PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Submitted to:
Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
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SECTION 1
INTRODUCTION

This document presents proposed revisions to the Point Arguello Unit Platform Hidalgo Development and Production Plan (DPP). The proposed revisions to the DPP cover development and production of oil and gas from the western half of the northwestern quarter (NW/4) of Federal Lease OCS-P 0450 (western half NW/4 of lease OCS-P 0450).

The DPP revisions have been developed to address all of the requirements specified in 30 CFR 550.241 that would be applicable to this DPP revision. The applicable DPP accompanying information, as required by 30 CFR 550.242, can be found in the accompanying information document, which has been submitted with this DPP revision document.

The proposal is to develop the oil and gas reserves from western half NW/4 of lease OCS-P 0450 from platform Hidalgo, which is one of the existing Point Arguello Platforms. The location of the western half NW/4 of lease OCS-P 0450 and the Point Arguello Platforms are shown in Figure 1.

Plains Exploration and Production Company (PXP), operator of the Point Arguello Unit and the western half NW/4 of lease OCS-P 0450, is proposing to drill development wells from Platform Hidalgo. The proposal is to drill a maximum of two (2) wells for development of the reserves on the western half NW/4 of lease OCS-P 0450. The eastern half of lease OCS-P 0450 is already being developed as part of the Point Arguello Unit.

As part of these DPP revisions, PXP has identified the approximate bottom hole locations of the two wells, which will be used to develop the western half NW/4 of lease OCS-P 0450. All of the wells will be directionally drilled using existing well slots on the platforms. The drill rig that will be used will be similar in size to drill rigs that have been used on the Point Arguello platforms in the past.

Drilling of the wells on the western half NW/4 of lease OCS-P 0450 is expected to last about six months with production lasting about six years. It is expected that drilling and production from the western half NW/4 of lease OCS-P 0450 will be completed within the remaining productive life of the Point Arguello platforms. This will maximize the reserves recovered in the shortest period of time and within the environmental time frame and footprint of the existing Point Arguello facilities as actually foreseen and evaluated in the Point Arguello/Southern Santa Maria Basin Area Study EIS/EIR.

All the oil production from the western half NW/4 of lease OCS-P 0450 will be combined with Point Arguello Unit and Rocky Point oil and transported to Gaviota in the existing PAPCO oil pipeline. From Gaviota, combined oil production from the western half NW/4 of lease OCS-P 0450 the Point Arguello Unit and Rocky Point will be transported to refineries in the existing All America Pipeline.

Gas from the western half NW/4 of lease OCS-P 0450 will be combined with Point Arguello Unit and Rocky Point gas on the production platforms. The combined gas will be sweetened for platform use or sale to shore via the existing PANGL pipeline. Gas volumes in excess of platform needs or sales to shore will be used for gas lift or injected into the producing reservoir for later recovery. Sweetened gas that is sent to shore, will be used as fuel for the PAPCO turbine generators that produce steam for oil heating and electricity for facility use and sales to the grid.

In brief, the development and production of the oil and gas reserves from the western half NW/4 of lease OCS-P 0450 will be accomplished by drilling extended reach wells from Platform Hidalgo using existing well slots, pipelines, equipment and facilities. Development of the reserves from the western half NW/4 of lease OCS-P 0450 will be accomplished within the expected lifetime of the Point Arguello Field. The total number of development wells for Point Arguello, Rocky Point, and the western half NW/4 of lease OCS-P 0450 will be significantly less than the number of wells originally anticipated and approved for the Point Arguello Unit alone.

In developing the reserves on the western half NW/4 of lease OCS-P 0450, PXP will comply with all lease stipulations for lease OCS-P 0450.

This DPP revision document has been divided into six (6) major sections that include the following.

- ***Introduction –*** Provides a brief overview of the proposed DPP revisions, background information on the western half NW/4 of lease OCS-P 0450 and a guide to the DPP revision document structure and content.

- ***Proposed Development Schedule for the Western Half NW/4 of lease OCS-P 0450 –*** Presents the proposed development and production schedule for the western half NW/4 of lease OCS-P 0450.

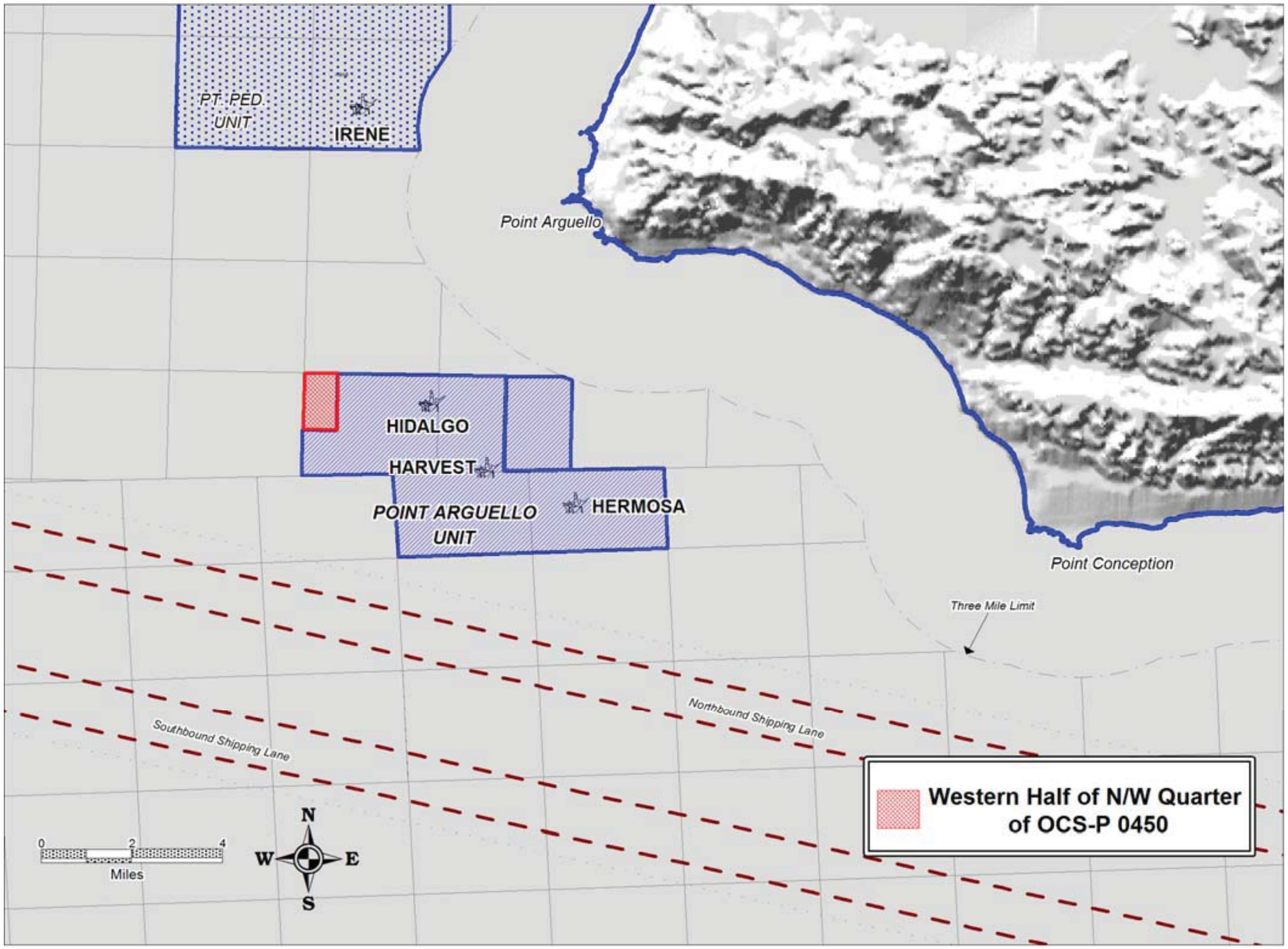
- ***Platform Site and Construction –*** Discusses the fact that there is no new platform sites or construction, other than development wells, associated with development of the oil and gas reserves from the western half NW/4 of lease OCS-P 0450.

- ***Drilling Facilities –*** Provides an overview on the drilling facilities that will be required to develop the reserves from the western half NW/4 of lease OCS-P 0450.

- ***Platform Facilities –*** Contains a description of the oil and gas facilities on the three existing Point Arguello platforms and the possible changes that may be needed to accommodate oil and gas production from the western half NW/4 of lease OCS-P 0450. Oil and gas production from the western half NW/4 of lease OCS-P 0450 will use the existing oil and gas production facilities on each of the platforms. The only new equipment that may be required for development of the western half NW/4 of lease OCS-P 0450 is an oil stabilizer on Platform Hidalgo. It may also be necessary to make some minor modifications to an existing vessel on Platform Hidalgo to accommodate the increased oil production.

– ***Pipeline System –*** Discusses the fact that the existing oil and gas pipeline system for Point Arguello will not have to be modified to handle the oil and gas production from the western half NW/4 of lease OCS-P 0450.

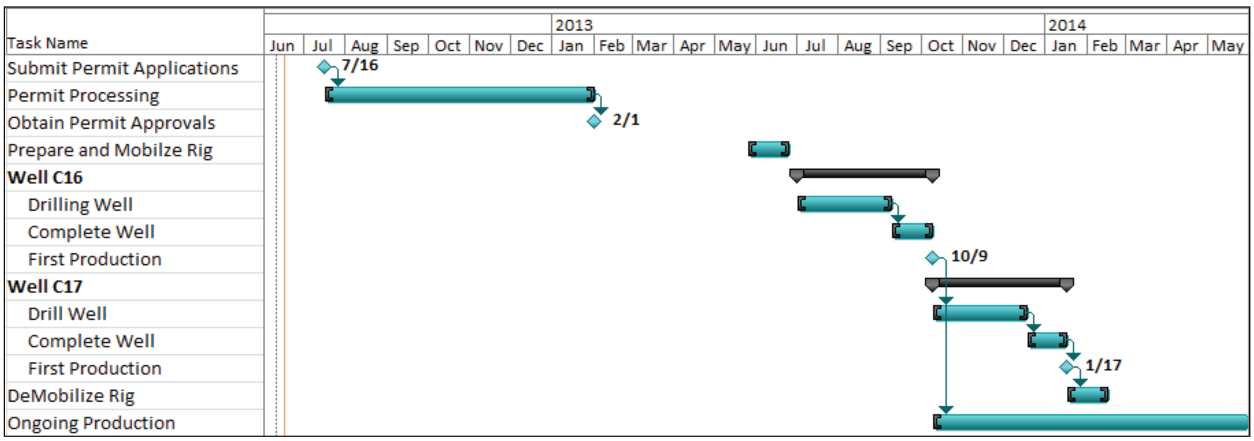
Figure 1 **Location of Western Half NW/4 of lease OCS-P 0450**



SECTION 2
PROPOSED DEVELOPMENT SCHEDULE FOR THE WESTERN HALF NW/4 OF LEASE OCS-P 0450

Figure 2 shows the projected schedule for development of the western half NW/4 of lease OCS-P 0450.

Figure 2 Estimated Development Schedule for the Western Half NW/4 of lease OCS-P 0450



The schedule shows drilling of the first well beginning in the 2nd quarter of 2013, with production beginning two to three months after the start of the first well. The drilling program should be complete by the end of the 1st quarter of 2014, assuming permit approvals allow drilling to commence as stated above.

Based on current data, PXP has estimated that two (2) wells will be needed to develop the western half NW/4 of lease OCS-P 0450.
Currently, PXP does not anticipate the drilling of any specific service wells for water disposal or gas injection. The existing water disposal capability of the Point Arguello platforms is assessed as adequate for the combined development.

When Point Arguello Unit production has no further economic potential, the field abandonment process will likely commence, unless other uses for the platforms arise and are approved.

SECTION 3
PLATFORM SITE AND CONSTRUCTION

There are no revisions needed to this section of the Hidalgo DPP to address the proposed development of the western half NW/4 of lease OCS-P 0450. No new platforms will need to be built to develop the western half NW/4 of lease OCS-P 0450. All of the development will occur from Platform Hidalgo using existing well slots and the oil and gas handling equipment on the Point Arguello platforms.

SECTION 4
DRILLING FACILITIES

4.1 Introduction

This section discusses the drilling facilities that are proposed for the development of the reserves from the western half NW/4 of lease OCS-P 0450. It is anticipated that two (2) wells will be drilled for development of the western half NW/4 of lease OCS-P 0450. The wells on the western half NW/4 of lease OCS-P 0450 will be drilled from the Platform Hidalgo.

A new well into the western half NW/4 of lease OCS-P 0450 will require approximately 70 days to drill and 30 days to complete (i.e., 100 days total). Drilling duration will depend on the directional program undertaken and the mechanical condition of the hole. The total drilling program is expected to last six months using one rig.

