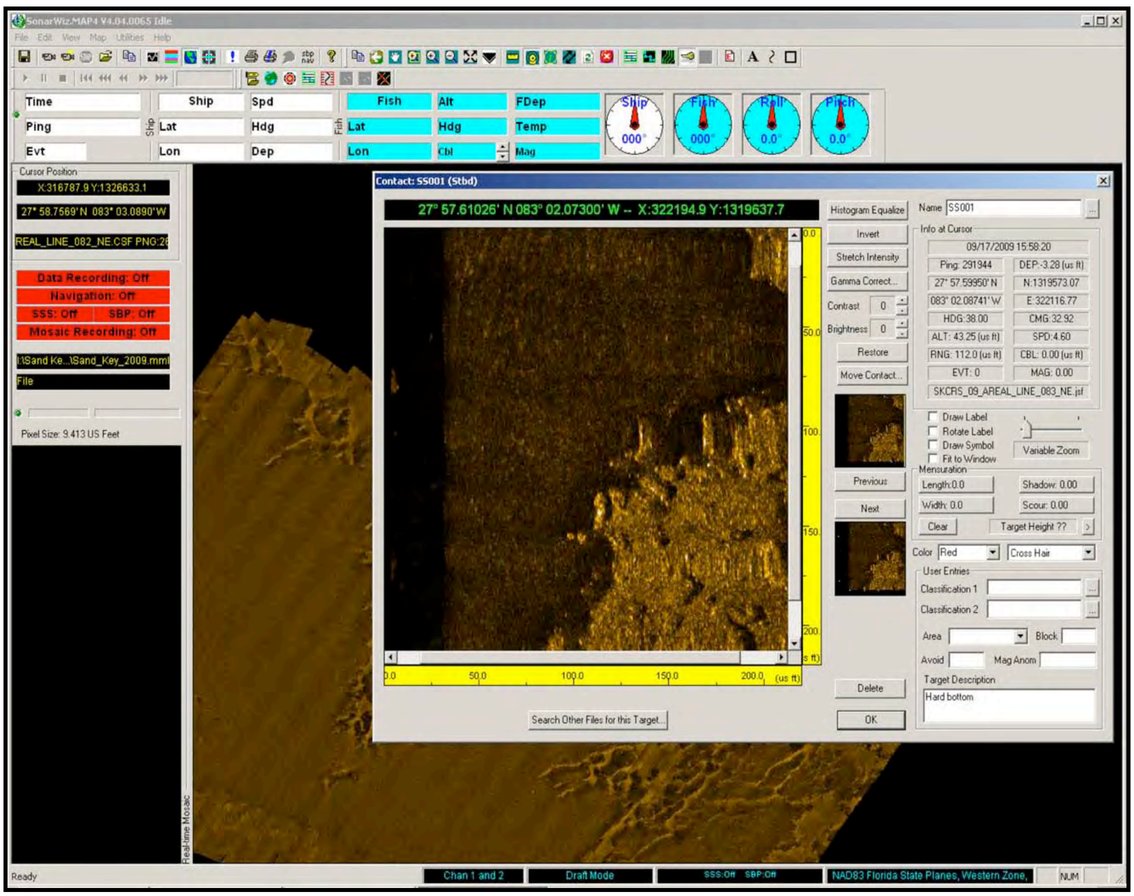


Figure 25. SonarWiz.MAP project with a sidescan sonar mosaic in the background and a hard bottom target image.

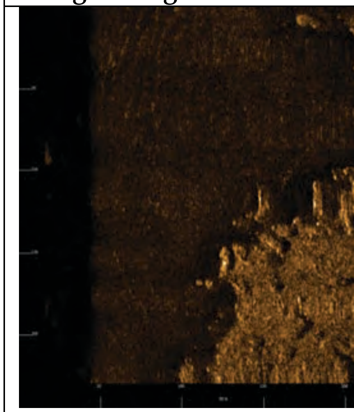
Target Image	Target Info	User Entered Info
	**SS001** • Sonar Time at Target: 09/17/2009 15:58:35 • Click Position (Lat/Lon Coordinates) 27° 57.61026' N 083° 02.07300' W (WGS84) 27° 57.61026' N 083° 02.07300' W (Local) 27° 57.59250' N 083° 02.08309' W (NAD27) • Click Position (Projected Coordinates) (X) 322,194.86 (Y) 1,319,637.66 • Map Proj: NAD83 Florida State Planes, Western Zone, US Foot • Acoustic Source File: SKCRS_09_AREAL_LINE_083_NE.jsf • Ping Number: 292076 • Range to Target: 140.83 US Feet • Fish Height: 44.69 US Feet • Heading: 35.00000000 • Event Number: 0 • Line Name: SKCRS_09_AREAL_LINE_083_NE	**Dimensions** Target Height = 0.0 US Feet Target Length: 0.0 US Feet Target Shadow: 0.0 US Feet Target Width: 0.0 US Feet Mag Anomaly: Avoidance Area: Classification 1: Classification 2: Area: Block: Description: Hard bottom

Figure 26. Example of a SonarWIZ.MAP sonar contact report.

Acoustic signatures must be assessed on the basis of several basic characteristics. Perhaps the most important factor in acoustic analysis is the configuration of the signature. As the acoustic record represents a reflection of specific target features, wreck signatures are often a highly detailed and accurate image of architectural and construction features (Figure 27). On sites with less structural integrity, signatures often reflect more of a geometric pattern that can be

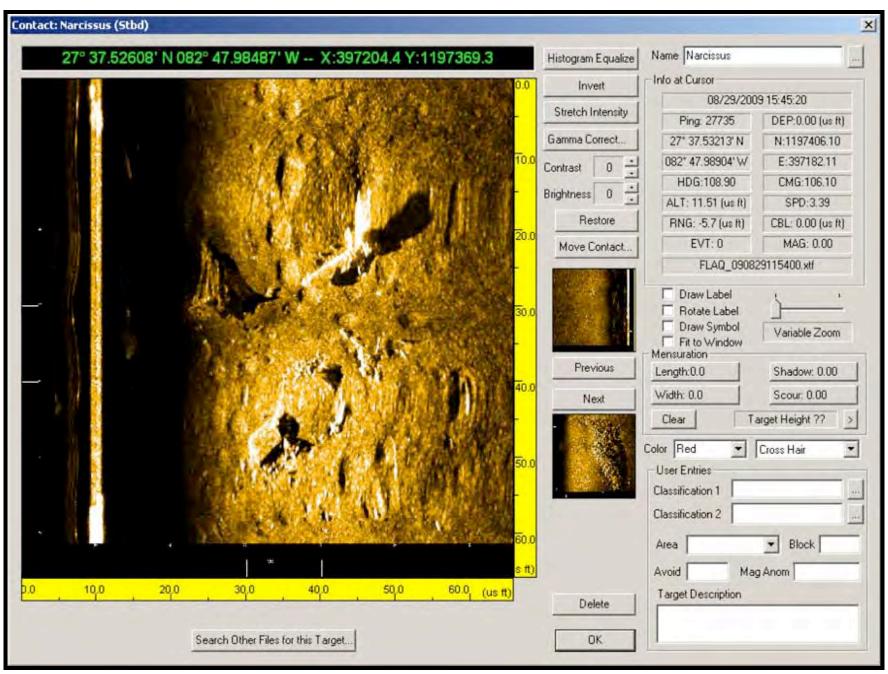


Figure 27. A sonar image of the USS *Narcissus* showing the exposed engine, propeller, boiler, and hull debris.

identified as structural material (Figure 28). Where hull remains are disarticulated the pattern can be little more than a texture on the bottom surface representing structure, ballast or shell hash associated with submerged deposits (Figure 29).

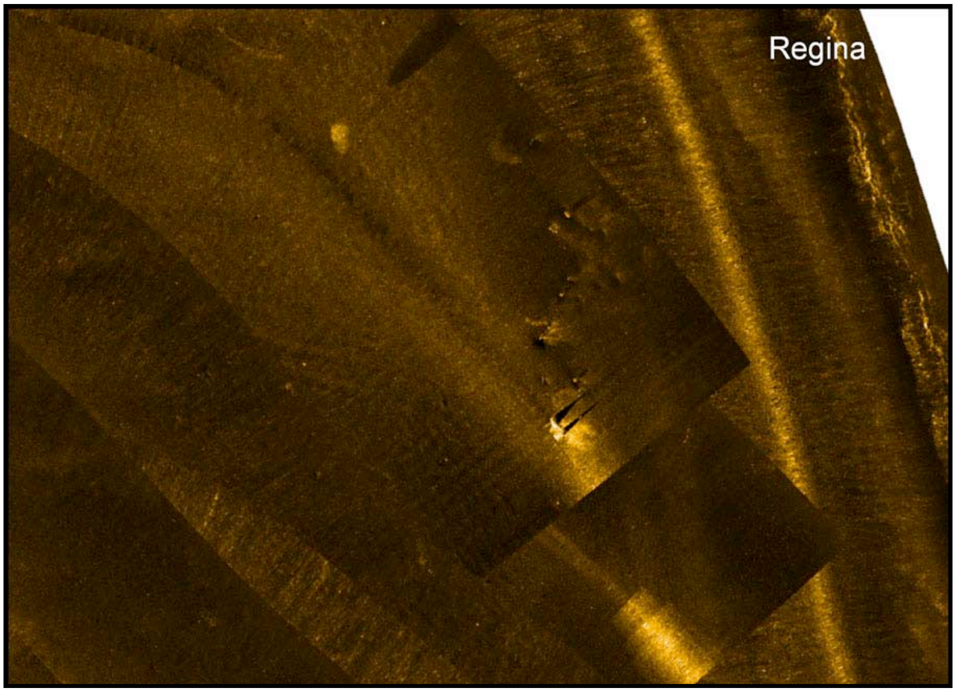


Figure 28. A sonar mosaic of the barge *Regina*.

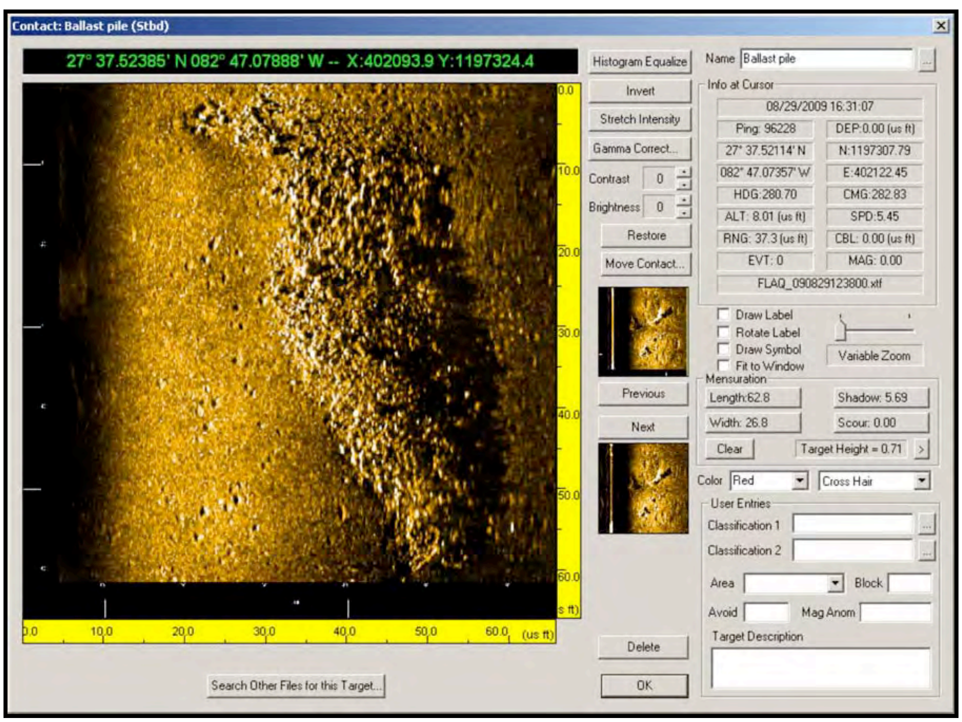


Figure 29. A sonar image of the ballast pile east of the USS *Narcissus*.

Subbottom Data Collection and Analysis

Subbottom profilers record subsurface strata by emitting a pulse of acoustic energy. This energy travels through water and sediment and is reflected as an echo to a receiver. As sediment and its acoustical properties change (acoustic impedence), some energy is reflected. The delay between when a sound is transmitted until it is received is converted into distance. The energy reflected by different sediment beds is used to create subbottom cross-section profiles, which are displayed as light and dark areas. While it is possible to detect and preliminarily map shipwrecks with this type of system (Quinn et al. 1998, Quinn et al. 2002, Plets et al. 2008), it is more useful for detecting subbottom buried paleo-landforms such as relict river and stream channels, estuary complexes, berms, dunes and hammocks, that are associated with prehistoric sites (Michel et al. 2004:10).

Subbottom profiler data was collected on 30 meter (98-foot) line spacing using EdgeTech's Discover software. Data correlated with RTK GPS positioning coordinates were recorded as .JSF files and stored by project, area designation, lane and lane direction. The EdgeTech system recorded data using the 0.7 KHz to 12 KHz 20ms FM pulse setting. The sonar towfish was towed approximately between 8 and 12 feet below the water surface. The pulse repetition rate was set at twelve pulses per second.

Like the sidescan sonar data, post processing of subbottom profiler data is accomplished using SonarWiz.MAP (Figure 30). For this application, the user views the data in a planar, trackline format. This program allows the digitization and classification of subbottom features and calculates linear extent and depth. The processed images can be exported to *.JPG format for inclusion as Figures in the report.

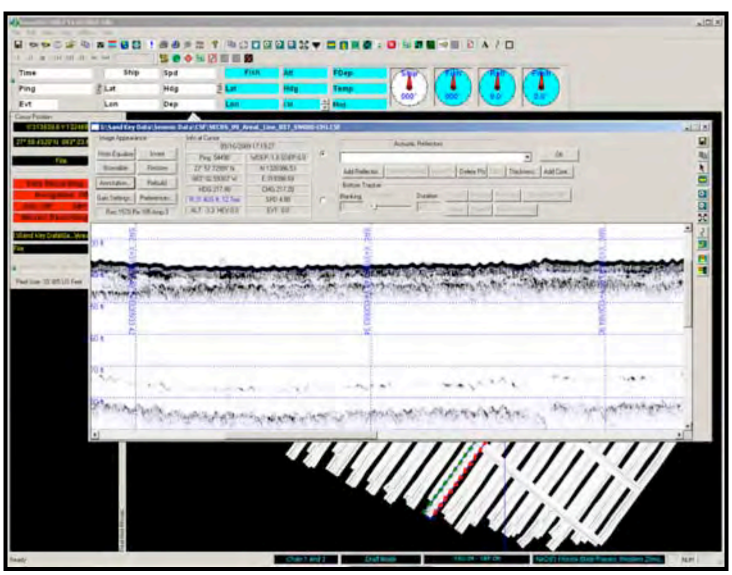


Figure 30. SonarWiz.MAP subbottom project with the digitizer window open.

The F-2 Investigation Area

In F-2 investigation area remote-sensing data was collected on a line spacing of 30 meters (98 feet) (Figure 31). Depths ranged from 41 to 57 feet, based on NAVD 88 (Figure 32). Analysis of the remote-sensing data generated in the F-2 investigation area identified seven magnetic anomalies in the survey area. Only two are within the proposed borrow site (Figure 33 and Appendix B). The magnetic signatures of all of those anomalies exhibit signature characteristics suggestive of modern debris such as fish and crab traps, pipes, small diameter rods, cable, wire rope, chain, or small boat anchors. One line of magnetic data (line 155) was found to be corrupted during analysis. The sonar and sub-bottom profiler data from that line were intact.

No cultural material was identified on the bottom surface in the F-2 investigation area (Figure 34). Analysis of the data generated by the sub-bottom profiler identified no relict landforms or other targets that are indicative of association with prehistoric or historic submerged cultural resources. Samples of the sub-bottom profiler data are included (Figures 35 and Figure 36).

Conclusions and Recommendations

A survey of historical and archaeological literature and background research confirmed evidence of sustained maritime activity associated with the southwest coast of Florida. Documented transportation activities along the western part of the peninsula and neighboring waterways date from the second half of the 16^{th} century. The Tampa Bay area became a focus for European activities as early as the 1560s when Pedro Menéndez explored the west coast of Florida. The Manatee River area was not permanently settled until the mid-19^{th} century when Americans arrived in the wake of the Seminole Wars. The area developed into an agricultural and livestock center with sugar cane and beef dominating economy, though by the last quarter of the 19^{th} century production had shifted to citrus and vegetables. Extension of rail and steamer service and the arrival of the automobile quickly transformed the region into a tourist center during the early years of the 20^{th} century. The islands of Anna Maria and Longboat Key quickly developed as a popular destination and remains an attraction for tourists today.

Historical research confirms the presence of vessel losses in the coastal waters offshore of Manatee and Sarasota counties. That research indicates that at least 28 vessels have been recorded lost in the geographical vicinity of the F-2 investigation area. The compiled list of ships known to have been lost in the waters off Anna Maria Island and Longboat Key cannot be considered exhaustive and unrecorded wrecks, especially from earlier periods, may be present in the area currently under consideration.

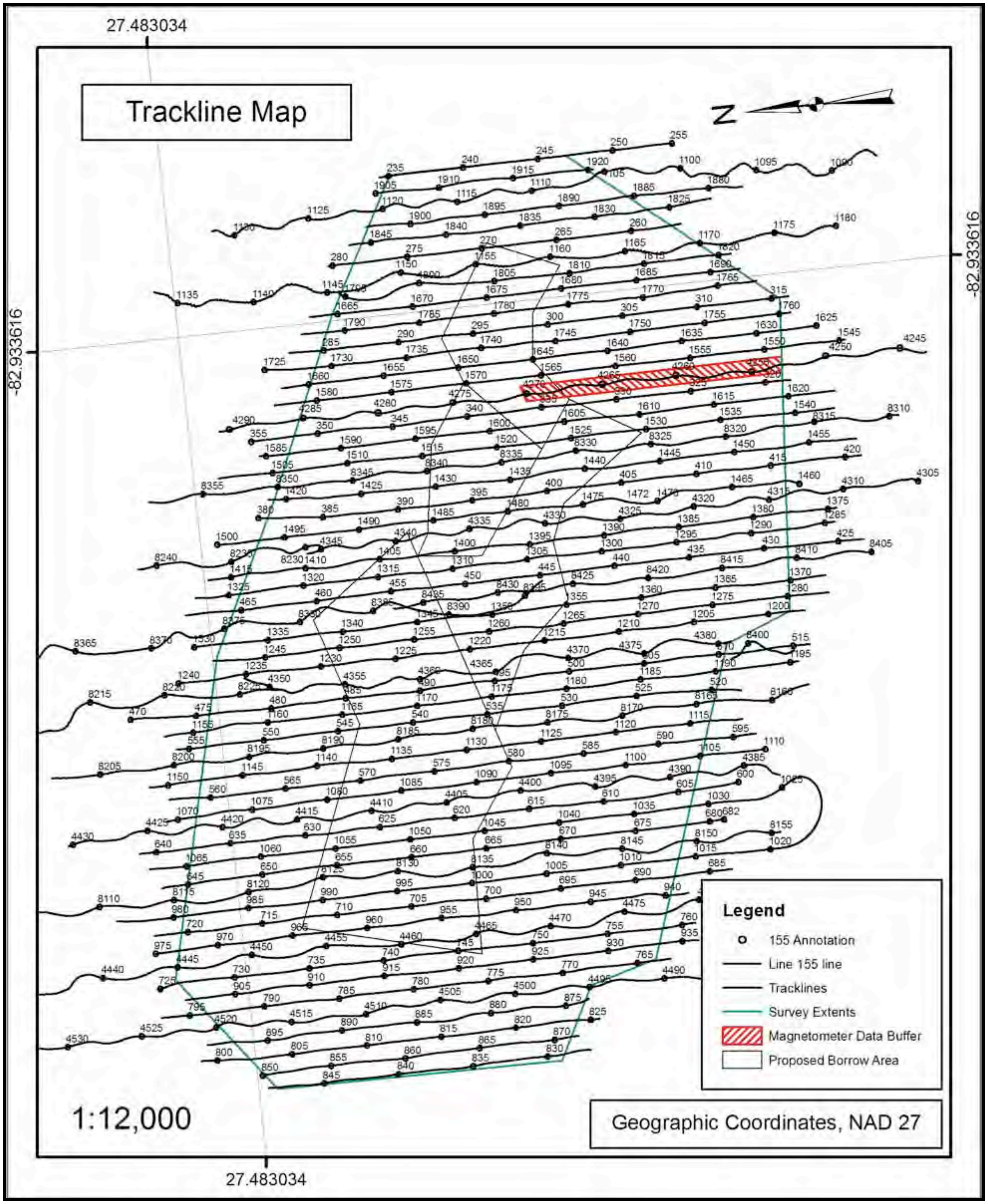


Figure 31. The F-2 investigation area survey trackline map with event marks.

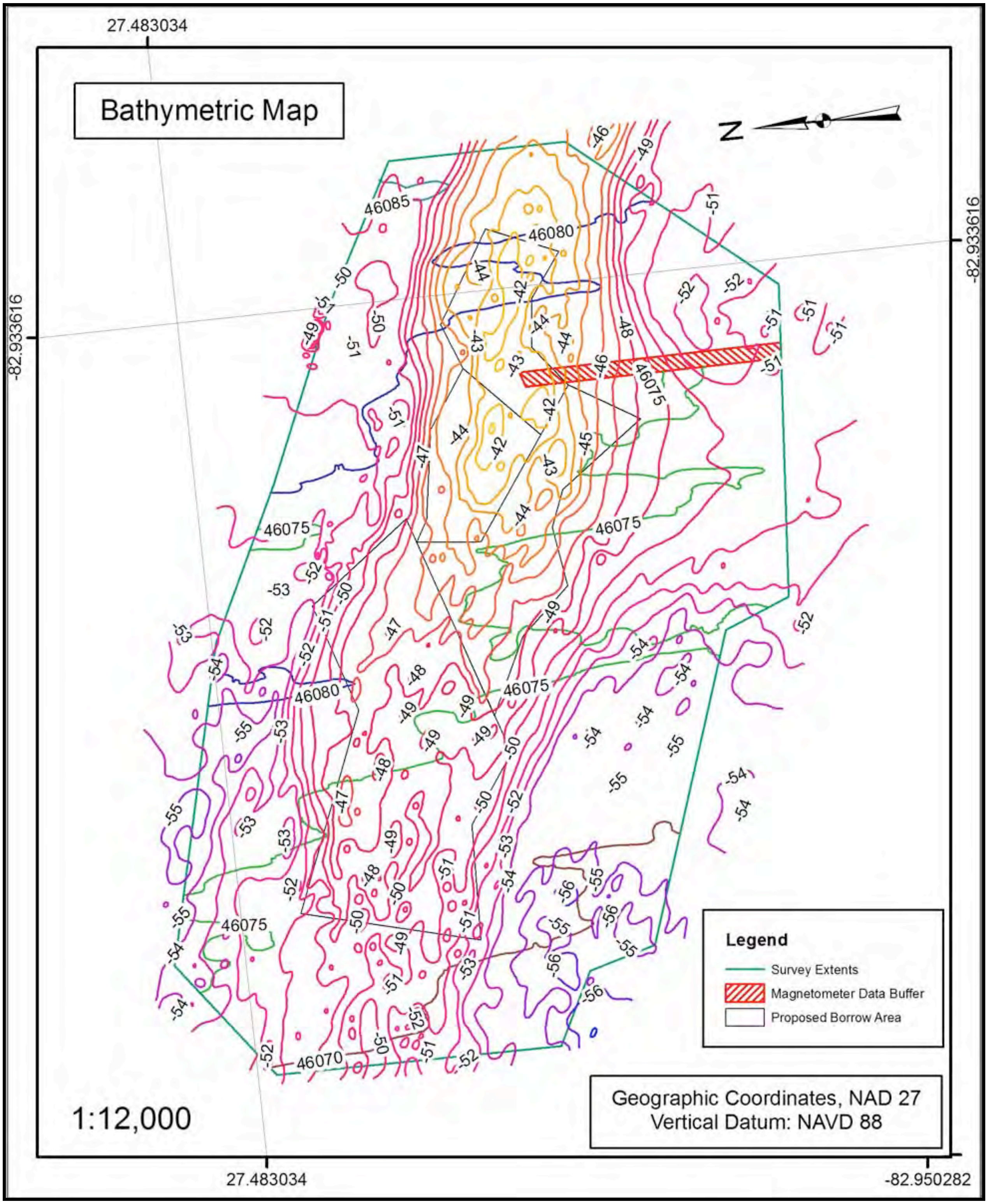


Figure 32. The F-2 investigation area bathymetric contour map.

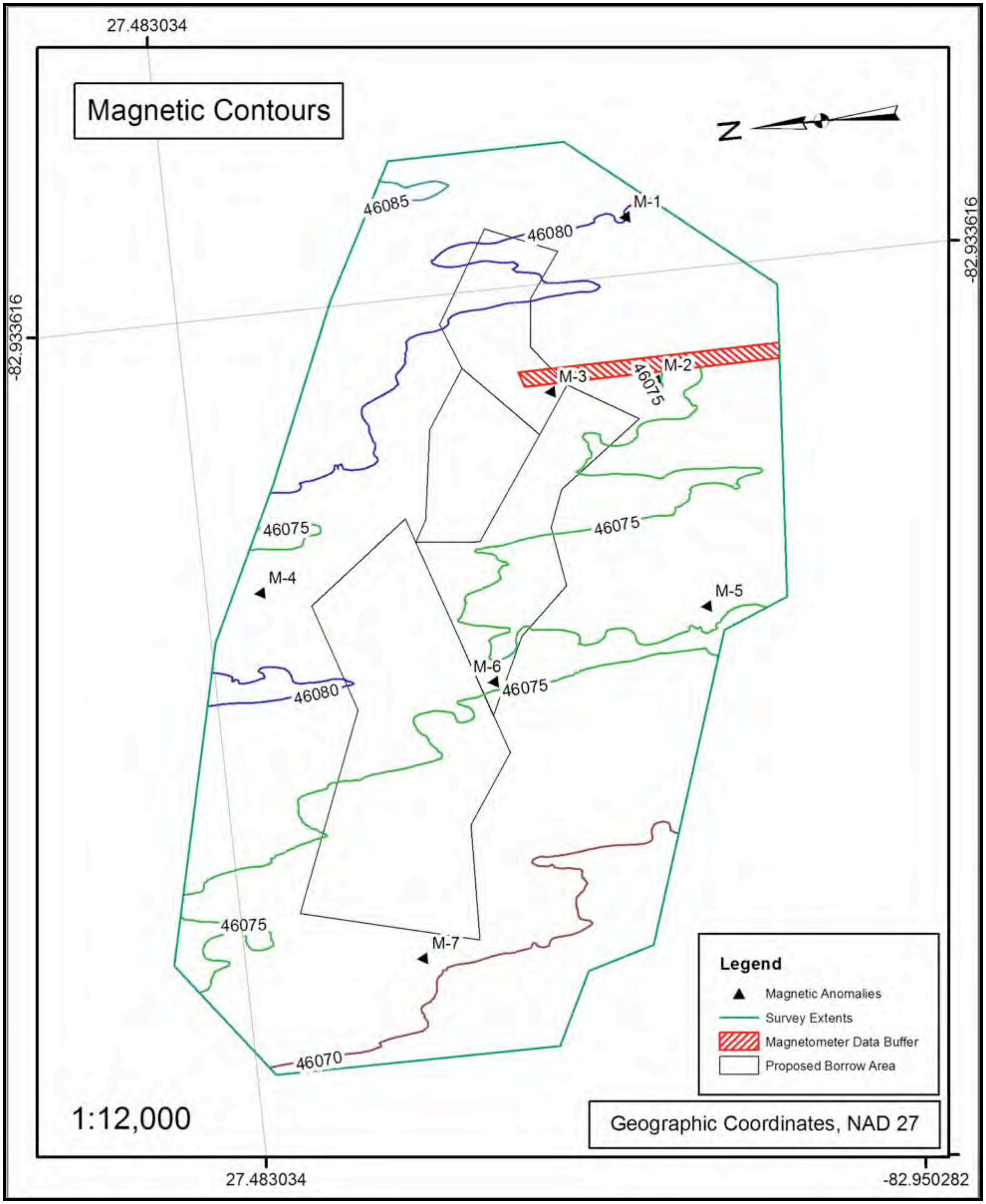


Figure 33. The F-2 investigation area magnetic contour map with anomalies.

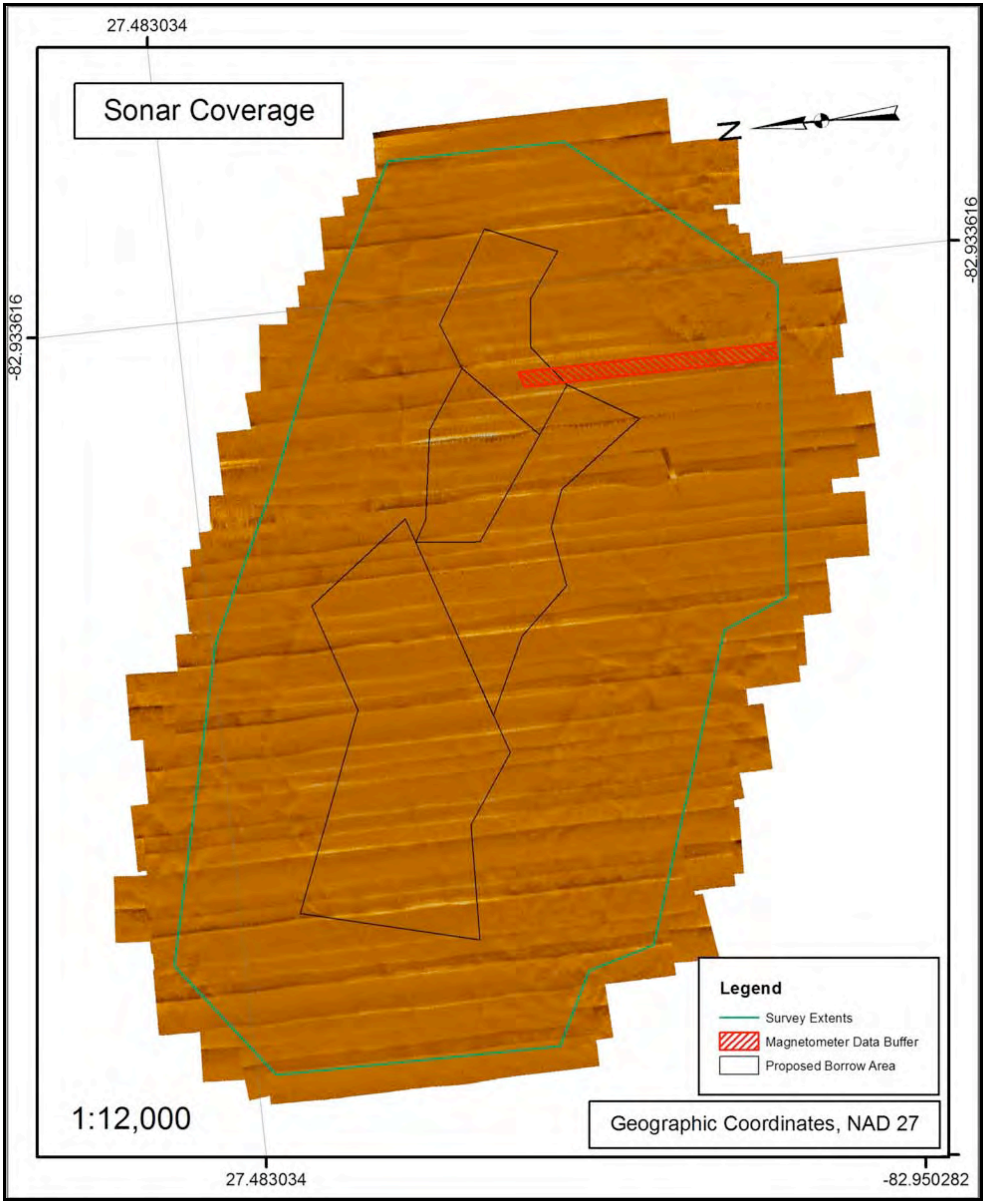


Figure 34. The F-2 investigation area sonar coverage mosaic.

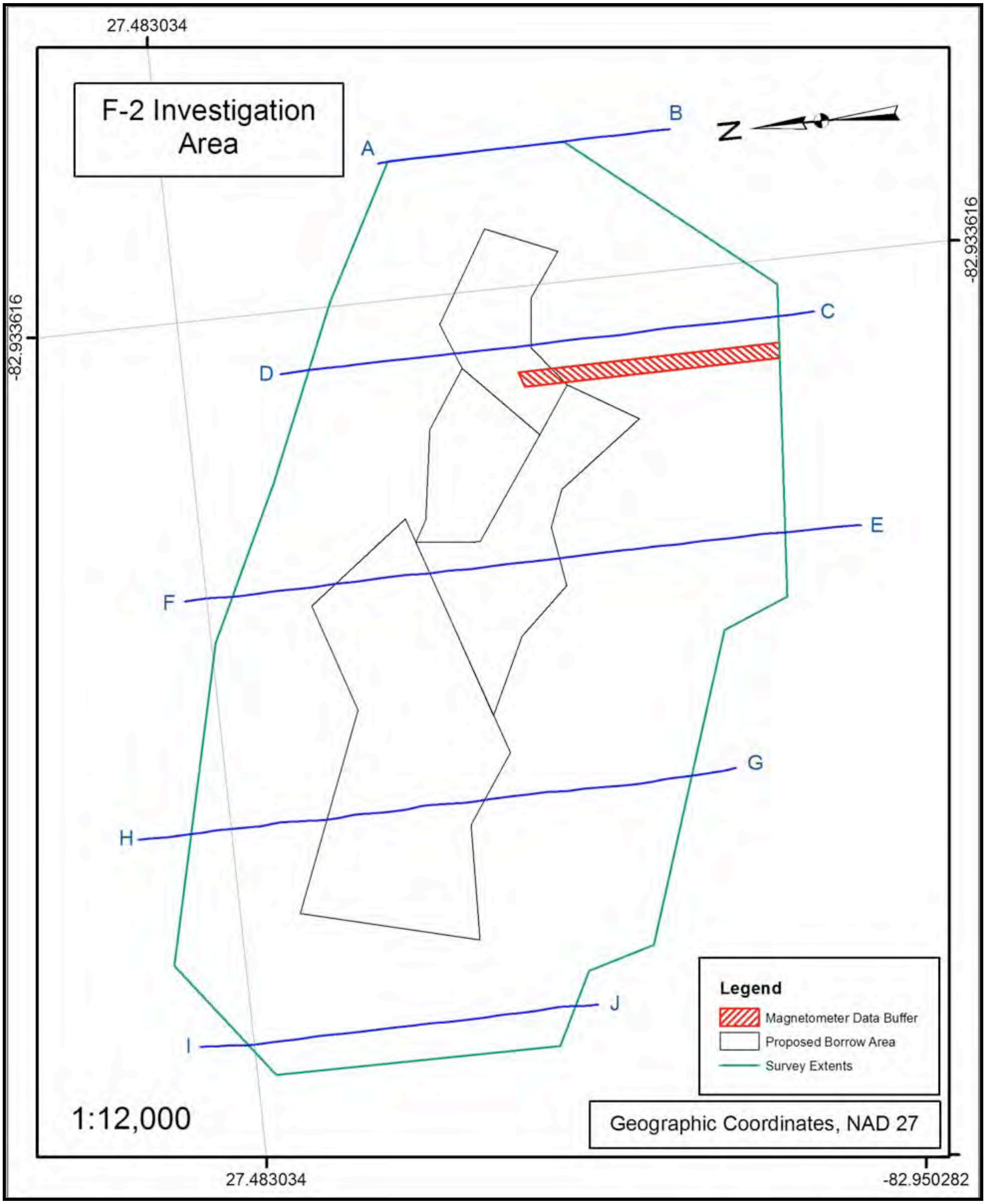


Figure 35. Survey line locations for sub-bottom profile data examples.

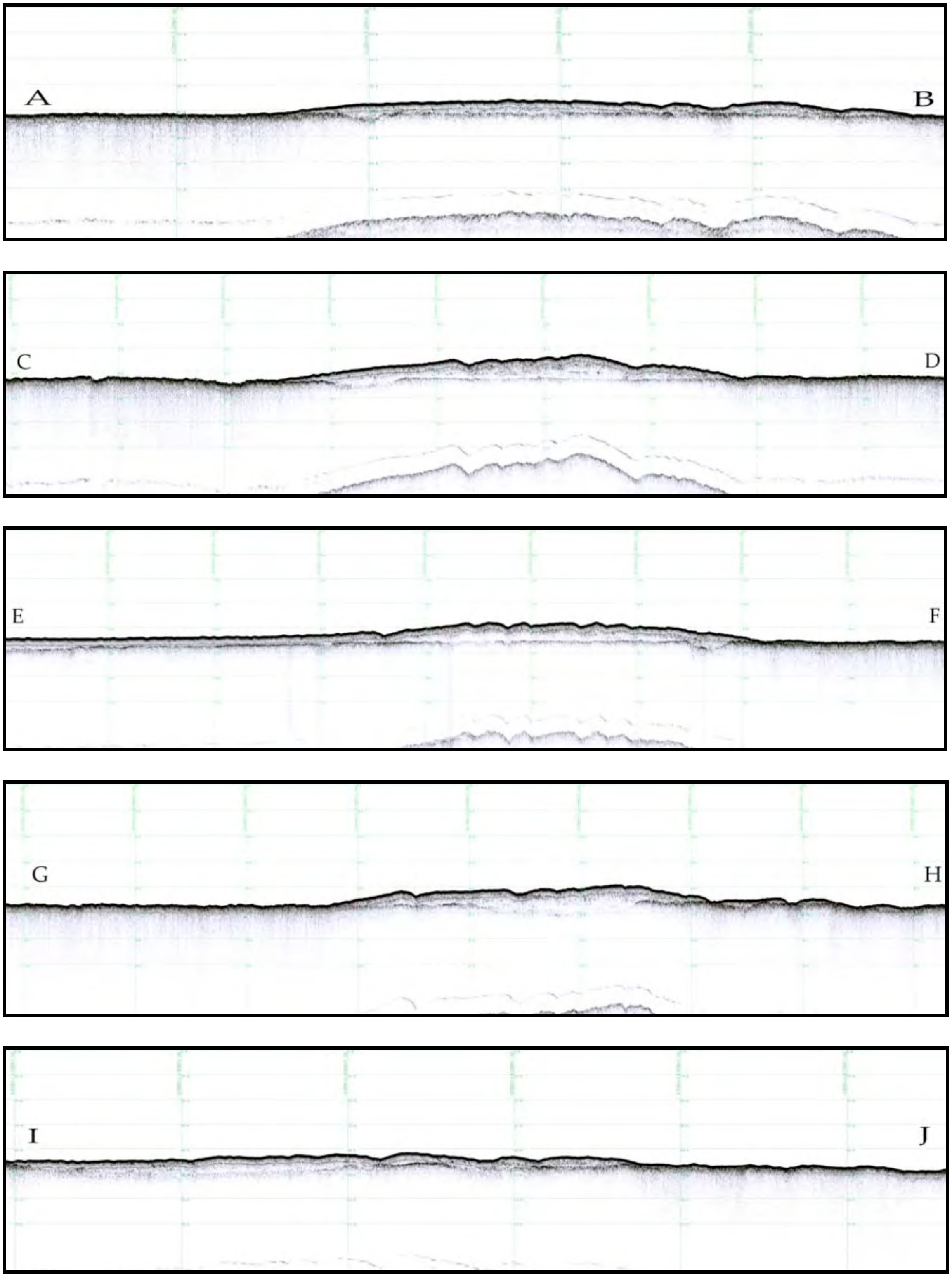


Figure 36. The F-2 investigation area subbottom profile data examples.

One wreck, the *Regina*, listed with the Florida Master Site File lies immediately offshore of Bradenton Beach (Hafford pers. comm. 2008). The *Regina* was a steel hull vessel built in Belfast, Northern Ireland at the Workman, Clark & Company Shipyard. The 1,155 ton ship was launched in 1904 and consigned to carry molasses from Cuba, Puerto Rico and the Dominican Republic to American ports. By 1940 the *Regina*'s machinery had been removed and the hull converted to a tanker barge. On 8 March 1940, the barge broke away from a tug during a heavy gale and went aground off Bradenton Beach. The barge became a total loss and subsequently broke apart. In 2005 the wreck was placed on the National Register of Historic Places. That same year it was designated a Underwater Archaeological Preserve (www.flheritage.com/archaeology/underwater/ preserves/uwregina.cfm

Based on the magnetic and acoustic data generated by remote sensing, anomalies identified in the F-2 investigation area represent modern debris, crab traps, small diameter rods, cable, wire rope, chain or small boat anchors and other small single ferrous objects. Those signature characteristics, including intensity, duration and spatial distribution, do not represent potentially significant submerged cultural resources and avoidance is not recommended. No additional investigation of the anomalies in the F-2 investigation area are recommended.

During the 2010 F-2 investigation area survey one line of magnetometer data (line 155) was found to be corrupted during analysis (Figure 31). The north half of that line was previously covered by a survey for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay carried out by T. Baker Smith, Inc., for Höegh LNG in 2006 (El Darragi and Landry 2007) and no anomalies were found near line 155 (Figure 37). That survey was carried out to define bottom conditions, identify hazards and locate submerged cultural resources in advance of construction of a proposed gas pipeline and mooring area west of Tampa Bay. That survey was carried out "in compliance with the guidelines set forth by Minerals Management Service (NTL 2005-G07)" (El Darragi and Landry 2007:1) Because there is no magnetometer data for the south half of line 155, that area has been buffered. Only a small portion of the north end of the line without magnetometer data lies within the proposed dredge cuts. No indication of submerged cultural resources was found in the sidescan sonar and sub-bottom profiler data on line 155.

The survey carried out by T. Baker Smith, Inc., for Höegh LNG in 2006, for the Port Dolphin Project pipeline covered most of the F-2 investigation area. That survey identified four magnetic anomalies in F-2. Only one of those corresponded approximately to one of the seven anomalies identified during the current survey. The remaining 3 are located between survey lines run in 2010 and were not of sufficient intensity or duration to be identified in the current data. None of the 2006 anomalies in this area were considered to be potentially significant (El Darragi and Landry 2007:Appendix C, Appendix F and Figure 37).

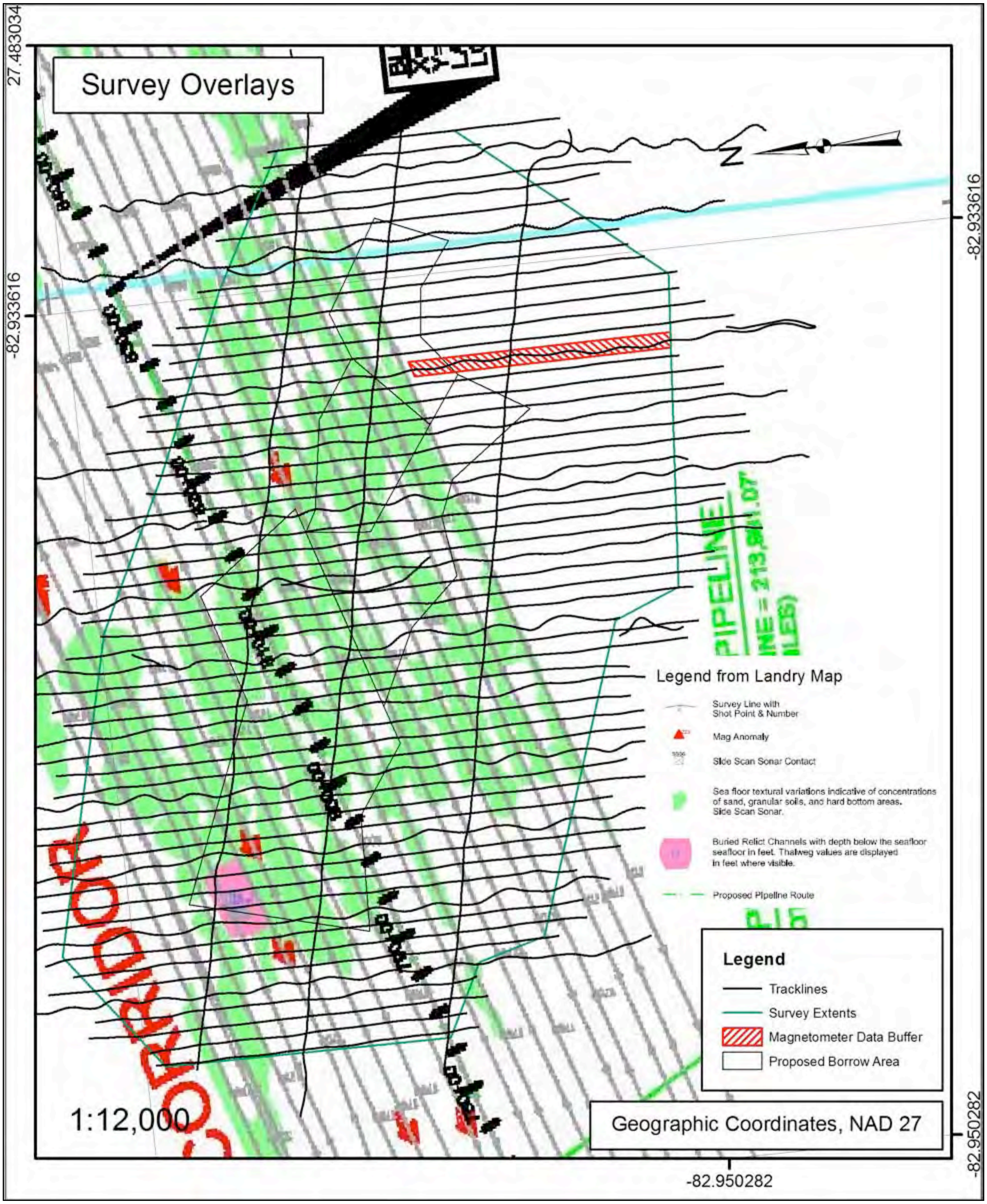


Figure 37. The F-2 investigation area showing the 2006 Landry survey coverage, proposed dredge cuts and area buffered for lack of magnetometer data.

With the exception of the area on line 155 that is buffered and recommended for avoidance due to corrupted data, analysis of the remote-sensing data identified no potentially significant submerged cultural resources. Consequently no additional investigation of the F-2 investigation area is recommended in conjunction with the proposed project.

Twelve pipeline corridors within State of Florida waters were cleared as having "no environmental impact" in conjunction with the 2005/06 island-wide beach renourishment project. Those corridors extend from the shoreline out to the 30-ft depth contour and range in width from 400 ft to 2,500 ft (Appendix D). Although the corridors are primarily soft bottom, sidescan sonar surveys revealed several patches of hard bottom within the alignments. The dredging contractor will be instructed to avoid those resources in a manner that was successfully implemented in 2005/06. While the pipeline corridors were not cleared for cultural resources using sub-bottom profilers and magnetometers, the sidescan sonar data was reviewed by CPE personnel. No exposed shipwrecks or other cultural resources were present. The pipeline will be laid on the bottom surface and removed as project progress is made along the shoreline. There is the potential for two pipelines to be deployed at one time if the contractor has the resources to do so (Beau Suthard elec. comm. 2011).

In the event that dredging and material transfer activity exposes prehistoric or historical cultural material not identified during the remote-sensing survey, the dredging company under contract to perform that work should be required to notify the contract administrator, CPE and the Florida SHPO. Notification should address the location, where possible, the nature of material exposed by project activities, and options for archaeological inspection and assessment of the site.

References Cited

Adorno, Rolena and Patrick Charles Pautz (editors)
2003 *The Narrative of Cabeza de Vaca*, expanded and revised from 1999 translation of Álvar Núñez Cabeza de Vaca's 1542 *Relación*. University of Nebraska Press, Lincoln, NE.

Ancient Native Village Living History Museum
2009 Ancient Native Village Living History Museum: Teacher's Guide. <www.ancientnative.org/pdf/part7.pdf>. Accessed 5 January 2010.

Anna Maria Island Chamber of Commerce (AMICC)
n.d. Demographics. Anna Maria Island Chamber of Commerce. Electronic document: <http://www.annamariaislandchamber.org/list.cfm?cat=47&scat=32>. Accessed 27 September 2010.

Applied Acoustic Engineering Limited
1998 *Fundamentals of High Resolution Seismic Surveying*. Applied Acoustic Engineering Limited, Great Yarmouth, Norfolk, UK. <http://www.saderet.co.uk/Admin/Datasheet/47_FundamentalsOfHi-Res.pdf>.

Arnade, Charles W.
1965 Three Early Spanish Tampa Bay Maps. *Tequesta* 25:83-96.

Belknap, Daniel (editor)
1983 Potential of Discovery of Human Occupation Sites on the Continental Shelves and Nearshore Coastal Zone. *Proceedings of the Fourth Annual Gulf of Mexico Information Transfer Meeting*. Science Applications, Raleigh, NC. U.S. Minerals Management Service, New Orleans, LA.

Benthos
2003 Product information on: Chirp II Subbottom Profiling System, SIS-1000 Chirp seafloor Imaging System, SIS-1500 Chirp Side Scan Sonar System. Benthos, North Falmouth, MA.

Beriault, John G., Robert S. Carr, Mark Lance and Steven Bertone
2003 A Phase I Archaeological Assessment of the Ten Thousand Islands National Refuge, Collier County, Florida. Draft Report. Archaeological and Historical Conservancy Technical Report #434. Submitted to the Rookery Bay National Estuarine Research Reserve and the U.S. Fish and Wildlife Service.

Berman, Bruce D.
1972 *Encyclopedia of American Shipwrecks*. Mariners Press, Boston, MA.

Bethell, John A.
1914 *Pinellas: A Brief History of the Lower Point*. Press of the Independent Job Department, St. Petersburg, FL.

Borremans, Nina
1990 *The Paleoindian Period*. Florida Historical Contexts, online document. Bureau of Archaeological Resources, Tallahassee.

Bullen, Ripley P.
1951 Archaeology of the Tampa Bay Area. *Florida Historical Quarterly* 30:133-135.

Burnett, Gene M.
1986 *Florida's Past: People & Events That Shaped the State*, Vol. 1, Pineapple Press, Sarasota, FL.

1991 *Florida's Past: People & Events That Shaped the State,* Vol. 3, Pineapple Press, Sarasota, FL.

Bushnell, Frank
1962 The Maximo Point Site – 1962. *The Florida Anthropologist* 15:89-101.

Calhoun, John C.
1961 The causes by which the Union is endangered. In *The Causes of the American Civil War,* Edwin C. Rozwenc, editor, pp. 1-10. D.C. Heath and Company, Boston, MA.

Cipra, David L.
1997 *Lighthouses, Lightships, and the Gulf of Mexico*. Cypress Communications, Alexandria, VA.

Clausen, Carl J., Brooks, H.K., and A.B. Weslowsky
1975 The Early Man Site at Warm Mineral Springs, Florida. *Journal of Field Archaeology* 2(3):191-213.

Clausen, C. J., A. D. Cohen, Cesare Emiliani, J. A. Holman, and J. J. Stipp
1979 Little Salt Spring, Florida: A Unique Underwater Site. *Science* 203(4381):609-614.

Coastal Environments
1986 Archaeological Investigations on the Outer Continental Shelf: A Study Within the Sabine River Valley, Offshore Louisiana and Texas. Report to the Minerals Management Service, Baton Rouge from Coastal Environments, Baton Rouge, LA.

Cockrell, W. A.
1981 Pleistocene Man in Florida. In: *In the Realms of Gold: The Proceedings of the Tenth Conference on Underwater Archaeology.* W.A. Cockrell, editor. Fathom Eight, San Marino, CA.

1988 Current Status of the Warm Mineral Springs Archaeological Research Project: 1987. In *Underwater Archaeology Proceedings from the Society for Historical Archaeology Conference*, James P. Delgado, editor, pp.20-24. Braun-Brumfield, Ann Arbor, MI.

Collier County Historical Society (CCHS)
1981 *Naples—Marco Island: An Illustrated History*. Moran Publishing Corporation, Baton Rouge, LA.

Copeland, Pat
2005a The name game: How Anna Maria got its name. *The Anna Maria Island Sun* 20 July 5(44). Archives. Electronic document: <http://www.amisun.com/archives/2005/july20/islandnews.htm>. Accessed 29 September 2010.

2005b Anna Maria Island Community Center: 45 Years of serving the community. *The Anna Maria Island Sun* 31 August 5(50). Archives. Electronic document: <http://www.amisun.com/archives/2005/aug31/business.htm>. Accessed 29 September 2010.

2009 Island Players: 60 years of entertainment. *The Anna Maria Island Sun* 30 September 10(1). Archives. Electronic document: <http://www.amisun.com/archives/2009/09-30-09/headlines.htm>. Accessed 29 September 2010.

Covington, James W.
1958 Life at Fort Brooke 1824-1836. *The Florida Historical Society Quarterly* 36(4):319-330.

Covington, James W. (editor)
1953 The Establishment of Fort Brooke, The Beginning of Tampa: From the Letters of Col. George M. Brooke. *The Florida Historical Society Quarterly* 31(4):273-278.

Cronan, Carl
1998 Port Manatee Develops Its Cargo, Passenger Business. *The Business Journal: Tampa Bay* 25 May. Online edition.

Cubberly, Frederick
1927 Fort King. *The Florida Historical Society Quarterly* 5(3):139-152.

Daniel, I. Randolph, Jr., and Michael Weisenbaker
1981 Test Excavations at 8Hi450(D): An Inland Archaic Occupation in Hillsborough County, Florida. *Interstate 75 Highway Phase II Archaeological Reports 1*. Florida Bureau of Historic Sites and Properties, Tallahassee.

1987 Harney Flats: A Florida Paleo-Indian Site. Baywood, Farmingdale, NY.

Davis, William Watson
1913 *The Civil War and Reconstruction in Florida*. Studies in History, Economics and Public Law, Vol. 53, No. 131. Columbia University, New York, NY.

Deagan, Kathleen
1988 The Archaeology of the Spanish Contact Period in the Caribbean. *Journal of World Prehistory* 2(2):187-233.

De Quesada, Alejandro M.
2006 *A History of Florida Forts: Florida's Lonely Outposts*. History Press, Charleston, SC.

Drysdale, William
1889 A RUINED FLORIDA TOWN: *THE DESERTED VILLAGE ON THE MANATEE*: FIRE AND BAD CROPS AND YELLOW FEVER HAVE MADE A WRECK OF A ONCE BUSY PLACE. *The New York Times* 17 November. New York, NY.

Dunbar, J. S.
1991 Resource orientation of Clovis and Suwannee age Paleoindian sites in Florida. In *Clovis: Origins and Adaptations*, R. Bonnichsen and K.L. Turnmire, editors, pp. 185-213. Peopling of America Publications, Center for the Study of the First Americans, Corvallis, OR.

Dunbar, J. S., and B. I. Waller
1983 A Distribution Analysis of the Clovis/Suwannee Paleo-Indian Sites of Florida – A Geographic Approach. *The Florida Anthropologist* 36(1-2):18-30.

EdgeTech
2003 Product information on: DF-1000 Digital Side Scan Sonar System, 560A Digital Side Scan Sonar Processor, 560D Digital Side Scan Sonar Processor. Edge Tech, Milford, MA.

El Darragi, S. Dean and Laura Landry
2007 Archaeological, Engineering, & Hazard Study, Proposed 36-Inch Gas Pipeline, Proposed LNG Facility, Block 545, St Petersburg Area, Offshore Florida to Tampa Bay, Florida. Report to Höegh LNG, Oslo, Norway from T. Baker Smith, Inc, Houma, LA.

Emery, K. O. and R. L. Edwards
1966 Archaeological Potential of the Atlantic Continental Shelf. *American Antiquity* 31(5):733-737.

Engineering-Contracting
1908 Miscellaneous. *Engineering-Contracting.* July-December 1908, 30:37. Chicago, IL.

Espey, Huston & Associates (EH&A)
1988 Marine Magnetometer Survey of a Sand Borrow Site off Egmont Key, Site Indian Rocks Beach Nourishment Project Pinellas County, Florida. Report to Pinellas County Board of Commissioners, Clearwater, FL, from Espey, Huston & Associates, Austin, TX.

Faught, Michael K.
2001 Continental Shelf Prehistoric Archaeology: A Northwest Florida Perspective. Department of Anthropology, Florida State University. <www.adp.fsu.edu/cont_shelf_principles/cont_shelf_principles.html>.

2003 Geophysical Remote-sensing and Underwater Cultural Resource Management of Submerged Prehistoric Sites in Apalachee Bay: A Deep-water Example, Site Predictive Models, and Site Discoveries. In *Proceedings Twenty Second Annual Gulf of Mexico Information Transfer Meeting*s *200,* M. McKay, editor, pp. 115-129. Minerals Management Service, New Orleans, LA.

Faught, Michael K., and J. M. Latvis
2000 *Paleo Aucilla Prehistory Project: Underwater Prehistoric Archaeology in Apalachee Bay, 1999 Interim Report*. Program in Underwater Archaeology Research Reports No. 1. Florida State University, Tallahassee.

Firestone, George
1977 *Historical, Architectural, and Archaeological Survey of Sarasota, Florida*. Miscellaneous Project Report Series No. 51 Bureau of Historic Sites and Properties, Division of Archives and History, and Records Management, Florida Department of State, Tallahassee.

Fisk, Harold N., and E. McFarlan
1955 *Late Quaternary Deltaic Deposits of the Mississippi River: Local Sedimentation and Basin Tectonics.* Reprinted from *The Crust of the Earth.* Geological Society of America Special Paper 62:279-302.

Florida Heritage Site
2010 Florida Division of Historical Resources. Florida Historical Contexts: The Paleoindian Period. <http://www.flheritage.com/facts/reports/contexts/paleo.cfm>. Accessed 10 March 2010.

Florida State University
1998 Field Research Design and Plan. Clovis Underwater ’98 - FSU Underwater Archaeology Summer Research Project. <www.adp.fsu.edu/clovis/clovis-field.html>.

Fuller, Walter P.
1969 Who Was The Frenchman of Frenchman’s Creek? *Tequesta* 29:45-59.

Gannon, Michael
2003 *Florida: A Short History*. University Press of Florida, Gainesville.

Geometrics
2003 Product information on G-877, G-880, G-881, G-882 Marine magnetometers. Geometrics, San Jose, CA.

Glasser, Joseph G. and Associates
1976 *Fact and Fable: Charlotte County.* First Federal Savings and Loan Association of Charlotte County, Punta Gorda, FL.

Goggin, John M.
1960 Underwater Archaeology: Its Nature and Limitations. *American Antiquity* 25(3):348-354.

Goodwin, R. Christopher
1999 Cultural Resources Inventory of the Gulfstream Gas System, L.L.C. Pipeline Proposed 36-inch Gas Pipeline Route, Port Manatee to the Three League Line. Report to ENSR, Tallahassee, FL, from R. Christopher Goodwin & Associates, Frederick, MD.

2000 Submerged Cultural Resources Evaluation of Fifteen Geomorphic Anomalies, Florida and Federal Waters, Within the Gulfstream Natural Gas Pipeline Corridor. Report to ENSR, Tallahassee, FL, from R. Christopher Goodwin & Associates, Frederick, MD.

Goodyear, A. C. I., S. B. Upchurch and M. J. Brooks
1980 Turtlecrawl Point: An Inundated Early Holocene Archeological Site on the West Coast of Florida. In *Holocene Geology and Man in Pinellas and Hillsborough Counties, Florida*, Sam Upchurch, compiler, pp. 24-33. Southeastern Geological Society Guidebook No. 22, Southeastern Geological Society, Tallahassee, FL.

Goodyear, A. C. I., S. B. Upchurch, M. J. Brooks and N. N. Goodyear
1983 Paleoindian Manifestations in the Tampa Bay Region, Florida. *Florida Anthropologist* 36:40-66.

Goodyear, A. C. I., and L. O. Warren
1972 Further Observations on the Submarine Oyster Shell Deposits of Tampa Bay. *Florida Anthropologist* 25:52-66.

Grismer, Karl H.
1950 *Tampa: A History of the City of Tampa and the Tampa Bay Region of Florida*. St. Petersburg Printing Company, St. Petersburg, FL.

Hall, Wesley
2001 A Cultural Resources Marine Remote-sensing Survey and Terrestrial Survey at Manatee Harbor, Manatee County, Florida. Report from Mid-Atlantic Technology and Environmental Research, Castle Hayne, NC, report to U. S. Army Corps of Engineers, Jacksonville District, Jacksonville, FL.

Hammond, E. A.
1973 The Spanish Fisheries of Charlotte Harbor. *Florida Historical Quarterly* 51:355-379.

Hann, John H.
2003 *Indians of Central and South Florida, 1513-1763*. University Press of Florida, Gainesville.

Heilprin, Angelo
1887 *Explorations Of The West Coast of Florida, And In The Okeechobee Wilderness.* Wagner Free Institute of Science, Philadelphia, PA.

Helps, Arthur
1900 *The Spanish Conquest in America: And Its Relation to the History of Slavery and to the Government of Colonies,* Vol. I, M. Oppenheim, ed. John Lane, New York, NY.

Hillsborough Board of County Commissioners
2009 History of Hillsborough County. <http://www.hillsboroughcounty.org/about/history.cfm>. Accessed 4 January 2010.

Hodges, T. R.
1913 Oyster Industry Will Be Rehabilitated If People Will Co-Operate With the State. *The Miami Metropolis* 25 October:11. Miami, FL.

Holmes, Jack D. L., and John D. Ware
1968 Juan Baptista Franco and Tampa Bay, 1756. *Tequesta* (28), pp. 91-97.

Hunt, Bruce
2003 *Visiting Small-Town Florida*. Pineapple Press, Sarasota, FL.

Hutchinson, Dale L.
2004 *Bioarchaeology of the Florida Gulf Coast: Adaptation, Conflict, and Change*. University Press of Florida, Gainesville.

James, Stephen R., Charles E. Pearson and Michael C. Krivor
2006 Historic Assessment, Remote Sensing Survey, and Diver Evaluations at Egmont Key, Hillsborough County, Florida. Report to U.S. Army Corps of Engineers, Jacksonville District, from Panamerican Consultants, Memphis, TN.

Jones, Edmunds and Associates, Inc.
1978 Report of Investigation: Magnetometer Survey of Borrow Area for Manatee County Beach Erosion Control Project, Florida. Report to U.S. Army Corps of Engineers, Jacksonville District, from Jones, Edmunds and Associates, Gainesville, FL.

Karklins, Karlis
1970 The Fish Creek Site, Hillsborough County, Florida. *The Florida Anthropologist* 23(2):62-80.

Klein Associates
2003 Product information on Klein 2000 Digital Side Scan Sonar, Klein 3000 Digital Side Scan Sonar, Klein Associates, Salem, NH.

Knetsch, Joe
2003 *Florida's Seminole Wars, 1817-1858*. Arcadia, Charleston, SC.

Kongsberg Simrad AS
2003 Product information on EA 600 Single-beam Hydrographic Echo sounder, EM 1002 Multibeam Echo sounder, EM 2000 Multibeam Echo sounder, EM 3000 Multibeam Echo sounder, EM 3002 Multibeam Echo sounder, MS 1000 Scanning Sonar. Kongsberg, Horten, Norway.

Krivor, Michael C.
2005 Diver Evaluations of 34 Targets in the Egmont Shoals Borrow Area, Pinellas County, Florida. Report to U.S. Army Corps of Engineers, Jacksonville District, from Panamerican Consultants, Memphis, TN.

Krosney, Laurie
2009 A BRIDGE TO HISTORY. *Anna Maria Island Sun* 30 September 10(1). Archives. Electronic document: <http://www.amisun.com/archives/2009/09-30-09/headlines.htm>. Accessed 29 September 2010.

Landry, Laura
2008a Archaeological Assessment of Marine Remote Sensing Surveys Conducted for the Port Dolphin Project, Gulf of Mexico and Tampa Bay, Manatee County, Florida. Report to T. Baker Smith, Houma, LA and Port Dolphin Energy, Tampa, FL, from Laura A. Landry & Associates, Hitchcock, TX.

2008b Archaeological Assessment of a Marine Remote Sensing Re-Route Survey Conducted for the Port Dolphin Project, Tampa Bay, Manatee and Hillsborough Counties, Florida. Report to T. Baker Smith, Houma, LA and Port Dolphin Energy, Tampa, FL, from Laura A. Landry & Associates, Hitchcock, TX.

Legislative Council of the Territory of Florida
1834 Sessions Laws, 12th Session, 22 January/25 January. Legislative Council of the Territory of Florida.

Lockhead, John L. (compiler)
1954 *Disasters to American Vessels, Sail and Steam, 1841-1846*. Compiled from New York Shipping and Commercial List, Mariners Museum, Newport News, VA.

Lonsdale, Adrian L., and H.R. Kaplan
1964 *A Guide to Sunken Ships In American Waters*. Compass, Arlington, VA.

Lytle, William M., and Forrest R. Holdcamper (compilers)
1975 *Merchant Steam Vessels of the United States, 1790-1868, "The Lytle-Holdcamper List."* Revised and edited by C. Bradford Mitchell. Steamship Historical Society of America, Staten Island, NY.

Lydecker, Andrew D. W.
2005 Submerged Cultural Resources Remote Sensing Survey, Historic Assessment, and Diver Evaluations of 31 Targets in Tampa Bay, Hillsborough and Pinellas Counties, Florida. Report to U.S. Army Corps of Engineers, Jacksonville District, from Panamerican Consultants, Memphis, TN.

Magrin, Jud
1980 City Incorporated March 13, 1950: Today Marks 30 Years Of Growth For Community Of Holmes. *Sarasota Herald-Tribune* 13 March:B-1. Sarasota, FL.

Manatee County Port Authority (MCPA)
2009 Mission Statement. Port Manatee. Manatee County Port Authority. Electronic document: <http://www.portmanatee.com/about.aspx>. Accessed 27 September 2010.

Marine Magnetics
2003 Product Literature on SeaSPY Overhauser magnetometer, Explorer Mini Marine magnetometer, Sea Quest Magnetic Gradiometer Platform. Marine Magnetics, Richmond Hill, Ontario, Canada.

Martin, R. A. and S. D. Webb
1974 Late Pleistocene mammals from the Devil's Den Fauna, Levy County. In *Pleistocene Mammals of Florida*. S. D. Webb, editor. University Presses of Florida, Gainesville.

Marx, Robert F.
1983 *Shipwrecks in the Americas*. Bonanza Books, New York, NY.

1985 *Shipwrecks in Florida Waters.* Mickler House, Chuluota, FL.

Matthews, Janet Snyder
1985 *Sarasota: Journal to Centennial.* Heritage Press, Tulsa, OK.

1993 *Edge of Wilderness: A Settlement History of Manatee River and Sarasota Bay.* Third reprint of the 1983 edition. Coastal Press, Sarasota, FL.

Mazel, Charles
1985 *Side Scan Sonar Record Interpretation*. Klein Associates, Salem, NH.

McCarthy, Kevin M.
2007 *Cedar Key Florida, A History*. History Press, Charleston, SC.

Meadows, Andrew
2003 On The Move In Manatee. *Tampa Tribune* 5 May Section:MoneySense:1. Tampa, FL.

Miami Beach 411
2009 Ports in Florida-Florida Cruise Guide. <http://www.miamibeach411.com/cruiseguide/cruise-ports-in-florida.htm#>. Accessed 8 October 2010.

Michel, Jacqueline, Gordon P. Watts, Jr., Rob Nairn and Tim Kenny
2004 *Archaeological Damage from Offshore Dredging: Recommendations for Pre-. Operational Surveys and Mitigation During Dredging to Avoid Adverse Impacts*. Report to Minerals Management Service, Herndon, VA from Research Planning, Columbia, SC, Tidewater Atlantic Research, Washington, NC, and W.F. Baird, Madison, WS.

Milanich, Jerald T.
1994 *Archaeology of Precolumbian* Florida. University Press of Florida, Gainesville.

1998 *Florida's Indians from Ancient Times to the Present*. University Press of Florida, Gainesville.

Milanich, Jerald T., and Susan Milbrath (editors)
1991 *First Encounters: Spanish Explorations in the Caribbean and the United States, 1491-1570*. Ripley P. Bullen Monographs in Anthropology and History, No. 9. University of Florida Press, Gainesville.

Morris, John William, Gordon Watts, Casey Coy, and Michael Terrell
2007 Tampa Bay Historical Shipwreck Survey Final Report. Manuscript, The Florida Aquarium, Tampa.

2008 Tampa Bay Historical Shipwreck Survey Final Report. Manuscript, The Florida Aquarium, Tampa.

Mulder, Kenneth W.
1991 *Finder of the Forgotten and the Unfindable*. Harris and Associates, Tampa, FL.

Murphy, Larry E.
1990 8SL17: Natural Site Formation Processes of a Multiple-Component Underwater Site in Florida. *Southwest Cultural Resources Center Professional Papers* No. 39. Santa Fe, NM.

Murphy, Larry E. (editor)
1993 *Dry Tortugas National Park Submerged Cultural Resources Assessment*. National Park Service, Submerged Cultural Resource Unit, Santa Fe, NM.

National Oceanic and Atmospheric Administration (NOAA)
1995 *Florida Keys National Marine Sanctuary: Draft Management Plan/Environmental Impact Statement*. Vol. II. U.S. Department of Commerce, Washington, DC.

National Register of Historic Places
n.d. State Listings. FLORIDA-Manatee County. Electronic document: <http://www.nationalregisterofhistoricplaces.com/FL/Manatee/state.html>. Accessed 28 September 2010.

Niles' Weekly Register
1821a No title. 24 March. Baltimore, MD.

1821b Florida. 30 June. Baltimore, MD.

Norwood, Carolyne
2003 *Anna Maria Island: The Early Days, 1893-1940*. Anna Maria Historical Society, Anna Maria Island, FL.

O'Brien, Sean Michael
2005 *In Bitterness and in Tears, Andrew Jackson's Destruction of the Creeks and Seminoles*. Lyons Press, Guilford, CT.

Ocean Data Equipment Corporation
2003 Product information on Bathy-500DF Dual Frequency Echo Sounder, Bathy1500 Dual Frequency Survey Echo Sounder, Bathy-2000P High Resolution Subbottom Profiler/Sounder Strata Box Marine geophysical Instrument. Ocean Data Equipment Corporation, Providence, RI.

Odom
2010 Digibar Pro. Teledyne Odom Hydographic, Baton Rouge <http://www.odomhydrographic.com/products/view/8/>. Accessed 5 January 2010.

Panamerican Consultants
2007 Mapping of the Fort Dade Historic Transportation Network Egmont Key Hillsborough County Florida. Vol. 1, Final. Report to U.S. Fish & Wildlife Service, Savannah, GA, from Panamerican Consultants, Tampa, FL.

Peterson, Mendell L.
1975 *The Funnel of Gold*. Little-Brown, Boston, MA.

Pizzo, Anthony P.
1968 *Tampa Town 1824-1886: Cracker Village with a Latin Accent*. Hurricane House, Miami, FL.

Plets, R. M. K., J. K. Dix, J. R. Adams, and A. I. Best
2008 3D reconstruction of a shallow archaeological site from high-resolution acoustic imagery: The *Grace Dieu*. *Applied Acoustics* 69:399-411.

Quinn, Rory, Jonathan R. Adams, Justin K. Dix and Jonathan M. Bull
1998 The *Invinvible* (1758) site – An Integrated Geophysical Assessment. *The International Journal of Nautical Archaeology* 27(2):126-138.

Quinn, Rory, Colin Breen, Wes Forsythe, Kevin Barton, Shane Rooney, and Deidre O'Hara
2002 Integrated Geophysical Surveys of the French Frigate *La Surveillante* (1797), Bantry Bay, Co. Cork, Ireland. *Journal of Archaeological Science* 29:413-422.

Reson
2003 Product information on NaviSound 200 Echo Sounder, NaviSound 400 Echo Sounder, NaviSound 2000 Multi-channel Echo Sounder, SeaBat 8125 Ultra High Resolution Multibeam Echo Sounder. Reson, Aberdeen, Scotland.

Roberts, Albert Hubbard
1927 The Dade Massacre. *The Florida Historical Society Quarterly* 5(3):123-138.

Ruppé, Reynold J.
1978 Underwater Site Detection by Use of a Coring Instrument. In *Beneath the Waters of Time: The Proceedings of the Ninth Conference on Underwater Archaeology*, edited by J. Barto Arnold, pp. 119-121. Texas Antiquities Committee, Austin, TX.

1980 The Archaeology of Drowned Terrestrial Sites: A Preliminary Report. Florida Bureau of Historic Sites and Properties Bulletin 6. Florida Division of Archives, Tallahassee.

Russo, Michael and Irvy R. Quitmyer
2008 Developing Models of Settlement for the Florida Gulf Coast. In *Case Studies in Environmental Archaeology*, Elizabeth J. Reitz, Sylvia J. Scudder and C. Margaret Scarry, editors, pp. 235-253. Springer, New York, NY.

Shomette, Donald G.
1973 *Shipwrecks of the Civil War: The Encyclopedia of Union and Confederate Naval Losses.* Donic, Washington, DC.

Singer, Steven D.
1998 *Shipwrecks of Florida.* Reprint of the 1992 edition. Pineapple Press, Sarasota, FL.

St. Petersburg Times
1925 MANATEE CITIZENS VOTE $1,500,00 FOR NEW HIGHWAYS. *St. Petersburg Times* 25 January:7. St. Petersburg, FL.

Technical Committee 1
2005 *Geotechnical & Geophysical Investigations for Offshore and Nearshore Developments*. International Society for Soil Mechanics and Geotechnical Engineering, London, England.

The Evening Independent
1910 TROOPS TO BE REMOVED FROM FORT DESOTO SOON: But Government Will Keep It in Readiness: USELESS EXPENSE THE CRY: Fort Dade Considered Strong Enough to Defend Entrance to Tampa Harbor. *The Evening Independent* 30 April:1. St. Petersburg, FL.

1926 STORM TAKES TOLL OF LIVES ON GULF: Two Schooners and Three Bodies Of Sailors Drift Ashore at Egmont Key. *The Evening Independent* 24 September:1. St. Petersburg, FL.

The Longboat Observer
1999 *The Longboat Observer* 7 October. Longboat Key, FL.

The National Historical Society (TNHS)
1987a *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Ser. I, Vol. 16. Republication of the original 1903 edition. The National Historical Society, Harrisburg, PA.

1987b *Official Records of the Union and Confederate Navies in the War of the Rebellion*, Ser. I, Vol. 17. Republication of the original 1903 edition. The National Historical Society, Harrisburg, PA.

The New York Times (TNYT)
1861a Egmont Key Occupied by Union Troops. *The New York Times* 15 August. New York, NY.

1861b The Blockading Service: Letter From on Board the *Cuyler*. *The New York Times* 29 September. New York, NY.

1863 The War in Florida: Interesting Account of the Late Naval Expedition to Tampa. *The New York Times* 12 November. New York, NY.

1866 Marine Disasters: Loss of the United States Steamer *Narcissus* with all on Board. *The New York Times* 2 February. New York, NY.

1884a UNDER THE SOLITARY PALM: A NEARER VIEW OF A UNIQUE FLORIDA TOWN: PALMA SOLA ON A SUNDAY AFTERNOON-ROBINSON CRUSOE HOUSES-THE ALLIGATOR BAYOU AND THE OYSTER TREES. *The New York Times* 6 April. New York, NY.

1884b FROM TAMPA TO KEY WEST: A MIDNIGHT MEETING IN TAMPA BAY. *The New York Times* 4 May. New York, NY

1900 New Batteries Named: Soldier Heroes of the Nation Honored in Titles Bestowed on Fortifications. *The New York Times* 8 April. New York, NY.

1902a No title. *The New York Times* 26 April. New York, NY.

1902b THE CAPT. BAYLY CHARGES. *The New York Times* 27 April. New York, NY.

1906 Roosevelt Makes Plea For Better Defenses: Sends Report of Expert Military Board to Congress. *The New York Times* 6 March. New York, NY.

1910 HURRICANE NOW IN FLORIDA: No Wires Working South of Tampa: Vessels In Peril: A Camp Wrecked. *The New York Times* 18 October. New York, NY.

Thomas, Brian (editor)
2010 *Prehistoric Site Potential and Historic Shipwrecks on the Atlantic Outer Continental Shelf*. Report to Bureau of Ocean Energy Management, Regulation and Enforcement, Camarillo, CA from TRC, Norcross, Georgia.

Thomas, Hugh
2004 *Rivers of Gold: The Rise of the Spanish*. Phoenix, London, England.

University of South Florida
2002 Fort Dade, Egmont Key. Special Collections Department, University of South Florida. <http:fcit.usf.edu/Florida/photos/military/misc/0329.htm>. Accessed 21 January 2010.

University of South Florida Libraries (USFL)
n.d.a Summary. Steamboat *Manatee* photograph. Manatee County Public Library Historic Photograph Collection. Electronic document:<http://digital.lib.usf.edu/?m1.298-a>. Accessed 1 October 2010.

n.d.b Summary. Brochure of Anna Marie Cottages. Manatee County Public Library Historic Photograph Collection. Electronic document:<http://digital.lib.usf.edu/?m1.2059-a>. Accessed 1 October 2010.

U.S. Coast Survey
1855 *Report Of The Superintendent Of The Coast Survey, Showing The Progress Of The Survey During The Year 1854*. U.S. Coast Survey, Washington, DC.