The remainder of this section provides information on the drilling rig, well construction, and drilling safety.

4.2 Drilling Rig

The exact drill rig that will be used for development of the western half NW/4 of lease OCS-P 0450 will not be known until a drilling contract is in place, and will depend on the availability of rigs. The typical specifications of a rig used for this type of drilling operation are shown in Table 1.

A portable drilling rig will be transported to the platform and placed on the upper main deck (i.e., drill deck). The drilling rig will be mounted on a rail system that allows for access to all well slots. The drilling rig will be electrically powered and equipped with a SCR system that will distribute power to individual rig components (e.g., drawworks, mud pumps, and rotary table). Some minor modifications to the transformer capacity and electrical distribution system may be necessary but no major modifications to any of the platforms are anticipated for installation of the drilling rig.

The platform turbine generators will provide the electrical power that is required for the drilling operations. If the platform generators are unable to supply adequate power to the rig, then the rig turbine generator or diesel generators will be used. Additional electrical loads include operation of the drilling rig, cranes, production equipment, oil/water separators, and water injection pumps. Standby diesel generators will be used to power the rig and mud pumps during emergencies, should electrical power fail on the platform.

Table 1 Typical Drill Rig Specifications

Item	Specification
Clear Working Height of Mast (feet)	165
Base Width of Mast (feet)	25
Hook Load-Gross Nominal Capacity (pounds)	1,333,000
Maximum wind load (mile per hour)	125
Motors (hp)	
– Drawworks	2 at 1,000
– Mud Pumps	2 at 1,600
– Rotary Table	1 at 1,000
– Top Drive	1 at 1,000

4.3 Well Construction

New development wells for the western half NW/4 of lease OCS-P 0450 will be completed in the Monterey Formation and will range in measured depth (MD) of 18,000 to approximately 20,000 feet, depending on bottom hole displacement from the platform. The well construction discussion presented below is what is anticipated for a typical well. The exact casing/cementing design will be approved by BSEE through the Application for Permit to Drill process required for each proposed well.

As needed a 24-inch structural conductor will set at approximately 460 feet below the ocean floor. The 18-5/8-inch conductor casing will be set at approximately 1,221 feet below the ocean floor. Once set, the conductor casing will be cemented with a sufficient amount to cause a return of cement to the mud line. Measured depths of conductor casing will vary because of directional drilling programs and mechanical and borehole conditions, as well as formation pressures and fracture gradients. Installation of casings will follow BSEE requirements.

The 13-3/8-inch surface casing will be set at approximately 2,835 feet below the mud line. The surface casing will be cemented with a sufficient amount to cause a return of cement to the mud line. Measured depths of surface casing will vary slightly because of directional drilling programs and mechanical and borehole conditions, as well as formation pressures and fracture gradients.

The 9-5/8-inch intermediate casing will be set above the reservoir zone to be produced and cemented. The top of the cement would be approximately 10,000 feet MD. The plan is not to bring the cement cap of the intermediate casing string above the shoe of the surface casing. Using this approach, the intermediate casing string can be cut and pulled to accommodate future redrills. The intermediate casing will be set at a total measured depth of approximately 16,980 feet, depending on the geological top of the Monterey zone. All zones which contain oil or gas shall be fully protected by casing and cement.

An 8-1/2-inch hole will be drilled from below the intermediate casing to total depth of 20,000 feet. If the zones are productive, then a 7-inch casing will be run to total depth and hung from the intermediate casing, with a minimum of 150 feet of overlap inside the intermediate casing. The 7-inch casing will be cemented in place. The hydrocarbon bearing zones across the cemented 7-inch casing will be jet perforated using tubing or wireline conveyed perforating tools.

Production tubing will be lowered near 100 feet above the 7-inch liner top. The 4-1/2-inch tubing string may consist of a 9-5/8-inch casing packer, gas lift mandrels, chemical injection mandrel, and surface controlled subsurface safety valve to allow delivery of hydrocarbons to the wellhead. It is possible electric submersible pumps may also be used to lift the production.

4.4 Drilling Safety

Drilling operations will be performed with "good engineering practices" using conventional drilling equipment and procedures, and will be in compliance with the current Bureau of Safety and Environmental Enforcement (BSEE) regulations. BSEE-approved drilling operations and procedures will not be altered without the prior approval of BSEE.

A blowout prevention (BOP) system will be used to shut-in the well in the event of an emergency and is designed to prevent any well fluids from entering the environment. The system is composed of an annular preventer, blind ram, two sets of pipe rams, choke and kill lines, and a diverter system. Attachment A, which is part of the supporting information document, contains a detailed description of a typical well control program.

Lifesaving and fire suppression systems are maintained on the platforms at all times. Evacuation and fire drills will be held on a regular basis to ensure familiarity with the equipment and with the responsibilities of individual crew members. Drills will be coordinated with production personnel to maximize effectiveness.

The platforms are equipped with Class 1 U.S. Coast Guard-approved navigational aids. All navigational components are connected to an emergency standby generator. Sufficient numbers of escape boats, PPE, and life jackets are readily accessible in the event evacuation of the platform becomes necessary.

For all phases of the drilling operation, lighting will be in place around the rig and its components (including the derrick), the cementing unit and its components, and the drill deck itself. All electrical work for the lighting will be Class 1, Division 1 or Division 2, as outlined by API Recommended Practices 500 or API Recommended Practices 505.

Crane lifts will be conducted from attendant supply and crew boats only when meteorological, oceanic, and logistical conditions allow for safe operations. All crane operators will be trained according to the API Recommended Practice 2D. The cranes will have regularly scheduled maintenance with pre-use daily, monthly, quarterly, and annual review of specific components according to manufacturer's recommendations and as provided for in APR RP 2D. The cranes are inspected and certified annually.

The drilling or production supervisor on a regular basis—to promote safety awareness—will conduct safety meetings. These meetings will cover a wide variety of subjects relating to the current activity (e.g., cementing, well control familiarity, wireline work, etc.).

The Point Arguello Field has an approved H_2S Contingency Plan, which will be used during the drilling program. The reader is referred to this BSEE-approved plan for further information.

SECTION 5
PLATFORM FACILITIES

This section provides some general information on the three Point Arguello drilling and production platforms, and a brief discussion of the oil and gas handling operations. The discussion presented below represents what may occur with the development of the western half NW/4 of lease OCS-P 0450.

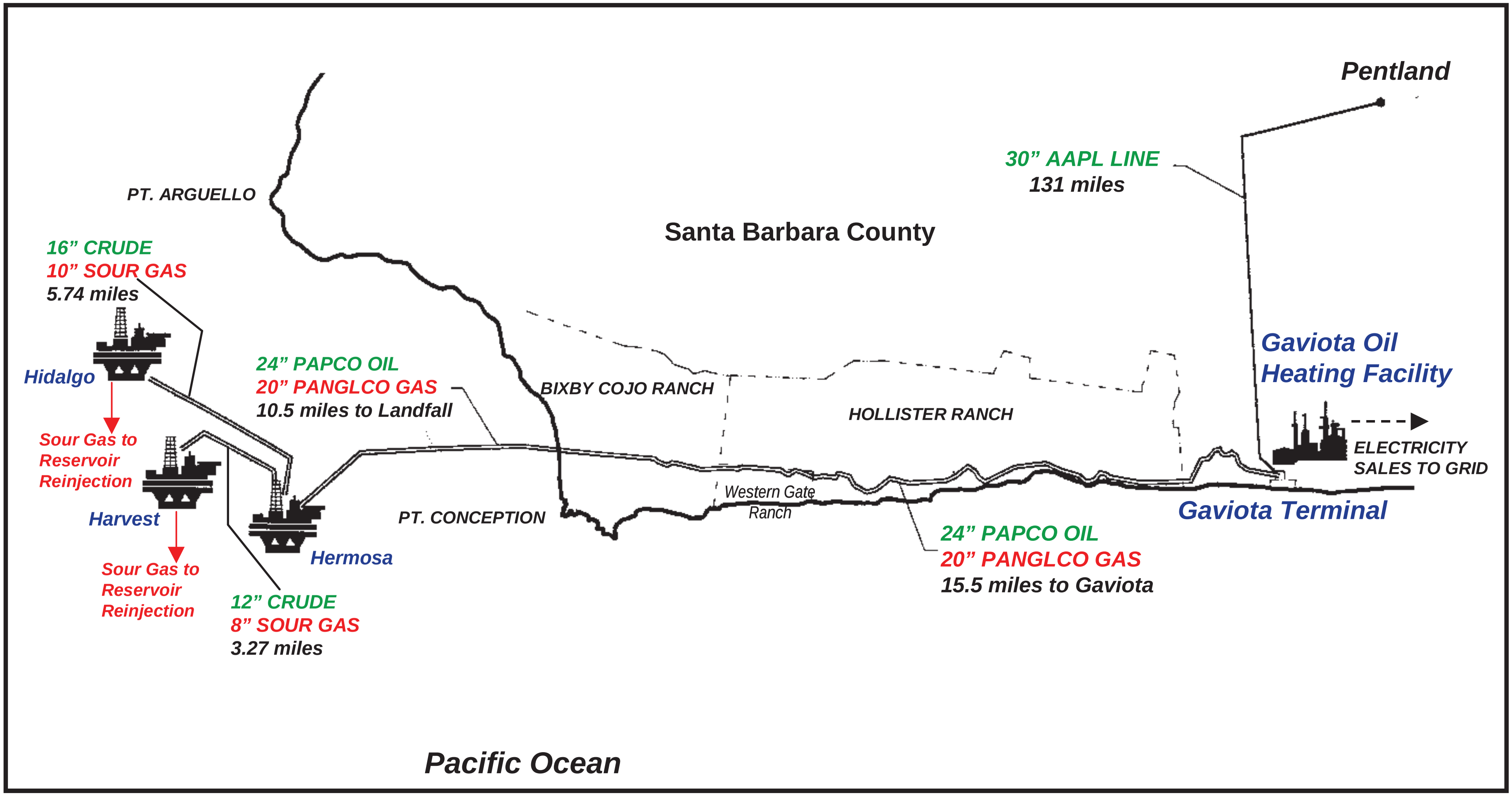
5.1 Introduction

The proposed project is to develop the western half NW/4 of lease OCS-P 0450, which is currently held by production, from Platform Hidalgo, which is part of the Point Arguello Unit. No new offshore structures will be needed to develop the western half NW/4 of lease OCS-P 0450. It is anticipated that wells will be drilled from Platform Hidalgo using extended reach drilling (ERD) technology. Table 2 provides general information on the three existing Point Arguello platforms. Figure 3 shows the location of the platforms.

Table 2 General Data for the Point Arguello Platforms

Platform/Location	Harvest	Hermosa	Hidalgo
Water Depth at Platform, ft	675	603	430
Platform location	Lambert Zone 6(ft) X=664,622 Y=866,189	Lambert Zone 6(ft) X=674,783 Y=860,793	UTM 10(m) X=710,975 Y=3,819,245
Well Slots	50	48	56
Number of Well Slots Used for Arguello Field and Rocky Point Development	18	17	21
Projected Number of Well Slots Needed for the western half NW/4 of lease OCS-P 0450 Development	0	0	2
Projected Future Well Slots for Point Arguello and Rocky Point	6	6	6
Well Slots Available for Future Development	25	25	27
OCS Lease	P 0315	P 0316	P 0450

Figure 3 **Location of Point Arguello Field Platforms and Pipelines**



Platforms Harvest and Hermosa were installed in 1985 and Platform Hidalgo was installed in 1986. All three platforms were installed for the development and production of Point Arguello Field oil and gas reserves. Production peaked from the Point Arguello Field in August 1993 at 89 mbd of oil and 27 mmscfd of gas. In August 1998 production from the field was approximately 23 mbd of oil and 3.6 mmscfd of gas. In 2003, a DPP revision was approved to allow the development of the eastern half of lease OCS-P 0451 (i.e., Rocky Point). Current oil production from the Point Arguello Field is approximately 5.0 mbd.

5.2 Platform Hermosa

Platform Hermosa is a three-deck structure that consists of a production/wellhead deck, a drilling deck, and a main deck. The height of the production/wellhead deck above mean lower low water (MLLW) approximates 51 feet. The main deck is approximately 79 feet above MLLW. Currently the only drilling that is occurring on Platform Hermosa is for well workovers and sidetracks. In the future new wells may be drilled into the Point Arguello reservoir depending upon economics and other factors.

The producing wells are arranged in rows, with short flowlines connecting each well to the manifold system. Each well is equipped with a “Christmas tree” valve stack. The manifold system allows production to be switched between production and test separators. A portion of the produced gas is used for gas lift on the production wells. All wells are equipped with down-hole surface controlled subsurface safety valves. These subsurface valves are hydraulically controlled from the platform. The wells are manifolded so the wells can be isolated for individual testing through one of three test separators.

No changes to the oil and gas processing operations on Platform Hermosa are anticipated with the development of the western half NW/4 of lease OCS-P 0450. During normal operations all the wells are ‘pooled’ into 3-phase production separator trains, which separate the produced oil, gas, and free water. A cleanup separator is provided for the initial unloading of wells to remove mud and water until the well is flowing sufficiently to be diverted into the normal production separators. After leaving the production separators, the oil is dehydrated and stabilized. Double-case positive displacement type meters equipped with a mechanical prover then meter the dry, stabilized oil. From the meters the oil is boosted to pipeline discharge pressures by electric motor-driven screw-type pumps. The oil is then sent ashore via the PAPCO pipeline to the Gaviota Facility.

A major portion of the produced gas is sweetened and then either used as fuel in the offshore turbines, as gas lift gas, or sent ashore via the PANGL pipeline as sales gas. The sales gas is used in the Gaviota plant turbines to generate electricity and steam to heat the crude oil stream to shipping specifications. The electricity is used by the facility, with any surplus sold to the grid. Produced gas that is not used as fuel or for sales is dehydrated and injected back into the reservoir at either Platform Harvest or Hidalgo with some gas injection taking place at Hermosa.

The fuel and sales gas is processed through an amine system to remove the hydrogen sulfide (H_2S). The H_2S removed from the fuel gas is injected back into formation via a separate acid gas injection system or the gas that is sent to Platforms Harvest or Hidalgo for injection.

Additional information on this project is provided in Gaviota Facility section of the DPP Revision Supporting Information Document.

The produced water is treated on the platform and then discharged into the ocean in accordance with the platform's NPDES permit, or injected back into the reservoir.

The electrical power requirements for Platform Hermosa are met using two 2,800-kW and one 3,100 kW gas-turbine generators. There is also one 2,800-kW stand-by turbine generator that is currently limited by APCD permit to operate 550 hours per year. The turbines have diesel alternate fuel capability, but are primarily run on produced gas.

The platform houses two vapor compression desalination units (one standby) to produce fresh water from seawater for potable and demineralized water systems.

The process heating requirements are obtained from the cogeneration system. This system utilizes the waste heat recovered from the turbine drivers on the electrical generators.

Utility and instrument air is provided at 125 psi and 100 psi, respectively. Two air compressors that are electrically driven provide the utility and instrument air.

Two salt water systems are used for fire suppression, washdown, process cooling, desalination, etc. The fire suppression system is designed for 2,500 gpm and is a diesel-driven system. An additional system supplies 3,000 gpm for other platform requirements. This system's pumps are electrically driven.

A packaged sewage treatment unit is used to process the sewage from the crew quarters building. The effluent from this unit complies with United States Coast Guard and EPA NPDES requirements.

5.3 Platform Harvest

Harvest is a four-deck platform consisting of a cellar deck, lower main production deck, and upper main production deck. The total overall height of the structure, including the drilling rig, is approximately 296 feet above MLLW. Currently the only drilling that is occurring on Platform Harvest is for well workovers and sidetracks. In the future new wells may be drilled into the Point Arguello reservoir depending upon economics and other factors.

The producing wells are arranged in two 5x5 wellbays, with short flowlines connecting each well to the manifold system. Each well is equipped with a "Christmas tree" valve stack. The manifold system allows production to be switched between production and test separators. A portion of the produced gas is used for gas lift on the production wells. All wells are equipped with down-hole surface controlled subsurface safety valves. These subsurface valves are hydraulically controlled from the platform. The wells are manifolded so the wells can be isolated for individual testing through one of three test separators.

No changes to the oil and gas processing operations on Platform Harvest would occur with the development of the western half NW/4 of lease OCS-P 0450. During normal operations, all the wells are 'pooled' into 3-phase production separator trains, which separate the produced oil, gas, and free water. A cleanup separator is provided for the initial unloading of wells to remove mud and water until the well is flowing sufficiently to be diverted into the normal production separators. After leaving the production separators, the oil is dehydrated, stabilized, metered, and shipped to Platform Hermosa via an inter-platform pipeline. At Platform Hermosa, the oil uses the PAPCO pipeline for shipment to the Gaviota Facility.

The produced gas is dehydrated on the platform, and then injected back into the reservoir. Produced gas can also be imported from Platforms Hermosa and Hidalgo for injection back into the reservoir at Platform Harvest. In addition, gas from Platform Harvest can be sent to Platform Hermosa for sweetening and then on to the Gaviota Facility as sales gas. Another option is to route gas from Platform Harvest to Platform Hidalgo for injection into the light pool reservoir. Under this scenario, gas is routed to Platform Hermosa and then on to Platform Hidalgo via the intra-platform gas pipelines.

A portion of the produced gas is used for fuel in the offshore turbines, which provide the platform's electrical power and heat needs. The gas used as fuel is processed though an amine system to remove the hydrogen sulfide (H_2S). The H_2S removed from the fuel gas is injected back into the gas that is injected back into the reservoir.

The produced water is treated on the platform and then discharged into the ocean in accordance with platform's NPDES permit, or injected back into the reservoir.

Platform Harvest generates the power requirements for drilling and production by using four 3,700-kW gas-fired turbine generators. A fifth 3,700-kW gas turbine generator is installed as a backup, which can operate full time.

The platform has two vapor compression-desalination units to produce fresh water from seawater for potable and demineralized water.

All process-heating requirements are obtained from the cogeneration system via a hot oil circulating system. This system utilizes the waste heat recovered from the turbine drivers on the electrical generators. Utility and instrument air is provided at 100 psi by two electrically driven air compressors.

Salt water systems are used for fire suppression, washdown, process cooling, desalination, etc. The fire suppression system is designed for 3,000 gpm and is a diesel-driven system. An additional system supplies 3,000 gpm for other platform requirements. This system's pumps are electrically driven.

A packaged sewage treatment unit is used to process the sewage from the crew quarters building. The effluent from this unit complies with United States Coast Guard and EPA NPDES requirements.

5.4 Platform Hidalgo

Platform Hidalgo is a three-deck structure that consists of a production/wellhead deck, a drilling deck, and a main deck. The height of the production/wellhead deck above MLLW is 62 feet. The main deck is 95 feet above MLLW. The total overall height of the structure, including the drilling rig approximates 260 feet above MLLW. Currently the only drilling that is occurring on Platform Hidalgo is for well workovers and sidetracks. In the future new wells may be drilled into the Point Arguello reservoir depending upon economics and other factors.

The producing wells are arranged in rows, with short flowlines connecting each well to the manifold system. Each well is equipped with a “Christmas tree” valve stack. The manifold system allows production to be switched between production and test separators. A portion of the produced gas is used for gas lift on the production wells. All wells are equipped with down-hole surface controlled subsurface safety valves. These subsurface valves are hydraulically controlled from the platform. The wells are manifolded so the wells can be isolated for individual testing through one of three test separators.

During normal operations all the wells are ‘pooled’ into 3-phase production separator trains, which separate the produced oil, gas, and free water. A cleanup separator is provided for the initial unloading of wells to remove mud and water until the well is flowing sufficiently to be diverted into the normal production separators. With the current Point Arguello production, the oil undergoes a primary dehydration process on Hidalgo and is then sent to Platform Hermosa via pipeline where it is undergoes additional dehydration and stabilization. With the western half NW/4 of lease OCS-P 0450 project, there may not be enough oil dehydration and stabilization capacity on Platform Hermosa to handle all the production from Platform Hidalgo.

PXP may need to install additional oil dehydration and new stabilization capacity on Platform Hidalgo as part of the western half NW/4 of lease OCS-P 0450 project. This would allow the oil production to be treated on Platform Hidalgo. Implementation of oil stabilization on Platform Hidalgo would require the installation on the platform of a vessel approximately 55.5 feet tall by 42 inches in diameter (tapering to 20 inches in diameter at 36 feet of elevation), and a re-boiler vessel which is 15 feet long by 27 inches in diameter. These vessels would be set upon a small deck extension on the platforms that would be installed on Platform Hidalgo. Minor piping modifications and instrumentation changes would be performed to implement oil stabilization. It is expected that 200 feet of piping would need to be added to Platform Hidalgo.

Installation of the oil stabilization equipment would be conducted utilizing permitted scheduled boat and helicopter trips. Installation of the vessel on Platform Hidalgo would be done in conjunction with routine maintenance that is required on the platforms and other installations proposed as part of this project. During tie-ins, the platforms may be shut-in for a brief period of time to allow for safe working conditions as needed. Installation would proceed as follows:

1. All prefabricated vessels and pipe spools and installation equipment will be sent to the platforms on scheduled boat runs and staged in the work areas.

2. Scaffolding equipment will then be installed in overhead hot work and bolt-up areas.

3. As a safety measure, during certain tie-ins, hot work or bolt-up, the platform may need to be shutdown depending on the particular work involved. After shutdown, affected process areas may need to be blown down, purged with nitrogen and then isolated for hot work or bolt-up. During shutdown, the platform generators are required to run on diesel because fuel gas processing systems are also shut-in; however, such will be done in compliance with existing air permits for the platform.

4. Hot work to make field welds will be conducted for installation of pipe spools and supports, and installation of the wing deck extensions on Platform Hidalgo (18' x 20'). During this shut down, other required repairs and maintenance will also be done.

5. Upon completion of the installations, affected vessels will be pressure tested and the platform will be put on production.

6. Equipment and personnel will be demobilized on regularly scheduled boat or helicopter trips.

With the addition and modification of this equipment the produced oil will be ‘pooled’ into 3-phase production separator trains, which separate the produced oil, gas, and free water. After leaving the production separators, the oil will be dehydrated, stabilized, metered and shipped to Platform Hermosa via an intra-platform pipeline. At Platform Hermosa, the oil uses the PAPCO pipeline for shipment to the Gaviota Facility.

The produced gas is dehydrated on the platform and used for gas lift purposes or shipped to Platform Hermosa via an inter-platform pipeline, where it is co-mingled with the Hermosa gas and then sent to Platform Harvest for injection back into the reservoir. Another option that is available is to inject the produced gas at Platform Hidalgo into the Light Pool reservoir, using existing compressors on the platform. Additional gas from Platforms Hermosa and Harvest can also be routed to Platform Hidalgo for injection into the Light Pool reservoir using the intra-platform gas pipelines. Injection of gas into the Light Pool reservoir at Platform Hidalgo does not require any new equipment. All of the injection is done with existing compressors.

A portion of the produced gas is used for fuel in the offshore turbines, which provide the platform’s electrical power and heat needs. The gas used as fuel is processed through an amine system to remove the hydrogen sulfide (H_2S). The H_2S removed from the fuel gas is injected back into the gas that is injected back into the reservoir.

The produced water is treated on the platform and then discharged into the ocean in accordance with platform’s NPDES permit, or injected back into the reservoir.

The electrical power requirements for Platform Hidalgo are met using two 2,800-kW and one 3,100 kW gas-turbine generators. There is also one 2,800-kW stand-by turbine generator that is currently limited by APCD permit to operate 550 hours per year. The turbines have diesel alternate fuel capability but are primarily run on produced gas.

Utility and instrument air is provided at 125 psi and 100 psi, respectively. Two air compressors that are electrically driven provide the utility and instrument air.

Two salt water systems are used for fire suppression, washdown, process cooling, desalination, etc. The fire suppression system is designed for 2,500 gpm and is a diesel-driven system. An additional system supplies 3,000 gpm for other platform requirements. This system's pumps are electrically driven.

A packaged sewage treatment unit is used to process the sewage from the crew quarters building. The effluent from this unit complies with United States Coast Guard and EPA NPDES requirements.

5.5 Platform Safety Systems

Safety systems can be broadly classified as those devices and practices that safeguard life and limb, the environment, and equipment. They relate specifically to good design practices, personnel training and operational and emergency modes. The safety features on the Point Arguello Platforms include:

- Fire detection and suppression systems;
- Navigational aids;
- Corrosion control program;
- H_2S contingency plans;
- Emergency power and lighting;
- Communication facilities;
- Escape and lifesaving equipment; and
- Oil Spill Response Plan.

Each of these safety systems is briefly described below.

Fire Detection and Suppression Systems
Each platform has a firewater system that uses a combination of electrically and diesel-driven fire water pumps. The firewater is distributed to hose reel stations, monitor nozzles, and deluge systems appropriately located around the platform. Additional fire fighting systems on the platforms include items such as fixed fire protection system for gas turbine generators and portable fire extinguishers appropriately located around the platform. The fire detection system makes extensive use of smoke detectors and flame detectors to provide early warning in the event of any fire. Pushbutton fire alarm stations are located around the platforms for use by platform personnel.