U.S. Commission of Fish and Fisheries
1887 *Report of the Commissioner For 1885*. Part XIII. U.S. Commission of Fish and Fisheries, Washington, DC.

1897 *The Fish and Fisheries of the Coastal Waters of Florida*. U.S. Commission of Fish and Fisheries, Washington, DC.

U.S. Department of Commerce and Labor (USDC&L)
1879 *Eleventh Annual List of Merchant Vessels of the United States: For the Year Ended June 30, 1879*. U.S. Bureau of Navigation, U.S. Department of Commerce and Labor, Washington, DC.

1883 *Fifteenth Annual List of Merchant Vessels of the United States: For the Year Ended June 30, 1883*. U.S. Bureau of Navigation, U.S. Department of Commerce, Washington, DC.

1909 *Forty-First Annual List of Merchant Vessels of the United States and Lists of Vessels Belonging to the United States Government For the Year Ended June 30 1909*. U.S. Department of Commerce and Labor, Bureau of Navigation, Washington, DC.

U.S. Department of State
1840 *Compendium of the Enumeration of the inhabitants and statistics of the United States, as obtained at the Department of State, from the returns of the Sixth Census*. Vol. 3. U.S. Department of State, Washington, DC.

U.S. War Department (USWD)
1895a *Report of the Secretary of War; Being Part Of The Message And Documents Communicated To The Two Houses Of Congress At The Beginning Of The First Session Of The Fifty-Fourth Congress, vol. II, part 1*. U.S. War Department, Washington, DC.

1895b *Report of the Secretary of War; Being Part Of The Message And Documents Communicated To The Two Houses Of Congress At The Beginning Of The First Session Of The Fifty-Fourth Congress, vol. II, part 2*. U.S. War Department, Washington, DC.

1896a *Report of the Secretary of War; Being Part Of The Message And Documents Communicated To The Two Houses Of Congress At The Beginning Of The Second Session Of The Fifty-Fourth Congress, vol. II, part 1.* U.S. War Department, Washington, DC.

1896b *Report of the Secretary of War; Being Part Of The Message And Documents Communicated To The Two Houses Of Congress At The Beginning Of The Second Session Of The Fifty-Fourth Congress, vol. II, part 2.* U.S. War Department, Washington, DC.

1897 *The War of the Rebellion: A Compilation of the Official Records of the Union and Confederate Armies*, Ser. II, Vol. II. U.S. War Department, Washington, DC.

1901 *Annual Reports of the War Department. Report of the Lieutenant-General Commanding the Army in Five Parts*, Pt I. 57th Congress, 1st Session, House of Representatives, Document No. 2. U.S. War Department, Washington, DC.

Vandiver, Frank E.
1962 *Basic History of the Confederacy*. D. Van Nostrand, Princeton, NJ.

Verdier, Jeannine
2009 Tour of Port Manatee. *Parrish Village News* February 2009, 16(2):14.

Warren, Daniel J.
2000 Submerged Cultural Resource Remote Sensing Survey of Two Proposed Borrow Areas Selected as Sources for Beach Renourishment Projects, Anna Maria Island, Manatee County, Florida. Report to Coastal Planning & Engineering, Boca Raton, FL, from C&C Technologies, Lafayette, LA.

Warren, L. O.
1966 A Possible Paleo-Indian Site in Pinellas County. *The Florida Anthropologist* 24:39-41.

1968 Caladesi Causeway: A possible inundated Paleo-Indian workshop. *Florida Anthropologist* 21(2):92-94.

Watts, Gordon P., Jr.
1999 Underwater Archaeological Remote-sensing Survey and Site Evaluation for the Civil War Union Steam Tug USS *Narcissus.* Report to Florida Division of Historic Resources, Tallahassee, from Institute for International Maritime Research, Washington, NC.

2001 A Remote Sensing Survey of the Proposed Egmont Channel Borrow Area, Pinellas County, Florida. Report to U.S. Army Corps of Engineers, Jacksonville District, from Tidewater Atlantic Research, Washington, NC.

2003 Submerged Cultural Resource Survey, Longboat Key Borrow Areas VIII & IX, Manatee County, Florida. Report to Coastal Planning & Engineering, Boca Raton, FL, from Tidewater Atlantic Research, Washington, NC.

2008 *Water Witch* Management Summary. Report to Georgia Department of Natural Resources, Skidaway Island, from Tidewater Atlantic Research, Washington, NC.

2009a A Remote-Sensing Survey of a Proposed Borrow Area and Pipeline Corridor off Anna Maria Island, Manatee County, Florida. Report to Coastal Planning & Engineering, Boca Raton, FL, from Tidewater Atlantic Research, Washington, NC.

2009b An Archaeological Remote-Sensing Survey of Sections of Scuffletown Creek, Chesapeake, Virginia. Report to Craney Island Design Partners, Norfolk, VA from Tidewater Atlantic Research, Washington, NC.

Weddle, Robert S.
1995 *Changing Tides: Twilight And Dawn In The Spanish Sea, 1763-1803*. Texas A&M University Press, College Station.

White, Nancy
1985 Nomenclature and Interpretation in Borderland Chronology: A Critical Overview of Northwest Florida Prehistory. *The Florida Anthropologist* 38(1-2):163-174.

Willey, Gordon R.
1949 *Archeology of the Florida Gulf Coast*. Smithsonian Miscellaneous Collections, Vol. 113, Washington, DC.

Williamson, Jeffrey G.
1997 *The Grapefruit*, revised from 1978 edition. Report to Horticultural Sciences Department, Cooperative Extension Service, Institute of Food and Agricultural Sciences, University of Florida, Gainesville. <http://university.uog.edu/cals/people/PUBS/Grapefrt/CH06300.pdf>. Accessed 10 January 2010.

Wilpon, Bonnie
1999 Sarasota and Bradenton, Florida. Arcadia Publishing, Charleston.

Wolf, Jeanne Kathryn
1975 "The Crystal Beach Site, Pinellas County: An Early Archaic Coastal Workshop". Miscellaneous Project Report Series No. 31. Bureau of Historic Sites and Properties, Division of Archives, History and Records Management, Florida Department of State.

Work Projects Administration (WPA)
1939 *Florida: A Guide to the Southernmost State*. Oxford University Press, New York.

Wynne, Lewis N., and Robert A. Taylor
2001 *Florida in the Civil War*. Civil War History Series. Arcadia, Charleston, SC.

Young, C. W.
2009 Egmont Key Celebrating 150 Years of "Lighting the Way" Into Tampa Bay. *Extensions of Remarks*, 15 January:E104-E106. *Congressional Record*, Washington, DC.

Zerfas, Lewis L.
n.d. The Hillsborough River Raid and the Battle of Ballast Point at Tampa Bay. <http://www.knology.net/~qed/USSFHpdf/battle_of_ballast_point.pdf>. Accessed 12 January 2010.

Appendix A

Known Shipwrecks Located in the Gulf of Mexico Vicinity of Anna Maria Island and Longboat Key, Florida

NAME	TYPE	TONS	BUILT	LOST	CAUSE	LOCATION
Unknown - Portuguese	-	-	-	1567	Lost	-
Unknown	-	-	-	Pre-1819	Unknown	West-Northwest of Egmont Key
J. Appleton	Schooner	-	-	15 Aug. 1851	Grounded & burned	Near Egmont Key Lighthouse
USS *Narcissus (Mary Cook)*	Steamer, tug rigged	115	1863	4 Jan. 1866	Sank	Off Egmont Key
Chimborazo	Bark British	850	1851	9 Feb. 1882	-	30 miles south of Egmont Key
Unknown	Steamboat	-	-	Before 1884	Unknown Ribs and part of boiler exposed 1884	200 yards from shore directly in front of Palma Sola Hotel [1884 site]
Unknown	Cattle ship	-	-	Before 1884	Unknown	Hulk floating in lower Tampa Bay
Millie Wales	Steamer	85.5	-	Dec 1884 or Jan. 1885	Burned	Passage Key Channel
Freddie L. Porter	Schooner	346	1866	20 Jan. 1887	Sank	Off Sarasota Pass 15 miles S of Egmont Key
Watulla	Schooner	14	1885	4 Jan. 1891	Went ashore and bilged	South side of Egmont Key
H. A. Dewitt	Schooner	-	-	16 June 1891	Abandoned	Off Egmont Key
Belle	Schooner (pilot boat)	23	1872	8 Feb. 1900	Went ashore in fog	South end of Egmont Key
John Smart	Schooner	17	1887	3 Oct. 1900	Wrecked	Mullet Key shoal, approx. 1 1/2 miles NW of Egmont Key Light
G. L. Daboll	Schooner	49	1872	17 April 1906	Stranded	Egmont Key
A. A. Rowe	Schooner	45	1859	19 Oct. 1906	Foundered on sand bar	Near Egmont Key
Davy Crockett	Schooner	85	1876	8 July 1909	Stranded	South Pass

NAME	TYPE	TONS	BUILT	LOST	CAUSE	LOCATION
Olga	Schooner	308	1881	26 April 1911	Sank	150 miles SW Egmont Key or 50 miles S Egmont Key
Iola	Steam Tug	72	1908	6 July 1912	Fire	Off Bradenton
Mildred (City of Haverhill)	Steamer	343	1902	Nov. 1914	Collided with schooner *Brazos*	Seven miles south of Egmont Key
John Francis	Schooner	322	1897	29 May 1919	Stranded	Egmont Key
Big Bazoo	Gas schooner	12	1881	25 Oct. 1921	Foundered	NW of Egmont Key
Francis	Schooner	14	1910	25 Oct. 1921	Foundered	SW of Egmont Key
D. Cash	Fishing smack	6				
Gwalia	Steamer (steel)	415	1907	4 Dec. 1925	Foundered	Egmont Key
Unknown	Cuban smack	-	-	21 Sept. 1926	Hurricane	"Anna Maria key"
W. D. Cash	Fishing schooner	-	-	24 Sept. 1926	Lost in storm after leaving Tampa	
Topsail Girl	Smack	-	-	24 Sept. 1926	"dismantled" in storm-recovered	West of southwest pass [near Anna Maria Island]
Hazel S. [or *Hazel B.]*	Fishing schooner	-	-	24 Sept. 1926	Hurricane	Anna Maria Point or [Passage Key Inlet]
Unknown	Schooner	-	-	Sept. 1926	Hurricane	Egmont Key beach
Unknown	Schooner	-	-	Sept. 1926	Hurricane	Passage Key
Unknown	Schooner	-	-	Sept. 1926	Hurricane	Off Anna Maria
Regina	Barge	1155	1904	8 March 1940	Stranded	Bradenton Beach
Belmont	Unknown	-	-	1940	Unknown	5 miles West of Egmont Key
Nancy B	Shrimp boat	-	-	June 1954	Ran aground	Total loss 1.5 off northern end of Anna Maria Island
Kim Too [Kim Two]	Oil screw shrimper (68/69 ft.)	63	1953	18 Jan 1955	Stranded "broke up"	1 mile NW of Anna Maria
Unknown	Cabin cruiser (26 ft.)	-	-	10 May 1957	Struck "submerged object" and sank	Off Egmont Key/Anna Maria Island
Zolalita [Zolaleta]	Banana boat (Bermudian)	-	-	March 1958	Grounded during dense fog	Off southern tip of Egmont Key
Piper Cub	Light plane	-	-	4 April 1958	Crashed in dense fog	Debris found in flight path-Mullet Key-Anna Maria Key
Unknown	Barge	-	-	24 Aug. 1958	"sunken"	"in 30 feet of water off Longboat Key"
Miss Powerama	Oil screw	64	1955	31 Jan. 1962	Stranded	Passage Key

NAME	TYPE	TONS	BUILT	LOST	CAUSE	LOCATION
Mary B.	**Shrimp boat**	**-**	**-**	**Feb 1965**	**Ran aground**	**Off north point of Anna Maria Island**
Campeche	**Fishing vessel (oil)**	**31**	**1926**	**7 March 1965**	**Stranded**	**Southwest Pass, Egmont Key**
Cindy	**Tug**	**-**	**-**	**1965**	**Wrecked**	**Approx. 1 1/2 miles, 196 degrees from Egmont Key Light at lat. 27 34 36 Long. 84 42 06**
Mark E. Singleton	**Oil vessel**	**99**	**1965**	**1 Aug. 1967**	**Burned**	**Off Egmont Key, approx. Lat. 27 36 00 Long. 82 45 00**
Miss Manatee	**Fishing vessel (60 ft.)**	**-**	**-**	**7 April 1971**	**Grounded**	**On Passage Key**
Gemini	**Oil vessel**	**101**	**1973**	**20 Dec. 1973**	**Stranded**	**Egmont Key**
Sundowner	**Oil vessel**	**100**	**1974**	**18 May 1976**	**Stranded**	**One mile, 305 degrees true from bell buoy 8, Egmont Channel**
Captain Justin	**Wood shrimp boat**	**-**	**-**	**-**	**Sunk**	**2 miles E Egmont Key**
Putt-Putt	**Cabin cruiser (22 ft.)**	**-**	**-**	**18 Oct. 1981**	**Wrecked**	**23 miles west of Longboat Key**
Unknown	**Barge**	**-**	**-**	**2 April 2008**	**Grounded Re-floated**	**Three miles west of Egmont Key**
Yankee	**Tug**	**-**	**-**	**2 April 2008**	**Grounded while towing above barge-refloated**	**Near mouth of Tampa Bay**

Berman, Bruce D.
1972 *Encyclopedia of American Shipwrecks*. Mariners Press, Boston, MA.

Espey, Huston & Associates, Inc
1988 *Marine Magnetometer Survey of a Sand Borrow Site off Egmont Key, Site Indian Rocks Beach Nourishment Project Pinellas County, Florida*. Submitted by Espey, Huston & Associate, Austin, TX to Pinellas County Board of Commissioners, Clearwater, FL.

Lytle, William M. and Forrest R. Holdcamper (compilers)
1975 *Merchant Steam Vessels of the United States*. Edited by Bradford Mitchell. Steamship Historical Society of America, Staten Island, NY.

Marx, Robert
1983 *Shipwrecks in the Americas*. Bonanza Books, New York, NY.

Miami Daily News
'Copter Saves Three At Sea. *Miami Daily News* 19 January:10A. Miami, FL.

Mitchell, C. Bradford (editor)
1975 *Merchant Steam Vessels of the United States: "The Lytle-Holdcamper List."* Steamship Historical Society, Staten Island, NY.

Royer, Jackie
1971 4 Are Rescued Off Anna Maria. *Sarasota Herald-Tribune* 8 April. Sarasota, FL.

Sarasota Herald-Tribune (SHT)
1926 Fishing Smack Believed Sunk At Anna Maria. *Sarasota Herald-Tribune* 22 September:3. Sarasota, FL.

1954 Gulf Hunt For Missing Captain Proves Fruitless. *Sarasota Herald-Tribune* 5 June:2. Sarasota, FL.

1955 'Copter saves 3 Off Anna Maria. *Sarasota Herald-Tribune* 20 January. Sarasota, FL.

1958a Banana Boat Off Egmont Key: Area 'Sportsmen' Accused of Looting Grounded Ship. *Sarasota Herald-Tribune* 11 March:5. Sarasota, FL.

1958b Skin Divers Find Specimen of Scarce Soft-Bodied Mollusk: Rare Purple Sea Hare Found Off Longboat Key. *Sarasota Herald-Tribune* 24 August. Sarasota, FL.

1998 Boat sinks after hitting buoy. *Sarasota Herald-Tribune* 24 December. Sarasota, FL.

Singer, Steven D.
1998 *Shipwrecks of Florida*, *Second Edition*. Pineapple Press, Sarasota, FL.

St. Petersburg Independent (SPI)
1926 MARINE NEWS. *St. Petersburg Independent* 30 September. St. Petersburg, FL.

St. Petersburg Times
1923 BELIEVE CREW LOST IN GULF: Tampa Fishing Smack is Thought to Have Sunk Off Egmont Key. *St. Petersburg Times* 17 October:1. St. Petersburg, FL.

1957 Searchers Find No Trace of 3 Boating Victims. *St. Petersburg Times* 11 May:18. St. Petersburg, FL.

The Evening Independent
1926a STORM TAKES TOLL OF LIVES ON GULF. Two Schooners and Three Bodies of Sailors Drift Ashore at Egmont Key. *The Evening Independent* 24 September:1. St. Petersburg, FL.

1926b Marine News. *The Evening Independent* 28 September:7. St. Petersburg, FL.

1926c Marine News. *The Evening Independent* 30 September:9. St. Petersburg, FL.

1971 Sinking Boat's Crew Rescued. *The Evening Independent* 7 April:9-A. St. Petersburg, FL.

1981 Coast Guard finds hull, but boat's 2 occupants missing. *The Evening Independent* 19 October. St. Petersburg, FL.

The Miami News
1958 Plane Debris Found, Two Are Missing. *The Miami News* 5 April:10A. Miami, FL.

The National Historical Society (TNHS)
1987 *Official Records of the Union and Confederate Navies in the War of the Rebellion*, ser. I, vol. 16. Republication of the original 1903 edition. The National Historical Society, Harrisburg, PA.

The New York Times
1884a Under The Solitary Palm: A Nearer View of a Unique Florida Town: Palma Sola On A Sunday Afternoon-Robinson Crusoe Houses-The Alligator Bayou And The Oyster Trees. *The New York Times* 6 April. New York, NY.

1884b From Tampa To Key West: A Midnight Meeting in Tampa Bay. *The New York Times* 4 May. New York, NY.

U.S. Department of Commerce (USDC)
1922 *Fifty-Fourth Annual List of Merchant Vessels of the United States And Lists of Vessels Belonging To the United States Government For The Year Ended June 30,1922*. Bureau of Navigation, U.S. Department of Commerce, Washington, DC.

U.S. Department of Commerce and Labor (USDC&L)
1906 *Thirty-Eighth Annual List of Merchant Vessels of the United States And Lists of Vessels Belonging To the United States Government For The Year Ended June 30, 1906.* Bureau of Navigation, U.S. Department of Commerce and Labor, Washington, DC.

U.S. War Department (USWD)
1896 Report of the Secretary of the War; Being Part of the Message and Documents Communicated to the Two Houses of Congress at the Beginning of the Second Session of the Fifty-Fourth Congress. Vol. II, Part 2. U.S. War Department, Washington, DC.

Vaught, Tom
2008 Fuel spill averted as barge runs aground. *The Anna Maria Island Sun* 9 April:8(29). Archives. Electronic document: <http://www.amisun.com/archives/2008/04-09-08/headlines.htm>, accessed 29 September 2010.

Appendix B

The F-2 Investigation Area Magnetic Anomalies

Anomaly Number	Area/ Block	Line No.	Shot Pt.	Tow Height (feet)	Signature	Intensity (gammas)	Duration (feet)	Latitude/ Longitude (NAD 27)	Minimum Avoidance Distance
M-1	PB 507	204	256	17.84	Dipolar	5	145	27.47467505 -82.9325618	0
M-2	PB 506	212	327	17.01	Negative Monopolar	6	90	27.47444264 -82.93559491	0
M-3	PB 506	212	334	10.31	Positive Monopolar	2	75	27.47638211 -82.93560206	0
M-4	PB 506	220	463	23.05	Positive Monopolar	2	45	27.48206674 -82.93870421	0
M-5	PB 506	223	1204	18.1	Positive Monopolar	2	90	27.47394748 -82.93981273	0
M-6	PB 506	225	1175	15.58	Negative Monopolar	2	60	27.47797736 -82.94077458	0
M-7	PB 506	237	917	16.6	Dipolar	2	40	27.47980721 -82.94567911	0

Appendix C
Survey Log Sheet

Ent D (FMSF only)___/___/___

Survey # (FMSF only)

Survey Log Sheet

Florida Master Site File
Version 4.1 1/07

Consult *Guide to the Survey Log Sheet* for detailed instructions.

Identification and Bibliographic Information

Survey Project (name and project phase) Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida, Phase I

Report Title (exactly as on title page) Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida

Report Author(s) (as on title page— individual or corporate; last names first) Watts, Gordon P., Jr.; Daniel, Joshua A.; Arnold, Robin C.

Publication Date (year) 2010 Total Number of Pages in Report (count text, figures, tables, not site forms) 122

Publication Information (Give series and no. in series, publisher and city. For article or chapter, cite page numbers. Use the style of *American Antiquity*.) Tidewater Atlantic Research, Washington, North Carolina

Supervisor(s) of Fieldwork (whether or not the same as author[s]; last name first) Watts, Gordon P., Jr.

Affiliation of Fieldworkers (organization, city) Tidewater Atlantic Research, Inc., Washington, North Carolina

Key Words/Phrases (Don't use the county, or common words like *archaeology*, *structure*, *survey*, *architecture*. Limit each word or phrase to 25 characters.) Remote-Sensing, Magnetometer, Sidescan Sonar, Sub-bottom Profiler, Phase I

Survey Sponsors (corporation, government unit, or person who is directly paying for fieldwork)

Name Coastal Planning & Engineering, Inc.

Address/Phone 2481 N.W.Boca Raton Blvd., Boca Raton, FL 33431; Tele: (561) 391-8102

Recorder of *Log Sheet* Joshua Daniel Date *Log Sheet* Completed 04/14/2011

Is this survey or project a continuation of a previous project? ✔ No ❏ Yes: Previous survey #(s) (FMSF only) ____________

Mapping

Counties (List each one in which field survey was done - do not abbreviate; use supplement sheet if necessary) Manatee County

USGS 1:24,000 Map(s) : Map Name/Date of Latest Revision (use supplement sheet if necessary): St. Petersburg quadrangle, Florida, 1988 Revision, 1:250,000

Description of Survey Area

Dates for Fieldwork: Start 08/3/2010 End 10/21/2010 Total Area Surveyed (fill in one) _______ hectares 375.57 acres

Number of Distinct Tracts or Areas Surveyed 1

If Corridor (fill in one for each): Width ______ meters ______ feet Length __________ kilometers ____________miles

Research and Field Methods

Types of Survey (check all that apply): ✔ archaeological ❑ architectural ❑ historical/archival ✔ underwater ❑ other: _______

Scope/Intensity/Procedures Remote-sensing survey utilizing a magnetometer, sidescan sonar, and sub-bottom profiler to detect potentially significant submerged cultural material

Preliminary Methods (✔ Check as many as apply to the project as a whole.)

❑ Florida Archives (Gray Building)
✔ library research- *local public*
❑ local property or tax records
✔ other historic maps
❑ Florida Photo Archives (Gray Building)
✔ library-special collection - *nonlocal*
✔ newspaper files
❑ soils maps or data
❑ Site File property search
❑ Public Lands Survey (maps at DEP)
✔ literature search
❑ windshield survey
✔ Site File survey search
❑ local informant(s)
❑ Sanborn Insurance maps
✔ aerial photography
❑ other (describe)______

Archaeological Methods (✔ Check as many as apply to the project as a whole.)

❑ Check here if NO archaeological methods were used.

❑ surface collection, controlled
❑ surface collection, uncontrolled
❑ shovel test-1/4"screen
❑ shovel test-1/8" screen
❑ shovel test 1/16"screen
❑ shovel test-unscreened
❑ other screen shovel test (size: _____)
❑ water screen (finest size: _____)
❑ posthole tests
❑ auger (size:_____)
❑ coring
❑ test excavation (at least 1x2 M)
❑ block excavation (at least 2x2 M)
❑ soil resistivity
✔ magnetometer
✔ side scan sonar
❑ pedestrian survey
❑ unknown
✔ other (describe): Sub-bottom profiler

Historical/Architectural Methods (✔ Check as many as apply to the project as a whole.)

✔ Check here if NO historical/architectural methods were used.

❑ building permits
❑ commercial permits
❑ interior documentation
❑ demolition permits
❑ exposed ground inspected
❑ local property records
❑ neighbor interview
❑ occupant interview
❑ occupation permits
❑ subdivision maps
❑ tax records
❑ unknown
❑ other (describe): ______

Survey Results (cultural resources recorded)

Site Significance Evaluated? ❑ Yes ✔ No If *Yes*, circle NR-eligible/significant site numbers below.

Site Counts: Previously Recorded Sites 0______ Newly Recorded Sites 0 ______

Previously Recorded Site #'s with Site File Update Forms (List site #'s without "8." Attach supplementary pages if necessary) ______

Newly Recorded Site #'s (Are you sure all are originals and not updates? Identify methods used to check for updates, i.e., researched Site File records. List site #'s without "8." Attach supplementary pages if necessary.) ______

Site Form Used: ✔ Site File Paper Form ❑ SmartForm II Electronic Recording Form

REQUIRED: ATTACH PLOT OF SURVEY AREA ON PHOTOCOPY OF USGS 1:24,000 MAP(S)

DO NOT USE SITE FILE USE ONLY DO NOT USE

BAR Related

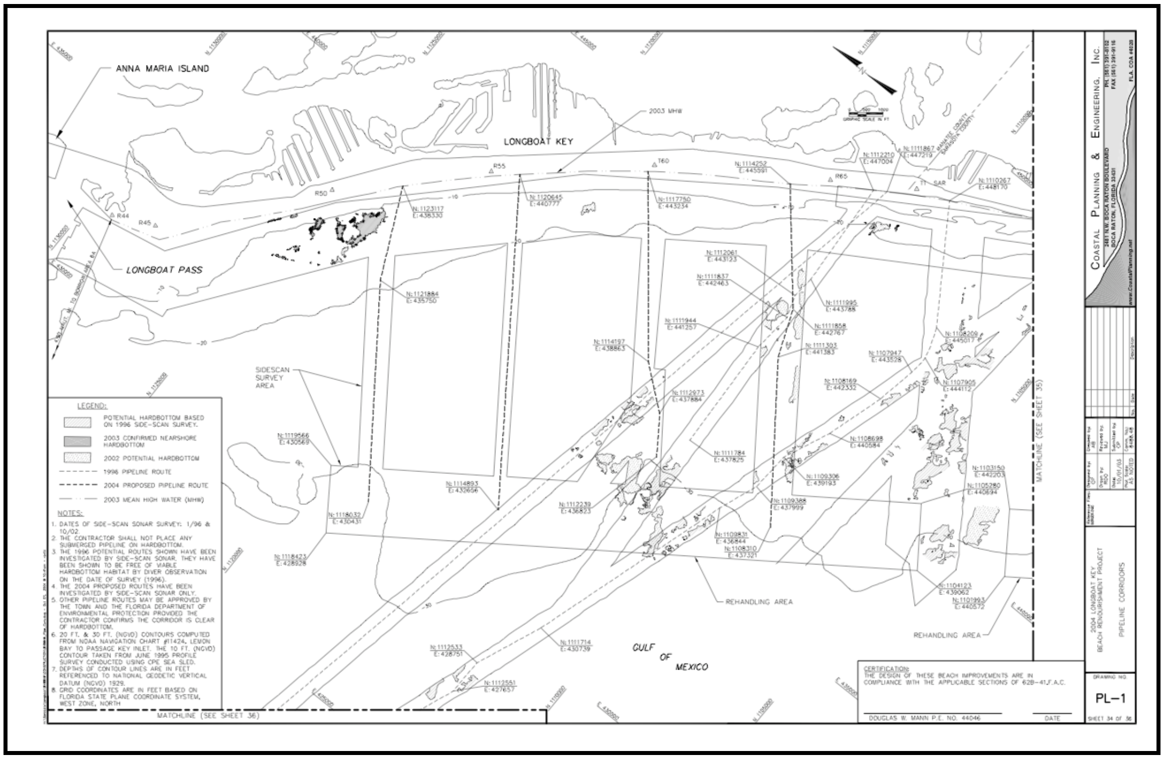
❑ 872 ❑ 1A32 #______
❑ CARL ❑ UW

BHP Related

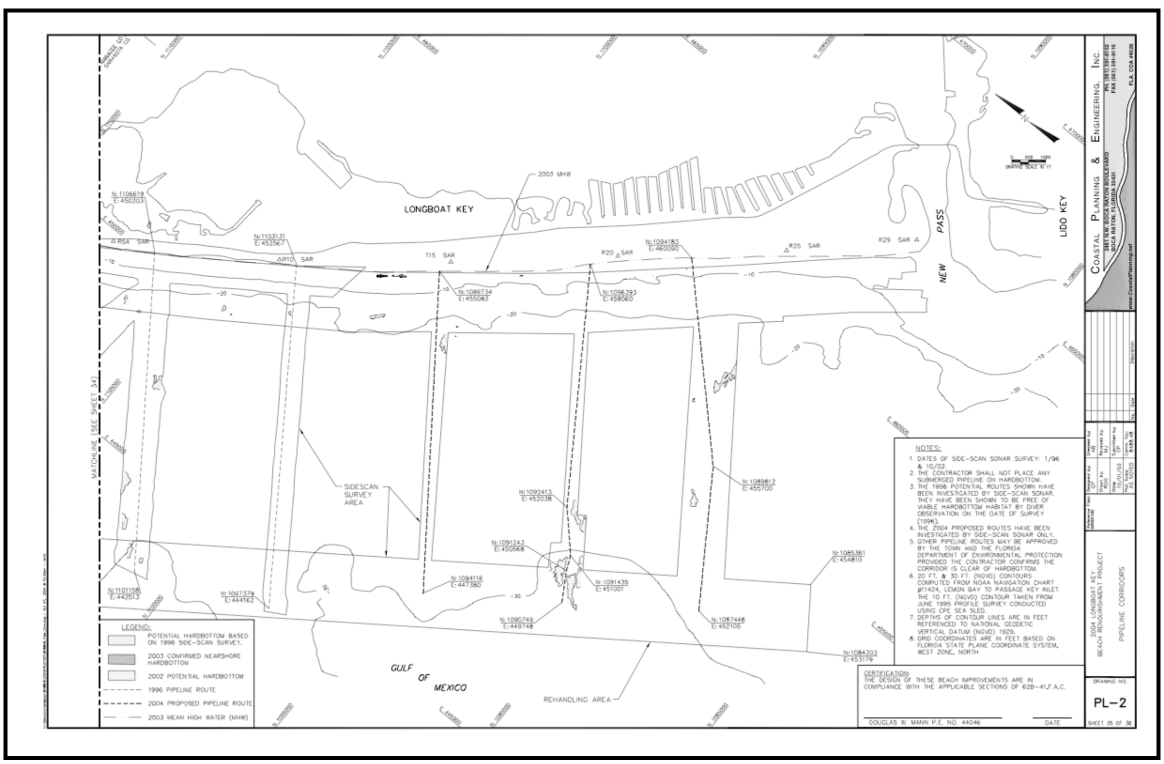
❑ State Historic Preservation Grant
❑ Compliance Review: CRAT #______

(USGS. "St. Petersburg quadrangle, Florida" 1:250,000)

Appendix D
Pipeline Corridors



ANNA MARIA ISLAND
LONGBOAT KEY
LONGBOAT PASS
2003 MHW
SIDESCAN SURVEY AREA
REHANDLING AREA
GULF OF MEXICO
LEGEND:
POTENTIAL HARDBOTTOM BASED ON 1996 SIDE-SCAN SURVEY.
2003 CONFIRMED NEARSHORE HARDBOTTOM
2002 POTENTIAL HARDBOTTOM
1996 PIPELINE ROUTE
2004 PROPOSED PIPELINE ROUTE
2003 MEAN HIGH WATER (MHW)
NOTES:
1. DATES OF SIDE-SCAN SONAR SURVEY: 1/96 & 10/02.
2. THE CONTRACTOR SHALL NOT PLACE ANY SUBMERGED PIPELINE ON HARDBOTTOM.
3. THE 1996 POTENTIAL ROUTES SHOWN HAVE BEEN INVESTIGATED BY SIDE-SCAN SONAR. THEY HAVE BEEN SHOWN TO BE FREE OF VIABLE HARDBOTTOM HABITAT BY DIVER OBSERVATION ON THE DATE OF SURVEY (1996).
4. THE 2004 PROPOSED ROUTES HAVE BEEN INVESTIGATED BY SIDE-SCAN SONAR ONLY.
5. OTHER PIPELINE ROUTES MAY BE APPROVED BY THE TOWN AND THE FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION PROVIDED THE CONTRACTOR CONFIRMS THE CORRIDOR IS CLEAR OF HARDBOTTOM.
6. 20 FT. & 30 FT. (NGVD) CONTOURS COMPUTED FROM NOAA NAVIGATION CHART #1424, LEMON BAY TO PASSAGE KEY INLET. THE 10 FT. (NGVD) CONTOUR TAKEN FROM JUNE 1995 PROFILE SURVEY CONDUCTED USING CPE SEA SLED.
7. DEPTHS OF CONTOUR LINES ARE IN FEET REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD) 1929.
8. GRID COORDINATES ARE IN FEET BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NORTH
MATCHLINE (SEE SHEET 36)
MATCHLINE (SEE SHEET 35)
CERTIFICATION:
THE DESIGN OF THESE BEACH IMPROVEMENTS ARE IN COMPLIANCE WITH THE APPLICABLE SECTIONS OF 62B-41, F.A.C.
DOUGLAS W. MANN P.E. NO. 44046
DATE
COASTAL PLANNING & ENGINEERING, INC.
2004 LONGBOAT KEY BEACH RENOURISHMENT PROJECT
PIPELINE CORRIDORS
PL-1



LONGBOAT KEY
2003 MHW
NEW PASS
LIDO KEY
SIDESCAN SURVEY AREA
REHANDLING AREA
GULF OF MEXICO
MATCHLINE (SEE SHEET 34)
NOTES:
1. DATES OF SIDE-SCAN SONAR SURVEY: 1/96 & 10/02.
2. THE CONTRACTOR SHALL NOT PLACE ANY SUBMERGED PIPELINE ON HARDBOTTOM.
3. THE 1996 POTENTIAL ROUTES SHOWN HAVE BEEN INVESTIGATED BY SIDE-SCAN SONAR. THEY HAVE BEEN SHOWN TO BE FREE OF VIABLE HARDBOTTOM HABITAT BY DIVER OBSERVATION ON THE DATE OF SURVEY (1996).
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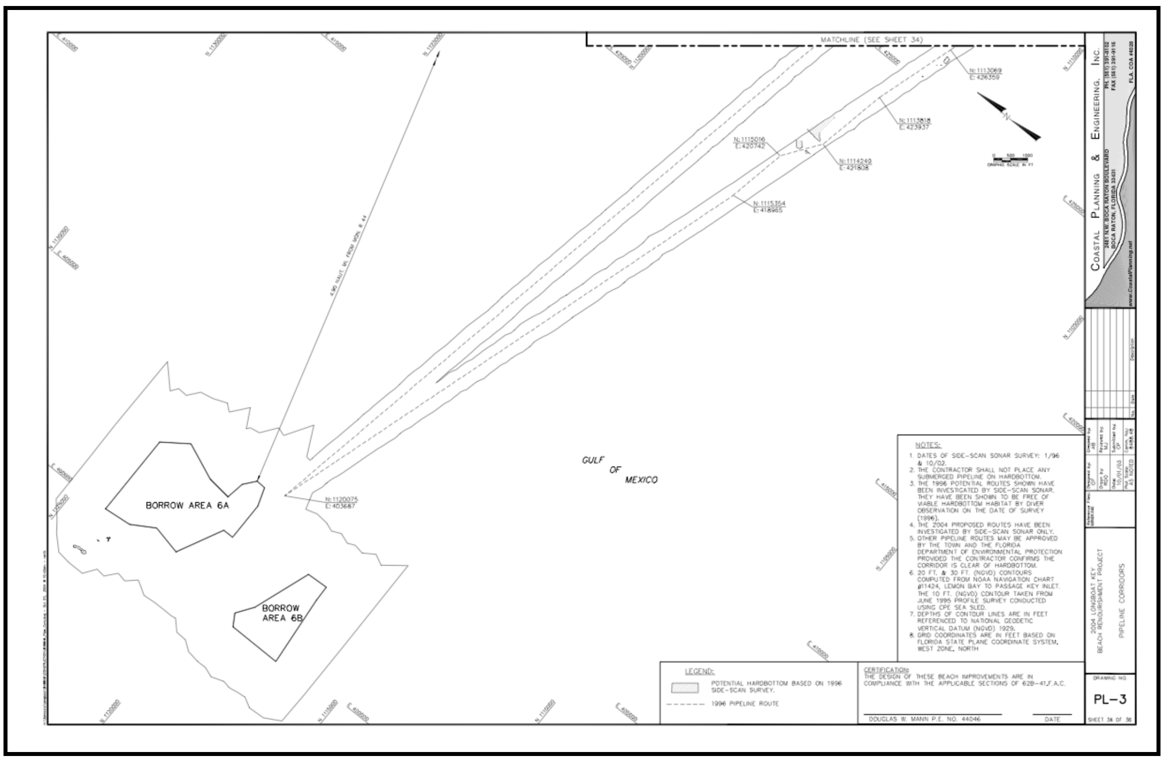
7. DEPTHS OF CONTOUR LINES ARE IN FEET REFERENCED TO NATIONAL GEODETIC VERTICAL DATUM (NGVD) 1929.
8. GRID COORDINATES ARE IN FEET BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NORTH
LEGEND:
POTENTIAL HARDBOTTOM BASED ON 1996 SIDE-SCAN SURVEY.
2003 CONFIRMED NEARSHORE HARDBOTTOM
2002 POTENTIAL HARDBOTTOM
1996 PIPELINE ROUTE
2004 PROPOSED PIPELINE ROUTE
2003 MEAN HIGH WATER (MHW)
CERTIFICATION:
THE DESIGN OF THESE BEACH IMPROVEMENTS ARE IN COMPLIANCE WITH THE APPLICABLE SECTIONS OF 62B-41, F.A.C.
DOUGLAS W. MANN P.E. NO. 44046
DATE
COASTAL PLANNING & ENGINEERING, INC.
2004 LONGBOAT KEY BEACH RENOURISHMENT PROJECT
PIPELINE CORRIDORS
PL-2


MATCHLINE (SEE SHEET 34)
BORROW AREA 6A
BORROW AREA 6B
GULF OF MEXICO
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N:1115354 E:418465
N:1115016 E:420742
N:1114249 E:421808
N:1113818 E:423937
N:1113069 E:426359
NOTES:
1. DATES OF SIDE-SCAN SONAR SURVEY: 1/96 & 10/02.
2. THE CONTRACTOR SHALL NOT PLACE ANY SUBMERGED PIPELINE ON HARDBOTTOM.
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6. 20 FT. & 30 FT. (NGVD) CONTOURS COMPUTED FROM NOAA NAVIGATION CHART #11424, LEMON BAY TO PASSAGE KEY INLET. THE 10 FT. (NGVD) CONTOUR TAKEN FROM JUNE 1995 PROFILE SURVEY CONDUCTED USING CPE SEA SLED.
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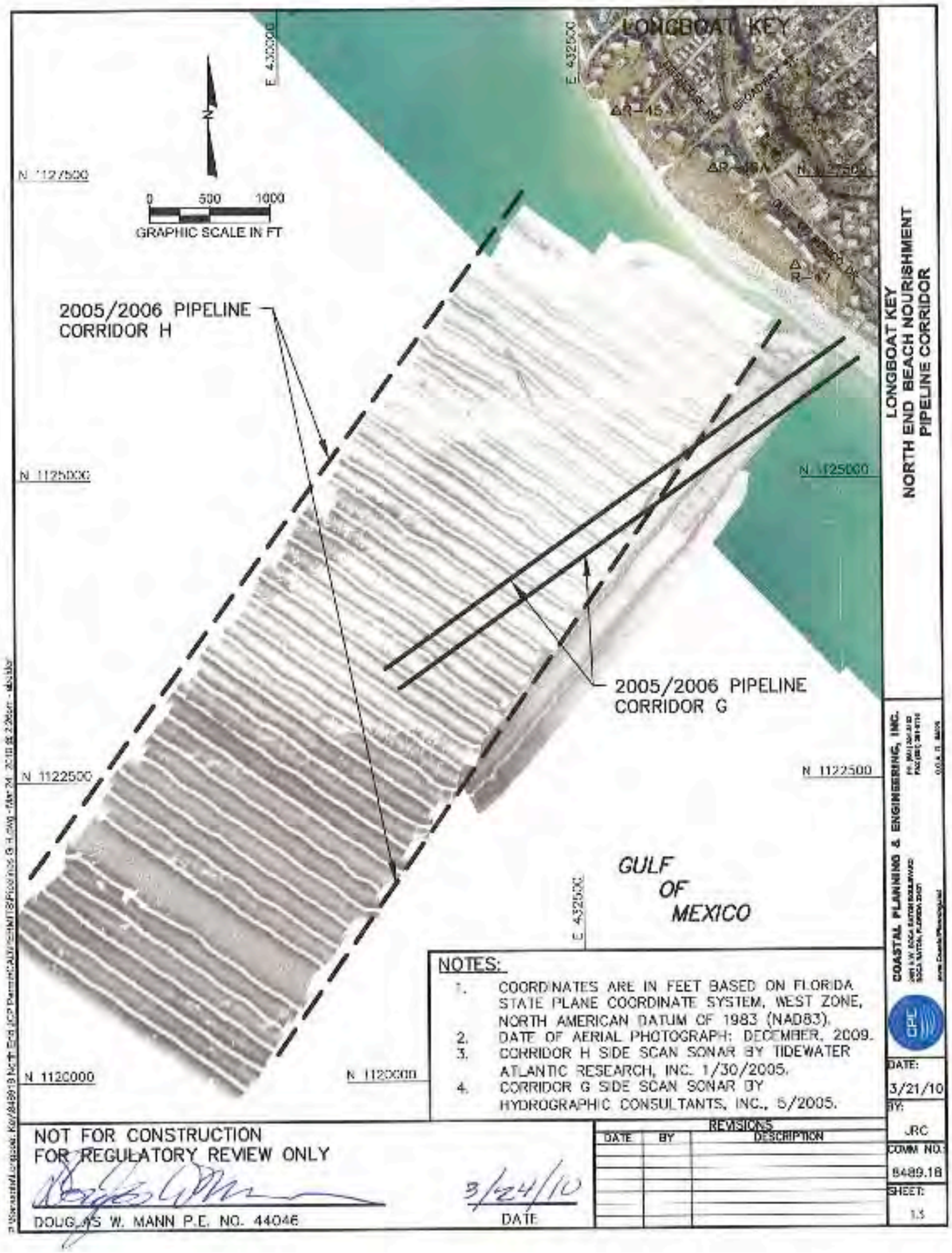
LEGEND:
POTENTIAL HARDBOTTOM BASED ON 1996 SIDE-SCAN SURVEY.
1996 PIPELINE ROUTE
CERTIFICATION:
THE DESIGN OF THESE BEACH IMPROVEMENTS ARE IN COMPLIANCE WITH THE APPLICABLE SECTIONS OF 62B-41,F.A.C.
DOUGLAS W. MANN P.E. NO. 44046
DATE
COASTAL PLANNING & ENGINEERING, INC.
2004 LONGBOAT KEY BEACH RENOURISHMENT PROJECT
PIPELINE CORRIDORS
PL-3

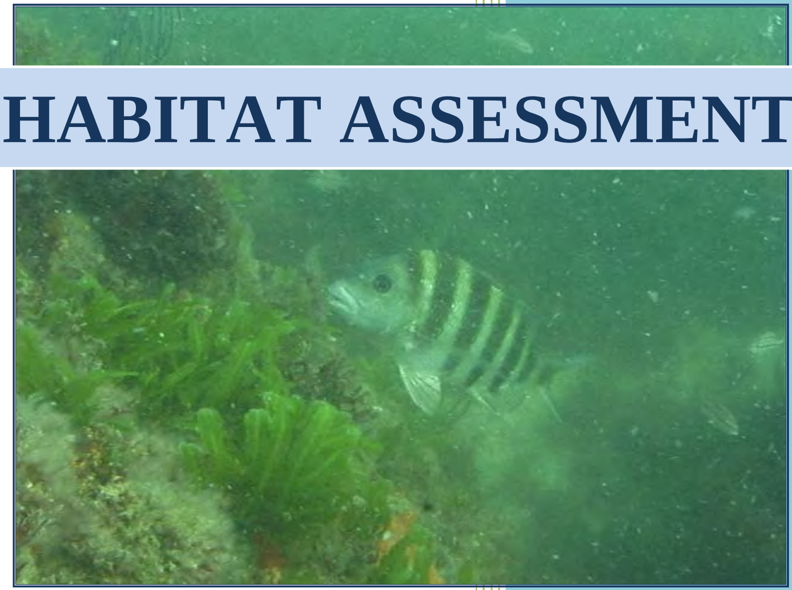

LONGBOAT KEY
E 430000
E 432500
N 1127500
N 1125000
N 1122500
N 1120000
0 500 1000
GRAPHIC SCALE IN FT
2005/2006 PIPELINE
CORRIDOR H
2005/2006 PIPELINE
CORRIDOR G
GULF
OF
MEXICO
NOTES:
1. COORDINATES ARE IN FEET BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83).
2. DATE OF AERIAL PHOTOGRAPH: DECEMBER, 2009.
3. CORRIDOR H SIDE SCAN SONAR BY TIDEWATER ATLANTIC RESEARCH, INC. 1/30/2005.
4. CORRIDOR G SIDE SCAN SONAR BY HYDROGRAPHIC CONSULTANTS, INC., 5/2005.
NOT FOR CONSTRUCTION
FOR REGULATORY REVIEW ONLY
DOUGLAS W. MANN P.E. NO. 44046
3/24/10
DATE
REVISIONS
DATE
BY
DESCRIPTION
LONGBOAT KEY
NORTH END BEACH NOURISHMENT
PIPELINE CORRIDOR
COASTAL PLANNING & ENGINEERING, INC.
DATE:
3/21/10
BY:
JRC
COMM NO.
8489.18
SHEET:
1.3

APPENDIX 7

ESSENTIAL FISH HABITAT ASSESSMENT

February 2011
Revised

ESSENTIAL FISH HABITAT ASSESSMENT



In Support of Consultation between the U.S. Army Corps of Engineers and
Bureau of Ocean Energy Management, Regulation and Enforcement
and the National Marine Fisheries Service for the
Town of Longboat Key Beach Renourishment Project
Town of Longboat Key, Florida

Prepared by
Coastal Planning & Engineering, Inc.
Boca Raton, Florida

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1.0 INTRODUCTION

The purpose of this Essential Fish Habitat (EFH) Assessment is to identify all EFH and managed species within the proposed Town of Longboat Key Beach Nourishment Project area, and to examine potential adverse effects on EFH for these managed species as required by the Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act), as amended through 2007. The EFH mandates of the MSFCMA represent an effort to integrate fishery management and habitat management by stressing the dependency of healthy, productive fisheries on the maintenance of viable and diverse estuarine and marine ecosystems. The consultation requirements in the MSFCMA direct federal agencies to consult with NOAA's National Marine Fisheries Service (NMFS) when any of their activities may have an adverse affect on EFH. Thus, the objective of this EFH Assessment is to determine how the actions of the proposed project may affect EFH designated by NMFS and the Gulf of Mexico Fisheries Management Council (GMFMC) for the area of influence of the project, and provide a vehicle for consultation between the U.S. Army Corps of Engineers (USACE) and NMFS.

According to the GMFMC, EFH within the Gulf of Mexico includes all estuarine and marine waters and substrates from the shoreline to the seaward limit of the Exclusive Economic Zone (EEZ). In 2005 the GMFMC proposed to amend the definition of EFH, removing EFH description and identification from waters between 100 fm and the seaward limit of the EEZ (GMFMC, 2005).

This EFH Assessment includes a description of the proposed action, a description of EFH and managed fish species located within the project area, and provides an analysis of the potential impacts to EFH and managed species that may occur as a result of this project. The objective of this analysis is to provide NMFS with the information needed to make appropriate determinations regarding the effects of the project on EFH.

2.0 PROJECT DESCRIPTION AND BACKGROUND

Longboat Key (LBK) is located on the central west coast of Florida and includes portions of Manatee and Sarasota Counties (Figure 1). The shoreline of LBK extends for approximately 10 miles and is mainly occupied by private residences and resort communities. There are public beach access areas along the key. In accordance with its Beach Management Program (CPE, 1995; 2008) in order to protect its beach infrastructure, the Town is seeking a 10-year permit for continued multiple nourishments of Longboat Key's shoreline from R44 in Manatee County to R29 in Sarasota County. An interim nourishment is first proposed for Fiscal Year (FY) 2011/2012 that will utilize sand from borrow areas located in both State and federal waters (Outer Continental Shelf, OCS). The interim phase will place sand in hot spots from R44 to R46a and R47.5 to R50.5 in Manatee County, and from R12 to R17 in Sarasota County. The hot-spot nourishment will require approximately 310,000 cy of sand. The Town also intends to nourish the entire island of Longboat Key in FY2013/2014, or later, using sand from both State and federal waters. Fill will be placed from: R44+220-R45-5, R47-R50, and R67 in Manatee County to T1 in Sarasota County, R13-R17 and R21-R29 in Sarasota County. Sand placed between R47 and R50.5 in Manatee County will be trucked in from an inland mine. The total estimated volume for the island-wide phase is 856,000 cy. In the event of changes in beach conditions prior to FY 2013/2014, sand may need to be placed in other reaches of the Longboat Key shoreline.

The interim nourishment phase will utilize sand from offshore borrow areas which fall within the path of a liquid natural gas (LNG) pipeline route planned by Port Dolphin Energy LLC, and construction of which is projected to commence in July 2012 (see Section 2.1); therefore, these sand resources must be extracted prior to pipeline construction when they will become inaccessible. Additional sand from portions of the OCS borrow area that do not fall within the Port Dolphin Pipeline corridor and will remain accessible will be used in the subsequent island-wide nourishment phase and may be used in future placement projects.

Authorizations

Although all nourishment phases will fall under a single project, there are federal actions which result from the distinct federal authorities of the U.S. Army Corps of Engineers (USACE) and Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). The USACE will serve as lead agency in EFH coordination for use of State sand sources and placement along Longboat Key; any conservation recommendations for use of the OCS borrow area are to be directed to the BOEMRE.

2.1 History of Port Dolphin LNG Pipeline and Relevance to Project

On March 29, 2007, Port Dolphin Energy LLC (Port Dolphin) submitted to the U.S. Coast Guard (USCG) and Maritime Administration (MARAD) an application under the Deepwater Port Act of 1974 (DWPA) for all federal authorizations required for license to own, construct, and operate a deepwater port off the coast of Florida. On June 15, 2007, USCG notified Port Dolphin that the application contained sufficient information to continue processing, and on June 25, 2007, the USCG and Maritime Administration issued a Notice of Application in the Federal Register summarizing the application (Public Docket: USCG-2007-28532).

The Town of Longboat Key became aware of the Port Dolphin project in May 2008 when the Draft Environmental Impact Statement was released. Town concerns were expressed regarding the position of the proposed pipeline corridor over permitted sand resources and sand resources identified for future use, including those planned for use in this project. Further discussion resulted in the submittal of the Port Dolphin LLC Deepwater Port License Application, Addendum II on December 18, 2008. Addendum II provided an additional pipeline re-route to avoid already permitted sand resources as requested by Manatee County and the Town of Longboat Key.

The Town is currently working to obtain a permit to utilize sand resources in federal waters that will become inaccessible once construction of the Port Dolphin LLC Deepwater Port begins. The OCS borrow area, termed BA-F2, lies approximately 12 miles directly west of Anna Maria Island. Once a lease for mining rights to BA-F2 is obtained from BOEMRE, material from this borrow area, along with sand from state waters, will be used first in the proposed interim nourishment phase in 2011/2012. Additional sand from portions of BA-F2 that do not fall within the Port Dolphin Pipeline corridor and will therefore remain accessible will be used in the subsequent island-wide nourishment phase and may be used in future placement projects.

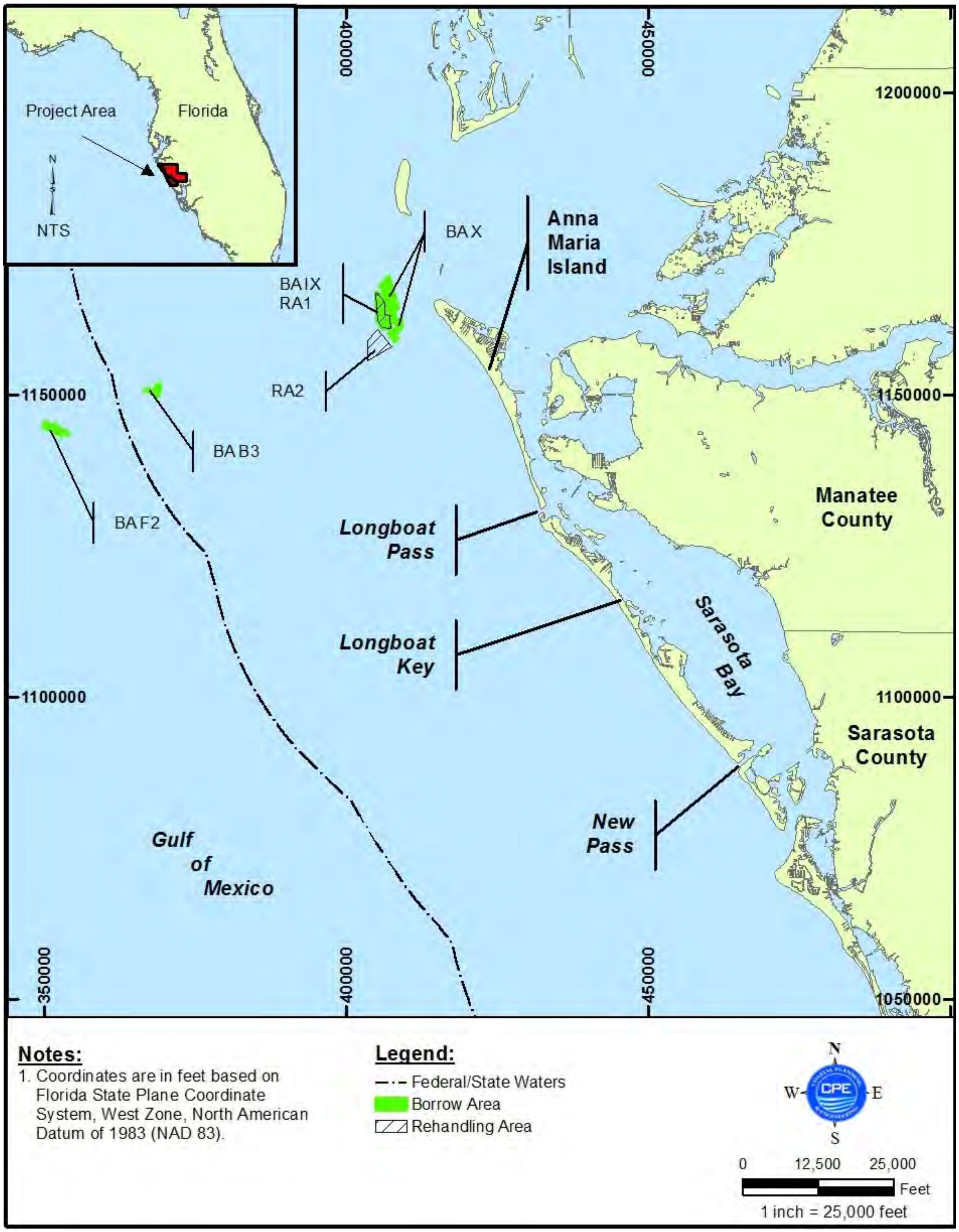

Figure 1. Project location map for the Longboat Key Beach Nourishment Project depicting proposed offshore and inshore borrow areas (BA) and rehandling areas (RA).

2.2 Dredging Operations

2.2.1 Pipeline Corridors

Eight pipeline corridors were cleared as no-impact corridors during the last (2005/06) island-wide beach renourishment project that may be utilized for the proposed project. The pipeline corridors extend from the shoreline out to the 30 ft depth contour and range in width from 400 ft to 2500 ft. Although the corridors are primarily softbottom, sidescan sonar surveys revealed several patches of hardbottom within the corridors; however, the contractor will be instructed to avoid these resources in a manner that was successfully implemented in 2005/06. The pipeline will be laid and removed as project progress is made along the shoreline. There exists the potential for two pipelines to be deployed at one time if the contractor has the resources to do so.

2.2.2 Borrow Areas

Four borrow areas are proposed for the planned nourishments. Two of the borrow areas are located offshore: BA-F2 is located in federal waters approximately 12 miles offshore of Anna Maria Island (AMI) in Manatee County, Florida and BA-B3 is on State of Florida sovereign submerged lands approximately nine miles offshore of AMI. One previously permitted borrow area, BA-IX, and newly designed BA-X, are also proposed as sand resources. Both borrow areas are on State of Florida sovereign submerged lands less than two miles northwest of AMI (Figure 1).

Borrow areas F2 and B3 are located within the proposed Port Dolphin pipeline corridor and will be dredged first in order to remove the sand prior to the planned pipeline construction in July, 2012. A medium-sized hopper dredge will excavate and transport the sand to the seaward end of the submerged beach pipeline for placement in the fill areas. It is anticipated that the dredge will move approximately 10,000 cy of sand per day, resulting in up to four round-trips from the borrow area to the pipeline per day. Table 1 presents the volume of sand that will be dredged from each borrow area and total duration of dredging activity that will occur for the interim nourishment phase.

Table 1. Borrow area volumes and dredging duration for the interim nourishment phase. BA-F2 is in the federal waters of the OCS and BA-B3 is in state waters.

BORROW AREA	Total Volume per Borrow Area	Minimum Volume to be Dredged from Port Dolphin Corridor	Duration of Dredging†
F2	668,200 cy	196,300 cy	31 days
B3	141,100 cy	76,400 cy	

†Assuming 10,000 cy of sand are excavated per dredge day. Weather, equipment failure, etc. may prolong this timeframe.

Borrow area IX abuts BA-X, which lies directly east of BA-IX. Borrow area IX was used during the 2005/06 beach nourishment project. No changes in the design of the borrow area have been made. The remaining volume in BA-IX has been calculated as 2,120,000 cy. Approximately 133,000 cy will be dredged from this borrow area during a separately permitted emergency nourishment at the north end of Longboat Key scheduled for March 2011. Borrow area X contains approximately 3,753,000 cy (Table 2). Because of the fine white sand located in to BA-F2, the remainder of this borrow area (up to ~400,000 cy) will likely be dredged first, followed by dredging from BA-IX. Any remaining volume required to fill the template will be obtained from BA-X.

Dredging BA-X and the shallow portions of BA-IX by medium sized hopper dredges may be precluded by the shallow nature of these borrow areas. Dredging of these areas by small hopper dredges is feasible, but the transport of the sand to Longboat Key is usually not cost effective. Because of the shallow borrow areas, two rehandling areas have been proposed. The sand will be excavated by a shallow-draft hopper dredge or cutterhead dredge from BA-X and the shallow portions of BA-IX and deposited by bottom dumping using a hopper, or discharging from a vertically oriented cutterhead discharge pipe into either of the rehandling areas. Rehandling Area 1 (RA1) is the excavated portion of BA-IX and Rehandling Area 2 (RA2) is a section of the Gulf of Mexico approximately 1 mile southwest of BA-IX and BA-X. The sand would be deposited in these areas, to be re-dredged and transported to the beach pipeline by a deeper-draft, medium or large hopper dredge.

Similar to dredging operations during the interim nourishment phase, approximately 10,000 cy of sand may be transported from the rehandling areas to the beach pipeline each day of dredging, taking approximately 87 days to complete. However, speed of transport from the shallow portions of the borrow areas to the rehandling areas will depend on the type of dredge used. A small hopper dredge may accomplish 20 cycles per day to transport 20,000 cy of sand, whereas a cutterhead may move as much as 40,000 cy per day. These smaller dredges may work ahead of or concurrently with the larger hopper dredge moving sand to the beach.

In addition to offshore sand sources, approximately 200,000 cy of sand will be trucked in from either E.R. Jahna's Green Cay mine or Surface Prep Supply mine in Davenport as part of the island-wide nourishment. The trucking operation will occur twice within the duration of the permit in order to limit the volume of sand on those profiles and avoid impacts to nearshore hardbottoms.

Table 2. Borrow area volumes available for the island-wide nourishment phase.

BORROW AREA	AVAILABLE VOLUME PER BORROW AREA
Upland source (trucked)	~ 200,000 cy
F2*	471,900 cy
IX	2,120,000 cy
X	3,753,000 cy

*Accessible volume remaining after placement of Port Dolphin natural gas pipeline.

3.0 ESSENTIAL FISH HABITAT

The Fishery Conservation and Management Act of 1976, amended Magnuson-Stevens Fishery Conservation and Management Act (Magnuson-Stevens Act) by the Sustainable Fisheries Act of 1996, and the Magnuson-Stevens Fishery Conservation and Management Reauthorization Act of

2006, set forth a new mandate to identify and protect important marine and anadromous fish species and their habitats. The U.S. Congress enacted the Magnuson-Stevens Act to support the government's goal of sustainable fisheries. Crucial to achieving this goal is the maintenance of suitable marine fishery habitat quality and quantity. This goal is achieved through identifying and describing EFH, describing non-fishing and fishing threats, and suggesting measures to conserve and enhance EFH.

3.1 Essential Fish Habitat in the Gulf of Mexico

Essential Fish Habitat is defined as "those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity" (16 U.S.C. 1802 (10)). EFH is separated into estuarine and marine components. For the estuarine component in the Gulf of Mexico, EFH is defined as "all estuarine waters and substrates (mud, sand, shell, rock and associated biological communities), including the sub-tidal vegetation (seagrasses and algae) and adjacent inter-tidal vegetation (marshes and mangroves)". In the marine waters of the Gulf of Mexico, EFH was defined by the GMFMC in 1998 as "all marine waters and substrates (mud, sand, shell, rock, hardbottom, and associated biological communities) from the shoreline to the seaward limit of the EEZ [Exclusive Economic Zone]" (GMFMC, 1998). In 2005 the GMFMC proposed to amend the definition of EFH, removing EFH description and identification from waters between 100 fm and the seaward limit of the EEZ (GMFMC, 2005). The GMFMC has identified various estuarine and marine areas as EFH based on the life stages of designated managed species. GMFMC EFH areas are listed in Table 3 below.

Table 3. Representative categories of estuarine and marine EFH areas identified in the Fishery Management Plan Amendment of the Gulf of Mexico Fishery Management Council (GMFMC). Generally, EFH for species managed under the NMFS Billfish and Highly Migratory Species (HMS) plans falls within the marine and estuarine water column habitats designated by the GMFMC (NMFS, 2008).

ESTUARINE AREAS	MARINE AREAS
Estuarine emergent wetlands	Water column
Mangrove wetlands	Vegetated bottoms
Submerged aquatic vegetation	Non-vegetated bottoms
Algal flats	Live bottoms
Mud, sand, shell and rock substrates	Coral reefs
Estuarine water column	Geologic features
	Continental Shelf features

3.2 Essential Fish Habitat Found Within the Project Area

The project area includes primarily marine EFH, although estuarine water column and sandy, unvegetated bottom are found at the entrances of Longboat Pass at the north end of Longboat Key and New Pass at the south end of Longboat Key. Extensive submerged aquatic vegetation (SAV) occurs within Sarasota Bay, and some patchy SAV resources are located within Longboat Pass, and New Pass (Sarasota County, 2010) (Figures 2a-d); however, no seagrass resources have been observed within the beach placement or borrow area sites.

Marine EFH within the project area includes the marine water column and non-vegetated bottoms in the borrow areas and fill placement area, and live bottom (i.e., hardbottom) resources located nearshore in some placement areas (Figures 2a-2d) and also offshore near BA-B3 and BA-F2 (Figure 3). Prior to construction of the 2005/2006 Town of Longboat Key Beach Renourishment Project, nearshore hardbottom formations were mapped by Coastal Planning & Engineering, Inc. (CPE). The results of these investigations documented and characterized the nearshore hardbottom habitats that may be affected by beach nourishment activities in the project area. Hardbottom habitat within the 2005/06 Town of Longboat Key Beach Renourishment Project area included three formations between FDEP monuments R49.5 and R51.5, comprising a total area of approximately 14 acres. Approximately 1.5 acres of this nearshore hardbottom habitat was projected to be buried by equilibration of the 2005/2006 beach fill; therefore, a 1.5-acre artificial reef was deployed to mitigate for these projected impacts (Figure 2a). According to Jeff Rester of the Gulf States Marine Fisheries Commission, the Gulf of Mexico Fishery Management Council has determined that artificial reefs are subject to EFH consultation process, but they are not identified as separate EFH habitat (personal communication, 2010; GMFMC, 2004).

Coastal Planning & Engineering, Inc. also conducted sand search and cultural resource investigations in the vicinity of BA-IX, BA-X, RA-1 and RA-2 in 2010. These surveys included a full suite of geophysical data, including sub-bottom profiler, magnetometer, sidescan sonar, and bathymetry. All borrow areas and re-handling areas were designed to eliminate impacts to both hardbottom and cultural resources. This includes a minimum 400-ft hardbottom buffer around the exterior boundaries of the borrow and re-handling areas. No hardbottom resources were found within the borrow areas or re-handling areas, or their associated 400-ft buffers. In addition, no significant naturally occurring hardbottom was observed anywhere in the investigation area. There are, however, several small areas of rubble/debris mounds discovered in the investigation area south of RA-2. The closest of these small rubble/debris mounds occurs 750 ft south of RA-2.

Offshore hardbottom resources were found and mapped by CPE around BA-F2 and BA-B3 between 2008 and 2010 in surveys similar to those described in the paragraph above (Figure 3). Hardbottom in the vicinity of BA-B3 and BA-F2 along the Port Dolphin pipeline route were assessed by Continental Shelf Associates, Inc. (CSA) between August and December 2006 using towed video and *in situ* diver verification. The benthic resources in proximity to the offshore borrow areas were characterized by CSA as having between 20% to 100% epibenthic cover (habitat A), 5% and 20% epibenthic cover (habitat B), and less than 5% epibenthic cover (habitat C); all are considered EFH. The towed video and diver photo-documentation revealed the hardbottom resources to be dominated by macroalgae and supporting stony corals, including *Solenastrea hyades*. Macroalgae genera observed included *Caulerpa*, *Gracilaria*, *Codium*, *Halimeda* and *Hypnea*. *Caulerpa* was the most abundant macroalgae documented.

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Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 1990 Hardbottom
- 1993 Hardbottom
- 1995 Hardbottom
- 2002 SSS Hardbottom
- 2003 Hardbottom
- 2006 Hardbottom
- 2007 Hardbottom
- 2008 Hardbottom
- Artificial Reef Sites
- FDEP Monuments
- 2006 FWRI Seagrass
  - Continuous
  - Discontinuous
- 2011/2012 Interim Nourishment Phase Fill Area
  - Construction Toe of Fill
  - Equilibrium Toe of Fill
- 2013/2014 Island-wide Nourishment Phase Project Limits

Feet
0 500 1,000
1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom Map
Longboat Key, Florida

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2a

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Notes:
1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

2006 FWRI Seagrass
- Continuous
- Discontinuous
- 2002 SSS Hardbottom
- 2013/2014 Island-wide Nourishment Phase Project Limits
- FDEP Monuments

Feet
0 500 1,000

1 inch = 1,017 feet

TITLE:

Nearshore Hardbottom Map
Longboat Key, Florida

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2b

Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

2002 SSS Hardbottom
FDEP Monuments

2006 FWRI Seagrass
Continuous
Discontinuous

2011/2012 Interim Nourishment Phase Fill Area
Construction Toe of Fill
Equilibrium Toe of Fill
2013/2014 Island-wide Nourishment Phase Project Limits

Feet
0 500 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom Map
Longboat Key, Florida

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PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11 | BY: HMV | COMM NO. : 8489.15 | Figure 2c

Matchline Figure 2c

Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

2002 SSS Hardbottom

FDEP Monuments

2006 FWRI Seagrass

Continuous

Discontinuous

2011/2012 Interim Nourishment Phase Fill Area

Construction Toe of Fill

Equilibrium Toe of Fill

2013/2014 Island-wide Nourishment Phase Project Limits

Feet
0 500 1,000

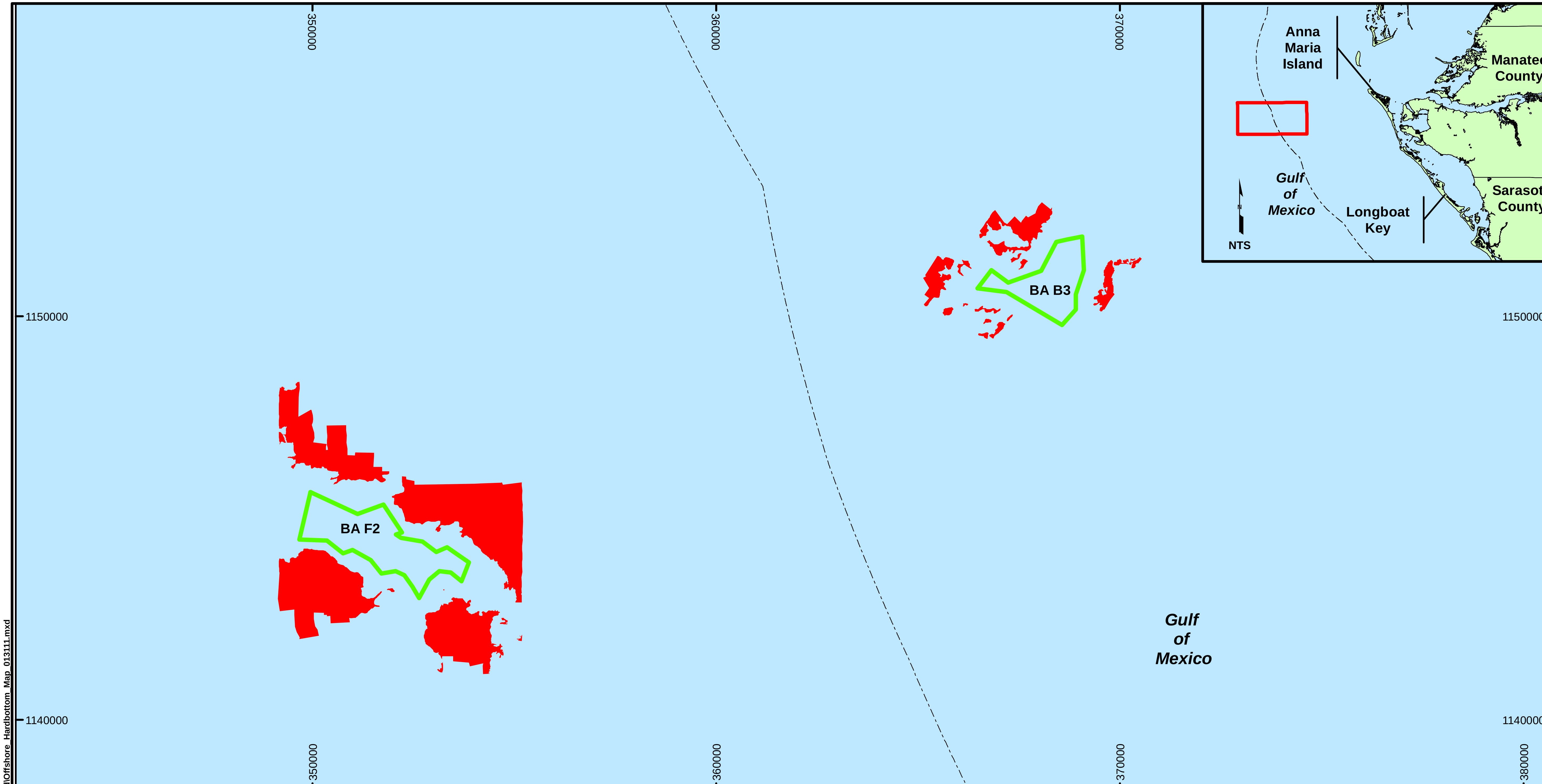
1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom Map
Longboat Key, Florida

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2d



Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Sidescan sonar hardbottom identified near F2 by CPE, Oct 20-23, 2009 and October 20, 2010.
3. Sidescan sonar hardbottom identified near B3 by CPE, December 7, 2008.

Legend:

- Federal/State Waters
- Borrow Area
- SSS Hardbottom 2008-2010

Feet
0 1,250 2,500

1 inch = 2,500 feet

TITLE:

Offshore Hardbottom Map
Longboat Key, Florida

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 01/06/11	BY: HMV	COMM NO. : 8489.15	**Figure 3**

3.3 Habitat Areas of Particular Concern

The rules set forth by the Magnuson-Stevens Act also direct the Fishery Management Councils to consider a second, more limited habitat designation for each species in addition to EFH. Habitat Areas of Particular Concern (HAPC) are subsets of identified EFH which are rare, particularly susceptible to human-induced degradation, especially ecologically important, or located in an environmentally stressed area. In general, HAPCs include high-value intertidal and estuarine habitats, offshore areas of high habitat value or vertical relief, and habitats used for migration, spawning, and rearing of fish and shellfish (NMFS, 2008). In the *Final Gulf Council EFH Amendment*, the GMFMC identifies specific HAPC sites in the Gulf of Mexico (Table 4). These designated HAPC sites replace the broad habitat classifications identified as HAPC in the 1998 Generic Amendment (GMFMC, 2005; 1998).

Table 4. Habitat Areas of Particular Concern (HAPC) identified in the 2005 Fishery Management Plan Amendment of the Gulf of Mexico Fishery Management Council (GMFMC, 2005).

HAPC - Gulf of Mexico
Madison-Swanson Marine Reserve
Tortugas North Ecological Reserve
Tortugas South Ecological Reserve
Florida Middle Grounds
Pulley Ridge
Individual reefs and banks of the Northwestern Gulf of Mexico:
East and West Flower Garden Banks, Stetson Bank, Sonnier Bank, MacNeil, 29 Fathom Bank, Rankin Bright Bank, Geyer Bank, McGrail Bank, Bouma Bank, Rezak Sidner Bank, Alderice Bank, and Jakkula Bank

No designated HAPC exists within the vicinity of project area.

4.0 MANAGED SPECIES

4.1 Managed Species in the Gulf of Mexico

There are Fishery Management Plans (FMPs) in the Gulf region for shrimp, red drum, reef fishes, coastal migratory pelagics (CMP), stone crabs, spiny lobsters, coral and coral reefs, and highly migratory species (e.g., billfish, swordfish, tuna, and sharks). Species identified by the GMFMC to be representative of the species that commonly occur throughout all of the estuarine and marine waters of the Gulf of Mexico are listed in Table 5 under their respective FMP's. In total, the GMFMC manages 55 species, not including species included in the coral complex (NMFS, 2008). In the Gulf of Mexico, highly migratory species (HMS) such as Atlantic tunas, swordfish, sharks, and billfish are federally managed by NOAA's National Marine Fisheries Service (NMFS) (Table 6).

Table 5. Fishery management plans and managed species for the Gulf of Mexico (NMFS, 2008).

Shrimp Fishery Management Plan
- brown shrimp - *Farfantepenaeus aztecus*
- pink shrimp - *F. duorarum*
- royal red shrimp - *Pleoticus robustus*
- white shrimp - *Litopenaeus setiferus*

Red Drum Fishery Management Plan
- red drum - *Sciaenops ocellatus*

Reef Fish Fishery Management Plan
- almaco jack - *Seriola rivoliana*
- anchor tilefish - *Caulolatilus intermedius*
- banded rudderfish - *S. zonata*
- blackfin snapper - *Lutjanus buccanella*
- blackline tilefish - *Caulolatilus cyanops*
- black grouper - *Mycteroperca bonaci*
- blueline tilefish - *C. microps*
- cubera snapper - *L. cyanopterus*
- dog snapper - *L. jocu*
- dwarf sand perch - *Diplectrum bivittatum*
- gag grouper - *M. microlepis*
- goldface tilefish - *C. chrysops*
- goliath grouper - *Epinephelus itajara*
- gray snapper - *L. griseus*
- gray triggerfish - *Balistes capriscus*
- greater amberjack - *S. dumerili*
- hogfish - *Lachnolaimus maximus*
- lane snapper - *Lutjanus synagris*
- lesser amberjack - *S. fasciata*
- mahogany snapper - *L. mahogoni*
- marbled grouper - *E. inermis*
- misty grouper - *E. mystacinus*
- mutton snapper - *L. analis*
- Nassau grouper - *E. striatus*
- queen snapper - *Etelis oculatus*
- red hind - *Epinephelus guttatus*
- red grouper - *E. morio*
- red snapper - *L. campechanus*
- rock hind - *E. adscensionis*
- sand perch - *Diplectrum formosum*
- scamp grouper - *M. phenax*
- schoolmaster - *L. apodus*
- silk snapper - *L. vivanus*
- snowy grouper - *E. niveatus*
- speckled hind - *E. drummondhayi*
- tilefish - *Lopholatilus chamaeleonticeps*
- vermilion snapper - *Rhomboplites aurorubens*
- Warsaw grouper - *E. nigritus*
- wenchman - *Pristipomoides aquilonaris*
- yellowedge grouper - *E. lavolimbatus*
- yellowfin grouper - *M. venenosa*
- yellowmouth grouper - *M. interstitialis*
- yellowtail snapper - *Ocyurus chrysurus*

Stone Crab Fishery Management Plan
- Florida stone crab - *Menippe mercenaria*
- gulf stone crab - *M. adina*

Spiny Lobster Fishery Management Plan
- Caribbean spiny lobster - *Panulirus argus*
- ridged slipper lobster - *Scyllarides nodifer*

Coral and Coral Reef Management Plan
- varied coral species and coral reef communities comprised of several hundred species

Coastal Migratory Pelagic Fishery Management Plan
- cobia - *Rachycentron canadum*
- king mackerel - *Scomberomorus cavalla*
- Spanish mackerel - *S. maculatus*

Table 6. Species managed in the Gulf of Mexico under federally implemented fishery management plans (NMFS, 2006; 2008).