Navigational Aids
Each of the platforms has been painted in accordance with United States Coast Guard (USCG) recommendations to increase the visibility of the platforms to ocean vessels. In addition, the platforms are equipped with navigational lights and fog horns in accordance with Federal requirements. The USCG has also established a 500 meter exclusion zone around the platforms.

Platform Harvest is equipped with a vessel tracking system that allows personnel on the platform to monitor vessel movement in the area of the Point Arguello Platforms.

Corrosion Control Program
Corrosion on the platforms is controlled using corrosion-resistant coatings on the top-side structures and equipment. For the underwater portions of the jackets, a sacrificial anode system is used to control corrosion. A number of the vessels and piping on the platforms have an internal coating to control corrosion. In addition, a corrosion inhibitor program is used to provide additional corrosion control.

H_2S Contingency Plan
H_2S contingency plans have been developed that detail emergency plan to be followed when encountering formations that contain H_2S while drilling. The platforms are equipped with self-contained breathing apparatus for all working crews and supervisors. Spare air bottles with refill capability are also available. Releases of H_2S can also occur during production operations from accidents involving the gas wells or gas processing equipment. H_2S sensors and alarms are located at the intake for the air ventilation system, and in other process areas where concentrations of H_2S are likely to occur. In these areas, H_2S sensors have both visible and audible alarms set to activate if a concentration of 10 ppm is reached.

Emergency Power and Lighting
Emergency AC power for lighting, communications equipment, hazard detection systems, quarters, controls, and minor utility systems is provided by a battery-backup uninterruptable power supply. Battery-powered emergency lighting units are installed in several areas of the platform to illuminate critical escape or facility work areas. Battery chargers and battery systems are provided for aids to navigation, communications, general alarm systems, generator starting, electrical switchgear control, and control and monitoring systems.

Communication Facilities
Intra-platform communication utilizes hardwired speakers and handsets. Additionally, there are hand-held portable radios for operational communication. For external communication with crew boats, supply boats, helicopters, shore bases, etc., there is a wide-area radio system for each platform, as well as a microwave system to provide telephone service and circuits for the pipeline leak detection system and onshore emergency shutdown system. .In addition to the above each platform has intrinsically safe cell phones for emergency use.

Escape and Life-Saving Equipment
Each platform is equipped with United States Coast Guard-approved escape capsules or life boats, plus an adequate number of life preservers, life floats, ring life buoys, first aid kits, litters, and other lifesaving appliances as required by 33 CFR144.

Oil Spill Response Plan
An Oil Spill Response Plan for each platform, which describes the measures that will be taken in the event of an oil spill and the personnel and equipment available to implement spill containment and cleanup procedures, has been developed and submitted to and approved by the BSEE. The basic procedure for a spill is to immediately ensure personnel safety, stop the

pollutant flow, begin the containment and cleanup procedure, and contact designated company personnel and Government agencies. The platform personnel would conduct the initial response activity. For a spill beyond the capability of the platform personnel and equipment, the primary sources of assistance would be the industry-sponsored spill containment cooperative—Clean Seas.

As per CFR 550.250, development of the western half of OCS-P 0450 would increase the maximum oil spill volume of Platforms Hidalgo and from associated pipelines (with a small increase along the Hermosa pipeline due to increase flow rates). The increase due to a well blowout would only last during the drilling period, when the wells are flowing under natural pressure. After the drilling period, the maximum oil spill volume for Platform Hidalgo would be slightly more than their current values due to increased flow rates.

PXP determined that the blow-out related worst-case discharge estimated flow rate for the proposed well (C-16) is 1,190 barrels of oil per day, which could result in a blow-out total volume of 132,090 barrels of oil released over a period of 111 days, the time it is estimated to mobilize a drilling rig and drill a relief well. The calculations for determining the worst-case discharge flow rate are contained in the attachments.

In a blowout scenario surface intervention would be attempted unless safety concerns ruled this option out (e.g. uncontrolled fire, unstable structure, etc.). Assuming there were no safety impediments that would prevent surface intervention, PXP would attempt to intervene as allowed by the situation. Based on this blowout scenario there is no functioning BOPE, therefore, if possible, the BOPE would be repaired to a functioning state, or a functioning BOPE would be positioned over the well and secured so that the well could be shut-in. This could be done in a number of ways depending upon the situation. All possible methods and attempts would be evaluated and attempted based upon the situation and as assessment of safety.

Primary response to the above scenario will be by the Clean Seas oil spill response vessel (OSRV) normally located in the Point Arguello/Point Pedernales area. Additional response resources maintained by Clean Seas that would be mobilized to the release are also listed in Appendix C of the Core Oil Spill Response Plan.

Aerial surveillance operations will be initiated as soon as possible. The primary Clean Seas OSRV will initiate site entry procedures prior to beginning the deployment of containment equipment and recovery operations to contain the initial spill volumes. Secondary response equipment mobilized to the spill location will be the Clean Seas OSRVs and smaller spill response vessels normally located in the Santa Barbara Channel, these additional response resources can be onsite and deployed within 3 - 6 hours.

Clean Seas has Environmental Response Contractor Agreements (ERCA), Master Time Charters, Memorandums of Understanding and Master Rental Agreements with specialized subcontractors who can assist in the operations of equipment deployment and recovery of spilled oil. These subcontractors can be mobilized and on scene within approximately 4 – 24 hours. Metson Marine Services (Ventura) provides approximately 15 employees who operate Clean Seas' vessels and barges. Patriot Environmental Services (Ventura) and National Response Corporation Environmental Services (Ventura) provide personnel and equipment for shoreline protection, beach cleanup, waste disposal, and DECON services. Southern California Ships Services (Terminal Island) provides licensed crew and vessels for booming and logistical support. Aspen Helicopter Inc. (Oxnard) provides personnel and equipment for surveillance and dispersant application. T & T Trucking (Ventura) provides material handling and transfer services. Maritime Logistics (Creston) and Castignola Tug Company (Santa Barbara) provides vessels for Vessels of Opportunity Skimming Systems (VOSS). Harley Marine Services (Port of L.A.) provides tank barges for the temporary storage of recovered oil. Harley Marine Services has approximately 202,000 barrels of tank barge storage capacity, with single tank barge storage capacity ranging between 23,000 – 60,000 barrels. Rain for Rent (Santa Paula) and Baker Tanks (Seal Beach) provide temporary on-shore storage equipment. TracTide Marine (Port Hueneme) provides approximately 8,800 barrels of onshore storage equipment as well as decontamination and vessel fueling services. General Petroleum (Port of L.A.) provides tug boat services. Associated Pacific (Morro Bay) provides crane barges and tug boat services as well. In addition, Clean Seas maintains agreements with local fisherman who participate in Clean Seas' Fisherman's Oil Spill Response Team (FORT) program. The current program consists of approximately 80 personnel and 40 vessels. Members of the FORT attend annual 8 hour Hazwoper training.

The Clean Seas "Ocean Keeper" (15,000 bbl. oil spill response barge) will most likely be staged in Cojo Bay for the temporary storage of oil recovered by the skimming vessels. It would take approximately 24 hours for the Ocean Keeper to be transferred to Cojo Bay. Transfer pump resources listed in Appendix C of the Core Oil Spill Response Plan will be used to offload the skimming vessels into the Ocean Keeper. Given the worst case discharge volume referenced in the scenario above, the Ocean Keeper can store 100% of the daily discharge volume for 12 days. The three OSRV's can store 100% of the daily discharge volume for another 2 days. In the meantime additional barge/s, between 23,000 - 60,000 barrel capacities, will be contracted through Harley Marine Services and brought on scene within approximately 7 days. These additional subcontracted temporary storage resources will facilitate the remainder of the storage requirement if the well were to continue releasing for the above referenced 111 days.

Additional information on the oil spill equipment and response can be found in the Oil Spill Response Plans that have been submitted to and approved by BSEE.

5.6 Oil and Gas Handling and Metering for the Western Half NW/4 of lease OCS-P 0450 Oil and Gas

The produced oil, gas, and water will typically be separated on each platform. The oil, gas, and water volumes will be prorated back to the individual wells based on periodic well test information for each well.

Some of the produced gas will be processed to remove sulfur and burned on the platform for pilot gas, purge gas, or for fuel to generate electricity or for gas lift purposes. Some produced gas will be sweetened offshore and sold to the onshore facility. This sales stream will be used to generate electricity for use at the onshore facility and sold to the grid. Gas which is sold to the onshore facility will be measured as described in the approved metering and allocation plan. This gas will be subject to OCS royalties. The remaining produced gas that is not used for pilot, purge, flare, or fuel will be injected on either Hidalgo or Harvest. The gas which goes to fuel, sales, flare, pilot, purge, or injection will be prorated back proportionally to each Point Arguello and western half NW/4 of lease OCS-P 0450 well based on well test data.

The oil stream at Hidalgo will be metered for allocation purposes and then pumped to Hermosa where it will be commingled with Hermosa production, stabilized and metered (for allocation and leak detection only) before it is sent to shore. The commingled Hermosa and Hidalgo oil stream is then metered; the difference between the Hidalgo meter reading and the Hidalgo/Hermosa commingled meter reading is equal to the Hermosa production. Harvest production is also passed through a meter for allocation purposes prior to leaving the platform. The Harvest oil stream commingles with the combined Hidalgo/Hermosa stream after metering.

The wells on each platform for the western half NW/4 of lease OCS-P 0450 and Point Arguello will be allocated their fair share of production based on the well test information applied to the allocation meter readings. At the Gaviota Facility the oil will pass through another meter (leak detection only), be heated, and finally pass through a lease automatic custody transfer (LACT) meter. This LACT is the meter that determines the volumes of oil that are subject to royalty.

When and if development of the western half NW/4 of lease OCS-P 0450 is approved, changes to the Measurement and Allocation Plan in effect for Point Arguello will be needed, which would include a full description of the measurement points, allocation procedures, and products subject to royalty for the western half NW/4 of lease OCS-P 0450 production streams.

SECTION 6
PIPELINE SYSTEM

There are no revisions needed to this section of the three existing DPPs for the Point Arguello Field Development to address the proposed development of the western half NW/4 of lease OCS-P 0450. No new pipelines will need to be built to develop the western half NW/4 of lease OCS-P 0450. The existing intra-platform pipelines and the pipelines from Platform Hermosa to the Gaviota Facility will be used to move the co-mingled production from the western half NW/4 of lease OCS-P 0450 and Point Arguello field.

PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume
Gaviota Facilities

Submitted to:
Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
Plains Exploration and Production Company

October 2012

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1.0 Introduction

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As part of the Point Arguello Project, PXP has received approval from the County of Santa Barbara for a Final Development Permit modification to allow the shipment of sweet gas from Platform Hermosa to the Gaviota Facility. If the western half NW/4 of OCS-P 0450 is developed some of the gas may be sold to the Gaviota Facility for use as fuel.

This application for revisions to the Hidalgo DPP is for development of the western half NW/4 of OCS-P 0450, which is held by production, and is not part of the OCS leases covered by the Norton decision.

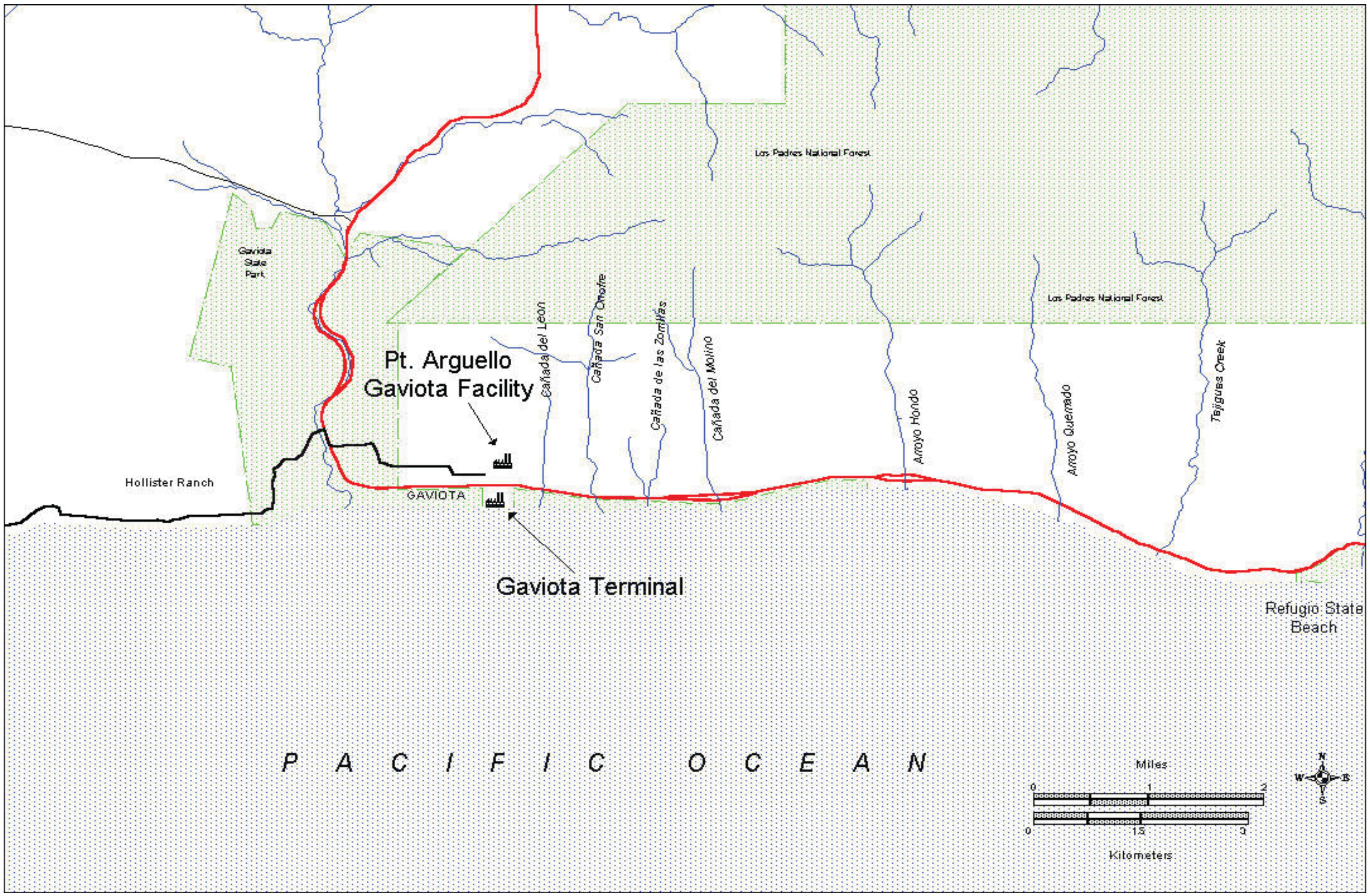
This section of the document provides a general description of the oil heating and metering operations that currently occur at the Gaviota Facilities. The section also contains information on the Sales Gas Project. This information is included as part of the DPP accompanying information to assist the reader in understanding the activities that occur at the Gaviota Facilities, since the production from the western half NW/4 of OCS-P 0450 will use these existing facilities.

2.0 Onshore Oil Handling

The crude oil from the western half NW/4 of OCS-P 0450 and Point Arguello Field will be co-mingled on the platform at the production well head manifold. The co-mingled production is then dehydrated and stabilized offshore before it is pumped to the Gaviota Facility via the PAPCO pipeline. Once the oil reaches the Gaviota Facility it is metered as part of the PAPCO leak detection system.

The oil then passes through a heat exchanger where it is heated to about 125^{O}F using waste heat from the onshore cogeneration units. The oil is then metered at the dry LACTs before being transferred via pipeline to the Gaviota Terminal Company storage tanks located on the south side of Highway 101. From the Gaviota Terminal Company storage tanks the oil is sent to the All American Pipeline for transport to various refining destinations.

Figure 1 **Location of Point Arguello Gaviota Facilities**



The only operations that are occurring at the Gaviota Facility are crude oil metering and heating. Oil processing no longer occurs at the Gaviota Facility. None of the operations at the Gaviota Facility will change with production from the western half NW/4 of OCS-P 0450. No modifications at the Gaviota Facility will be needed to handle the production from the western half NW/4 of OCS-P 0450.

The following oil handling operations occur at the Gaviota Facility.

Pigging Operations. The existing Gaviota oil pig receiver remains in service at the Gaviota Facility. Pig receiver drains are sent to T-25, the oily water tank. The pig receiver vents are routed to the flare.

Metering. LACT metering operations and SCADA/Leak Detection functions continue to operate as they always have.

Heating. The crude oil is heated in heat exchangers using waste heat from the cogeneration units.

Oily Water Handling. All the process drains from the facility are collected in T-25, the oily water tank, where the oil and water are separated. The oil is routed to GTC, and the water is routed to a wastewater disposal system. The T-25 vents are routed to the flare. The oil wastewater from T-25 is sent to a set of filters to remove any solids. The water is then routed to a set of pumps, which are used to inject the water into disposal wells. These wells have been used for the entire life of the Gaviota Facility for handling oily water. The water is injected into an old oil and gas reservoir located near the Gaviota Facility. These injection wells are permitted through the California Division of Oil and Gas.

Power Generation. Currently gas from the Point Arguello Field is used to fuel the cogeneration system, which produces electricity and provides heat for the crude oil and other facility systems.

Other ancillary systems that would continue to be operated at the Gaviota Facility include impoundment basins, utility and instrument air, nitrogen system, desalinization system, fresh water system, firewater system, fuel gas system, sewage treatment system, control room, administration building, and the flare.

3.0 Onshore Gas Handling

The gas plant at the Gaviota Facility ceased operating in October of 1998 when the Point Arguello partners began injecting the gas in to the Point Arguello reservoir. Since that time no produced gas has been sent to the Gaviota Facility from the Point Arguello platforms.

As discussed above, PXP received an FDP modification from the County of Santa Barbara to allow sweet sales gas to be shipped from Platform Hermosa to the Gaviota Facility for use as fuel in the cogeneration system. This project was approved as part of the Point Arguello Project.

The Sales Gas Project was implemented in order to comply with the Bureau of Safety and Environmental Enforcement (BSEE) directive requiring PXP to sell gas from the Point Arguello Unit. The sweet gas is used to fuel up to three of the power generating turbines and to meet the heat needs of the facility. Electricity which is a by product of the generation process is sold to the grid.

The purpose of the Sales Gas Project was to reduce the volume of gas that is being injected back into the Point Arguello reservoir, thereby complying with the BSEE directive to initiate sales gas onshore from the Point Arguello Project. In addition, the project is reducing operating costs by eliminating the need to purchase natural gas from The Gas Company to fuel the turbines. The project also has the ability to provide the electrical grid system with up to 10 megawatts (MW) of power. The amount of power sold to the grid is dependent on the amount of gas available for shipment from the Point Arguello Platforms.

With the Sales Gas Project, produced gas from the Point Arguello Field is sweetened (i.e., the H_2S and some of the CO_2 removed from the gas) on Platform Hermosa. The sweet gas is then shipped via the Point Arguello Natural Gas Pipeline (PANGL) to the Gaviota Facility, where the gas is metered and fed to the turbines to generate electrical power and heat. The Sales Gas Project was implemented with only minor piping changes at the Gaviota Facility.

Incoming gas to Gaviota is routed through V-1000 to allow liquids to drop out, in the unlikely event that liquids form in the gas during transport through the PANGL pipeline.

The gas from V-1000 is routed through existing piping to an existing meter run on the outlet of V-1000 that has been modified for royalty accounting purposes. The gas is then routed through the two existing gas plant fuel meters for distribution. One of the meters measures the gas going to the cogeneration unit and other existing users on the lower level of the plant, such as the facility flare. The second meter is used to measure gas that is sent to the upper level of the plant.

In the unlikely event that liquids drop out of the gas during transport through the PANGL pipeline, they accumulate in V-1000. The accumulated liquids from V-1000 are drained to Relief Knock Out Drum V-50. Liquids from V-50 are then pumped to T-2. The vapors from V-50 go to the flare. The liquids from T-2 are handled in the existing oil or wastewater disposal systems.

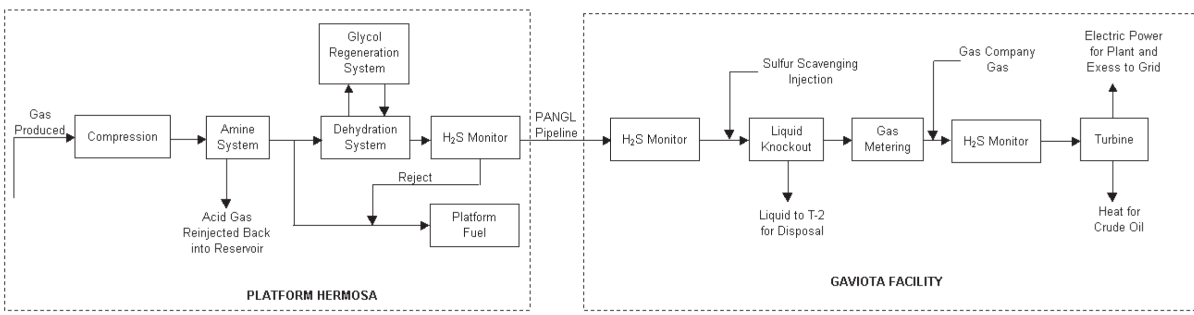
The Gaviota Facility has five cogeneration turbines, each one with a nominal capacity of about 3.7 MW. The current electrical load at the Gaviota Facility is about 0.8 MW. Under Phase I of the project approximately 1.15 mmscfd of sweet gas is shipped from Platform

Hermosa to the Gaviota Facility. The electricity generated is used as needed at the Gaviota facilities (approximately 0.8 MW) with the excess being sold to the public utility grid (approximately 2.9 MW). It should be noted that the amount of fuel used and the amount of power generated is dependent on a number of factors such as the BTU content of the fuel, and the atmospheric conditions. Given that these factors will vary with time, the fuel use and electrical power generating numbers presented in this document are on a nominal basis.

The waste heat from the turbine is used to generate steam, which is used at the Gaviota facilities to heat the oil and for other in plant utilities such as the deaerator and flare assist.

Figure 2 shows a simplified block flow diagram of the Point Arguello gas handling system.

Figure 2 Block Flow Diagram of Point Arguello Gas Handling System



In normal operating mode, gas from The Gas Company is replaced by sweet gas from Platform Hermosa. When the turbine is run at a higher load, then excess steam is vented to the atmosphere. With one turbine at full load approximately 14,000 lbs. per hour of steam is vented to atmosphere.

The Gaviota gas system provide for a contingency option to run all turbines with gas purchased from The Gas Company in the event that gas is not available from the offshore platforms. This option allows the Gaviota facilities to continue to operate if problems occur offshore that would prevent the delivery of sweet gas ashore. The operational contingency plan also allows for the venting of steam in the event of a fin-fan cooler system failure.

PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume
Reservoir Evaluation

Submitted to:
Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
Plains Exploration and Production Company

October 2012

Address Inquires To:

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available in the proprietary copies

Reservoir Evaluation Section

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), the information contained in this section is deleted from the public information copy of this submission.

Proprietary

Not for Public Release

PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume
Cementing Program and Muds and Cuttings

Submitted to:
Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
Plains Exploration and Production Company

October 2012

Address Inquires To:

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This application for revisions to the Platform Hidalgo DPP is for development of the western half NW/4 of OCS-P 0450.

1.0 Cementing Program

A cementing system will be used to force cement down the well to seal the annulus between the casing and the hole or between concentric casing strings. The cementing program details are provided in Table 1.

2.0 Mud System

A mud system is used to control well pressure, lubricate the drill pipe and bit, and return drill cuttings to the surface. In addition, muds containing additives not approved by the EPA, or containing concentrations above EPA limits will be taken ashore via boats. Attachment B provides a more detailed description of the mud equipment. Attachment C contains the estimated mud composition for a sample well (C-16).

Mud monitoring equipment will be installed and maintained for all drilling below the 24-inch diameter conductor casing, primarily for the purpose of well control. The equipment includes: sensors, which continuously record mud pit level and flowline flow; alarms at the driller's station will indicate lost circulation displacement volume; and on-bottom kicks.

The trip tank monitors fluid gain or loss from the wellbore while the drill string is being pulled out of the hole.