Tuna

- albacore - *Thunnus alalunga*
- Atlantic bigeye - *T. obesus*
- Atlantic bluefin - *T. thynnus*
- Atlantic yellowfin - *T. albacares*
- skipjack - *Katsuwonus pelamis*

Swordfish

- swordfish - *Xiphias gladius*

Billfish

- blue marlin - *Makaira nigricans*
- sailfish - *Istiophorus platypterus*
- white marlin - *T. albidus*
- longbill spearfish - *Tetrapturus pfluegeri*

Large Coastal Sharks

- basking shark - *Cetorhinus maximus*
- great hammerhead – *Sphyrna mokarran*
- scalloped hammerhead - *S. lewini*
- smooth hammerhead - *S. zygaena*
- white shark - *Carcharodon carcharias*
- nurse shark - *Ginglymostoma cirratum*
- bignose shark - *Carcharhinus altimus*
- blacktip shark - *C. limbatus*
- bull shark - *C. leucas*
- Caribbean reef shark - *C. perezi*
- dusky shark - *C. obscurus*
- Galapagos shark - *C. galapagensis*
- lemon shark - *Negaprion brevirostris*
- narrowtooth shark - *C. brachyurus*
- night shark - *C. signatus*
- sandbar shark - *C. plumbeus*
- silky shark - *C. falciformis*
- spinner shark - *C. brevipinna*
- tiger shark - *Galeocerdo cuvieri*
- bigeye sand tiger - *Odontaspis noronhai*
- sand tiger shark - *O. taurus*
- whale shark - *Rhinocodon typus*

Small Coastal Sharks

- Atlantic angel shark - *Squatina dumerili*
- bonnethead - *Sphyrna tiburo*
- Atlantic sharpnose – *R. terraenovae*
- blacknose shark - *C. acronotus*
- Caribbean sharpnose shark - *R. porosus*
- finetooth shark - *C. isodon*
- smalltail shark - *C. porosus*

Pelagic Sharks

- bigeye sixgill shark - *Hexanchus vitulus*
- sevengill shark – *Heptranchias perlo*
- sixgill shark - *H. griseus*
- longfin mako shark - *Isurus paucus*
- porbeagle shark - *Lamna nasus*
- shortfin mako shark - *I. oxyrinchus*
- blue shark - *Prionace glauca*
- oceanic whitetip shark - *C. longimanu*
- bigeye thresher shark - *Alopias superciliosus*
- common thresher shark - *A. vulpinus*

4.2 Managed Species in the Project Area

The project area includes EFH designated for all seven fisheries managed by the GMFMC: Shrimp, Red Drum, Reef Fish, Stone Crab, Spiny Lobster, Coral and Coral Reef, and CMP (GMFMC, 2005; NMFS, 2008). Essential Fish Habitat for highly migratory species (HMS) managed by NMFS is also located within the project area (NMFS, 2008). This section presents the EFH designations for these fisheries within the Gulf of Mexico as defined by the GMFMC and NMFS (GMFMC, 2005). Basic ecological information for species which are most likely to occur in the action area is provided below. Appendix 1 provides EFH information by life stage and habitat for GMFMC managed species in Ecoregion 1, which extends from the Florida Keys to Tarpon Springs, Florida and includes the project area. This table was provided by Jeff Rester, of the Gulf States Marine Fisheries Commission. A complete listing of the HMS EFH definitions by life stage for HMS species located in the project area is provided as Appendix 2.

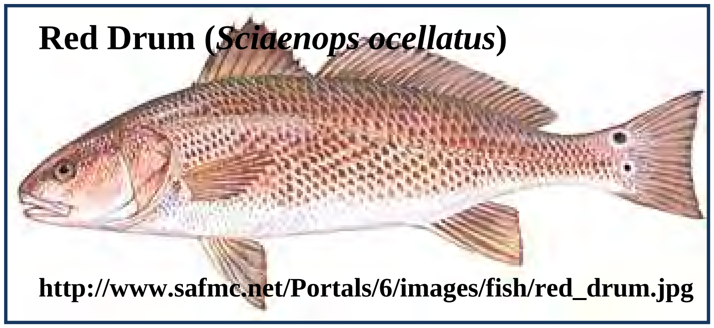
4.2.1 Shrimp Fishery

EFH for shrimp consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to Fort Walton Beach, Florida, from estuarine waters out to depths of 100 fm; waters and substrates extending from Grand Isle, Louisiana to Pensacola Bay, Florida, between depths of 100 and 325 fm; waters and substrates extending from Pensacola Bay, Florida, to the boundary between the areas covered by the Gulf of Mexico Fishery Management Council and the South Atlantic Fishery Management Council (SAFMC) out to depths of 35 fm, with the exception of waters extending from Crystal River, Florida, to Naples, Florida, between depths of 10 and 25 fm and in Florida Bay between depths of 5 and 10 fm (NMFS, 2008; GMFMC, 2005).

Pink shrimp are expected to occur in the project area. Brown shrimp are found far north of the project area within estuaries to offshore depths of 110 m in the Gulf of Mexico, ranging mainly from Apalachicola Bay to the Yucatan Peninsula. Royal Red shrimp are scarce in depths less than 250 m, and therefore are not expected to occur in the project area (GMFMC, 2004). In the Gulf of Mexico, white shrimp are found from Florida’s Big Bend through Texas, far from the project area (GMFMC, 2004; NMFS, 2010).

4.2.1.1 Pink Shrimp (Farfantepenaeus duorarum). Pink shrimp occur in estuaries and to depths of 110 m (most abundant <50 m) and are the dominant shrimp species off South Florida. Spawning occurs in water depths ranging from 4 – 18 m. Postlarval pink shrimp move from distant spawning areas inshore to nursery areas in estuaries beginning in April and early May, most likely by shoreward countercurrents. Postlarval and juvenile pink shrimp are commonly found in seagrass habitats where they burrow into the substrate by day and emerge to feed at night. Shrimp that survive the winter grow rapidly in late winter and early spring before migrating to the ocean. Adult pink shrimp are most abundant in Gulf waters from 9 - 48 m deep on coarse mixtures of sand and shell with less than 1% organic material (GMFMC, 2004; NMFS, 2010).

4.2.2 Red Drum Fishery



EFH for red drum consists of all Gulf of Mexico estuaries; waters and substrates extending from Vermilion Bay, Louisiana, to the eastern edge of Mobile Bay, Alabama, out to depths of 25 fm; waters and substrates extending from Crystal River, Florida to Naples, Florida, between depths of 5 and 10 fm; and waters and substrates extending from Cape Sable, Florida, to the boundary between the areas covered by the GMFMC and the SAFMC between depths of 5 and 10 fm (NMFS, 2008; GMFMC, 2005).

4.2.2.1 Red Drum (Sciaenops ocellatus). Red drum occur throughout the Gulf of Mexico in a variety of habitats, ranging from depths of about 40 m offshore to shallow estuarine waters. They commonly occur in virtually all of the Gulf's estuaries where they are found over a variety of substrates, including seagrass, sand, mud and oyster reefs. Types of habitat occupied depend upon the life stage of the fish. Spawning occurs from August to November near the mouths of bays and inlets, and on the Gulf side of the barrier islands. The eggs hatch mainly in the Gulf, and larvae are transported into the estuary where the fish mature before moving back to the Gulf. Juvenile red drum are found inshore until they attain roughly 75 cm (4 years), then they migrate to join the nearshore population. Adult red drum use estuaries but tend to spend more time offshore as they mature. Schools of large red drum are common in Gulf waters less than 70 m. Red drum feed on crustaceans, fish and mollusks, and may survive to 20 years or more (GMFMC, 2004; FWC, 2010).

4.2.3 Reef Fish Fishery

EFH for reef fish consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 100 fm (NMFS, 2008; GMFMC, 2005).

The GMFMC manages 43 species within the Reef Fish FMP, many of which have the potential to utilize the project area during some part of their life history. In general, reef fish are widely distributed in the Gulf of Mexico, occupying both pelagic and benthic habitats during their life cycle. Information is presented here only for some of the species which are most likely to occur in the project area. This is not a comprehensive list of species that may occur in the area, only a list highlighting a few of those most commonly found in this region.

4.2.3.1 Red Grouper (Epinephelus morio). The red grouper is demersal and occurs throughout the Gulf of Mexico at depths from approximately 3 - 200 m, preferring 30 - 120 m depths. It is most abundant off west Florida and the Yucatan coasts. Spawning occurs at depths of approximately 40 - 120 m on the Florida Banks between February and June, with peaks during April and May. Adults spawn offshore in coastal waters in depths of 20 -100 m. Eggs are pelagic and require at least 32 ppt salinity for buoyancy. Larvae leave the planktonic stage to become benthic at about 20 mm standard length. Juveniles live in shallow-water nearshore reefs. They prefer grass beds, rock formations, and shallow reefs. Late juveniles select inshore hardbottom to depths of about 50 m, seeking shelter in crevices and other hiding places. Favored nursery areas for juveniles are grass beds, rock formations, and shallow reefs. Juveniles remain in the nursery areas until mature before moving to deeper Gulf waters. Adults generally occur over flat rock perforated with solution holes and are commonly found in the caverns and crevices of limestone reef in the Gulf of Mexico. Adults select rocky outcrops, wrecks, reefs, ledges, crevices and caverns of rock bottom, as well as "live bottom" areas, in depths of 3-190 m (GMFMC, 2004; FWC, 2010).

4.2.3.2 Gag Grouper (Mycteroperca microlepis). Gag are demersal and most common in the eastern Gulf, especially the west Florida shelf. Adults occupy hardbottom substrates, including offshore reefs and wrecks, coral and live bottoms, and depressions and ledges. Spawning adults form aggregations in depths of 50 to 120 m, with the densest aggregations occurring around the Big Bend area of Florida. Spawning occurs along the west Florida shelf from December-April with a peak in the early spring (February-March). Madison-Swanson is a 298 square km (115 square mile) area, south of Panama City, Florida, containing high-relief hardbottom habitat, and is a known spawning ground for gag. The Madison-Swanson Fishery Reserve (a HAPC) is located over 30 miles offshore, well outside of the project area. Eggs are pelagic, occurring in December-April, with areas of greatest abundance offshore on the west Florida shelf. Larvae are pelagic and are most abundant in the early spring. Postlarvae and pelagic juveniles move through inlets into coastal lagoons and high salinity estuaries in April-May where they become benthic and settle into grass flats and oyster beds. Late juveniles move offshore in the fall to shallow reef habitat in depths of 1- 50 m. Adults are found in deeper waters (10-100 m) on hardbottoms, offshore reefs and wrecks, coral, and live bottom (GMFMC, 2004; FWC, 2010).

4.2.3.3 Gray Snapper (Lutjanus griseus). Gray snapper occur in estuaries and shelf waters of the Gulf and are particularly abundant off south and southwest Florida. The gray snapper is considered to be one of the more abundant snappers inshore, inhabiting waters to depths of about 180 m. Adults are demersal and mid-water dwellers, found in marine, estuarine, and riverine habitats. They occur up to 32 km offshore and inshore as far as coastal plain freshwater creeks and rivers. They are found among mangroves, sandy grassbeds, and coral reefs and over sandy, muddy and rocky bottoms. Spawning occurs offshore around reefs and shoals from June to August. Eggs are pelagic, and are present June through September, occurring in offshore shelf waters and near coral reefs.

Larvae are planktonic, occurring in peak abundance June through August in offshore shelf waters and near coral reefs from Florida through Texas. Postlarvae move into estuaries and are found especially over dense grass beds of *Halodule* and *Syringodium*. Juveniles are marine, estuarine, and riverine dwellers, often found in estuaries, channels, bayous, ponds, grassbeds, marshes, mangrove swamps, and freshwater creeks. They appear to prefer *Thalassia* grass flats, marl bottoms, seagrass meadows, and mangrove roots (GMFMC, 2004).

4.2.3.4 Lane Snapper (L. synagris). Lane snapper occur throughout the shelf area of the Gulf in depths ranging from 1 - 130 m. The species is demersal, occurring over all bottom types, but is most common in coral reef areas and sandy bottoms. Spawning occurs in offshore waters from March through September (peak July - August). Information on habitat preferences of larvae and postlarvae is non-existent and is in need of research. Nursery areas include the mangrove and grassy estuarine areas in southern Texas and Florida and shallow areas with sandy and muddy bottoms off all Gulf states. Early and late juveniles appear to favor grass flats, reefs, and soft bottom areas to offshore depths of 20 m. Adults occur offshore at depths of 4 - 132 m on sand bottom, natural channels, banks, and man- made reefs and structures (GMFMC, 2004).

4.2.4 Stone Crab Fishery

EFH for stone crab consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to Sanibel, Florida from estuarine waters out to depths of 10 fm; waters and substrates extending from Sanibel, Florida to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 15 fm (NMFS, 2008; GMFMC, 2005).

4.2.4.1 Florida Stone Crab (Menippe mercenaria) and Gulf Stone Crab (M. adina). Florida stone crab, *Menippe mercenaria*, and Gulf stone crab, *M. adina* comprise the stone crab fishery in the Gulf of Mexico. Gulf stone crabs are found from northwest Florida around the Gulf of Mexico to the state of Tamaulipus, Mexico. Florida stone crabs are found from west central Florida around the peninsula to east central Florida and North Carolina. An extensive hybrid zone where the ranges of the two interbreeding species meet occurs from the Big Bend area of Florida to west central Florida, and a smaller hybrid zone occurs from east central Florida through South Carolina. Mating sites have not been identified, but research has suggested that oyster reefs and seagrass beds may be important habitat for mating. Stone crabs spawn in spring to fall. Larvae are planktonic and are found in nearshore coastal waters and within estuaries. Juveniles

inhabit hiding places such as crevices in and beneath rock or shell. Adult stone crabs are benthic organisms and can be found from the shoreline out to depths of 61 m. They occupy a variety of habitats including burrows under rock ledges, coral heads, dead shell, or seagrass patches. Adults also inhabit oyster bars and rock jetties and are commonly found on artificial reefs where adequate refugia are present. Adult Gulf stone crabs are found on mud flats and oyster reefs in nearshore and estuarine areas. Adult Florida stone crabs live in seagrass beds or rocky substrate in higher salinity waters. Little is known about the movement and migration of stone crabs. They may move in response to environmental factors or seasons. Large males appear to move inshore in the fall to mate with molting females (GMFMC, 2004; NMFS, 2010).

4.2.5 Spiny Lobster Fishery

EFH for spiny lobster consists of Gulf of Mexico waters and substrates extending from Tarpon Springs, Florida to Naples, Florida between depths of 5 and 10 fathoms; waters and substrates extending from Cape Sable, Florida to the boundary between the areas covered by the GMFMC and the SAFMC out to depths of 15 fathoms (NMFS, 2008; GMFMC, 2005).

4.2.5.1 Caribbean Spiny Lobster (Panulirus argus). The spiny lobster fishery is managed throughout its range from North Carolina through Texas. The commercial fishery and a large proportion of the recreational fishery occur in waters offshore of south Florida, primarily off Monroe County, Florida in the Florida Keys. The principal habitat used by spiny lobster is offshore coral reefs and seagrass to depths of 80 m or more. Areas of high relief on the continental shelf serve as spiny lobster habitat and include coral reefs, artificial reefs, rocky hardbottom substrates, ledges and caves, sloping soft-bottom areas, and limestone outcroppings. Spiny lobster spawn in offshore waters along the deeper reef fringes. Adult males and females occasionally inhabit bays, lagoons, estuaries, and shallow banks; however, they are not known to spawn in these shallower areas. According to calculated levels of habitat use in the Gulf of Mexico by Spiny Lobster FMP species within eco-region 1 (Florida Keys to Tarpon Springs, FL), overall habitat use was highest for offshore reefs, estuarine SAV, nearshore SAV, nearshore hardbottom, and nearshore reefs (GMFMC, 2004).

4.2.6 Coral and Coral Reef Fishery

EFH for coral consists of the total distribution of coral species and life stages throughout the Gulf of Mexico including the East and West Flower Garden Banks, Florida Middle Grounds, southwest tip of the Florida reef tract, and predominant patchy hardbottom offshore of Florida from approximately Crystal River south to the Keys, and scattered along the pinnacles and banks from Texas to Mississippi, at the shelf edge (NMFS, 2008; GMFMC, 2005).

Prior to construction of the 2005/2006 Town of Longboat Key Beach Renourishment Project, nearshore hardbottom formations were mapped by Coastal Planning & Engineering, Inc. (CPE), including three formations between FDEP monuments R49.5 and R51.5 (Figures 2a-2d), comprising a total area of approximately 14 acres. The hardbottom formations are generally low relief (<2 ft) and some portions are ephemeral in nature. Biological monitoring revealed a community dominated by turf and macroalgae. The macroalgae community primarily consisted of *Hypnea, Gracilaria, Codium*, and *Sargassum* species. *Dictyota, Caulerpa*, and *Padina* species were also frequently observed. A total of 21 macroalgae genera were identified on the nearshore natural hardbottom throughout monitoring. Tunicates and sponges dominated the invertebrate community. The sponge community was found to mainly consist of the bioeroding sponges *Cliona celata* and *Pione lampa*. Coral cover in the nearshore benthic community was generally less than 1%. *Leptogorgia virgulata* and *Leptogorgia hebes* were the primary octocoral species encountered; the stony coral community included *Solenastrea* spp., *Siderastrea siderea, Phyllangia americana, Oculina robusta,* and *Cladocora arbuscula*. The average size of stony coral colonies in the nearshore habitat is small (< 3cm) (CPE, 2010).

A 1.5-acre artificial reef was deployed in 2005/2006 to mitigate for projected impacts from beach nourishment (Figure 2a). These installations were monitored simultaneously with the nearshore hardbottom in conjunction with the 2005/06 renourishment. By four years post-deployment, the artificial reefs appeared to have a benthic community that was functionally similar to the natural hardbottom: macroalgae-dominated with few stony corals (CPE, 2010).

Hardbottom resources in the vicinity of the offshore borrow areas were assessed by Continental Shelf Associates, Inc. (CSA) between August and December 2006 using towed video and *in situ* diver verification. The benthic resources in proximity to these borrow areras were characterized as having between 20% and 100% epibenthic cover (habitat A), 5% and 20% epibenthic cover (habitat B), and less than 5% epibenthic cover (habitat C); all are considered essential fish habitat (EFH) (CSA, 2007). Observations revealed hardbottom resources dominated by macroalgae and supporting some stony corals, including *Solenastrea hyades.* Macroalgae genera observed included *Caulerpa, Gracilaria, Codium, Halimeda* and *Hypnea. Caulerpa* was the most abundant macroalgae observed in the photo-documentation.

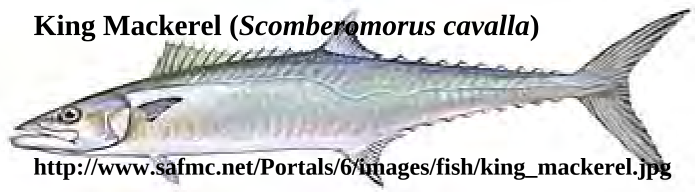
4.2.7 Coastal Migratory Pelagics (CMP) Fishery

EFH for CMP consists of Gulf of Mexico waters and substrates extending from the US/Mexico border to the boundary between the areas covered by the GMFMC and the SAFMC from estuarine waters out to depths of 100 fm (NMFS, 2008; GMFMC, 2005).

4.2.7.1 Cobia (Rachycentron canadum). Cobia is a pelagic species, living in the open ocean in tropical, subtropical, and temperate waters. They prefer to live near objects such as piers, buoys, boats, and platforms. In the Gulf of Mexico, cobia are found in coastal and offshore waters (from bays and inlets to the continental shelf) in depths between 1 - 70 m. Spawning occurs in coastal bays and estuaries from late summer to early fall in the Gulf of Mexico. Cobia migrate seasonally in the Atlantic and Gulf of Mexico. In the Gulf of Mexico, cobia annually migrate north in early spring to spawning grounds in the northern Gulf of Mexico, returning to the Florida Keys by winter. Adults feed on fishes and crustaceans, including crabs. Eggs are found in the top meter of the water column, drifting with the currents. Larvae are typically found in offshore waters of the northern Gulf of Mexico, where they likely feed on zooplankton. Juveniles occur in coastal and offshore waters feeding on small fishes, squid, and shrimp (GMFMC, 2004; NMFS, 2010).

4.2.7.2 King Mackerel (Scomberomorus cavalla). King mackerel occur in the Gulf of Mexico, with centers of distribution in south Florida and Louisiana. King mackerel are a "coastal pelagic" species, meaning they live in the open waters near the coast. They are found at depths of 38 - 197 m. Adults spawn over the outer continental shelf from May to October, with the northwestern and northeastern Gulf of Mexico considered important spawning areas. The pelagic eggs are found offshore over depths of 35 - 180 m in spring and summer. Larvae occur over the middle and outer continental shelf, principally in the north-central and northwestern Gulf. Juveniles are found from inshore to the middle shelf. Adults form large schools and are found over reefs and in coastal waters, although they rarely enter estuaries. Migrations to the northern Gulf in the spring are believed to be temperature dependent, and the species is found in waters >20°C. While adults can be found at the shelf edge in depths to 200 m, they generally occur in <80 m, at oceanic salinities from 32 - 36 ppt. Adults feed mostly on fishes, and less often on crustaceans and mollusks with a diet that includes jacks, snappers, grunts, halfbeaks, penaeid shrimp, and squid. Adult king mackerel are preyed upon by pelagic sharks, little tunny, dolphin, and bottlenose dolphin (GMFMC, 2004; NMFS, 2010).

King Mackerel (*Scomberomorus cavalla*)



http://www.safmc.net/Portals/6/images/fish/king_mackerel.jpg

4.2.7.3 Spanish mackerel (Scomberomorus maculatus). Spanish mackerel occur in the Gulf of Mexico, with their center of distribution off Florida. Adults spawn over the inner continental shelf from May to September, with the north-central and northeastern Gulf of Mexico considered important spawning areas. In the eastern Gulf of Mexico, Spanish mackerel spawn closer to shore and in shallower waters than king mackerel. The pelagic eggs are found over the inner continental shelf at depths <50 m in spring and summer. Larvae occur over the inner continental shelf, mainly in the northern Gulf. Juveniles occur in estuarine and coastal waters. Adults are found in inshore coastal waters (<75 m) and may enter estuaries in pursuit of baitfish. Spanish mackerel form immense, fast-moving schools that travel great distances. In the eastern Gulf of Mexico, they migrate to the west of Cape San Blas, Florida. They remain in the north until September and migrate south in the fall. Adults feed mostly on fishes, and less often on crustaceans and mollusks with a diet that includes clupeids, engraulids, carangids, and squid. Adult Spanish mackerel are preyed upon by large pelagics like sharks and tunas, and also bottlenose dolphin (GMFMC, 2004; NMFS, 2010).

4.2.8 Highly Migratory Species (HMS)

Most species found in Federal waters are managed by Fishery Management Councils (FMCs). These Councils, through NMFS, implement regulations for species in their area. However, HMS such as Atlantic tunas, swordfish, sharks, and billfish are different in that they are found throughout the Atlantic Ocean and must be managed on domestic and international levels. Due to these concerns, on November 28, 1990, the President of the United States signed into law the Fishery Conservation Amendments of 1990 (Pub. L. 101-627) (NMFS, 2010b). According to NMFS, identifying EFH for tuna, swordfish and many pelagic shark species is challenging

because, although some HMS may frequent the neritic waters of the continental shelf as well as inshore areas, they are primarily blue-water (i.e., open-ocean) species. Most of these species frequent coastal and estuarine habitats during various life stages and travel over great horizontal distances, commonly migrating vertically within the water column (NMFS, 1999).

Due to the variety of habitats utilized by most HMS during various life stages, most HMS have the potential to occur somewhere in the project area. Essential Fish Habitat for HMS was updated in the Final Amendment 1 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan (NMFS, 2009). Tuna, swordfish and billfish EFH is located offshore; however some shark species have EFH designated in nearshore waters of the Gulf of Mexico within the project vicinity. Table 7 lists HMS which have life stages with designated EFH located in the project area. A complete listing of the HMS EFH definitions for these species is provided as Appendix 2. No HMS HAPC exists in the project vicinity (NMFS, 2009).

Table 7. HMS EFH in the Project Area (NMFS, 2009).

SPECIES	LIFE STAGES WITHIN PROJECT AREA
Great Hammerhead	Neonate/YOY, Juveniles, and Adults
Scalloped Hammerhead	Neonate/YOY, Juveniles, and Adults
Nurse Shark	Juveniles and Adults
Blacktip Shark	Neonate/YOY, Juveniles, and Adults
Bull Shark	Neonate/YOY, Juveniles, and Adults
Lemon Shark	Neonate/YOY, Juveniles, and Adults
Sandbar Shark	Adults
Silky Shark	Neonate/YOY, Juveniles, and Adults
Spinner Shark	Neonate/YOY, Juveniles, and Adults
Tiger Shark	Juveniles and Adults
Blacknose Shark	Neonate/YOY, Juveniles, and Adults
Bonnethead Shark	Neonate/YOY, Juveniles, and Adults
Atlantic Sharpnose	Neonate/YOY, Juveniles, and Adults

Notes: YOY = Young of the year

5.0 ASSESSMENT OF IMPACTS

This section assesses potential impacts to EFH and managed fish species that may occur as a result of the Longboat Key Beach Renourishment Project. There are two primary drivers of impacts to EFH: 1) dredging of borrow areas, and 2) placement of fill (Table 8). These two main factors drive potential impacts to EFH and managed species including sedimentation and turbidity, burial of resources, entrainment, possible contamination, physical injury to resources and noise.

Table 8. Summary of potential and anticipated impacts from project activities.

ACTIVITY	ESTUARINE WATER COLUMN	ESTUARINE SUBSTRATE	SUBMERGED AQUATIC VEGETATION	MARINE WATER COLUMN	MARINE NON-VEGETATED BOTTOM	MARINE LIVE BOTTOM
Dredging of Borrow Areas F2 and B3				• Potential entrainment • Temporary noise disturbance • Temporary elevated turbidity	• Removal of benthic fauna/infauna • Physical impacts to sediment • Temporary elevated turbidity and sedimentation	• Potential temporary elevated turbidity
Dredging of Borrow Areas IX and X, and Rehandling Areas	• Potential temporary elevated turbidity and sedimentation in Tampa and Sarasota Bays • Potential Entrainment • Temporary noise disturbance	• Potential sedimentation in Tampa and Sarasota Bays • Removal of benthic fauna/infauna • Physical impacts to sediment	• Potential sedimentation and temporary elevated turbidity over SAV in Tampa and Sarasota Bays	• Potential entrainment • Temporary noise disturbance • Temporary elevated turbidity	• Removal of benthic fauna/infauna • Physical impacts to sediment • Temporary elevated turbidity and sedimentation	• Potential temporary elevated turbidity
Placement of Beach Fill	• Sedimentation and temporary elevated turbidity (at the north end)	• Potential sedimentation (at the north end)	• Potential temporary elevated turbidity and sedimentation over SAV (at the north end)	• Temporary elevated turbidity • Temporary noise disturbance	• Burial of benthic fauna/infauna • Temporary elevated turbidity and sedimentation	• Temporary elevated turbidity and sedimentation outside ETOF • Burial and sedimentation from fill equilibration inside ETOF

5.1 Dredging of Borrow Areas

5.1.1 Direct Impacts

5.1.1.1 Removal of benthic fauna/infauna. Removal of sediment from the borrow areas will directly impact the marine non-vegetated bottom found there. Most epibiotal and demersal fish populations would have a low probability of being adversely impacted directly by the dredging of surficial sediments, as most demersal populations exhibit naturally dynamic distributions and are distributed over a wide geographic area (LFR, 2004; Greene, 2002). However, dredging has a direct biological impact by removing benthic infaunal and epifaunal assemblages found within and on the surficial sediments in the borrow area (Culter and Mahadevan, 1982; Greene, 2002). Benthic organisms are an important food source for finfish, shrimp and other invertebrates, so removal of the non-vegetated bottom sediment will impact those managed fish species which prey on benthic resources (GMFMC, 2004). A reduction of infaunal biomass resulting from sediment removal could have an indirect effect on the distribution of certain demersal fishes and other epibenthic predators by interrupting established energy pathways to the higher trophic levels represented by these foraging taxa. The benthic community is critical to the health of higher trophic levels and serves as an important indicator of the effects of dredging (Gulland, 1970).

However, impacts to benthic fauna and the resulting indirect impacts to fishes which prey on these species will likely be temporary. Studies have shown that though recovery rates are variable, the abundance and diversity of benthic fauna within the borrow areas frequently returns to pre-nourishment levels relatively quickly, often within one year post-dredging recovery periods (NRC, 1995; Greene, 2002; Blake *et al.*, 1996). Most studies indicate that dredging had only temporary effects on the infaunal community, and in some studies, differences in infaunal communities were attributed to seasonal variability or to hurricanes rather than to dredging (Posey and Alphin, 2000). Impacts to fish species that prey on infauna will be dependent on the time for infauna resources to recover; these impacts are likely to be localized and short-term, lasting less than one year.

5.1.1.2 Physical impacts to sediment. Dredging may also potentially cause physical impacts to the marine non-vegetated bottoms, such as lower sand content, poorer sorting, and a higher organic content. However, these physical effects have also been observed to be temporary, with borrow area sediments resembling undisturbed areas after a period of only one year (Blake *et al.*, 1996). The impacts on sediments at the dredging site may also include increased post-dredging sedimentation in the newly deepened areas for new work projects and possible slumping of materials from the sides of the dredging areas (LFR, 2004). Impacts to the marine non-vegetated bottom from borrow area dredging will be temporary, with the physical characteristics of the borrow area sediments likely returning to pre-dredging conditions in as soon as one year.

5.1.1.3 Entrainment. The operation of the dredge will directly impact those species which typically utilize the non-vegetated bottom and water column in that area. Entrainment occurs when organisms are trapped during the uptake of sediments and water by dredging machinery. Benthic infauna are particularly vulnerable to being entrained by dredging uptake, but motile epibenthic and demersal organisms such as burrowing shrimp, crabs, and fish may also be susceptible to entrainment under some conditions (Nightingale and Simenstad, 2001). Greene (2002) reviewed studies on impacts to shrimp by dredge entrainment, and found that the number of postlarval shrimp entrained by dredging was inconsequential when compared to overall penaeid shrimp production. Physical injury through entrainment of adult fishes by hydraulic dredging has been reported (Larson and Moehl, 1988; McGraw and Armstrong, 1990; Reine *et al.*, 1998). Most entrained fishes were demersal species such as flatfishes, sand lance, and sculpin; however, three pelagic species (anchovy, herring, and smelt) were recorded. Entrainment rates for the pelagic species were very low, ranging from 1 to 18 fishes/1,000 cy (McGraw and Armstrong, 1990). Comparisons between relative numbers of entrained fishes with numbers captured by trawling showed that some pelagic species were avoiding the dredge. Few of the coastal pelagic fishes occurring offshore of Florida should become entrained because the dredge's suction field exists near the bottom and many pelagic species have sufficient mobility to avoid the suction field. Entrainment of biota is expected to be a minor, localized impact lasting only as long as the duration of dredge operations. Impacts to any managed species are expected to be insignificant.

5.1.1.4 Noise disturbance. Noise from dredge operations may impact the water column EFH for all species that occur in the project area. Noise associated with dredging may affect organisms in several ways. Noise has been documented to influence fish behavior and has been hypothesized to interrupt migrations (Thomsen *et al*., 2009). Fish detect and respond to sound utilizing cues to hunt for prey, avoid predators, and for social interaction (LFR, 2004). Some reef fish larvae have been shown to respond to sound stimuli as a sensory queue to settlement sites (Stobutzki and Bellwood, 1998; Tolimieri *et al.*, 2000). Alterations of background noise may impair the ability of newly settled fishes to locate preferred substrate. Changes in noise levels also may affect feeding or reproductive activities of reef fishes that depend on sound for these activities (Myrberg and Fuiman, 2002). High intensity sounds can also permanently damage fish hearing (Nightingale and Simenstad, 2001). Dredging operations generally produce lower levels of sound energy and often last around the clock for extended periods of time (Nightingale and Simenstad, 2001). Due to the short duration of this dredging project, the impacts of underwater noise on fish populations are expected to be temporary and localized. However, more research is required before the effect of dredging noise on fishes can be fully evaluated (Nightingale and Simenstad, 2001).

The disturbance caused by the presence and operation of construction equipment will likely deter species of reef fish, coastal migratory pelagic species, HMS, and motile invertebrates such as crabs and lobsters that are common to that area. Fish and other motile species which might otherwise be found in the immediate area of the dredge operations are able to leave and avoid temporarily impacted areas, and will return to the area following completion of dredging (Adriaanse and Coosen, 1991). Direct impacts to the marine water column EFH due to disturbance caused by borrow area dredging should be temporary, lasting only for the duration of dredge operations.

5.1.2 Indirect Impacts

5.1.2.1 Turbidity and sedimentation. Dredging within the offshore borrow areas and nearshore rehandling areas will likely utilize a trailing suction hopper dredge (TSHD), causing temporary increased turbidity around the dredge during project operations. For TSHDs, increases in turbidity from dredging can be generated from the draghead on the seafloor and from the discharge of hopper overflow (Baird & Associates Ltd., 2004). Sediments are suspended at the draghead during the process of removing sediments from the seafloor. Suspended sediments from dredging operations are usually confined to the immediate vicinity of the draghead and do not reach the surface (LaSalle *et al.*, 1991). Dredging of the borrow areas and rehandling areas using a hopper dredge will impact the marine water column and marine non-vegetated bottoms within and around the borrow areas, although in the sandy substrates typical of borrow sites, the extent of suspended sediments is likely to be very restricted (Baird & Associates Ltd., 2004).

Using a hopper dredge for dredging BA-X and portions of BA-IX may be precluded by the shallow nature of these borrow areas or portions thereof. The sand from these borrow areas will thus be double-handled using either a shallow-draft hopper dredge or cutter suction dredge (CSD) and deposited by bottom dumping using a hopper, or discharging from a vertically oriented cutterhead discharge pipe into rehandling areas. The sand would be deposited in these areas, to be re-dredged and transported to the beach pipeline by a deeper-draft, medium or large hopper dredge. The turbidity associated with hopper dredges is discussed in the paragraph above. Turbidity plumes generated by CSDs, however, are confined to near bed re-suspension around the cutterhead and are generally more confined than plumes created by hopper dredges (Baird & Associates Ltd., 2004). Should a hopper be used to dump sediment from these borrow areas into the rehandling areas, the resultant water-column turbidity would likely be, temporarily, higher than using a vertically oriented cutterhead pipe to discharge into the rehandling areas. However, the duration of rehandling would be shorter than using a cutterhead discharge pipe.

Dredge-related sediment plumes can divert pelagic fishes from normal migratory routes, feeding grounds, or spawning areas. The turbidity surrounding the dredge may reduce visibility, temporarily impact the ability of reef fish, CMP and HMS to locate prey in the area, but most fish species can move outside the areas of elevated turbidity for the duration of dredging and can return to forage in the area following conclusion of dredging. Suspended sediments can have other impacts, including abrasion of the body and clogging of the gills (LFR, 2004). Studies have shown that suspended sediments can cause changes in respiration rate, choking, coughing, abrasion, and puncturing of structures (e.g., gills/epidermis) reduced water filtration rates, and reduced response to physical stimulus (Anchor Environmental, 2003). In another study, turbidity was believed to cause excessive mucus secretion, excretory interference, and respiratory interference, adaptations that either prevent or permit survival (Wallen, 1951; LFR, 2004). Elevated turbidity is typically limited to the period of dredging activity. Once dredging is finished, though, water quality is usually restored (Greene, 2002).

In hardbottom habitats, the greatest potential impacts are from sediment deposition, which could bury organisms, clog filter-feeding organisms such as sponges, cause corals to expend energy producing mucous to clear sediment from their surfaces, and reduce hard surface area available for recruitment (Baird & Associates Ltd., 2004). A monitoring study conducted during the South Siesta Key Renourishment Project, located just south of Longboat Key, examined potential impacts to hardbottom resources located near four offshore borrow areas. Each borrow area was designed to include a buffer area of at least 400 ft between dredging boundaries and hardbottom resources. Results of this study found that sedimentation from dredging activities did not have a significant effect on hardbottom resources and benthic communities located near the offshore borrow areas (CPE, 2007). Large expanses of hardbottom are present around BA-F2 and BA-B3. This hardbottom provides EFH for species within the Reef Fish Fishery and the Coral and Coral Reef Fishery. However, with the exception of the Port Dolphin pipeline route, 400-ft buffer zones have been implemented in the design of these borrow areas. Although a 300-m mixing zone has been proposed that will extend over the hardbottoms, based on results of previous projects these resources are not anticipated to be impacted. A 400-ft buffer has also been designed around the nearshore borrow areas and rehandling areas, though no hardbottom resources have been observed near these areas. There are, however, several small areas of rubble/debris mounds discovered in the investigation area; the closest of these small rubble/debris mounds occurs 750 ft south of RA-2.

Direct impacts from increased turbidity on sessile organisms can include abrasion, clogging of respiratory organs and filter-feeding appendages, and interference with feeding, growth, or respiration (Berry *et al.*, 2003). In extreme cases, resettled sediments could smother benthic organisms, although many benthic invertebrates would be able to burrow vertically through resettled sediments (Berry *et al.*, 2003). Potential indirect impacts on soft-bottom benthic organisms, seagrasses, and macroalgae would be associated primarily with light attenuation caused by suspended sediment particles. This, in turn, could affect the feeding efficiency and behavior (e.g., avoidance of predators) of benthic organisms, or alter habitat by changing substrate composition. Increases in turbidity could also cause a decrease in photosynthesis in macroalgae and seagrasses. Either of these impacts could change the distribution of infaunal and epifaunal species (Berry *et al.,* 2003). Greene (2002) reviewed several early studies that examined infaunal response to increased turbidity and sedimentation and found the following: suffocation of benthic organisms from heavy silt loads; difficulty in locating and capturing food by filter feeders as a result of increased non-nutritive particles in suspension; reduced macroalgal production for the duration of dredging; changes in water chemistry; and decreased light penetration for SAV. Borrow Areas F2 and B3 are far enough offshore that sedimentation from dredging is not anticipated to reach the estuarine waters of Longboat Pass and nearby SAV, or any of the managed species found there such as shrimp, crabs and the numerous species of reef fish, CMP and HMS that utilize SAV as nursery grounds. Dredging and rehandling of the nearshore borrow areas could, however, introduce turbidity plumes into Tampa Bay and potentially the northern portion of Sarasota Bay, which supports extensive areas of SAV.

The borrow areas being utilized for the interim project have all been selected for the similarity of the sediment to native beach sediment; this sand has a low silt content, which will reduce turbidity around the dredge during dredge operations. The temporary increased turbidity will be limited to the 300-m mixing-zone around the dredge operating within each borrow area. The extent of the turbidity plume generated would depend on the amount of sediment disturbed, the grain size and weight of the disturbed sediment particles and the ambient current dynamics. Coarser, heavier sediment particles would resettle quickly (e.g., within hours), while finer, lighter sediment particles would remain suspended for longer periods of time (e.g., days).

Natural turbidity around the Longboat Key project area during average conditions is in the 2-12 NTU range (Hanes and Stubbs, 1994). During higher wave conditions, turbidity values ranging from 30-65 NTUs can occur (Hanes and Stubbs, 1994). Beach nourishment permits granted by the Florida Department of Environmental Protection and the U.S. Army Corps of Engineers typically require the contractor to limit increases in turbidity to 15 or 29 NTUs above background levels. During the 1996-1997 project on Longboat Key, the turbidity never exceeded 15 NTUs above background at the borrow area (CPE, 1996). During 2001 project, the turbidity exceeded 15 NTUs only 9% of the time at the borrow area. The 1993, 1996-1997, 2001 and 2005-2006 projects never generated turbidity in excess of 29 NTUs above background levels (Hanes and Stubbs, 1994; CPE, 1996, 2001, 2006). It is expected that turbidity-related impacts to EFH and the species that utilize these habitats will be localized and temporary, with water quality returning to natural conditions following conclusion of dredge operations (Greene, 2002).

5.1.2.2 Unanticipated impacts. During the dredging process accidental leaks and spills of fuel, lubricants, and other contaminants from dredges, scows, and work vessels could occur. The minor releases of these types of contaminants could result in short-term and long-term, minor, direct adverse impacts on the water column, soft-bottom, and live-bottom EFH. The proposed nourishment activities will dredge sediments that have been approved for disposal on the beach, partly on the assumption of very low pollutant concentrations and negligible toxicity. Accordingly, the proposed project is not expected to have significant impacts on water resources related to chemical pollutants.

The construction equipment would be governed by Coast Guard regulations, including the recently-promulgated Vessel General Permit, that address the use and control of potential pollutants on vessels and specify the response to accidental releases. Ships can discharge oily wastes in U.S. territorial water only when the vessel is underway more than 12 nautical miles from land and only after processing the oily waste through an oil-water separator, resulting in an effluent that does not exceed 15 parts per million and does not cause a visible sheen. Ships can retain bilge water onboard when in port or deposit untreated bilge water into a pipe line, slop barge, or tank truck which carries the wastewater to a licensed wastewater treatment plant capable of treating oily wastewater (USACE, 2006). Nevertheless, accidental releases of chemical pollutants from construction equipment may occur. Accidental discharges have typically been small volumes (USACE, 2006), and it is reasonable to assume that the increased potential for accidental discharges would have a minimal impact to surface water quality.

5.2 Placement of Fill in Nearshore Environment

5.2.1 Direct Impacts

5.2.1.1 Burial of benthic fauna/infauna. Placement of beach fill also impacts the non-vegetated bottom, directly burying benthic organisms in the nearshore marine environment as the beach is widened. Effects of burial are dependent on sediment type, depth of sediment, and the size and behavior of infaunal or epifaunal organisms (including the species' ability to burrow and species' mobility) (SCDNR, 1995). Direct burial results in mortality to sessile or attached animals, while some motile species can survive by moving either horizontally outside the placement area, or vertically to the surface of the placement fill (Blake *et al.*, 1996; NRC, 1995). Mortality during sedimentation has been found to depend on a species' ability to burrow through redeposited sediments and the rate at which sediment is deposited (IMG, 2004). In laboratory experiments, most estuarine infaunal species were able to survive burial to depths of 20 cm or more. If the bottom is covered with greater than 0.5 m of sand, most of the benthic fauna will be unable to move up through the placed fill (Adriaanse and Coosen, 1991).

However, fauna inhabiting the shallow nearshore marine habitat in the project area are adapted to a dynamic environment and therefore the recovery of these communities can take place relatively quickly (Nelson, 1993). A review of infaunal studies revealed that invertebrate recovery following placement of dredged material in relatively stable, unstressed marine environments generally takes between one and four years, while recovery in more naturally stressed areas is faster, often achieved within nine months (Bolam and Rees, 2003). A study conducted in Brevard County, Florida found that distribution, abundance and diversity of nearshore benthic fauna did not experience significant negative effects following beach nourishment (Gorzelany and Nelson, 1987). Most studies that did find impacts to nearshore infaunal communities generally found only limited or short-term alterations in the abundance, diversity and species composition (NRC, 1995). The quality of the dredged material used for project activities will be similar to that of the native beach, and therefore, of the subtidal marine environment. The similarity of the dredged sediment to the native sediment will aid in the recovery of the benthic communities impacted by the placement of the fill material. Impacts to the marine non-vegetated bottom EFH as a result of placement of beach-compatible sediment in the nearshore marine habitat will be temporary, with recovery of the benthic community expected to occur within nine months to four years following the beach nourishment project.

5.2.1.2 Noise disturbance. Disturbance caused by the construction operations necessary for placement of fill in the nearshore marine environment will temporarily impact those species which typically utilize the water column in that area. Refer to Section 5.1.1.4 for a description of potential impacts caused by noise disturbance during dredge operations.

5.2.2 Indirect Impacts

5.2.2.1 Turbidity and sedimentation. The discharging of effluent is expected to create some degree of construction-related turbidity in excess of the natural condition in the proximity of the placement site. The mixing zone for the fill placement area will extend 250 m offshore and 1,000 m downcurrent from the point of discharge into the Gulf of Mexico. Placement of fill at the northern end of Longboat Key may cause temporary elevated turbidity within Longboat Pass; this may, in turn temporarily impact estuarine waters, estuarine substrates and possibly SAV located in Sarasota Bay. Placement of dredged material along the shoreline will cause temporary increased turbidity in the nearshore marine environment, which will temporarily impact marine water column, marine non-vegetated bottom, and nearshore hardbottom (including artificial reef habitat) (Figures 2a-2d). However, during construction of the project, fish and other motile species can avoid most of the direct effects of beach nourishment by temporarily leaving impacted areas and traveling to other suitable areas. These species can return to these areas following conclusion of construction activity. Surveys of nearshore fish populations conducted in Florida before and after beach nourishment showed no evidence of any adverse impacts on the abundance and composition of the fishes sampled (NRC, 1995). Refer to Section 5.1.2.1 for additional information on impacts of turbidity and sedimentation on estuarine and marine habitats.

Project nourishment activities will utilize offshore sand that has been selected for its similarity to native beach sediment; using sand with a comparable composition (and low silt content) will reduce turbidity in the fill placement area. Effects of increased turbidity in the nearshore marine environment will be limited, as this area is already a dynamic habitat accustomed to wave action in the breaker zone (Adriaanse and Coosen, 1991). These impacts are expected to be temporary, with suspended particles settling out within a short time without measurable effects on water quality. During construction, turbidity levels will be monitored at the placement sites in order to ensure compliance with FDEP's Water Quality Certification.

Natural turbidity around the project area during average conditions is in the 2 to 12 NTU range (Hanes and Stubbs, 1994). During higher wave conditions, turbidity values ranging from 30-65 NTUs can occur (Hanes and Stubbs, 1994). During the 1993 beach nourishment project on Longboat Key, turbidity increases at the beach fill area were on the order of 4 NTUs, with a maximum value of 12 NTUs (Hanes and Stubbs, 1994). During the 1996-1997 Mid-Key Interim Nourishment Project on Longboat Key, average observed turbidity increase at the beach fill area was 10 NTUs, and the maximum observed turbidity was 27 NTUs (CPE, 1996). During the 2001 beach fill project on Longboat Key, average turbidity in the beach fill area was 5 NTUs and the maximum turbidity increase was 15 NTUs (CPE, 2001). The 1993, 1996-1997, 2001 and 2005-2006 projects never generated turbidity in excess of 29 NTUs above background levels (Hanes and Stubbs, 1994; CPE, 1996, 2001, 2006).

The likelihood of turbidity remaining above background levels after a renourishment project is low. The 1993 beach nourishment project on Longboat Key used fine sand with a mean grain size on the order of 0.20 mm (CPE, 1995). Turbidity was sampled extensively by Hanes and Stubbs (1994) for a 1-year period following the project's completion. Differences between the turbidity along the project area and the turbidity at nearby Siesta Key and St. Petersburg Beach were insignificant (Hanes and Stubbs, 1994). Direct impacts to the marine water column EFH and the species which utilize this habitat as a result of disturbance by construction activities in the nearshore marine habitat will be localized and temporary, lasting only as long as the construction of the project.

5.2.2.2 Fill equilibration. The proposed nourishment activities will first place approximately 310,000 cy of fill, and then approximately 865,000 cy of fill along Longboat Key between 2011 and 20114 (or later). It is anticipated that up to 1.5 ac of re-exposed hardbottom would be buried from equilibration of fill. As mitigation for the anticipated impacts from the 2005/06 project, 1.5 acres of artificial reef were constructed. The proposed nourishments will place fill within the 2005/06 template, which would result in re-burial of the hardbottom resources that have previously been mitigated for.

Impacts from fill equilibration over hardbottom may include burial of sessile organisms such as corals and sponges. Colonization of hardbottom organisms could also be reduced by covering potential substrate and burying newly settled juveniles (IMG, 2004). Nearshore hardbottom in Florida also provides habitat for early life stages of fish including newly settled, early juvenile, and juvenile fish. Lindeman and Snyder (1999) found that 80% of all individuals observed in the nearshore habitat were early life stages. This study also suggested that use of the nearshore habitat may be bidirectional as a primary nursery for incoming early life stages that would be subject to increased predation mortality without shelter and as a secondary nursery habitat for juveniles that emigrate out of inlets towards offshore reefs. Pre- and post-nourishment surveys conducted by Lindeman and Snyder (1999) determined that burial of nearshore hardbottom reduced individual and species abundance by over 30 and 10 times, respectively, one year after nourishment. Species such as red grouper, stone crabs, stony coral and octocorals which are commonly found on nearshore hardbottom resources near Longboat Key may be impacted by fill equilibration due to loss of habitat (CPE, 2010); however, the 1.5 acres of artificial reef already built as mitigation for impacts to this habitat will not be impacted by this project. This artificial reef provides similar habitat to the nearshore habitat it is meant to replace, and therefore impacts to species will be minimal.

5.2.2.3 Unanticipated impacts. Refer to Section 5.1.2.2 for a description of potential impacts to EFH from pollutant discharge associated with this project.

There is also potential for impacts to nearshore hardbottom resources from placement of beach discharge pipelines. Eight pipeline corridors were cleared as no-impact corridors during the last (2005/06) island-wide beach renourishment project that may be utilized for the proposed project actions. The pipeline corridors extend from the shoreline out to the 30 ft depth contour and range in width from 400 ft to 2500 ft. Although the corridors are primarily softbottom, sidescan sonar surveys revealed several patches of hardbottom within the corridors; however, the contractor will be instructed to avoid these resources in a manner that was successfully implemented in 2005/06. As such, impacts from pipeline placement are not anticipated.

6.0 CONCLUSIONS

Motile fish (Red Drum, Reef Fish, CMP and HMS) that utilize the water column have the ability to temporarily avoid areas of dredging and fill placement, and will return to these areas following construction. Other motile species such as crabs and lobsters also have the ability to avoid disturbance by construction activities. The number of fish that may be entrained or experience physical damage from dredging is insignificant and, as such, these fisheries will not be adversely impacted. Benthic fauna within the non-vegetated bottom habitat will be removed from borrow areas and buried in fill placement areas, but studies have shown that impacts are temporary, and that recovery of benthic communities in both areas occurs quickly. There may be potential cumulative impacts from multiple, repetitive nourishment projects on Longboat Key, but the spacing between projects is approximately 4-8 years, depending on the severity of erosion at certain portions of shoreline each year, which has been shown to be enough time to allow recovery of softbottom communities between projects. Increased turbidity at the dredge and fill placement sites will also be temporary, lasting only as long as construction. It is unlikely that turbidity will impact estuarine EFH, and species such as shrimp that utilize this habitat; but if currents do extend turbidity from sand placement at the north end of Longboat Key or from dredging and rehandling of nearshore borrow areas into estuarine habitat, impacts should be minimal and short-term. Hardbottom habitat, which includes some coral species, is located within the project area. Nearshore hardbottom may be impacted by fill equilibration, but 1.5 acres of artificial reef have already been constructed to mitigate for impacts to this habitat. Impacts to offshore hardbottom is not anticipated. Based upon the project design and the minimal short-term impacts associated with dredging and fill placement, adverse effects to managed species from this project are not expected to be significant and effects to EFH have already been mitigated for.

7.0 LITERATURE CITED

Adriaanse, L.A. and J. Coosen, 1991. Beach and dune nourishment and environmental aspects. *Coastal Engineering,* 16: 129-146.

Anchor Environmental LLC, 2003. Literature review of effects of resuspended sediments due to dredging operations. iii+87 pp.+App. A-C. June. Prepared for Los Angeles Contaminated Sediments Task Force.

Baird & Associates Ltd., 2004. Review of existing and emerging environmentally friendly offshore dredging technologies. Prepared for Minerals Management Service, U.S. Department of Interior, Herndon, Virginia, July, 2004. *OCS Study MMS 2004-076*, 441 p.

Berry, W., N. Rubinstein, B. Melzian, and B. Hill, 2003. The Biological Effects of Suspended Sediment (SABS) in Aquatic Systems: A Review. An Internal USEPA Report.

Blake, N.J.; L.J. Doyle, and J.J. Culter, 1996. Impacts and Direct Effects of Sand Dredging for Beach Renourishment on the Benthic Organisms and Geology of the West Florida Shelf, Final Report. Herndon, VA: U.S. Department of the Interior, Minerals Management Service, Office of International Activities and Marine Minerals, *OCS Report MMS 95-0005*, 109 p.

Bolam, S.G. and H.L.Rees, 2003. Minimizing impacts of maintenance dredged material disposal in the coastal environment: a habitat approach. *Environmental Management,* 32(2): 171-188.

Coastal Planning & Engineering, Inc. (CPE), 1995. Town of Longboat Key Comprehensive Beach Management Plan, Prepared for the Town of Longboat Key, November 1995. Coastal Planning & Engineering, Inc., Boca Raton, FL.

Coastal Planning & Engineering, Inc. (CPE), 1996. Letter to Paden Woodruff, Florida Department of Environmental Protection, December 8, 1996.

Coastal Planning & Engineering, Inc. (CPE), 2001. Town of Longboat Key, April 2001 Beach Nourishment Project, Project Completion Report, Coastal Planning & Engineering, Inc., Boca Raton.

Coastal Planning & Engineering, Inc. (CPE), 2006. Town of Longboat Key, April 2005-2006 Beach Nourishment Project, Project Completion Report, Coastal Planning & Engineering, Inc., Boca Raton.

Coastal Planning & Engineering, Inc. (CPE), 2007. South Siesta Key Beach Renourishment Project: Year-One Post-Construction Biological Monitoring Report. Boca Raton, Florida. 94 p. (Prepared for Sarasota County).

Coastal Planning & Engineering, Inc. (CPE). 2008. Town of Longboat Key Comprehensive Beach Management Plan, 2008 Update, Prepared for the Town of Longboat Key, February 2008. Coastal Planning & Engineering, Inc., Boca Raton, Florida.

Coastal Planning & Engineering, Inc. (CPE), 2010. Town of Longboat Key, 2005/06 Beach Renourishment Project Fourth Post-Construction Hardbottom Monitoring and Mitigation Report. Boca Raton, Florida. 44 p. (Prepared for the Florida Department of Environmental Protection).

Culter, J.K. and S. Mahadevan, 1982. Long-term effects of beach nourishment on the benthic fauna of Panama City, Florida. U.S. Army Corps of Engineers, Coastal Engineering Research Center, Miscellaneous report No. 82-2.

Florida Fish and Wildlife Conservation Commission (FWC), 2010. Species Information: Saltwater Fish Identification. http://myfwc.com/wildlifehabitats/SaltFishID.htm. Last accessed March 5, 2010.

Greene, K., 2002. Beach Nourishment: A Review of the Biological and Physical Impacts. *Atlantic States Marine Fisheries Commission (ASMFC) Habitat Management Series #7, November 2002*, 174 p.

Gulf of Mexico Fishery Management Council (GMFMC), 1998. *Generic Amendment for Addressing Essential Fish Habitat Requirements in the following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, United States Waters, Red Drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico, Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic, Stone Crab Fishery of the Gulf of Mexico, Spiny Lobster in the Gulf of Mexico and the South Atlantic, Coral and Coral Reefs of the Gulf of Mexico*. Gulf of Mexico Fishery Management Council, National Oceanic and Atmospheric Administration.

Gulf of Mexico Fishery Management Council (GMFMC), 2004. *Final Environmental Impact Statement for the Generic Essential Fish Habitat Amendment to the following fishery management plans of the Gulf of Mexico (GOM): Shrimp Fishery of the Gulf of Mexico; Red Drum Fishery of the Gulf of Mexico; Reef Fish Fishery of the Gulf of Mexico; Stone Crab Fishery of the Gulf of Mexico; Coral and Coral Reef Fishery of the Gulf of Mexico; Spiny Lobster Fishery of the Gulf of Mexico and South Atlantic; Coastal Migratory Pelagic Resources of the Gulf of Mexico and South Atlantic*. Gulf of Mexico Fishery Management Council. Tampa, FL. March 2004.

Gulf of Mexico Fishery Management Council (GMFMC), 2005. *Final Generic Amendment Number 3 For Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing in the following Fishery Management Plans of the Gulf of Mexico: Shrimp Fishery of the Gulf of Mexico, United States Waters; Red Drum Fishery of the Gulf of Mexico; Reef Fish Fishery of the Gulf of Mexico; Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic; Stone Crab Fishery of the Gulf of Mexico; Spiny Lobster in the Gulf of Mexico and South Atlantic; Coral and Coral Reefs of the Gulf of Mexico.* Gulf of Mexico Fishery Management Council. Tampa, FL. March 2005.

Gulland, J.A., 1970. Food chain studies and some problems in world fisheries. In: J.H. Steels, Marine food chains. Oliver and Boyd, Edinburgh, England. P. 296-515.

Gorzelany, J.F. and W.G. Nelson, 1987. The effects of beach replenishment on the benthos of a sub-tropical Florida beach. *Marine Environmental Research*, 21: 75-94.

Hanes, Daniel M., Darwin, Stubbs, 1994. Sedimentation, Turbidity, and Wave Monitoring: Longboat Key, Florida, University of Florida, Gainesville.

IMG-Golder Corporation (IMG), 2004. *Report on Review of Potential Effects of Dredging in the Beaufort Sea*. Submitted to Fisheries and Oceans Canada. 04-1337-006. June 2004.

Larson, K.W. and C.E. Moehl, 1988. Entrainment of Anadromous Fish by Hopper Dredge at the Mouth of the Columbia River. In: C.A. Simenstad (ed.), Effects of Dredging on Anadromous Pacific Coast Fishes, Workshop Proceedings, University of Washington Sea Grant, pp. 102-112.

LFR Levine-Fricke (LFR), 2004. Framework for Assessment of Potential Effects of Dredging on Sensitive Fish Species in San Francisco Bay - Final Report. Prepared for U.S. Army Corps of Engineers, San Francisco District, San Francisco, California. August 5, 2004.

Lindeman, K.C. and D.B. Snyder, 1999. Nearshore hardbottom fishes of southeast Florida and effects of habitat burial caused by dredging. *Fisheries Bulletin* 97: 508-525.

McGraw, K.A. and D.A. Armstrong, 1990. Fish Entrainment by Dredges in Grays Harbor, Washington. In: C.A. Simenstad (ed.), Effects of Dredging on Anadromous Pacific Coast Fishes, Workshop Proceedings, University of Washington Sea Grant, Seattle. pp. 113-131.

Myrberg, A.A., Jr. and L.A. Fuiman, 2002. The Sensory World of Coral Reef Fishes, pp. 123-148. In: P.F. Sale (ed.), Coral Reef Fishes: Dynamics and Diversity in a Complex Ecosystem. Academic Press, San Diego, CA.

National Marine Fisheries Service (NMFS), 1999. *Final fishery management plan for Atlantic tunas, swordfish, and sharks.* Volumes 1-3. U.S. Department of Commerce, National Marine Fisheries Service, Highly Migratory Species Division. April 1999.

National Marine Fisheries Service (NMFS), 2006. *Final Consolidated Atlantic Highly Migratory Species Fishery Management Plan.* National Marine Fisheries Service. Silver Spring, MD.

National Marine Fisheries Service (NMFS), 2008. *Essential Fish Habitat: A Marine Fish Habitat Conservation Mandate for Federal Agencies, Gulf of Mexico Region.* National Marine Fisheries Service, National Oceanic and Atmospheric Administration. Revised August 2008.

National Marine Fisheries Service (NMFS), 2009. *Final Amendment 1 to the 2006 Consolidated Atlantic Highly Migratory Species Fishery Management Plan, Essential Fish Habitat*. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division, Silver Spring, MD. Public Document. pp. 395.

National Marine Fisheries Service (NMFS), 2010. Fish Watch: U.S. Seafood Facts. http://www.nmfs.noaa.gov/fishwatch/. Last accessed March 5, 2010.

National Marine Fisheries Service (NMFS), 2010b. Highly Migratory Species. http://www.nmfs.noaa.gov/sfa/hms/intro_HMS.htm. Last accessed May 6, 2010.

National Research Council (NRC), Committee on Beach Nourishment and Protection, 1995. Beach Nourishment and Protection. Washington, DC: National Academy Press. 334 p.

Nelson, W.G., 1993. Beach restoration in the Southeastern U.S.: environmental effects and biological monitoring. *Ocean & Coastal Management*, 19: 157-182.

Nightingale, B. and C.A. Simenstad, 2001. Dredging Activities: Marine Issues. Seattle, Washington: University of Washington, *Research Project T1803, Task 35 Overwater Whitepaper,* July 2001.

Posey, M.H. and T.D. Alphin, 2000. Monitoring of Benthic Faunal Responses to Sediment Removal Associated with the Carolina Beach and Vicinity – Area South Project. Wilmington, N.C.: Center of Marine Science, University of North Carolina at Wilmington. *Final Report, CMS Report No. 01-01.*

Reine, K.J., D.D. Dickerson, and D.G. Clarke, 1998. Environmental Windows Associated with Dredging Operations. U.S. Army Corps of Engineers Research and Development Center, Vicksburg, MS. Dredging Operations and Environmental Research Technical Notes Collection (TN DOER-E2), 14 pp.

Rester, Jeff, 2010. Personal communication with Jeff Rester (Habitat and SEAMAP Coordinator, Gulf States Marine Fisheries Commission) regarding EFH designation and managed species in Ecoregion 1. Email correspondence, April 2010.

Sarasota County, 2010. Sarasota County Water Atlas, Seagrass Habitat Map. http://maps.wateratlas.usf.edu/sarasota/index.asp. Last accessed March 25, 2010.

South Carolina Department of Natural Resources (SCDNR), 1995. *A Review of the Potential Impacts of Mechanical Harvesting on Subtidal and Intertidal Shellfish Resources*.

Stobutzki, I.C. and D.R. Bellwood, 1998. Nocturnal orientation to reefs by late pelagic stage coral reef fishes. *Coral Reefs* 17: 103-110.

Thomsen, F., S. McCully, D. Wood, F. Pace, and P. White. 2009. A generic investigation into noise profiles of marine dredging in relation to the acoustic sensitivity of the marine fauna in UK waters with particular emphasis on aggregate dredging: PHASE 1 Scoping and review of key issues. Marine Aggregate Levy Sustainable Fund. MEPF Ref No. MEPF/08/P21.

Tolimieri, N., A. Jeffs, and J. Montgomery, 2000. Ambient sound as a cue for navigation by the pelagic larvae of reef fishes. *Marine Ecology Progress Series* 207: 219-224.

U.S. Army Corps of Engineers (USACE), 2006. Final Environmental Impact Statement Proposed Marine Container Terminal at the Charleston Naval Complex North Charleston, South Carolina.

Wallen, I. E., 1951. The direct effect of turbidity on fishes. Bull. Okla. Agric. Mech. Coll., Biol. Ser. 2, 48(2):1-27.

APPENDIX 1

EFH IN ECOREGION 1 FOR GULF OF MEXICO FISHERY MANAGEMENT COUNCIL (GMFMC) MANAGED SPECIES

EFH Interpretations by Ecoregion for Gulf of Mexico Fishery Management Council Managed Species

Ecoregion 1 EFH, Florida Keys to Tarpon Springs, FL

Species	Life Stage	System[1]	EFH
Pink shrimp[2]	eggs	M	sand/shell bottom
	larvae	M	planktonic, sand/shell bottom, SAV
	juvenile	E	sand/shell substrate
	adults	M	sand/shell substrate
Stone crab	eggs	E/M	<18 m N & <27 m S of Cape Sable; soft/shell/hard bottoms, SAV, oyster reefs
	larvae	E/M	<18 m N & <27 m S of Cape Sable; planktonic
	juvenile	E/M	<18 m N & <27 m S of Cape Sable; sand/shell/hard bottoms, SAV
	adults	M	<18 m N & <27 m S of Cape Sable; sand/shell/hard bottoms, SAV, reefs
Spiny lobster	eggs	M	9-18 m N of Naples, <27 m S of Cape Sable; reefs
	larvae	M	9-18 m N of Naples, <27 m S of Cape Sable; planktonic, SAV
	juvenile	M	9-18 m N of Naples, <27 m S of Cape Sable; SAV, hard bottoms, reefs
	adults	M	9-18 m N of Naples, <27 m S of Cape Sable; SAV, hard bottoms, reefs
Red drum	eggs	M	planktonic
	larvae/postlarvae	E	planktonic, SAV, sand/shell/soft bottom, emergent marsh
	juvenile	M/E	<5 m; SAV, sand/shell/soft/hard bottom, emergent marsh
	adults	M/E	9-18 m S of Cape Sable and N of Naples (other areas 1-46 m); SAV, pelagic, sand/shell/soft/hard bottom, emergent marsh
Red grouper	eggs	M	20-100 m; planktonic
	larvae	M	20-100 m; planktonic
	juvenile	M/E	<50 m; hard bottoms, SAV, reefs
	adults	M	3-190 m; reefs, hard bottoms
Black grouper	eggs	M	18-28 m; planktonic
	larvae	M	10-150 m; planktonic
	juvenile	M/E	SAV, hard bottoms, reefs
	adults	E/M	10-150 m; hard bottoms, mangrove, reefs
Gag grouper	eggs	M	50-120 m; planktonic
	larvae	M	50-120 m; planktonic
	juvenile	M/E	<50 m; SAV, reefs, hard bottom
	adults	M	20-100 m; hard bottom, reefs

[1] E=estuarine, M=marine
[2] Shrimp EFH is generally less than 64 meters, but is less in some parts of the ecoregion, refer to the 2005 fishery management plan and final environmental impact statement.

Ecoregion 1 EFH, Florida Keys to Tarpon Springs, FL -- Continued

Species	Life Stage	System	EFH
Goliath grouper	eggs	M	36-46 m; planktonic
	larvae	M	36-46 m; planktonic
	postlarvae/juvenile	M/E	<3 m; mangrove, SAV, hard bottom, reefs
Misty grouper	eggs	M	150-183 m; planktonic
	larvae	M	150-183 m; planktonic
Nassau grouper	eggs	M	planktonic
	larvae	M	2-50 m; planktonic
	juvenile	M	SAV, reefs
Snowy grouper	eggs	M	30-183 m; planktonic
	larvae	M	30-183 m; planktonic
	juvenile	M	17-60 m; reefs
Warsaw grouper	eggs	M	40-183 m; planktonic
	larvae	M	40-183 m; planktonic
	juvenile	M	20-30 m; reefs
Yellowedge grouper	eggs	M	35-183 m; planktonic
	larvae	M	35-183 m; planktonic
	juvenile	M	35-183 m; hard bottom
	adults	M	35-183 m; reefs bottom
Yellowfin grouper	eggs	M	2-183 m; planktonic
	larvae	M	2-183 m; planktonic
	juvenile	M/E	2-4 m; SAV, hard bottom
Yellowmouth grouper	eggs	M	20-183 m; planktonic
	larvae	M	20-183 m; planktonic
	juvenile	M/E	18-24 m; mangroves, reefs
Red hind	eggs	M	18-110 m; planktonic
	larvae	M	18-110 m; planktonic
	postlarvae/juvenile	M	2-110 m; reefs
	adults	M	18-110 m; reefs, hard/sand/shell bottom
Rock hind	eggs	M	2-100 m; planktonic
	larvae	M	2-100 m; planktonic
	juvenile	M	2-110 m; reefs
Speckled hind	eggs	M	146-183 m; planktonic
	larvae	M	146-183 m; planktonic
Scamp	eggs	M	60-183 m; planktonic
	larvae	M	60-183 m; planktonic
	juvenile	M	hard bottoms, reefs, mangrove
Schoolmaster	eggs	M	<90 m; planktonic
	larvae	M	<90 m; planktonic
	juvenile	M/E	<90 m; SAV, mangrove, emergent marsh, reefs, hard bottom
Red snapper	eggs	M	18-37 m; planktonic
	larvae	M	18-37 m; planktonic
	juvenile	M	17-183 m; hard/soft/sand/shell bottom
	adults	M	7-146 m; reefs, hard/sand/shell bottoms

Ecoregion 1 EFH, Florida Keys to Tarpon Springs, FL -- Continued

Species	Life Stage	System	EFH
Vermilion snapper	eggs	M	<183 m; planktonic
	juvenile	M	<183 m; reefs, hard bottom
	adult	M	<183 m; reefs, hard bottom
Gray snapper	eggs	M	<180 m; planktonic, reefs
	larvae	M/E	<180 m; planktonic, reefs
	postlarvae/juvenile	E/M	<180 m; SAV, mangrove, emergent marsh
	adults	E/M	<180 m; mangrove, emergent marsh, reefs, sand/shell/soft/hard bottoms
Yellowtail snapper	eggs	M	1-183 m; planktonic
	juvenile	M/E	1-183 m; SAV, mangrove, soft bottom, reefs
	adults	M	1-183 m; reefs, hard bottom, shoals/banks
Lane snapper	eggs	M	4-132 m; planktonic
	larvae	M/E	4-132 m; reefs, SAV
	juvenile	E/M	<20 m; SAV, mangrove, reefs, sand/shell/soft bottom
	adults	M	4-132 m; reefs, sand/shell bottom, shoals/banks, shelf edge
Blackfin snapper	eggs	M	40-183 m; planktonic
	juvenile	M	12-40 m; hard bottom
Cubera snapper	eggs	M	10-85m; planktonic
	juvenile	M/E	<85 m; SAV, mangrove, emergent marsh
Dog snapper	eggs	M	planktonic
	larvae	M	planktonic
	juvenile	M/E	SAV, mangrove, emergent marsh
Mutton snapper	eggs	M	reefs
	larvae	M	reefs
	juvenile	M/E	reefs, mangrove, SAV, emergent marsh
	adult	E/M	reefs, SAV, shoals/banks, shelf edge 25-95 m spawning
Queen snapper	eggs	M	95-183 m; planktonic
	larvae	M	95-183 m; planktonic
Hogfish	juvenile	M/E	3-30 m; SAV
Dwarf sand perch	juvenile	M	hard bottom
Greater amberjack	eggs	M	1-183 m; planktonic
	larvae	M	1-183 m; planktonic
	juvenile	M	1-183 m; drift algae (*Sargassum*)
	adults	M	1-183 m; pelagic, reefs
Lesser amberjack	eggs	M	planktonic
	larvae	M	planktonic
	juvenile	M	55-130 m; drift algae (*Sargassum*)
Almaco jack	eggs	M	15-160 m; planktonic
	juvenile	M	15-160 m; drift algae (*Sargassum*)

Ecoregion 1 EFH, Florida Keys to Tarpon Springs, FL -- Continued

Species	Life Stage	System	EFH
Banded rudderfish	eggs	M	planktonic
	larvae	M	10-130 m; planktonic
	juvenile	M	10-130 m; drift algae (*Sargassum*)
Blackline tilefish	eggs	M	60-183 m; planktonic
	larvae	M	60-183 m; planktonic
Blueline tilefish	eggs	M	60-183 m; planktonic
	larvae	M	60-183 m; planktonic
Goldface tilefish	eggs	M	60-183 m; planktonic
	larvae	M	60-183 m; planktonic
Golden tilefish	eggs	M	80-183 m; planktonic
	larvae	M	80-183 m; planktonic
	juvenile	M	80-183 m; hard/soft bottom, shelf edge/slope
Gray triggerfish	eggs	M	10-100 m; reefs
	larvae	M	drift algae (*Sargassum*)
	postlarvae/juvenile	M	10-100 m; drift algae (*Sargassum*), mangroves, reefs
King mackerel	adults	M	35-180 m; pelagic
Spanish mackerel	adults	E/M	<75 m; pelagic
Cobia	adults	M	<70 m; pelagic
Coral	all stages	M	plankton, reefs

APPENDIX 2

EFH DESIGNATIONS BY LIFE STAGE FOR HIGHLY MIGRATORY SPECIES (HMS) IN THE PROJECT AREA

Species	Life Stage	EFH Designation
Great Hammerhead	Neonate/YOY, Juveniles, and Adults	EFH designation for all life stages have been combined and are considered the same. Coastal areas throughout the west coast of Florida and scattered in the Gulf of Mexico from Alabama to Texas. Atlantic east coast from the Florida Keys to New Jersey. Eastern Puerto Rico.
Scalloped Hammerhead	Neonate/YOY (≤60 cm TL)	Coastal areas in the Gulf of Mexico from Texas to the southern west coast of Florida. Atlantic east coast from the mid-east coast of Florida to southern North Carolina.
	Juveniles (61 to 179 cm TL)	Coastal areas in the Gulf of Mexico from the southern to mid-coast of Texas, eastern Lousainia to the southern west coast of Florida, and the Florida Keys. Offshore from the mid-coast of Texas to eastern Louisiania. Atlantic east coast of Florida through New Jersey.
	Adults (≥180 cm TL)	Coastal areas in the Gulf of Mexico along the southern Texas coast, and eastern Lousainia through the Florida Keys. Offshore from southern Texas to eastern Louisiania. Atlantic east coast of Florida to Long Island, NY.
Nurse Shark	Juvenile (52 to 230 cm TL)	Coastal areas in the Gulf of Mexico from the Florida Panhandle to the Florida Keys. Atlantic east coast of Florida to southern Georgia. Virgin Islands.
	Adults (≥231 cm TL)	Coastal areas in the Gulf of Mexico from the Florida Panhandle to the Florida Keys. Atlantic east coast of Florida.
Blacktip Shark	Neonate/YOY (≤75 cm TL)	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas from northern Florida through Georgia, and the mid-coast of South Carolina.
	Juvenile (76 to 136 cm TL)	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas localized off of the southeast Florida coast and from West Palm Beach, Florida to Cape Hattaras.
	Adult (≥137 cm TL)	Coastal areas in the Gulf of Mexico from Texas through the Florida Keys. In Atlantic coastal areas southeast Florida to Cape Hattaras.

Notes: YOY = Young of the year, TL = Total length

Species	Life Stage	EFH Designation
Bull Shark	Neonate/YOY (≤95 cm TL)	Gulf of Mexico coastal areas along Texas, and localized areas off of Mississippi, the Florida Panhandle, and west coast of Florida; as well as the Atlantic mid-east coast of Florida.
	Juveniles (96 to 219 cm TL)	Gulf of Mexico coastal areas along the Texas coast, eastern Louisiana to the Florida Panhandle, and the west coast of Florida through the Florida Keys. Atlantic coastal areas localized from the mid-east coast of Florida to South Carolina.
	Adults (≥220 cm TL)	Gulf of Mexico along the southern and mid-coast of Texas to western Louisiana, eastern Louisania to the Florida Keys. East coast of Florida to South Carolina in the Atlantic.
Lemon Shark	Neonate/YOY (≤86cm TL)	Gulf of Mexico coastal areas along the Texas midcoast and the Florida Keys, and a localized area on the mid-west coast of Florida. Puerto Rico and Virgin Islands.
	Juveniles (87 to 239 cm TL)	Gulf of Mexico coastal areas along Texas, eastern Louisiana, and the Florida Panhandle through the Florida Keys. Coastal areas along the Atlantic east coast of Florida. Puerto Rico and Virgin Islands.
	Adults (≥240 cm TL)	Gulf of Mexico coastal areas along the west coast of Florida through the Florida Keys. Localized coastal areas along the southern and northern east coast of Florida in the Atlantic.
Sandbar Shark	Adult (≥191 cm TL)	Localized area off of Alabama, and coastal areas from the Florida Panhanle to the Florida Keys in the Gulf of Mexico. Atlantic coastal areas throughout Florida to southern New England.
Silky Shark	Neonate/YOY, Juvenile, and Adult	EFH designation for all life stages have been combined and are considered the same. In the Gulf of Mexico from the southern coast of Texas across the central Gulf of Mexico, and from eastern Louisiana to the Florida Keys. Atlantic east coast from Florida to New Jersey, with localized areas in southern New England.

Notes: YOY = Young of the year, TL = Total length

Species	Life Stage	EFH Designation
Spinner Shark	Neonate/YOY (≤70 cm TL)	Localized coastal areas in the Gulf of Mexico along Texas, eastern Louisania, the Florida Panhandle, Florida west coast, and the Florida Keys; and in the Atlantic along the east coast of Florida to southern North Carolina.
	Juveniles (71 to 179 cm TL)	Gulf of Mexico coastal areas from Texas to the Florida Panhandle, and the mid-west coast of Florida to the Florida Keys. Atlantic east coast of Florida through North Carolina.
	Adults (≥180 cm TL)	Localized areas in the Gulf of Mexico off of southern Texas, Louisania trhough the Florida Panhandle, and from the mid-coast of Florida through the Florida Keys. In the Atlantic along the east coast of Florida, and localized areas from South Carolina to Virginia.
Tiger Shark	Juveniles (205 to 319 cm TL)	In the central Gulf of Mexico and off Texas and Louisiana, and from Mississippi through the Florida Keys. Atlantic east coast from Florida to New England.
	Adults (≥320 cm TL)	In the Gulf of Mexico, from Texas to the west coast of Florida, and the Florida Keys. Atlantic east coast from Florida to southern New England.
Blacknose Shark	Neonate/YOY (≤55 cm TL)	In the Gulf of Mexico coastal areas from the Florida Panhandle and west coast of Florida. In Atlantic coastal areas from Georgia to southern North Carolina.
	Juveniles (56 to 90 cm TL)	Localized areas off Texas and western Louisania, and coastal areas from Mississippi through the Florida Keys in the Gulf of Mexico. Atlantic east coast from the mid-coast of Florida to Cape Hattaras.
	Adults (≥91 cm TL)	Localized areas off Texas and central Louisania, and coastal areas from eastern Louisiania through the Florida Keys in the Gulf of Mexico Atlantic east coast from the mid-coast of Florida to Cape Hattaras.