Table 1 Cementing Program Details C-16

Casing Diameter (in)	Type	Seawater or Fresh	Density (ppg)	Yield, (cft/sack)	Top of Cement[1] (feet) MD	Openhole Excess (%)	Number of Sacks	Blend
24	Lead	Seawater	14.28	1.64	543 (mudline)	100	1,347	Type III + 10% A-10 + 1 ghs FP-6L
18.625	Lead	Seawater	14.2	1.64	0	100	1,068	Type III + 10% A-10 + 1 ghs FP-6L
13.375	Lead	Seawater	12.5	2.28	0	50	1,914	Type III + 10% bwoc BA-90 + 0.75% bwoc EC-1 + 6% bwoc LW-6 + 0.25 lbs/sack Cello Flake + 0.2% bwoc CD-32 + 15 lbs/sack LCM-1 + 0.7% bwoc FL-62 + 1 ghs FP-6L + 0.5% bwoc Sodium Metasilicate + 91.9% Sea Water
13.375	Tail	Seawater	16	1.14	5,000	50	487	Class G + 6 ghs sack R- 21L + 1 ghs FP-6L + 2 ghs ASA-301L + 5 ghs CD-32L + 20 ghs FL-67L + 41.8% Sea Water
9.625	Lead	Seawater	16.0	1.14	10,000	25	2426	Class G + 6 ghs R- 21L + 1 ghs FP-6L + 2 ghs ASA-301L + 5 ghs CD-32L + 20 ghs FL-67L + 41.8% Sea Water
7	Lead	Seawater	13.5	1.29	16,480	29	460	Class G + 8 ghs R-21L + 1 ghs FP-6L + 2 ghs ASA-301L + 5 ghs CD-32L + 20 ghsFL-67L + 68.6% Sea Water

1. *Measured from rig floor. Numbers assume Platform Hidalgo.*

Nomenclature:

ghs – gallons per 100 sacks of cement
cft/sack – cubic feet per sack of cement
A-10 – liquid thixotropic additive
CD-32 – dispersant
Cello – Flake – cellophane flakes for lost circulation
CD-31L – liquid cement dispersant, friction reducer
LCM-1 lost circulation material
R-21L – liquid retarder
FL-67L – liquid fluid loss
ppg – pounds per gallon
FP-6L – liquid foam preventer
BA-90 – liquid free water control and anti setting agent
CD-32L – liquid dispersant
EC-1 – bond improver
FL-62 – fluid loss
LW-6 – microspheres to reduce weight
Sodium Metasilicate – Cement extender
ASA-301L – liquid anti-setting

As is evident by the lengthy production history of Point Arguello Field, it is not expected that any shallow gas will be encountered. Diligent efforts will be maintained to keep the wellbore full of fluid whenever possible.

3.0 Drilling Fluids and Cutting Disposal

The estimated water based cuttings and drilling fluid volumes for C-16 is 19,773 bbls and for C-17 is 19,087 bbls. The information is based on use of an environmentally acceptable water base drilling fluid. All water-based drill cuttings and drilling fluid will be discharged into the ocean in accordance with the current approved NPDES permit assuming they contain concentrations below EPA approved limits. Table 2 provides an estimate of the properties of the water based drilling fluids that will be used for the drilling program.

Table 2 Proposed Water Based Drilling Fluid Properties

Property	Drill Hole Size				
	30"	22"	17 1/2"	12 1/4"	8 1/2"
MW, ppg	8.8 – 10.0	9.0 – 10.5	9.0 – 10.5	9.0 – 10.5	8.8 – 9.0
Plastic Viscosity (cp)	12 - 20	12 - 20	12 - 20	ALAP	ALAP
Fluid Loss (cc 30 min)	NC	<20	<6	4 - 8	4 - 8
Yield Point (lb/100ft2)	20 - 30	20 - 30	15 - 25	10 - 16	10 - 16
Solids Content	<8 LGS	<8 LGS	<8 % LGS	< 5 % LGS	< 5 % LGS
Mud Components	Seawater MI Gel Soda Ash	Seawater MI Gel Soda Ash Polypac Sodium Bicarb	Seawater MI Gel SP101 Soda Ash Polypac Lube167	ULTRAHIB ULTRACAP ULTRAFREE Duovis Polypac M-I BarDefoam X	ULTRAHIB ULTRACAP ULTRAFREE Duovis Polypac M-I Bar Defoam X

ALAP-as low as possible

PXP

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Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume
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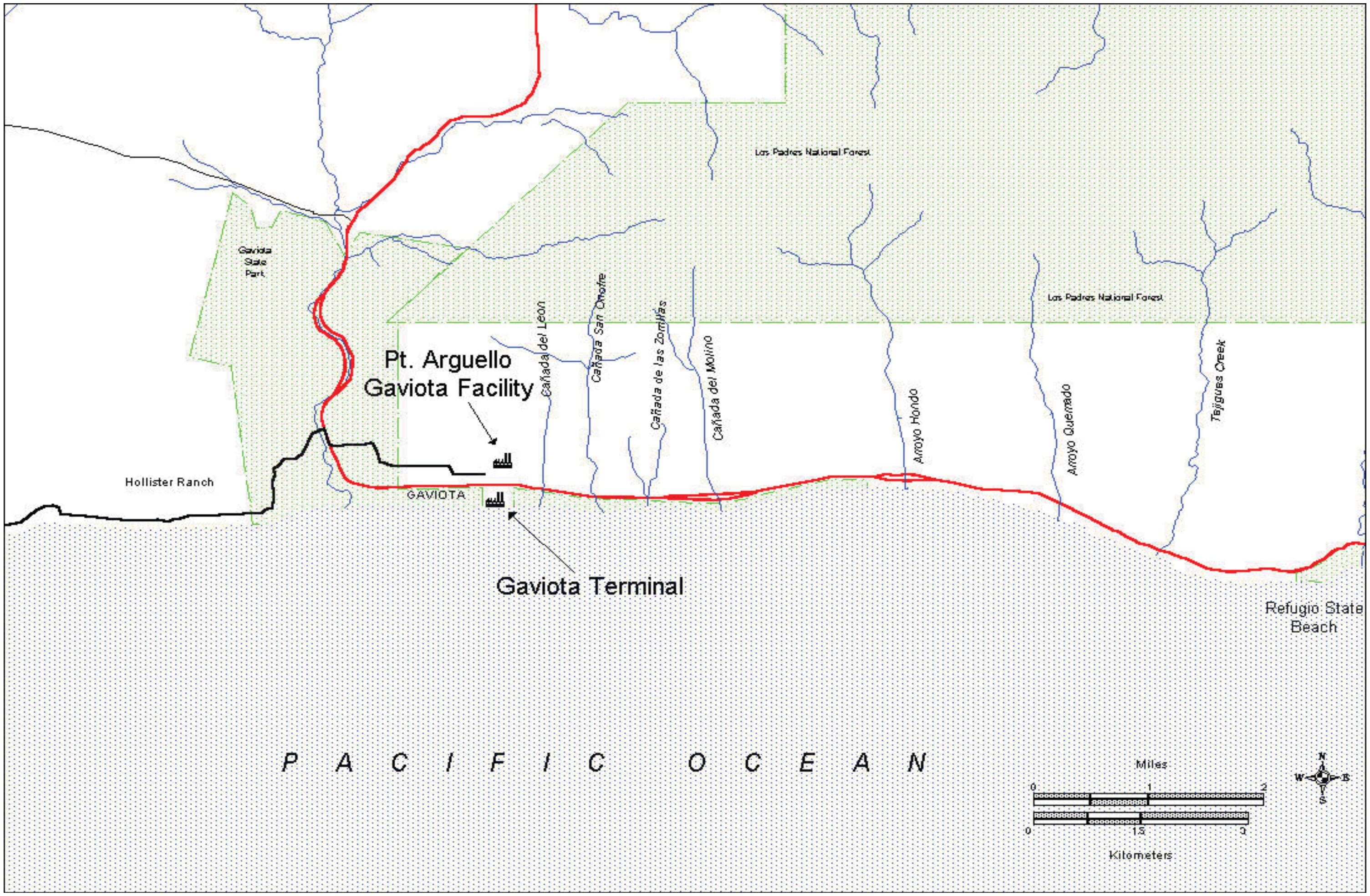
The oil then passes through a heat exchanger where it is heated to about 125^{O}F using waste heat from the onshore cogeneration units. The oil is then metered at the dry LACTs before being transferred via pipeline to the Gaviota Terminal Company storage tanks located on the south side of Highway 101. From the Gaviota Terminal Company storage tanks the oil is sent to the All American Pipeline for transport to various refining destinations.

Figure 1 Location of Point Arguello Gaviota Facilities



The only operations that are occurring at the Gaviota Facility are crude oil metering and heating. Oil processing no longer occurs at the Gaviota Facility. None of the operations at the Gaviota Facility will change with production from the western half NW/4 of OCS-P 0450. No modifications at the Gaviota Facility will be needed to handle the production from the western half NW/4 of OCS-P 0450.

The following oil handling operations occur at the Gaviota Facility.

Pigging Operations. The existing Gaviota oil pig receiver remains in service at the Gaviota Facility. Pig receiver drains are sent to T-25, the oily water tank. The pig receiver vents are routed to the flare.

Metering. LACT metering operations and SCADA/Leak Detection functions continue to operate as they always have.

Heating. The crude oil is heated in heat exchangers using waste heat from the cogeneration units.

Oily Water Handling. All the process drains from the facility are collected in T-25, the oily water tank, where the oil and water are separated. The oil is routed to GTC, and the water is routed to a wastewater disposal system. The T-25 vents are routed to the flare. The oil wastewater from T-25 is sent to a set of filters to remove any solids. The water is then routed to a set of pumps, which are used to inject the water into disposal wells. These wells have been used for the entire life of the Gaviota Facility for handling oily water. The water is injected into an old oil and gas reservoir located near the Gaviota Facility. These injection wells are permitted through the California Division of Oil and Gas.

Power Generation. Currently gas from the Point Arguello Field is used to fuel the cogeneration system, which produces electricity and provides heat for the crude oil and other facility systems.

Other ancillary systems that would continue to be operated at the Gaviota Facility include impoundment basins, utility and instrument air, nitrogen system, desalinization system, fresh water system, firewater system, fuel gas system, sewage treatment system, control room, administration building, and the flare.

3.0 Onshore Gas Handling

The gas plant at the Gaviota Facility ceased operating in October of 1998 when the Point Arguello partners began injecting the gas in to the Point Arguello reservoir. Since that time no produced gas has been sent to the Gaviota Facility from the Point Arguello platforms.

As discussed above, PXP received an FDP modification from the County of Santa Barbara to allow sweet sales gas to be shipped from Platform Hermosa to the Gaviota Facility for use as fuel in the cogeneration system. This project was approved as part of the Point Arguello Project.

The Sales Gas Project was implemented in order to comply with the Bureau of Safety and Environmental Enforcement (BSEE) directive requiring PXP to sell gas from the Point Arguello Unit. The sweet gas is used to fuel up to three of the power generating turbines and to meet the heat needs of the facility. Electricity which is a by product of the generation process is sold to the grid.

The purpose of the Sales Gas Project was to reduce the volume of gas that is being injected back into the Point Arguello reservoir, thereby complying with the BSEE directive to initiate sales gas onshore from the Point Arguello Project. In addition, the project is reducing operating costs by eliminating the need to purchase natural gas from The Gas Company to fuel the turbines. The project also has the ability to provide the electrical grid system with up to 10 megawatts (MW) of power. The amount of power sold to the grid is dependent on the amount of gas available for shipment from the Point Arguello Platforms.

With the Sales Gas Project, produced gas from the Point Arguello Field is sweetened (i.e., the H_2S and some of the CO_2 removed from the gas) on Platform Hermosa. The sweet gas is then shipped via the Point Arguello Natural Gas Pipeline (PANGL) to the Gaviota Facility, where the gas is metered and fed to the turbines to generate electrical power and heat. The Sales Gas Project was implemented with only minor piping changes at the Gaviota Facility.

Incoming gas to Gaviota is routed through V-1000 to allow liquids to drop out, in the unlikely event that liquids form in the gas during transport through the PANGL pipeline.

The gas from V-1000 is routed through existing piping to an existing meter run on the outlet of V-1000 that has been modified for royalty accounting purposes. The gas is then routed through the two existing gas plant fuel meters for distribution. One of the meters measures the gas going to the cogeneration unit and other existing users on the lower level of the plant, such as the facility flare. The second meter is used to measure gas that is sent to the upper level of the plant.

In the unlikely event that liquids drop out of the gas during transport through the PANGL pipeline, they accumulate in V-1000. The accumulated liquids from V-1000 are drained to Relief Knock Out Drum V-50. Liquids from V-50 are then pumped to T-2. The vapors from V-50 go to the flare. The liquids from T-2 are handled in the existing oil or wastewater disposal systems.