Notes: YOY = Young of the year, TL = Total length

Species	Life Stage	EFH Designation
Bonnethead Shark	Neonate/YOY (≤55 cm TL)	Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the midcoast of Florida to South Carolina.
	Juveniles (56 to 81 cm TL)	Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the midcoast of Florida to South Carolina.
	Adults (≥82 cm TL)	Coastal areas in the Gulf of Mexico along Texas, and from eastern Mississippi through the Florida Keys. Atlantic east coast from the mid-coast of Florida to Cape Lookout.
Atlantic Sharpnose	Neonate/YOY (≤60 cm TL)	Gulf of Mexico coastal areas from Texas through the Florida Keys. In the Atlantic from the mid-coast of Florida to Cape Hattaras.
	Juveniles (61 to 71 cm TL)	Gulf of Mexico coastal areas from Texas through the Florida Keys. In the Atlantic from the mid-coast of Florida to Cape Hattaras, and a localized area off of Delaware.
	Adults (≥72 cm TL)	Gulf of Mexico from Texas through the Florida Keys out to a depth of 200 meters. In the Atlantic from the mid-coast of Florida to Maryland.

Notes: YOY = Young of the year, TL = Total length

APPENDIX 8

EMISSIONS CALCULATIONS
(EXCEL SPREADSHEET - ELECTRONIC COPY ONLY)

APPENDIX 9

USACE CONSENT TO APPLY
USFWS STATEWIDE PROGRAMMATIC BIOLOGICAL OPINION

United States Department of the Interior
U. S. FISH AND WILDLIFE SERVICE
7915 BAYMEADOWS WAY, SUITE 200
JACKSONVILLE, FLORIDA 32256-7517

IN REPLY REFER TO:
FWS Log No. 41910-2010-F-0009

June 8, 2011

RECEIVED
JUN 13 2011
TAMPA REG. OFFICE

Colonel Alfred A. Pantano, Jr. District Engineer
Department of the Army
Jacksonville District Corps of Engineers
Tampa Regulatory Office
10117 Princess Palm Drive, Suite 120
Tampa, FL 33610

Dear Colonel Pantano:

Thank you for your September 23, 2009, request for formal consultation and for your project modification letters that we received on September 25, 2009 and May 15, 2011, for sand placement at Longboat Key. The U.S. Fish and Wildlife Service (Service) reviewed the proposed sand placement project for the beach at Longboat Key in Manatee and Sarasota Counties, Florida, and its effects on the Florida manatee (*Trichechus manatus*), piping plover (*Charadrius melodus*), and loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

The Corps and the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) determined that the proposed project may affect, but was not likely to adversely affect, the Florida manatee (*Trichechus manatus latirostris*) and the nonbreeding piping plover (*Charadrius melodus*). The Corps and the BOEMRE also determined that the proposed project may affect, and is likely to adversely affect the loggerhead and green sea turtles. The Service concurred with these determinations.

The proposed plan is for a two phased sand placement event. In 2011/2012 sand will be placed along 10,000 linear feet of beach between Florida Department of Environment Protection (FDEP) R-Monument 44 to R-Monument 46 and R-Monument 47.5 to R-Monument 50.5 in Manatee County and FDEP R-Monument 12 to R-Monument 17 in Sarasota County. In 2013/2014, sand will be placed along 19,000 linear feet of beach between FDEP R-Monument 44 to R-Monument 45.5 and R-Monument 47 to R-Monument

50 in Manatee County, R-Monument 67 to T1 /Manatee-Sarasota County, R-Monument 13 to R-Monument 17 and R-Monument 21 to R-Monument 29 in Sarasota County.

The Service has determined that the proposed project is appropriate to apply to the Statewide Programmatic Biological Opinion (SPBO) concerning sand placement activities along the coast of Florida for the Corps dated April 19, 2011 (FWS Log No. 41910-2011-F-0170).
http://www.fws.gov/northflorida/BOs/20110418_bo_FINAL_USFWS_Statewide_Programmatic_BO_Beach_Nourish_signed.pdf

The minimization measures, Reasonable and Prudent Measures, and Terms and Conditions in the SPBO are applicable to the proposed project and must be followed for sea turtles and manatees. We have assigned log number FWS Log Number 41910-2010-F-0009 to this individual consultation.

<u>Piping plover</u>

The Corps and BOEMRE also determined that the proposed project may affect, and is likely to adversely affect the piping plover. Non-breeding piping plovers were documented on Longboat Key, Florida. In 2005, three piping plovers were observed. In 2006, one piping plover was observed. In 2009, seven piping plovers were observed.

Natural organic material deposited on the beach (wrack) provides important foraging and roosting habitat for piping plovers and other shorebirds. It also serves to protect important shorebird habitat by helping stabilize beaches through reduction in erosive processes such as eolian sand transport. Protection of wrack can help to offset the direct and indirect impacts associated with beach nourishment and ensuing human disturbance.

The Service conducted a conference call with the applicant and Florida Fish and Wildlife Conservation Commission (FWC) on April 29, 2010, to discuss areas and the importance of wrack on the shoreline year-round.

In a letter from the applicant's agent, to the following conservation measures will be included into the proposed project action:

1. Protection of wrack will minimize impacts to shorebird habitat occurring directly or indirectly by the proposed project and ensuing human disturbance and assist with shoreline stabilization efforts. Wrack removal is not conducted by the Town of Longboat Key. Currently, no wrack is protected from Longboat Pass to approximately four miles south.

2. Educational signs will be installed highlighting the importance of beach habitats to wildlife and explaining the importance of the wrack along the shoreline. The FWC will provide examples of the information to include on these signs.

3. Vehicles including all-Terrain Vehicles (ATVs) traversing the beach, used by beach life-guards, beach maintenance employees, turtle watch volunteers and law enforcement will avoid the soft sand areas in the wrack protection zone and follow the FWC's Beach Driving Best Management Practices: (http://www.myfwc.com/CONSERVATION/ConservationYouLiving_w_Wildlife_BeachDriving.htm). Emergency vehicles shall have full access to the beach including the wrack protection zone.

4. The Town will put up educational signage at public access areas indicating the importance and contribution of beach wrack to the coastal biological community. An example poster designed by the Florida Fish and Wildlife Conservation Commission (FWC) is included in Attachment A.

5. The Town will also publish information on the importance of wrack on the Longboat Key website along with a link to the FWC news release entitled *That Bunch of Seaweed on the Beach Teems with Life*. http://www.myfwc.com/NEWSROOM/09/statewide/News_09_X_BeachWrack.htm

6. The Town will meet with each private property owner who removes the wrack on their beach to discuss the importance of wrack and the following options:
   i. Leaving a designated portion of wrack year round; and
   ii. Leaving the wrack from September 1 through May 1st.

7. The Town will provide a summary report of these actions to the Service and FWC.

The Service has determined that the proposed project may affect, but is not likely to adversely affect the piping plover provided the inclusion of the following additional conditions:

1. Piping plover optimal habitat shall be avoided to the maximum extent practicable. Site selection for equipment staging, travel corridors, construction vehicles including all - terrain vehicles and pipeline alignment shall stay just above or just below the primary "wrack" line and swash zone. The water and land-based loading and unloading of equipment, materials, supplies, and personnel shall be limited to the footprint of the staging and storage area, with the exception of the transportation of job-related personnel.

2. The Town of Longboat Key will work with the Service and FWC to develop shore protection design guidelines and/or mitigation measures that can be utilized during future project planning to protect and/or enhance high value piping plover habitat locations (i.e., washover fans) as well as the progress of protecting the wrack.

Based on the preceding, the Service has determined that the proposed project may affect, but is not likely to adversely affect the piping plover provided that applicant modified their project plans to include the above measures to preserve piping plover feeding and roosting habitat within the project area.

Please submit a report for the proposed project as described in the SPBO Term and Condition A22 following completion of the proposed work.

Thank you for your cooperation in the effort to conserve fish and wildlife resources. Should you have any questions or require clarification regarding this letter, please contact Terri Callison of this office at (904) 731-3286.

Sincerely,

for David L. Hankla
Field Supervisor

cc: Robbin Trindell- FWC
Ken Graham- Service/Atlanta

United States Department of the Interior

BUREAU OF OCEAN ENERGY
MANAGEMENT, REGULATION AND ENFORCEMENT

Washington, DC 20240

Mr. Scott M. Stroh III, SHPO
Division of Historical Resources
Department of State
500 South Bronough Street, Room 305
Tallahassee, Florida 32399-0250

Dear Mr. Stroh:

On May 3, 2011, the Tampa Section of the Department of the Army issued a Public Notice concerning the application (SAJ-2009-03350) it received for a permit pursuant to Section 404 of the Clean Water Act (33 U.S.C. §1344) and Section 10 of the Rivers and Harbors Act of 1899 (33 U.S.C. §403) (see enclosure). The applicant, the Town of Longboat Key, is proposing beach nourishments along 9.8 miles of Longboat Key's shoreline. The Town of Longboat Key is also seeking to use Borrow Area F2 located on the Outer Continental Shelf (OCS), which is under the sole jurisdiction of the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE). The purpose of the project is to provide storm protection, to provide aesthetically pleasing recreational beach for the public, and to continue to support the livelihoods of the upland owners who depend on tourist use of the beach.

An interim nourishment phase is first proposed for FY 2011/2012. The interim phase will utilize sand from borrow areas located in both state and federal waters, and will utilize sand from two off-shore borrow areas (B3 & F2), which fall within the path of a liquid natural gas pipeline route planned by Port Dolphin Energy, LLC (Corps application No. SAJ-2007-1064). Sand from off-shore borrow areas, shall be dredged via hopper dredge, transported to a rehandling, and/or pump out, area, and pumped to shore via pipeline where land-based equipment such as bulldozers will then shape the beach fill. Pipeline corridors previously established offshore of Longboat Key will be utilized.

The BOEMRE and the Corps are working collaboratively to ensure effective implementation of the required National Environmental Policy Act (NEPA) and the National Historic Preservation Act Section 106 process. The BOEMRE is initiating coordination with the State Historic Preservation Officer (SHPO), pursuant to Section 106 of the NHPA, on the dredging activities associated with OCS Borrow Area F2 only. The F-2 investigation area (i.e., the area of potential effect (APE)) is located approximately 10.5 nautical miles west-southwest of the northern extremity of Anna Maria Island and is a polygon measuring 3,825 feet in width, 5,350 feet in length and covers an area of 375.57 acres. The APE contains a considerable buffer around the proposed borrow areas to take into account any ancillary bottom-disturbance activities related to the proposed undertaking. The coordination with the SHPO for the borrow, rehandling, pumpout, and placement areas in state waters has been finalized through the

Joint Coastal Permit and Florida Clearinghouse process (see enclosed DHR Project File No.: 2011-00818(2010-05807)).

To determine the project's effects on potentially significant submerged cultural resources, Coastal Planning and Engineering, the agent of the Town of Longboat Key, contracted with Tidewater Atlantic Research, Inc. (TAR) of Washington, North Carolina to supervise the conduct of a submerged cultural resource remote-sensing survey of the borrow site. Enclosed you will find a copy of the report, "Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida," for your review. In the F-2 investigation area, remote-sensing data was collected on a line spacing of 30 meters (98 feet). The conclusions of the report are summarized as follows:

> Analysis of the F-2 investigation area remote-sensing data identified a total of seven magnetic anomalies. None of those signatures are considered to represent shipwreck remains or other potentially significant submerged cultural resources. Sonar identified no bottom surface contacts in the area and no evidence of relict land forms or other potentially significant features are apparent in the sub-bottom profiler data. A previous survey carried out in 2006 by Laura A. Landry & Associates, Inc. for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay pipeline covered most of the F-2 investigation area. That survey identified four magnetic anomalies in the F-2 investigation area. Only one of those corresponded approximately to one of the seven anomalies identified during the current survey and none of the 2006 anomalies were considered to be potentially significant. Based on the acoustic and magnetic data from both the 2006 and 2010 surveys, dredging material from F-2 will not impact any potentially significant submerged cultural resources. No additional investigation of the area is recommended in conjunction with the proposed project. However, in the event that shipwreck remains or other cultural material is encountered during dredging, CPE and BOEMRE should be notified and on-site activity shifted until an assessment of the archaeological significance of the disturbed material can be assessed.

The report also notes that "one line of magnetic data (line 155) was found to be corrupted during analysis. The sonar and sub-bottom profiler data from that line were intact." The north half of that line was previously covered by a survey for the Port Dolphin Project in the Gulf of Mexico and Tampa Bay and no anomalies were found near line 155. Because there is no magnetometer data for the south half of line 155, that area has been buffered. Only a small portion of the north end of the line without magnetometer data lies within the proposed dredge cuts. No indication of submerged cultural resources was found in the side-scan sonar and sub-bottom profiler data on line 155.

The BOEMRE concurs with the conclusion of this report that the proposed undertaking will have no effect to historic resources (NEHP) within the APE. The following conditions will be included in the negotiated agreement for OCS Borrow Area F2:

- Due to the corrupted data in line 155, no dredging will be authorized in the buffer area as denoted in the report (see enclosed Draft Dredge Design Drawing for Borrow Area F2); and
- If you discover man-made debris that appears to indicate the presence of a shipwreck or prehistoric remains (e.g., a sonar image or visual confirmation of an iron, steel, or wooden hull, wooden timbers, anchors, concentrations of man-made

objects such as bottles or ceramics, piles of ballast rock, stone artifacts) during dredging operations or beach renourishment, you must immediately halt operations in that area, take steps to ensure that the site is not disturbed in any way, and contact the BOEMRE within 48 hours of its discovery. You must cease all operations within 1,000 feet (305 meters) of the site until BOEMRE instructs you on what steps you must take to assess the site's potential historic significance and what steps you must take to protect it.

Pursuant to 36 C.F.R. §800, BOEMRE invites comments regarding the enclosed report and BOEMRE's finding of no effect on historic properties within the APE. Should you have any questions about this undertaking, you may contact me at (703) 787-1748 or Brian.Jordan@BOEMRE.gov. Written correspondence may be sent to the following address:

Bureau of Ocean Energy Management,
Regulation and Enforcement
Branch of Environmental Assessment
381 Elden St, MS 4042
Herndon, VA 20170

Thank you in advance for your timely response and cooperation. I look forward to receiving your response within 30 days of receipt of this submittal in accordance with 36 C.F.R. §800.3(c)(4).

Sincerely,

Brian Jordan, PhD.
Federal Preservation Officer
Headquarters Archaeologist

Enclosures:

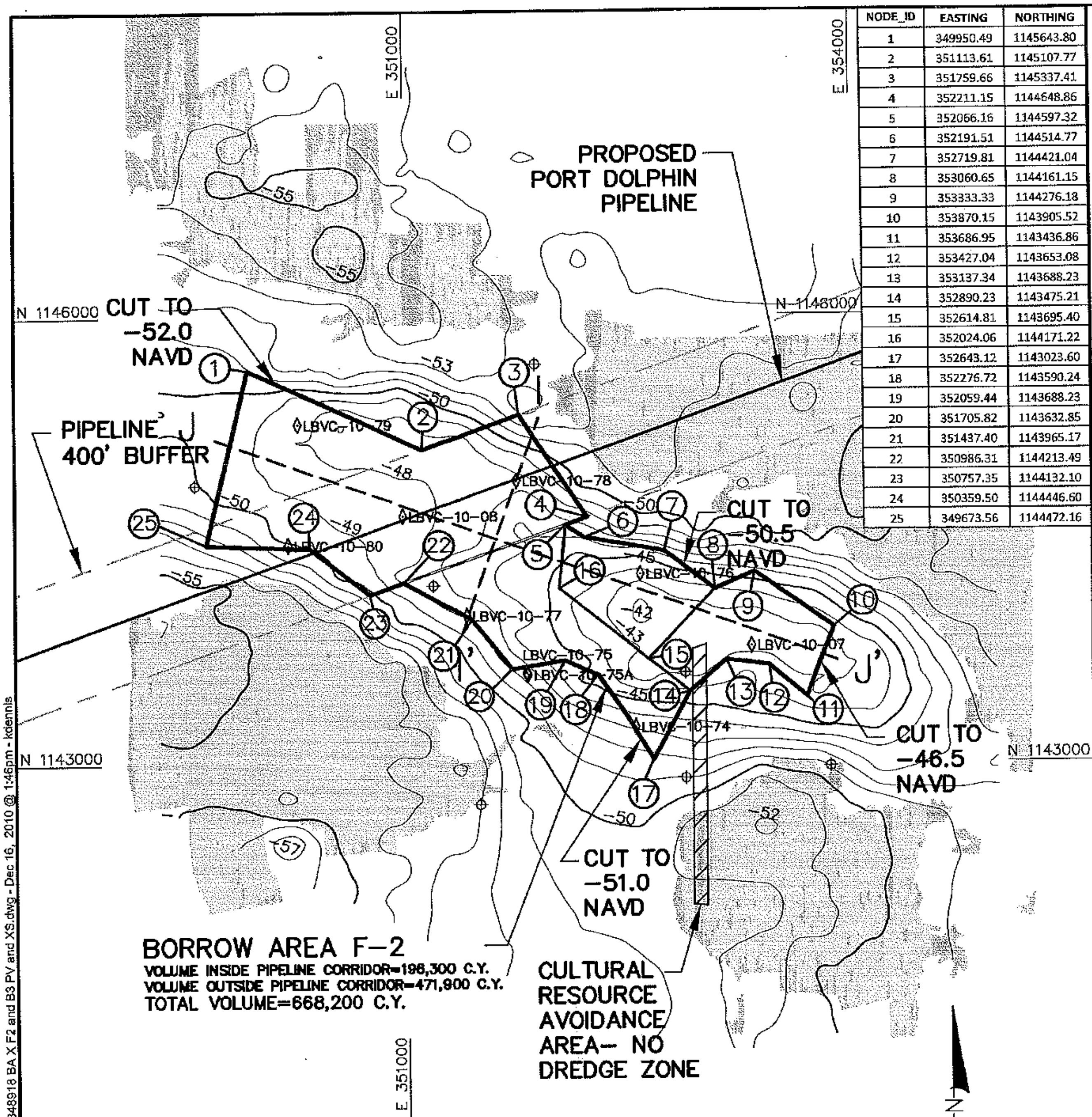
Submerged Cultural Resource Survey of the F-2 Investigation Area Offshore of Manatee and Sarasota Counties, Florida
DHR Project File No.: 2011-00818(2010-05807)
Draft Dredge Design Drawing for Borrow Area F2

cc: Dr. Barbara Mattick
Bureau of Historic Preservation
500 South Bronough Street
Tallahassee, FL 32399-0250

Ms. Laura Kammerer
Bureau of Historic Preservation
500 South Bronough Street
Tallahassee, FL 32399-0250

Mark E. Peterson
USACE Jacksonville District
Tampa Permitting Section
10117 Princess Palm Avenue, Suite 120
Tampa, FL 33610-8302

Charlie Broadwater
Bureau of Ocean Energy Management, Regulation and Enforcement
Leasing Division



NODE_ID	EASTING	NORTHING
1	349950.49	1145643.80
2	351113.61	1145107.77
3	351759.66	1145337.41
4	352211.15	1144648.86
5	352066.16	1144597.32
6	352191.51	1144514.77
7	352719.81	1144421.04
8	353060.65	1144161.15
9	353333.33	1144276.18
10	353870.15	1143905.52
11	353686.95	1143436.86
12	353427.04	1143653.08
13	353137.34	1143688.23
14	352890.23	1143475.21
15	352614.81	1143695.40
16	352024.06	1144171.22
17	352643.12	1143023.60
18	352276.72	1143590.24
19	352059.44	1143688.23
20	351705.82	1143632.85
21	351437.40	1143965.17
22	350986.31	1144213.49
23	350757.35	1144132.10
24	350359.50	1144446.60
25	349673.56	1144472.16

2011 LONGBOAT KEY BEACH NOURISHMENT PROJECT BORROW AREA F-2 BATHYMETRY

LEGEND:

- ◊ LBVC-10-65 CPE 2010 VIBRACORE
- ⊕ TAR 2010 MAGNETIC ANOMALIES
- CPE 2010 DIGITIZED HARDBOTTOM
- ▨ CULTURAL RESOURCE AVOIDANCE AREA– NO DREDGE ZONE

NOTES:

1. COORDINATES ARE IN FEET BASED ON FLORIDA STATE PLANE COORDINATE SYSTEM, WEST ZONE, NORTH AMERICAN DATUM OF 1983 (NAD83).
2. ELEVATIONS ARE IN FEET REFERENCED TO NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88).
3. DATE OF CPE BATHYMETRIC SURVEY: OCTOBER, 2009 AND AUGUST, 2010.

NOT FOR CONSTRUCTION
FOR REGULATORY REVIEW ONLY

MELANY LARENAS P.G. NO. PG2397 — 12/17/10 DATE

REVISIONS		
DATE	BY	DESCRIPTION

COASTAL PLANNING & ENGINEERING, INC.
2481 N.W. BOCA RATON BOULEVARD
BOCA RATON, FLORIDA 33431
PH. (561) 391-8102
FAX (561) 391-9116
C.O.A. FL. #4028
C.O.A. LA. #2331
www.CoastalPlanning.net

DATE: 11/11/10
BY: KD
COMM NO.: 8489.18
SHEET: 12

FILE COPY

FLORIDA DEPARTMENT OF STATE
Kurt S. Browning
Secretary of State
DIVISION OF HISTORICAL RESOURCES

Mr. Gordon P. Watts, Jr., Ph.D.
Tidewater Atlantic Research, Inc.
P.O. Box 2494
Washington, North Carolina 27889

March 30, 2011

Re: DHR Project File No.: 2011-00818 (2010-05807) / 1A-32 Permit No.: 1011.018
Received by DHR: March 4, 2011
Final Report: *Submerged Cultural Resource Survey of Two Borrow Sites and One Transfer Site Offshore of Manatee and Sarasota Counties, Florida*

Dear Dr. Watts:

Our office received and reviewed the above referenced survey report in accordance with Section 106 of the *National Historic Preservation Act of 1966* (Public Law 89-665), as amended in 1992, and *36 C.F.R., Part 800: Protection of Historic Properties*, and Chapter 267, *Florida Statutes*, for assessment of possible adverse impact to cultural resources (any prehistoric or historic district, site, building, structure, or object) listed, or eligible for listing, in the National Register of Historic Places (NRHP).

In July and September 2009, Tidewater Atlantic Research, Inc. (TAR) conducted an underwater remote sensing survey of two proposed borrow sites and one proposed material transfer site for use at the Longboat Key beach nourishment project. The survey was completed on behalf of Coastal Planning and Engineering, Inc. TAR identified 38 magnetic anomalies and one side-scan sonar target within the X investigation area, two magnetic anomalies in the B-3 investigation area, and eighteen magnetic anomalies and two side-scan sonar targets in the Rehandling Area 2 investigation area during the survey.

TAR found that the anomalies and targets in the X and B-3 investigation areas appear to represent modern debris and require no additional investigation. TAR identified two areas consisting of four magnetic anomalies and two side-scan sonar targets within the Rehandling Area 2 that may represent historic shipwreck or other potentially significant cultural resources. TAR recommends avoidance of these areas with three hundred foot radius protective buffers. The rest of the anomalies within Rehandling Area 2 were determined to represent non-significant modern debris.

As a result of our review of the draft report, this agency recommended that the potentially significant anomalies within Rehandling Area 2 be ground truthed. Subsequently, Coastal Planning and Engineering, Inc. reduced Rehandling Area 2 to eliminate the anomalies from the area of potential effect. Therefore, our agency has rescinded our request for ground truthing in conjunction with the referenced project.

Based on the information provided, our office concurs with the determinations contained in the final report and finds the submitted document complete and sufficient in accordance with Chapter 1A-46, *Florida Administrative Code*.

For any questions concerning our comments, please contact Rudy Westerman, Historic Preservationist, by electronic mail at rjwesterman@dos.state.fl.us, or by phone at 850.245.6333. We appreciate your continued interest in protecting Florida's historic properties.

Sincerely,

Laura A. Kammerer

Laura A. Kammerer
Deputy State Historic Preservation Officer
For Review and Compliance

Pc: Louis Tesar, Interoffice Mail Station 8B

United States Department of the Interior

U. S. FISH AND WILDLIFE SERVICE

7915 BAYMEADOWS WAY, SUITE 200
JACKSONVILLE, FLORIDA 32256-7517

IN REPLY REFER TO:
FWS Log No. 41910-2010-F-0009

June 8, 2011

Colonel Alfred A. Pantano, Jr. District Engineer
Department of the Army
Jacksonville District Corps of Engineers
Tampa Regulatory Office
10117 Princess Palm Drive, Suite 120
Tampa, FL 33610

Dear Colonel Pantano:

Thank you for your September 23, 2009, request for formal consultation and for your project modification letters that we received on September 25, 2009 and May 15, 2011, for sand placement at Longboat Key. The U.S. Fish and Wildlife Service (Service) reviewed the proposed sand placement project for the beach at Longboat Key in Manatee and Sarasota Counties, Florida, and its effects on the Florida manatee (*Trichechus manatus*), piping plover (*Charadrius melodus*), and loggerhead (*Caretta caretta*) and green (*Chelonia mydas)* sea turtles in accordance with section 7 of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq*.).

The Corps and the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE) determined that the proposed project may affect, but was not likely to adversely affect, the Florida manatee (*Trichechus manatus latirostris*) and the nonbreeding piping plover (*Charadrius melodus*). The Corps and the BOEMRE also determined that the proposed project may affect, and is likely to adversely affect the loggerhead and green sea turtles. The Service concurred with these determinations.

The proposed plan is for a two phased sand placement event. In 2011/2012 sand will be placed along 10,000 linear feet of beach between Florida Department of Environment Protection (FDEP) R-Monument 44 to R-Monument 46 and R-Monument 47.5 to R-Monument 50.5 in Manatee County and FDEP R-Monument 12 to R-Monument 17 in Sarasota County. In 2013/2014, sand will be placed along 19,000 linear feet of beach between FDEP R-Monument 44 to R-Monument 45.5 and R-Monument 47 to R-Monument

50 in Manatee County, R-Monument 67 to T1 /Manatee-Sarasota County, R-Monument 13 to R-Monument 17 and R-Monument 21 to R-Monument 29 in Sarasota County.

The Service has determined that the proposed project is appropriate to apply to the Statewide Programmatic Biological Opinion (SPBO) concerning sand placement activities along the coast of Florida for the Corps dated April 19, 2011 (FWS Log No. 41910-2011-F-0170).
http://www.fws.gov/northflorida/BOs/20110418_bo_FINAL_USFWS_Statewide_Programmatic_BO_Beach_Nourish_signed.pdf

The minimization measures, Reasonable and Prudent Measures, and Terms and Conditions in the SPBO are applicable to the proposed project and must be followed for sea turtles and manatees. We have assigned log number FWS Log Number 41910-2010-F-0009 to this individual consultation.

Piping plover

The Corps and BOEMRE also determined that the proposed project may affect, and is likely to adversely affect the piping plover. Non-breeding piping plovers were documented on Longboat Key, Florida. In 2005, three piping plovers were observed. In 2006, one piping plover was observed. In 2009, seven piping plovers were observed.

Natural organic material deposited on the beach (wrack) provides important foraging and roosting habitat for piping plovers and other shorebirds. It also serves to protect important shorebird habitat by helping stabilize beaches through reduction in erosive processes such as eolian sand transport. Protection of wrack can help to offset the direct and indirect impacts associated with beach nourishment and ensuing human disturbance.

The Service conducted a conference call with the applicant and Florida Fish and Wildlife Conservation Commission (FWC) on April 29, 2010, to discuss areas and the importance of wrack on the shoreline year-round.

In a letter from the applicant's agent, to the following conservation measures will be included into the proposed project action:

1. Protection of wrack will minimize impacts to shorebird habitat occurring directly or indirectly by the proposed project and ensuing human disturbance and assist with shoreline stabilization efforts. Wrack removal is not conducted by the Town of Longboat Key. Currently, no wrack is protected from Longboat Pass to approximately four miles south.

2. Educational signs will be installed highlighting the importance of beach habitats to wildlife and explaining the importance of the wrack along the shoreline. The FWC will provide examples of the information to include on these signs.

3. Vehicles including all-Terrain Vehicles (ATVs) traversing the beach, used by beach life-guards, beach maintenance employees, turtle watch volunteers and law enforcement will avoid the soft sand areas in the wrack protection zone and follow the FWC's Beach Driving Best Management Practices: (http://www.myfwc.com/CONSERVATION/ConservationYouLiving_w_Wildlife_BeachDriving.htm). Emergency vehicles shall have full access to the beach including the wrack protection zone.

4. The Town will put up educational signage at public access areas indicating the importance and contribution of beach wrack to the coastal biological community. An example poster designed by the Florida Fish and Wildlife Conservation Commission (FWC) is included in Attachment A.

5. The Town will also publish information on the importance of wrack on the Longboat Key website along with a link to the FWC news release entitled *That Bunch of Seaweed on the Beach Teems with Life*. http://www.myfwc.com/NEWSROOM/09/statewide/News_09_X_BeachWrack.htm

6. The Town will meet with each private property owner who removes the wrack on their beach to discuss the importance of wrack and the following options:
   i. Leaving a designated portion of wrack year round; and
   ii. Leaving the wrack from September 1 through May 1st.

7. The Town will provide a summary report of these actions to the Service and FWC.

The Service has determined that the proposed project may affect, but is not likely to adversely affect the piping plover provided the inclusion of the following additional conditions:

1. Piping plover optimal habitat shall be avoided to the maximum extent practicable. Site selection for equipment staging, travel corridors, construction vehicles including all - terrain vehicles and pipeline alignment shall stay just above or just below the primary "wrack" line and swash zone. The water and land-based loading and unloading of equipment, materials, supplies, and personnel shall be limited to the footprint of the staging and storage area, with the exception of the transportation of job-related personnel.

2. The Town of Longboat Key will work with the Service and FWC to develop shore protection design guidelines and/or mitigation measures that can be utilized during future project planning to protect and/or enhance high value piping plover habitat locations (i.e., washover fans) as well as the progress of protecting the wrack.

Based on the preceding, the Service has determined that the proposed project may affect, but is not likely to adversely affect the piping plover provided that applicant modified their project plans to include the above measures to preserve piping plover feeding and roosting habitat within the project area.

Please submit a report for the proposed project as described in the SPBO Term and Condition A22 following completion of the proposed work.

Thank you for your cooperation in the effort to conserve fish and wildlife resources. Should you have any questions or require clarification regarding this letter, please contact Terri Callison of this office at (904) 731-3286.

Sincerely,

for David L. Hankla
Field Supervisor

cc: Robbin Trindell- FWC
Ken Graham- Service/Atlanta

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, Florida 33701-5505
(727) 824-5317; FAX 824-5300
http://sero.nmfs.noaa.gov

June 1, 2011 F/SER46/MS/mt

Colonel Alfred A. Pantano, Jr., District Engineer
Jacksonville District Corps of Engineers
Tampa Permits Section
10117 Princess Palm Avenue, Suite 120
Tampa, Florida 33610-8302

Dear Colonel Pantano:

NOAA's National Marine Fisheries Service (NMFS), Southeast Region, Habitat Conservation Division (HCD) has reviewed the public notice dated May 3, 2011, concerning permit application SAJ-2009-03350 (IP-MEP). The Town of Longboat Key proposes multiple beach re-nourishment activities along approximately 9.8 linear miles of beach on Longboat Key in the Gulf of Mexico within Manatee and Sarasota counties, Florida.

The original permit for this activity was issued on July 27, 1992. Bathymetric, diver reconnaissance, and sidescan sonar surveys were conducted between May 21 through 25, 1991, to identify hard bottom reef habitats which may have existed within the re-nourishment area. A subsequent beach re-nourishment project similar to the one that occurred in 1992 was requested by the applicant through a public notice dated March 28, 1996. NMFS HCD, by letter dated April 24, 1996, requested that authorization for that activity be held in abeyance until compliance with the mitigation conditions of the COE permit could be verified and reviewed by state and federal natural resource agencies. NMFS reviewed the monitoring reports and, by letter dated June 18, 1996, concurred with the COE's findings that the artificial reefs were progressing in a satisfactory manner. We further stated that we had no objections to the proposed project at that time.

Through our October 1, 2003, letter (copy enclosed) in response to the public notice dated September 2, 2003, regarding similar beach re-nourish activities on Longboat Key, we provided an essential fish habitat (EFH) conservation recommendation for projected impacts to approximately 1.5 acres of nearshore hard bottom habitats in the vicinity of Florida Department of Environmental Protection (FDEP) monuments R-49.5 through R-51. To compensate for these unavoidable impacts, 1.5 acres of nearshore hard bottom habitats were created. Further, through our subsequent February 17, 2004, letter (copy enclosed), we modified the EFH conservation recommendation to be consistent with the FDEP's hard bottom mitigation and monitoring plans. As indicated in that letter and following our revisions to and adoption of the FDEP recommended mitigation and monitoring plans, NMFS HCD had no objection to permit issuance for this project.

Hard bottom and unvegetated marine habitats in the project area have been identified by the Gulf of Mexico Fishery Management Council (GMFMC) as essential fish habitat (EFH) for several life stages of federally managed fish and invertebrate species, including: juvenile and adult red grouper; adult black grouper; adult lane, red and yellowtail snapper; juvenile vermillion snapper; and adult spiny lobster. Detailed information on federally managed fisheries and their EFH is provided in the 2005 amendment of the Fishery Management Plans for the Gulf of Mexico prepared by the GMFMC.

From our review of the information in the current public notice and Coastal Planning and Engineering, Incorporated's "Essential Fish Habitat Assessment" dated February 2011; Figures 2c and 2d indicate that phased island-wide re-nourishment activities are planned for 2013-2014 between FDEP monuments R-13 through R-17, and R-21 through R-29, respectively. From our interagency pre-application site inspection of portions of the re-nourishment areas on October 28, 2009, and Figure 2c of the EFH assessment, an undetermined amount of nearshore hard bottom habitat occurs in the proposed equilibrium toe of fill immediately offshore of monuments R-13 through R-14.5; similarly, Figure 2d indicates an undetermined amount of nearshore hard bottom habitat in the proposed equilibrium toe of fill immediately offshore of monuments R-24.5 through R-29.

Compensatory mitigation for previously authorized unavoidable nearshore hard bottom impacts that occurred during 2006 in the vicinity of monuments R-49.5 through R-51 has been implemented through the creation of 1.5 acres of nearshore artificial reef structures. However, from our review of the current project's public notice describing island wide re-nourishment activities, NMFS believes that additional compensatory mitigation for adverse impacts to (undetermined acreages of) nearshore hard bottom habitat should be implemented to offset ecological services expected to be lost through the placement of sand between R-13 to R-17 and R-21 to R-29. Necessary artificial reef structures to be constructed to offset ecological losses as a result of this project should be sited and designed to replicate the existing nearshore geomorphic reef structure to the maximum extent practical, and should be located to avoid potential similar future re-nourishment areas.

In consideration of the potential impacts to EFH and managed fishery resources associated with the proposed re-nourishment of the beaches along Longboat Key, NMFS HCD recommends the following:

EFH Conservation Recommendations

1. A benthic assessment, including but not limited to sidescan sonar and diver reconnaissance, should be conducted of nearshore hard bottom habitats occurring in the project area between R-13 to R-17 and R-21 to R-29 to determine the acreage of hard bottom habitat potentially affected by proposed re-nourishment activities.

2. Compensatory mitigation for adverse impacts to undetermined acreage of hard bottom habitat shall include the creation of similar acreage of nearshore, low-profile, hard bottom habitat off Longboat Key. Necessary hard bottom mitigation areas should be located in areas outside of future construction and toe of fill areas.

Compensatory mitigation should be required for all documented impacts to hard bottom marine habitats. The associated mitigation plan should include the following elements: 1) description of the mitigation project; 2) mitigation implementation schedule; 3) quantification of hard bottom impact acreage versus proposed mitigation acreage and the scientific rationale for the proposed mitigation acreage; 4) sampling protocols for determining mitigation success; 5) identification of targeted hard bottom climax communities expected in mitigation area(s), including their acreage and configurations; 6) materials and methods to be used to achieve the intended mitigation; 7) a comprehensive five-year monitoring and reporting schedule; and 8) contingency plans by which equivalent mitigation would be completed if the proposed mitigation fails.

Please be advised that the Magnuson-Stevens Act and the regulation to implement the EFH provisions (50 CFR Section 600.920) require the COE to provide a written response to this letter within 30 days and at least 10 days prior to final agency action. A preliminary response is acceptable if final action cannot be completed within 30 days. The COE's final response must include a description of measures to be required to avoid, mitigate, or offset the adverse impacts of the activity. If the COE's response is inconsistent with these EFH conservation recommendations, the COE must provide an explanation of the reasons for not implementing those recommendation(s). We request that a copy of your final response also be sent to the GMFMC, 2203 North Lois Avenue, Suite 1100, Tampa, Florida, 33607-2370.

If you have questions regarding our views on this project, or need technical assistance in developing an adequate mitigation plan to compensate for impacts to fishery resources as a result of this project, please contact Mark Sramek at the above address or by calling (727) 824-5311.

Sincerely,

W. Mark Thompson

for Miles M. Croom
Assistant Regional Administrator
Habitat Conservation Division

cc:
F/SER4
F/SER46

cc: email
EPA, Atlanta
FDEP, Tampa
FDEP, Tallahassee (Miller)
FWCC
FWS, Vero Beach, Jacksonville
F/SER3

COASTAL PLANNING & ENGINEERING, INC.

2481 NW BOCA RATON BOULEVARD, BOCA RATON, FL 33431
561-391-8102 PHONE 561-391-9116 FACSIMILE
Website: www.coastalplanning.net
E-mail: mail@coastalplanning.net

8489.26

June 15, 2011

Mr. Mark E. Peterson
U.S. Army Corps of Engineers, Jacksonville District
Tampa Permitting Section
10117 Princess Palm Avenue, Suite 120
Tampa, FL 33610-8302

RE: Town of Longboat Key
SAJ-2009-03350 (IP-MEP)

Dear Mark:

This letter is in response to the National Marine Fisheries Service (NMFS) letter to the U.S. Army Corps of Engineers (USACE) dated June 1, 2011. The NMFS letter expressed concern over impacts to potential hardbottom resources in the nearshore habitat of Longboat Key as identified in a sidescan sonar (SSS) survey conducted in October 2002. The SSS hardbottom identified in Figures 2c and 2d from the Longboat Key Essential Fish Habitat (EFH) Assessment are specifically referenced in the NMFS letter. This letter aims to clarify the data presented in these figures and provide additional information to aid in NMFS-HCD's conservation recommendations for the proposed renourishment project on Longboat Key. The hardbottom referenced in the NMFS letter was labeled as 2002 SSS hardbottom, but has been revised (Attachment 1) to more accurately present this data as 2002 SSS *potential* hardbottom. The potential hardbottom identified by SSS was subsequently investigated by divers in December 2002 to accurately verify the signature as hardbottom or other substrate. The results of these diver investigations were not clearly identified in Figures 2a-2d from the EFH Assessment. Figures 2a-2d in Attachment 1 have also been updated to present the locations of the resource investigation dives conducted in December 2002. Attachment 2 presents the observation report for this resource investigation.

The following provides the EFH Conservation Recommendations from NMFS and our response to these recommendations:

1. A benthic assessment, including but not limited to sidescan sonar and diver reconnaissance, should be conducted of nearshore hardbottom habitats occurring in the project area between R-13 to R-17 and R-21 to R-29 to determine the acreage of hardbottom habitat potentially affected by proposed renourishment activities.

A benthic assessment was conducted between R-13 to R-17 and R-21 to R-29 in 2002 as part of the resource investigations for the 2005/06 nourishment of Longboat Key. This included sidescan sonar (October 2002) and diver reconnaissance (December 2002 – see Attachments 1 and 2). The area between R-21 and R-29 was identified as sandy substrate with no indication of hardbottom habitat. There were two sites between R-13 and R-17 identified as hardbottom resources (Sites 5 and 6). Site 8 was identified as an artificial reef that served as mitigation for the nearshore hardbottom impacted by the 1993 nourishment (Sites 5 and 6). All other diver investigations in the nearshore habitats presented in Figures 2c and 2d (Attachment 2) were identified as sandy substrate. The following table presents the findings at each diver resource investigation location.

Resource Verification Dive No.	Substrate Identified
1	Sandy substrate
2	Sandy substrate
3	Sandy substrate
4	Sandy substrate
5	Hardbottom
6	Hardbottom
7	Sandy substrate
8	Artificial reef
9	Hardbottom
10	Hardbottom
11	Hardbottom
12	Hardbottom
13	Hardbottom
14	Hardbottom
15	Hardbottom
16	Low-relief, patchy hardbottom with rubble
17	Low-relief, patchy hardbottom with rubble

2. Compensatory mitigation for adverse impacts to undetermined acreage of hardbottom habitat shall include the creation of similar acreage of nearshore, low-profile hardbottom habitat off Longboat Key.

Artificial reefs were constructed as compensatory mitigation for impacts to hardbottom resources in the vicinity of R-13 from the 1993 nourishment, and for impacts to hardbottom in the vicinity of R-49.5 from the 2005/06 nourishment. As compensatory mitigation has already been created for impacts to the nearshore hardbottom referenced in NMFS' letter, no additional mitigation is required.

Please discuss this information with NMFS-HCD. If you have any questions, please call me.

Very truly yours,

COASTAL PLANNING & ENGINEERING, INC.

Douglas W. Mann, P.E., D.CE.
Senior Coastal Engineer

cc: Juan Florensa, Town of Longboat Key
Mark Sramek, NMFS
Ann Marie Lauritsen, USFWS
Geoff Wikel, BOEMRE
Beau Suthard, P.G., CPE
Jessica Craft, CPE
Stacy Prekel, CPE

Enclosures

Attachment 1

Figures 2a – 2d

G:\Enterprise\Sarasota\848915_LBK_MMS_EA_Mxd\EA_Fig2a_Nearshore_020711.mxd

Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 1990 Hardbottom
- 1993 Hardbottom
- 1995 Hardbottom
- 2003 Hardbottom
- 2006 Hardbottom
- 2007 Hardbottom
- 2008 Hardbottom
- Artificial Reef Sites
- 2002 SSS Potential Hardbottom
- 2002 Diver Resource Investigation Locations
- FDEP Monuments

2006 FWRI Seagrass
- Continuous
- Discontinuous

2011/2012 Interim Nourishment Phase Fill Area
- Construction Toe of Fill
- Equilibrium Toe of Fill
- 2013/2014 Island-wide Nourishment Phase Project Limits

Feet
0 500 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2a

Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 2002 SSS Potential Hardbottom
- FDEP Monuments
- 2006 FWRI Seagrass
  - Continuous
  - Discontinuous
- 2013/2014 Island-wide Nourishment Phase Project Limits

Feet: 0 — 500 — 1,000

1 inch = 1,017 feet

TITLE:

Nearshore Hardbottom Longboat Key Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2b

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Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

2002 SSS Potential Hardbottom

2002 Diver Resource Investigation Locations

FDEP Monuments

2006 FWRI Seagrass

Continuous

Discontinuous

2011/2012 Interim Nourishment Phase Fill Area

Construction Toe of Fill

Equilibrium Toe of Fill

2013/2014
Island-wide Nourishment Phase
Project Limits

N

Feet
0 500 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2c

Notes:

1. Coordinates are in feet based on Florida State Plane Coordinate System, West Zone, North American Datum of 1983 (NAD 83).
2. Aerial photography downloaded from the Manatee County GIS Department, date flown February 2008.
3. 2013/2014 Project Limits subject to change. Width varies.

Legend:

- 2002 SSS Potential Hardbottom
- 2002 Diver Resource Investigation Locations
- FDEP Monuments

2006 FWRI Seagrass
- Continuous
- Discontinuous

2011/2012 Interim Nourishment Phase Fill Area
- Construction Toe of Fill
- Equilibrium Toe of Fill
- 2013/2014 Island-wide Nourishment Phase Project Limits

Feet
0 500 1,000

1 inch = 1,000 feet

TITLE:

Nearshore Hardbottom
Longboat Key
Beach Renourishment Project Area

COASTAL PLANNING & ENGINEERING, INC.
2481 N. W. BOCA RATON BOULEVARD
BOCA RATON, FL 33431
PH. (561) 391-8102
FAX (561) 391 9116

DATE: 1/05/11	BY: HMV	COMM NO. : 8489.15	Figure 2d

Attachment 2

2002 Diver Resource Investigation Observation Report

FIELD OBSERVATION REPORT

DATE:	December 12, 2002
PROJECT:	Longboat Key Hardbottom Characterization
COMMISSION NO:	8488.54
LOCATION:	Longboat Key, Florida (Sarasota County)
FIELD REPRESENTATIVES:	Robert Baron, Marine Biologist and Jennifer Davis, Coastal Engineer

---

An underwater inspection of the Longboat Key nearshore habitat was conducted by Coastal Planning & Engineering on December 12, 2002. The purpose of the investigation was to investigate, characterize and document 17 potential nearshore hardbottom habitats located within and adjacent to the proposed Longboat Key Beach Renourishment Project identified during a side scan sonar survey conducted from October 14 to October 18, 2002. Probable hardbottom habitat locations and extent identified by side scan sonar methods were used to plan the hardbottom investigations performed by marine biologists from Coastal Planning & Engineering, Inc.

Weather conditions during the field survey were overcast with periods of light rain. Air temperature fluctuated between 63 and 66 degrees Fahrenheit. Maximum water temperature at the average 12-foot depth was 63 degrees Fahrenheit. Sea conditions were calm offshore (less than 2 feet), however 1-2 foot nearshore swells were present during the investigation. Underwater visibility during the inspection was considered to be poor (1 inch to 1.5 feet), and did not allow for photographic documentation of the observed hardbottom communities.

The 17 investigation sites are identified from south to north in numerical order (Site 1 to 17). Figures 1-3 provides the location of the sites investigated.

Site investigations including a patterned search around the entry point of Sites 1, 2, 3, 4 and 7 showed a sandy substrate with no indications of hardbottom habitat. However, field investigations of Sites 5 and 6 documented hardbottom habitats. A 6 to 7-inch vertical ledge extending above the sand, surrounded the hardbottom community at Sites 5 and 6. The Sites were characterized as being dominated by the red macroalgae *(Hypnea cervicornis*) (Rhodophyta). Due to the limited visibility (less than 3 inches), additional benthic species were not identified at Sites 5 and 6. Additional investigations will be conducted in the near future to further characterize these sites once conditions improve.

Site 8, located approximately 1,200 feet offshore of DEP monument R-13, is an artificial reef constructed as mitigation in 1993. The man-made substrate was found to be composed of culverts and pilings. Visibility at this site improved significantly (1 to 1.5 feet) therefore, a greater number of benthic organisms and fish were observed and identified. The higher vertical relief, averaging approximately 12 inches, and available surface area at Site 8 contributes to the habitat available to the flora and fauna. The dominant macro algal species observed at Site 8 was

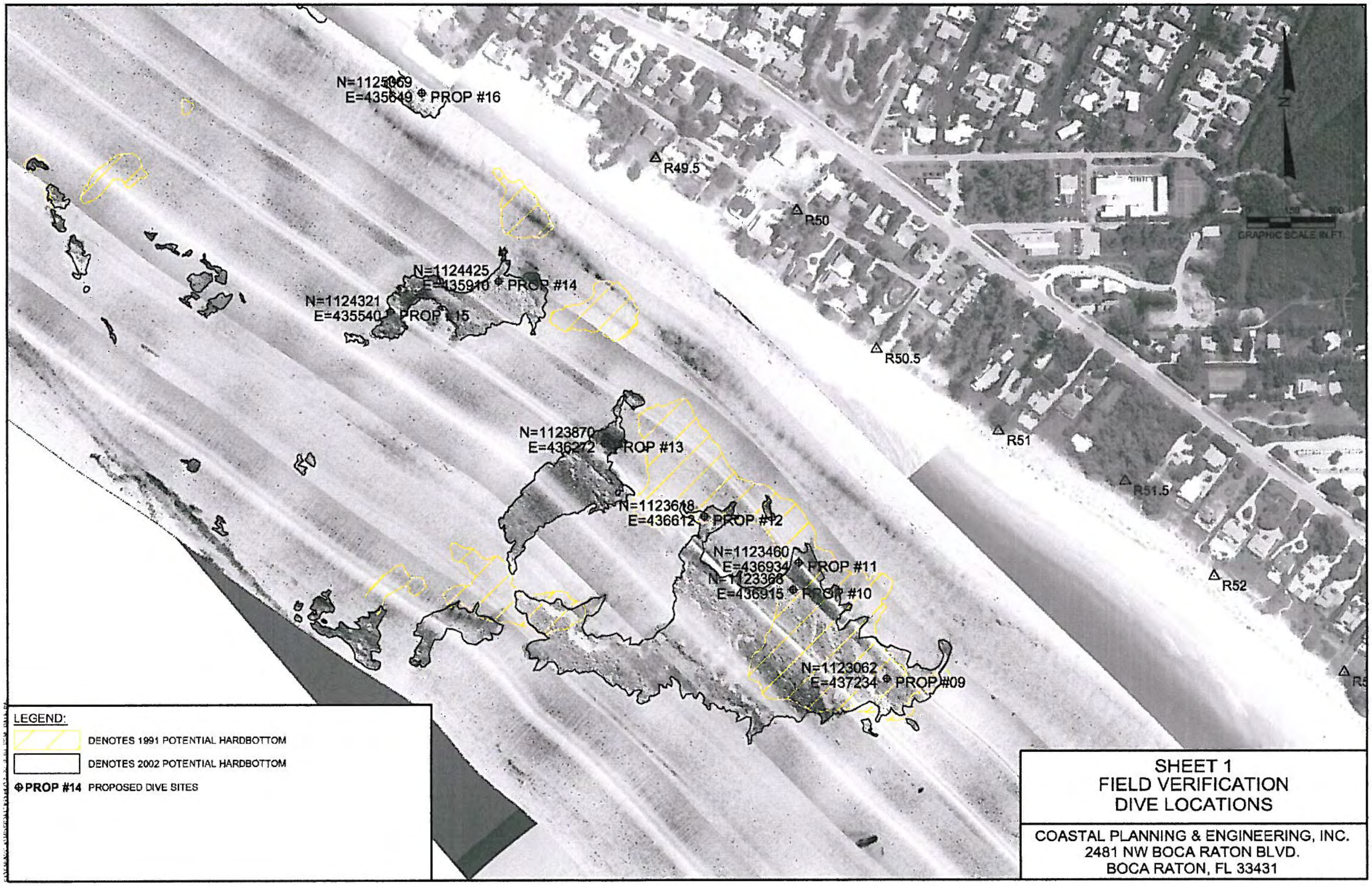
Sargassum pteropleuron (Phaeophyta). Additional algal species observed were *Heterosiphonia gibbesii* (Rhodophyta), and *Coduim* sp. (Chlorophyta). Other benthic organisms noted were the overgrowing mat tunicate (*Trididemum solidum*), unidentified colonial orange tunicates (Class Ascidiacea), and an unidentified sea whip (*Pterogorgia* sp.). Two scleractinian coral species were observed on the artificial reef, the knobby star coral (*Solenastrea hyades*), and an unidentified flower coral (Family Caryophylliidae). Fish observed were sheepshead (*Archosargus probatocephalus*), white grunt *(Haemulon plumieri*), juvenile porkfish (*Anisotremus virginicus*), spottail pinfish (*Diplodus holbrooki*), and belted sandfish (*Serranus subligarius*).

Hardbottom habitat was confirmed at Sites 9, 10, 11, 12, 13, 14 and 15, although poor visibility (less than 3 inches) prevented thorough investigations of the hardbottom benthic community, several macro algal species were identifiable. The dominant species included *Sargassum pteropleuron*, *Gracilaria* sp. (Rhodophyta), and *Hypnea cervicornis*. One additional (non-algal) benthic organism observed was the mat tunicate (*Trididemum solidum*).

The northernmost investigation areas (Sites 16 and 17) showed signs of low-relief, patchy hardbottom with very little benthic coverage. This substrate is composed of rubble with a possible transitional zone from sand to hardbottom substrate. Approximately 100 feet inshore of Site 17, scattered hardbottom formations (at water's edge) were exposed and could be seen from the surface. It was not determined whether these formations were natural or of man-made origin.

Although benthic organism species richness and abundance appeared to be minimal on the nearshore hardbottom habitats, the presence of additional species were unidentifiable due to poor visibility at many of the sites. Historically, water clarity is minimal at these nearshore locations during the winter months. Additional investigations of these sites is scheduled to occur in January 2003, with the intent of providing a more comprehensive characterization of the nearshore hardbottom habitats.

An investigation of the benthic community at Anna Maria Island (approximately 3 miles north) was completed in October 2002. The results of this investigation showed the presence of similar benthic organisms. Macroalgae and tunicates comprised the dominant species characteristically observed on nearshore hardbottom habitats. Benthic species abundance seemed to be much greater at Anna Maria Island; however visibility was significantly greater (approximately 8 feet) during the October 2002 investigations, which allowed the marine biologists to conduct a more comprehensive and accurate observation and species identification. The Longboat Key and Anna Maria Island hardbottom locations are in close proximity and are influenced by similar abiotic and biotic factors. An assumption can then be made that benthic coverage may be comparable in species abundance and richness at the nearshore hardbottom habitats of Longboat Key versus Anna Maria Island.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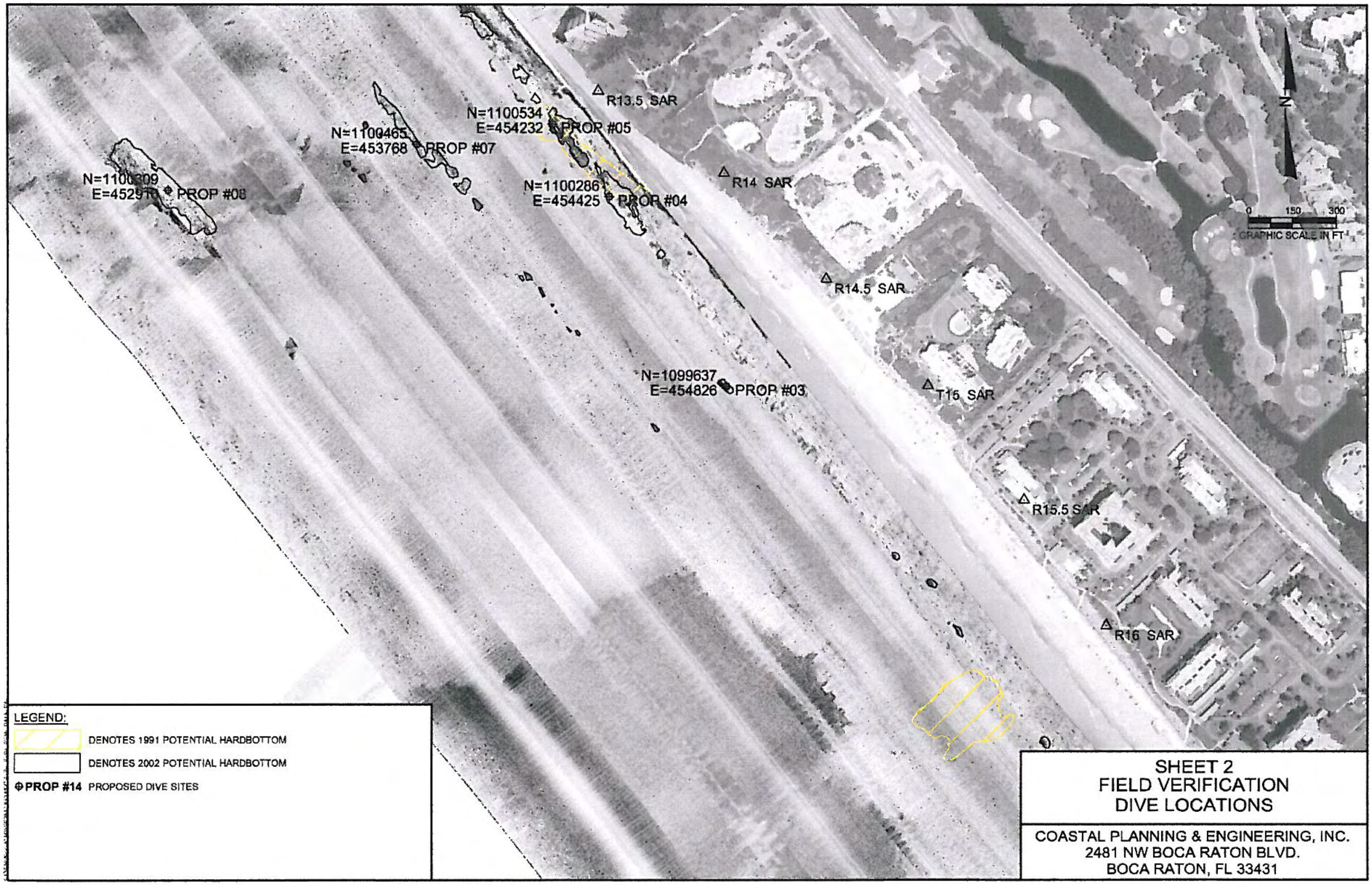
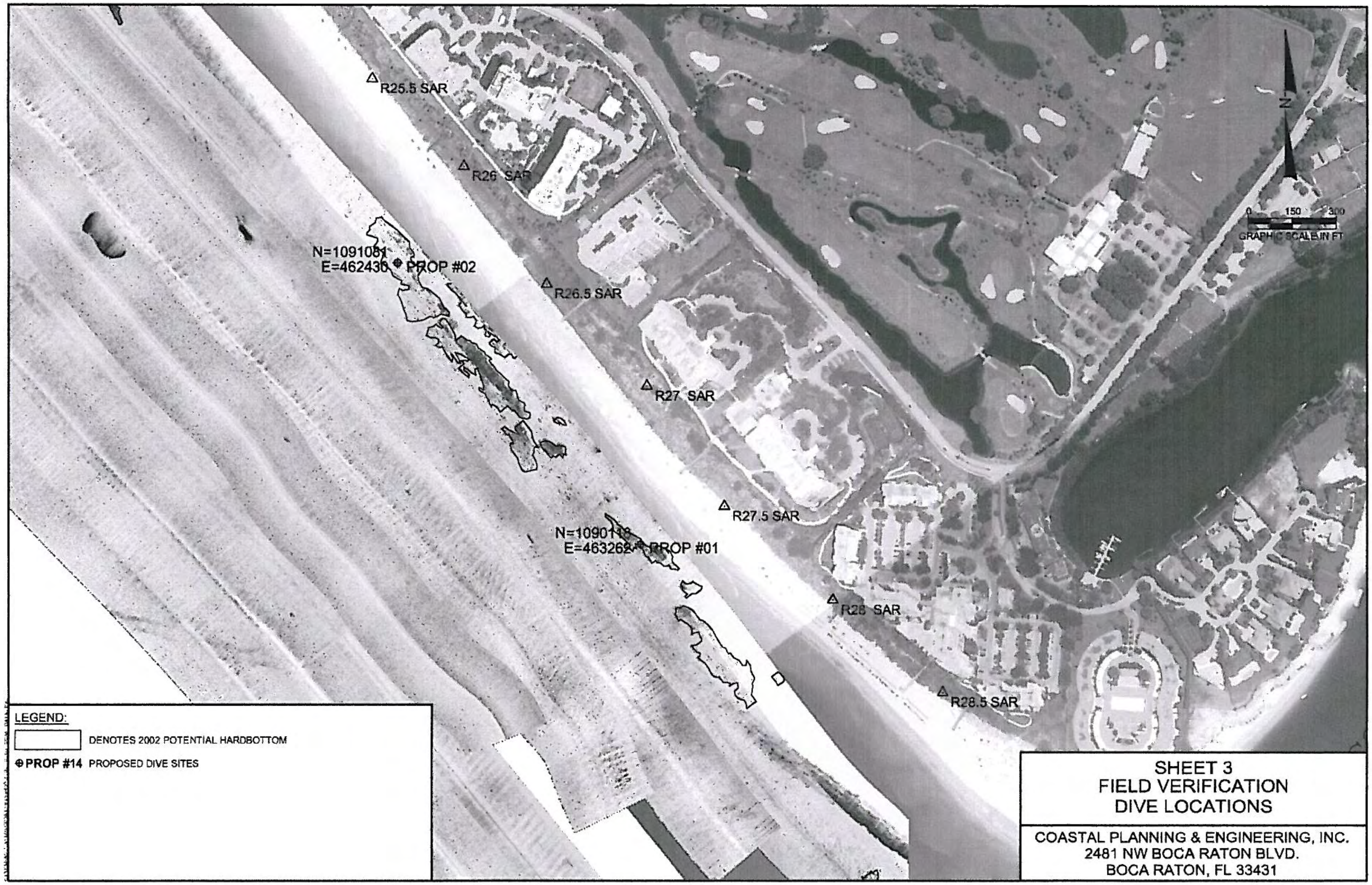
LEGEND:
DENOTES 1991 POTENTIAL HARDBOTTOM
DENOTES 2002 POTENTIAL HARDBOTTOM
PROP #14 PROPOSED DIVE SITES
SHEET 1
FIELD VERIFICATION
DIVE LOCATIONS
COASTAL PLANNING & ENGINEERING, INC.
2481 NW BOCA RATON BLVD.
BOCA RATON, FL 33431



SHEET 2
FIELD VERIFICATION
DIVE LOCATIONS

COASTAL PLANNING & ENGINEERING, INC.
2481 NW BOCA RATON BLVD.
BOCA RATON, FL 33431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PROP #01
R28 SAR
R28.5 SAR
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GRAPHIC SCALE IN FT
LEGEND:
DENOTES 2002 POTENTIAL HARDBOTTOM
PROP #14 PROPOSED DIVE SITES
SHEET 3
FIELD VERIFICATION
DIVE LOCATIONS
COASTAL PLANNING & ENGINEERING, INC.
2481 NW BOCA RATON BLVD.
BOCA RATON, FL 33431

From:	Mark Sramek
To:	Peterson, Mark E SAJ
Cc:	"Mann, Douglas"; Prekel, Stacy; AnnMarie_Lauritsen@fws.gov; Jason Rueter; Edwards, Lainie
Subject:	Town of Longboat Key, SAJ-2009-03350 (IP-MEP)
Date:	Tuesday, October 04, 2011 10:39:33 AM

NOAA's National Marine Fisheries Service (NMFS), Southeast Region, Habitat Conservation Division (HCD), has reviewed Coastal Planning & Engineering, Incorporated's (CP&E) observation report and video documentation/hardbottom resource investigation results dated September 20, 2011, as provided to our offices for review and comment. The hardbottom resource investigation and resultant video documentation were conducted on September 2, 2011, in near shore marine habitats of the Gulf of Mexico adjacent to the south end of Longboat Key, Sarasota County, Florida, between FDEP monuments R-26 through R-28 to verify or disprove the presence of potential hardbottom habitats in these areas.

From our review of the information detailed in the September 20, 2011, letter and accompanying video results provided on DVD as enclosure to the letter, the field investigation findings and benthic video results adequately address the essential fish habitat (EFH) recommendations previously provided to your office by NMFS, HCD, through our letter dated June 1, 2011. NMFS had provided two EFH conservation recommendations to the Department of the Army, Corps of Engineers' (COE) office in response to the COE public notice, dated May 3, 2011, concerning the subject project. Further, artificial reefs were previously constructed as compensatory mitigation for impacts to hardbottom resources in the vicinity of R-13 from the 1993 nourishment activity and therefore were not needed to be verified as part of the September 2, 2011, field investigation by CP&E.

This satisfies the consultation procedures outlined in 50 CFR Section 600.920, of the regulation to implement the EFH provisions of the Magnuson-Stevens Fishery Conservation and Management Act. Therefore, no further consultation is required for this action. Thank you for your efforts to coordinate these activities through our office.

-------- Original Message --------
Subject: Longboat Key
Date: Sat, 24 Sep 2011 20:40:09 +0000
From: Prekel, Stacy <Stacy.Prekel@shawgrp.com> <mailto:Stacy.Prekel@shawgrp.com>
To: Mark Sramek <Mark.Sramek@noaa.gov> <mailto:Mark.Sramek@noaa.gov>

Hi Mark,

I just wanted to check in and make sure you got the resource verification observation report that we sent to you last week – the one with regard to the potential hardbottom at the south end of Longboat.

Also, do you have updated Conservation Recommendations? Call me when you get a chance.

Thanks!

Stacy

Stacy E. Prekel

Senior Marine Biologist

Coastal Planning & Engineering, Inc.

A Shaw Group Company

2481 NW Boca Raton Blvd

Boca Raton, FL 33431

561.361.3185 direct

561.239.0263 cell

561.391.9116 fax

stacy.prekel@shawgrp.com

www.coastalplanning.net <http://www.coastalplanning.net/>

www.shawgrp.com <http://www.shawgrp.com/>

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UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Southeast Regional Office
263 13th Avenue South
St. Petersburg, FL 33701-5505
727.824.5312, FAX 824.5309
http://sero.nmfs.noaa.gov

APR 24 2012

F/SER31:JR

Mr. Geoffrey Wikel
Bureau of Ocean Energy Management
Department of the Interior
381 Elden Street Mailstop 4042
Herndon, VA 20170

Re: Town of Longboat Key Outer Continental Shelf Resources Lease

Dear Mr. Wikel:

Enclosed is the National Marine Fisheries Service's (NMFS) biological opinion issued in accordance with Section 7 of the Endangered Species Act (ESA) of 1973, on the Bureau of Ocean Energy Management's (BOEM) proposed action to issue an offshore sand lease to the Town of Longboat Key (Town). The Town proposes to renourish the beaches of Longboat Key with sand obtained from federal and state waters off Manatee and Sarasota Counties, Florida.

This biological opinion is the product of a reinitiated biological opinion (F/SER/2011/01074) and supersedes the findings of that prior opinion. The biological opinion analyzes the project's effects on five species of sea turtles and smalltooth sawfish. This opinion is based on project-specific information provided by BOEM, the applicant, and the applicant's consultants, as well as our review of published literature. It is our opinion that the action, as proposed, may adversely affect, but is not likely to jeopardize, sea turtles and smalltooth sawfish.

We look forward to further cooperation with you on other BOEM projects to ensure the conservation and recovery of our threatened and endangered marine species. If you have any questions regarding this consultation, please contact Jason Rueter, fishery biologist, at (727) 824-5350, or by e-mail at Jason.Rueter@noaa.gov.

Sincerely,

Roy E. Crabtree, Ph.D.
Regional Administrator

Enclosure
File: 1514-22.F.4
Ref: F/SER/2012/00110

Endangered Species Act - Section 7 Consultation
Biological Opinion

Action Agency: Bureau of Ocean Energy Management (BOEM)

Activity: Authorization for Dredging of Gulf of Mexico Sand Mining ("Borrow") Areas Using Hopper Dredges for the Town of Longboat Key, Beach Renourishment Project (Consultation Number F/SER/2012/00110) – Reinitiation of Consultation F/SER/2011/01074.

Consulting Agency: National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Regional Office, Protected Resources Division, St. Petersburg, Florida

Approved by:

Roy E. Crabtree, Ph.D., Regional Administrator
NMFS, Southeast Regional Office
St. Petersburg, Florida

Date Issued: APR 24 2012

Contents

Section 7(a)(2) of the Endangered Species Act (ESA) of 1973, as amended (16 U.S.C. § 1531 *et seq.*), requires that each federal agency shall ensure that any action authorized, funded, or carried out by such agency is not likely to jeopardize the continued existence of any endangered or threatened species or result in the destruction or adverse modification of critical habitat of such species. When the action of a federal agency may affect a protected species, that agency is required to consult with either the National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS) or the U.S. Fish and Wildlife Service (USFWS), depending upon the protected species that may be affected.

This document represents NMFS' biological opinion (opinion) based on our review of the proposed authorization by BOEM for dredging of Gulf of Mexico sand mining ("borrow") areas using hopper dredges for the Town's beach renourishment project and its effects on green sea turtles *(Chelonia mydas*), leatherback sea turtles (*Dermochelys coriacea*), hawksbill sea turtles *(Eretmochelys imbricata*), loggerhead sea turtles (*Caretta caretta*), Kemp's ridley sea turtles *(Lepidochelys kempii*), and smalltooth sawfish (*Pristis pectinata*).

Consultations are required when action agencies determine that a proposed action "may affect" listed species or designated critical habitat. Consultations on most listed marine species are conducted between the action agency and NMFS. Consultations are concluded after we determine that an action is not likely to adversely affect listed species or critical habitat, or after issuance of an opinion that identifies whether a proposed action is likely to jeopardize the continued existence of a listed species, or destroy or adversely modify critical habitat. The opinion also states the amount or extent of incidental taking that may occur. Non-discretionary measures ("reasonable and prudent measures" - RPMs) to reduce the likelihood of interactions are developed, and conservation recommendations are made. Notably, there are no reasonable and prudent measures associated with critical habitat, only reasonable and prudent alternatives that avoid destruction or adverse modification.

This opinion is based on information provided by BOEM; the Town of Longboat Key ("the Town"); Coastal Planning and Engineering, Inc. (CP&E); previous NMFS opinions on hopper dredging including the November 19, 2003, regional biological opinion on hopper dredging in the Gulf of Mexico by the U.S. Army Corps of Engineers' (COE) combined Jacksonville, Mobile, New Orleans, and Galveston Districts, as amended; and dredging and sea turtle relocation trawling reports submitted by the COE and/or maintained on their Sea Turtle Data Warehouse Web site (http://el.erdc.usace.army.mil/seaturtles/index.cfm).

1.0 Consultation History

On March 16, 2011, a request was received from BOEM to initiate formal consultation under Section 7 of the ESA for the Town's proposed beach renourishment project in Longboat Key, Florida. Sand is proposed to be mined from borrow areas located in both state and federal waters to renourish Longboat Key. A biological assessment (BA) prepared by CP&E was included with the request. The BA was adopted by BOEM.

On May 19, 2011, a conference call with CP&E, BOEM, the U.S. Army Corps of Engineers' (COE) Jacksonville District, and NMFS' Habitat Conservation Division and Protected Resources Division was conducted for the Town to provide answers to outstanding questions on the project. Formal consultation was initiated.

NMFS issued its biological opinion to BOEM (F/SER/2011/01074) for the BOEM-authorized project on November 28, 2011.

On December 1, 2011, BOEM notified NMFS that there were concerns with the biological opinion's proposed action statement.

On December 5, 2011, a conference call was held with BOEM where NMFS was informed that the Town, unbeknownst to NMFS, had made significant modifications to the quantity, timing, and location of proposed sand extractions, thus significantly changing the scope and effects of the Town's proposed action. NMFS advised that reinitiation of formal consultation would be necessary.

On December 30, 2011, NMFS received a detailed list of the revised proposed action and the changes needed to be incorporated into a new (the present) biological opinion. Formal consultation was initiated on this date. The present opinion supersedes F/SER/2011/01074.

2.0 Description of the Action

Proposed Actions Occurring in Federal Waters

BOEM is proposing to issue a lease for the use of sand resources in the borrow area F2 (BAF2) of the Outer Continental Shelf (OCS) (i.e., federal waters) off the Town of Longboat Key ("the Town"), Florida. A map of the project area is provided in Figure 1.1. The Town is seeking a 10-year dredging permit for continued multiple nourishments of Longboat Key's shoreline from R44 in Manatee County to R29 in Sarasota County. An interim nourishment project is proposed for fiscal year 2011 and 2012 utilizing sand resources in OCS BAF2, which is located 12 miles offshore of Anna Maria Island in Manatee County, Florida. The interim project will take place between R12 and R17, R44 and R46a, and R47.5 and R50.5. The Town will then renourish the entire length of beach in FY 2013 and 2014, or later, using the remaining resources of BAF2 not located within the Port Dolphin Pipeline Corridor (http://www.portdolphin.com/). A medium-sized hopper dredge will excavate and transport sand from the borrow area to the seaward end of the submerged pipelines for pumping to the beach fill areas. Approximately 10,000 cubic yards (cy) of sand are expected to be moved each day from the borrow area, with a maximum of 466,500 cy from BAF2 being moved over the course of dredging. During the 10 years of potential dredging activities, operations within BAF2 will only occur for a total of 47 days over that 10-year time frame. At this time, however, the dredging plan only calls for the removal of 339,500 cy from BAF2 (34 days of dredging). The Town has agreed to comply with NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions* and the reasonable and prudent measures, and implementing terms and conditions, of NMFS' 2003 Gulf of Mexico regional biological opinion[1] (GRBO) to the COE, as amended through Revision 2 dated January 9, 2007. The latter states (Term and Condition No. 1) that hopper dredging activities in Gulf of Mexico waters shall be conducted, whenever possible, between December 1 and March 31.

[1] NMFS regional biological opinion dated November 19, 2003, "Dredging of Gulf of Mexico Navigation Channels and Sand Mining ("Borrow") Areas Using Hopper Dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts," (Consultation Number F/SER/2000/01287).

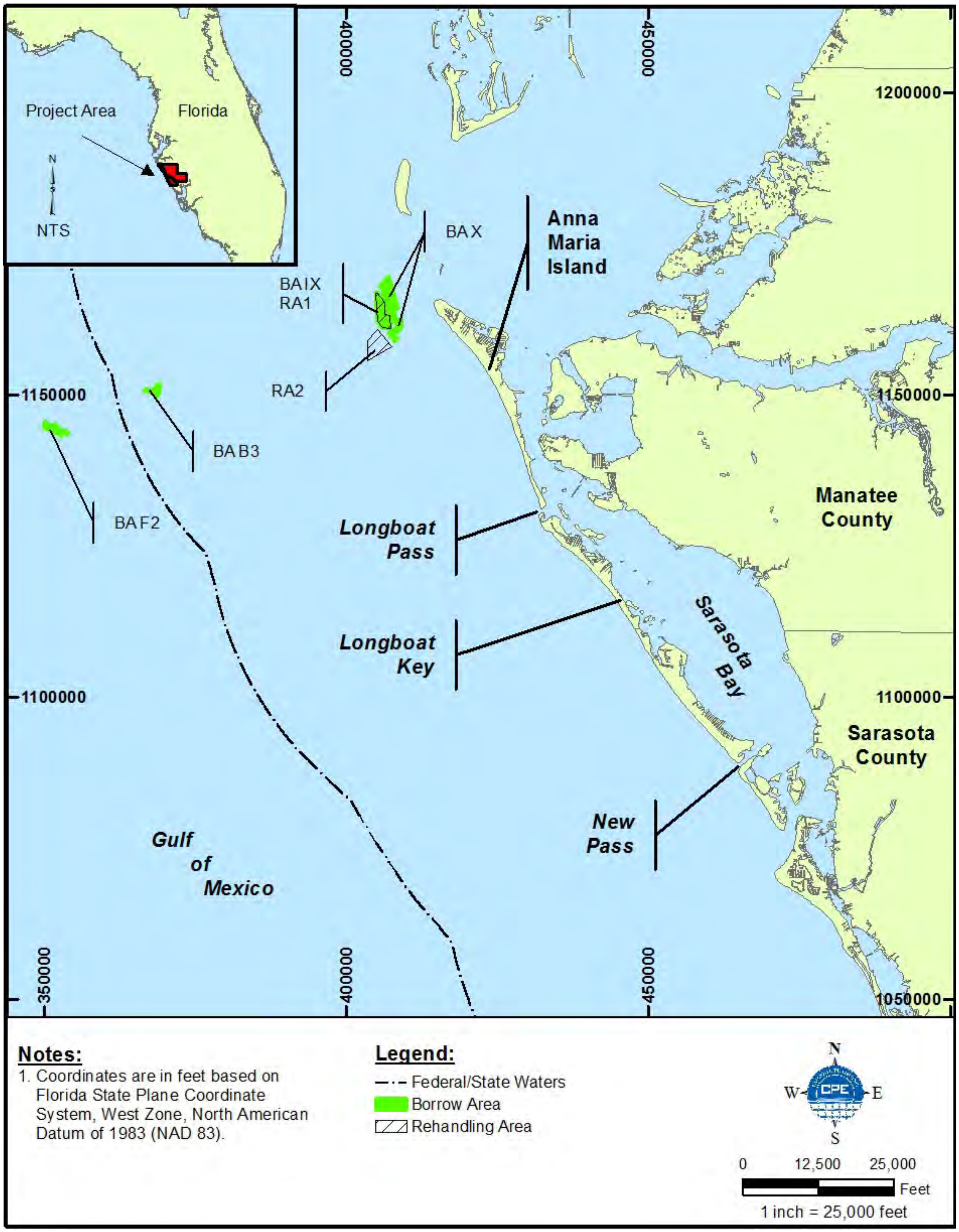

Figure 1.1. Map of project area.

Activities currently occurring and planned in conjunction with this project, as well as an emergency renourishment project completed in June 2011, and future sand extractions and renourishment activities conducted within *state* waters as part of the Longboat Key project, are within the scope of a previous NMFS Gulf of Mexico regional hopper dredging biological opinion issued to the COE (the GRBO). The GRBO governs (and is limited to) maintenance dredging, sand mining, and beach nourishment activities occurring in state waters, under the regulatory authority of the COE under Section 10 of the Rivers and Harbors Act and/or Section 404 of the Clean Water Act. Authorization to permit activities in federal waters, such as the proposed offshore sand mining, resides solely with BOEM (Geoffrey Wikel, BOEM, October 19, 2011, e-mail to Jill Lewandowski, BOEM), under the Outer Continental Shelf Lands Act . Since the Longboat Key project will use sand taken from borrow areas located in state and federal waters, those sand extractions from state waters as well as the associated renourishment activities, are considered to be interrelated and interdependent to the BOEM-proposed action, pursuant to the definition of effects of agency actions (50 CFR § 402.02), and must be considered in the present analysis. Therefore, the present opinion to BOEM considers *all* potential effects of the Longboat Key project, including protected species relocation trawling and all sand extractions (and beach placement of sand) by hopper dredging in state and/or federal waters from the shoreline of Longboat Key seaward to and including areas under the jurisdiction of each agency.