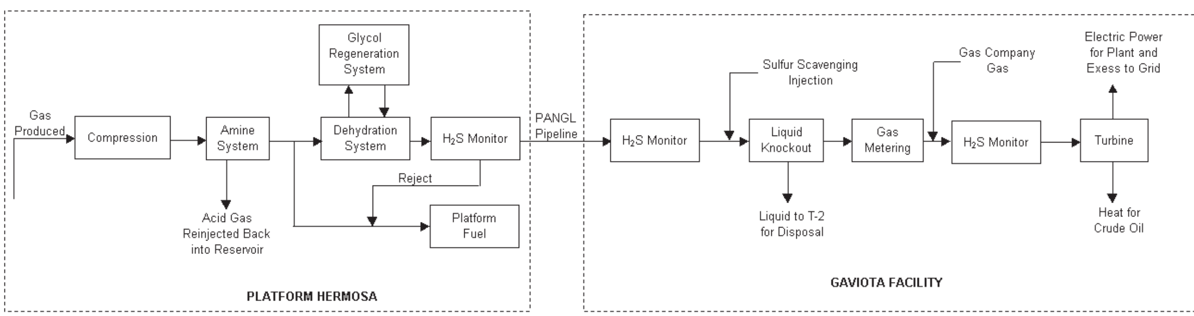
The Gaviota Facility has five cogeneration turbines, each one with a nominal capacity of about 3.7 MW. The current electrical load at the Gaviota Facility is about 0.8 MW. Under Phase I of the project approximately 1.15 mmscfd of sweet gas is shipped from Platform

Hermosa to the Gaviota Facility. The electricity generated is used as needed at the Gaviota facilities (approximately 0.8 MW) with the excess being sold to the public utility grid (approximately 2.9 MW). It should be noted that the amount of fuel used and the amount of power generated is dependent on a number of factors such as the BTU content of the fuel, and the atmospheric conditions. Given that these factors will vary with time, the fuel use and electrical power generating numbers presented in this document are on a nominal basis.

The waste heat from the turbine is used to generate steam, which is used at the Gaviota facilities to heat the oil and for other in plant utilities such as the deaerator and flare assist.

Figure 2 shows a simplified block flow diagram of the Point Arguello gas handling system.

Figure 2 Block Flow Diagram of Point Arguello Gas Handling System



In normal operating mode, gas from The Gas Company is replaced by sweet gas from Platform Hermosa. When the turbine is run at a higher load, then excess steam is vented to the atmosphere. With one turbine at full load approximately 14,000 lbs. per hour of steam is vented to atmosphere.

The Gaviota gas system provide for a contingency option to run all turbines with gas purchased from The Gas Company in the event that gas is not available from the offshore platforms. This option allows the Gaviota facilities to continue to operate if problems occur offshore that would prevent the delivery of sweet gas ashore. The operational contingency plan also allows for the venting of steam in the event of a fin-fan cooler system failure.

PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume
Environmental Evaluation

Submitted to:
Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
Plains Exploration and Production Company

October 2012

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1.0 Introduction

This document presents proposed revisions to the Point Arguello Unit Platform Hidalgo Development and Production Plan (DPP). The proposed revisions to the DPP cover development and production of oil and gas from the western half of the northwest corner (NW/4) of Federal Lease OCS-P 0450 (western half of OCS-P 0450), which is held by production, and is not part of the OCS leases covered by the Norton decision.

Plains Exploration and Production Company (PXP), operator of the Point Arguello Unit and the western half NW/4 of lease OCS-P 0450, is proposing to drill development wells from Platform Hidalgo. The proposal is to drill a maximum of two (2) wells for development of the reserves on the western half NW/4 of lease OCS-P 0450. The eastern half of lease OCS-P 0450 is already been developed as part of the Point Arguello Unit. All of the wells will be directionally drilled using existing well slots on Platform Hidalgo. Drilling of the wells is expected to last approximately six months with production lasting approximately six years.

With drilling and production expected to be concluded in this timeframe, the reserves will be produced within the remaining productive life of Point Arguello platforms. This approach to the development of the western half of OCS-P 0450 will maximize the reserves recovered in the shortest period of time and within the environmental time frame and footprint of the existing Point Arguello facilities as actually foreseen and evaluated in the Point Arguello/Southern Santa Maria Basin Area Study EIS/EIR.

All oil production from the western half of OCS-P 0450 will be combined with Point Arguello Unit oil and transported to Gaviota in the existing PAPCO oil pipeline. From Gaviota, the oil from the western half of OCS-P 0450 and the Point Arguello Unit will be combined and transported to refineries in the existing All America Pipeline.

Gas from the western half of OCS-P 0450 will be combined with Point Arguello Unit gas on the production platforms. The combined gas will be sweetened for platform use or sale to shore via the existing PANGL pipeline. A portion of the gas will also be used for gas lift operations. Gas volumes in excess of platform needs or sales to shore will be injected into the producing reservoir for later recovery and use or sales. Sweetened gas that is sent to shore will be used as fuel for the PAPCO turbine generators that produce steam for oil heating and electricity for facility use and sales to the grid.

In brief, the development and production of the oil and gas reserves from the western half of OCS-P 0450 will be accomplished by drilling extended reach wells from the existing Platform Hidalgo using existing wells slots, pipelines, equipment and facilities. Development of the reserves from the western half of OCS-P 0450 will be accomplished within the expected lifetime of the Point Arguello Field. The total number of development wells for Point Arguello, Rocky Point, and the western half of OCS-P 0450 combined will be significantly less than the number of wells originally anticipated and approved for the Point Arguello Unit alone.

This document has been prepared to provide some of the additional supporting information required by 30 CFR 550.242. The remainder of the document addresses the environmental impacts associated with the development and production of oil and gas reserves from the western half of OCS-P 0450.

This Environmental Evaluation is divided into four major sections that include the following.

- ***Introduction –*** Provides an overview of the project and an outline of the Environmental Evaluation document.

- ***Proposed Project Description –*** Provides a general description of the proposed development plan for the western half of OCS-P 0450.

- ***Scope and Approach to the Environmental Evaluation –*** Presents the scope and approach to the project-specific environmental impact evaluation.

- ***Proposed Project Environmental Evaluation –*** Discusses the environmental baseline, the environmental impacts of the proposed development of the western half of OCS-P 0450. This section also presents mitigation measures for the project. The analysis in this section is presented by issue area.

The Supporting Information Volume also contains a number of attachments that serve to support the environmental evaluation presented in this document.

2.0 Proposed Project Description

This section provides a brief description of the proposed development project. PXP is proposing to develop the western half of OCS-P 0450, which is held by production, and is not part of the Norton decision. The reader is referred to the Development and Production Plan (DPP) revisions for a detailed description of the project.

The western half of OCS-P 0450 is geographically located approximately 8 miles northwest of the coastline at Point Conception, Offshore California (see Figure 2-1). Oil and gas reserves on the western half of OCS-P 0450 were discovered in 1983 by Chevron with a number of exploratory wells. The discovery well, OCS-P 0449 No. 1, spudded in 1983, successfully tested oil and gas from zones in the upper Monterey Formation and Lower Sisquoc Formation.

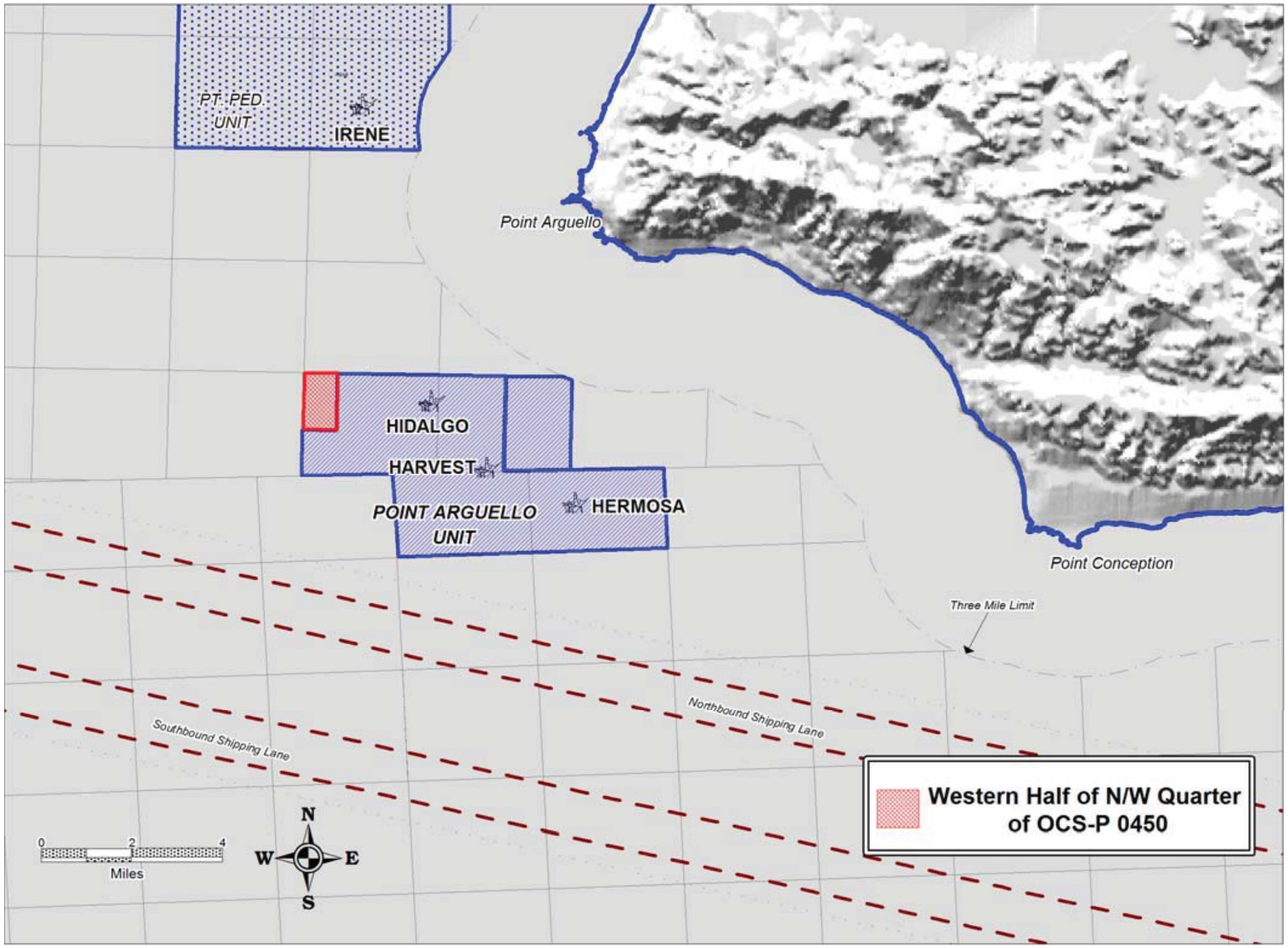
The proposed project is to develop the western half of OCS-P 0450 from Platform Hidalgo using two new development wells. No new offshore structures will be needed to develop the reserves on the western half of OCS-P 0450. Table 2.1 provides general information on the three Point Arguello platforms Figure 2-1 shows the location of the Point Arguello platforms.

Table 2.1 Point Arguello Platform General Data

Platform/Location	Harvest	Hermosa	Hidalgo
Water Depth at Platform, ft	675	603	430
Platform Location	Lambert Zone 6(ft) X=664,622 Y=866,189	Lambert Zone 6(ft) X=674,783 Y=860,793	UTM 10(m) X=710,975 Y=3,819,245
Well Slots	50	48	56
Number of Well Slots Used for Arguello Field and Rocky Point Development	18	17	21
Projected Number of Well Slots Needed for Development of the Western Half of OCS-P 0450	0	0	2
Projected Future Well Slots for Point Arguello and Rocky Point	6	6	6
Well Slots Available for Future Development	25	25	27
OCS Lease	P 0315	P 0316	P 0450

Platforms Harvest and Hermosa were installed in 1985 and Platform Hidalgo was installed in 1986. All three platforms were installed for the development and production of Point Arguello Field oil and gas reserves. Production peaked from the Point Arguello Field in August 1993 at 89 mbd of oil and 27 mmscfd of gas. In August 1998 production from the field was approximately 23 mbd of oil and 3.6 mmscfd of gas. In 2003, a DPP revision was approved to allow the development of the eastern half of lease OCS-P 0451 (i.e., Rocky Point). Current oil production from the Point Arguello Field is approximately 5.0 mbd.

Figure 2-1 Location of Western Half OCS-P 0450



2.1 Drilling Program

Two (2) wells will be needed in order to develop the western half of OCS-P 0450, which will be drilled from Platform Hidalgo, an existing Point Arguello platform. All of the wells will be drilled using extended reach drilling (ERD). Extended reach drilling, sometimes called directional or slant drilling, is a method by which a well is drilled intentionally in a direction laterally away from the surface location.

The drilling crew required for the drilling program will consist of 12 men for each 12-hour shift. In addition to the drilling crew, a contract-drilling supervisor, two directional drilling engineers, two measurement while drilling (MWD) engineers, two mudloggers, a mud engineer, and a crane operator will provide continuous supervision on a 24-hour basis. Specialty personnel such as directional drilling engineers or mud loggers will be on site on an as needed basis; in addition, other specialty contractors such as casing crew, cementing crews, wellhead specialists, logging engineers, etc. will be on site as their services are needed.