The GRBO has already analyzed and authorized hopper dredging interactions with threatened and/or endangered species in state waters, and that opinion (and its Incidental Take Statement) is still valid, *but only for the portion of the proposed Longboat Key dredging project's protected species interactions that may occur in state waters*. All protected species interactions resulting from any aspects of the proposed action that occur in state waters are under the sole jurisdiction and permitting authority of the COE, and are previously discussed and accounted for in the GRBO, whose proposed action includes "Federal, federally-permitted, or federally-sponsored hopper dredging of all U.S. Gulf of Mexico sand mining areas ("borrow sites") and virgin (previously unused) sand mining areas for beach nourishment, restoration, and protection projects, outside of designated Gulf sturgeon critical habitat, in state waters." By regulatory permit issued to the Town, the COE has authorized the Town a limited number of protected species interactions, based on the scope and timing of the action and Town compliance with the reasonable and prudent measures, and implementing terms and conditions, of the GRBO.

The effects and jeopardy analyses of the present opinion account for and analyze interactions that may result from the entire scope of the proposed action, but *only authorizes* the take of listed species that is expected to occur from activities in *federal* waters. Protected species interactions (lethal and non-lethal takes) in state waters fall under the GRBO.

Proposed Actions Occurring in State/Federal Waters in FY 11/12

Sand may be hopper-dredged from borrow area B3 (BAB3), borrow area IX (BAIX), and borrow area X (BAX), all located in state waters adjacent to Anna Maria Island (located just northwest and west of Longboat Key). In total, approximately 310,000 cy of sand will be dredged from BAF2 (the only borrow area in federal waters) and BAB3 and will be placed on Longboat Key in FY 11/12. Although up to 131,500 cy of sand could be dredged from BAB3 in FY 11/12, it is anticipated at this time that only 70,500 cy will be dredged (the remaining 239,500 cy will be dredged from BAF2 in federal waters).

Proposed Actions Occurring in State/Federal Waters in FY 13/14
In total, approximately 865,000 cubic yards of sand dredged from both federal and state waters, and sand obtained from upland sources, will be placed on Longboat Key in FY 13/14. Although up to 227,000 cy may be dredged from BAF2 (federal waters), at this time it is anticipated that only 100,000 cy will be dredged from BAF2 for the FY 13/14 project. The remaining 765,000 cy will come from state waters (BAIX and BAX (565,000 cy)) and from upland sources (200,000).

Conservation Measures that will be Implemented by BOEM and the COE in Federal and State Waters
Conservation actions that must occur during hopper dredging in state waters are laid out in the reasonable and prudent measures, and implementing terms and conditions, of the 2003 GRBO (as amended through Revision 2, dated January 9, 2007) to the COE; *identical conservation actions* are proposed to be implemented by BOEM for hopper dredging in federal waters. The GRBO is included as Appendix 1 of this document, for ease of reference. Revision 2 of the GRBO is included as Appendix 2. In addition, during dredging activities, the Town has agreed to comply with the NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions*, included as Appendix 3 of this opinion. As part of these conditions, if a smalltooth sawfish or sea turtle is observed within 100 yards of construction operations, appropriate precautions shall be implemented to ensure protection of the species, including cessation of operation if an animal moves within 50 ft of any moving equipment. Additionally, the conditions require avoiding collisions with swimming sea turtles, operation at "no wake/idle" speeds in the construction area, and reporting any collision with and/or injury to a sea turtle to NMFS' Protected Resources Division and the local sea turtle stranding/rescue organization (in this case, Mote Marine Laboratory).

To reduce potential impacts from project lighting, the Town will limit direct lighting to immediate construction areas during sea turtle nesting season (April 1 – September 30). Lighting on offshore and onshore equipment shall be minimized through reduction, shielding, lowering, and appropriate light placement to avoid excessive illumination of the water's surface and nesting beach. Further, light intensity will be lowered to the minimum standard required by OSHA for General Construction areas in order to not misdirect sea turtles.

Additionally, protected species observers will live aboard the dredges, monitoring dredge loads 24-hours a day for evidence of impacts to endangered and threatened species, as well as recording water temperatures, bycatch information, and any sightings of species in the area. Hopper dredges will be required to have rigid turtle deflectors installed on all dragheads; deflector designs not previously approved by NMFS will not be allowed. Screening will be placed on all points of inflow prior to work beginning. Finally, relocation trawling will occur at the dredge site and any captured turtles will be photographed, measured, tagged, biopsied for future genetic analyses by NMFS, and released at least 3 nautical miles away. Relocation trawling will begin 24 hours prior to dredging operations with one trawling vessel operating 24 hours/day, 7 days/week. Relocation trawling will only cease if dredging operations are shut down. Tow times during relocation trawling will be strictly limited to less than 42 minutes total time.

Action Area
"Action area" means all areas to be affected directly or indirectly by the federal action and not merely the immediate area involved in the action area (50 CFR 402.02). The action area ranges from the onshore area of R44 in Manatee County south to R29 in Sarasota County, seaward from the northern-most borrow area, BAX, to the western-most borrow area, BAF2, south to New Pass (Figure 1.1). This area will encompass all areas expected to be impacted directly or indirectly by the proposed project. No areas south of New Pass are expected to be impacted by the project due to the sink effect of the pass on sediment transport; no impacts west of BAF2 are expected because of the currents/wave patterns in the area. Any onshore impacts will be limited to the beach area being renourished, ranging from marker R44 in Manatee County to R29 in Sarasota County.

3.0 Status of the Species

Much of the information for this section, as well as additional detailed information relating to the species biology, habitat requirements, threats, and recovery objectives, can be found in the recovery plan for each species (see "References Cited" section). The following listed species under our jurisdiction are known to occur in the Gulf of Mexico:

<u>Endangered</u>	
Green sea turtle[2]	*Chelonia mydas*
Leatherback sea turtle	*Dermochelys coriacea*
Hawksbill sea turtle	*Eretmochelys imbricata*
Kemp's ridley sea turtle	*Lepidochelys kempii*
Sperm whale	*Physeter macrocephalus*
Humpback whale	*Megaptera novaeangliae*
Fin whale	*Balaenoptera physalus*
Blue whale	*Balaenoptera musculus*
Sei whale	*Balaenoptera borealis*
North Atlantic right whale	*Eubalaena glacialis*
Smalltooth sawfish	*Pristis pectinata*
<u>Threatened</u>	
Loggerhead sea turtle[3]	*Caretta caretta*
Gulf sturgeon	*Acipenser oxyrinchus desotoi*

[2]Green turtles are listed as threatened except for the Florida and Pacific coast of Mexico breeding populations, which are listed as endangered.

[3] Northwest Atlantic Ocean DPS (Distinct Population Segment)

3.1 Species Not Likely to be Adversely Affected

We believe that Gulf sturgeon and whales are not likely to be adversely affected by the proposed dredging, beach nourishment, and associated relocation trawling activities. Gulf sturgeon occur in the Gulf of Mexico, but the proposed action occurs south of their known range in the Gulf (the southern extent of their range ends at the Suwannee River) thus they are not likely to be adversely affected. Sperm whales (*Physeter macrocephalus*) occur in the Gulf of Mexico but are rare in inshore waters (such as the project area) and are unlikely to be adversely affected. Other endangered whales, including North Atlantic right whales (*Eubalaena glacialis)* and humpback whales (*Megaptera novaeangliae*) have been observed occasionally in the Gulf of Mexico. The individuals observed have likely been inexperienced juveniles straying from the normal range of these stocks. We believe there are no resident stocks of these species in the Gulf of Mexico, and these species are not likely to be adversely affected by projects in the Gulf. We believe that blue, fin, and sei whales (*Balaenoptera musculas*, *B. physalus*, and *B. borealis*, respectively) are not likely to be adversely affected by hopper dredging operations; the possibility of dredge collisions is remote since these are deepwater, pelagic, outer continental shelf species unlikely to be found near hopper dredging sites. There has never been a report of a lethal, whale interaction by a hopper dredge, although in February 2005 off the Brunswick Harbor Entrance Channel, Georgia, a hopper dredge did strike and injure a whale, thought by the onboard endangered species observer to be a North Atlantic right whale from the shape of the pectoral flippers (C. Slay, Coastwise Consulting, pers. comm. to B. Zoodsma, NMFS, February 24, 2005). Based on the unlikelihood of their presence, the above-mentioned cetaceans are not considered further in this opinion.

3.2 Species Likely to be Adversely Affected

We believe that five species of sea turtles and the smalltooth sawfish may be adversely affected by the proposed dredging, beach nourishment, or associated relocation trawling activities.

3.2.1 Green Sea Turtle

Green turtles are distributed circumglobally and can be found in the Pacific, Indian, and Atlantic Oceans, as well as the Mediterranean Sea (NMFS and USFWS 1991, Seminoff 2004, NMFS and USFWS 2007a). In 1978, the Atlantic population of the green sea turtle was listed as threatened under the ESA, except for the breeding populations in Florida and on the Pacific coast of Mexico, which were listed as endangered.

3.2.1.1 Pacific Ocean

Green turtles occur in the eastern, central, and western Pacific. Foraging areas are also found throughout the Pacific and along the southwestern U.S. coast (NMFS and USFWS 1998a). Nesting is known to occur in the Hawaiian archipelago, American Samoa, Guam, and various other sites in the Pacific. The only major population (>2,000 nesting females) of green turtles in the western Pacific occurs in Australia and Malaysia, with smaller colonies throughout the area. Green turtles have generally been thought to be declining throughout the Pacific Ocean, with the exception of Hawaii, from a combination of overexploitation and habitat loss (Seminoff 2002). Indonesia has a widespread distribution of green turtles, but has experienced large declines over the past 50 years. Historically, green turtles were used in many areas of the Pacific for food.

They were also commercially exploited and this, coupled with habitat degradation, led to their decline in the Pacific (NMFS and USFWS 1998a). Green turtles in the Pacific continue to be affected by poaching, habitat loss or degradation, fishing gear interactions, and fibropapillomatosis (NMFS and USFWS 1998a, NMFS 2004).

Hawaiian green turtles are genetically distinct and geographically isolated, and the population appears to be increasing in size despite the prevalence of fibropapilloma and spirochidiasis (Aguirre et al. 1998 in Balazs and Chaloupka 2003). The East Island nesting beach in Hawaii is showing a 5.7 percent annual growth rate over 25 plus years (Chaloupka et al. 2007). In the Eastern Pacific, mitochondrial DNA analysis has indicated that there are three key nesting populations: Michoacán, Mexico; Galapagos Islands, Ecuador; and Islas Revillagigedos, Mexico (Dutton 2003). The number of nesting females per year exceeds 1,000 females at each site (NMFS and USFWS 2007a). However, historically, greater than 20,000 females per year are believed to have nested in Michoacán alone (Cliffton et al. 1982, NMFS and USFWS 2007a). Thus, the current number of nesting females is still far below what has historically occurred. There is also sporadic green turtle nesting along the Pacific coast of Costa Rica. At least a few of the non-Hawaiian nesting stocks in the Pacific have recently been found to be undergoing long-term increases. Datasets over 25 years in Chichi-jima, Japan; Heron Island, Australia; and Raine Island, Australia, show increases (Chaloupka et al. 2007). These increases are thought to be the direct result of long-term conservation measures.

3.2.1.2 Indian Ocean

There are numerous nesting sites for green sea turtles in the Indian Ocean. One of the largest nesting sites for green sea turtles worldwide occurs on the beaches of Oman where an estimated 20,000 green sea turtles nest annually (Hirth 1997). Based on a review of the 32 index sites used to monitor green sea turtle nesting worldwide, Seminoff (2004) concluded that declines in green turtle nesting were evident for many of the Indian Ocean index sites. While several of these had not demonstrated further declines in the more recent past, only the Comoros Island index site in the western Indian Ocean showed evidence of increased nesting (Seminoff 2004).

3.2.1.3 Atlantic Ocean

Life History and Distribution
The estimated age at sexual maturity for green sea turtles is between 20-50 years (Balazs 1982, Frazer and Ehrhart 1985). Green sea turtle mating occurs in the waters off the nesting beaches. Each female deposits 1-7 clutches (usually 2-3) during the breeding season at 12-14 day intervals. Mean clutch size is highly variable among populations, but averages 110-115 eggs/nest. Females usually have 2-4 or more years between breeding seasons, whereas males may mate every year (Balazs 1983). After hatching, green sea turtles go through a post-hatchling, pelagic stage during which they are associated with drift lines of algae and other debris. At approximately 20- to 25-cm carapace length, juveniles leave pelagic habitats and enter benthic foraging areas (Bjorndal 1997).

Green sea turtles are primarily herbivorous, feeding on algae and sea grasses, but also occasionally consume jellyfish and sponges. The post-hatchling, pelagic-stage individuals are assumed to be omnivorous, but little data are available.

Green sea turtle foraging areas in the southeastern United States include any coastal shallow waters having macroalgae or seagrasses. This includes areas near mainland coastlines, islands, reefs, or shelves, as well as open-ocean surface waters, especially where advection from wind and currents concentrates pelagic organisms (Hirth 1997, NMFS and USFWS 1991). Principal benthic foraging areas in the southeastern United States include Aransas Bay, Matagorda Bay, Laguna Madre and the Gulf inlets of Texas (Doughty 1984, Hildebrand 1982, Shaver 1994), the Gulf of Mexico off Florida from Yankeetown to Tarpon Springs (Caldwell and Carr 1957, Carr 1984), Florida Bay and the Florida Keys (Schroeder and Foley 1995), the Indian River Lagoon system in Florida (Ehrhart 1983), and the Atlantic Ocean off Florida from Brevard through Broward Counties (Wershoven and Wershoven 1992, Guseman and Ehrhart 1992). Adults of both sexes are presumed to migrate between nesting and foraging habitats along corridors adjacent to coastlines and reefs.

Some of the principal feeding pastures in the western Atlantic Ocean include the upper west coast of Florida and the northwestern coast of the Yucatán Peninsula. Additional important foraging areas in the western Atlantic include the Mosquito Lagoon and Indian River Lagoon systems and nearshore wormrock reefs between Sebastian and Ft. Pierce Inlets in Florida, Florida Bay, the Culebra archipelago and other Puerto Rico coastal waters, the south coast of Cuba, the Caribbean coast of Panama, the Miskito Coast in Nicaragua, and scattered areas along Colombia and Brazil (Hirth 1997). The summer developmental habitat for green turtles also encompasses estuarine and coastal waters from North Carolina to as far north as Long Island Sound (Musick and Limpus 1997).

Population Dynamics and Status

Nest counts can also be used to estimate the number of reproductively mature females nesting annually. The 5-year status review for the species identified eight geographic areas considered to be primary sites for green sea turtle nesting in the Atlantic/Caribbean and reviewed the trend in nest count data for each (NMFS and USFWS 2007a). These sites include: (1) Yucatán Peninsula, Mexico; (2) Tortuguero, Costa Rica; (3) Aves Island, Venezuela; (4) Galibi Reserve, Suriname; (5) Isla Trindade, Brazil; (6) Ascension Island, United Kingdom; (7) Bioko Island, Equatorial Guinea; and (8) Bijagos Achipelago, Guinea-Bissau (NMFS and USFWS 2007a). Nesting at all of these sites was considered to be stable or increasing with the exception of Bioko Island and the Bijagos Archipelago where the lack of sufficient data precluded a meaningful trend assessment for either site (NMFS and USFWS 2007a). Seminoff (2004) likewise reviewed green sea turtle nesting data for eight sites in the western, eastern, and central Atlantic, including all of the above with the exception that nesting in Florida was reviewed in place of Isla Trindade, Brazil. Seminoff (2004) concluded that all sites in the central and western Atlantic showed increased nesting, with the exception of nesting at Aves Island, Venezuela, while both sites in the eastern Atlantic demonstrated decreased nesting. These sites are not inclusive of all green sea turtle nesting in the Atlantic. However, other sites are not believed to support nesting levels high enough that would change the overall status of the species in the Atlantic (NMFS and USFWS 2007a).

By far, the most important nesting concentration for green turtles in the western Atlantic is in Tortuguero, Costa Rica (NMFS and USFWS 2007a). Nesting in the area has increased considerably since the 1970s, and nest count data from 1999-2003 suggest nesting by 17,402-37,290 females per year (NMFS and USFWS 2007a). The number of females nesting per year on beaches in the Yucatán, Aves Island, Galibi Reserve, and Isla Trindade number in the hundreds to low thousands, depending on the site (NMFS and USFWS 2007a). The vast majority of green sea turtle nesting within the southeastern United States occurs in Florida (Meylan et al. 1995, Johnson and Ehrhart 1994). Green sea turtle nesting in Florida has been increasing since 1989 (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute Index Nesting Beach Survey Database). Certain Florida nesting beaches have been designated index beaches. Index beaches were established to standardize data collection methods and effort on key nesting beaches. Since establishment of the index beaches in 1989, the pattern of green turtle nesting shows biennial peaks in abundance with a generally positive trend during the ten years of regular monitoring. This is perhaps due to increased protective legislation throughout the Caribbean (Meylan et al. 1995). A total statewide average (all beaches, including index beaches) of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). Data from the index nesting beaches program in Florida substantiate the dramatic increase in nesting. In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, further dropping under 3,000 in 2009, but that consecutive drop was a temporary deviation from the normal biennial nesting cycle for green turtles, as 2010 saw an increase back to 8,426 nests on the index nesting beaches (FWC Index Nesting Beach Survey Database). Occasional nesting has been documented along the Gulf coast of Florida, at southwest Florida beaches, as well as the beaches on the Florida Panhandle (Meylan et al. 1995). More recently, green turtle nesting occurred on Bald Head Island, North Carolina; just east of the mouth of the Cape Fear River; on Onslow Island; and on Cape Hatteras National Seashore. In 2010, a total of 18 nests were found in North Carolina, 6 nests in South Carolina, and 6 nests in Georgia (nesting databases maintained on www.seaturtle.org). Increased nesting has also been observed along the Atlantic coast of Florida, on beaches where only loggerhead nesting was observed in the past (Pritchard 1997). Recent modeling by Chaloupka et al. (2007) using data sets of 25 years or more has resulted in an estimate of the Florida nesting stock at the Archie Carr National Wildlife Refuge growing at an annual rate of 13.9 percent, and the Tortuguero, Costa Rica, population growing at 4.9 percent annually.

There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas of the southeastern United States, where they come to forage. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant in St. Lucie County, Florida, shows that the annual number of immature green sea turtles captured by their offshore cooling water intake structures has increased significantly over the years. Green sea turtle annual captures averaged 19 for 1977-1986, 178 for 1987-1996, and 262 for 1997-2001 (FPL 2002). In the five years from 2002-2006, green sea turtle captures averaged 333 per year, with a high of 427 and a low of 267 (FPL and Quantum Resources 2007). More recent unpublished data shows 101 captures in 2007, 299 in 2008, 38 in 2009 (power output was cut—and cooling water intake concomitantly reduced—for part of that year) and 413 in 2010. Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area. It is likely that immature green sea turtles foraging in the southeastern United States come from multiple genetic stocks; therefore, the status of immature green sea turtles in the southeastern United States might also be assessed from trends at all of the main regional nesting beaches, principally Florida, Yucatán, and Tortuguero.

Threats

The principal cause of past declines and extirpations of green sea turtle assemblages has been the overexploitation of green sea turtles for food and other products. Although intentional poachingof green sea turtles and their eggs is not extensive within the southeastern United States, green sea turtles that nest and forage in the region may spend large portions of their life history outside the region and outside U.S. jurisdiction, where exploitation is still a threat. However, there are still significant and ongoing threats to green sea turtles from human-related causes in the United States. These threats include beach armoring, erosion control, artificial lighting, beach disturbance (e.g., driving on the beach), pollution, foraging habitat loss as a result of direct destruction by dredging, siltation, boat damage, other human activities, and interactions with fishing gear. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known. Sea sampling coverage in the pelagic driftnet, pelagic longline, Southeast shrimp trawl, and summer flounder bottom trawl fisheries has recorded interactions with green turtles. There is also the increasing threat from green sea turtle fibropapillomatosis disease. Presently, this disease is cosmopolitan and has been found to affect large numbers of animals in some areas, including Hawaii and Florida (Herbst 1994, Jacobson 1990, Jacobson et al. 1991). Other sources of natural mortality include cold-stunning and biotoxin exposure. Cold-stunning is not considered a major source of mortality in most cases. As temperatures fall below 8°-10°C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989). During January 2010, an unusually large cold-stunning event in the southeastern United States resulted in around 4,600 sea turtles, mostly greens, found cold-stunned, with hundreds found dead, or dying after they were gathered. Another cold-stunning event occurred in the western Gulf of Mexico in February 2011, resulting in approximately 1,500 green turtles found cold-stunned off Texas, and another 300 or so off Mexico, with an as yet undetermined number found dead or dying after they were found.

There is a large and growing body of literature on past, present, and future impacts of global climate change exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of green turtles may result (NMFS and USFWS 2007a). In marine turtles, sex is determined by temperature in the middle third of incubation, with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007a). Green sea turtle hatchling size also appears to be influenced by incubation temperatures, with smaller hatchlings produced at higher temperatures (Glen et al. 2003).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of green sea turtles.

3.2.1.4 Summary of Status for Atlantic Green Sea Turtles

Green turtles range in the western Atlantic from Massachusetts to Argentina, including the Gulf of Mexico and the Caribbean Sea, but are considered rare in benthic areas north of Cape Hatteras (Wynne and Schwartz 1999). Green turtles face many of the anthropogenic threats for other sea turtles described herein. In addition, green turtles are also susceptible to fibropapillomatosis, which can result in death. In the continental United States, green turtle nesting occurs on the Atlantic coast of Florida (Ehrhart 1979). Recent population estimates for the western Atlantic area are not available. The pattern of green turtle nesting shows biennial peaks in abundance, with a generally positive trend during the almost 20 years of regular monitoring since establishment of index beaches in Florida in 1989.

3.2.2 Hawksbill Sea Turtle

The hawksbill turtle was listed as endangered under the precursor of the ESA on June 2, 1970, and is considered critically endangered by the International Union for the Conservation of Nature (IUCN). The hawksbill is a medium-sized sea turtle, with adults in the Caribbean ranging in size from approximately 62.5 to 94.0 cm straight carapace length. The species occurs in all ocean basins, although it is relatively rare in the Eastern Atlantic and Eastern Pacific, and absent from the Mediterranean Sea. Hawksbills are the most tropical sea turtle species, ranging from approximately 30°N latitude to 30°S latitude. They are closely associated with coral reefs and other hardbottom habitats, but they are also found in other habitats including inlets, bays, and coastal lagoons (NMFS and USFWS 1993). There are only five remaining regional nesting populations with more than 1,000 females nesting annually. These populations are in the Seychelles, Mexico, Indonesia, and two in Australia (Meylan and Donnelly 1999). There has been a global population decline of over 80 percent during the last three generations (105 years) (Meylan and Donnelly 1999).

3.2.2.1 Pacific Ocean

Anecdotal reports throughout the Pacific indicate the current Pacific hawksbill population is well below historical levels (NMFS 2004). It is believed that this species is rapidly approaching extinction in the Pacific because of harvesting for its meat, shell, and eggs as well as destruction of nesting habitat (NMFS 2004). Hawksbill sea turtles nest in the Hawaiian Islands as well as the islands and mainland of Southeast Asia, from China to Japan, and throughout the Philippines, Malaysia, Indonesia, Papua New Guinea, the Solomon Islands, and Australia (NMFS 2004). However, along the eastern Pacific Rim where nesting was common in the 1930s, hawksbills are now rare or absent (Cliffton et al. 1982, NMFS 2004).

3.2.2.2 Atlantic Ocean

In the western Atlantic, the largest hawksbill nesting population occurs on the Yucatán Peninsula of Mexico (Garduño-Andrade et al. 1999). With respect to the United States, nesting occurs in Puerto Rico, the U.S. Virgin Islands, and along the southeast coast of Florida. Nesting also occurs outside of the United States and its territories, in Antigua, Barbados, Costa Rica, Cuba, and Jamaica (Meylan 1999). Outside of the nesting areas, hawksbills have been seen off the U.S. Gulf of Mexico states and along the Eastern Seaboard as far north as Massachusetts, although sightings north of Florida are rare (NMFS and USFWS 1993).

Life History and Distribution

The best estimate of age at sexual maturity for hawksbill sea turtles is about 20-40 years (Chaloupka and Limpus 1997, Crouse 1999a). Reproductive females undertake periodic (usually non-annual) migrations to their natal beach to nest. Movements of reproductive males are less well known, but are presumed to involve migrations to their nesting beach or to courtship stations along the migratory corridor (Meylan 1999). Females nest an average of 3-5 times per season (Meylan and Donnelly 1999, Richardson et al. 1999). Clutch size is larger on average (up to 250 eggs) than that of other sea turtles (Hirth 1980). Reproductive females may exhibit a high degree of fidelity to their nest sites.

The life history of hawksbills consists of a pelagic stage that lasts from the time they leave the nesting beach as hatchlings until they are approximately 22-25 cm in straight carapace length (Meylan 1988, Meylan and Donnelly 1999), followed by residency in developmental habitats (foraging areas where juveniles reside and grow) in coastal waters. Adult foraging habitat, which may or may not overlap with developmental habitat, is typically coral reefs, although other hard-bottom communities and occasionally mangrove-fringed bays may be occupied. Hawksbills show fidelity to their foraging areas over several years (van Dam and Díez 1998).

The hawksbill's diet is highly specialized and consists primarily of sponges (Meylan 1988). Other food items, notably corallimorphs and zooanthids, have been documented to be important in some areas of the Caribbean (van Dam and Díez 1997, Mayor et al. 1998).

Population Dynamics and Status

Nesting within the southeastern United States and U.S. Caribbean is restricted to Puerto Rico (>650 nests/yr), the U.S. Virgin Islands (~400 nests/yr), and, rarely, Florida (0-4 nests/yr) (Eckert 1995, Meylan 1999, Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute's Statewide Nesting Beach Survey data 2002). At the two principal nesting beaches in the U.S. Caribbean where long-term monitoring has been carried out, populations appear to be increasing (Mona Island, Puerto Rico) or stable (Buck Island Reef National Monument, St. Croix, USVI) (Meylan 1999).

Threats

As with other sea turtle species, hawksbill sea turtles are affected by habitat loss, habitat degradation, marine pollution, marine debris, fishery interactions, and poaching in some parts of their range. There continues to be a black market for hawksbill shell products ("tortoiseshell"), which likely contributes to the harvest of this species.

There is a large and growing body of literature on past, present, and future impacts of global climate change exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of hawksbill turtles may result (NMFS and USFWS 2007d). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007d).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, coral reefs, forage fish, etc. Since hawksbills are typically associated with coral reef ecosystems, increases in global temperatures leading to coral death (Sheppard 2006) could adversely affect the foraging habitats of this species.

3.2.2.3 Summary of Status for Hawksbill Sea Turtles

Worldwide, hawksbill sea turtle populations are declining. They face many of the same threats affecting other sea turtle species. In addition, there continues to be a commercial market for hawksbill shell products, despite protections afforded to the species under U.S. law and international conventions.

3.2.3 Kemp's Ridley Sea Turtle

The Kemp's ridley was listed as endangered on December 2, 1970. Internationally, the Kemp's ridley is considered the most endangered sea turtle (Zwinenberg 1977, Groombridge 1982, TEWG 2000). Kemp's ridleys nest primarily at Rancho Nuevo, a stretch of beach in Mexico's Tamaulipas State. This species occurs mainly in coastal areas of the Gulf of Mexico and the northwestern Atlantic Ocean. Occasional individuals reach European waters (Brongersma 1972). Adults of this species are usually confined to the Gulf of Mexico, although adult-sized individuals sometimes are found on the east coast of the United States.

Life History and Distribution
The TEWG (1998) estimates age at maturity from 7-15 years. Females return to their nesting beach about every 2 years (TEWG 1998). Nesting occurs from April into July and is essentially limited to the beaches of the western Gulf of Mexico, near Rancho Nuevo in southern Tamaulipas, Mexico. The mean clutch size for Kemp's ridleys is 100 eggs/nest, with an average of 2.5 nests/female/season.

Little is known of the movements of the post-hatchling stage (pelagic stage) within the Gulf of Mexico. Studies have shown the post-hatchling pelagic stage varies from 1-4 or more years, and the benthic immature stage lasts 7-9 years (Schmid and Witzell 1997). Benthic immature Kemp's ridleys have been found along the eastern seaboard of the United States and in the Gulf of Mexico. Atlantic benthic immature sea turtles travel northward as the water warms to feed in the productive, coastal waters off Georgia through New England, returning southward with the onset of winter (Lutcavage and Musick 1985, Henwood and Ogren 1987, Ogren 1989). Studies suggest that benthic immature Kemp's ridleys stay in shallow, warm, nearshore waters in the northern Gulf of Mexico until cooling waters force them offshore or south along the Florida coast (Renaud 1995).

Stomach contents of Kemp's ridleys along the lower Texas coast consisted of nearshore crabs and mollusks, as well as fish, shrimp, and other foods considered to be shrimp fishery discards (Shaver 1991). A 2005 dietary study of immature Kemp's ridleys off southwest Florida documented predation on benthic tunicates, a previously undocumented food source for this species (Witzell and Schmid 2005). These pelagic stage Kemp's ridleys presumably feed on the available *Sargassum* and associated infauna or other epipelagic species found in the Gulf of Mexico.

Population Dynamics and Status

Of the seven extant species of sea turtles in the world, the Kemp's ridley has declined to the lowest population level. Most of the population of adult females nest on the Rancho Nuevo beaches (Pritchard 1969). When nesting aggregations at Rancho Nuevo were discovered in 1947, adult female populations were estimated to be in excess of 40,000 individuals (Hildebrand 1963). By the mid-1980s, nesting numbers were below 1,000 (with a low of 702 nests in 1985). However, observations of increased nesting (with 6,277 nests recorded in 2000) suggest that the decline in the ridley population has stopped and the population is now increasing (USFWS 2000). The number of nests observed at Rancho Nuevo and nearby beaches increased at a mean rate of 11.3 percent per year from 1985 to 1999 (TEWG 2000). These trends are further supported by 2004-2007 nesting data from Mexico. The number of nests over that period has increased from 7,147 in 2004, to 10,099 in 2005, to 12,143 in 2006, and 15,032 during the 2007 nesting season (Gladys Porter Zoo nesting database 2007). In 2008, there were 17,882 nests in Mexico (Gladys Porter Zoo 2008), and nesting in 2009 reached 21,144 (Gladys Porter Zoo 2010). In 2010, nesting declined significantly, to 13,302 (Gladys Porter Zoo 2010). Final numbers for 2011were not available at the time of this opinion; however, preliminary information for Kemp’s ridley nesting in Mexico indicates there were fewer nests than in 2009, but nesting numbers did rebound from 2010’s reduced nesting to over 20,000 (pers. comm. Jaime Peña, Gladys Porter Zoo). A small nesting population is also emerging in the United States, primarily in Texas, rising from 6 nests in 1996 to 128 in 2007, 195 in 2008, and 197 in 2009. Texas nesting then experienced a decline similar to that seen in Mexico for 2010, with 140 nests (National Park Service data, http://www.nps.gov/pais/naturescience/strp.htm), but nesting rebounded in 2011 with a record 199 nests (National Park Service data, http://www.nps.gov/pais/naturescience/current-season.htm).

A period of steady increase in benthic immature ridleys has been occurring since 1990 and appears to be due to increased hatchling production and an apparent increase in survival rates of immature sea turtles beginning in 1990. The increased survivorship of immature sea turtles is attributable, in part, to the introduction of TEDs in the United States’ and Mexico’s shrimping fleets. As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp’s ridleys could reach the recovery plan’s intermediate recovery goal of 10,000 nesters by the year 2015. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS 2007f, Gladys Porter Zoo 2007).

Next to loggerheads, Kemp’s ridleys are the second most abundant sea turtle in Virginia and Maryland waters, arriving in these areas during May and June (Keinath et al. 1987, Musick and Limpus 1997). The juvenile population of Kemp’s ridley sea turtles in Chesapeake Bay is estimated to be 211 to 1,083 sea turtles (Musick and Limpus 1997). These juveniles frequently forage in submerged aquatic grass beds for crabs (Musick and Limpus 1997). Kemp’s ridleys consume a variety of crab species, including *Callinectes* spp., *Ovalipes* spp., *Libinia* spp., and *Cancer* spp. Mollusks, shrimp, and fish are consumed less frequently (Bjorndal 1997). Upon leaving Chesapeake Bay in autumn, juvenile Kemp’s ridleys migrate down the coast, passing Cape Hatteras in December and January (Musick and Limpus 1997). These larger juveniles are joined there by juveniles of the same size from North Carolina sounds and smaller juveniles from New York and New England to form one of the densest concentrations of Kemp's ridleys outside of the Gulf of Mexico (Musick and Limpus 1997, Epperly et al. 1995a, Epperly et al. 1995b).

Threats

Kemp's ridleys face many of the same threats as other sea turtle species, including destruction of nesting habitat from storm events, natural predators at sea, and oceanic events such as cold-stunning. Although cold-stunning can occur throughout the range of the species, it may be a greater risk for sea turtles that utilize the more northern habitats of Cape Cod Bay and Long Island Sound. For example, in the winter of 1999-2000, there was a major cold-stunning event where 218 Kemp's ridleys, 54 loggerheads, and 5 green sea turtles were found on Cape Cod beaches (R. Prescott, NMFS, pers. comm. 2001). Annual cold-stunning events do not always occur at this magnitude; the extent of episodic major cold-stun events may be associated with numbers of sea turtles utilizing Northeast waters in a given year, oceanographic conditions, and the occurrence of storm events in the late fall. Many cold-stunned sea turtles can survive if found early enough, but cold-stunning events can still represent a significant cause of natural mortality. A complete list of other indirect factors can be found in NMFS SEFSC (2001).

Although changes in the use of shrimp trawls and other trawl gear have helped to reduce mortality of Kemp's ridleys, this species is also affected by other sources of anthropogenic impacts similar to those discussed in previous sections. For example, in the spring of 2000, a total of 5 Kemp's ridley carcasses were recovered from the same North Carolina beaches where 275 loggerhead carcasses were found. Cause of death for most of the sea turtles recovered was unknown, but the mass mortality event was suspected to have been from a large-mesh gillnet fishery operating offshore in the preceding weeks. The 5 Kemp's ridley carcasses that were found are likely to have been only a minimum count of the number of Kemp's ridleys that were killed or seriously injured as a result of the fishery interaction because it is unlikely that all of the carcasses washed ashore.

The impacts of pollution on Kemp's ridley sea turtles, as with all sea turtles, are still poorly understood. There is little data to provide an understanding of how water quality impacts sea turtles. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

There is a large and growing body of literature on past, present, and future impacts of global climate change induced by human activities, i.e., global warming. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. The Environmental Protection Agency's climate change Web page provides basic background information on these and other measured or anticipated effects (see www.epa.gov/climatechange/index.html). However, the impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty.

The Intergovernmental Panel on Climate Change has stated that global climate change is unequivocal (IPCC 2007) and its impacts may be significant to the hatchling sex ratios of Kemp's ridley sea turtles (Wibbels 2003, NMFS and USFWS 2007c). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward a higher numbers of females (NMFS and USFWS 2007c).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction has denuded vegetation. Sea level rise from global climate change (IPCC 2007) is also a potential problem, particularly for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increased frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, forage fish, etc., which could ultimately affect the primary foraging areas of Kemp's ridley sea turtles.

3.2.3.1 Summary of Kemp's Ridley Status

The only major nesting site for Kemp's ridleys is a single stretch of beach near Rancho Nuevo, Tamaulipas, Mexico (Carr 1963). The number of nests observed at Rancho Nuevo and nearby beaches increased from 1985 to 2008. Nesting has also exceeded 12,000 nests per year from 2004-2010 (Gladys Porter Zoo database). Kemp's ridleys mature at an earlier age (7-15 years) than other chelonids; thus, "lag effects" as a result of unknown impacts to the non-breeding life stages would likely have been seen in the increasing nest trend beginning in 1985 (USFWS and NMFS 1992).

The largest contributors to the decline of Kemp's ridleys in the past were commercial and local exploitation, especially poaching of nests at the Rancho Nuevo site, as well as the Gulf of Mexico trawl fisheries. The advent of TED regulations for trawlers and protections for the nesting beaches has allowed the species to begin to recover. Many threats to the future of the species remain, including interactions with fishery gear, marine pollution, foraging habitat destruction, illegal poaching of nests and potential threats to the nesting beaches from such sources as global climate change, development, and tourism pressures.

3.2.4 Northwest Atlantic Ocean DPS of Loggerhead Sea Turtle

The loggerhead sea turtle was listed as a threatened species throughout its global range on July 28, 1978. It was listed because of direct interactions (i.e., poaching), incidental capture in various fisheries, and the alteration and destruction of its habitat. Loggerhead sea turtles inhabit the continental shelves and estuarine environments along the margins of the Atlantic, Pacific, and Indian Oceans. The majority of loggerhead nesting occurs in the Western Atlantic Ocean (south Florida, United States), and the western Indian Ocean (Masirah, Oman); in both locations nesting assemblages have more than 10,000 females nesting each year (NMFS and USFWS 2008). Loggerhead sea turtles are the most abundant species of sea turtle in U.S. waters.

On March 16, 2010, NMFS and the USFWS published a proposed rule in the Federal Register to list nine Distinct Population Segments (DPSs) of loggerhead sea turtles as endangered or threatened under the ESA (75 FR 12598). The proposed rule represented NMFS' and USFWS' 12-month findings on petitions to list North Pacific populations and Northwest Atlantic populations as endangered and included a proposed rule to designate nine DPSs worldwide. In the final rule, issued on September 16, 2011, retaining their proposed status, five DPSs were listed as endangered and four others were listed as threatened. This opinion considers the Northwest Atlantic Ocean DPS of loggerhead sea turtles, listed as threatened under the ESA.

In the Western Atlantic, most loggerhead sea turtles nest from North Carolina to Florida and along the Gulf coast of Florida. Previous Section 7 analyses have recognized at least five Western Atlantic subpopulations, divided geographically as follows: (1) a northern nesting subpopulation, occurring from North Carolina to Northeast Florida at about 29ºN; (2) a South Florida nesting subpopulation, occurring from 29°N on the east coast to Sarasota on the west coast; (3) a Florida Panhandle nesting subpopulation, occurring at Eglin Air Force Base and the beaches near Panama City, Florida; (4) a Yucatán nesting subpopulation, occurring on the Eastern Yucatán Peninsula, Mexico (Márquez 1990 and TEWG 2000); and (5) a Dry Tortugas nesting subpopulation, occurring in the islands of the Dry Tortugas, near Key West, Florida (NMFS 2001b). The recently published recovery plan for the Northwest Atlantic population of loggerhead sea turtles concluded, based on recent advances in genetic analyses, that there is no genetic distinction between loggerheads nesting on adjacent beaches along the Florida Peninsula and that specific boundaries for subpopulations could not be designated based on genetic differences alone. Thus, the plan uses a combination of geographic distribution of nesting densities, geographic separation, and geopolitical boundaries, in addition to genetic differences, to identify recovery units. The recovery units are: (1) the Northern Recovery Unit (Florida/Georgia border north through southern Virginia); (2) the Peninsular Florida Recovery Unit (Florida/Georgia border through Pinellas County, Florida); (3) the Dry Tortugas Recovery Unit (islands located west of Key West, Florida); (4) the Northern Gulf of Mexico Recovery Unit (Franklin County, Florida, through Texas); and (5) the Greater Caribbean Recovery Unit (Mexico through French Guiana, the Bahamas, Lesser Antilles, and Greater Antilles) (NMFS and USFWS 2008). The recovery plan concluded that all recovery units are essential to the recovery of the species.

Life History and Distribution
Past literature gave an estimated age at maturity of 21-35 years (Frazer and Ehrhart 1985, Frazer et al. 1994) with the benthic immature stage lasting at least 10-25 years. However, based on new data from tag returns, strandings, and nesting surveys, NMFS SEFSC (2001) estimated ages of maturity ranging from 20-38 years and benthic immature stage (sea turtles that have come back

to inshore and nearshore waters)—the life stage following the pelagic immature stage—lasting from 14-32 years.

Mating takes place in late March-early June, and eggs are laid throughout the summer, with a mean clutch size of 100-126 eggs in the southeastern United States. Individual females nest multiple times during a nesting season, with a mean of 4.1 nests per individual (Murphy and Hopkins 1984). Nesting migrations for an individual female loggerhead are usually on an interval of 2-3 years, but can vary from 1-7 years (Dodd 1988). Generally, loggerhead sea turtles originating from the Western Atlantic nesting aggregations are believed to lead a pelagic existence in the North Atlantic Gyre for as long as 7-12 years or more. Stranding records indicate that when pelagic immature loggerheads reach 40-60 cm straight-line carapace length they begin to live in coastal inshore and nearshore waters of the continental shelf throughout the U.S. Atlantic and Gulf of Mexico, although some loggerheads may move back and forth between the pelagic and benthic environment (Witzell 2002). Benthic immature loggerheads have been found from Cape Cod, Massachusetts, to southern Texas, and occasionally strand on beaches in northeastern Mexico.

Tagging studies have shown loggerheads that have entered the benthic environment undertake routine migrations along the coast that are limited by seasonal water temperatures. Loggerhead sea turtles occur year-round in offshore waters off North Carolina where water temperature is influenced by the Gulf Stream. As coastal water temperatures warm in the spring, loggerheads begin to immigrate to North Carolina inshore waters (e.g., Pamlico and Core Sounds) and also move up the coast (Epperly et al. 1995a-c), occurring in Virginia foraging areas as early as April and on the most northern foraging grounds in the Gulf of Maine in June. The trend is reversed in the fall as water temperatures cool. The large majority of loggerheads leave the Gulf of Maine by mid-September but some may remain in mid-Atlantic and Northeast areas until late fall. By December loggerheads have emigrated from inshore North Carolina waters and coastal waters to the north to waters offshore of North Carolina, particularly off Cape Hatteras, and waters further south where the influence of the Gulf Stream provides temperatures favorable to sea turtles (≥ 11°C) (Epperly et al. 1995a-c). Loggerhead sea turtles are year-round residents of central and south Florida.

Pelagic and benthic juveniles are omnivorous and forage on crabs, mollusks, jellyfish, and vegetation at or near the surface (Dodd 1988). Sub-adult and adult loggerheads are primarily coastal dwelling and typically prey on benthic invertebrates such as mollusks and decapod crustaceans in a variety of habitats.

More recent studies are revealing that the loggerhead's life history is more complex than previously believed. Rather than making discrete developmental shifts from oceanic to neritic environments, research is showing that both adults and (presumed) neritic stage juveniles continue to use the oceanic environment and will move back and forth between the two habitats (Witzell 2002, Blumenthal et al. 2006, Hawkes et al. 2006, McClellan and Read 2007). One of the studies tracked the movements of adult females post-nesting and found a difference in habitat use was related to body size with larger turtles staying in coastal waters and smaller turtles traveling to oceanic waters (Hawkes et al. 2006). A tracking study of large juveniles found that the habitat preferences of this life stage were also diverse with some remaining in neritic waters while others moved off into oceanic waters (McClellan and Read 2007). However, unlike the Hawkes et al. study (2006), there was no significant difference in the body size of turtles that remained in neritic waters versus oceanic waters (McClellan and Read 2007). In either case, the research not only supports the need to revise the life history model for loggerheads but also demonstrates that threats to loggerheads in both the neritic and oceanic environments are likely impacting multiple life stages of this species.

Population Dynamics and Status

A number of stock assessments and similar reviews (TEWG 1998, TEWG 2000, NMFS SEFSC 2001 and 2009d, Heppell et al. 2003, NMFS and USFWS 2008, Conant et al. 2009, TEWG 2009) have examined the stock status of loggerheads in the Atlantic Ocean, but none have been able to develop a reliable estimate of absolute population size.

Numbers of nests and nesting females can vary widely from year to year. However, nesting beach surveys can provide a reliable assessment of trends in the adult female population, due to the strong nest site fidelity of females turtles, as long as such studies are sufficiently long and effort and methods are standardized (see, e.g., NMFS and USFWS 2008). NMFS and USFWS (2008) concluded that the lack of change in two important demographic parameters of loggerheads, remigration interval and clutch frequency, indicate that time series on numbers of nests can provide reliable information on trends in the female population. Recent analysis of available data for the Peninsular Florida Recovery Unit has led to the conclusion that the observed decline in nesting for that unit over the last several years can best be explained by an actual decline in the number of adult female loggerheads in the population (Witherington et al. 2009).

Annual nest totals from beaches within what NMFS and USFWS have defined as the Northern Recovery Unit (NRU) averaged 5,215 nests from 1989-2008, a period of near-complete surveys of NRU nesting beaches (GDNR unpublished data, NCWRC unpublished data, SCDNR unpublished data), and represent approximately 1,272 nesting females per year (4.1 nests per female, Murphy and Hopkins 1984). The loggerhead nesting trend from daily beach surveys showed a significant decline of 1.3 percent annually. Nest totals from aerial surveys conducted by SCDNR showed a 1.9 percent annual decline in nesting in South Carolina since 1980. Overall, there is strong statistical data to suggest the NRU has experienced a long-term decline. Data in 2008 has shown improved nesting numbers, but future nesting years will need to be analyzed to determine if a change in trend is occurring. In 2008, 841 loggerhead nests were observed compared to the 10-year average of 715 nests in North Carolina. The number dropped to 276 in 2009, but rose again to 846 in 2010. In South Carolina, 2008 was the seventh highest nesting year on record since 1980, with 4,500 nests, but this did not change the long-term trend line indicating a decline on South Carolina beaches. Then in 2009 nesting dropped to 2183, with an increase to 3,141 in 2010. Georgia beach surveys located a total of 1,648 nests in 2008. This number surpassed the previous statewide record of 1,504 nests in 2003. In 2009, the number of nests declined to 998, and in 2010, a new statewide record was established with 1,760 loggerhead nests. According to analyses by Georgia DNR, the 40-year time-series trend data show an overall decline in nesting, but the shorter comprehensive survey data (20 years) indicate a stable population (SCDNR 2008; GDNR, NCWRC, and SCDNR nesting data located at www.seaturtle.org).

Another consideration that may add to the importance and vulnerability of the NRU is the sex ratio of this subpopulation. NMFS scientists have estimated that the Northern subpopulation produces 65 percent males (NMFS SEFSC 2001). However, research conducted over a limited time frame has found opposing sex ratios (Wyneken et al. 2004), so further information is needed to clarify the issue. Since nesting female loggerhead sea turtles exhibit nest fidelity, the continued existence of the Northern subpopulation is related to the number of female hatchlings that are produced. Producing fewer females will limit the number of subsequent offspring produced by the subpopulation.

The Peninsular Florida Recovery Unit (PFRU) is the largest loggerhead nesting assemblage in the Northwest Atlantic. A near-complete nest census (all beaches including index nesting beaches) undertaken from 1989 to 2007 showed a mean of 64,513 loggerhead nests per year, representing approximately 15,735 nesting females per year (from NMFS and USFWS 2008). The statewide estimated total for 2010 was 73,702 (FWRI nesting database). An analysis of index nesting beach data shows a 26 percent decline in nesting by the PFRU between 1989 and 2008, and a mean annual rate of decline of 1.6 percent despite a large increase in nesting for 2008, to 38,643 nests (Witherington et al. 2009, NMFS and USFWS 2008, FWRI nesting database). In 2009, nesting levels, while still higher than the lows of 2004, 2006, and 2007, dropped below 2008 levels to approximately 32,717 nests, but in 2010 a large increase was seen, with 47,880 nests on the index nesting beaches (FWRI nesting database). The 2010 index nesting number is the largest since 2000.

The remaining three recovery units—Dry Tortugas (DTRU), Northern Gulf of Mexico (NGMRU), and Greater Caribbean (GCRU)—are much smaller nesting assemblages but still considered essential to the continued existence of the species. Nesting surveys for the DTRU are conducted as part of Florida's statewide survey program. Survey effort has been relatively stable during the 9-year period from 1995-2004 (although the 2002 year was missed). Nest counts ranged from 168-270, with a mean of 246, but with no detectable trend during this period (Florida Fish and Wildlife Conservation Commission, Florida Marine Research Institute, Statewide Nesting Beach Survey Data, NMFS and USFWS 2008). Nest counts for the NGMRU are focused on index beaches rather than all beaches where nesting occurs. The 12-year dataset (1997-2008) of index nesting beaches in the area shows a significant declining trend of 4.7 percent annually (NMFS and USFWS 2008). Similarly, nesting survey effort has been inconsistent among the GCRU nesting beaches and no trend can be determined for this subpopulation. Zurita et al. (2003) found a statistically significant increase in the number of nests on seven of the beaches on Quintana Roo, Mexico, from 1987-2001, where survey effort was consistent during the period. However, nesting has declined since 2001, and the previously reported increasing trend appears to not have been sustained (NMFS and USFWS 2008).

Determining the meaning of the nesting decline data is confounded by various in-water research that suggests the abundance of neritic juvenile loggerheads is steady or increasing (Ehrhart et al. 2007, M. Bresette, pers. comm. regarding captures at the St. Lucie Power Plant, SCDNR unpublished SEAMAP-SA data, Epperly et al. 2007). Ehrhart et al. (2007) found no significant regression-line trend in the long-term dataset. However, notable increases in recent years and a statistically significant increase in CPUE of 102.4 percent from the 4-year period of 1982-1985 to the 2002-2005 periods were found. Epperly et al. (2007) determined the trends of increasing loggerhead catch rates from all the aforementioned studies in combination provide evidence there has been an increase in neritic juvenile loggerhead abundance in the southeastern United States in the recent past. A study led by the South Carolina Department of Natural Resources found that standardized trawl survey CPUEs for loggerheads from South Carolina to North Florida was 1.5 times higher in summer 2008 than summer 2000. However, even though there were persistent inter-annual increases from 2000-2008, the difference was not statistically significant, likely due to the relatively short time series. Comparison to other datasets from the 1950s through 1990s showed much higher CPUEs in recent years regionally and in the South Atlantic Bight, leading SCDNR to conclude that it is highly improbable that CPUE increases of such magnitude could occur without a real and substantial increase in actual abundance (Arendt et al. 2009). Whether this increase in abundance represents a true population increase among juveniles or merely a shift in spatial occurrence is not clear. NMFS and USFWS (2008), citing Bjorndal et al. 2005, caution about extrapolating localized in-water trends to the broader population and relating localized trends in neritic sites to population trends at nesting beaches. The apparent overall increase in the abundance of neritic loggerheads in the southeastern United States may be due to increased abundance of the largest Stage III individuals (oceanic/neritic juveniles, historically referred to as small benthic juveniles), which could indicate a relatively large cohort that will recruit to maturity in the near future (TEWG 2009). However, in-water studies throughout the eastern United States also indicate a substantial decrease in the abundance of the smallest Stage III loggerheads, a pattern also corroborated by stranding data (TEWG 2009).

The NMFS Southeast Fishery Science Center has developed a preliminary stage/age demographic model to help determine the estimated impacts of mortality reductions on loggerhead sea turtle population dynamics (NMFS SEFSC 2009). This model does not incorporate existing trends in the data (such as nesting trends) but instead relies on utilizing the available information on the relevant life-history parameters for sea turtles and then predicts future population trajectories based upon model runs using those parameters. Therefore, the model results do not build upon, but instead are complementary to, the trend data obtained through nest counts and other observations. The model uses the range of published information for the various parameters including mortality by stage, stage duration (years in a stage), and fecundity parameters such as eggs per nest, nests per nesting female, hatchling emergence success, sex ratio, and remigration interval. Model runs were done for each individual recovery unit as well as the western North Atlantic population as a whole, and the resulting trajectories were found to be very similar. One of the most robust results from the model was an estimate of the adult female population size for the western North Atlantic in the 2004-2008 time frame. The distribution resulting from the model runs suggest the adult female population size to be likely between approximately 20,000 to 40,000 individuals, with a low likelihood of being up to 70,000 (NMFS SEFSC 2009). A much less robust estimate for total benthic females in the western North Atlantic was also obtained, with a likely range of approximately 30,000-300,000 individuals, up to less than 1 million (NMFS SEFSC 2009).

The results of one set of model runs suggest that the western North Atlantic population is most likely declining, but this result was very sensitive to the choice of the position of the parameters within their range and hypothesized distributions. This example was run to predict the distribution of projected population trajectories for benthic females using a range of starting population numbers from the 30,000 estimated minimum to the greater than the 300,000 likely upper end of the range and declining trajectories were estimated for all of the population estimates. After 10,000 simulation runs of the models using the parameter ranges, 14 percent of the runs resulted in growing populations, while 86 percent resulted in declining populations. While this does not translate to an equivalent statement that there is an 86 percent chance of a declining population, it does illustrate that given the life history parameter information currently thought to comprise the likely range of possibilities, it appears most likely that with no changes to those parameters the population is projected to decline. Additional model runs using the range of values for each life history parameter, the assumption of non-uniform distribution for those parameters, and a 5 percent natural (non-anthropogenic) mortality for the benthic stages resulted in a determination that a 60-70 percent reduction in anthropogenic mortality in the benthic stages would be needed to bring 50 percent of the model runs to a static (zero growth or decline) or increasing trajectory.

As a result of the large uncertainty in our knowledge of loggerhead life history, at this point predicting the future populations or population trajectories of loggerhead sea turtles with precision is very uncertain. The model results, however, are useful in guiding future research needs to better understand the life history parameters that have the most significant impact in the model. Additionally, the model results provide valuable insights into the likely overall declining status of the species and in the impacts of large-scale changes to various life history parameters (such as mortality rates for given stages) and how they may change the trajectories. The results of the model, in conjunction with analyses conducted on nest count trends (such as Witherington et al. 2009) which have suggested that the population decline is real, provides a strong basis for the conclusion that the western North Atlantic loggerhead population is in decline. NMFS also recently convened a new Turtle Expert Working Group (TEWG) for loggerhead sea turtles that gathered available data and examined the potential causes of the nesting decline and what the decline means in terms of population status. The TEWG ultimately could not determine whether or not decreasing annual numbers of nests among the Western North Atlantic loggerhead subpopulations were due to stochastic processes resulting in fewer nests, a decreasing average reproductive output of the adult females, decreasing numbers of adult females, or a combination of those factors. Past and present mortality factors that could impact current loggerhead nest numbers are many, and it is likely that several factors compound to create the current decline. Regardless of the source of the decline, it is clear that the reduced nesting will result in depressed recruitment to subsequent life stages over the coming decades (TEWG 2009).

Threats

The 5-year status review of loggerhead sea turtles recently completed by NMFS and the USFWS provides a summary of natural as well as anthropogenic threats to loggerhead sea turtles (NMFS and USFWS 2007c). The Loggerhead Recovery Team also undertook a comprehensive evaluation of threats to the species, and described them separately for the terrestrial, neritic, and oceanic zones (NMFS and USFWS 2008). The diversity of sea turtles' life history leaves them susceptible to many natural and human impacts, including impacts while they are on land, in the benthic environment, and in the pelagic environment. Hurricanes are particularly destructive to sea turtle nests. Sand accretion and rainfall that result from these storms, as well as wave action, can appreciably reduce hatchling success. For example, in 1992 all of the eggs over a 90-mile length of coastal Florida were destroyed by storm surges on beaches that were closest to the eye of Hurricane Andrew (Milton et al. 1994). Also, many nests were destroyed during the 2004 and 2005 hurricane seasons. Other sources of natural mortality include cold-stunning and biotoxin exposure. Cold-stunning is not considered a major source of mortality, but cold-stunning of loggerhead turtles has been reported at several locations in the northeast and southeast United States, including the Indian River Lagoon in Florida (Mendonca and Ehrhart 1982, Witherington and Ehrhart 1989) and Texas inshore waters (Hildebrand 1982). Cold-stunning is a phenomenon during which turtles become incapacitated as a result of rapidly dropping water temperatures (Witherington and Ehrhart 1989, Morreale et al. 1992). As temperatures fall below 8°-10°C, turtles may lose their ability to swim and dive, often floating to the surface. The rate of cooling that precipitates cold-stunning appears to be the primary threat, rather than the water temperature itself (Milton and Lutz 2003). Sea turtles that overwinter in inshore waters are most susceptible to cold-stunning because temperature changes are most rapid in shallow water (Witherington and Ehrhart 1989). In January 2010, an unusually large cold-stunning event occurred throughout the southeast United States, with well over 3,000 sea turtles (mostly greens but also hundreds of loggerheads) found cold-stunned. Most were able to be saved, but a few hundred were found dead or died after being discovered in a cold-stunned state.

Anthropogenic factors that impact hatchlings and adult female sea turtles on land or the success of nesting and hatching include: beach erosion, beach armoring and nourishment, artificial lighting, beach cleaning, increased human presence, recreational beach equipment, beach driving, coastal construction and fishing piers, exotic dune and beach vegetation, and poaching. An increase in human presence at some nesting beaches or close to nesting beaches has led to secondary threats such as the introduction of exotic fire ants, feral hogs, dogs, and an increased presence of native species (e.g., raccoons, armadillos, and opossums), which raid and feed on turtle eggs. Although sea turtle nesting beaches are protected along large expanses of the Northwest Atlantic coast (in areas like Merritt Island, Archie Carr, and Hobe Sound National Wildlife Refuges), other areas along these coasts have limited or no protection. Sea turtle nesting and hatching success on unprotected East Florida nesting beaches from Indian River to Broward County, including some high density beaches, are affected by all of the above threats.

Loggerhead sea turtles are affected by a completely different set of anthropogenic threats in the marine environment. These threats include oil and gas exploration, coastal development, marine transportation, marine pollution (which may have a direct impact, or an indirect impact by causing harmful algal blooms), underwater explosions, hopper dredging, offshore artificial lighting, power plant entrainment and/or impingement, entanglement in debris, ingestion of marine debris, marina and dock construction and operation, boat collisions, poaching, and fishery interactions. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating much higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known. Loggerheads in the pelagic environment are exposed to a series of longline fisheries, which include the highly migratory species' Atlantic pelagic longline fisheries, an Azorean longline fleet, a Spanish longline fleet, and various longline fleets in the Mediterranean Sea

(Aguilar et al. 1995, Bolten et al. 1994). Loggerheads in the benthic environment in waters off the coastal United States are exposed to a suite of fisheries in federal and state waters including trawl, purse seine, hook-and-line, gillnet, pound net, longline, and trap fisheries. The sizes and reproductive values of sea turtles killed or injured by fisheries vary significantly, depending on the location and season of the fishery, and size-selectivity resulting from gear characteristics. Therefore, it is possible for fisheries that interact with fewer, more reproductively valuable turtles to have a greater detrimental effect on the population than one that interacts with greater numbers of less reproductively valuable turtles if the fishery removes a higher overall reproductive value from the population (Wallace et al. 2008). The Loggerhead Biological Review Team determined that the greatest threats to the Northwest Atlantic DPS of loggerheads result from cumulative fishery bycatch in neritic and oceanic habitats (Conant, et al. 2009). Attaining a more thorough understanding of the characteristics, as well as the quantity, of sea turtle bycatch across all fisheries is of great importance.

There is a large and growing body of literature on past, present, and future impacts of global climate change exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however significant impacts to the hatchling sex ratios of loggerhead turtles may result (NMFS and USFWS 2007c). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). Increases in global temperature could potentially skew future sex ratios toward higher numbers of females (NMFS and USFWS 2007c). Modeling suggests an increase of 2°C in air temperature would result in a sex ratio of over 80 percent female offspring for loggerheads nesting near Southport, North Carolina. The same increase in air temperatures at nesting beaches in Cape Canaveral, Florida, would result in close to 100 percent female offspring. More ominously, an air temperature increase of 3°C is likely to exceed the thermal threshold of most clutches, leading to death (Hawkes et al. 2007).

Warmer sea surface temperatures have been correlated with an earlier onset of loggerhead nesting in the spring (Weishampel et al. 2004, Hawkes et al. 2007), as well as short inter-nesting intervals (Hays et al. 2002) and shorter nesting season (Pike et al. 2006).

The effects from increased temperatures may be exacerbated on developed nesting beaches where shoreline armoring and construction have denuded vegetation. Erosion control structures could potentially result in the permanent loss of nesting beach habitat or deter nesting females (NRC 1990). Alternatively, nesting females may nest on the seaward side of the erosion control structures, potentially exposing them to repeated tidal overwash (NMFS and USFWS 2007c). Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as an increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Other changes in the marine ecosystem caused by global climate change (e.g., salinity, oceanic currents, dissolved oxygen levels, nutrient distribution, etc.) could influence the distribution and abundance of phytoplankton, zooplankton, submerged aquatic vegetation, crustaceans, mollusks, forage fish, etc., which could ultimately affect the primary foraging areas of loggerhead sea turtles.

Actions have been taken to reduce anthropogenic impacts to loggerhead sea turtles from various sources, particularly since the early 1990s. These include lighting ordinances, predation control, and nest relocations to help increase hatchling survival, as well as measures to reduce the mortality of pelagic immatures, benthic immatures, and sexually mature age classes in various fisheries and other marine activities. Recent actions have taken significant steps towards reducing the recurring sources of mortality of sea turtles in the environmental baseline and improving the status of all loggerhead subpopulations. For example, the Turtle Excluder Device (TED) regulation published on February 21, 2003 (68 FR 8456), represents a significant improvement in the baseline effects of trawl fisheries on loggerhead sea turtles, though shrimp trawling is still considered to be one of the largest source of anthropogenic mortality on loggerheads (NMFS SEFSC 2009).

3.2.4.1 Summary of Status for Loggerhead Sea Turtles

In the Atlantic Ocean, absolute population size is not known, but based on extrapolation of nesting information, loggerheads are likely much more numerous than in the Pacific Ocean. NMFS recognizes five recovery units of loggerhead sea turtles in the western North Atlantic based on genetic studies and management regimes. Cohorts from all of these are known to occur within the action area of this consultation. There are long-term declining nesting trends for the two largest Western Atlantic recovery units: the PFRU and the NRU. Furthermore, no long-term data suggest any of the loggerhead subpopulations throughout the entire North Atlantic are increasing in annual numbers of nests (TEWG 2009). Additionally, using both computation of susceptibility to quasi-extinction and stage-based deterministic modeling to determine the effects of known threats to Northwest Atlantic loggerheads, the Loggerhead Biological Review Team determined that this population is likely to decline in the foreseeable future, driven primarily by the mortality of juvenile and adult loggerheads from fishery bycatch throughout the North Atlantic Ocean. These computations were done for each of the recovery units, and all of them resulted in an expected decline (Conant et al. 2009). Because of its size, the PFRU may be critical to the survival of the species in the Atlantic Ocean. In the past, this nesting aggregation was considered second in size only to the nesting aggregation on islands in the Arabian Sea off Oman (Ross 1979, Ehrhart 1989). However, the status of the Oman colony has not been evaluated recently; and it is located in an area of the world where it is highly vulnerable to disruptive events such as political upheavals, wars, catastrophic oil spills, and lack of strong protections for sea turtles (Meylan et al. 1995). Given the lack of updated information on this population, the status of loggerheads in the Indian Ocean basin overall is essentially unknown.

On March 5, 2008, NMFS and USFWS published a 90-day finding that a petitioned request to reclassify loggerhead turtles in the Western North Atlantic Ocean as a distinct population segment may be warranted (73 FR 11849). NMFS and USFWS convened a Loggerhead Biological Review Team that determined that loggerhead turtles in the Atlantic meet the required characteristics to be separated into three DPSs: the Northwest Atlantic DPS, Northeast Atlantic DPS, and South Atlantic DPS (Conant et al. 2009). On March 10, 2010, NMFS and USFWS announced their proposed determination that loggerhead sea turtles should be listed as nine separate DPSs, and that seven of these, including Northwest Atlantic loggerheads, should be listed as endangered. In the final rule, issued on September 16, 2011, five DPSs were listed as endangered – Northeast Atlantic Ocean, Mediterranean Sea, North Indian Ocean, North Pacific Ocean, and South Pacific Ocean; and four others were listed as threatened – Northwest Atlantic Ocean, South Atlantic Ocean, Southeast Indo-Pacific Ocean, and Southwest Indian Ocean. All loggerhead DPSs are faced with a multitude of natural and anthropogenic effects that negatively influence the status of the species. Many anthropogenic effects occur as a result of activities outside of U.S. jurisdiction (i.e., fisheries in international waters).

3.2.5 Leatherback Sea Turtle

The leatherback sea turtle was listed as endangered throughout its global range on June 2, 1970. Leatherbacks are widely distributed throughout the oceans of the world and are found in waters of the Atlantic, Pacific, and Indian Oceans (Ernst and Barbour 1972). Leatherback sea turtles are the largest living turtles and range farther than any other sea turtle species. The large size of adult leatherbacks and their tolerance to relatively low temperatures allows them to occur in northern waters such as off Labrador and in the Barents Sea (NMFS and USFWS 1995). Adult leatherbacks forage in temperate and subpolar regions from 71°N to 47°S latitude in all oceans and undergo extensive migrations to and from their tropical nesting beaches. In 1980, the leatherback population was estimated at approximately 115,000 adult females globally (Pritchard 1982); that number, however, is probably an overestimation as it was based on a particularly good nesting year in 1980 (Pritchard 1996). By 1995, the global population of adult females had declined to 34,500 (Spotila et al. 1996). Pritchard (1996) also called into question the population estimates from Spotila et al. (1996) and felt they may be somewhat low because it ended the modeling on data from a particularly bad nesting year (1994) while excluding nesting data from 1995, which was a good nesting year. The most recent population estimate for leatherback sea turtles from just the North Atlantic breeding groups is a range of 34,000-90,000 adult individuals (20,000-56,000 adult females) (TEWG 2007).

3.2.5.1 Pacific Ocean

Based on published estimates of nesting female abundance, leatherback populations have collapsed or have been declining at all major Pacific basin nesting beaches for the last two decades (Spotila et al. 1996, NMFS and USFWS 1998b, Sarti et al. 2000, Spotila et al. 2000). For example, the nesting assemblage on Terengganu, Malaysia–which was one of the most significant nesting sites in the western Pacific Ocean–has declined severely from an estimated 3,103 females in 1968 to 2 nesting females in 1994 (Chan and Liew 1996). Nesting assemblages of leatherback turtles are in decline along the coasts of the Solomon Islands, a historically important nesting area (D. Broderick, pers. comm., in Dutton et al. 1999). In Fiji, Thailand, Australia, and Papua New Guinea (East Papua), leatherback turtles have only been known to nest in low densities and scattered colonies.

Only an Indonesian nesting assemblage has remained relatively abundant in the Pacific basin. The largest extant leatherback nesting assemblage in the Indo-Pacific lies on the north Vogelkop coast of Irian Jaya (West Papua), Indonesia, with over 3,000 nests recorded annually (Putrawidjaja 2000, Suárez et al. 2000). During the early-to-mid 1980s, the number of female leatherback turtles nesting on the two primary beaches of Irian Jaya appeared to be stable. More recently, this population has come under increasing threats that could cause this population to experience a collapse that is similar to what occurred at Terengganu, Malaysia. In 1999, for example, local Indonesian villagers started reporting dramatic declines in sea turtle populations near their villages (Suárez 1999). Unless hatchling and adult turtles on nesting beaches receive more protection, this population will continue to decline. Declines in nesting assemblages of leatherback turtles have been reported throughout the western Pacific region, with nesting assemblages well below abundance levels observed several decades ago (e.g., Suárez 1999).

In the western Pacific Ocean and South China Seas, leatherback turtles are captured, injured, or killed in numerous fisheries, including Japanese longline fisheries. The poaching of eggs, killing of nesting females, human encroachment on nesting beaches, beach erosion, and egg predation by animals also threaten leatherback turtles in the western Pacific.

In the eastern Pacific Ocean, nesting populations of leatherback turtles are declining along the Pacific coast of Mexico and Costa Rica. According to reports from the late 1970s and early 1980s, three beaches on the Pacific coast of Mexico supported as many as half of all leatherback turtle nests for the eastern Pacific. Since the early 1980s, the eastern Pacific Mexican population of adult female leatherback turtles has declined to slightly more than 200 individuals during 1998-1999 and 1999-2000 (Sarti et al. 2000). Spotila et al. (2000) reported the decline of the leatherback turtle population at Playa Grande, Costa Rica, which had been the fourth largest nesting colony in the world. Between 1988 and 1999, the nesting colony declined from 1,367 to 117 female leatherback turtles. Based on their models, Spotila et al. (2000) estimated that the colony could fall to less than 50 females by 2003-2004. Leatherback turtles in the eastern Pacific Ocean are captured, injured, or killed in commercial and artisanal swordfish fisheries off Chile, Colombia, Ecuador, and Peru, and purse seine fisheries for tuna in the eastern tropical Pacific Ocean, and California/Oregon drift gillnet fisheries. Because of the limited data, we cannot provide high-certainty estimates of the number of leatherback turtles captured, injured, or killed through interactions with these fisheries. However, between 8-17 leatherback turtles were estimated to have died annually between 1990 and 2000 in interactions with the California/Oregon drift gillnet fishery; 500 leatherback turtles are estimated to die annually in Chilean and Peruvian fisheries; 200 leatherback turtles are estimated to die in direct harvests in Indonesia; and, before 1992, the North Pacific driftnet fisheries for squid, tuna, and billfish captured an estimated 1,000 leatherback turtles each year, killing about 111 of them each year.

Although all causes of the declines in leatherback turtle colonies in the eastern Pacific have not been documented, Sarti et al. (1998) suggest that the declines result from egg poaching, adult and subadult mortalities incidental to high seas fisheries, and natural fluctuations due to changing environmental conditions. Some published reports support this suggestion. Sarti et al. (2000)

reported that female leatherback turtles have been killed for meat on nesting beaches like Píedra de Tiacoyunque, Guerrero, Mexico. Eckert (1997) reported that swordfish gillnet fisheries in Peru and Chile contributed to the decline of leatherback turtles in the eastern Pacific. The decline in the nesting population at Mexiquillo, Mexico, occurred at the same time that effort doubled in the Chilean driftnet fishery. In response to these effects, the eastern Pacific population has continued to decline, leading some researchers to conclude that the leatherback is on the verge of extinction in the Pacific Ocean (e.g., Spotila et al. 1996, Spotila et al. 2000). The NMFS assessment of three nesting aggregations in its February 23, 2004, opinion supports this conclusion: If no action is taken to reverse their decline, leatherback sea turtles nesting in the Pacific Ocean either have high risks of extinction in a single human generation (for example, nesting aggregations at Terrenganu and Costa Rica) or they have a high risk of declining to levels where more precipitous declines become almost certain (e.g., Irian Jaya) (NMFS 2004).

3.2.5.2 Atlantic Ocean

In the Atlantic Ocean, leatherbacks have been recorded as far north as Newfoundland, Canada, and Norway, and as far south as Uruguay, Argentina, and South Africa (NMFS 2001a). Female leatherbacks nest from the southeastern United States to southern Brazil in the western Atlantic and from Mauritania to Angola in the eastern Atlantic. The most significant nesting beaches in the Atlantic, and perhaps in the world, are in French Guiana and Suriname (NMFS 2001). Previous genetic analyses of leatherbacks using only mitochondrial DNA (mtDNA) resulted in an earlier determination that within the Atlantic basin there are at least three genetically different nesting populations: the St. Croix nesting population (U.S. Virgin Islands), the mainland nesting Caribbean population (Florida, Costa Rica, Suriname/French Guiana), and the Trinidad nesting population (Dutton et al. 1999). Further genetic analyses using microsatellite markers in nuclear DNA along with the mtDNA data and tagging data has resulted in Atlantic Ocean leatherbacks now being divided into seven groups or breeding populations: Florida, Northern Caribbean, Western Caribbean, Southern Caribbean/Guianas, West Africa, South Africa, and Brazil (TEWG 2007). When the hatchlings leave the nesting beaches, they move offshore but eventually utilize both coastal and pelagic waters. Very little is known about the pelagic habits of the hatchlings and juveniles, and they have not been documented to be associated with the *Sargassum* areas as are other species. Leatherbacks are deep divers, with recorded dives to depths in excess of 1,000 m (Eckert et al. 1989, Hays et al. 2004).

Life History and Distribution
Leatherbacks are a long-lived species, living for well over 30 years. It has been thought that they reach sexual maturity somewhat faster than other sea turtles (except Kemp's ridley), with an estimated range of 3-6 years (Rhodin 1985) to 13-14 years (Zug and Parham 1996). However, some recent research using sophisticated methods of analyzing leatherback ossicles has cast doubt on the previously accepted age to maturity figures, with leatherbacks in the western North Atlantic possibly not reaching sexual maturity until as late as 29 years of age (Avens and Goshe 2007). Continued research in this area is vitally important to understanding the life history of leatherbacks and has important implications in management of the species.

Female leatherbacks nest frequently (up to 10 nests per year) during a nesting season and nest about every 2-3 years. During each nesting, they produce 100 eggs or more in each clutch and, thus, can produce 700 eggs or more per nesting season (Schultz 1975). However, a significant portion (up to approximately 30 percent) of the eggs can be infertile. Thus, the actual proportion of eggs that can result in hatchlings is less than this seasonal estimate. The eggs incubate for 55-75 days before hatching. Based on a review of all sightings of leatherback sea turtles of <145-cm curved carapace length (ccl), Eckert (1999) found that leatherback juveniles remain in waters warmer than 26°C until they exceed 100 ccl.

Although leatherbacks are the most pelagic of the sea turtles, they enter coastal waters on an irregular basis to feed in areas where jellyfish are concentrated. Leatherback sea turtles feed primarily on cnidarians (medusae, siphonophores) and tunicates.

Evidence from tag returns and strandings in the western Atlantic suggests that adult leatherback sea turtles engage in routine migrations between boreal, temperate, and tropical waters (NMFS and USFWS 1992). A 1979 aerial survey of the outer continental shelf from Cape Hatteras, North Carolina, to Cape Sable, Nova Scotia, showed leatherbacks to be present throughout the area with the most numerous sightings made from the Gulf of Maine south to Long Island. Leatherbacks were sighted in waters where depths ranged from 1 to 4,151 m, but 84.4 percent of sightings were in areas where the water was less than 180 m deep (Shoop and Kenney 1992). Leatherbacks were sighted in waters of a similar sea surface temperature as loggerheads from 7°C to 27.2°C (Shoop and Kenney 1992). However, this species appears to have a greater tolerance for colder waters because more leatherbacks were found at the lower temperatures (Shoop and Kenney 1992). This aerial survey estimated the in-water leatherback population from near Nova Scotia, Canada, to Cape Hatteras, North Carolina, at approximately 300-600 animals.

General differences in migration patterns and foraging grounds may occur between the seven nesting assemblages identified by the TEWG in 2007, but data is limited. Marked or satellite tracked turtles from the Florida and North Caribbean assemblages have been re-sighted off North America, in the Gulf of Mexico, and along the Atlantic coast, and a few have moved to western Africa, north of the equator. In contrast, Western Caribbean and Southern Caribbean/Guianas animals have been found more commonly in the eastern Atlantic, off Europe and northern Africa, as well as along the North American coast. There are no reports of marked animals from the Western North Atlantic assemblages entering the Mediterranean Sea or the South Atlantic Ocean, though in the case of the Mediterranean this may be due more to a lack of data rather than failure of Western North Atlantic turtles moving into the Sea. The tagging data coupled with the satellite telemetry data indicate that animals from the western North Atlantic nesting subpopulations use virtually the entire North Atlantic Ocean. In the South Atlantic Ocean, tracking and tag return data follow three primary patterns. Although telemetry data from the West African nesting assemblage showed that all but one remained on the shallow continental shelf, there clearly is movement to foraging areas of the south coast of Brazil and Argentina. There is also a small nesting aggregation of leatherbacks in Brazil, and while data are limited to a few satellite tracks, these turtles seem to remain in the southwest Atlantic foraging along the continental shelf margin as far south as Argentina. South African nesting turtles apparently forage primarily south, around the tip of the continent.

Population Dynamics and Status

The status of the Atlantic leatherback population has been less clear than the Pacific population. This uncertainty has been a result of inconsistent beach and aerial surveys, cycles of erosion and reformation of nesting beaches in the Guianas (representing the largest nesting area), a lesser degree of nest-site fidelity than occurs with the hardshell sea turtle species, and inconsistencies in the availability and analyses of data. However, recent coordinated efforts at data collection and analyses by the Leatherback Turtle Expert Working Group have helped to clarify the understanding of the Atlantic population status (TEWG 2007).

The Southern Caribbean/Guianas stock is the largest known Atlantic leatherback nesting aggregation (TEWG 2007). This area includes the Guianas (Guyana, Suriname, and French Guiana), Trinidad, Dominica, and Venezuela, with the vast majority of the nesting occurring in the Guianas and Trinidad. Past analyses had shown that the nesting aggregation in French Guiana had been declining at about 15 percent per year since 1987 (NMFS 2001a). However, from 1979-1986, the number of nests was increasing at about 15 percent annually, which could mean that the current decline could be part of a nesting cycle that coincides with the erosion cycle of Guiana beaches described by Schultz (1975). It is thought that the cycle of erosion and reformation of beaches has resulted in shifting nesting beaches throughout this region. This was supported by the increased nesting seen in Suriname, where leatherback nest numbers have shown large recent increases concurrent with declines elsewhere (with more than 10,000 nests per year since 1999 and a peak of 30,000 nests in 2001), and the long-term trend for the overall Suriname and French Guiana population was thought to possibly show an increase (Girondot 2002 in Hilterman and Goverse 2003). In the past, many sea turtle scientists have agreed that the Guianas (and some would include Trinidad) should be viewed as one population and that a synoptic evaluation of nesting at all beaches in the region is necessary to develop a true picture of population status (Reichart et al. 2001). Genetics studies have added support to this notion and have resulted in the designation of the Southern Caribbean/Guianas stock. Using both Bayesian modeling and regression analyses, the TEWG (2007) determined that the Southern Caribbean/Guianas stock had demonstrated a long-term, positive population growth rate (using nesting females as a proxy for population). This positive growth was seen within major nesting areas for the stock, including Trinidad, Guyana, and the combined beaches of Suriname and French Guiana (TEWG 2007).

The Western Caribbean stock includes nesting beaches from Honduras to Colombia. The most intense nesting in that area occurs in Costa Rica, Panama, and the Gulf of Uraba in Colombia (Duque et al. 2000). The Caribbean coast of Costa Rica and extending through Chiriquí Beach, Panama, represents the fourth largest known leatherback rookery in the world (Troëng et al. 2004). Examination of data from three index nesting beaches in the region (Tortuguero, Gandoca, and Pacuare in Costa Rica) using various Bayesian and regression analyses indicated that the nesting population likely was not growing over the 1995-2005 time series of available data (TEWG 2007). Other modeling of the nesting data for Tortuguero indicates a possible 67.8 percent decline between 1995 and 2006 (Troëng et al. 2007).

Nesting data for the Northern Caribbean stock is available from Puerto Rico, the U.S. Virgin Islands (St. Croix), and the British Virgin Islands (Tortola). In Puerto Rico, the primary nesting beaches are at Fajardo and on the island of Culebra. Nesting between 1978 and 2005 has ranged between 469-882 nests, and the population has been growing since 1978, with an overall annual growth rate of 1.1 percent (TEWG 2007). At the primary nesting beach on St. Croix, the Sandy Point National Wildlife Refuge, nesting has fluctuated from a few hundred nests to a high of 1,008 in 2001, and the average annual growth rate has been approximately 1.1 percent from 1986-2004 (TEWG 2007). Nesting in Tortola is limited, but has been increasing from 0-6 nests per year in the late 1980s to 35-65 per year in the 2000s, with an annual growth rate of approximately 1.2 percent between 1994 and 2004 (TEWG 2007).

The Florida nesting stock nests primarily along the east coast of Florida. This stock is of growing importance, with total nests between 800-900 per year in the 2000s following nesting totals fewer than 100 nests per year in the 1980s (Florida Fish and Wildlife Conservation Commission, unpublished data). Using data from the index nesting beach surveys, the TEWG (2007) estimated a significant annual nesting growth rate of 1.17 percent between 1989 and 2005. In 2007, a record 517 leatherback nests were observed on the index beaches in Florida, with 265 in 2008, and then an increase to a new record of 615 nests in 2009, and a slight decline in 2010 back to 552 nests (FWC Index Nesting Beach database). This up-and-down pattern is thought to be a result of the cyclical nature of leatherback nesting, similar to the biennial cycle of green turtle nesting, but overall the trend shows rapid growth on Florida's east coast beaches.

The West African nesting stock of leatherbacks is a large, important, but mostly unstudied aggregation. Nesting occurs in various countries along Africa's Atlantic coast, but much of the nesting is undocumented and the data are inconsistent. However, it is known that Gabon has a very large amount of leatherback nesting, with at least 30,000 nests laid along its coast in one season (Fretey et al. 2007). Fretey et al. (2007) also provide detailed information about other known nesting beaches and survey efforts along the Atlantic African coast. Because of the lack of consistent effort and minimal available data, trend analyses were not possible for this stock (TEWG 2007).

Two other small but growing nesting stocks utilize the beaches of Brazil and South Africa. For the Brazilian stock, the TEWG (2007) analyzed the available data and determined that between 1988 and 2003 there was a positive annual average growth rate of 1.07 percent using regression analyses and 1.08 percent using Bayesian modeling. The South African stock has an annual average growth rate of 1.06 based on regression modeling and 1.04 percent using the Bayesian approach (TEWG 2007).

Estimates of total population size for Atlantic leatherbacks are difficult to ascertain due to the inconsistent nature of the available nesting data. In 1996, the entire Western Atlantic population was characterized as stable at best (Spotila et al. 1996), with numbers of nesting females reported to be on the order of 18,800. A subsequent analysis by Spotila (pers. comm.) indicated that by 2000, the Western Atlantic nesting population had decreased to about 15,000 nesting females. Spotila et al. (1996) estimated that the leatherback population for the entire Atlantic basin, including all nesting beaches in the Americas, the Caribbean, and West Africa, totaled approximately 27,600 nesting females, with an estimated range of 20,082-35,133. This is consistent with the estimate of 34,000-95,000 total adults (20,000-56,000 adult females; 10,000-21,000 nesting females) determined by the TEWG (2007).

Threats

Zug and Parham (1996) pointed out that the main threat to leatherback populations in the Atlantic is the combination of fishery-related mortality (especially entanglement in gear and drowning in trawls) and the intense egg harvesting on the main nesting beaches. Other important ongoing threats to the population include pollution, loss of nesting habitat, and boat strikes.

Of sea turtle species, leatherbacks seem to be the most vulnerable to entanglement in fishing gear. This susceptibility may be the result of their body type (large size, long pectoral flippers, and lack of a hard shell), their attraction to gelatinous organisms and algae that collect on buoys and buoy lines at or near the surface, possibly their method of locomotion, and perhaps their attraction to the lightsticks used to attract target species in longline fisheries. They are also susceptible to entanglement in gillnets and pot/trap lines (used in various fisheries) and capture in trawl gear (e.g., shrimp trawls).

Leatherbacks are exposed to pelagic longline fisheries in many areas of their range. Unlike loggerhead turtle interactions with longline gear, leatherback turtles do not usually ingest longline bait. Instead, leatherbacks are typically foul-hooked by longline gear (e.g., on the flipper or shoulder area) rather than getting mouth-hooked or swallowing the hook (NMFS 2001a). A total of 24 nations, including the United States (accounting for 5-8 percent of the hooks fished), have fleets participating in pelagic longline fisheries in the area. Basin-wide, Lewison et al. (2004) estimated that 30,000-60,000 leatherback sea turtle captures occurred in Atlantic pelagic longline fisheries in the year 2000 alone (note that multiple captures of the same individual are known to occur, so the actual number of individuals captured may not be as high). Genetic studies performed within the Northeast Distant Fishery Experiment indicate that the leatherbacks captured in the Atlantic highly migratory species pelagic longline fishery were primarily from the French Guiana and Trinidad nesting stocks (over 95 percent); individuals from West African stocks were surprisingly absent (Roden et al. in press).

Leatherbacks are also susceptible to entanglement in the lines associated with trap/pot gear used in several fisheries. From 1990-2000, 92 entangled leatherbacks were reported from New York through Maine (Dwyer et al. 2002). Additional leatherbacks stranded wrapped in line of unknown origin or with evidence of a past entanglement (Dwyer et al. 2002). Fixed gear fisheries in the mid-Atlantic have also contributed to leatherback entanglements. In North Carolina, two leatherback sea turtles were reported entangled in a crab pot buoy inside Hatteras Inlet (D. Fletcher, pers. comm. to S. Epperly in NMFS 2001a). A third leatherback was reported entangled in a crab pot buoy in Pamlico Sound near Ocracoke. This turtle was disentangled and released alive; however, lacerations on the front flippers from the lines were evident (D. Fletcher, pers. comm. to S. Epperly in NMFS 2001a). In the Southeast, leatherbacks are vulnerable to entanglement in Florida's lobster pot and stone crab fisheries. In the U.S. Virgin Islands, where one of five leatherback strandings from 1982 to 1997 was due to entanglement (Boulon 2000), leatherbacks have been observed with their flippers wrapped in the line of West Indian fish traps (R. Boulon, pers. comm. to J. Braun-McNeill in NMFS 2001a). Because many entanglements of this typically pelagic species likely go unnoticed, entanglements in fishing gear may be much higher.

Leatherback interactions with the Southeast Atlantic shrimp fishery, which operates predominately from North Carolina through southeast Florida (NMFS 2002), have also been a common occurrence. Leatherbacks, which migrate north annually, are likely to encounter shrimp trawls working in the coastal waters off the Atlantic coast from Cape Canaveral, Florida, to the Virginia/North Carolina border. Leatherbacks also interact with the Gulf of Mexico shrimp fishery. For many years, TEDs required for use in these fisheries were less effective at excluding leatherbacks than the smaller, hard-shelled turtle species. To address this problem, on February 21, 2003, the NMFS issued a final rule to amend the TED regulations, which required modifications to the size and design of TEDs to exclude leatherbacks and large and sexually mature loggerhead and green turtles. Mortality of leatherbacks in the shrimp fishery is now estimated at 54 turtles per year.

Other trawl fisheries are also known to interact with leatherback sea turtles. In October 2001, a Northeast Fisheries Science Center (NEFSC) observer documented the take of a leatherback in a bottom otter trawl fishing for *Loligo* squid off Delaware; TEDs are not required in this fishery. The winter trawl flounder fishery, which did not come under the revised TED regulations, may also interact with leatherback sea turtles.

Gillnet fisheries operating in the nearshore waters of the Mid-Atlantic States are also suspected of capturing, injuring, and/or killing leatherbacks when these fisheries and leatherbacks co-occur. Data collected by the NEFSC Fisheries Observer Program from 1994 through 1998 (excluding 1997) indicate that a total of 37 leatherbacks were incidentally captured (16 lethally) in drift gillnets set in offshore waters from Maine to Florida during this period. Observer coverage for this period ranged from 54 to 92 percent.

Poaching is not known to be a problem for nesting populations in the continental United States. However, in 2001 the NMFS Southeast Fisheries Science Center (SEFSC) noted that poaching of juveniles and adults was still occurring in the U.S. Virgin Islands and the Guianas. In all, four of the five strandings in St. Croix were the result of poaching (Boulon 2000). A few cases of fishermen poaching leatherbacks have been reported from Puerto Rico, but most of the poaching is on eggs.

Pollution may also represent a significant problem for leatherback sea turtles. Leatherback sea turtles may be more susceptible to marine debris ingestion than other species due to their pelagic existence and the tendency of floating debris to concentrate in convergence zones that adults and juveniles use for feeding areas and migratory routes (Lutcavage et al. 1997, Shoop and Kenney 1992). Investigations of the stomach contents of leatherback sea turtles revealed that a substantial percentage (44 percent of the 16 cases examined) contained plastic (Mrosovsky 1981). Along the coast of Peru, intestinal contents of 19 of 140 (13 percent) leatherback carcasses were found to contain plastic bags and film (Fritts 1982). The presence of plastic debris in the digestive tract suggests that leatherbacks might not be able to distinguish between prey items and plastic debris (Mrosovsky 1981). Balazs (1985) speculated that the object might resemble a food item by its shape, color, size, or even movement as it drifts about, and induce a feeding response in leatherbacks. In 2010, there was a massive oil well release in the Gulf of Mexico at British Petroleum's Deepwater Horizon well. Official estimates are that 4.9 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. At this time the assessment of total direct impact to sea turtles has not been determined. Additionally, the long-term impacts to sea turtles as a result of habitat impacts, prey loss, and subsurface oil particles and oil components broken down through physical, chemical, and biological processes are not known.

It is important to note that, like marine debris, fishing gear interactions and poaching are problems for leatherbacks throughout their range. Entanglements are common in Canadian waters where Goff and Lien (1988) reported that 14 of 20 leatherbacks encountered off the coast of Newfoundland/Labrador were entangled in fishing gear including salmon net, herring net, gillnet, trawl line and crab pot line. Leatherbacks are reported taken by many other nations that participate in Atlantic pelagic longline fisheries, including Taipei, Brazil, Trinidad, Morocco, Cyprus, Venezuela, Korea, Mexico, Cuba, U.K., Bermuda, People's Republic of China, Grenada, Canada, Belize, France, and Ireland (see NMFS 2001a for a description of take records). Leatherbacks are known to drown in fish nets set in coastal waters of Sao Tome, West Africa (Castroviejo et al. 1994, Graff 1995). Gillnets are one of the suspected causes of the decline in the leatherback sea turtle population in French Guiana (Chevalier et al. 1999), and gillnets targeting green and hawksbill turtles in the waters of coastal Nicaragua also incidentally catch leatherback turtles (Lageux et al. 1998). Observers on shrimp trawlers operating in the northeastern region of Venezuela documented the capture of six leatherbacks from 13,600 trawls (Marcano and Alio-M. 2000). A study by the Trinidad and Tobago's Institute for Marine Affairs (IMA) in 2002 confirmed that bycatch of leatherbacks is high in Trinidad. IMA estimated that more than 3,000 leatherbacks were captured incidental to gillnet fishing in the coastal waters of Trinidad in 2000. As much as one-half or more of the gravid turtles in Trinidad and Tobago waters may be killed (Lee Lum 2003), though many of the turtles do not die as a result of drowning, but rather because the fishermen butcher them in order to get them out of their nets (NMFS 2001a).

There is a large and growing body of literature on past, present, and future impacts of global climate change exacerbated and accelerated by human activities. Some of the likely effects commonly mentioned are sea level rise, increased frequency of severe weather events, and change in air and water temperatures. NOAA's climate information portal provides basic background information on these and other measured or anticipated effects (see http://www.climate.gov).

Impacts on sea turtles currently cannot, for the most part, be predicted with any degree of certainty; however, significant impacts to the hatchling sex ratios of leatherback turtles may result (NMFS and USFWS 2007b). In marine turtles, sex is determined by temperature in the middle third of incubation with female offspring produced at higher temperatures and males at lower temperatures within a thermal tolerance range of 25°-35°C (Ackerman 1997). However, unlike other sea turtles species, leatherbacks tend to select nest locations in the cooler tidal zone of beaches (Kamel and Mrosovsky 2004). This preference may help mitigate the effects from increased beach temperature (Kamel and Mrosovsky 2004).

Sea level rise from global climate change is also a potential problem for areas with low-lying beaches where sand depth is a limiting factor, as the sea may inundate nesting sites and decrease available nesting habitat (Daniels et al. 1993, Fish et al. 2005, Baker et al. 2006). The loss of habitat as a result of climate change could be accelerated due to a combination of other environmental and oceanographic changes such as increase in the frequency of storms and/or changes in prevailing currents, both of which could lead to increased beach loss via erosion (Antonelis et al. 2006, Baker et al. 2006).

Global climate change is likely to influence the distribution and abundance of jellyfish, the primary prey item of leatherbacks (NMFS and USFWS 2007b). Several studies have shown leatherback distribution is influenced by jellyfish abundance (e.g., Houghton et al. 2006, Witt et al. 2006, Witt et al. 2007). How these changes in jellyfish abundance and distribution will impact leatherback sea turtle foraging behavior and distribution is currently unclear (Witt et al. 2007).

3.2.5.3 Summary of Leatherback Status

In the Pacific Ocean, the abundance of leatherback turtle nesting individuals and colonies has declined dramatically over the past 10 to 20 years. Nesting colonies throughout the Eastern and Western Pacific Ocean have been reduced to a fraction of their former abundance by the combined effects of human activities that have reduced the number of nesting females. In addition, egg poaching has reduced the reproductive success of the remaining nesting females. At current rates of decline, leatherback turtles in the Pacific basin are a critically endangered species with a low probability of surviving and recovering in the wild.

In the Atlantic Ocean, our understanding of the status and trends of leatherback turtles is somewhat more confounded, although the overall trend appears to be stable to increasing. The data indicate increasing or stable nesting populations in all of the regions except West Africa (no long-term data are available) and the Western Caribbean (TEWG 2007). Some of the same factors that led to precipitous declines of leatherbacks in the Pacific also affect leatherbacks in the Atlantic (i.e., leatherbacks are captured and killed in many kinds of fishing gear and interact with fisheries in state, federal, and international waters). Poaching is also a problem that affects leatherbacks occurring in U.S. waters. Leatherbacks are also more susceptible to death or injury from ingesting marine debris than other turtle species.

3.2.6 The Deepwater Horizon MC252 Oil Release Event and Impacts to Sea Turtles in the Northern Gulf

On April 20, 2010, while working on an exploratory well approximately 50 miles offshore Louisiana, the semi-submersible drilling rig Deepwater Horizon (DWH) experienced an explosion and fire. The rig subsequently sank and oil and natural gas began leaking into the Gulf of Mexico. Oil flowed for 86 days, until finally being capped on July 15, 2010. Official estimates are that just under 5 million barrels of oil were released into the Gulf, with some experts estimating even higher volumes. Additionally, approximately 1.84 million gallons of chemical dispersant were applied both subsurface and on the surface to attempt to break down the oil. There is no question that the unprecedented Deepwater Horizon event and associated response activities (e.g., skimming, burning, and application of dispersants) have resulted in adverse effects on listed sea turtles. Smalltooth sawfish may also be adversely affected by oil, but at this time there is no evidence documenting effects on smalltooth sawfish from this particular oil spill.

At this time, the total effects of the oil spill on species found throughout the Gulf of Mexico, including ESA-listed sea turtles, are not known. Potential DWH-related impacts to all sea turtle species include direct oiling or contact with dispersants from surface and subsurface oil and dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is currently an ongoing investigation and analysis being conducted under the Oil Pollution Act (33 U.S.C. 2701 *et seq*.) to assess natural resource damages and to develop and implement a plan for the restoration, rehabilitation, replacement or acquisition of the equivalent of the injured natural resources. The final outcome of that investigation may not be known for many months to years from the time of this biological opinion. Consequently, other than some emergency restoration efforts, most restoration efforts that occur pursuant to the Oil Pollution Act have yet to be determined and implemented, and so the ultimate restoration impacts on the species are unknowable at this time. However, despite the lack of solid information on the population level impacts to sea turtles, if any, we must attempt a reasonable assessment of what those impacts may be based upon the limited available information, knowledge of the species involved, and best professional scientific judgment. This is needed in order to analyze how the proposed action would impact the status of sea turtle species in light of the DWH event.

During the initial response phase to the DWH oil spill (April 26 – October 20, 2010) a total of 1,146 sea turtles were recovered (Table 3.2.1), either as strandings (dead or debilitated generally onshore or nearshore) or were collected offshore during sea turtle search and rescue operations. Subsequent to the response phase a few sea turtles with visible evidence of oiling were recovered as strandings. The available data on sea turtle strandings and response collections during the time of the spill are expected to represent a fraction (currently unknown) of the actual losses to the species, as most individuals likely were not recovered. The number of strandings does not provide insights into potential sub-lethal impacts that could reduce long-term survival or fecundity of individuals affected. However, it does provide some insight into the potential relative scope of the impact among the sea turtle species in the area. Kemp’s ridley sea turtles may have been the most affected sea turtle species, as they accounted for almost 71 percent of all recovered turtles (alive and dead), and 79 percent of all dead turtles recovered. Green turtles accounted for 17.5 percent of all recoveries (alive and dead), and 4.8 percent of the dead turtles recovered. Loggerheads comprised 7.7 percent of total recoveries (alive and dead) and 11 percent of the dead turtle recovered. The remaining turtles were hawksbills and decomposed hardshell turtles that were not identified to species. No leatherbacks were among the sea turtles recovered in the spill response area. (Note: leatherbacks were documented in the spill area, but they were not recovered alive or dead).

Kemp’s Ridley Sea Turtles

The vast majority of sea turtles collected in relation to the DWH oil release were Kemp’s ridleys; 328 were recovered alive and 481 were recovered dead. We expect that additional mortalities occurred that were undetected and are, therefore, currently unknown. It is likely that the Kemp’s ridley sea turtle was also the species most impacted by the DWH event on a population level. Relative to the other species, Kemp's ridley populations are much smaller, yet stranding recoveries during the DWH oil spill response were much higher. The location and timing of the DWH event were also important factors. Although significant assemblages of juvenile Kemp's ridleys occur along the U.S. Atlantic coast, Kemp's ridley sea turtles use the Gulf of Mexico as their primary habitat for most life stages, including all of the mating and nesting. As a result, all mating and nesting adults in the population necessarily spend significant time in the Gulf of Mexico, as do all hatchlings as they leave the beach and enter the pelagic environment. However, not all of those individuals will have encountered oil and/or dispersants, depending on the timing and location of their movements relative to the location of the subsurface and surface oil. In addition to mortalities, the effects of the spill may have included disruptions to foraging and resource availability, migrations, and other unknown effects as the spill began in late April just before peak mating/nesting season (May-July) although the distance from the MC252 well to the primary mating and nesting areas in Tamaulipas, Mexico greatly reduces the chance of these disruptions to adults breeding in 2010. However, turtle returns from nesting beaches to foraging areas in the northern Gulf of Mexico occurred while the well was still spilling oil. At this time we cannot determine the specific reasons accounting for year-to-year fluctuations in numbers of Kemp's ridley nests (the number of nests increased in 2011 as compared to 2010); however, there may yet be long-term population impacts from the oil spill. How quickly the species returns to the previous fast pace of recovery may depend in part on how much of an impact the DWH event has had on Kemp's ridley food resources (Crowder and Heppell 2011).

Loggerhead Sea Turtles
As presented earlier, 88 loggerhead sea turtles were documented within the designated spill during response activities; 67 were dead and 21 were alive. As mentioned previously, it is unclear how many of those without direct evidence of oil were actually impacted by the spill and spill-related activities versus other sources of mortality. There were likely additional mortalities that were undetected and, therefore, currently unknown. Although we believe that the DWH event had adverse effects on loggerheads, the population level effect was not likely as severe as for Kemp's ridleys. In comparison to Kemp's ridleys, we believe the relative proportion of the loggerhead population exposed to the effects of the event was much smaller, the number of turtles recovered (alive and dead) was fewer in absolute numbers, and the overall population size is believed to be many times larger. Additionally, unlike Kemp's ridleys, the majority of nesting for the Northwest Atlantic Ocean loggerhead DPS occurs on the Atlantic coast. However, it is likely that impacts to the Northern Gulf of Mexico Recovery Unit of the NWA loggerhead DPS would be proportionally much greater than the impacts occurring to other recovery units because of impacts to nesting (as described above) and a larger proportion of the NGMRU recovery unit, especially mating and nesting adults, having been exposed to the spill. However, the impacts to that recovery unit, and the possible effect of such a disproportionate impact on that small recovery unit to the NWA DPS, remain unknown.

Green Sea Turtles
Green sea turtles comprised the second-most common species recovered during the DWH response. Of the 201 green turtles recovered, 29 were found dead or later died while undergoing rehabilitation. The mortality number is lower than that for loggerheads despite loggerheads having far fewer total strandings, but this is because the majority of green turtles came from the

offshore rescue (pelagic stage), of which almost all turtles (of all species) survived after rescue, whereas a greater proportion of the loggerhead recoveries were nearshore neritic stage individuals found dead. While green turtles regularly use the northern Gulf of Mexico, they have a widespread distribution throughout the entire Gulf of Mexico, Caribbean, and Atlantic. As described in the Status of the Species section, nesting is relatively rare on the northern Gulf coast. Therefore, while it is expected that adverse impacts occurred, the relative proportion of the population that is expected to have been exposed to and directly impacted by the DWH event, and thus the population-level impact, is likely much smaller than for Kemp's ridleys.

Hawksbill and Leatherback Sea Turtles
Currently available information indicates hawksbill and leatherback sea turtles were least affected by the oil spill. Sixteen hawksbills (all alive) were recovered during the response phase for the DWH spill. Oceanic stage juvenile hawksbills use the offshore waters of the northern Gulf of Mexico, but overall they are proportionally fewer in number than the other species discussed above. Hawksbill nesting in the northern Gulf of Mexico is a very rare event. Leatherbacks rarely nest along the Gulf coast, but do use the offshore waters. Potential DWH-related impacts to leatherback sea turtles include direct oiling or contact with surface and subsurface dispersants, inhalation of volatile compounds, disruption of foraging or migratory movements due to surface or subsurface oil, ingestion of prey species contaminated with oil and/or dispersants, and loss of foraging resources which could lead to compromised growth and/or reproductive potential. There is no information currently available to determine the extent of those impacts, if they occurred.

3.2.7 Smalltooth Sawfish

The U.S. Distinct Population Segment (DPS) of smalltooth sawfish was listed as endangered under the ESA on April 1, 2003 (68 FR 15674). The smalltooth sawfish is the first elasmobranch to be listed in the United States. The recovery plan for the species was finalized in January 2009. Critical habitat for the species was designated on September 2, 2009 (74 FR 45353). The two units designated are located along the southwestern coast of Florida between Charlotte Harbor and Florida Bay. Historically, smalltooth sawfish occurred commonly in the inshore waters of the Gulf of Mexico and along the Eastern Seaboard up to North Carolina, and more rarely as far north as New York. Today, smalltooth sawfish remain in the United States typically in protected or sparsely populated areas off the southern and southwestern coasts of Florida though a nursery area has been established in the Caloosahatchee River in an area of waterfront residences and seawalls and adults and juveniles are not uncommon in the Florida Keys (NMFS 2010).

Life History and Distribution
Smalltooth sawfish are approximately 31 in (80 cm) in total length at birth and may grow to a length of 18 feet (540 cm) or greater. A recent study by Simpfendorfer (2008) suggests rapid juvenile growth occurs during the first two years after birth. First year growth is 26-33 in (65-85 cm) and second year growth is 19-27 in (48-68 cm). Growth rates beyond two years are uncertain; however, the average growth rate of captive smalltooth sawfish has been reported between 5.8 in (13.9 cm) and 7.7 in (19.6 cm) per year. Apart from captive animals, little is known of the species' age parameters (i.e., age-specific growth rates, age at maturity, and maximum age). Simpfendorfer (2000) estimated age at maturity between 10 and 20 years, and a

maximum age of 30 to 60 years. Simpfendorfer (2008) reported that males appear to mature between 100-150 in (253 - 381 cm) total length, and unpublished data from Mote Marine Laboratory (MML) and NMFS indicates male smalltooth sawfish do not reach maturity until they reach 133 in (340 cm) total length.

No directed research on smalltooth sawfish prey preferences exists. Reports of sawfish feeding habits suggest they subsist chiefly on small schooling fish, such as mullets and clupeids. They are also reported to feed on crustaceans and other bottom-dwelling organisms. Observations of sawfish feeding behavior indicate that they attack fish by slashing sideways through schools, and often impale the fish on their rostral (saw) teeth (Breder 1952). Recent research (Wueringer et al. 2012) suggests smalltooth sawfish use their rostrum for both prey detection and capture. The fish are subsequently scraped off the teeth by rubbing them on the bottom and then ingested whole. The oral teeth of sawfish are ray-like, having flattened cusps that are better suited to crushing or gripping.

Very little is known about the specific reproductive biology of the smalltooth sawfish. No confirmed breeding sites have been identified to date since directed research began in 1998. As with all elasmobranchs, fertilization occurs internally. Development in sawfish is believed to be ovoviparous. The embryos of smalltooth sawfish, while still bearing the large yolk sac, resemble adults relative to the position of their fins and absence of the lower caudal lobe. During embryonic development, the rostral blade is soft and flexible. The rostral teeth are also encapsulated or enclosed in a sheath until birth. Shortly after birth, the teeth become exposed and attain their full size, proportionate to the size of the saw. (Bigelow and Schroeder 1953) reported gravid females have been documented carrying between 15-20 embryos; however, the source of their data is unclear and may represent an over-estimate of litter size. Studies of largetooth sawfish in Lake Nicaragua (Thorson 1976) report brood sizes of 1-13 individuals, with a mean of 7 individuals. The gestation period for largetooth sawfish is approximately 5 months, and females likely produce litters every second year. Although there are no such studies on smalltooth sawfish, their similarity to the largetooth sawfish implies that their reproductive biology may be similar. Genetic research currently underway may assist in determining reproductive characteristics (i.e., litter size and breeding periodicity). Research is also underway to investigate areas where adult smalltooth sawfish have been reported to congregate along the Everglades coast to determine if breeding is occurring in the area.

Life history information on the smalltooth sawfish has been evaluated using a demographic approach and life history data on largetooth sawfish and similar species from the literature. Simpfendorfer estimates intrinsic rates of natural population increase as 0.08 to 0.13 per year and population doubling times from 5.4 to 8.5 years (Simpfendorfer 2000). These low intrinsic rates of population increase are associated with the life history strategy known as "k-selection." K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment. J.A. Musick (1999) noted that intrinsic rates of increase less than ten percent were low, and such species are particularly vulnerable to excessive mortalities and rapid population declines, after which recovery may take decades, (Musick, Harbin et al. 2000). Thus, smalltooth sawfish populations are expected to recover slowly from depletion. Simpfendorfer (2000) concluded that recovery was likely to take decades or longer, depending on how effectively sawfish could be protected. However, if ages at maturity for both sexes prove to be lower than those previously used in demographic assessments, then population growth rates are likely to be greater and recovery times shorter (Simpfendorfer et al. 2008).

Smalltooth sawfish are tropical marine and estuarine elasmobranch (e.g., sharks, skates, and rays) fish that are reported to have a circumtropical distribution. The historic range of the smalltooth sawfish in the United States extends from Texas to New York (NMFS 2009). The U.S. region has historically harbored the largest number of smalltooth sawfish is south and southwest Florida from Charlotte Harbor to the Dry Tortugas. Most capture records along the Atlantic coast north of Florida are from spring and summer months and warmer water temperatures. Most specimens captured along the Atlantic coast north of Florida have also been large (greater than 10 feet or 3 m) adults and are thought to represent seasonal migrants, wanderers, or colonizers from a core or resident population(s) to the south rather than being resident members of a continuous, even-density population (Bigelow and Schroeder 1953). Historic records from Texas to the Florida Panhandle suggest a similar spring and summer pattern of occurrence. While less common, winter records from the northern Gulf of Mexico suggest a resident population, including juveniles, may have once existed in this region. The Status Review Team (NMFS 2000) compiled information from all known literature accounts, museum collection specimens, and other records of the species. The species suffered significant population decline and range constriction in the early to mid 1900s. Encounters with the species outside of Florida have been rare since that time.

Since the 1990s, the distribution of smalltooth sawfish in the United States has been restricted to peninsular Florida (Seitz and Poulakis 2002); (Poulakis and Seitz 2004); (Simpfendorfer and Wiley 2005); National Sawfish Encounter Database [NSED]). The Florida Museum of Natural History manages the NSED and is currently under contract with NMFS for smalltooth sawfish research. Encounter data indicates smalltooth sawfish encounters can be found with some regularity only in south Florida from Charlotte Harbor to Florida Bay. A limited number of reported encounters (one in Georgia, one in Alabama, one in Louisiana, and one in Texas) have occurred outside of Florida since 1998.

Peninsular Florida is the main U.S. region that historically and currently hosts the species year-round because the region provides the appropriate climate (subtropical to tropical) and contains the habitat types (lagoons, bays, mangroves, and nearshore reefs) suitable for the species. Encounter data and research efforts indicate a resident, reproducing population of smalltooth sawfish exists only in southwest Florida (Simpfendorfer and Wiley 2005).

General Habitat Use Observations

Encounter databases have provided some general insight into the habitat use patterns of smalltooth sawfish. Poulakis and Seitz (2004) reported that where the substrate type of encounters was known 61 percent were mud, 11 percent sand, 10 percent seagrass, 7 percent limestone, 4 percent rock, 4 percent coral reef, and 2 percent sponge. Simpfendorfer and Wiley (2005a) reported closer associations between encounters and mangroves, seagrasses, and the shoreline than expected at random. Encounter data have also demonstrated that smaller smalltooth sawfish occur in shallower water, and larger sawfish occur regularly at depths greater than 32 feet (10 m). Poulakis and Seitz (2004) reported that almost all of the sawfish <10 feet (3 m) in length were found in water less than 32 feet (10 m) deep and 46 percent of encounters with sawfish >10 feet (3 m) in Florida Bay and the Florida Keys were reported to occur at depths between 200 to 400 feet (70 to 122 m). Simpfendorfer and Wiley (2005a) also reported a substantial number of larger sawfish in depths greater than 32 feet (10 m). Simpfendorfer and Wiley (2005a) demonstrated a statistically significant relationship between the estimated size of sawfish and depth, with smaller sawfish on average occurring in shallower waters than large sawfish. There are few verified depth encounters for adult smalltooth sawfish and more information is needed to verify the depth distribution for this size class of animals.

Encounter data has also identified river mouths as areas where many people observe sawfish. Seitz and Poulakis (2002) noted that many of the encounters occurred at or near river mouths in southwest Florida. Simpfendorfer and Wiley (2005a) reported a similar pattern of distribution along the entire west coast of Florida. Information on juvenile smalltooth sawfish indicates that they prefer shallow euryhaline habitats adjacent to red mangroves (NMFS 2009).

Juvenile habitat use

Very small juveniles < 39 in (100 cm) in length

Very small sawfish are those that are less than 39 in (100 cm), and are young-of-the-year. Like all elasmobranchs of this age, they are likely to experience relatively high levels of mortality due to factors such as predation (Heupel and Simpfendorfer 2002) and starvation (Lowe 2002). Many elasmobranchs utilize specific nursery areas that have lower numbers of predators and abundant food resources (Simpfendorfer and Milward 1993). Acoustic tracking results for very small smalltooth sawfish indicate that shallow depths and red mangrove root systems are likely important in helping them avoid predators (Simpfendorfer 2003). At this size smalltooth sawfish spend the vast majority of their time on shallow mud or sand banks that are less than 1 foot (30 cm) deep. Since water depth on these banks varies with the tide, the movement of the very small sawfish appears to be directed towards remaining in shallow water. It is hypothesized that by staying in these very shallow areas the sawfish are inaccessible to predators (mostly sharks) and increase their chances of survival. The dorso-ventrally compressed body shape helps them in inhabiting these shallow areas, and they can often be observed swimming in only a few inches of water.

The use of red mangrove prop root habitat is also likely to aid very small sawfish in avoiding predators. Simpfendorfer (2003) observed very small sawfish moving into prop root habitats when shallow habitats were less available (especially at high tide). One small animal tracked over three days moved into a small mangrove creek on high tides when the mud bank on which it spent low tide periods was inundated at depths greater than 1 foot (30 cm). While in this creek it moved into areas with high prop root density. The complexity of the prop root habitat likely restricts the access of predators and so protects the sawfish.

Very small sawfish show high levels of site fidelity, at least over periods of days and potentially for much longer. Acoustic tracking studies have shown that at this size sawfish will remain associated with the same mud bank over periods of several days. These banks are often very small and daily home range sizes can be of the magnitude of 100–1,000 m^2 (Simpfendorfer

2003). Acoustic monitoring studies have shown that juveniles have high levels of site fidelity for specific nursery areas for periods up to almost 3 months (Wiley and Simpfendorfer 2007b). The combination of tracking and monitoring techniques used expanded the range of information gathered by generating both short- and long-term data (Wiley and Simpfendorfer 2007b, NMFS SEFSC 2010) and further analysis of these data is currently underway.

Small juveniles 39–79 in (100–200 cm) in length

Small juveniles have many of the same habitat use characteristics seen in the very small sawfish. Their association with very shallow water (< 1 foot deep) is weaker, possibly because they are better suited to predator avoidance due to their larger size and greater experience. They do still have a preference for shallow water, remaining in depths mostly less than 3 feet (90 cm). They will, however, move into deeper areas at times. One small sawfish acoustically tracked in the Caloosahatchee River spent the majority of its time in the shallow waters near the riverbank, but for a period of a few hours it moved into water 4–6 feet deep (Simpfendorfer 2003). During this time, it was constantly swimming, a stark contrast to active periods in shallow water that lasted only a few minutes before resting on the bottom for long periods.

Site fidelity has been studied in more detail in small sawfish. Several sawfish approximately 59 in (150 cm) in length fitted with acoustic tags have been relocated in the same general areas over periods of several months, suggesting a high level of site fidelity (Simpfendorfer 2003). The daily home ranges of these animals are considerably larger (1–5 km^2) than for the very small sawfish and there is less overlap in home ranges between days. The recent implementation of acoustic monitoring systems to study the longer-term site fidelity of sawfish has confirmed these observations, and also identified that changes in environmental conditions (especially salinity) may be important in driving changes in local distribution and, therefore, habitat use patterns (Simpfendorfer et al 2011). Results from Simpfendorfer et al (2011), salinity electivity analysis indicate an affinity for salinities between 18 and at least 24 psu, suggesting movements are likely made in part, to remain within this range.

Nursery areas for juveniles ≤ 79 in or 200 cm in length

Using the Heupel et al. (2007) framework for defining nursery areas for sharks and related species such as sawfish, and juvenile smalltooth sawfish encounter data, NMFS identified two nursery areas (Charlotte Harbor Estuary Unit and Ten Thousand Islands/Everglades Unit) for juvenile smalltooth sawfish in south Florida. Heupel et al. (2007), argue that nursery areas are areas of increased productivity, which can be evidenced by natal homing or philopatry (use of habitats year after year), and that juveniles in such areas should show a high level of site fidelity (remain in the area for extended periods of time). Heupel et al. (2007) proposed that shark nursery areas can be defined based on three primary criteria: (1) juveniles are more common in the area than other areas, i.e., density in the area is greater than the mean density over all areas; (2) juveniles have a tendency to remain or return for extended periods (weeks or months), i.e., site fidelity is greater than the mean site fidelity for all areas; and (3) the area or habitat is repeatedly used across years whereas other areas are not. NMFS analyzed juvenile smalltooth sawfish encounter data and mapped the location of the areas that met the Heupel et al. (2007) criteria for defining a nursery area. Two nursery areas were identified as meeting these criteria and were included in a critical habitat designation in 2009 (74 FR 45353). The northern nursery area is located within the Charlotte Harbor Estuary and the southern nursery area is located in the

Ten Thousand Islands area south into the ENP. The essential features of the nursery areas are red mangroves and shallow euryhaline habitats with water depths less than 3 feet Mean Lower Low Water.

Large juveniles >79 in (200 cm) in length

There are few data on the habitat use patterns of large juvenile sawfish. No acoustic telemetry or acoustic monitoring studies have examined this size group. Thus there is no detailed tracking data to identify habitat use and preference. However, some data are available from the deployment of pop-up archival transmitting (PAT) tags. These tags record depth, temperature, and light data, which is stored on the tag until it detaches from the animal, floats to the surface, and sends data summaries back via the ARGOS satellite system. More detailed data can be obtained if the tag is recovered. A PAT tag deployed on a 79-in (200 cm) sawfish in the Marquesas Keys collected 120 days of data. The light data indicated that the animal had remained in the general vicinity of the outer Keys for this entire period. Depth data from the tag indicated that this animal remained in depths less than 17 feet (5 m) for the majority of this period, making only two excursions to water down to 50 feet (15 m) in depth. There is no information on site fidelity in this size class of sawfish. More data is needed from large juveniles before conclusions about their habitat use and preferences can be made.

Adult Habitat Use

Information on the habitat use of adult smalltooth sawfish comes from encounter data, observers onboard fishing vessels, and from PAT tags. The encounter data suggest that adult sawfish occur from shallow coastal waters to deeper shelf waters. Poulakis and Seitz (2004) observed that nearly half of the encounters with adult-sized sawfish in Florida Bay and the Florida Keys occurred in depths from 200 to 400 feet (70 to 122 m). Simpfendorfer and Wiley (2005a) also reported encounters in deeper water off the Florida Keys, noting that these were mostly reported during winter. Observations on commercial longline fishing vessels and fishery independent sampling in the Florida Straits report large sawfish in depths up to 130 feet (~40 meters) (NSED). Little information is available on the habitat use patterns of the adults from the encounter data.

PAT tags have been successfully deployed on several sawfish and have provided some data on movements and habitat use. One large mature female was fitted with a tag near East Cape Sable in November 2001. The tag detached from this animal 60 days later near the Marquesas Keys, a straight-line distance of 80 nautical miles (148 km). The data from this tag indicated that the fish most likely traveled across Florida Bay to the Florida Keys and then along the island chain until it reached the outer Keys. The depth data indicated that it spent most of its time at depths less than 30 feet (10 m), but that once it arrived in the outer Keys it made excursions (1–2 days) into water as deep as 180 feet (60 m).

Limited data are available on the site fidelity of adult sawfish. Seitz and Poulakis (2002) reported that one adult-sized animal with a broken rostrum was captured in the same location over a period of a month near Big Carlos Pass suggesting that they may have some level of site fidelity for relatively short periods. However, historic occurrence of seasonal migrations along the U.S. east coast also suggests that adults may be more nomadic than the juveniles with their distribution controlled, at least in part, by water temperatures.

Population Dynamics and Status
Despite being widely recognized as common throughout their historic range (Texas to North Carolina) up until the middle of the 20th century, the smalltooth sawfish population declined dramatically during the middle and later parts of the century. The decline in the population of smalltooth sawfish is attributed to fishing (both commercial and recreational), habitat modification, and sawfish life history. Large numbers of smalltooth sawfish were caught as bycatch in the early part of this century. Smalltooth sawfish were historically caught as bycatch in various fishing gears throughout their historic range, including gillnet, otter trawl, trammel net, seine, and to a lesser degree, handline. Frequent accounts in earlier literature document smalltooth sawfish being entangled in fishing nets from areas where smalltooth sawfish were once common but are now rare (Evermann and Bean 1897). There are few long-term abundance data sets that include smalltooth sawfish. One dataset from shrimp trawlers off Louisiana from the late 1940s through the 1970s suggests a rapid decline in the species from the period 1950-1964 (NMFS 2009). However, this dataset has not been validated nor subjected to statistical analysis to correct for factors unrelated to abundance.

The Everglades National Park has established a fisheries monitoring program based on sport fisher dock-side interviews since 1972 (Schmidt, Degado et al. 2000). An analysis of these data using a log-normal generalized linear model to correct for factors unrelated to abundance (e.g., change in fishing practices) indicate that the population in the ENP is stable and may be increasing (Carlson et al. 2007). From 1989-2004, smalltooth sawfish relative abundance has increased by about 5 percent per year.

There is currently no estimate of smalltooth sawfish abundance throughout its range. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, including the current range, areas where recovery may be expected to occur, and the habitat needs of various size classes. Conclusions about the current abundance of smalltooth sawfish cannot be made because outreach efforts and observation effort have not expanded evenly across each study period (Wiley 2010). However, based on genetic sampling, the estimates of current effective population size are 269.6 – 504.9 individuals (95% Confidence Interval 139.3 – 1515). (E-mail communication between Demian Chapman and Tonya Wiley, April 11, 2010). Chapman also states that this number is usually ½ - ¼ census population size (breeding adults, male and female) in elasmobranchs, so it appears high hundreds to low thousands is probably the estimated range expected for the extant breeders

Threats
Smalltooth sawfish are threatened today by the loss of southeastern coastal habitat through such activities as agricultural and urban development, commercial activities, dredge-and-fill operations, boating, erosion, and diversions of freshwater runoff. Dredging, canal development, seawall construction, and mangrove clearing have degraded a significant proportion of the coastline. Smalltooth sawfish have been found near warm water discharge areas near power plants. Power plant discharges may provide a warm water refuge for the species during cold weather conditions. Smalltooth sawfish, especially small juveniles (less than 79 in or 200 cm in

length) are vulnerable to coastal habitat degradation due to their use of shallow, red mangrove, estuarine habitats for foraging and to avoid predation from sharks.

Recreational and commercial fisheries also still pose a threat to smalltooth sawfish. Although changes over the past decade to U.S. fishing regulations such as Florida's "Net Ban", which includes both a prohibition on the use of gill and entangling nets in all state waters and a size limit on other nets such as seines, have reduced these threats to the species over parts of its range; however, smalltooth sawfish are still incidentally caught in commercial shrimp trawls, bottom longlines, and by recreational rod-and-reel fisheries.

The current and future abundance of the smalltooth sawfish is limited by its life history characteristics (NMFS 2000). Slow-growing, late-maturing, and long-lived, these combined characteristics result in a very low intrinsic rate of population increase and are associated with the life history strategy known as "K-selection." As noted earlier in this section, K-selected animals are usually successful at maintaining relatively small, persistent population sizes in relatively constant environments. Consequently, they are not able to respond effectively (rapidly) to additional and new sources of mortality resulting from changes in their environment (Musick 1999). Simpfendorfer demonstrated that the life history of this species makes it impossible to sustain any significant level of fishing and makes it slow to recover from any population decline (Simpfendorfer 2000). Thus, the species is susceptible to population decline, even with relatively small increases in mortality.

4.0 Environmental Baseline

The environmental baseline describes the status of the species within the action area, provides the results of any surveys that may have been done in the action area, and describes the factors affecting the species within the action area. The distribution of sea turtle nesting activity on Florida's Gulf coast (Manatee, Sarasota, Charlotte, Lee, and Collier Counties) makes up a small percentage of the overall nesting activity within the state when compared to the east coast epicenter of sea turtle nesting located between Brevard and Palm Beach Counties. According to the FWC statewide nesting database, 9 percent of the total 2009 nesting activity on Florida's coastline occurred on the Gulf coast. During the 2009 nesting season, Sarasota County and Manatee County, combined, accounted for approximately 4 percent of the overall sea turtle nesting in the state of Florida (FWRI 2010a). Although green, Kemp's ridley, hawksbill, and leatherback sea turtles have been documented as nesting on Florida's Gulf coast beaches, the loggerhead sea turtle is by far the dominant nesting species. Sea turtle monitoring for Longboat Key is conducted by Mote Marine Lab (MML) Sea Turtle Conservation and Research Program (STCRP) personnel, interns, and volunteers authorized under FWC Marine Turtle Permits #054 and #027 issued to Ms. Paula Clark.

Green Sea Turtles
Since 1994, 101 green sea turtle nests have been deposited in Sarasota County; 11 were deposited in 2009 and 7 in 2008. Mote Marine Lab reported a total of 5 green sea turtle nests observed on Longboat Key since 2001; one in 2003, one in 2004, two in 2007, and one in 2008 (Tucker et al. 2009).

Hawksbill Sea Turtles
One hawksbill sea turtle nest was documented on Longboat Key by FWC staff in 1979. This nest was verified at the time by phone descriptions; however, no specimens were taken for further verification. Because hawksbills are typically tropical nesters, MML questions the validation of this single hawksbill nest (CP&E BA 2010). Within the continental United States, hawksbill nesting is restricted to and rare in the southeast coast of Florida and the Florida Keys (NMFS 2010). Florida is not considered one of the nesting concentrations for hawksbill sea turtles (NMFS and USFWS 2007a).

Kemp's Ridley Sea Turtles
In 2009, two nests were observed on Casey Key and one on Venice in Sarasota County and one nest was documented on Sanibel Island in Lee County. In Sarasota County, these were the first recordings of a Kemp's ridley nest since 1999. According to data collected by MML, no Kemp's ridley sea turtle nests have ever been observed on Longboat Key beaches (CP&E BA 2010). As for swimming sea turtles, Davis et al. (2000) reported three Kemp's ridleys in open waters along the continental shelf in the northern Gulf of Mexico based on aerial and boat surveys. The observations noted here are not near the borrow areas or the fill areas of the proposed project on Longboat Key.

Loggerhead Sea Turtles
Loggerhead turtles account for the majority of nests observed on Longboat Key. Table 4.1 presents Longboat Key loggerhead sea turtle nesting data collected by MML between 2002 and 2009 (Tucker et al. 2009), including the total number of loggerhead nests and the percentage of the total nesting activity on Longboat Key that were loggerhead nests; green sea turtles are the only other documented species to nest on Longboat Key during this time frame.

Table 4.1. Loggerhead sea turtle nests observed on Longboat Key from 2002-2009 and the percentage Loggerhead nests account for of all sea turtle nests observed.

Year	No. of Nests	Percent of Total Nesting activity
2002	213	100
2003	293	99.7
2004	161	99.4
2005	151	100
2006	160	100
2007	143	98.6
2008	252	99.6
2009	216	100

Leatherback Sea Turtles
With the exception of a few nests on the west coast, leatherback nesting occurs primarily on the east coast of Florida - almost 50 percent of all nests in Florida occur in Palm Beach County (FWRI2010a). The first leatherback nesting event documented along the central west coast shoreline of Florida occurred on May 31, 2001, on Longboat Key in Sarasota County (Tucker, pers. comm. 2010); one nest was also deposited on Sanibel Island in Lee County in 2009 (Tucker et al. 2009).

Smalltooth Sawfish
While the center of distribution and the designated critical habitat for the species are located approximately 40 miles to the south of the action area, the species may be affected by project activities. While no smalltooth sawfish interactions are known to have occurred from hopper dredging, a smalltooth sawfish was captured in August 2006 in a relocation trawl just north of this project during the Egmont Key channel dredging project. Thus, smalltooth sawfish may potentially be captured during relocation trawling activities associated with hopper dredging.

4.2 Other Factors Affecting Sea Turtles in the Action Area

The activities that shape the environmental baseline in the action area of this consultation are primarily federal fisheries. Other environmental impacts include effects of vessel operations, military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution.

4.2.1 Federal Actions

NMFS has undertaken a number of Section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on threatened and endangered sea turtle species, and when appropriate, has authorized the incidental taking of these species. Each of those consultations sought to minimize the adverse impacts of the action on sea turtles through changes to the action as proposed or through reasonable and prudent measures. The summary below includes only those federal actions in the action area that have already concluded or are currently undergoing formal Section 7 consultation.

4.2.1.1 Fisheries

Threatened and endangered sea turtles are adversely affected by fishing gears used throughout the continental shelf of the action area. Gillnet, pelagic and bottom longline, other types of hook-and-line gear, trawl, and pot fisheries have all been documented as interacting with sea turtles.

For all fisheries for which there is an FMP or for which any federal action is taken to manage that fishery, impacts have been evaluated under Section 7. Formal Section 7 consultations have been conducted on the following fisheries, occurring at least in part within the action area, found likely to adversely affect threatened and endangered sea turtles: Southeast shrimp trawl, Atlantic HMS pelagic longline, HMS directed shark, reef fish, and coastal migratory pelagic resources fisheries. Anticipated take levels associated with these actions are presented in Appendix 2; the take levels reflect the impact on sea turtles and other listed species of each activity anticipated from the date of the ITS forward in time.

Gulf shrimp trawl fisheries
Shrimp trawling has had the greatest adverse effect on sea turtles in the Gulf of Mexico. As sea turtles rest, forage, or swim on or near the bottom, they are captured by shrimp trawls pulled along the bottom. Shrimp trawling increased dramatically in the Gulf between the 1940s and the 1960s. By the late 1970s, there was evidence thousands of sea turtles were being killed annually

in the Southeast (Henwood and Stunz 1987). In 1990, the NRC concluded the Southeast shrimp trawl fishery affected more sea turtles than all other activities combined and was the most significant anthropogenic source of sea turtle mortality in U.S. waters, in part due to the high reproductive value of the large, mature turtles taken in this fishery (NRC 1990).

NMFS has prepared opinions on shrimp trawling in the Gulf of Mexico and U.S. South Atlantic numerous times over the years (i.e., NMFS 1992, 1994, 1996a, 1996b, 1998). The consultation history and the effects of shrimp trawling on sea turtles are closely tied to the lengthy regulatory history governing the use of TEDs and a series of regulations aimed at reducing potential for incidental mortality of sea turtles in commercial shrimp trawl fisheries. The level of annual mortality described in NRC 1990 is believed to have continued until 1992-1994, when U.S. law required all shrimp trawlers in the Atlantic and Gulf of Mexico to use turtle excluder devices (TEDs), which allowed some turtles to escape nets before drowning (NMFS 2002b). TEDs approved for use have had to demonstrate 97 percent effectiveness in excluding sea turtles from trawls in controlled testing. These regulations have been refined over the years to ensure that TED effectiveness is maximized through proper placement and installation, configuration (e.g., width of bar spacing), flotation, and more widespread use.

Despite the success of TEDs for some species of sea turtles, it was later discovered that TEDs were not adequately protecting all species and size classes of sea turtles. Analyses by Epperly and Teas (2002) indicated that the minimum requirements for the escape opening dimension in TEDs in use at that time were too small and that as many as 47 percent of the loggerheads stranding annually along the Atlantic and Gulf of Mexico were too large to fit the existing openings.

On December 2, 2002, NMFS completed the most recent opinion for shrimp trawling in the southeastern U.S. (NMFS 2002b) under proposed revisions to the TED regulations (68 FR 8456, February 21, 2003). This opinion determined that the shrimp trawl fishery under the revised TED regulations would not jeopardize the continued existence of any sea turtle species. This determination was based, in part, on the opinion’s analysis that showed the revised TED regulations were expected to reduce shrimp trawl related mortality by 94 percent for loggerheads and 97 percent for leatherbacks.

The 2002 shrimp opinion take estimates are based in part on 2001 fishery effort levels. In recent years, low shrimp prices, rising fuel costs, competition with imported products, and the impacts of recent hurricanes in the Gulf of Mexico have all impacted the shrimp fleets; in some cases reducing fishing effort by as much as 50 percent for offshore waters of the Gulf of Mexico (GMFMC 2007).

On August 16, 2010, NMFS reinitiated Section 7 consultation on the continued implementation of the sea turtle conservation regulations affecting the shrimp trawl fisheries in state and federal waters of the Southeast U.S and its effects on sea turtles. The reinitiation was primarily based on elevated strandings in the northern Gulf of Mexico during the spring of 2010 (that were observed again in the spring of 2011), necropsy information indicating that drowning may have contributed to many of the mortalities, and evidence of fisher compliance with Turtle Excluder Device (TED) requirements that was much lower than assumed, collectively indicating sea turtles may be affected by shrimp trawling to an extent not previously considered in the December 2, 2002, biological opinion. As part of the ongoing reinitiated consultation, NMFS is updating its 2002 estimates of the numbers of sea turtle interactions and mortalities (bycatch) in Southeast shrimp fisheries based on the best available new information. The new estimates will consider: (1) declines in shrimp fishing effort in the Southeast, (2) increases in the population sizes of Kemp's ridley and green sea turtles, and (3) information on shrimp industry compliance with TED regulations. The new shrimp bycatch estimates will also incorporate bycatch from all gear types, including skimmer trawls, which account for a large fraction of the shrimp fishing effort in the Gulf of Mexico, and try nets. These other gear types were previously considered for their effects on sea turtles, but only qualitatively.

U.S. Gulf shrimp fisheries target primarily brown, white, and pink shrimp in inland waters and estuaries through the state-regulated territorial seas and into federal waters of the EEZ. Brown shrimp are the most important species in the Gulf fishery, with catches high along the Texas, Louisiana, and Mississippi coast. They are caught out to at least 50 fathoms, but most come from waters less than 30 fathoms. White shrimp, second in value, generally range along the Gulf coast from the mouth of the Ochlockonee River in Florida, to Campeche, Mexico, in nearshore waters to 20 fathoms, with most of the catch coming from less than 15 fathoms. Pink shrimp are most abundant off Florida's west coast and particularly in the Tortugas off the Florida Keys. Thus, while a small amount of shrimp effort likely does occur within the action area, most shrimp fishing and its associated historic and current sea turtle bycatch occurs outside of the action area in other areas of the Gulf.

Atlantic pelagic longline fisheries

Atlantic pelagic longline fisheries targeting swordfish and tuna are also known to incidentally capture large numbers of loggerhead and leatherback sea turtles. U.S. pelagic longline fishermen began targeting highly migratory species in the Atlantic Ocean in the early 1960s. The fishery is comprised of five relatively distinct segments, but the Gulf yellowfin tuna fishery is the only segment in our action area. Pelagic longlines targeting yellowfin tunas in the Gulf are set in the morning (pre-dawn) in deep water and hauled in the evening. Although this fishery does occur in the Gulf EEZ, fishing typically occurs further offshore than where the proposed action will occur. The fishery mainly interacts with leatherback sea turtles and pelagic juvenile loggerhead sea turtles, thus, younger, smaller loggerhead sea turtles than the other fisheries described in this environmental baseline.

Over the past two decades, NMFS has conducted numerous consultations on this fishery, some of which required RPAs to avoid jeopardizing loggerhead and/or leatherback sea turtles. The estimated historical total number of loggerhead and leatherback sea turtles caught between 1992-2002 (all geographic areas) is 10,034 loggerhead and 9,302 leatherback sea turtles of which 81 and 121 were estimated to be dead when brought to the vessel (NMFS 2004b). This does not account for post-release mortalities, which historically were likely substantial.

NMFS most recently reinitiated consultation in 2004 on this fishery as a result of exceeded incidental take levels for loggerheads and leatherbacks (NMFS 2004b). The resulting opinion (NMFS 2004b) stated the long-term continued operation of this fishery was likely to jeopardize the continued existence of leatherback sea turtles, but RPAs were implemented allowing for the continued authorization of the pelagic longline fishing that would not jeopardize leatherback sea turtles. The 2004B opinion evaluated a rule implementing management measures to reduce bycatch and bycatch mortality of Atlantic sea turtles in the Atlantic pelagic longline fishery (69 FR 40734, July 6, 2004). The management measures include mandatory circle hook and bait requirements, and mandatory possession and use of sea turtle release equipment to reduce bycatch mortality. The 2004B opinion's reasonable and prudent alternatives and reasonable and prudent measures were designed to ensure the predicted significant benefits in mortality reduction to endangered and threatened sea turtles actually occur.

Atlantic HMS Directed Shark Fisheries
Atlantic HMS commercial directed shark fisheries also adversely affect sea turtles via capture and/or entanglement in the action area. The commercial component uses bottom longline and gillnet gear. Bottom longline is the primary gear used to target large coastal sharks (LCS) in the Gulf. Gillnets are the dominant gear for catching small coastal sharks (SCS); most shark gillnetting occurs off southeast Florida, outside of the action area. The largest concentration of bottom longline fishing vessels is found along the central Gulf coast of Florida, with the John's Pass - Madeira Beach area considered the center of directed shark fishing activities.

Growing demand for shark and shark products encouraged expansion of the commercial shark fishery through the 1970s and 1980s. As catches accelerated through the 1980s, shark stocks started to show signs of decline. Peak commercial landings of large coastal and pelagic sharks were reported in 1989. Atlantic sharks have been managed by NMFS since the 1993 FMP for Atlantic Sharks. At that time, NMFS identified LCS as overfished and implemented commercial quotas for LCS (2,436 mt dressed weight [dw]) and established recreational harvest limits for all sharks. In 1994, under the rebuilding plan implemented in the 1993 Shark FMP, the LCS quota was increased to 2,570 mt dw; in 1997, NMFS reduced the LCS commercial quota by 50 percent to 1,285 mt dw and the recreational retention limit to two LCS, SCS, and pelagic sharks combined per trip with an additional allowance of two Atlantic sharpnose sharks per person per trip (62 FR 16648, April 2, 1997). Since 1997, the directed LCS fishing season has generally been open for the first three months of the year and then a few weeks in July/August.

Observation of bycatch in directed HMS shark fisheries has been ongoing since 1994, but a mandatory program was not implemented until 2002. Neritic juvenile and adult loggerhead sea turtles are the primary species taken, but leatherback sea turtles have also been observed caught and a few observations have been unidentified species of turtles. Between 1994 and 2002, the observer program covered 1.6 percent of all hooks, and over that time period the fishery caught 31 loggerhead sea turtles, 4 leatherback sea turtles, and 8 unidentified turtles with estimated annual average take levels of 30, 222, and 56, respectively (NMFS 2003a).

In 2008, NMFS completed a Section 7 consultation on the continued authorization of directed Atlantic HMS shark fisheries under the Consolidated HMS FMP, including Amendment 2 (NMFS 2008). To protect declining shark stocks, Amendment 2 sought to greatly reduce the fishing effort in the commercial component of the fishery. These reductions are likely to greatly reduce the interactions between the commercial component of the fishery and sea turtles. Amendment 2 to the Consolidated HMS Fishery Management Plan (FMP) (73 FR 35778, June 24, 2008, corrected at 73 FR 40658, July 15, 2008) established, among other things, a shark research fishery to maintain time series data for stock assessments and to meet NMFS' 2009 research objectives. The shark research fishery permits authorize participation in the shark research fishery and the collection of sandbar and non-sandbar large coastal sharks (LCS) from federal waters in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea for the purposes of scientific data collection subject to 100-percent observer coverage. The commercial vessels selected to participate in the shark research fishery are the only vessels authorized to land/harvest sandbars subject to the sandbar quota available for each year. The base quota is 87.9 mt dw/year through December 31, 2012, although this number may be reduced in the event of overharvests, if any, and 116.6 mt dw/year starting on January 1, 2013. The selected vessels have access to the non-sandbar LCS, small coastal shark (SCS), and pelagic shark quotas. Commercial vessels not participating in the shark research fishery may only land non-sandbar LCS, SCS, and pelagic sharks subject to the retention limits and quotas per 50 CFR 635.24 and 635.27, respectively. The 2008 opinion stated that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected by the bottom longline and the gillnet fishery. However, the proposed action was not expected to jeopardize the continued existence of any of these species and an ITS was provided. Since implementation of Amendment 2, only one sea turtle (a loggerhead) has been observed caught in the research fishery. Also, vessels fishing outside of the research fishery have 5 to 8 percent observer coverage, and no sea turtles have been observed to date.

Coastal Migratory Pelagic Resources Fisheries
NMFS completed a Section 7 consultation on the continued authorization of the coastal migratory pelagic resources fishery in the Gulf of Mexico and South Atlantic (NMFS 2007a). In the Gulf of Mexico, commercial fishermen target king and Spanish mackerel with hook-and-line (i.e., handline, rod-and-reel, and bandit), gillnet, and cast net gears. Recreational fishermen use only rod-and-reel. Trolling is the most common hook-and-line fishing technique used by both commercial and recreational fishermen and the only technique used in the action area. Although run-around gillnets accounted for the majority of the king mackerel catch from the late 1950s through 1982, in 1986, and in 1993, handline gear has been the predominant gear used in the commercial king mackerel fishery since 1993 (NMFS 2007a). A winter troll fishery operates along the east and south Gulf coast. The gillnet fishery for king mackerel is restricted to the use of “run-around” gillnets in Gulf to Monroe and Collier Counties in January. Run-around gillnets are still the primary gear used to harvest Spanish mackerel, but the fishery is relatively small because Spanish mackerel are typically more concentrated in state waters where gillnet gear is prohibited. The 2007 opinion concluded that green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles may be adversely affected only by the gillnet component of the fishery. The continued authorization of the fishery was not expected to jeopardize the continued existence of any of these species and an ITS was provided.

4.2.1.2 Vessel Operations and Military Activities

Potential sources of adverse effects from federal vessel operations in the action area include operations of the U.S. Department of Defense (DOD), USN, Air Force (USAF), USCG, Environmental Protection Agency (EPA), NOAA, and COE. NMFS has also conducted Section 7 consultations on vessel traffic related to energy projects in the Gulf of Mexico (MMS, FERC, and MARAD) to implement conservation measures. The USCG has recently engaged NMFS in consultation on these actions to determine the magnitude of the adverse impacts resulting from these events in nearshore waters. Consultations on individual activities have been completed (e.g., NMFS 1995b, NMFS 1997), and a formal consultation on overall USN activities on the East coast has been completed (NMFS 2011). However, no overall consultation on USN or USCG efforts in the Gulf of Mexico has been completed at this time. Refer to the opinion for the USCG (NMFS 1995b) for details on the scope of vessel operations for these agencies and conservation measures being implemented as standard operating procedures.

4.2.1.3 ESA Permits

Sea turtles are the focus of research activities authorized by Section 10 permits under the ESA. Regulations developed under the ESA allow for the issuance of permits allowing take of certain ESA-listed species for the purposes of scientific research under Section 10(a)(1)(a) of the ESA. Authorized activities range from photographing, weighing, and tagging sea turtles incidentally taken in fisheries, to blood sampling, tissue sampling (biopsy), and performing laparoscopy on intentionally captured sea turtles. The number of authorized takes varies widely depending on the research and species involved, but may involve the taking of hundreds of sea turtles annually. Most takes authorized under these permits are expected to be (and are) non-lethal. Before any research permit is issued, the proposal must be reviewed under the permit regulations (i.e., must show a benefit to the species). In addition, since issuance of the permit is a federal activity, issuance of the permit by NMFS must also be reviewed for compliance with Section 7(a)(2) of the ESA to ensure that issuance of the permit does not result in jeopardy to the species or adverse modification of its critical habitat.

4.2.2 State or Private Actions

4.2.2.1 Vessel Traffic

Commercial vessel traffic and recreational boating can have adverse effects on sea turtles via propeller and boat strike injuries. The Sea Turtle Stranding and Salvage Network (STSSN) includes many records of vessel interactions (propeller injury) with sea turtles off Gulf of Mexico coastal states such as Florida, where there are high levels of vessel traffic.

4.2.3 Other Potential Sources of Impacts in the Environmental Baseline

4.2.3.1 Marine Debris and Acoustic Impacts

A number of activities that may indirectly affect listed species in the action area of this consultation include anthropogenic marine debris and acoustic impacts. The impacts from these activities are difficult to measure. Where possible, conservation actions are being implemented to monitor or study impacts from these sources.

4.2.3.2 Marine Pollution and Environmental Contamination

Sources of pollutants along the Gulf of Mexico include atmospheric loading of pollutants such as PCBs, stormwater runoff from coastal towns and cities into rivers and canals emptying into bays and the ocean (e.g., Mississippi River), and groundwater and other discharges. Nutrient loading from land-based sources such as coastal community discharges is known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. Although pathological effects of oil spills have been documented in laboratory studies of marine mammals and sea turtles (Vargo et al. 1986), the impacts of many other anthropogenic toxins have not been investigated.

Coastal runoff, marina and dock construction, dredging, aquaculture, oil and gas exploration and extraction, increased under water noise and boat traffic can degrade marine habitats used by sea turtles (Colburn et al. 1996). The development of marinas and docks in inshore waters can negatively impact nearshore habitats. An increase in the number of docks built increases boat and vessel traffic. Fueling facilities at marinas can sometimes discharge oil, gas, and sewage into sensitive estuarine and coastal habitats. Although these contaminant concentrations do not likely affect the more pelagic waters, the species of turtles analyzed in this biological opinion travel between near shore and offshore habitats and may be exposed to and accumulate these contaminants during their life cycles.

There are studies on organic contaminants and trace metal accumulation in green and leatherback sea turtles (Aguirre et al. 1994; Caurant et al. 1999; Corsolini et al. 2000). Mckenzie *et al.* (1999) measured concentrations of chlorobiphenyls and organochlorine pesticides in sea turtles tissues collected from the Mediterranean (Cyprus, Greece) and European Atlantic waters (Scotland) between 1994 and 1996. Omnivorous loggerhead turtles had the highest organochlorine contaminant concentrations in all the tissues sampled, including those from green and leatherback turtles (Storelli et al. 2008). It is thought that dietary preferences were likely to be the main differentiating factor among species. Decreasing lipid contaminant burdens with turtle size were observed in green turtles, most likely attributable to a change in diet with age. Sakai et al (1995) found the presence of metal residues occurring in loggerhead turtle organs and eggs. Storelli et al (1998) analyzed tissues from twelve loggerhead sea turtles stranded along the Adriatic Sea (Italy) and found that characteristically, mercury accumulates in sea turtle livers while cadmium accumulates in their kidneys, as has been reported for other marine organisms like dolphins, seals and porpoises (Law et al. 1991). No information on detrimental threshold concentrations is available, and little is known about the consequences of exposure of organochlorine compounds to sea turtles. Research is needed on the short- and long-term health and fecundity effects of chlorobiphenyl, organochlorine, and heavy metal accumulation in sea turtles.

Nutrient loading from land-based sources, such as coastal communities and agricultural operations, are known to stimulate plankton blooms in closed or semi-closed estuarine systems. The effects on larger embayments are unknown. An example is the large area of the Louisiana continental shelf with seasonally-depleted oxygen levels (< 2 mg/Liter) is caused by eutrophication from both point and non-point sources. Most aquatic species cannot survive at such low oxygen levels and these areas are known as "dead zones." The oxygen depletion, referred to as hypoxia, begins in late spring, reaches a maximum in mid-summer, and disappears in the fall. Since 1993, the average extent of mid-summer, bottom-water hypoxia in the northern Gulf of Mexico has been approximately 16,000 km^2, approximately twice the average size measured between 1985 and 1992. The hypoxic zone attained a maximum measured extent in 2002, when it was about 22,000 km^2 which is larger than the state of Massachusetts (U.S.

Geological Service 2005). The hypoxic zone has impacts on the animals found there, including sea turtles, and the ecosystem-level impacts continue to be investigated.

4.2.4 Conservation and Recovery Actions Benefiting Sea Turtles

We have implemented a series of regulations aimed at reducing the potential for incidental capture and mortality of sea turtles from commercial fisheries in the action area. These include sea turtle release and gear requirements for Atlantic HMS, Gulf of Mexico reef fish, and shrimp TED requirements.

Under Section 6 of the ESA, we may enter into cooperative research and conservation agreements with states to assist in recovery actions of listed species. In the Gulf of Mexico, we currently have an agreement with the State of Florida and is finalizing an agreement with Texas. Prior to issuance of these agreements, the proposal must be reviewed for compliance with Section 7 of the ESA.

Outreach and Education, Sea Turtle Entanglements, and Rehabilitation
NMFS and cooperating states have established an extensive network of Sea Turtle Stranding and Salvage Network (STSSN) participants along the Atlantic and Gulf of Mexico coasts that not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

Sea Turtle Handling and Resuscitation Techniques
We have issued regulations (66 FR 67495, December 31, 2001) detailing handling and resuscitation techniques for sea turtles that are incidentally caught during scientific research or fishing activities. Persons participating in fishing activities or scientific research are required to handle and resuscitate (as necessary) sea turtles as prescribed in the final rule. These measures help to prevent mortality of hard-shelled turtles caught in fishing or scientific research gear. There is an extensive network of Sea Turtle Stranding and Salvage Network participants along the Atlantic and Gulf of Mexico coasts who not only collect data on dead sea turtles, but also rescue and rehabilitate any live stranded sea turtles.

A final rule (70 FR 42508) published on July 25, 2005, allows any agent or employee of NMFS, the USFWS, the U.S. Coast Guard, or any other federal land or water management agency, or any agent or employee of a state agency responsible for fish and wildlife, when acting in the course of his or her official duties, to take endangered sea turtles encountered in the marine environment if such taking is necessary to aid a sick, injured, or entangled endangered sea turtle, or dispose of a dead endangered sea turtle, or salvage a dead endangered sea turtle that may be useful for scientific or educational purposes. NMFS already affords the same protection to sea turtles listed as threatened under the ESA [50 CFR 223.206(b)].

On August 3, 2007, we published a final rule requiring selected fishing vessels to carry observers on board to collect data on sea turtle interactions with fishing operations, to evaluate existing measures to reduce sea turtle takes, and to determine whether additional measures to address prohibited sea turtle takes may be necessary (72 FR 43176). This rule also extended the number of days, from 30 to 180, that NMFS observers were placed on vessels. This was done in response to a determination by the Assistant Administrator that the unauthorized take of sea turtles may be likely to jeopardize their continued existence under existing regulations, days.

Other Actions
A revised recovery plan for the loggerhead sea turtle was completed December 8, 2008 (NMFS and USFWS 2008). The recovery plan for the Kemp's ridley sea turtle was completed September 22, 2011 (NMFS et al 2011). Recovery teams comprised of sea turtle experts have been convened and are currently working towards revising these plans based upon the latest and best available information. Five-year status reviews have recently been completed for green, hawksbill, Kemp's ridley, leatherback, and loggerhead sea turtles. These reviews were conducted to comply with the ESA mandate for periodic status evaluation of listed species to ensure that their threatened or endangered listing status remains accurate. Each review determined that no delisting or reclassification of a species status (i.e., threatened or endangered) was warranted at this time. However, further review of species data for the green, hawksbill, leatherback, and loggerhead sea turtles was recommended, to evaluate whether distinct population segments (DPS) should be established for these species (NMFS and USFWS 2007a-e). As described in the Status of the Species section above, loggerhead sea turtles are now identified as DPS's. The final rule was published on September 22, 2011, and took effect on October 24, 2011.

4.2.5 Summary and Synthesis of Environmental Baseline for Sea Turtles

In summary, several factors adversely affect sea turtles in the action area. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Fisheries in the action area likely had the greatest adverse impacts on sea turtles in the mid to late 1980s, when effort in most fisheries was near or at peak levels. With the decline of the health of managed fish stocks, fishing effort has generally been declining. Over the past five years, the impacts associated with fisheries have also been reduced through the Section 7 consultation process and regulations implementing effective bycatch reduction strategies. However, interactions with commercial and recreational fishing gear are ongoing and are expected to occur contemporaneously with the proposed action. Other environmental impacts including effects of vessel operations, additional military activities, dredging, oil and gas exploration, permits allowing take under the ESA, private vessel traffic, and marine pollution have also had and continue to have adverse effects on sea turtles in the action area. The recent DWH oil release event is expected to have had an adverse impact on the status of sea turtles, but the extent of that impact is not yet well understood.

4.3 Smalltooth Sawfish within the Action Area

Smalltooth sawfish are not highly migratory species, although some large mature individuals may engage in seasonal north/south movement. The core range of the U.S. DPS of smalltooth sawfish is currently in south and southwest Florida. The action area comprises a very small portion of this range and may be the current northern extent.

4.3.1 Federal Actions

In recent years, NMFS has undertaken Section 7 consultations to address the effects of federally-permitted fisheries and other federal actions on smalltooth sawfish, and when appropriate, has authorized the incidental taking of the species. Each of those consultations sought to minimize the adverse impacts of the action on smalltooth sawfish. The following sections summarize anticipated sources of incidental take of smalltooth sawfish in the action area, which have already concluded formal Section 7 consultation.

4.3.1.1 Fisheries

Several federal fisheries in the Gulf are believed to adversely affect smalltooth sawfish, including the Gulf shrimp trawl, coastal migratory pelagic resources, spiny lobster fisheries, and Gulf HMS shark fisheries. Gulf HMS shark fisheries include commercial shark bottom longline and drift gillnet fisheries and recreational shark fisheries under the FMP for Atlantic Tunas, Swordfish, and Sharks (HMS FMP). NMFS has consulted formally twice on effects of HMS shark fisheries on smalltooth sawfish (i.e., NMFS 2003a and NMFS 2008). Both bottom longline and gillnet gear are known to adversely affect smalltooth sawfish. The observer program for sharks covered approximately 598,384 hooks or 1.6 percent of all hooks in the bottom longline fleet between 1994 and 2002. Over that time, eight smalltooth sawfish were observed caught and of these, none were within the action area. Since then, four additional smalltooth sawfish have been caught on shark bottom longlines, but they have all been in the Atlantic. Only one smalltooth sawfish has been observed incidentally caught in the shark drift gillnet fishery and this capture occurred in the Atlantic, where the shark drift gillnet fishery predominantly operates.

The most recent ESA Section 7 consultation was completed on May 20, 2008, on the continued operation of HMS shark fisheries under Amendment 2 to the Consolidated HMS FMP (NMFS 2008). The consultation concluded the proposed action was not likely to jeopardize the continued existence of the smalltooth sawfish. An ITS was provided authorizing 51 interactions every three years, only 1 of which is expected to be lethal. Based on past interactions, the majority of these interactions will be in the Atlantic, outside of the action area.

The other fisheries have been consulted on separately and were determined to not be likely to jeopardize the continued existence of smalltooth sawfish (NMFS 2006b, NMFS 2007a, NMFS 2009d). An ITS was provided for each fishery. The Gulf Shrimp trawl fishery is anticipated to result in up to one take annually, anticipated being lethal. NMFS has reinitiated consultation for the shrimp trawl fishery and will analyze any new information to determine if the anticipated interaction level has changed. The coastal migratory pelagic resources fishery is anticipated to result in two non-lethal smalltooth sawfish entanglements in gillnet gear annually. The Gulf spiny lobster fishery is anticipated to result in only two non-lethal smalltooth sawfish interactions every three years via entanglement in trap lines.

4.3.1.2 ESA Permits

Regulations developed under the ESA allow for the taking of ESA-listed species for scientific research purposes. Prior to issuance of these authorizations for taking, the proposal must be reviewed for compliance with Section 7 of the ESA. There are currently two active research permits issued for the smalltooth sawfish. The permits allow researchers to capture, handle, collect tissue and blood samples, and tag smalltooth sawfish. Although the research may result in disturbance and injury of smalltooth sawfish, the activities are not expected to affect the reproduction of the individuals that are caught, nor result in mortality.

4.3.2 State or Private Actions

Fisheries
The incidental capture of sawfish by private recreational fishermen has been documented in the action area and adjacent nearshore areas. Additionally, lost fishing gear such as line cut after snagging on rocks, or discarded hooks and line, can also pose an entanglement threat to smalltooth sawfish in the area.

4.3.3 Other Potential Sources of Impacts in the Environmental Baseline

Marine Pollution
Marine pollution, including litter and discarded fishing gear, also pose potential problems for sawfish. Smalltooth sawfish have been encountered with polyvinyl pipes and fishing gear on their rostrum (Gregg Poulakis, pers. comm. 2007). The same sources of pollutants described in Section 4.2.3.2 may also adversely affect smalltooth sawfish.

4.3.4 Conservation and Recovery Actions Shaping the Environmental Baseline

Regulations restricting the use of gear known to incidentally catch smalltooth sawfish may benefit the species by reducing their incidental capture and/or mortality in these gear types. In 1994, entangling nets (including gillnets, trammel nets, and purse seines) were banned in Florida state waters. Although intended to restore the populations of inshore gamefish, this action removed possibly the greatest source of fishing mortality on smalltooth sawfish (Simpfendorfer 2002). Florida's ban of the use of all but very small shrimp trawls within three nautical miles of the Gulf coast may also aid recovery of this species.

Research, monitoring, and outreach efforts on smalltooth sawfish are providing valuable information on which to base effective conservation management measures. Research on smalltooth sawfish is currently being conducted by NMFS SEFSC and the FWCC, Fish and Wildlife Research Institute, and the Florida Museum of Natural History (FLMNH) at the University of Florida. Surveys are conducted using longlines, setlines, gillnets, and seine nets in southwest Florida, as well as in South Florida and the northern Indian River Lagoon. Cooperating fishermen, guides, and researchers are also reporting smalltooth sawfish they encounter. Data collected are providing new insight on the species' current distribution, abundance, and habitat use patterns.

Public outreach efforts are also helping to educate the public on smalltooth sawfish status and proper handling techniques and helping to minimize interaction, injury, and mortality of encountered smalltooth sawfish. Information regarding the status of smalltooth sawfish and what the public can do to help the species is available on the Web site of the FLMNH,[4] NMFS,[5]

[4] http://www.flmnh.ufl.edu/fish/Sharks/Sawfish/SRT/srt.htm

and the Ocean Conservancy.[6] Reliable information is also available at websites maintained by noted sawfish expert Matthew McDavitt.[7] These organizations and individuals also educate the public about sawfish status and conservation through regular presentations at various public meetings.

In September 2003, NMFS convened a smalltooth sawfish recovery team. Under section 4(f)(1) of the ESA, NMFS is required to develop and implement recovery plans for the conservation and survival of endangered and threatened species. Such plans are to include: (1) A description of site-specific management actions necessary to conserve the species or populations; (2) objective, measurable criteria which, when met, will allow the species or populations to be removed from the endangered and threatened species list; and (3) estimates of the time and funding required to achieve the plan's goals and intermediate steps. The final smalltooth sawfish recovery plan published on January 21, 2009.

4.3.5 Summary of Environmental Baseline for Smalltooth Sawfish

In summary, several factors are presently adversely affecting smalltooth sawfish in the action area. These factors are ongoing and are expected to occur contemporaneously with the proposed action. Despite smalltooth sawfish being highly susceptible to entanglement, few interactions are documented. Impacts on smalltooth sawfish over the last several decades may be limited in large part by the scarcity of smalltooth sawfish in the action area. As the population slowly grows, fisheries and other activity stressors in the action area may have a greater impact on the species.

5.0 Effects of the Action

Effects of the action include the direct and indirect effects of an action on the species, together with the effects of other activities that are interrelated or interdependent with the action. Indirect effects are those that are caused by the proposed action and are later in time, but still are reasonably certain to occur. Interrelated actions are those that are part of a larger action and depend on the larger action for their justification. Interdependent actions are those that have no independent utility apart from the action under consideration.

Direct and indirect effects of the proposed action will be attributable to dredging, movement of the dredge, sand deposition on Longboat Key, and relocation trawling, and will be discussed below. The full scope of effects of the project results from BOEM's proposed action and all activities that are interdependent and interrelated to the proposed action. Therefore, effects must be evaluated from dredging of sand from sources located in state and federal waters, and precautionary sea turtle relocation trawling in federal and state waters, and sand deposition on Longboat Key. These actions are analyzed individually and additively in the following paragraphs.

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[5] http://www.sero.nmfs.noaa.gov/pr/SmalltoothSawfish.htm
[6] http://www.oceanconservancy.org/site/PageServer?pagename=fw_sawfish
[7] http://hometown.aol.com/nokogiri/

Amount and Duration of Hopper Dredging in Federal Waters
Dredging in federal waters will occur preferentially before dredging in state waters because the Dolphin Pipeline LNG project will start in 2013, and will eliminate access to BAF2 in federal waters. Thus, portions of this sand source will not be utilizable after 2013. A medium-sized hopper dredge will excavate sand from BAF2 and transport it to the seaward end of the submerged pipeline for pumping to fill areas. Dredging activities in BAF2 are expected to remove up to 239,500 cy in the initial phase of the project (FY 11/12) and may remove up to an additional 227,000 cy over the duration of the project (FY 13/14); however, at this time, it is anticipated that only 100,000 cy will be removed for the FY 13/14 portion of the project. It is anticipated that the medium-sized hopper dredge will move approximately 10,000 cy of sand per day, resulting in up to four round-trips from the borrow area to the pipeline per day. Using these estimates, we can assume dredging in BAF2 will last approximately 34 days (339,500 cy of sand/10,000 cy per day). However, because an additional 227,000 cy may be removed from BAF2 in FY 13/14, we will use the more conservative estimate of dredging occurring for 47 days in BAF2 (239,500 cy/10,000 cy per day in FY 11/12 + 227,000 cy of sand/10,000 cy per day in FY 13/14).

Amount and Duration of Hopper Dredging in State Waters
The hopper dredge may alternately excavate sand from borrow areas BA3, BAIX, and BAX, and transport it to the seaward end of the submerged pipeline for pumping to fill areas; i.e., alternating its dredging cycles from federal to state waters and vice versa, based on sand quality and nourishment needs. Using current projections, dredging activities in BA3, BAIX, and BAX will remove a total of up 635,000 cy of material. It is anticipated that the medium-sized hopper dredge will move approximately 10,000 cy of sand per day, resulting in up to four round-trips from the borrow areas to the pipeline per day. Using these estimates, we can assume dredging in BA3, BAIX, and BAX will last approximately 64 days (635,000 cy of sand/10,000 cy per day).

Sand Placement in State Waters
The Town's permit application to the COE included a request to dredge sand from BAIX and BAX with temporary placement within two rehandling areas. While this methodology is not certain to be implemented by the dredging contractor, it is an option within the scope of the project. Rehandling would involve discharging through a pipe or bottom-dumping sand into deeper water areas so that it can be more efficiently transported via a medium-size hopper dredge to Longboat Key. If rehandling related to dredging in BAIX and BAX occurs, additional dredging days will occur from the rehandling site. This could involve the rehandling of up to 565,000 cy of material. Using the estimates for hopper dredge material movement (10,000 cy/day) and the rehandling material volume, an additional 57 days of dredging in state waters may occur.

Although there are nearshore hardgrounds that might serve as foraging habitat and attract sea turtles to the area and that could be impacted by placing sand on the beach or discharging sand into rehandling areas, the contractor is required to avoid all hardground areas for the duration of the project. All vessel operators will be provided with maps and GPS coordinates of the location of hardbottom areas. Electronic navigations systems aboard the dredge vessel should enable it to easily avoid hardbottom areas. During dredging activities vessel operators will maintain a 400-ft (minimum) buffer from the hardbottom areas. Thus, no impacts to these nearshore hardgrounds are expected, nor were any recorded during similar sand placement operations, with similar precautions in place, in 2005-2006.

Summary of Anticipated Dredging Days and Volumes over the Project Duration
We conservatively anticipates that dredging in state and federal waters combined will take approximately 168 days over the 10-year life of the project (47 days for BAF2 + 64 days for BA3, BAIX, and BAX, + 57 days for potential re-handling).

Dredging for the Longboat Key beach nourishment project is expected to remove approximately 975,000 cubic yards from submerged lands adjacent to Longboat Key and Anna Maria Island. While it is estimated that up to 5,783,000 cy of material is available within state waters and 446,500 cy of material is available from federal waters, not all of this potential volume is needed for the current project. The exact volumes to be used from borrow areas are not known at this time, as the Town would like to maintain flexibility to maximize the use of BAF2 prior to the construction of the Port Dolphin pipeline (once the pipeline is in operation, BAF2 will not be able to be used for sand extractions) and minimize project costs by providing a suite of options to dredge contractors. At this time, approximately 339,500 cy of material is projected to be removed from federal waters and up to 635,000 cy of material is projected to be removed from state waters. However, up to 466,500 cy of material could be removed from BAF2.

Vessel Traffic Effects
We believe that the possibility that the hopper dredges will collide with and injure or kill sea turtles or smalltooth sawfish during dredging and/or sand pumpout operations is discountable, given the vessels' slow speed, the mobility of these species, anticipated avoidance behavior by sea turtles, and the benthic habitats of smalltooth sawfish.

Hopper Dredge Observers
NMFS-approved protected species observers monitor dredged material inflow and overflow screening baskets on many hopper dredging projects, and observers will be required as well on this project to monitor the proposed action. During the proposed dredging operations, protected species observers (2) will live aboard the dredges, monitoring every load, 24 hours a day, for evidence of dredge related impacts to protected species, particularly sea turtles. Additionally, rigid turtle deflectors will be installed on the dragheads before work begins and all points of dredged material inflow into the hopper will be screened. Cages will be attached to the ends of discharge pipes into the hopper, be constructed of steel bar-stock, and welded in a grid pattern with openings approximately 4-in x 4-in. Observers will clean and inspect these screens, 24-hours a day, to document any evidence of sea turtle interactions. Observers will also maintain a bridge watch for protected species and keep a logbook noting the date, time, location, species, number of animals, distance and bearing from dredge, direction of travel, and other information, for all sightings. During all phases of dredging operations, the dredge and crew will be required to adhere to NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions*.

NMFS Estimates of Unobserved Interactions
Dredged material screening, however, is only partially effective, and observed interactions likely provide only partial estimates of total sea turtle mortality. We believe that some turtles killed by hopper dredges go undetected because body parts are forced through the sampling screens by

water pressure and are buried in the dredged material, or animals are crushed or killed but their bodies or body parts are not entrained by the suction and so the interactions may go unnoticed. The only mortalities that are noticed and documented are those where body parts float, are large enough to be caught in the screens, and can be identified as sea turtle parts. Body parts that are forced through the 4-inch (or greater) inflow screens by the suction-pump pressure and that do not float are very unlikely to be observed, since they will sink to the bottom of the hopper and not be detected by the overflow screening. Unobserved interactions are not documented, thus, observed interactions may under-represent actual lethal interactions. It is not known how many turtles are killed but unobserved. Because of this, in the GRBO (NMFS 2003b), in our jeopardy analysis, we estimated that up to one out of two impacted turtles may go undetected (i.e., that observed interactions constitute only about 50 percent of total interactions), an estimate which we will use in the present opinion, since we have no new information that would change the basis of that previous conclusion and estimate.

Estimated Sea Turtle Interactions from the Proposed Dredging

Based on STSSN data (Figure 5.0.1 and 5.0.2), historical distribution data, hopper dredge observer reports, and relocation trawling information, green, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles may occur in the action area and may be taken by the relocation trawling or hopper dredging operations of this project.

Our estimates of sea turtle interactions with hopper dredges during the proposed action are largely based on interactions occurring during past hopper dredging projects at the same approximate location. The Town undertook a beach renourishment project in 2005-2006. During this project, approximately 346 "dredge days" were logged, completing 1,353 loads. Two sea turtles (one loggerhead and one green) were observed and documented by onboard protected species observers as killed during dredging activities. The observer's main job is to sort through screened boxes that the dredged material passes through on its way into the hopper, looking for evidence of sea turtle entrainment (i.e., turtle body parts). The first sea turtle was killed on November 5, 2005, three days prior to the implementation of relocation trawling (discussed below); the other was observed and documented by onboard protected species observers as killed on January 25, 2006. Dredged material screening, however, is only partially effective, and observed interactions likely do not represent total sea turtle mortality. Thus, during 2005-2006 dredging, we estimated that a total of four sea turtles may have been killed: two documented and two unobserved. During that dredging, 129 turtles were relocated. From March 23 to June 20, 2011, approximately 89 dredging days, the north end of Longboat Key was renourished by hopper dredge, using sand dredged from a nearshore borrow area in state waters. Hopper dredging during this activity resulted in zero documented turtle interactions, though 25 sea turtles were relocated by capture trawlers.

During 2005-2006 dredging, approximately 2,122,299 cubic yards of material were moved from state waters. This results in an estimated sea turtle lethal interaction rate of 0.0000018 turtle per cubic yard dredged (4 turtles per 2,122,299 cubic yards). For the present project, approximately 635,000 cubic yards of material are projected to be hopper dredged from state waters, yielding a total estimate of lethal interactions of 1.14 turtles. Additionally, approximately 565,000 cy of material may be re-handled in state waters, yielding a total estimate of lethal interaction of 1.017 turtles. These interactions are covered by the GRBO, since the COE is anticipated to issue a regulatory permit for the portion of dredging during this project that occurs in state waters. The COE retains the authority to modify their regulatory permit conditions at any time and rescind the permit, if need be.

Applying to federal waters the same estimated turtle lethal interaction rate of 0.0000018 turtle per cubic yard dredged that was applied to state waters, we anticipate, based on a maximum of 466,500 cubic yards of material that could be dredged under BOEM permitting authority, that 0.84 turtle may be killed by dredging in federal waters during this project. Thus, an estimated total of three turtles (1.017 + 1.14+ 0.84 = 2.997, rounded to 3) may be killed (includes observed and unobserved) during hopper dredging of 975,000 cy in state and federal waters for this project.

Based on the aforementioned GRBO estimate of 50 percent detection rate by NMFS-approved, shipboard protected species observers, it is likely that only one or two of these three total turtle takes will be observed and documented by onboard observers in state and federal waters. However, we cannot reliably predict whether the projected turtle interactions will take place in federal or state waters; individual hopper dredge loads may be comingled with sand from both sources, making it impossible to determine where a take occurred. Sometimes, matching turtle parts are recovered days after the initial mortality, in subsequent loads, moved by currents to different areas. Given this uncertainly and the need to avoid underestimating the amount of take that may occur in federal waters, we will assume that up to two *observed* and one unobserved lethal sea turtle interactions may occur in federal waters under BOEM's jurisdiction as a result of hopper dredge suction draghead entrainment during this project. We estimate that the interactions occurring under actions authorized by BOEM will be with green and/or loggerhead sea turtles, because these are the most common in the action area, the most abundant species in the STSSN data, and the only species interacted with during the 2005-2006 project. We estimate that the two observed incidental, lethal interactions in federal waters will consist of one green and one loggerhead during the estimated 47 days of dredging in federal waters over the project's 10-year time frame.

Previous Longboat Key Relocation Trawling as a Basis for Estimating Future Relocation Trawling Interactions

The Town undertook a beach renourishment project in 2005-2006. During the final eight months of this project, relocation trawling was conducted on more than 200 days. During that time, 129 sea turtles were relocated from dredging areas, including 74 loggerheads, 41 Kemp's ridleys, 12 greens, and 2 hawksbills, for a turtle capture rate of 0.645 turtle per trawl day. Only two loggerheads were captured and sent for rehabilitation during this time; one with propeller cuts not thought to be associated with trawling activities, the other severely emaciated. Additionally, only two recaptures occurred, suggesting relocation trawling is highly efficient at limiting impacts to sea turtles. During the Longboat Key dredging project from March 23-June 20, 2011, authorized by the COE under regulatory permit SAJ-2010-1056, a total of 25 turtles were captured and relocated, with one recapture and one turtle sent for rehabilitation, for a turtle capture rate of 0.281 turtle per trawl day; no turtles were captured at the borrow site.

As discussed previously, dredging operations are projected to last 47 days in BAF2 to remove up to 466,500 cubic yards and 64 days in combined borrow areas BA3, BAIX, and BAX to remove the remaining maximum of 635,500 cubic yards of materials. However, up to 466,500 cy of material could be removed from BAF2 if the other borrow areas are not used, which would occur over a total of 47 days. Based on these estimates, the data from the 2005-2006 project, STSSN data from 2008-2010, and data from the 2011 project, we can estimate the number of turtles to be captured during relocation trawling activities in association with the dredging activities in BA F2 (in federal waters) and BA3, BAIX, and BAX (in state waters).

Estimated Sea Turtle Captures and Mortality by Relocation Trawling
We have previously estimated that the proposed action will require 168 days of dredging in state and federal waters combined. Since relocation trawling will occur simultaneously with dredging, we will assume 168 days of relocation trawling. We will use the sea turtle capture rate achieved during the 200 days of relocation trawling in 2005-2006 to estimate numbers of captures during the proposed action. To be conservative in our estimate of the number of turtle captures that may occur during the proposed action in both state and federal waters, we purposely chose the highest trawl capture rate from previous Longboat Key dredging/turtle relocation projects in making capture estimates. Thus, based on 200 days of relocation trawling which resulted in 129 turtle captures in 2005-2006 and a per trawl-day capture rate of 0.645 turtle, during the proposed action we estimate that relocation trawling in state and federal waters combined may result in 108.36 (109) trawl captures in 168 days (i.e., 129/200 x 168).

We also estimate that, based on STSSN species percent strandings composition data presented in Figure 5.0.2, and accounting for rounding errors, the 109 trawl captures in state and federal waters will consist of 49 loggerheads, 44 greens, 11 Kemp's ridleys, 4 hawksbills, and 1 leatherback during the 168 days of the project over the 10-year time frame.

To estimate the location (i.e., state or federal waters) of these estimated 109 trawl captured turtles, we multiplied the trawl-day capture rate (0.645) by the days in federal waters (47) versus the days in state waters (121). We estimate that, of these 109 trawl captures, there will be 0.645 x 47 = 30.3 (31) from federal waters and 0.645 x 121 = 78.045 (78) from state waters.

To estimate the species distribution of turtles captured in federal waters, we used the percent stranding data by species from SSTSN Table 5.0.1 and determined that the 31turtles taken in federal waters will consist of 14 loggerheads, 12 greens, 3 Kemp's ridleys, 1 hawksbill, and 1 leatherback.

Similarly, we estimate using the percentage species composition data from STSSN presented in Table 5.0.1 that sea turtle species composition of the 78 turtles anticipated to be captured in state waters will consist of 35 loggerheads, 31 greens, 8 Kemp's ridleys, 3 hawksbills, and 1 leatherback. As previously discussed, any trawler takes of turtles in state waters are already anticipated and authorized by, and counted against the ITS of, the GRBO.

The relocation trawling may result in sea turtle capture, but this type of interaction is not expected to be injurious or lethal due to the short duration of the tow times (less than 42 minutes per tow) and required safe-handling procedures. We cannot rule out that injury or mortality could occur, but such events are rare. Based on a conservative 0.5 percent estimate of trawl-related sea turtle mortality (as previously discussed in *Total Impact of Relocation Trawling on*

Sea Turtles section), we estimate 0.545 turtle mortality associated with the 109 trawl captures in combined state and federal waters trawling; therefore, to be conservative, we estimate that one sea turtle may die from relocation trawling injuries during this project. Because we cannot predict if this event will occur in state or federal waters, we will assume that this capture-mortality will occur in the phase of the project that occurs in federal waters. Based on STSSN data from the action area, this trawl capture mortality, if it occurs, will most likely be either a loggerhead or a green sea turtle.

Estimated Smalltooth Sawfish Captures by Relocation Trawling
Previous relocation trawling activities in the project area captured no smalltooth sawfish. However, as discussed previously, one smalltooth sawfish was captured in August 2006 in a relocation trawl during the Egmont Key channel dredging, north of the current proposed action area. Thus, while this project is approximately 40 miles north of the center of the species' distribution and critical habitat, the Egmont Key channel project was still further away, yet captured a large (approximately 20-ft male) sawfish during relocation trawling associated with the dredging activities. The animal was released alive and unharmed. Therefore, we estimate that relocation trawling activities during this project may result in the incidental, non-injurious capture of one smalltooth sawfish in federal waters. Trawler interactions with smalltooth sawfish in state waters are not anticipated to occur and were deemed discountable in the GRBO.

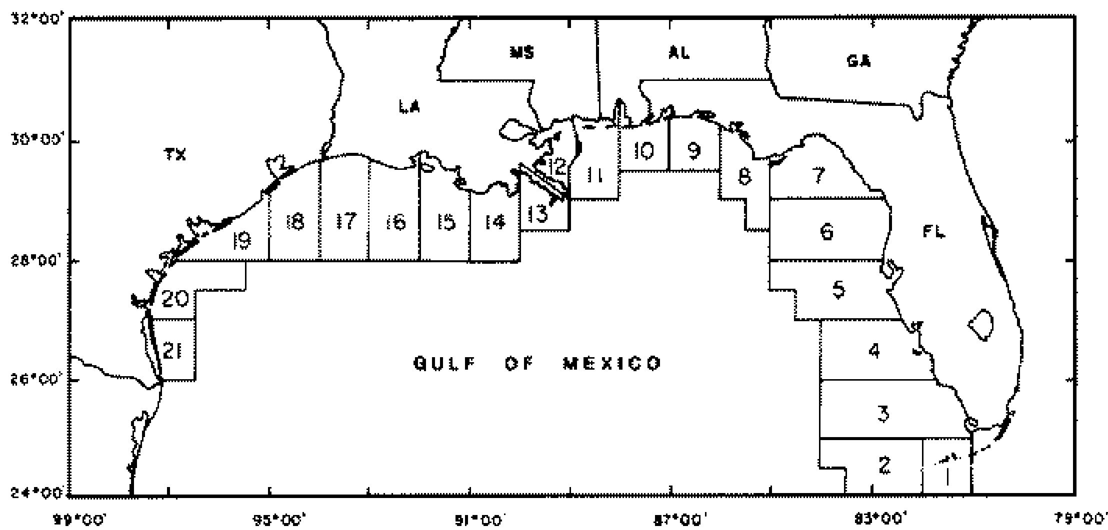

Figure 5.0.1. STSSN statistical zone map.

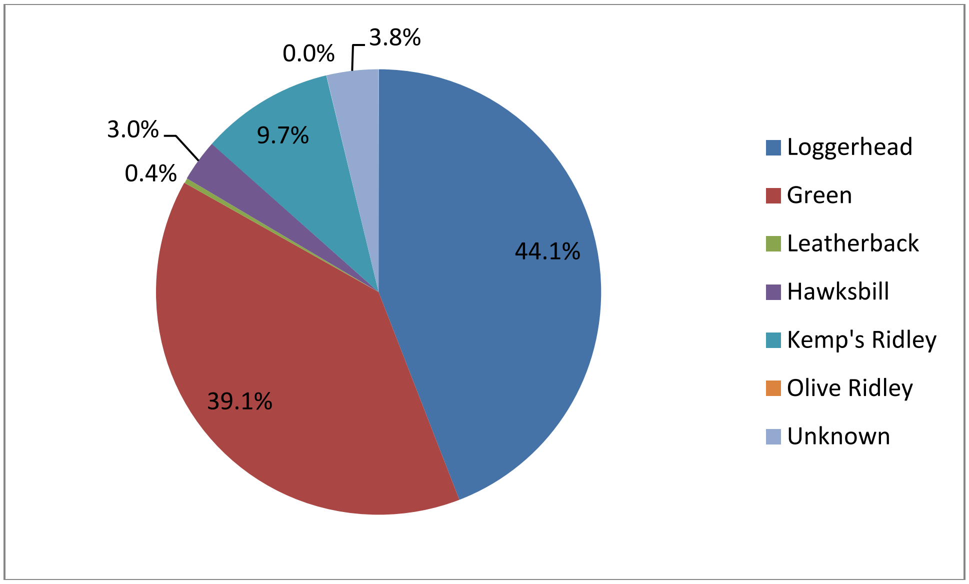

Figure 5.0.2. STSSN stranding data for statistical zone 5 for 2008-2010.

Relocation Trawling

The function and purpose of capture relocation trawling is to capture sea turtles that may be in the dredge's path and relocate them away from the action area. By reducing the sea turtle density immediately in front of the dredge's suction dragheads, the potential for draghead-turtle interactions is reduced. Even though relocation trawling involves the direct (not incidental) capture and collection of sea turtles, we determined it constitutes a legitimate reasonable and prudent measure (RPM) in past biological opinions on hopper dredging because it reduces the level of almost certain injury and mortality of sea turtles by hopper dredges, and it allows the sea turtles captured non-injuriously by trawl to be relocated out of the path of the dredges. Without relocation trawling, the number of sea turtle mortalities resulting from hopper dredging would likely be significantly greater than the estimated number discussed above and specified in the ITS. The Consultation Handbook (for Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998) expressly authorizes such directed interactions as an RPM (page 4-54).

The relocation trawler typically pulls two, standard (60-foot headrope), shrimp trawl nets, as close as safely possible in front of the advancing hopper dredge. The trawler also continues sweeping the area to be dredged (channels or borrow areas) even while the hopper dredge is not actively dredging, e.g., when the dredge is enroute to pipelines or disposal areas. Relocation trawling has been successful at temporarily displacing Kemp's ridley, loggerhead, hawksbill, and green sea turtles from channels in the Atlantic Ocean and Gulf of Mexico during periods when hopper dredging was imminent or ongoing (Dickerson et al. 2007). Historically, relocation trawling has been used to reduce turtle interactions with the dredge by capturing turtles in a modified shrimp net, bringing them onboard the trawler, and transporting them approximately 3-5 miles from the dredging site where they are released into the ocean. Dickerson et al. (2007) found that the effectiveness of relocation trawling was increased: (1) when the trawling was initiated at the beginning or early in the project, and (2) by the intensity of trawling effort (i.e., more time trawling per hour). Dickerson (pers. comm. 2008) noted that when a relocation trawler is used – whether or not turtles are actually captured – the incidence of lethal sea turtle take by hopper dredges decreases. Dickerson concluded that the action of the trawl gear on the bottom results in stimulating turtles off the bottom and into the water column, where they are no longer likely to be impacted by the suction draghead of a hopper dredge. The effects of relocation trawling on sea turtles will be further discussed below.

Effects of Recapture during Relocation Trawling
Some sea turtles captured during relocation trawling operations return to the dredge site and subsequently are recaptured. For example, sea turtle relocation studies by Standora et al. (1993) at Canaveral Channel, Florida, relocated 34 turtles to six release sites of varying distances north and south of the channel. Ten turtles returned from southern release sites, and seven from northern sites, suggesting that there was no significant difference between directions. The observed return times from the southern release sites suggested a direct correlation between relocation distance and likelihood of return or length of return time to the channel. No correlation was observed between the northern release sites and the time or likelihood of return. The study found that relocation of turtles to the site 70 km (43 miles) south of the channel would result in a return time of over 30 days. Over a 7-day period in February 2002, REMSA, a private company contracted to conduct relocation trawling, captured, tagged, and relocated 69 turtles (55 loggerheads and 14 greens) from Canaveral Channel, Florida, with no recaptures; turtles were relocated a minimum of 3 to 4 miles away (T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, June 2, 2003). Twenty-four hour per day relocation trawling conducted by REMSA at Aransas Pass Entrance Channel (Corpus Christi Ship Channel) from April 15, 2003, to July 7, 2003, resulted in the relocation of 71 turtles (56 loggerheads, 15 Kemp's ridleys, and 1 leatherback) between 1.5 and 5 miles from the dredge site, with 3 recaptures, all loggerheads (T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, July 24, 2003). One turtle released on June 14, 2003, approximately 1.5 miles from the dredge site, was recaptured four days later at the dredge site; another turtle captured June 9, 2003, and released about 3 miles from the dredge site was recaptured nine days later at the dredge site. Subsequent releases occurred five miles away. Of these 68 subsequent capture/releases, one turtle released on June 22, 2003, was recaptured 13 days later (REMSA Final Report, Sea Turtle Relocation Trawling, Aransas Pass, Texas, April-July 2003) at the dredge site. Over the course of 15 days of dredging and associated turtle relocation trawling conducted between July 9 and 23, 2010, for the construction of 35 miles of oil-barrier sand-berms at Hewes Point, Chandeleur Islands, Louisiana, resulted in 194 sea turtle trawl-captures and relocations (185 loggerheads, 8 Kemp's ridleys, and 1 green), with 11 turtles recaptured (all loggerheads) at the sand borrow site after being relocated at least 3 miles away from the dredge site (L. Brown, COE, pers. comm. via e-mail to E. Hawk, NMFS, February 22, 2011). The channel maintenance dredging project at Gulfport, Mississippi, relocated 71 turtles, with one recapture, from April 23-July 27, 2011.

Trawling that occurred over 200 days in the Town's renourishment project during 2005-2006 relocated 129 turtles (74 loggerheads, 41 Kemp's ridley, 12 greens, and 2 hawksbills) with only two recaptures (one Kemp's ridley, one not noted) occurring. More recently, from April 11-June 11, 2011, during the most recent Longboat Key beach nourishment project, 23 sea turtles were captured and relocated (20 loggerheads, two Kemp's, and one green). One, a large, sexually-mature male loggerhead, was captured at the borrow site (and relocated) three times, released each time at least 3-5 miles away from the capture site, each time in a different compass direction from the borrow site. The last time, the turtle was released with a satellite transmitter attached (E. Hawk, NMFS, pers. comm. June 13, 2011). Table 5.0.1 below compares the various recapture rates for relocation trawling.

Table 5.0.1. Comparison of Recapture Rates for Relocation Trawling.

Number of Turtles Released/Relocated	Relocation Distance from dredge site	Number of Turtles Recaptured	Recapture Timing	Citation
34	43 miles (Southern release site)	10	> 30 days	Standora et al. (1993); Cape Canaveral, Florida
69	Minimum 3-4 miles	0	N/A	T. Bargo, REMSA, pers. comm. to Eric Hawk, NMFS SER, June 2, 2003; Cape Canaveral, Florida
71	1.5-5 miles	3	4-13 days	REMSA Final Report, Sea Turtle Relocation Trawling, Aransas Pass, Texas, April-July 2003
194	Minimum 3 miles	11	15 days	L. Brown, COE, pers. comm. via e-mail to E. Hawk, NMFS, February 22, 2011; Hewes Point, Chandeleur Islands, Louisiana
129	Minimum 3 miles	2	28 days	Coastwise Consulting, Final Report on the Monitoring and Mitigation Impacts to Protected Species During Beach Restoration at Longboat Key, Florida, 2005-2006.
71	3-5 miles	1	46 days	Coastwise Consulting, Inc. Gulfport, MS dredging project; pers. comm. to Eric Hawk, NMFS SER, August 1, 2011

The capture and handling of sea turtles can result in raised levels of stressor hormones, and can cause some discomfort during tagging procedures; based on past observations obtained during similar research trawls for turtles, these physiological effects are expected to dissipate within a day (Stabenau and Vietti 1999). During the course of 1,600 days of relocation trawling at Wilmington, North Carolina, Kings Bay and Savannah, Georgia, Pensacola, Florida, and Sabine

Pass, Galveston, Freeport, Matagorda Pass, and Corpus Christi, Texas, Coastwise Consulting, Inc., successfully captured, tagged, and released over 770 loggerhead, Kemp's ridley, green, and hawksbill, and leatherback sea turtles (C. Slay, Coastwise Consulting, pers. comm. via e-mail to E. Hawk, NMFS, January 25, 2007). Only one leatherback mortality was documented and attributed to illegal artificial reef material deployed within a designated borrow area; the trawl net that captured the leatherback got entangled on the reef material and the trawler was unable to haul its nets within the 42 minutes required by the GRBO and the turtle drowned before the net was able to be freed and brought to the surface. On the Atlantic coast, REMSA also successfully tagged and relocated over 140 turtles in the last several years, most notably, 69 turtles (55 loggerheads and 14 greens) in a 7-day period at Canaveral Channel in October 2002, with no significant injuries. Other sea turtle relocation contractors (R. Metzger in 2001; C. Oravetz in 2002) have also successfully and non-injuriously trawl-captured and released sea turtles out of the path of oncoming hopper dredges. In the Gulf of Mexico, in 2003, REMSA captured, tagged, and relocated 71 turtles at Aransas Pass, Texas, with no apparent long-term ill effects to the turtles. Three injured turtles captured were transported to University of Texas Marine Science Institute rehabilitation facilities for treatment (two had old, non-trawl related injuries or wounds; the third turtle may have sustained an injury to its flipper, apparently from the door chain of the trawl, during capture). Three of the 71 captures were recaptures and were released around 1.5, 3, and 5 miles, respectively, from the dredge site; none exhibited any evidence their capture, tag, release, and subsequent recapture, was in any way detrimental (T. Bargo, REMSA, pers. comm. to E. Hawk, NMFS, June 2, 2003). Given that sea turtle recaptures are relatively infrequent, and recaptures that do occur typically happen several days to weeks after initial capture, cumulative adverse effects from recapture are not expected.

Relocation Trawling Tow-Time Effects on Sea Turtles

The Commission on Life Sciences (1990) reported the proportion of sea turtles caught in nets that are dead or comatose increased with an increase in tow time from 0 percent during the first 50 minutes to about 70 percent after 90 minutes. The National Research Council (NRC) report "Decline of the Sea Turtles: Causes and Prevention" (NRC 1990) suggested that limiting tow durations to 40 minutes in summer and 60 minutes in winter would yield sea turtle survival rates that approximate those required for the approval of new TED designs, i.e., 97 percent. The NRC report also concluded that mortality of turtles caught in shrimp trawls increases markedly for tow times greater than 60 minutes. Current NMFS TED regulations allow, under very specific circumstances, for shrimpers with no mechanical-advantage trawl retrieval devices on board, to be exempt from TED requirements if they limit tow times to 55 minutes during April through October and 75 minutes from November through March. The presumption is that these tow time limits will result in turtle survivability comparable to having TEDs installed.

Rarely, properly conducted relocation trawling can result in accidental sea turtle deaths, as the following examples illustrate. Henwood (T. Henwood, pers. comm. to E. Hawk, December 6, 2002) noted that trawl-captured loggerhead sea turtles died on several occasions during handling on deck during winter trawling in Canaveral Channel in the early 1980s, after short (approximately 30 minutes) tow times. However, Henwood also noted that a significant number of the loggerheads captured at Canaveral during winter months appeared to be physically stressed and in "bad shape" compared to loggerheads captured in the summer months from the same site that appeared much healthier and robust. In November 2002, during relocation trawling conducted in York Spit, Virginia, a Kemp's ridley sea turtle was likely struck by one of the heavy trawl doors or it may have been struck and killed by another vessel shortly before trawl net capture. The hopper dredge was not working in the area at the time (T. Bargo, pers. comms. and e-mails to E. Hawk, December 6 and 9, 2002). Additionally, during relocation trawling conducted off Destin, Florida, on December 2, 2006, a leatherback turtle was captured and killed. However, this mortality by drowning occurred after the trawler encountered and entangled its trawl net on a large section of uncharted bottom debris, and was unable to retrieve it from the bottom for several hours (C. Slay, pers. comms. and e-mails to E. Hawk, December 4, 2006; see also Dickerson et al. 2007). Over 15 days of dredging and associated turtle relocation trawling conducted between July 9 and 23, 2010, for the construction of 35 miles of oil-barrier sand-berms at Hewes Point, Chandeleur Islands, Louisiana, 194 sea turtles were trawl-captured, with 3 mortalities in 584 thirty-minute tows, or a 1.5 percent mortality rate (R. Crabtree, NMFS, letter to COE, dated January 14, 2011). NMFS considers that this rate is unusually high, given the last two decades of relocation trawling experience. The reason for the unusually high level of relocation trawler turtle mortalities associated with the berm project is unknown. At Mayport, Florida, channel dredging in April 2011, a green turtle was drowned when it entangled in an improperly designed non-capture trawl net (non-capture trawl nets have typical tow times of 3-4 hours).

Since 1991, the COE has documented more than 65 hopper-dredging projects in the South Atlantic and Gulf of Mexico where a trawler was used as part of the project, consisting of thousands of individual tows of relocation trawling nets. In addition, the COE has also conducted or permitted abundance assessments and/or project-specific relocation trawling of sea turtles in navigation channels and sand borrow areas in the Southeast and Gulf of Mexico using commercial shrimp vessels equipped with otter trawls (COE Sea Turtle Data Warehouse; D. Dickerson 2007). On eight occasions a turtle has been killed or injured by a relocation trawler (six in the Gulf of Mexico and two in the South Atlantic) over the same 20-year period (COE Sea Turtle Warehouse; pers. comm. T. Jordan, COE, to E. Hawk, NMFS, May 23, 2011).

Current NMFS SER opinions typically limit tow times for relocation trawling to 42 minutes or less, measured from the time the trawl doors enter the water when setting the net to the time the trawl doors exit the water during haulback ("doors in – doors out"). This approximates 30 minutes of bottom-trawling time. As previously stated, the COE limits authorized relocation trawling time in association with hopper dredging and its limit is at least as conservative in terms of allowable tow times as NMFS'; the COE's current hopper dredging/relocation trawling protocol limits capture-trawling relocation tow times to 30 minutes or less, doors in to doors out. Overall, the significantly reduced tow times used by relocation trawling contractors, compared to those used during the 1998 studies on the effects of unrestricted, 55-minute, and 75-minute tow times, leads NMFS to conclude that current relocation trawling mortalities occur (and will continue to occur) at a much lower rate. Recent relocation trawling data bears this out strikingly: from October 1, 2006, to June 14, 2011, COE dredging projects relocated 1,216 turtles in the Gulf of Mexico and South Atlantic; there were only 5 documented trawling-related mortalities during those relocation events, or 0.4 percent overall (COE Sea Turtle Data Warehouse, queried June 14, 2011), including the three aforementioned Chandeleur Islands mortalities in 2010.

Total Impact of Relocation Trawling on Sea Turtles
Even though relocation trawling involves the capture and collection of sea turtles, it has constituted a legitimate reasonable and prudent measure (RPM) in past NMFS biological opinions on hopper dredging because it reduces the level of almost certain injury and mortality of sea turtles by hopper dredges, and it allows the sea turtles captured non-injuriously by trawl to be relocated out of the path of the dredges. Without relocation trawling, the number of sea turtle mortalities resulting from hopper dredging would likely be significantly greater than the estimated number discussed above and specified in the ITS. The Consultation Handbook (for Procedures for Conducting Consultation and Conference Activities under Section 7 of the Endangered Species Act, U.S. Fish and Wildlife Service and National Marine Fisheries Service, March 1998) expressly authorizes such directed interactions as an RPM at page 4-54. Therefore, in this section we will evaluate the expected number of sea turtles collected or captured during required relocation trawling, so that these numbers can be included in the evaluation of whether the proposed action will jeopardize the continued existence of the species.

We believe that properly conducted and supervised relocation trawling (i.e., observing NMFS-recommended trawl speed, low tow-time limits, and taking adequate precautions to release captured animals) and tagging is unlikely to result in adverse effects (i.e., injury or death) to sea turtles. As discussed above, we estimate that, overall, sea turtle trawling and relocation efforts will result in considerably less than 0.5 percent mortality of captured turtles, with any mortalities that do occur being primarily due to the turtles being previously stressed or diseased or struck by trawl doors or suffering accidents on deck during codend retrieval and handling. On the other hand, hopper dredge entrainments invariably result in injury, and are almost always fatal.

The number of sea turtles collected or captured by trawlers in association with hopper dredging projects varies considerably by project area, amount of effort, and time of year. Additionally, sea turtle distribution can be very patchy, resulting in significant differences in number of turtle captures by relocation trawler, and in some areas, one species may dominate the captures. For example, Canaveral, Florida, is known for its abundance of green turtles; Calcasieu, Louisiana, and Gulfport, Mississippi for their almost exclusive capture of Kemp's ridleys; Brunswick, Georgia, and Mississippi-River Gulf Outlet, Louisiana, captures are predominantly loggerheads (E. Hawk, NMFS, pers. comm., June 13, 2011).

Between October 2011 and June 14, 2011, of the 1,216 turtle captures by relocation trawler, the majority (1,145) occurred in the Gulf of Mexico, while 71 occurred in the South Atlantic (COE Sea Turtle Data Warehouse, June 14, 2011 data). Dickerson et al. (2007) evaluated the effectiveness of relocation trawling for reducing incidental interactions with sea turtles by analyzing incidental interactions recorded in endangered species observer reports, relocation trawling reports, and hopper dredging project reports from 1995 through 2006. From 1995 through 2006, 319 hopper dredging projects throughout the Gulf of Mexico (n=128) and Atlantic Ocean (n=191) used endangered species monitoring and a total of 358 dredging-related sea turtle interactions were reported (Regions: Gulf=147 sea turtles; Atlantic=211 sea turtles). During the 70 projects with relocation trawling efforts, 1,239 sea turtles were relocated (Regions: Gulf=844; Atlantic=395). Loggerhead is the predominant species for both dredge interactions and relocation trawling interactions with sea turtles. Kemp's ridleys rank second. Green turtles have been captured in trawls only during December through March in the Gulf of Mexico. Two hawksbills and 6 leatherbacks were relocated during 1995-2006.

The number of sea turtles captured by relocation trawlers does not directly translate into potential mortalities by hopper dredges in the absence of relocation trawling, due to the differences in footprint between the two gear types. The spread of a relocation trawler's net is much greater than the width of a hopper dredge's dragheads; therefore, the trawler will encounter a significantly greater number of sea turtles. Mostly non-injurious interactions may be expected with the implementation of relocation trawling.

Flipper Tagging
Flipper tagging is not expected to have any detrimental effects on captured animals. Tagging prior to release will help us learn more about the habits and identity of trawl-captured animals after they are released, and if they are recaptured the data will enable improvements in relocation trawling design to further reduce the effect of the hopper dredging activities. External and internal flipper tagging is not considered a dangerous procedure by the sea turtle research community, is routinely done by thousands of volunteers in the United States and abroad, and can be safely accomplished with minimal training. We know of no instance where flipper tagging has resulted in mortality or serious injury to a trawl-captured sea turtle. Such an occurrence would be extremely unlikely because the technique of applying a flipper tag is minimally traumatic and relatively non-invasive; in addition, these tags are attached using sterile techniques. Important growth, life history, and migratory behavior data may be obtained from turtles captured and subsequently relocated. Therefore, these turtles should not be released without tagging (and prior scanning for pre-existing tags).

Genetic Sampling
Taking skin tags or biopsy punches is not expected to have any detrimental effects on captured animals. Analysis of genetic samples may provide information on sea turtle populations such as life history, nesting beach identification, and distribution/stock overlap. This may ultimately lead to enhanced sea turtle protection measures. Tissue sampling is performed to determine the genetic origins of captured sea turtles, and learn more about turtle nesting beach/population origins. This is important information because some populations or recovery units may be declining. For all tissue sample collections, a sterile 4- to 6-mm punch sampler is used. Researchers who examined turtles caught two to three weeks after sample collection noted that the sample collection site was almost completely healed (Witzell, pers. comm.). We do not expect the collection of a tissue sample from each captured turtle to cause any additional stress or discomfort to the turtle beyond that experienced during capture, collection of measurements, and tagging.

6.0 Cumulative Effects

Cumulative effects include the effects of future state, tribal, local, or private actions reasonably certain to occur within the action area considered in this opinion. Future federal actions that are unrelated to the proposed action are not considered in this section because they require separate consultation pursuant to Section 7 of the ESA.

Cumulative effects from unrelated, non-federal actions occurring in the Gulf may affect sea turtles and smalltooth sawfish and their habitats. Stranding data indicate sea turtles in Gulf waters die of various natural causes, including cold stunning and hurricanes, as well as human activities, such as incidental capture in state fisheries, ingestion of and/or entanglement in debris, ship strikes, and degradation of nesting habitat. The cause of death of most sea turtles recovered by the stranding network is unknown.

The fisheries occurring within the action area are expected to continue into the foreseeable future. Numerous fisheries in state waters along the Gulf coast have also been known to adversely affect threatened and endangered sea turtles and the endangered smalltooth sawfish. We are not aware of any proposed or anticipated changes in these fisheries that would substantially change the impacts each fishery has on the sea turtles and smalltooth sawfish covered by this opinion.

In addition to fisheries, we are not aware of any proposed or anticipated changes in other human-related actions (e.g., poaching, habitat degradation) or natural conditions (e.g., over-abundance of land or sea predators, changes in oceanic conditions, etc.) that would substantially change the impacts that each threat has on the sea turtles and smalltooth sawfish covered by this opinion. Therefore, we expect that the levels of interactions with sea turtles and smalltooth sawfish described for each of the fisheries and non-fisheries will continue at similar levels into the foreseeable future.

7.0 Jeopardy Analysis

This section evaluates the likelihood that the proposed action will jeopardize the continued existence of green, hawksbill, Kemp's ridley, and loggerhead sea turtles and smalltooth sawfish in the wild. To *jeopardize the continued existence of* is defined as "to engage in an action that reasonably would be expected, directly or indirectly, to reduce appreciably the likelihood of both the survival and recovery of a listed species in the wild by reducing the reproduction, numbers, or distribution of that species" (50 CFR 402.02). Section 3 describes the status of the species affected by the proposed action. Section 5 describes the effects of the proposed action on green, hawksbill, Kemp's ridley, loggerhead sea turtles and smalltooth sawfish, and the extent of those effects in terms of an estimate of the number of sea turtles or smalltooth sawfish that would be killed or otherwise taken. The term "take" means to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture, or collect, or to attempt to engage in any such conduct. As explained above, the effects and jeopardy analyses of this opinion consider the full effects of BOEM's proposed action, including effects of interdependent and interrelated dredging and renourishment activities under the jurisdiction of the COE.

To summarize, we estimated the following most-probable scenario of quantities of take by species, for state and federal waters combined, to be:
Loggerhead and green sea turtles: lethal take of up to 3 total (2 documented and 1 unobserved) loggerhead or green sea turtles (in any combination) by hopper dredge in state and federal waters.
Loggerhead sea turtle: non-lethal take of 49 loggerhead turtles by relocation trawling (14 in federal waters and 35 in state waters).

Green sea turtle: non-lethal take of 43 green turtles by relocation trawling (12 in federal waters and 31 in state waters).
Kemp's ridley sea turtle: non-lethal take of 11 Kemp's ridleys by relocation trawling (3 in federal waters and 8 in state waters).
Hawksbill sea turtle: non-lethal take of 4 hawksbill turtles by relocation trawling (1 in federal waters and 3 in state waters).
Leatherback sea turtle: non-lethal take of 2 leatherback sea turtle by relocation trawling (1 each in federal waters and state waters).
Smalltooth sawfish: non-lethal take of one smalltooth sawfish in either state or federal waters.

In the following analysis, we discuss the anticipated takes of these listed species in the context of the best available information on their current population statuses and trends, the environmental baseline, and cumulative impacts.

Our jeopardy analysis first considers if we would reasonably expect the action to result in reductions in reproduction, numbers, or distribution of these sea turtle species or smalltooth sawfish (including reductions that may not necessarily be observed, as discussed in Section 5). The analysis next considers whether any such reduction would in turn result in an appreciable reduction in the likelihood of survival of these species in the wild, and the likelihood of recovery of these species in the wild. In sum, we evaluated whether or not any anticipated take of that species will result in any reduction in reproduction, numbers, or distribution of that species that may appreciably increase a species' risk of extinction, or appreciably interfere with achieving recovery objectives, in the wild.

In the following analyses, we find that although some reduction in numbers and reproduction is expected for green and loggerhead sea turtles species as a result of anticipated lethal takes by hopper dredging of these species, the anticipated lethal take of green, and loggerhead sea turtles—and the anticipated non-lethal take (by relocation trawling) of hawksbill, Kemp's ridley, and leatherback sea turtles, and smalltooth sawfish—will not appreciably increase the risk of extinction of these species in the wild, or appreciably interfere with achieving recovery objectives for the species.

Sea Turtles
All sea turtle life stages are important to the survival and recovery of the species; however, it is important to note that individuals of one life stage are not equivalent to those of other life stages. For example, the take of male juveniles may affect survivorship and recruitment rates into the reproductive population in any given year, and yet not significantly reduce the reproductive potential of the population. For sea turtles, a very low percent of hatchlings is typically expected to survive to reproductive age. The death of mature, breeding females can have an immediate effect on the reproductive rate of the species. Sub-lethal effects on adult females may also reduce reproduction by hindering foraging success, as sufficient energy reserves are probably necessary for producing multiple clutches of eggs in a breeding year. Different age classes may experience varying rates of mortality and resilience.

Loggerhead Sea Turtles

The non-lethal capture of 49 loggerheads will not result in a reduction in the species' numbers because relocation efforts are not expected to result in mortality, whereas hopper dredge entrainments invariably result in injury, and are almost always fatal. The lethal take of up to 3 loggerhead sea turtles by hopper dredge would result in an instantaneous, but temporary reduction in total population numbers. Thus, the proposed action will result in a reduction of sea turtle numbers. Sea turtle mortality resulting from hopper dredges could result in the loss of reproductive value of an adult turtle. For example, an adult female loggerhead sea turtle can lay 3 or 4 clutches of eggs every 2 to 4 years, with 100 to 130 eggs per clutch. The loss of two adult female sea turtles during the 10-year project could preclude the production of thousands of eggs and hatchlings, of which a small percentage is expected to survive to sexual maturity. Thus, the death of an adult female eliminates an individual's contribution to future generations, and the action will result in a reduction in loggerhead sea turtle reproduction.

Considering their population sizes in the western North Atlantic, we believe loggerhead sea turtle populations are sufficiently large enough to persist and recruit new individuals to replace those expected to be lethally taken. We use the following estimates for loggerhead sea turtle populations to support our determination.

Because nesting activity by loggerheads is highly monitored it produces reliable data from which to evaluate numbers of adult female sea turtles. NMFS SEFSC (2009a) estimated the likely minimum adult female population size for the western North Atlantic subpopulation in the 2004-2008 time frame to be between 20,000 to 40,000 (median 30,050) female individuals, with a low likelihood of there being as many as 70,000 individuals. The estimate of western North Atlantic adult loggerhead females was considered conservative for several reasons. The number of nests used for the western North Atlantic was based primarily on U.S. nesting beaches; as such, the results are a slight underestimate of total nests because of the inability to collect complete nest counts for many non-U.S. nesting beaches. In estimating the current population size for adult nesting female loggerhead sea turtles, NMFS SEFSC (2009a) simplified the number of assumptions and reduced uncertainty by using the minimum total annual nest count over the last five years (i.e., 48,252 nests). This was a particularly conservative assumption considering how the number of nests and nesting females can vary widely from year to year, (cf., 2008's nest count of 69,668 nests, which would have increased proportionately the adult female estimate to between 30,000 and 60,000). Further, minimal assumptions were made about the distribution of remigration intervals and nests per female parameters, which are fairly robust and well-known parameters.

Based on the total numbers of adult females and benthic females estimated by NMFS SEFSC for the western North Atlantic population of loggerhead sea turtles, the anticipated lethal take of up to 3 loggerheads resulting from the proposed action represents the removal of, at most, approximately 0.015 percent (3/20,000 x 100) of the estimated adult loggerhead female population.

The Services' recovery plan for the Northwest Atlantic population of the loggerhead turtle (NMFS and USFWS 2009), which is in essence the same population of turtles as comprise the NWA DPS, provides additional explanation of the goals and vision for recovery for this population. The objectives of the recovery plan most pertinent to the threats posed by hopper dredging associated activities are numbers 1, 11, and 13:

1. Ensure that the number of nests in each recovery unit is increasing and that this increase corresponds to an increase in the number of nesting females….
11. Minimize trophic changes from … habitat alteration….
13. Minimize vessel strike mortality.

The recovery plan anticipates that, with implementation of the plan, the western North Atlantic population will recover within 50 to 150 years, but notes that reaching recovery in only 50 years would require a rapid reversal of the declining trends of the Northern, Peninsular Florida, and Northern Gulf of Mexico Recovery Units.

The potential lethal take of up to 3 loggerheads over the duration of the project will result in reduction in numbers when take occurs and possibly by lost future reproduction, but, given the magnitude of these trends and likely large absolute population size, it is unlikely to have any detectable influence on the population objectives and trends noted above. The expected 49 non-lethal takes from relocation trawling are not expected to impact the reproductive potential, fitness, or growth of the captured sea turtle because they will be immediately released unharmed, or released with only minor injuries from which they are expected to fully recover, or be rehabilitated prior to release. Thus, the proposed action will not interfere with achieving the recovery objectives and will not result in an appreciable reduction in the likelihood of loggerhead sea turtles' recovery in the wild.

Green Sea Turtles
The anticipated lethal take of up to 2 documented and 1 unobserved green turtle is a reduction in numbers. These lethal takes, as well as the non-lethal take of 43 due to relocation trawling, is expected to result in a reduction in reproduction as well, as a result of reductions in fitness and growth prior to maturity of any juveniles that are captured and the disturbance to nesting activities of any females attempting to nest on the Town's beach.

The most up-to-date data provided by CP&E indicates that since 2001, only four nests have been recorded (one in 2003, one in 2004, two in 2007, and one in 2008) on Longboat key. This does not account for the fact that green turtle nesting has been steadily increasing in Florida in recent years. Based upon statewide nesting data from FWC, green sea turtle nests have increased by a factor of ten since 1989 (FWRI 2010). However, this increase has not been as dramatic on the west coast of Florida or on Longboat Key.

As reported in the August 2007 ESA 5-year review of the green sea turtle (NMFS and USFWS 2007a), nesting populations are stable or increasing in all rookery areas in the Western Atlantic Ocean, including rookeries in Costa Rica, Florida, Mexico, Venezuela, and Suriname. Further, based on the results from the first 24 years of an ongoing study of the composition, population structures, and population trends of green sea turtles in the central region of the Indian River Lagoon in Florida, Ehrhart et al. (2007) reported a 661-percent increase in juvenile green turtle capture rates at their study area. This increase in capture rates is similar to those recorded at the St. Lucie Power Plant over a similar period (Wilcox et al. 1998). During the 24-

year period studied by Ehrhart et al. (2007), green turtle nest deposition in Florida has increased exponentially. Since 1982, Ehrhart et al. (2007) have surveyed marine turtle nesting on a 21-km stretch of beach in southern Brevard County, Florida, now part of the Archie Carr National Wildlife Refuge. From 1990-91 to 2004-05, green turtle nest deposition increased 358 percent in southeast Florida (Ehrhart et al. 2007). Since 1989, the Florida Fish and Wildlife Research Institute's results of monitoring from index nesting beaches shows that 90 percent of Florida green turtle nest deposition occurs in southeast Florida (Brevard through Miami-Dade Counties). The pattern of green sea turtle nesting shows biennial peaks in abundance since establishment of index beaches in Florida in 1989. There has been a generally positive trend during the twenty one years of regular monitoring.

Green sea turtles are highly migratory, and individuals from all Atlantic nesting populations may range throughout the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. While the potential lethal take and relocation of turtles captured in trawls would result in a displacement of individuals from important developmental habitat, the loss is not significant in terms of local, regional, or global distribution as a whole. The Florida population distribution would be expected to remain the same. Therefore, we believe the anticipated impacts will not affect the species' distribution.

We believe that the expected impact of up to 3 green sea turtle mortalities represents an adverse impact to the species. However, this species is currently showing a very large increasing nesting trend in Florida, with nesting numbers already approaching or exceeding those required by the recovery plan for the species. Therefore, we believe that the reduction in reproduction as a result of the anticipated takes detailed above is not expected to appreciably reduce the likelihood of survival of the species, and the reduction in species numbers is not expected to appreciably reduce the likelihood of survival of green sea turtles in the wild.

We also consider the recovery objectives in the recovery plan prepared for the U.S. populations of green sea turtles that may be affected by the predicted reduction in numbers and reproduction. The recovery plan for green sea turtles (NMFS and USFWS 1991) lists the following relevant recovery objectives:

(1) The level of nesting in Florida has increased to an average of 5,000 nests per year for at least 6 years. Nesting data must be based on standardized surveys.

Status: An average of 5,039 green turtle nests were laid annually in Florida between 2001 and 2006, with a low of 581 in 2001 and a high of 9,644 in 2005 (NMFS and USFWS 2007a). That average increased to 7,436 nests per year for the 6-year period of 2004-2009. Data from the index nesting beach program in Florida support the dramatic increase in nesting. In 2007, there were 9,455 green turtle nests found just on index nesting beaches, the highest since index beach monitoring began in 1989. The number fell back to 6,385 in 2008, but that is thought to be part of the normal biennial nesting cycle for green turtles (FWC Index Nesting Beach Survey Database). An additional drop to just below 3,000 nests was seen on the index nesting beaches in 2009, but the occasional break from the normal biennial pattern is not without precedent, as there were two consecutive years of increase from 2003-2005 (FWC Index Nesting Beach Survey Database). Preliminary nesting data for 2010 show an increase in green turtle nests (Anne Meylan –FWRI, pers. comm.).

(2) A reduction in stage class mortality is reflected in higher counts of individuals on foraging grounds.

Status: There are no reliable estimates of the number of immature green sea turtles that inhabit coastal areas (where they come to forage) of the southeastern United States. However, information on incidental captures of immature green sea turtles at the St. Lucie Power Plant (they have averaged 215 green sea turtle captures per year since 1977) in St. Lucie County, Florida, show that the annual number of immature green sea turtles captured has increased significantly in the past 26 years (FPL 2002). Ehrhart et al. (2007) has also documented a significant increase in in-water abundance of green turtles in the Indian River Lagoon area.

The expected lethal takes described above will result in a reduction in numbers and reproduction, but will not have any detectable influence on the population and nesting trends noted above. The average loss per year will not have an appreciable impact on total recruitment of new sea turtles to the population given the extent of the impact versus the very rapid population increases occurring over the past decade. The estimated non-lethal take described above would not affect these trends either as they are not expected to impact the survival, distribution, or fecundity of individuals taken in an appreciable manner relative to the population size. Thus, the proposed action will not interfere with achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of green sea turtles' recovery in the wild.

Kemp's Ridley Sea Turtles
As demonstrated by nesting increases at the main nesting sites in Mexico, adult ridley numbers have increased over the last decade. The population model used by TEWG (2000) projected that Kemp's ridleys could reach the recovery plan's intermediate recovery goal of 10,000 nesters by the year 2015. Recent calculations of nesting females determined from nest counts show that the population trend is increasing towards that recovery goal, with an estimate of 4,047 nesters in 2006 and 5,500 in 2007 (NMFS 2007, Gladys Porter Zoo 2007). Recent nesting data indicated a population of an estimated 8,460 females in 2009 and 5,320 females in 2010 (J. Peña, Gladys Porter Zoo, pers. comm. to S. Heberling, NMFS, March 21, 2011). Based on this information, the anticipated non-lethal take of up to 11 Kemp's ridley sea turtles by relocation trawling would not be expected to have a detectable effect on the Kemp's ridley sea turtle population.

The non-lethal take of 11 Kemp's ridleys by relocation trawling over the 10-year duration of the proposed project (only 168 days of work in the action area) could potentially result in short-term effects on individuals; however, these effects do not constitute an appreciable reduction in reproduction and numbers. Changes in distribution, even short-term, are not expected from non-lethal takes (interactions/releases from relocation trawling, vessel strikes, etc.) during the project. Interactions with vessels and/or relocation trawlers may elicit startle or avoidance responses and the effects of the proposed action may result in temporary changes in behavior of sea turtles (minutes to hours) over small areas, but are not expected to reduce the distribution of any sea turtles in the action area. The relocation of up to 11 Kemp's ridleys is anticipated during the proposed project. Because all potential take is expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse, no reduction in the distribution of Kemp's ridley sea turtles is expected from the take of these individuals.

Based on the above analysis, we believe that the non-lethal take of 11 Kemp's ridley sea turtles associated with the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of these species in the wild.

The following analysis considers the effects of the take on the likelihood of recovery in the wild. We consider the recovery objectives in the recovery plan prepared for the Kemp's ridley sea turtle that relate to population numbers or reproduction that may be affected by the proposed action.

The recovery plan for Kemp's ridley sea turtles (USFWS and NMFS 1992), herein incorporated by reference, lists the following relevant recovery objective: Attain a population of at least 10,000 females nesting in a season.

The potential relocation of 11 Kemp's ridleys will not result in a reduction in overall population numbers in any given year. We already have determined this take is not likely to reduce population numbers over time due to current population sizes and expected recruitment. Capture of sea turtles by relocation trawlers will not affect the adult female nesting population or number of nests per nesting season. Thus, the proposed action will not result in an appreciable reduction in the likelihood of Kemp's ridleys sea turtles recovery in the wild.

Hawksbill Sea Turtles

No reductions in numbers of hawksbill sea turtles are expected as a result of the proposed action. Additionally, only four hawksbill turtles are expected to be captured (non-injuriously) by relocation trawling. This take is not expected to appreciably reduce the likelihood of survival of hawksbill sea turtles in the wild.

Hawksbill sea turtles are highly migratory, and individuals may range throughout the Gulf of Mexico, Atlantic Ocean, and Caribbean Sea. While the potential take could result in a loss of reproductive value for the action area if the captures interrupted nesting activity, the loss is not significant in terms of local, regional, or global distribution as a whole, especially given the very minimal nesting by hawksbills in the action area and surrounding beaches. Therefore, we believe the anticipated impacts will not affect the species' distribution and are not expected to appreciably reduce the species' likelihood of survival in the wild.

We also consider the recovery objectives in the recovery plan prepared for the U.S. populations of hawksbill sea turtles that may be affected by the predicted reduction in numbers. The recovery plan for hawksbill sea turtles (NMFS and USFWS 1993) concludes that the U.S. populations of hawksbill turtles can be considered for delisting if, over a period of 25 years, the following recovery criteria are met:

(1) The adult female population is increasing, as evidenced by a statistically significant trend in the annual number of nests on at least five index beaches, including Mona Island and Buck Island Reef National Monument (BIRNM).

Status: To date hawksbill nesting on U.S. beaches does not show a clear trend. Hawksbill nesting is solitary, and often occurs at remote beaches. Nesting is also very limited, with Mona Island as the predominant site with only 500-1000 (Diez and van Dam 2006) nests per year, and thus determining a trend is difficult. The two largest nesting populations, Mona Island and BIRNM do appear to have been experiencing an increase over the last few decades (Meylan 1999) but the overall U.S. nesting shows no clear signs of recovery after the severe population reductions that occurred in the 20th century (NMFS and USFWS 1993, Meylan and Donnelly 1999).

(2) Numbers of adults, subadults, and juveniles are increasing, as evidenced by a statistically significant trend on at least five key foraging areas within Puerto Rico, USVI, and Florida.

Status: There are no reliable data to determine the trend of hawksbill turtle abundance in the key foraging areas within U.S. waters.

The potential take described above will not result in a reduction in numbers and reproduction, and will not have any detectable influence on the population and nesting trends noted. Thus, the proposed action will not interfere with achieving the recovery objectives above and will not result in an appreciable reduction in the likelihood of hawksbill sea turtles' recovery in the wild.

Leatherback Sea Turtles
The proposed action may result in 2 non-lethal captures of leatherback sea turtles by relocation trawling during the 10-year lease.

The non-lethal take of up to 2 leatherback sea turtles would not reduce the population. Therefore, we would not expect a reduction in future reproduction. The anticipated take is expected to occur anywhere in the action area and sea turtles generally have large ranges in which they disperse; thus, no reduction in the distribution of leatherback sea turtles is expected from the non-lethal take of an individual.

Based on the above analysis, we believe the proposed action is not reasonably expected to cause, directly or indirectly, an appreciable reduction in the likelihood of survival of these species of sea turtles in the wild.

The Atlantic recovery plan for the U.S. population of the leatherback sea turtles (NMFS and USFWS 1992) lists the following relevant recovery objective:

- The adult female population increases over the next 25 years, as evidenced by a statistically significant trend in the number of nests at Culebra, Puerto Rico; St. Croix, USVI; and along the east coast of Florida.
    - In Puerto Rico, the main nesting areas are at Fajardo on the main island of Puerto Rico and on the island of Culebra. Between 1978 and 2005, nesting increased in Puerto Rico from a minimum of 9 nests recorded in 1978 and to a minimum of 469-

882 nests recorded each year between 2000 and 2005. Annual growth rate was estimated to be 1.1 with a growth rate interval between 1.04 and 1.12, using nest numbers between 1978 and 2005 (NMFS and USFWS 2007d).

- In the U.S. Virgin Islands, researchers estimated a population growth of approximately 13 percent per year on Sandy Point National Wildlife Refuge from 1994 through 2001. Between 1990 and 2005, the number of nests recorded has ranged from 143 (1990) to 1,008 (2001). The average annual growth rate was calculated as approximately 1.10 (with an estimated interval of 1.07 to 1.13) (NMFS and USFWS 2007d).
- In Florida, a Statewide Nesting Beach Survey program has documented an increase in leatherback nesting numbers from 98 (1989) to 800-900 (early 2000s). Based on standardized nest counts made at Index Nesting Beach Survey sites surveyed with constant effort over time, there has been a substantial increase in leatherback nesting in Florida since 1989. The estimated annual growth rate was approximately 1.18 (with an estimated 95 percent interval of 1.1 to 1.21) (NMFS and USFWS 2007d).

The potential non-lethal take of 2 leatherback sea turtles during the 10-year project lease is not likely to reduce population numbers, reproduction or distribution, as discussed above. Thus, we believe the proposed action is not likely to impede the recovery objectives above and will not result in an appreciable reduction in the likelihood of leatherback sea turtles' recovery in the wild.

Smalltooth Sawfish

There is currently no reliable estimate of smalltooth sawfish abundance throughout its range. Although smalltooth sawfish encounter databases may provide a useful future means of measuring changes in the population and its distribution over time, including the current range, areas where recovery may be expected to occur, and the habitat needs of various size classes, available data is currently not robust enough to support such analysis. Conclusions about the current abundance of smalltooth sawfish cannot be made because outreach efforts and observation effort have not expanded evenly across each study period (Wiley 2010). However, based on genetic sampling, the estimates of current effective population size are 269.6 – 504.9 individuals (95% Confidence Interval 139.3 – 1515). (E-mail communication between Demian Chapman and Tonya Wiley, April 11, 2010). Chapman also states that this number is usually ½ - ¼ census population size (breeding adults, male and female) in elasmobranchs, so high hundreds to low thousands is a reasonable approximate range of the population size of extant breeders.

The recovery plan for smalltooth sawfish lists the following relevant recovery objectives:

- Minimize human interactions and associated injury and mortality
- Ensure smalltooth sawfish abundance increases substantially and the species reoccupies areas from which it had been previously extirpated.

The potential non-lethal take of one smalltooth sawfish during the 10-year project is not likely to reduce population numbers over time or decrease the species ability to reoccupy areas from which it has been previously extirpated.

8.0 Conclusion

Green, Hawksbill, Kemp's Ridley, Leatherback, and Loggerhead Sea Turtles

Based on the analyses of the proposed action on green, hawksbill, Kemp's ridley, leatherback, and the Northwest Atlantic DPS of loggerhead sea turtles, it is our opinion that the proposed action is not likely to jeopardize the continued existence of these species in the wild. Because the proposed action will not reduce the likelihood of survival and recovery of any Atlantic populations of sea turtles it is our opinion that the proposed project is also not likely to jeopardize the continued existence of green, hawksbill, Kemp's ridley, loggerhead, and leatherback sea turtles in the wild.

Smalltooth Sawfish

Based on the analyses of the proposed action on smalltooth sawfish, it is our opinion that the proposed project is not likely to jeopardize the continued existence of smalltooth sawfish.

9.0 Incidental Take Statement (ITS)

Section 9 of the ESA and protective regulations issued pursuant to Section 4(d) of the ESA prohibit the take of endangered and threatened species, respectively, without a special exemption. Take is defined as to harass, harm, pursue, hunt, shoot, wound, kill, trap, capture or collect, or attempt to engage in any such conduct. Incidental take is defined as take that is incidental to, and not the purpose of, the carrying out of an otherwise lawful activity. Under the terms of Section 7(b)(4) and Section 7(o)(2), taking that is incidental to and not intended as part of the agency action is not considered to be prohibited taking under the ESA provided that such taking is in compliance with the RPMs and terms and conditions of the ITS.

Section 7(b)(4)(c) of the ESA specifies that in order to provide an incidental take statement for an endangered or threatened species of marine mammal, the taking must be authorized under Section 101(a)(5) of the MMPA. Since no incidental take of listed marine mammals is expected or has been authorized under Section 101(a)(5) of the MMPA, no statement on incidental take of endangered whales is provided, and no take is authorized. Nevertheless, BOEM must immediately notify (within 24 hours, if communication is possible) NMFS' Protected Resources Division in St. Petersburg, Florida, should a take of a listed marine mammal occur.

9.1 Anticipated Amount or Extent of Incidental Take

This ITS includes only incidental take resulting from actions in federal waters, i.e., those occurring under BOEM's authority. The ITS does not include activities occurring in state waters under the authority of the COE; the incidental take for that portion of the project is included in the ITS for the GRBO (NMFS Consultation Number F/SER/2000/01287). As such, the numbers of interactions/takes in the ITS are not the same as those used in Section 5.0 "Effects of the Action" or Section 7.0 "Jeopardy Analysis."

Sea Turtles

We anticipate that *documented* (i.e., by onboard observers) incidental take in federal waters, by injury or mortality, will consist of 1 green and 1 loggerhead sea turtle; and the *documented* incidental take, by non-injurious relocation trawling, will consist of 31 sea turtles (14 loggerheads, 12 greens, 3 Kemp's ridleys, 1 hawksbill, and 1 leatherback) during the estimated 47 days of the project in federal waters over its 10-year time frame. In addition, we anticipate that hopper dredging will result in 2 *unobserved* lethal takes of 1 green and 1 loggerhead.

Smalltooth Sawfish
We anticipate that one non-injurious incidental take of a smalltooth sawfish by relocation trawling will occur during the 47 days of the project in federal waters over the 10-year time frame.

9.2 Effect of the Take

NMFS has determined the anticipated level of incidental take specified in Section 9.1 is not likely to jeopardize the continued existence of loggerhead, green, Kemp's ridley, hawksbill, or leatherback sea turtles, or smalltooth sawfish.

9.3 Reasonable and Prudent Measures

Section 7(b)(4) of the ESA requires NMFS to issue a statement specifying the impact of any incidental take on listed species, which results from an agency action otherwise found to comply with Section 7(a)(2) of the ESA. It also states the reasonable and prudent measures (RPMs) necessary to minimize the impacts of take and the terms and conditions to implement those measures, must be provided and must be followed to minimize those impacts. Only incidental taking by the federal agency that complies with the specified terms and conditions is authorized.

The RPMs and terms and conditions are specified as required, by 50 CFR 402.01(i)(1)(ii) and (iv), to document the incidental take by the proposed action and to minimize the impact of that take on ESA-listed species. These measures and terms and conditions are non-discretionary, and must be implemented by the BOEM in order for the protection of Section 7(o)(2) to apply. The BOEM has a continuing duty to regulate the activity covered by this incidental take statement. If the BOEM fails to adhere to the terms and conditions through enforceable terms, and/or fails to retain oversight to ensure compliance with these terms and conditions, the protective coverage of Section 7(o)(2) may lapse.

NMFS has determined that the following reasonable and prudent measures must be implemented by the BOEM:

1) relocation trawling to minimize lethal entrainment of sea turtles in hopper dredges; and

2) monitoring and reporting on turtle and smalltooth sawfish interactions.

9.4 Terms and Conditions

In order to be exempt from the prohibitions of Section 9 of the ESA, the BOEM would be required to comply with the terms and conditions, which implement the RPMs.

The following terms and conditions implement the RPM for relocation trawling:

To temporarily reduce the abundance of listed species in the path of the hopper dredge and in order to reduce the possibility of lethal hopper dredge interactions, relocation trawling shall be conducted according to the following conditions:

a. *Trawl Time*: Trawl tow-time duration shall not exceed 42 minutes (doors in - doors out) and trawl speeds shall not exceed 3.5 knots.

b. *Handling During Trawling*: Sea turtles and smalltooth sawfish captured pursuant to relocation trawling shall be handled in a manner designed to ensure their safety and viability, and shall be released over the side of the vessel, away from the propeller, and only after ensuring that the vessel's propeller is in the neutral, or disengaged, position (i.e., not rotating).

c. *Captured Turtle Holding Conditions*: Captured turtles shall be kept moist, and shaded whenever possible, until they are released.

d. *Weight and Size Measurements*: All turtles shall be measured (standard carapace measurements including body depth) and tagged, and weighed when safely possible, prior to release; smalltooth sawfish shall be measured (fork length and total length) and–when safely possible–tagged, weighed, and a tissue sample taken prior to release. Any external tags shall be noted and data recorded into the observer's log. Only NOAA Fisheries-approved observers or observer candidates in training under the direct supervision of a NOAA Fisheries-approved observer shall conduct the tagging/measuring/weighing/tissue sampling operations.

e. *Take and Release Time During Trawling - Turtles*: Turtles shall be kept no longer than 12 hours prior to release (unless permission is received from NMFS SERO to hold them longer) and shall be released not less than 3 nautical miles (nmi) from the dredge site. If two or more released turtles are later recaptured, subsequent turtle captures shall be released not less than 5 nmi away. If it can be done safely, turtles may be transferred onto another vessel for transport to the release area to enable the relocation trawler to keep sweeping the dredge site without interruption.

f. *Take and Release Time During Trawling – Smalltooth Sawfish*: Smalltooth sawfish shall be released immediately after capture, away from the dredge site or into already dredged areas, unless the trawl vessel is equipped with a suitable well-aerated seawater holding tank (e.g., plastic "kiddie pool" not less than 1ft in depth by 5 ft in diameter), where a maximum of one sawfish may be held for not longer than 30 minutes before it must be released or relocated away from the dredge site.

g. *Injuries and Incidental Take Quota*: Any protected species injured or killed during or as a consequence of relocation trawling shall count toward the incidental take quota. Minor skin abrasions resulting from trawl capture are considered non-injurious. Injured sea turtles shall be immediately transported to the nearest sea turtle rehabilitation facility.

h. *Flipper Tagging*: All sea turtles captured by relocation trawling shall be flipper-tagged prior to release with external tags which shall be obtained prior to the project from the University of Florida's Archie Carr Center for Sea Turtle Research. This Opinion serves as the permitting authority for any NOAA Fisheries-approved endangered species observer aboard these relocation trawlers to flipper-tag with external tags (e.g., Inconel tags) captured sea turtles. Columbus crabs or other organisms living on external sea turtle surfaces may also be sampled and removed under this authority.

i. *Smalltooth Sawfish Tagging*: Tagging of live-captured smalltooth sawfish may also be done under the permitting authority of this opinion; however, it may be done only by personnel with prior fish tagging experience or training, and is limited to external tagging only, unless the observer holds a valid smalltooth sawfish research permit (obtained pursuant to Section 10 of the ESA, from the NOAA Fisheries' Office of Protected Resources, Permits Division) authorizing sampling, either as the permit holder, or as designated agent of the permit holder.

j. *PIT-Tag Scanning*: All sea turtles captured by relocation trawling or dredges shall be thoroughly scanned for the presence of PIT tags prior to release using a scanner powerful enough to read dual frequencies (125 and 134 kHz) and read tags deeply embedded deep in muscle tissue (e.g., manufactured by Biomark or Avid). Turtles which have been previously PIT tagged shall never-the-less be externally flipper tagged. The data collected (PIT tag scan data and external tagging data) shall be submitted to NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov.

k. *CMTTP:* External flipper tag and PIT tag data generated and collected by relocation trawlers shall also be submitted to the Cooperative Marine Turtle Tagging Program (CMTTP), on the appropriate CMTTP form, at the University of Florida's Archie Carr Center for Sea Turtle Research.

l. *Tissue Sampling*: All live or dead sea turtles captured by relocation trawling or dredging shall be tissue-sampled prior to release, according to the protocols described in Appendix II or Appendix III of the November 19, 2003, Gulf of Mexico Regional Biological Opinion on Hopper Dredging, as revised through Revision No. 2, included as Appendix 1 of this opinion. Tissue samples shall be sent within 60 days of capture to: NOAA, National Marine Fisheries Service, Southeast Fisheries Science Center, Attn: Lisa Belskis, 75 Virginia Beach Drive, Miami, Florida 33149. All data collected shall be submitted in electronic format within 60 working days to Lisa.Belskis@noaa.gov. The present opinion to BOEM serves as the permitting authority for any NOAA Fisheries-approved endangered species observers aboard relocation trawlers or hopper dredges to tissue-sample live- or dead-captured sea turtles, without the need for an ESA Section 10 permit.

The following terms and conditions implement the RPM for monitoring turtle interactions: In this case, in order to monitor turtle and smalltooth sawfish interactions, all interactions must be reported within 24 hours to: takereport.nmfsser@noaa.gov and must reference this opinion by date issued, title, and NMFS Public Consultation Tracking System identifier number (i.e., Dredging of Gulf of Mexico Sand Mining Areas Using Hopper Dredges by BOEM for the Town Beach Renourishment Project; F/SER/2011/01074).

10.0 Conservation Recommendations

Section 7(a)(1) of the ESA directs federal agencies to utilize their authority to further the purposes of the ESA by carrying out conservation programs for the benefit of endangered and threatened species. Conservation recommendations are discretionary agency activities to minimize or avoid adverse effects of a proposed action on listed species or critical habitat to help implement recovery plans or to develop information. For the Town beach renourishment project, no conservation recommendations are included.

11.0 Reinitiation of Consultation

This concludes formal consultation on the Town of Longboat Key beach renourishment project, in Manatee County, Florida. As provided in 50 CFR 402.16, reinitiation of formal consultation is required where discretionary federal agency involvement or control over the action has been retained (or is authorized by law) and if: (1) The amount or extent of taking specified in the incidental take statement is exceeded; (2) new information reveals effects of the action may affect listed species or critical habitat in a manner or to an extent not previously considered; (3) the identified action is subsequently modified in a manner that causes an effect to listed species or critical habitat that was not considered in the biological opinion; or (4) a new species is listed or critical habitat designated that may be affected by the identified action.

12.0 Literature Cited

Ackerman, R.A. 1997. The nest environment and embryonic development of sea turtles. Pp 83-106. In: Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, New York. 432 pp.

Aguilar, R., J. Mas and X. Pastor. 1995. Impact of Spanish swordfish longline fisheries on the loggerhead sea turtle, *Caretta caretta*, population in the western Mediterranean, pp. 1. *In*: 12th Annual Workshop on Sea Turtle Biology and Conservation, February 25-29, 1992, Jekyll Island, Georgia.

Anders, P.J., C.R. Gelok, and M.S. Powell. 2002. Population structure and mitochondrial DNA (mtDNA) diversity in North American white sturgeon (*Acipenser transmontanus*). Proceedings of the Fourth International Sturgeon Symposium, 8-13 July 2001. Oshkosh, Wisconsin.

Antonelis, G.A., J.D. Baker, T.C. Johanos, R.C. Braun, and A.L. Harting. 2006. Hawaiian monk seal (*Monachus schauinslandi*): status and conservation issues. Atoll Research Bulletin 543:75-101.

Arendt, M., J. Byrd, A. Segars, P. Maier, J. Schwenter, D. Burgess, J. Boynton, J.D. Whitaker, L. Ligouri, L. Parker, D. Owens, and G. Blanvillain. 2009. Examination of local movement and migratory behavior of sea turtles during spring and summer along the Atlantic Coast off the Southeastern United States. Final Project Report to the National Marine Fisheries Service. Prepared by: South Carolina Department of Natural Resources. 164pp.

ASSRT. 2007. Status review of the Atlantic sturgeon (*Acipenser oxyrinchus oxyrhincus*) Report to the National Marine Fisheries Service, Northeast Regional Office. 174pp.

Auer, N.A. 1996. Importance of habitat and migration to sturgeons with emphasis on lake sturgeon. Canadian Journal of Fisheries and Aquatic Sciences 53 (Suppl.1): 152-160.

Bain, M B. 1997. Atlantic and shortnose sturgeons of the Hudson River: common and divergent life history attributes. Environmental Biology of Fishes 48:347-358.

Bain, M.B., N. Haley, J.R. Waldman, and K. Arend. 2000. Harvest and habitats of Atlantic sturgeon *Acipenser oxyrinchus* Mitchill, 1815 in the Hudson River estuary: lessons for sturgeon conservation. Bol. Inst. Esp. Oceanogr. 16:43-53.

Baker, J.D., C.L. Littnan, and D.W. Johnston. 2006. Potential effects of sea level rise on the terrestrial habitats of endangered and endemic megafauna on the Northwestern Hawaiian Islands. Endangered Species Research 2:21-30.

Baldwin, R., G.R. Hughes, and R.I.T. Prince. 2003. Loggerhead turtles in the Indian Ocean. Pages 218-232 *in* Bolten, A.B. and B.E. Witherington (editors). Loggerhead Sea Turtles. Smithsonian Books, Washington D.C.

Bath, D.W., J.M. O'Conner, J.B. Alber, and L.G. Arvidson. 1981. Development and identification of larval Atlantic sturgeon (*Acipenser oxyrinchus*) and shortnose sturgeon (*A. brevirostrum*) from the Hudson River estuary, New York. Copeia 1981: 711-717.

Bemis WE, Grande L. 1992. Early development of the actinopterygian head. I. External development and staging of the paddlefish *Polyodon spathula*. J Morphol. 213:47–83.

Berlin, W.H., R.J. Hesselberg, and M.J. Mac. 1981. Chlorinated hydrocarbons as a factor in the reproduction and survival of lake trout (*Salvelinus namaycush*) in Lake Michigan. Technical Paper 105, U.S. Fish and Wildlife Service. 42 pp.

Birstein, V.J. and W.E. Bemis. 1997. How many species are there within the genus *Acipenser?* Environmental Biology of Fishes, 48: 157–163.

Bjorndal, K.A. 1997. Foraging ecology and nutrition of sea turtles. *In*: Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, Florida.

Blumenthal, J.M., J.L. Solomon, C.D. Bell, T.J. Austin, G. Ebanks-Petrie, M.S. Coyne, A.C. Broderick, B.J. Godley. 2006. Satellite tracking highlights the need for international cooperation in marine turtle management. Endangered Species Research 7:1-11.

Bolten, A.B., K.A. Bjorndal, and H.R. Martins. 1994. Life history model for the loggerhead sea turtle (*Caretta caretta*) populations in the Atlantic: Potential impacts of a longline fishery. U.S. Department of Commerce, NOAA Tech. Memo. NMFS-SWFSC-201:48-55.

Bolten, A.B., J.A. Wetheral, G.H. Balazs, and S.G. Pooley (compilers). 1996. Status of marine turtles in the Pacific Ocean relevant to incidental take in the Hawaii-based pelagic longline fisheries. NOAA Tech. Memo. NOAA-TM-NMFS-SWFSC-230.

Bonsdorff , E. 1980. Macrozoobenthic recolonization of a dredged brackish water bay in SW Finland. Ophelia Suppl. 1: 145-155.

Boreman, J. 1997. Sensitivity of North American sturgeons and paddlefish to fishing mortality. Environmental Biology of Fishes 48(1-4): 399-405

Brongersma, L. 1972. European Atlantic Turtles. Zool. Verhand. Leiden, 121: 318 pp.

Buckley, J. and B. Kynard. 1981. Spawning and rearing of shortnose sturgeon from the Connecticut River. Progressive Fish Culturist 43: 74-76.

Buckley, J. and B. Kynard. 1985a. Habitat use and behavior of pre-spawning and spawning shortnose sturgeon, *Acipenser brevirostrum*, in the Connecticut River. North American Sturgeons 111-117.

Buckley, J. and B. Kynard. 1985b. Yearly movements of shortnose sturgeons in the Connecticut River. Transactions of the American Fisheries Society 114: 813-820.

Caldwell, D.K. and A. Carr. 1957. Status of the sea turtle fishery in Florida. Transactions of the 22nd North American Wildlife Conference, March 4-7, 1957, pp. 457-463.

Cameron, P., J. Berg, V. Dethlefsen, and H.V. Westernhagen. 1992. Developmental defects in pelagic embryos of several flatfish species in the southern North Sea. Netherlands Journal of Sea Research 29: 239-256.

Campbell, J.G. and L.R. Goodman. 2004. Acute sensitivity of juvenile shortnose sturgeon to low dissolved oxygen concentrations. Transactions of the American Fisheries Society 133: 772-776.

Carlson, D.M. and K.W. Simpson. 1987. Gut contents of juvenile sturgeon in the upper Hudson Estuary. Copeia 1987: 796-802.

Caron, F., D.Hatin, and R. Fortin. 2002. Biological characteristics of adult Atlantic sturgeon (*Acipenser oxyrinchus*) in the Saint Lawrence River estuary and the effectiveness of management rules. Journal of Applied Ichthyology 18:580-585.

Carr, A. 1963. Pan specific reproductive convergence in *Lepidochelys kempii*. Ergebn. Biol. 26: 298-303.

Carr, A. 1984. So Excellent a Fishe. Charles Scribner's Sons, New York.

Catesby M. 1734. The natural history of Carolina, Florida and the Bahama Islands, 1731-1734.

Chaloupka, M., K.A. Bjorndal, G.H. Balazs, A.B. Bolten, L.M. Ehrhart, C.J. Limpus, H. Suganuma, S. Troëng, and M. Yamaguchi. 2007. Encouraging outlook for recovery of a once severely exploited marine megaherbivore. Global Ecol. Biogeogr. (Published online Dec. 11, 2007; to be published in the journal in 2008).

Chapman, D. 2008. Carolina River War Has Big Ripples. Atlanta Journal Constitution. Atlanta, Georgia, August 24, 2008.

Chytalo, K. 1996. Summary of Long Island Sound dredging windows strategy workshop. In: Management of Atlantic Coastal Marine Fish Habitat: Proceedings of a workshop for habitat managers. ASMFC Habitat Management Series #2.

Clarke, D. and C.A. Miller-Way. 1992. An environmental assessment of the effects of open-water disposal of maintenance dredged material on benthic resources in Mobile Bay, Alabama. USAE Waterways Exp. Stn. MP-D-92-1.

Cobb, J.N. 1900. The sturgeon fishery of Delaware River and Bay. Report to the Commissioner, U.S. Commission of Fish and Fisheries. 25: 369-381.

Cochnauer, T.G. 1983. Abundance, distribution, growth and management of white sturgeon (*Acipenser transmontanus*) in the middle Snake River, Idaho. Ph.D. Dissertation, University of Idaho, Moscow, ID. 52 pp.

Collins, M.R. and T.I.J. Smith. 1993. Characteristics of the adult segment of the Savannah River population of shortnose sturgeon. Proceedings of the Annual Conference of the Southeastern Association of Fish and Wildlife Agencies 47: 485-491.

Collins, M.R. and T.I.J. Smith. 1997. Management Briefs: Distributions of Shortnose and Atlantic Sturgeons in South Carolina. North American Journal of Fisheries Management 17: 995-1000.

Collins, M.R., S.G. Rogers, and T.I.J. Smith. 1996. Bycatch of sturgeons along the southern Atlantic coast of the USA. North American Journal of Fisheries Management 16: 24-29.

Collins, M.R., S.G. Rogers, T.I.J. Smith, and M.L. Moser. 2000a. Primary factors affecting sturgeon populations in the southeastern US: fishing mortality and degradation of essential habitats. Bulletin of Marine Science 66(3): 917-928.

Collins, M.R., T.I.J. Smith, W.C. Post, and O. Pashuk. 2000b. Habitat utilization and biological characteristics of adult Atlantic sturgeon in two South Carolina rivers. Transactions of the American Fisheries Society 129:982-988.

Collins, M. R., W.C. Post, and D.C. Russ. 2001. Distribution of shortnose sturgeon in the lower Savannah River. Final Report to the Georgia Ports Authority. 21 p.

Collins, M. R., W.C. Post, D.C. Russ, and T.I.J. Smith. 2002. Habitat use and movements of juvenile shortnose sturgeon in the Savannah River, Georgia-South Carolina. Transactions of the American Fisheries Society 131:975-979.

Collins, M.R., D. Cooke, B. Post, J. Crane, J. Bulak, T.I.J. Smith, T.W. Greig, and J.M. Quattro. 2003. Shortnose sturgeon in the Santee-Cooper Reservoir System, South Carolina. Transactions of the American Fisheries Society 132: 1244-1250.

Collins, M.R., C. Norwood, B. Post and A. Hazel. 2006. Shortnose and Atlantic Sturgeons: Final Report to NFWF. South Carolina Department of Natural Resources. 38 pp.

Collins, M.R., C. Norwood, and A. Rourk. 2008. Shortnose and Atlantic sturgeon age growth, status, diet, and genetics. Final Report to National Fish and Wildlife Foundation. South Carolina Department of Natural Resources, Charleston, South Carolina, 2006-0087-009. 41p.

Commission on Life Sciences (CLS). 1990. Conservation Measures, In: N. Grossblatt (eds.), Decline of the sea turtles: causes and prevention. National Academy Press, Washington D.C.

Conant, T.A., P.H. Dutton, T. Eguchi, S.P. Epperly, C.C. Fahy, M.H. Godfrey, S.L. MacPherson, E.E. Possardt, B.A. Schroeder, J.A. Seminoff, M.L. Snover, C.M. Upite, and B.E. Witherington. 2009. Loggerhead sea turtle (*Caretta caretta*) 2009 status review under the U.S. Endangered Species Act. Report of the Loggerhead Biological Review Team to the National Marine Fisheries Service, August 2009. 222 pages.

Cooper, K. 1989. Effects of polychlorinated dibenzo-p-dioxins and polychlorinated dibenzofurans on aquatic organisms. Reviews in Aquatic Sciences 1(2): 227-242.

COSEWIC 2005. COSEWIC assessment and update status report on the shortnose sturgeon *Acipenser brevirostrum* in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa. vi + 27 pp. (www.sararegistry.gc.ca/status/status_e.cfm).

Counihan, T.D., J.D. DeVore, and M.J. Parsley. In press. The effect of river discharge and water temperature on the year-class strength of Columbia River white sturgeon. Transactions of the American Fisheries Society.

Craft, C., J. Clough, J. Ehmna, S. Joye, R. Park, S. Pennings, H. Guo, and M. Machmuller. 2008. Forecasting the effects of accelerated sea-level rise on tidal march ecosystem services. Frontiers in Ecology and the Environment.

Crocker, C.E. and J.J. Cech. 1997. Effects of environmental hypoxia on oxygen consumption rate and swimming activity in juvenile white sturgeon, *Acipenser transmontanus*, in relation to temperature and life intervals. Environmental Biology of Fishes 50: 382-389.

Dadswell, M.J. 1979. Biology and population characteristics of the shortnose sturgeon, *Acipenser brevirostrum* LeSueur 1818 (Osteichthyes: Acipenseridae), in the Saint John River estuary, New Brunswick, Canada. Canadian Journal of Zoology 57: 2186-2210.

Dadswell, M.J., B.D. Taubert, T.S. Squiers, D. Marchette, and J. Buckley. 1984. Synopsis of biological data on shortnose sturgeon, *Acipenser brevirostrum* LeSueur, 1818. NOAA Technical Report-14. 53 pp.

Daniels, R.C., T.W. White, and K.K. Chapman. 1993. Sea-level rise: destruction of threatened and endangered species habitat in South Carolina. Environmental Management, 17(3):373-385.

DeVries, R.J. 2006. Population dynamics, movements, and spawning habitat of the shortnose sturgeon, *Acipenser brevirostrum*, in the Altamaha River. Master's Thesis, University of Georgia. 103 pp.

Dial-Cordy and Associates. 2010. Sediment survey of the lower Savannah River.

Diamond, J.M. 1984. "Normal" extinctions of isolated populations. Pp. 191-246 *In:* M.H. Nitecki (ed). Extinctions. University of Chicago Press, Chicago.

Dickerson, D., K. Reine, D. Nelson, and C. Dickerson, Jr. 1995. Assessment of sea turtle abundance in six south Atlantic U.S. channels. Miscellaneous Paper EL-95-5, U.S. Army Engineer Waterways Experiment Station, Vicksburg, MS.

Dickerson, D.D. and J.E. Clausner. 2003. Draft: Summary of Sea Turtle/Dredging Issues and Recommended Action Tasks Generated by the Improved Draghead Design Meeting, September 4, 2003, Atlanta, Georgia. U.S. Army Corps of Engineers, Engineering Research and Development Center, Vicksburg, Mississippi. 13pp.

Dickerson, D., M. Wolters, C. Theriot, D. Slay. 2004. Dredging impacts on sea turtles in the southeastern USA: A historical review of protection. Submitted for proceedings of the World Dredging Congress, Hamburg, Germany, 27 September-1 October 2004.

Dickerson, D.D, C. Theriot, M. Wolters, C. Slay, T. Bargo, W. Parks. 2007. Effectiveness of relocation trawling during hopper dredging for reducing incidental take of sea turtles. 2007 World Dredging Conference. Available at: http://el.erdc.usace.army.mil/seaturtles/docs/07-DickersonWODCON.pdf

Diffendorfer, J. 1998. Testing models of source-sink dynamics and balanced dispersal. – Oikos 81: 417–433.

Dodd, C.K. 1988. Synopsis of the biological data on the loggerhead sea turtle *Caretta caretta* (Linnaeus 1758). U.S. Fish and Wildlife Service Biological Report, 88-14, 1988. 110 pp.

Doughty, R.W. 1984. Sea turtles in Texas: A forgotten commerce. Southwestern Historical Quarterly 88: 43-70.

Dovel, W.L., and T.J. Berggren. 1983. Atlantic sturgeon of the Hudson River estuary, New York. New York. Fish and Game Journal 30:140-172.

Dovel, W.L., A.W. Pekovitch, and T.J. Berggren. 1992. Biology of the shortnose sturgeon (*Acipenser brevirostrum* Lesueur, 1818) in the Hudson River estuary, New York. Pages 187-216 In: C.L. Smith (Ed) Estuarine Research in the 1980s. State University of New York Press, Albany, New York.

Ehrhart, L.M. 1983. Marine turtles of the Indian River lagoon system. Florida Sci. 46(3/4): 337-346.

Ehrhart, L.M. 1989. Status Report of the Loggerhead Turtle. Ogren, L., F. Berry, K. Bjorndal, H. Kumpf, R. Mast, G. Medina, H. Reichart, and R. Witham (Eds.). Proceedings of the Second Western Atlantic Turtle Symposium. NOAA Technical Memorandum NMFS-SEFSC-226, pp. 122-139.

Ehrhart, L.M., W.E. Redfoot, D.A. Bagley. 2007. Marine turtles of the central region of the Indian River Lagoon system. Florida Scientist 70(4): 415-434.

Epperly, S.P. and W.G. Teas. 2002. Turtle excluder devices: Are the escape openings large enough? Fish Bull. 100: 466-474.

Epperly, S.P., J. Braun, and A.J. Chester. 1995a. Aerial surveys for sea turtles in North Carolina inshore waters. Fishery Bulletin 93: 254-261.

Epperly, S.P., J. Braun, and A. Veishlow. 1995b. Sea turtles in North Carolina waters. Conserv. Biol. 9: 384-394.

Epperly, S.P., J. Braun, A. J. Chester, F.A. Cross, J. Merriner, and P.A. Tester. 1995c. Winter distribution of sea turtles in the vicinity of Cape Hatteras and their interactions with the summer flounder trawl fishery. Bull. Mar. Sci. 56(2): 519-540.

Epperly, S., L. Avens, L. Garrison, T. Henwood, W. Hoggard, J. Mitchell, J. Nance, J. Poffenberger, C. Sasso, E. Scott-Denton, and C. Yeung. 2002. Analysis of sea turtle bycatch in the commercial shrimp industry of southeast U.S. waters and the Gulf of Mexico. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-490. 88 pp.

Epperly, S.P., J. Braun-McNeill, P.M. Richards. 2007. Trends in the catch rates of sea turtles in North Carolina, U.S.A. Endangered Species Research. 3: 283-293.

Erickson, D.L., J.A. North, J.E. Hightower, J. Weber, and L. Lauck. 2002. Movement and habitat use of green sturgeon *Acipenser medirostris* in the Rogue River, Oregon, U.S.A. Journal of Applied Ichthyology 18:565.569.

Evermann, B.W. and B.A. Bean. 1898. Indian River and its fishes. Report of the United States Fisheries Commission 1896: 227-248.

Fish, M.R., I.M. Cote, J.A. Gill, A.P. Jones, S. Renshoff, and A.R. Watkinson. 2005. Predicting the impact of sea-level rise on Caribbean sea turtle nesting habitat. Conservation Biology, 19(2):482-491.

Flournoy, P.H., S.G. Rogers, and P.S. Crawford. 1992. Restoration of shortnose sturgeon in the Altamaha River, Georgia. Final Report to the United States Fish and Wildlife Service. 29 pp.

Frazer, N.B. and L.M. Ehrhart. 1985. Preliminary growth models for green, *Chelonia mydas*, and loggerhead, *Caretta caretta*, turtles in the wild. Copeia 1985: 73-79.

Frazer, N.B., C.J. Limpus, and J.L. Greene. 1994. Growth and age at maturity of Queensland loggerheads. U.S. Department of Commerce. NOAA Technical Memorandum, NMFS-SEFSC-351: 42-45.

Garduño-Andrade, M., V. Guzman, E. Miranda, R. Briseno-Duenas, and F.A. Abreu-Grobois. 1999. Increases in hawksbill turtle (*Eretmochelys imbricata*) nestings in the Yucatan Peninsula, Mexico, 1977-1996: data in support of successful conservation? Chelonian Conservation and Biology 3(2): 286-295.

Giesy, J.P., J. Newsted, and D.L. Garling. 1986. Relationships between chlorinated hydrocarbon concentrations and rearing mortality of chinook salmon (*Oncorhynchus tshawytscha*) eggs from Lake Michigan. Journal of Great Lakes Research 12(1): 82-98.

Gilbert, C.R. 1989. Species profiles: life histories and environmental requirements of coastal fishes and invertebrates (Mid-Atlantic Bight): Atlantic and shortnose sturgeons. United States Fish and Wildlife Service Biological Report-Report Number-82 (11.91).

Gladys Porter Zoo. 2007. Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, Lepidocheyls kempii, on the coasts of Tamaulipas and Veracruz, Mexico – 2007. Report submitted to the U.S. Fish and Wildlife Service, Department of Interior.

Gladys Porter Zoo. 2008. Final Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, on the Coasts of Tamaulipas, Mexico. Report presented by Dr. Patrick M. Burchfield and prepared by Luis Jaime Pena- Gladys Porter Zoo, Brownsville, Texas.

Gladys Porter Zoo. 2010. Summary Final Report on the Mexico/United States of America Population Restoration Project for the Kemp's Ridley Sea Turtle, *Lepidochelys kempii*, on the Coasts of Tamaulipas, Mexico. Report presented by Dr. Patrick M. Burchfield and prepared by Luis Jaime Pena- Gladys Porter Zoo, Brownsville, Texas.

Greene, K.E., J.L. Zimmerman, R.W. Laney, and J.C. Thomas-Blate. 2009. Atlantic coast diadromous fish habitat: A review of utlization, threats, recommendations for conservation, and research needs. Atlantic States Marine Fisheries Commission Habitat Management Series No. 9. Washingotn, D.C.

Groombridge, B. 1982. The IUCN Amphibia - Reptilia Red Data Book. Part 1. Testudines, Crocodylia, Rhynchocephalia. Int. Union Conserv. Nature and Nat. Res., 426pp.

Gross, M.R., J. Repka, C.T. Robertson, D.H. Secor, and W.V. Winkle. 2002. Sturgeon conservation: insights from elasticity analysis. Pages 13-30 In: V.W. Webster et al. (eds.). Biology, management, and protection of North American sturgeon, Symposium 28. American Fisheries Society, Bethesda, Maryland.

Grunwald, C., J. Stabile, J. R. Waldman, R.Gross, and I. Wirgin. 2002. Population genetics of shortnose sturgeon *Acipenser brevirostrum* based on mitochondrial DNA control region sequences. Molec. Ecol. 11:1885-1898.

Grunwald, C., L. Maceda, J. Waldman, J. Stabile, I. Wirgin. 2007. Conservation of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*: delineation of stock structure and distinct population segments. Conserv. Genet 9:1111–1124.

Guseman, J.L. and L.M. Ehrhart. 1992. Ecological geography of Western Atlantic loggerheads and green turtles: evidence from remote tag recoveries. *In* Salmon M. and J. Wyneken (compilers), Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFC-302. 50 pp.

Hall, J.W., T.I.J. Smith, and S.D. Lamprecht. 1991. Movements and habitats of shortnose sturgeon, *Acipenser brevirostrum*, in the Savannah River. Copeia 1991(3): 695-702.

Hansen, P.D. 1985. Chlorinated hydrocarbons and hatching success in Baltic herring spring spawners. Marine Environmental Research 15: 59-76.

Hanski, I. 1999. Old and new challenges. Pp. 264-265 in: Metapopulation Ecology (I. Hanski, ed.). Oxford University Press, Oxford.

Hanski, I., and D. Simberloff. 1997. The metapopulation approach, its history, conceptural domain, and application to conservation. Pp. 5-26 in: Metapopulation Biology: Ecology, Genetics and Evolution (I. Hanski and M.E. Gilpin, eds.). Academic Press, New York.

Hardy, R.S. and M.K. Litvak. 2004. Effects of temperature on the early development, growth, and survival of shortnose sturgeon, *Acipenser brevirostrum*, and Atlantic sturgeon, *Acipenser oxyrinchus*, yolk-sac larvae. Environmental Biology of Fishes 70: 145-154.

Harrison, S. 1991. Local extinction in a metapopulation context: an empirical evaluation. Biological Journal of the Linnean Society 42:73-88.

Hatase, H., M. Kinoshita, T. Bando, N. Kamezaki, K. Sato, Y. Matsuzawa, K. Goto, K. Omuta, Y. Nakashima, H. Takeshita, and W. Sakamoto. 2002. Population structure of loggerhead turtles, *Caretta caretta*, nesting in Japan: Bottlenecks on the Pacific population. Marine Biology 141:299-305.

Hawkes, L.A., A.C. Broderick, M.S. Coyne, M.H. Godfrey, L.-F. Lopez-Jurado, P. Lopez-Suarez, S.E. Merino, N. Varo-Cruz, and B.J. Godley. 2006. Phenotypically linked dichotomy in sea turtle foraging requires multiple conservation approaches. Current Biology 16: 990-995.

Hawkes, L.A., A.C. Broderick, M.H.Godfrey, and B.J. Godley. 2007. Investigating the potential impacts of climate change on a marine turtle population. Global Change Biology, 13:923-932.

Hays, G.C., A.C. Broderick, F. Glen, B.J. Godley, J.D.R. Houghton, and J.D. Metcalfe. 2002. Water temperature and internesting intervals for loggerhead (*Caretta caretta*) and green (*Chelonia mydas*) sea turtles. Journal of Thermal Biology, 27:429-432.

Heidt, A.R. and R.J. Gilbert. 1978. The shortnose sturgeon in the Altamaha River drainage. Pp 54-60 In: R.R. Odum and L. Landers (eds.) Proceedings of the rare and endangered wildlife symposium. Georgia Department of Natural Resources, Game and Fish Division.

Henwood, T.A. and L.H. Ogren. 1987. Distribution and migrations of immature Kemp's ridley (*Lepidochelys kempii*) and green turtles (*Chelonia mydas*) off Florida, Georgia, and South Carolina. Northeast Gulf Sci. 9: 153-159.

Heppell, S.S., L.B. Crowder, D.T. Crouse, S.P. Epperly, and N.B. Frazer. 2003. Population models for Atlantic loggerheads: past, present, and future. *In*: Loggerhead Sea Turtles. Bolten, A.B. and B.E. Witherington (eds.). Smithsonian Books, Washington. pp 255-273.

Hildebrand, H.H. 1963. Hallazgo del area de anidacion de la tortuga marina "lora" *Lepidochelys kempii* (Garman), en la costa occidental del Golfo de Mexico. Ciencia Mexicana 22(4): 105-112.

Hildebrand, H.H. 1982. A historical review of the status of sea turtle populations in the Western Gulf of Mexico. In Bjorndal, K.A. (ed.), Biology and Conservation of Sea Turtles. Smithsonian Institution Press, Washington D.C. pp 447-453.

Hill, J. 1996. Environmental considerations in licensing hydropower projects; policies and practices of the Federal Energy Regulatory Commission. American Fisheries Society Symposium 16: 190-199.

Hirth, H.F. 1997. Synopsis of the biological data on the green turtle *Chelonia mydas* (Linnaeus 1758). Biological Report 97(1), U.S. Fish and Wildlife Service, U.S. Dept. of the Interior. 120 pp.

Hoff, T.B., R.J. Klauda and J.R. Young. 1988. Contribution to the biology of shortnose sturgeon in the Hudson River Estuary. Pp 171-189 In: C.L. Smith (ed.) Fisheries Research in the Hudson River. Hudson River Environmental Society. State University of New York press, Albany, New York.

Huff, J.A. 1975. Life history of Gulf of Mexico sturgeon, *Acipenser oxyrinchus desotoi*, in Suwannee River, Florida. Florida Department of Natural Resources, Marine Research Publication 16, St. Petersburg, FL.

Hulme, P.E. 2005. Adapting to climate change: is there scope for ecological management in the face of global threat? Journal of Applied Ecology 43: 617-627.

IPCC (Intergovernmental Panel on Climate Change). 2007. Summary for Policymakers. In: Climate Change 2007: The Physical Science Basis. Contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Quin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M. Tignor and H.L. Miller (eds)] Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

Jager, H.I., W. VanWinkle, J.A. Chandler, K.B. Lepla, P. Bates, and T.D. Counihan. 2002. A simulation study of factors controlling white sturgeon recruitment in the Snake River. American Fisheries Society Symposium 28: 127-150.

Jarvis, P. L., J. S. Ballantyne, and W. E. Hogans. 2001. The influence of salinity on the growth of juvenile shortnose sturgeon. North American Journal of Aquaculture 63:272-276.

Jenkins, W.E., T.I.J.Smith, L.D. Heyward, and D.M. Knott. 1993. Tolerance of shortnose sturgeon, *Acipenser brevirostrum*, juveniles to different salinity and dissolved oxygen concentrations. Proceedings of the Annual Conference of Southeastern Association of Fish and Wildlife Agencies 47: 476-484.

Jensen, A. and G. Silber. 2003. Large Whale Ship Strike Database. U.S. Department of Commerce, NOAA Technical Memorandum. NMFS-F/OPR-25, 37 pp.

Johnson, S.A. and L.M. Ehrhart. 1994. Nest-site fidelity of the Florida green turtle. *In* Schroeder, B.A. and B.E. Witherington (compilers), Proceedings of the Thirteenth Annual Symposium on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-341. 83 pp.

Kahn, J. and M. Mohead. 2010. A Protocol for Use of Shortnose, Atlantic, Gulf, and Green Sturgeons. U.S. Dep. Commerce, NOAA Tech. Memo. NMFS-OPR-45, 62 p.

Kahnle, A.W., K.A. Hattala, K.A. McKown, C.A. Shirey, M.R. Collins, T.S. Squiers, Jr., and T. Savoy. 1998. Stock Status of Atlantic sturgeon of Atlantic Coast Estuaries. Report for the Atlantic States Marine Fisheries Commission. Draft III.

Kaplan, E.H., J.R. Welker, M.G. Kraus, and S. McCourt. 1975. Some factors affecting the colonization of a dredged channel. Marine Biology 32,193e204.

Keinath, J.A., J.A. Musick and R.A. Byles. 1987. Aspects of the biology of Virginia's sea turtles: 1979-1986. Virginia J. Sci. 38(4):329-336.

Keiser, R.K. 1976. Species composition, magnitude and utilization of the incidental catch of the South Carolina shrimp fishery. S.C. Mar. Resour. Cent. Tech. Rep. 16, 94 p.

Kieffer, M.C. and B. Kynard. 1993. Annual movements of shortnose and Atlantic sturgeons in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 122: 1088-1103.

Kieffer, M. and B. Kynard. 1996. Spawning of shortnose sturgeon in the Merrimack River, Massachusetts. Transactions of the American Fisheries Society 125: 179-186.

Kindvall, O. and I. Ahlen. 1992. Geometrical factors and metapopulation dynamics of the brush cricket, *Metrioptera bicolor* Phillippi (Orthoptera: Tettigoniidae). Conservation Biology 6: 520-529.

King, T. L., B. A. Lubinski, and A. P. Spidle. 2001. Microsatellite DNA variation in Atlantic sturgeon (*Acipenser oxyrinchus oxyrinchus*) and cross-species amplification in the Acipenseridae. Conservation Genetics 2: 103-119.

King, T.L., A.P Henderson, B.E. Kynard, M.C. Kiefer, D.L. Peterson and D.S. Pavek. In prep. A nuclear DNA perspective on delineating fundamental units of management and distinct population segments in the endangered shortnose sturgeon. Final Report to the National Capital Region, U.S. National Park Service and Eastern Region, USGS.

Kite-Powell, H.K., A. Knowlton, and M. Brown. 2007. Modeling the effect of vessel speed on right whale ship strike risk. Project report for NOAA/NMFS Project NA04NMF47202394. April 2007.

Knowlton, A.R. and S.D. Kraus. 2001. Mortality and serious injury of northern right whales (Eubalaena glacialis) in the western North Atlantic Ocean. Journal of Cetacean Research and Management (Special Issue) 2:193-208.

Kynard, B. 1997. Life history, latitudinal patterns and status of shortnose sturgeon, *Acipenser brevirostrum*. Environmental Biology of Fishes 48: 319-334.

Kynard, B. 1998. Twenty-two years of passing shortnose sturgeon in fish lifts on the Connecticut River: What has been learned? In: Fish migration and fish bypasses, M. Jungwirth, S. Schmutz, and S. Weiss, Editors. pp. 255-264.

Kynard, B. and M. Horgan. 2002. Ontogenetic behavior and migration of Atlantic sturgeon, *Acipenser oxyrinchus oxyrinchus*, and shortnose sturgeon, *A. brevirostrum*, with notes on social behavior. Environmental Behavior of Fishes 63: 137-150.

Kynard, B., M. Kieffer, M. Burlingame and M. Horgan. 1999. Studies on shortnose sturgeon. Final Report to Northeast Utilities Service Company, Berlin, Connecticut and the City of Holyoke, Massachusetts.

Kynard, B., M. Horgan, M. Kieffer, and D. Seibel. 2000. Habitats used by shortnose sturgeon in two Massachusetts rivers, with notes on estuarine Atlantic sturgeon: a hierarchical approach. Transactions of the American Fisheries Society 129: 487-503.

Laist, D.W. and C. Shaw. 2006. Preliminary evidence that boat speed restrictions reduce deaths of Florida manatees. Marine Mammal Science 22(2):472-479.

Laist, D.W., A.R. Knowlton, J.G. Mead, A.S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17(1):35-75.

Lande, R. 1988. Genetics and demography in biological conservation. Science 241: 1455-1460.

Laurent, L., P. Casale, M.N. Bradai, B.J. Godley, G. Gerosa, A.C. Broderick, W. Schroth, B. Schierwater, A.M. Levy, D. Freggi, E.M. Abd El-Mawla, D.A. Hadoud, H.E. Gomati, M. Domingo, M. Hadjichristophorou, L. Kornaraki, F. Demirayak, and C. Gautier. 1998. Molecular resolution of the marine turtle stock composition in fishery bycatch: A case study in the Mediterranean. Molecular Ecology 7:1529-1542.

León, Y.M. and C.E. Diez, 2000. Ecology and population biology of hawksbill turtles at a Caribbean feeding ground (Proceedings of the Eighteenth International Sea Turtle Symposium. U.S. Dept. of Commerce. NOAA Technical Memorandum NMFS-SEFSC-436, 293 pp.; 2000, p. 32-33)

Levins, R. 1969. Some demographic and genetic consequence of environmental heterogeneity for biological control. Bulletin of the Entomological Society of America. 15: 237-240.

Limpus, C.J. and D.J. Limpus. 2003. Loggerhead turtles in the equatorial Pacific and southern Pacific Ocean: A species in decline. *In*: Bolten, A.B., and B.E. Witherington (eds.), Loggerhead Sea Turtles. Smithsonian Institution.

Longwell, A.C., S. Chang, A. Hebert, J. Hughes, and D. Perry. 1992. Pollution and developmental abnormalities of Atlantic fishes. Environmental Biology of Fishes 35: 1-21.

Lutcavage, M. and J.A. Musick. 1985. Aspects of the biology of sea turtles in Virginia. Copeia (1985): 449-456.

Mac, M.J. and C.C. Edsall. 1991. Environmental contaminants and the reproductive success of lake trout in the Great Lakes: An epidemiological approach. Journal of Toxicology and Environmental Health 33: 375-394.

Mangin, E. 1964. Croissance en Longueur de Trois Esturgeons d'Amerique du Nord: *Acipenser oxyrhynchus*, Mitchill, *Acipenser fulvescens*, Rafinesque, et *Acipenser brevirostris* LeSueur. Verh. Int. Ver. Limnology 15: 968-974.

Marchette, D.E. and R. Smiley. 1982. Biology and life history of incidentally captured shortnose sturgeon, *Acipenser brevirostrum,* in South Carolina. South Carolina Wildlife and Marine Resources. Unpublished MS.

Margaritoulis, D., R. Argano, I. Baran, F. Bentivegna, M.N. Bradai, J.A. Camiñas, P. Casale, G.De Metrio, A. Demetropoulos, G. Gerosa, B.J. Godley, D.A. Haddoud, J. Houghton, L.Laurent, and B. Lazar. 2003. Loggerhead turtles in the Mediterranean Sea: present knowledge and conservation perspectives. Pages 175-198 *in* Bolten, A.B. and B.E.Witherington (editors). Loggerhead Sea Turtles. Smithsonian Books, Washington D.C.

Márquez, R. 1990. FAO Species Catalogue, Vol. 11. Sea turtles of the world, an annotated and illustrated catalogue of sea turtle species known to date. FAO Fisheries Synopsis, 125. 81 pp.

McCleave, J.D., S.M. Fried, and A.K. Towt. 1977. Daily movements of shortnose sturgeon, *Acipenser brevirostrum*, in a Maine estuary. Copeia 1977: 149-157.

McCord, J.W. 1998. Investigation of fisheries parameters for anadromous fisheries in South Carolina. South Carolina Department of Natural Resources. Completion report to National Marine Fisheries Service (AFC -53).

McClellan, C.M. and A.J. Read. 2007. Complexity and variation in loggerhead sea turtle life history. Biology Letters 3:592-594.

McDonald, M. 1887. The rivers and sound of North Carolina. Pp 625-637 *In:* G.B. Goode (ed.) The fisheries and fishery industries of the United States, Section V, Volume 1. U.S. Commission on Fish and Fisheries, Washington D.C.

McElhaney, P., M.H. Rucklelshaus, M.J. Ford, T.C. Wainwright, and E.P. Bjorkstedt. 2000. Viable salmonid populations and the recovery of evolutionary significant units. U.S. Dept. Commer. NOAA Tech Memo. NMFS-NWFSC-42. 156 p.

McMaster, H. 2007. South Carolina Attorney General's Office, Current Cases, State of South Carolina vs. State of North Carolina Water War. November 13, 2008. http://www.scattorneygeneral.org/currentcases/waterwar.html

Mendonca, M.T., and L.M. Ehrhart. 1982. Activity, Population Size and Structure of Immature *Chelonia mydas* and *Caretta caretta* in Mosquito Lagoon, Florida. Copeia 1:161-167.

Meylan, A. 1999. Status of the Hawksbill Turtle (*Eretmochelys imbricata*) in the Caribbean Region. Chelonian Conservation and Biology 3(2): 177B184. Available at (http://www.iucn-mtsg.org/publications/cc&b_april1999/4.14-Meylan-Status.pdf).

Meylan, A., B. Schroeder, and A. Mosier. 1995. Sea turtle nesting activity in the state of Florida. Florida Marine Research Publications, No. 52

Milton, S.L., S. Leone-Kabler, A.A. Schulman, and P.L. Lutz. 1994. Effects of Hurricane Andrew on the sea turtle nesting beaches of South Florida. Bulletin of Marine Science, 54(3): 974-981.

Milton, S.L., Lutz , P.L. 2003 Physiological and genetic responses to environmental stress. *In*: Lutz PL, Musick JA, Wyneken J (eds) The biology of sea turtles, Vol II. CRC Press, Boca Raton, FL, p 163–197

Moorehead, K.K. and M.M. Brinson. 1995. Response of wetlands to rising sea level in the lower coast plain of North Carolina. Ecological Applications 5: 261-271.

Moser, M. L. and S. W. Ross. 1993. Distribution and movements of shortnose sturgeon (*Acipenser brevirostrum*) and other anadromous fishes of the lower Cape Fear River, North Carolina. Final Report to the U.S. Army Corps of Engineers, Wilmington, North Carolina.

Moser, M.L. and S.W. Ross. 1995. Habitat use and movements of shortnose and Atlantic sturgeons in the Lower Cape Fear River, North Carolina. Transactions of the American Fisheries Society 124: 225-234.

Moser M. L., J. B. Bichy, and S. B. Roberts. 1998. Sturgeon distribution in North Carolina. Center for Marine Science Research. Final Report to U.S. ACOE, Wilmington District, NC.

Moser, M.L., M. Bain, M.R. Collins, N. Haley, B. Kynard, J.C. O'Herron II, G. Rogers, and T.S. Squiers. 2000. A Protocol for Use of Shortnose and Atlantic Sturgeons. U.S. Department of Commerce, NOAA Technical Memorandum-NMFS-OPR-18. 18 pp.

Munro, J., R.E. Edwards, and A.W. Kahnle. 2007. Anadromous sturgeons: habitats, threats, and management. American Fishereis Society Symposium 56: 1-15.

Murawski, S.A. and A.L. Pacheco. 1977. Biological and fisheries data on Atlantic sturgeon, *Acipenser oxyrhynchus* (Mitchill). National Marine Fisheries Service, Sandy Hool Lab., Sandy Hook. Tech. Report No. 10. 78 pp.

Murdoch, P.S., J.S. Baron and T.L. Miller. 2000. Potential effects of climate change on surface-water quality in North America. Journal of the American Water Resources Association 36: 347-366.

Murphy, T.M. and S.R. Hopkins. 1984. Aerial and ground surveys of marine turtle nesting beaches in the Southeast region, U.S. Final Report to the National Marine Fisheries Service; NMFS Contract No. NA83-GA-C-00021. 73 pp.

Musick, J.A. 1999. Ecology and conservation of long-lived marine animals. Pp 1-10 In: J.A. Musick (ed.) Life in the slow land: ecology and conservation of long-lived marine animals. American Fisheries Society Symposium 23, Bethesda, Maryland.

Musick, J.A. and C.J. Limpus. 1997. Habitat utilization in juvenile sea turtles. *In* Lutz, P.L. and J.A. Musick (eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, Florida. pp. 137-163.

NAST (National Assessment Synthesis Team). 2000. Climate change impacts on the United States: the potential consequences of climate variability and change. US Global Change Research Program, Washington D.C.

Niklitschek, E.J. 2001. Bioenergetics modeling and assessment of suitable habitat for juvenile Atlantic and shortnose sturgeons (*Acipenser oxyrinchus* and *A. brevirostrum*) in the Chesapeake Bay [dissertation]. [College Park(MD)]: University of Maryland.

Niklitschek, E.J. and D.H. Secor. 2005. Modeling spatial and temporal variation of suitable nursery habitats for Atlantic sturgeon in the Chesapeake Bay. Estuarine, Coastal and Shelf Science 64:135–148.

NIDIS (National Integrated Drought Information System). 2008. Current Drought Conditions for the State of Georgia, November 4, 2008. http://www.drought.gov/portal/server.pt?uuID=%7B950C0A74-978E-47AF-2FF0-9159361A2000%7D&mode=2&in_hi_userid=2&state=GA

NMFS. 1991. Biological Opinion for the Dredging of channels in the Southeastern United States from North Carolina through Cape Canaveral, Florida.

NMFS. 1995. Endangered Species Act section 7 consultation on United States Coast Guard vessel and aircraft activities along the Atlantic coast. Biological Opinion. September 15.

NMFS. 1996. Endangered Species Act section 7 consultation on reinitiation of consultation on United States Coast Guard Vessel and Aircraft Activities along the Atlantic Coast. Biological Opinion. July 22.

NMFS. 1997a. Endangered Species Act section 7 consultation on Navy activities off the southeastern United States along the Atlantic Coast. Biological Opinion. May 15.

NMFS. 1997b. Endangered Species Act section 7 consultation on the continued hopper dredging of channels and borrow areas in the southeastern United States. Biological Opinion. September 25.

NMFS. 1998. Endangered Species Act section 7 consultation on COE permits to Kerr-McGee Oil and Gas Corporation for explosive rig removals off of Plaquemines Parish, Louisiana. Draft Biological Opinion. September 22.

NMFS. 1998. Recovery plan for the shortnose surgeon (*Acipenser brevirostrum*). Prepared by the Shortnose Sturgeon Recovery Team. 119 pp.

NMFS. 2001a. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S. Department of Commerce NOAA Technical Memorandum NMFS-SEFSC-455.

NMFS. 2001b. Endangered Species Act section 7 consultation on the reinitiation of consultation on the Atlantic highly migratory species fishery management plan and its associated fisheries. Biological Opinion. June 14.

NMFS. 2002. Endangered Species Act section 7 consultation on shrimp trawling in the southeastern United States under the sea turtle conservation regulations and as managed by the fishery management plans for shrimp in the South Atlantic and the Gulf of Mexico. Biological Opinion, December 2.

NMFS. 2003. Endangered Species Act section 7 consultation on the continued operation of Atlantic shark fisheries (commercial shark bottom longline and drift gillnet fisheries and recreational shark fisheries) under the Fishery Management Plan for Atlantic Tunas, Swordfish, and Sharks (HMS FMP) and the Proposed Rule for Draft Amendment 1 to the HMS FMP. Biological Opinion. July 2003.

NMFS. 2004a. Endangered Species Act section 7 consultation on proposed regulatory amendments to the FMP for the pelagic fisheries of the western Pacific region. Biological opinion. February 23.

NMFS. 2004b. Endangered Species Act section 7 reinitiation consultation on the Atlantic pelagic longline fishery for highly migratory species. Biological Opinion. June 1.

NMFS. 2007. Endangered Species Act section 7 consultation on the dredging of Gulf of Mexico navigation channels and sand mining ("borrow") areas using hopper dredges by COE Galveston, New Orleans, Mobile, and Jacksonville Districts. Revised Biological Opinion (November 2003). January 2007.

NMFS SEFSC (Southeast Fisheries Science Center). 2001. Stock assessments of loggerhead and leatherback sea turtles and an assessment of the impact of the pelagic longline fishery on the loggerhead and leatherback sea turtles of the Western North Atlantic. U.S.

Department of Commerce, National Marine Fisheries Service, Miami, Florida, SEFSC Contribution PRD-00/01-08; Parts I-III and Appendices I-V1.

NMFS-SEFSC. 2009. Estimated impacts of mortality reductions on loggerhead sea turtle population dynamics, preliminary results. Presented at the meeting of the Reef Fish Management Committee of the Gulf of Mexico Fishery Management Council, June 16, 2009, Tampa, Florida, 20p. (Posted 6/2009 at http://www.sefsc.noaa.gov/seaturtleabstracts.jsp)

NMFS and USFWS. 1991a. Recovery Plan for U.S. Population of Atlantic Green Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1991b. Recovery Plan for U.S. Population of Loggerhead Turtle. National Marine Fisheries Service, Washington, D.C.

NMFS and USFWS. 1993. Recovery Plan for Hawksbill Turtles in the U.S. Caribbean Sea, Atlantic Ocean, and Gulf of Mexico. National Marine Fisheries Service, St. Petersburg, Florida.

NMFS and USFWS. 1995. Status reviews for sea turtles listed under the Endangered Species Act of 1973. National Marine Fisheries Service, Silver Spring, Maryland.

NMFS and USFWS. 1998a. Recovery Plan for U.S. Pacific Populations of the Green Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS and USFWS. 1998b. Recovery Plan for U.S. Pacific Populations of the Hawksbill Turtle (*Eretmochelys imbricata*). National Marine Fisheries Service, Silver Spring, Maryland.

NMFS and USFWS. 1998c. Recovery Plan for U.S. Pacific Populations of the Leatherback Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS and USFWS. 1998d. Recovery Plan for U.S. Pacific Populations of the Loggerhead Turtle. Prepared by the Pacific Sea Turtle Recovery Team.

NMFS and USFWS. 2007a. Loggerhead Sea Turtle (*Caretta caretta*) 5-Year Review: Summary and Evaluation.

NMFS and USFWS. 2007b. Kemp's Ridley Sea Turtle (*Lepidochelys kempii*) 5-Year Review: Summary and Evaluation.

NMFS and USFWS. 2007c. Green Sea Turtle (*Chelonia mydas*) 5-Year Review: Summary and Evaluation.

NMFS and USFWS. 2007d. Leatherback sea turtle (Dermochelys coriacea) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 79 pp.

NMFS and USFWS. 2007e. Loggerhead sea turtle (Caretta caretta) 5 year review: summary and evaluation. National Marine Fisheries Service, Silver Spring, Maryland. 65 pp.

NMFS and USFWS. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. National Marine Fisheries Service, Silver Spring, MD.

NMFS, USFWS, and SEMARNAT. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. National Marine Fisheries Service. Silver Spring, Maryland 156 pp. + appendices

NRC (National Research Council, Committee on Sea Turtle Conservation). 1990. Decline of the Sea Turtles: Causes and Prevention. National Academy Press, Washington D.C.

Ogren, L.H. 1989. Distribution of juvenile and subadult Kemp's Ridley Sea Turtles: Preliminary Results from the 1984-1987 Surveys. *In* Caillouet, C.W., Jr. and A.M. Landry, Jr. (eds.), Proceedings of the First International Symposium on Kemp's Ridley Sea Turtle Biology, Conservation and Management. Texas A&M University Sea Grant College Program, Galveston. TAMU-SG-89-105

O'Herron, J.C., K.W. Able, and R.W. Hastings. 1993. Movements of shortnose sturgeon (*Acipenser brevirostrum*) in the Delaware River. Estuaries 16:235-240.

Ong, T.L., J. Stabile, I. Wirgin, and J.R.Waldman. 1996. Genetic divergence between *Acipenser oxyrhinchus oxyrhinchus* and *A. o. desotoi:* An assessment by mitochondrial DNA analysis Copeia 2: 464–469.

Pace, R.M. and G.K. Silber. 2005. Abstract. Simple analyses of ship and large whale collisions: Does speed kill? Sixteenth Biennial Conference on the Biology of Marine Mammals, San Diego, December 2005.

Palmer, M.A., C.A. Reidy Liermann, C. Nilsson, M. Florke, J. Alcama, P.S. Lake and N. bond. 2008. Climate change and the world's river basins: anticipating management options. Frontiers in Ecology and the Environment 6: 81-89.

Panigada, S., G. Pesante, M. Zanardelli, F. Capoulade, A. Gannier, and M.T. Weinrich. 2006. Mediterranean whales at risk from fatal ship strikes. Marine Pollution Bulletin 52, 1287–1298.

Paragamian, V.L. and J.P. Duehr. 2005. Variation in vertical location of Kootenai River white sturgeon during the prespawn and spawning periods. Trans. Am. Fish. Soc. 134 (1):261-266.

Paragamian, V.L., and G. Kruse. 2001. Kootenai River white sturgeon spawning migration behavior and a predictive model. North American Journal of Fisheries Management 21:22-33.

Park, R.A., J.K. Lee, P.W. Mausel, and R.C. Howe. 1991. The effects if sea level rise on US coastal wetlands. In: J.B. Smith and D.A. Tirpak (eds), The potential effects of global climate change on the United States. Appendix B – sea-level rise. Washington DC: US Environmental Protection Agency.

Peterson, D.L., P. Vecsei, C.A. Jennings. 2006. Ecology and biology of the lake sturgeon: a synthesis of current knowledge of a threatened North American *Acipenseridae*. Rev. Fish Biol. Fisheries 17:59–76.

Pike, D.A., R.L. Antworth, and J.C. Stiner. 2006. Earlier nesting contributes to shorter nesting seasons for the Loggerhead sea turtle, *Caretta caretta*. Journal of Herpetology, 40(1):91-94.

Poddubny, S.P. and D.L. Galat. 1995. Habitat associations of Upper Volga River fishes: effects of reservoirs. Regulated Rivers: Research and Management 11: 67-84.

Pottle, R., and M.J. Dadswell. 1979. Studies on larval and juvenile shortnose sturgeon (*Acipenser brevirostrum*). Report to the Northeast Utilities Service Company, Hartford, Connecticut.

Pritchard, P.C.H. 1969. Sea turtles of the Guianas. Bull. Fla. State Mus. 13(2): 1-139.

Pritchard, P.C.H. 1997. Evolution, phylogeny, and current status. *In*: Lutz, P.L. and J.A. Musick (ed). The Biology of Sea Turtles. pp 1-28. CRC Press. Boca Raton, Florida.

Quattro, J.M., T.W. Greig, D.K. Coykendall, B.W. Bowen, and J.D. Baldwin. 2002. Genetic issues in aquatic species management: the shortnose sturgeon (*Acipenser brevirostrum*) in the southeastern United States. Conservation Genetics 3: 155-166.

Ray, G. 1997. Benthic Assemblages of the Padilla Bay National Estuarine Research. Reserve, Mount Vemon, Washington. Washington State Department of Ecology Publication No., Padilla Bay National Estuarine Research Reserve Technical Report No. 21, Mount Vernon, Washington. 91pp.

Renaud, M.L. 1995. Movements and submergence patterns of Kemp's ridley turtles (*Lepidochelys kempii*). Journal of Herpetology 29: 370-374.

Richmond, A. and B. Kynard. 1995. Ontogenetic behavior of shortnose sturgeon. Copeia 1995: 172-182.

Rogers, S.G. and W. Weber. 1994. Occurrence of shortnose sturgeon (*Acipenser brevirostrum*) in the Ogeechee-Canoochee river system, Georgia, during the summer of 1993. Final Report of the United States Army to the Nature Conservancy of Georgia.

Rogers, S.G. and W. Weber. 1995. Status and restoration of Atlantic and shortnose sturgeons in Georgia. Final Report to the National Marine Fisheries Service, Southeast Regional Office, St. Petersburg, Florida.

Rogers, S.G., P.H. Flourney, and W. Weber. 1994. Status and restoration of Atlantic sturgeon in Georgia. Final report to the National Marine Fisheries Service Project NA46F0098-01, -02, -03.

Rosenthal, H. and D.F. Alderdice. 1976. Sublethal effects of environmental stressors, natural and pollutional, on marine fish eggs and larvae. Journal of the Fisheries Research Board of Canada 33: 2047-2065.

Ross, J.P. 1979. Historical decline of loggerhead, ridley, and leatherback sea turtles. *In*: Bjorndal, K.A. (editor), Biology and Conservation of Sea Turtles. pp. 189-195. Smithsonian Institution Press, Washington, D.C. 1995.

Ruelle, R. and K.D. Keenlyne. 1993. Contaminants in Missouri River Pallid Sturgeon. Bulletin of Environmental Contamination and Toxicology 50: 898-906.

Rusert, W., and R. Cummings. 2004. Characteristics of Water-use Control Policies: A Survey of 28 Eastern States. Water Policy Working Paper #2004-001. North Georgia Water Planning and Policy Center, Andrew Young School of Policy Studies, Georgia State University, Atlanta, Georgia, February 2004.

Sæther, B.E., S. Engen, A. Islam, R. McCleery, and C. Perrins. (1998) Environmental stochasticity and extinction risk in a population of a small song bird, the great tit. American Naturalist, 151, 441–450.

Savoy, T. 1991. Sturgeon status in Connecticut Waters. Connecticut Department of Environmental Protection. 43 pp.

SCDNR. 2008. Loggerheadlines. July-December 2008.

Schlosser, I.J. and P.L. Angermeier. 1995. Spatial variations in demographic processes of lotic fishes: conceptual models, empirical evidence, and implications for conservation. Pp 392-401 In: J.L. Nielsen (ed.) Evolution and the Aquatic Ecosystem: Defining Unique Unites in Population Conservation. American Fisheries Society. Bethesda, MD.

Schmid, J.R. and W.N. Witzell. 1997. Age and growth of wild Kemp's ridley turtles (*Lepidochelys kempii*): Cumulative results of tagging studies in Florida. Chelonian Conservation and Biology 2: 532-537.

Schroeder, B.A., and A.M. Foley. 1995. Population studies of marine turtles in Florida Bay. *In* Richardson, J.I. and T. H. Richardson (compilers), Proceedings of the Twelfth Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFSC-361. 117 pp.

Schueller, P., and D.L. Peterson. 2010. Abundance and recruitment of juvenile Atlantic sturgeon in the Altamaha River, Georgia. Transactions of the American Fisheries Society 139: 1526-1535.

Scott, W.B. and E.J. Crossman. 1973. Freshwater fishes of Canada. Fisheries Research Board of Canada Bulletin 184: 966 pp.

Secor, D.H. 1995. Chesapeake Bay Atlantic sturgeon: current status and future recovery. Summary of findings and recommendations from a workshop convened 8 November 1994 at Chesapeake Biological Laboratory. Chesapeake Bay Biological Laboratory, Center for Estuarine and Environmental Studies, University of Maryland System, Solomons, MD.

Secor, D.H. 2002. Atlantic sturgeon fisheries and stock abundances during the late nineteenth century. American Fisheries Society Symposium 28: 89-98.

Secor, D.H. and T.E. Gunderson. 1998. Effects of hypoxia and temperature on survival, growth, and respiration of juvenile Atlantic sturgeon (*Acipenser oxyrinchus*). Fishery Bulletin U.S. 96: 603-613.

Secor, D.H. and E.J. Niklitschek. 2001. Hypoxia and sturgeons. Chesapeake Biological Laboratory Technical Report Series-Number TS-314-01-CBL. 26 pp.

Secor, D.H. and E.J. Niklitschek. 2003. Sensitivity of sturgeons to environmental hypoxia: physiological and ecological evidence. Pp 61-78 In: Fish Physiology, Toxicology, and Water Quality – Proceedings of the Sixth International Symposium, La Paz, Mexico, January 22-26, 2001. U.S. EPA Office of Research and Development, Ecosystems Research Division, Athens, Georgia.

Secor, D. H. and J. R. Waldman. 1999. Historical abundance of Delaware Bay Atlantic sturgeon and potential rate of recovery. American Fisheries Society Symposium 23: 203-216.

Secor, D., P. Anders, V.W. Webster, and D. Dixon. 2002. Can we study sturgeon to extinction? What we do and don't know about the conservation of North American sturgeon. Pages 3-9. In: V.W. Webster et al. (eds.) Biology, management, and protection of North American sturgeon, Symposium 28. American Fisheries Society, Bethesda, Maryland

Shaver, D.J. 1991. Feeding ecology of wild and head-started Kemp's ridley sea turtles in south Texas waters. Journal of Herpetology. Vol. 23, 1991.

Shaver, D.J. 1994. Relative abundance, temporal patterns, and growth of sea turtles at the Mansfield Channel, Texas. Journal of Herpetology 28: 491-497.

Shoop, C., T. Doty and N. Bray. 1982. A characterization of marine mammals and turtles in the mid- and north-Atlantic areas of the U.S. outer continental shelf: Final Report, December 1982. Univ. Rhode Island, Kingston.

Simberloff, D. 1988. The contribution of population and community biology to conservation science. Annual Review of Ecology and Systematics 19: 473-511.

Sindermann, C.J. 1994. Quantitative effects of pollution on marine and anadromous fish populations. NOAA Technical Memorandum NMFS-F/NEC-104, National Marine Fisheries Service, Woods Hole, Massachusetts.

Smith, T.I.J. 1985. The fishery, biology, and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. Environmental Biology of Fishes 14:61-72.

Smith, T.I.J. and J.P. Clugston. 1997. Status and management of Atlantic sturgeon, *Acipenser oxyrinchus*, in North America. Environmental Biology of Fishes 48: 335-346.

Smith, T.I.J., E.K. Dingley, and E.E. Marchette. 1980. Induced spawning and culture of Atlantic sturgeon. Progressive Fish Culturist 42:147-151.

Smith, T.I.J., D.E. Marchette, and R.A. Smiley. 1982. Life history, ecology, culture and management of Atlantic sturgeon, *Acipenser oxyrhynchus*, Mitchill, in South Carolina. South Carolina Wildlife and Marine Resources. Resources Department, Final Report to U.S. Fish and Wildlife Service Project AFS-9. 75 p.

Smith, T.I.J., D.E. Marchette, and G.F. Ulrich. 1984. The Atlantic sturgeon fishery in South Carolina. North American Journal of Fisheries Management 4: 164-176.

Smith, T.I.J., E. Kennedy and M.R. Collins. 1992. Identification of critical habitat requirements of shortnose sturgeon in South Carolina. Final Report to USFWS. Atlanta, Georgia.

Smith, T.I.J., M.R. Collins, and E.Kennedy. 1993. Identification of critical habitat requirements of shortnose sturgeon in South Carolina. Final Report Project AFS-17, USFWS. Atlanta, GA. 97 pp.

Smith, T. I. J., M.C. Collins, W.C. Post, and J.W. McCord. 2002. Stock enhancement of shortnose sturgeon: a case study. Pages 31–44 in W. Van Winkle, P. J. Anders, D.H. Secor, and D. A. Dixon, editors. Biology, management, and protection of North American sturgeon. American Fisheries Society, Symposium 28, Bethesda, Maryland.

Soule, M.E. 1986. Conservation biology: the science of scarcity and diversity. Sinauer Associates, Sunderland, Massachusetts.

Spencer, D., and L.B. Muzekari. 2002. Source Water Assessment Plans Across State Lines Beaufort Jasper Water & Sewer Authority and the City of Savannah. Presented at the 2002 South Carolina Environmental Conference.

Spotila, J.R., A.E. Dunham, A.J. Leslie, A.C. Steyermark, P.T. Plotkin, and F.V. Paladino. 1996. Worldwide population decline of *Dermochelys coriacea*: are leatherback turtles going extinct? Chel. Conserv. Biol. 2(2): 209-222.

Stabenau, E.K. and K.R. Vietti. 1999. Physiological effects of short-term submergence of loggerhead sea turtles, *Caretta caretta*, in TED-equipped commercial fishing nets. Final Report to National Marine Fisheries Service, Pascagoula Laboratory, Pascagoula, Mississippi.

Standora, E.A., S.J. Morreale, A. Bolten, M.D. Eberle, J.M. Edbauer, T.S. Ryder, and K.L. Williams. 1993. Diving behavior, daily movements, and homing of loggerhead turtles (*Caretta caretta*) at Cape Canaveral, Florida. March and April 1993. Contr. Report to COE.

Stevenson, J.C. and M.S. Kearney. In press. Impacts of global climate change and sea level rise on tidal wetlands. In: B.R. Silliman, M.D. Bertness and D. Strong (eds.), Anthropogenic modification of North American salt marshes. Berkeley, CA: University of California Press.

Stevenson, J.C. and D.H. Secor. 1999. Age determination and growth of Hudson River Atlantic sturgeon, *Acipenser oxyrinchus*. Fishery Bulletin 97:153-166.

Swingle, M., S. Barco, T. Pitchford, W. McLellan and D.A. Pabst. 1993. The occurrence of foraging juvenile humpback whales (*Megaptera novaeangliae*) in Virginia Coastal Waters. Marine Mammal Science. 9(3):309-315.

Taubert, B.D. 1980. Reproduction of the shortnose sturgeon (*Acipenser brevirostrum*) in Holyoke Pool, Connecticut River, Massachusetts. Copeia 1: 114-117.

Taubert. B.D. and M.J. Dadswell. 1980. Description of some larval shortnose sturgeon (*Acipenser brevirostrum*) from the Holyoke Pool, Connecticut River, Massachusetts, U.S.A. and the Saint John River, New Brunswick, Canada. Canadian Journal of Zoology 58: 1125-1128.

TEWG (Turtle Expert Working Group). 1998. An Assessment of the Kemp's ridley sea turtle (*Lepidochelys kempii*) and loggerhead (*Caretta caretta*) sea turtle populations in the western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-409. 96 pp.

TEWG (Turtle Expert Working Group). 2000. Assessment update for the Kemp's ridley and loggerhead sea turtle populations in the Western North Atlantic. U.S. Department of Commerce, NOAA Technical Memorandum NMFS-SEFSC-444. 115 pp.

TEWG (Turtle Expert Working Group). 2007. An Assessment of the Leatherback Turtle Population in the Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-555, 116p.

TEWG (Turtle Expert Working Group). 2009. An Assessment of the Loggerhead Turtle Population in the Western North Atlantic Ocean. NOAA Technical Memorandum NMFS-SEFSC-575, 131p.

Thomas, C.D. 1990. Environmental fluctuations and extinction – single species. Theoretical Population Biology 27: 1-26.

Thomas, C.D. 1994. Extinction, colonization, and metapopulations: environmental tracking by rare species. Conservation Biology 8: 373-378.

Tillman, M. 2000. Internal memorandum, dated July 18, 2000, from M. Tillman (NMFS-Southwest Fisheries Science Center) to R. McInnis (NMFS-Southwest Regional Office).

USACE. 2011. Sea Turtle Data Warehouse. http://el.erdc.usace.army.mil/seaturtles/.

USDOI (U.S. Department of Interior). 1973. Threatened wildlife of the United States. Resource Publication 114, March 1973.

USFWS (U.S. Fish and Wildlife Service). 1993. Pallid Sturgeon Recovery Plan. U.S. Fish and Wildlife Service, Bismarck, North Dakota. 55 pp.

USFWS. 2000. Report on the Mexico/United States of America Population Restoration Project for the Kemp's ridley sea turtle, *Lepidochelys kempii*, on the coasts of Tamaulipas and Veracruz, Mexico.

USFWS and NMFS. 1992. Recovery Plan for the Kemp's ridley sea turtle (*Lepidochelys kempii*). U.S. Fish and Wildlife Service, Washington, DC.

USFWS and NMFS. 1998. Consultation Handbook: Procedures for conducting consultation and conference activities under section 7 of the Endangered Species Act.

USFWS, NMFS, and SCDNR. 2001. Santee-Cooper Basin Diadromous Fish Passage Restoration Plan. 72 pp.

van Dam, R.P., and C.E. Diez. 1998. Home range of immature hawksbill turtles (*Eretmochelys imbricata*) at two Caribbean islands. J. Exp. Mar. Biol. Ecol. 220:15-24.

Van Den Avyle, M. J. 1984. Species profile: Life histories and environmental requirements of coastal fishes and invertebrates (South Atlantic): Atlantic sturgeon. U.S. Fish and Wildlife Service Report No. FWS/OBS-82/11.25, and U. S. Army Corps of Engineers Report No. TR EL-82-4, Washington, D.C.

Vanderlaan, A.S.M and C.T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. Marine Mammal Science 23(1):144-156.

Van Dolah, R.F., D.R. Calder, F.W. Stapor, Jr., R.H. Dunlap, and C.R. Richter. 1979 Atlantic Intracoastal Waterway environmental studies at Sewee Bay and North Edisto River. South Carolina Marine Resources Center Technical Report No. 39. South Carolina Wildlife and Marine Resources Department, Charleston, SC.

Van Dolah, R.F., D.R. Calder, and D.M. Knott. 1984. Effects of dredging and open water disposal on benthic macroinvertebrates in a South Carolina estuary. Estuaries 7:28-37.

Van Eenennaam, J.P., S.I. Doroshov, G.P. Moberg, J.G. Watson, D.S. Moore, and J. Linares. 1996. Reproductive conditions of the Atlantic sturgeon (*Acipenser oxyrhichus*) in the Hudson River. Estuaries 19: 769-777.

Varanasi, U. 1992. Chemical contaminants and their effects on living marine resources. Pp 59-71 In: R.H. Stroud (ed.) Stemming the Tide of Coastal Fish Habitat Loss. Proceedings of the Symposium on Conservation of Fish Habitat, Baltimore, Maryland. Marine Recreational Fisheries Number 14. National Coalition for Marine Conservation, Inc., Savannah, Georgia.

Vargo, S., P. Lutz, D. Odell, E. van Vleet, and G. Bossart. 1986. The effects of oil on marine turtles. Final Report, Vol. 2. Prepared for Mineral Management Services, U.S. Department of Interior. OCS Study MMS 86-0070

Vecsei, P. and D. Peterson. 2004. Sturgeon ecomorphology: A descriptive approach. Pp 103-133 In: G.T.O. LeBreton et al. (eds.) Sturgeons and Paddlefishes of North America. Kluwer Academic, Netherlands.

Vladykov, V. D. and J. R. Greely. 1963. Order Acipenseroidei. In: Fishes of Western North Atlantic. Sears Foundation. Marine Research, Yale Univ. 1630 pp.

von Westernhagen, H., H. Rosenthal, V. Dethlefsen, W. Ernst, U. Harms, and P.D. Hansen. 1981. Bioaccumulating substances and reproductive success in Baltic flounder *Platichthys flesus*. Aquatic Toxicology 1:85-99.

Waldman, J.R., J.T. Hart, and I. Wirgin. 1996. Stock composition of the New York Bight Atlantic sturgeon fishery based on analysis of mitochondrial DNA. Trans. Am. Fish. Soc. 125:364–371.

Waldman, J.R., C. Grunwald, J. Stabile, and I. Wirgin. 2002. Impacts of life history and biogeography on the genetic stock structure of Atlantic sturgeon *Acipenser oxyrinchus oxyrinchus*, Gulf sturgeon *A. oxyrinchus desotoi*, and shortnose sturgeon *A. brevirostrum*. Journal of Applied Ichthyology 18: 509-518.

Wallace, B.P., S.S. Heppell, R.L. Lewison, S. Kelez, and L.B. Crowder. 2008. Impacts of fisheries bycatch on loggerhead turtles worldwide inferred from reproductive value analyses. Journal of Applied Ecology 45:1076–1085.

Walsh, M.G., M.B. Bain, T. Squires Jr., J.R. Waldman, and I. Wirgin. 2001. Morphological and genetic variation among shortnose sturgeon *Acipenser brevirostrum* from adjacent and distant rivers. Estuaries 24: 41-48.

Wang, Y.L. F.P. Binkowski and S.I. Doroshov. 1985. Effect of temperature on early development of white and lake sturgeon, *Acipenser transmontanus* and *A. fulvescens*. Environmental Biology of Fishes 14: 43-50.

Weber, W. 1996. Population size and habitat use of shortnose sturgeon, *Acipenser brevirostrum,* in the Ogeechee River system, Georgia. MSc. Thesis. University of Georgia, Athens, Georgia.

Weber, W., C.A. Jennings, and S.G. Rogers. 1999. Population size and movement patterns of shortnose sturgeon in the Ogeechee River system, Georgia. Proceedings of the annual conference of the Southeastern Association of Fish and Wildlife Agencies. 52: 18-28.

Weishampel, J.F., D.A. Bagley, and L.M. Ehrhart. 2004. Earlier nesting by loggerhead sea turtles following sea surface warming. Global Change Biology, 10:1424-1427

Welcomme, R.L. 1995. Relationships between fisheries and the integrity of river systems. Regulated Rivers: Research and Management 11: 121-136.

Wershoven, J.L. and R.W. Wershoven. 1992. Juvenile green turtles in their nearshore habitat of Broward County, Florida: a five year review. *In* Salmon M. and J. Wyneken (compilers), Proceedings of the Eleventh Annual Workshop on Sea Turtle Biology and Conservation, NOAA Technical Memorandum NMFS-SEFC-302: 121-123.

Wiley, D.N., R. A. Asmutis, T.D. Pitchford, and D.P. Gannon. 1995. Stranding and mortalities of humpback whales, *Megaptera novaeangliae*, in the mid-Atlantic and southeast United States, 1985-1992. Fishery Bull. 93:196-205.

Williamson, M. 1981. Island populations. Oxford University Press, Oxford.

Winger, P. V., P. J. Lasier, D. H. White, J. T. Seginak. 2000. Effects of contaminants in dredge material from the lower Savannah River. Archives of Environmental Contamination and Toxicology 38: 128-136.

Wirgin, I., J.R. Waldman, J. Rosko, R. Gross, M. Collins, S.G. Rogers, and J. Stabile. 2000. Genetic structure of Atlantic sturgeon populations based on mitochondrial DNA control region sequences. Transactions of the American Fisheries Society 129: 476-486.

Wirgin, I., J. Waldman, J. Stabile, B. Lubinski and T. King. 2002. Comparison of mitochondrial DNA control region sequence and microsatellite DNA analyses in estimating population structure and gene flow rates in Atlantic sturgeon (*Acipenser oxyrinchus*). Journal of Applied Ichthyology 18: 313-219.

Wirgin, I., C. Grunwald, E. Carlson, J. Stabile, D.L. Peterson, and J. Waldman. 2005. Range-wide population structure of shortnose sturgeon *Acipenser brevirostrum* based on sequence analysis of the mitochondrial DNA control region. Estuaries 28(3): 406-421.

Wirgin, I., C. Grunwald, J. Stabile and J.R. Waldman. 2009. Delineation of discrete population segments of shortnose sturgeon *Acipenser brevirostrum* based on mitochondrial DNA control region sequence analysis. Conserv. Genet. doi: 10.1007/s10592-009-9840-1.

Witherington, B., P. Kubilis, B. Brost, and A. Meylan. 2009. Decreasing annual nest counts in a globally important loggerhead sea turtle population. Ecological Applications 19:30–54.

Witzell, W.N. 2002. Immature Atlantic loggerhead turtles (*Caretta caretta*): suggested changes to the life history model. Herpetological Review 33(4): 266-269.

Witzell, W.N. and J.R. Schmid. 2005. Diet of immature Kemp's ridley turtles (*Lepidochelys kempi*) from Gullivan Bay, Ten Thousand Islands, southwest Florida. Bull. Mar. Sci. 77: 191-199.

Wooley, C.M. and E.J. Crateau. 1985. Movement, microhabitat exploitation and management of Gulf of Mexico sturgeon, Apalachicola River, Florida. North Am. J. Fish Manage. 5, 590–605.

Wueringer, B.E., L. Squire, Jr., S.M. Kajiura, N.S. Hart, and S.P. Collin. 2012. The Function of the Sawfish's Saw. Current Biology (22) 5.

Wyneken, J., K. Blair, S. Epperly, J. Vaughan, and L. Crowder. 2004. Surprising sex ratios in west Atlantic loggerhead hatchlings – an unexpected pattern. Poster presentation at the 2004 International Sea Turtle Symposium in San Jose, Costa Rica.

Young, J.R., T.B. Hoff, W.P. Dey, and J.G. Hoff. 1988. Management recommendations for a Hudson River Atlantic sturgeon fishery based on an age-structured population model. Fisheries Research in the Hudson River. State of University of New York Press, Albany, New York. 353 p.

Ziegeweid, J.R., C.A. Jennings, and D.L. Peterson. 2008a. Thermal maxima for juvenile shortnose sturgeon acclimated to different temperatures. Environmental Biology of Fishes 82: 299-307.

Ziegeweid, J.R., C.A. Jennings, D.L. Peterson, and M.C. Black. 2008b. Effects of salinity, temperature, and weight on the survival of young-of-year shortnose sturgeon. Environmental Biology of Fishes 137:1490-1499.

Zurita, J.C., R. Herrera, A. Arenas, M.E. Torres, C. Calderon, L. Gomez, J.C. Alvarado, and R. Villavicencio. 2003. Nesting loggerhead and green sea turtles in Quintana Roo, Mexico. Pp. 125-127 *In*: Proceedings of the Twenty-Second Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum. NMFS SEFSC.

Zwinenberg. A.J. 1977. Kemp's ridley, *Lepidochelys kempii* (Garman, 1880), undoubtedly the most endangered marine turtle today (with notes on the current status of *Lepidochelys olivacea*). Bulletin of the Maryland Herpetological Society, 13(3): 170-192.

Summary of Environmental Impacts and Mitigation

ENVIRONMENTAL RESOURCE	**2011 EA IMPACTS**	**MITIGATION**
AIR QUALITY	Temporary and localized decrease in air quality from construction-equipment emissions. (p. 66-67)	None
ARCHAEOLOGY/ CULTURAL RESOURCES	No historic or cultural properties identified in BA-F2 or the placement area. Two possible archaeological resources were identified in Rehandling Area 2, this area was reduced to exclude these 2 anomalies. Within BA-F2, the survey results included corrupted data in line 155 (Attachment 3)	Due to corrupted data line 155, no dredging will be authorized in the buffer area noted in the figure (Attachment 3). Implement dredge with positioning equipment. Implement chance finds clause.
BEACH COMPATIBILITY / COASTAL HABITAT	Stabilization of eroding beach and dune habitats (p.71-73). Meets multiple FDEP requirements.	Implement best construction practices, beach sampling, and beach profiling requirements of Florida DEP Consistency Certification.
BENTHIC RESOURCES	Short-term and localized reduction in beach and borrow area infaunal invertebrates. (p. 61)	None
BIRDS AND WILDLIFE	Short and localized disruption of feeding, foraging, and nesting during construction activities. (p. 70) Increased stabilization of roosting habitat for birds.	Coordination with the USFWS for the piping plover resulted in several conservation measures as outlined in the correspondence (Attachment 4).
FISH AND ESSENTIAL FISH HABITAT (EFH)	Short and localized disturbance of surf zone habitat and fish during pump-out and sand re-distribution from elevated noise and turbidity levels, as well as burial. Short and	Impacts are repetitive of those which occurred in the 2005/2006 nourishment cycle and have been previously mitigated for. Therefore, no additional mitigation was required (Attachment 5).

	localized disturbance of borrow area habitat from disturbance. Possibility of entrainment. Direct burial of nearshore hardbottom (p. 69)	
NON-THREATENED MARINE MAMMALS	Some temporary avoidance may occur due to noise (p. 65-66). Temporary elevated turbidity near borrow area (p. 60). Very low probability of strike impact (p. 64).	Implement FDEP Water Quality monitoring requirements.
PHYSICAL OCEANOGRAPHY	Not evaluated due to the relative distance of the borrow area from the shoreline. No impacts are expected.	Conduct pre- and post-construction bathymetric surveys to monitor physical changes in borrow area per FDEP and BOEM requirements
RECREATION AND TOURISM	Significantly increased area for beach recreation; temporary and localized visual and noise impact from construction activities.	Publish Local Notice to Mariners.
THREATENED AND ENDANGERED SPECIES	Potential increase of nesting habitat for sea turtles; potential disturbance and take of sea turtles, small tooth sawfish, and related to beach scarping, lighting, dredge entrainment, and vessel strike. (p. 80-82)	Implement terms and conditions of 1) NMFS 2012 BO (Attachment 6), 2) NMFS 2003 GRBO (as amended through Revision 2, dated January 9, 2007), 3) comply with the NMFS' *Sea Turtle and Smalltooth Sawfish Construction Conditions* and 4) FWS Statewide Programmatic Biological Opinion (SPBO) for sea turtles and manatees. Coordination with the USFWS for the piping plover resulted in several conservation measures as outlined in the correspondence (Attachment 4). Lighting restrictions per FDEP permit
WATER QUALITY	Temporary, minor impacts (elevated turbidity, decreased dissolved oxygen) in placement area. (	Monitoring water quality conditions per requirements of Florida DEP Consistency Certification. Implement marine pollution control plan. Ensure compliance with U.S. Coast Guard requirements and U.S. EPA Vessel General Permit as applicable.

CUMULATIVE IMPACTS	Restore beach and ecosystem and prevent property damage	See mitigation for Fish and Essential Fish Habitat