2.2 Muds and Cuttings

PXP is proposing to drill the wells using all water based mud. All water based drill cuttings and drilling fluid will be discharged into the ocean in accordance with the current approved NPDES permit as long as they contain concentrations below EPA approved limits. Table 2.2 provides an estimate of the muds and cutting volumes for each of the wells.

Table 2.2 Estimated Muds and Cutting Volumes by Well

Wells	Drilling Fluid (bbls)	Cuttings (bbls)
Well C-16	14,036	5,697
Well C-17	13,575	5,512
Total Western Half of OCS-P 0450	***27,611***	***11,209***

2.3 Transportation Requirements

Drilling personnel will be transported via helicopter from the Santa Maria Airport, which is the current departure point for personnel working offshore at the Point Arguello Field. They will be transported using the existing regularly scheduled helicopter trips. Once drilling is complete, no additional crew will be needed above the current requirements for the Point Arguello Field.

The drilling rig, heavy drilling equipment, rig supplies, and bulk drilling mud and cement materials will be shipped to the platform via supply boat. During drilling rig installation and removal, the supply boat will make approximately 20 round trips from Port Hueneme to Platform

Hidalgo. Each round trip will take approximately one to two days. It is estimated that between 30 and 60 days will be required for mobilization and demobilization of the rig and associated equipment to and from the shore base facility at Port Hueneme.

Supplies will be transported to the platforms by supply boat from Port Hueneme. Boat traffic to and from the platform, with the exception of drilling rig installation and removal, is projected to consist of one round trip per week for the supply boat above and beyond what is occurring today for the Point Arguello Field operations. On return trips, the supply boat will transport any waste material generated from onboard activities requiring onshore disposal.

There will be no need for modification or expansion of supply yards to accommodate this project, nor will there be any demand for additional support personnel. Support services will be staged out of Ventura areas from existing service companies using existing industry bases. Table 2.3 provides estimates of the number of incremental truck trips that will be needed for the proposed project.

Table 2.3 Estimated Truck Trips for the Proposed Project

Source	Number of Round Trips			
	Per Peak Day	Per Week	Per Year	Total
Truck Trips for Drill Rig Delivery/Removal	1	5	20	20
Truck Trips for Drilling Supplies	1	4	80	80
Truck Trips Miscellaneous Wastes	1	1	20	20

2.4 Oil and Gas Processing

This section provides a description of the oil and gas processing that would occur with production from the western half of OCS-P 0450. The oil and gas processing would be essentially the same as what is occurring today for the Point Arguello production. The oil and gas would be processed offshore, and only dry oil and sweet natural gas would be sent ashore to the Gaviota Facility.

Oil Processing

The development wells from the western half of OCS-P 0450 will be tied into the production manifold on platform Hidalgo. The oil will be dehydrated and stabilized and then sent to the Gaviota Facility via the Point Arguello Pipeline Company (PAPCO) pipeline. Once the oil reaches the Gaviota Facility it will be metered as part of the PAPCO leak detection system. The oil will then passes through a heat exchanger where it will be heated to about 125ºF using waste heat from the onshore cogeneration units. The oil will then metered at the dry LACTs before being transferred via pipeline to the Gaviota Terminal Company storage tanks located on the south side of Highway 101. From the Gaviota Terminal Company storage tanks the oil will be sent to the All American Pipeline for transport to various refining destinations. This is the same operations that are occurring today with the Point Arguello crude oil.

In order to accommodate the development of the western half of OCS-P 0450 a number of modifications may be needed at Platform Hidalgo. PXP may need to install additional oil dehydration and new stabilization capacity on Platform Hidalgo as part of the project. This would allow the oil production to be treated on Platform Hidalgo. Currently, the oil production from Platform Hidalgo is partially dehydrated on the platform. The remaining dehydration and stabilization of the Platform Hidalgo oil is done on Platform Hermosa. With the development of the western half of OCS-P 0450 there may not be enough dehydration and stabilization capacity on Platform Hermosa to handle all of the production.

Implementation of oil stabilization on Platform Hidalgo would require the installation on the platform of a vessel approximately 55.5 feet tall by 42 inches in diameter (tapering to 20 inches in diameter at 36 feet of elevation), and a re-boiler vessel which is 15 feet long by 27 inches in diameter. These vessels would be set upon a small deck extension on the platforms that would be installed on Platform Hidalgo. Minor piping modifications and instrumentation changes would be performed to implement oil stabilization. It is expected that 200 feet of piping would need to be added to Platform Hidalgo.

Installation of the oil stabilization equipment would be conducted utilizing permitted scheduled boat and helicopter trips. Installation of the vessel on Platform Hidalgo would be done in conjunction with routine maintenance that is required on the platforms and other installations proposed as part of this project. During tie-ins, the platforms may be shut-in for a brief period of time to allow for safe working conditions as needed. Installation would proceed as follows:

1. All prefabricated vessels and pipe spools and installation equipment will be sent to the platforms on scheduled boat runs and staged in the work areas.

2. Scaffolding equipment will then be installed in overhead hot work and bolt-up areas.

3. As a safety measure, during certain tie-ins, hot work or bolt-up, the platform may need to be shutdown depending on the particular work involved. After shutdown, affected process areas may need to be blown down, purged with nitrogen and then isolated for hot work or bolt-up. During shutdown, the platform generators are required to run on diesel because fuel gas processing systems are also shut-in; however, such will be done in compliance with existing air permits for the platform.

4. Hot work to make field welds will be conducted for installation of pipe spools and supports, and installation of the wing deck extensions on Platform Hidalgo (18’ x 20’). During this shut down, other required repairs and maintenance will also be done.

5. Upon completion of the installations, affected vessels will be pressure tested and the platform will be put on production.

6. Equipment and personnel will be demobilized on regularly scheduled boat or helicopter trips.

Two options have been identified to provide oil dehydration on Platform Hidalgo. The first option is to convert a portion of vessel V-8 from an oil surge tank to an oil dehydration service. With the addition and modification of this equipment the produced oil will be 'pooled' into 3-phase production separator trains, which separate the produced oil, gas, and free water. After leaving the production separators, the oil will be dehydrated, stabilized, metered and shipped to Platform Hermosa via an intra-platform pipeline. At Platform Hermosa, the oil uses the PAPCO pipeline for shipment to the Gaviota Facility.

Gas Processing

The produced gas is dehydrated on the platform and used for gas lift purposes or shipped to Platform Hermosa via an inter-platform pipeline, where it is co-mingled with the Hermosa gas and then sent to Platform Harvest for injection back into the reservoir. Another option that is available is to inject the produced gas at Platform Hidalgo into the Light Pool reservoir, using existing compressors on the platform. Additional gas from Platforms Hermosa and Harvest can also be routed to Platform Hidalgo for injection into the Light Pool reservoir using the intra-platform gas pipelines. Injection of gas into the Light Pool reservoir at Platform Hidalgo does not require any new equipment. All of the injection is done with existing compressors.

A portion of the produced gas is used for fuel in the offshore turbines, which provide the platform's electrical power and heat needs. The gas used as fuel is processed through an amine system to remove the hydrogen sulfide (H_2S). The H_2S removed from the fuel gas is injected back into the gas that is injected back into the reservoir.

2.5 Produced Water

The produced water that is generated from development of the western half of OCS-P 0450 will be handled in the same manner as the existing produced water from the Point Arguello Field. It is anticipated that no new equipment will be needed to handle the produced water from the western half of OCS-P 0450. Development of the western half of OCS-P 0450 will result in increased volumes of produced water that will be treated and discharged to the ocean in accordance with the existing NPDES permit. Any produced water that does not meet the NPDES permit discharge limits will be injected back into the reservoir, which is the current practice. Table 2.4 provides estimates of the peak produced water discharge rates that are expected from each of the three Point Arguello platforms, the western half of OCS-P 0450, and the two combined.

Table 2.4 Estimated Peak Produced Water Discharge Rates

Platform	Point Arguello and Rocky Point Only (bbls/day)	Western Half of OCS-P 0450 (bbls/day)	Total Point Arguello , Rocky Point, and Western Half of OCS-P 0450 (bbls/day)
Harvest	75,000	0	68,000
Hermosa	72,000	0	72,000
Hidalgo	10,000	6,500	16,500

Table 2.4 shows that the development of the western half of OCS-P 0450 will result in increased levels of produced water discharge at Platform Hidalgo only. Table 2.5 provides the various produced water discharge parameters for each of the platforms. All produced water discharges will comply with the current NPDES permit for the Point Arguello Platforms.

Table 2.5 Produced Water Discharge Parameters

Platform	Flow Rate (bbls/day)	Effluent Salinity (psu)	Process Temperature (°C)	Exit Temperature (°C)	Pipe/Pile Diameter (in)	Pipe/Pile Depth (ft)	Water Depth (ft)
Harvest	75,000	27	85	83.0	10" to 204' 8" to 438' 6" to 647'[a]	647[a]	675
Hermosa	72,000	27	85	82.8	10" to 159' 8" to 375'	375	603
Hidalgo	16,500	29	85	81.6	10" to 100' 8" to 218'	214	430

a. New multiport diffuser to be installed in July 2012.

2.6 Production Estimates for The Western Half of OCS-P 0450

Table 2.6 shows the estimated oil and gas properties for the development of the western half of OCS-P 0450.

Table 2.6 Estimated Oil and Gas Properties

Property	Value
API Gravity	13-20
Kinematic Viscosity (cs @ 100^{O}F)	20-1,000
Sulfur in Crude (wt%)	2-3
H_2S Content of Gas (ppm)	10,000-15,000

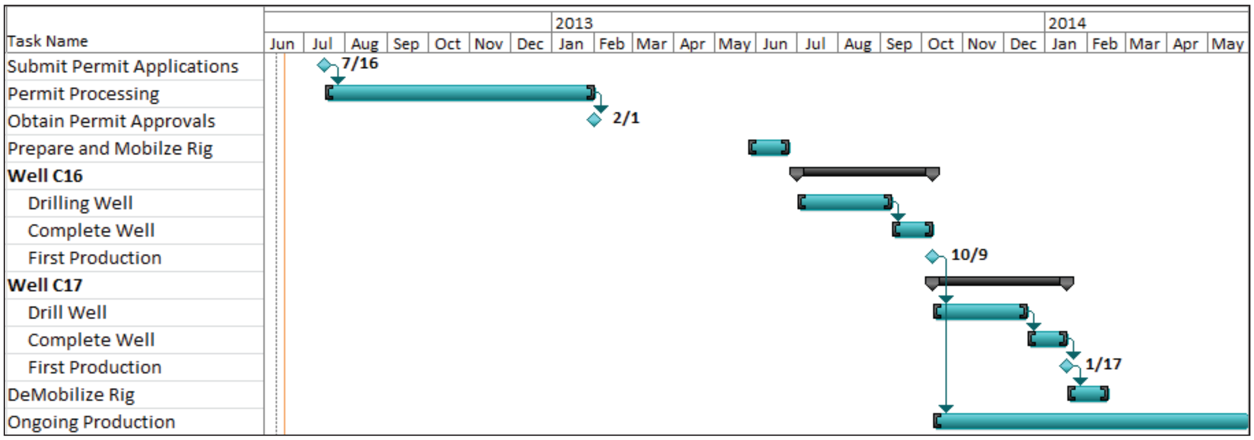
These values are estimates based on data collected from Point Arguello producing wells. The actual production data may be different. Actual hydrogen sulfide measurements of produced gas from well OCS-P 0449 #1 during the exploratory DST's indicated significantly lower levels than that shown above, including some tests with no hydrogen sulfide at all. The levels shown above are more typical of the Point Arguello Field and are used as conservative estimates.

Production from development of the western half of OCS-P 0450 is expected to peak at around 2,500 BPD of oil and 1.5 mmscfd of gas six months after production starts. It is expected that the combined production from the western half of OCS-P 0450 and Point Arguello will peak at around 6,400 BPD of oil and 9 mmscfd of gas six months after production begins from the western half of OCS-P 0450.

2.7 Development Schedule for the Western Half of OCS-P 0450

Figure 2-2 shows the projected schedule for development of the western half of OCS-P 0450.

Figure 2-2 Estimated Development Schedule for the Western Half NW/4 of lease OCS-P 0450



The schedule shows drilling of the first well beginning in the 2nd quarter of 2013, with production beginning two to three months after the start of the first well. The drilling program should be complete by the end of the 1st quarter of 2014, assuming permit approvals allow drilling to commence as stated above.

Based on current data, PXP has estimated that two (2) wells will be needed to develop the western half of OCS-P 0450.

Currently, PXP does not anticipate the drilling of any specific service wells for water disposal or gas injection. The existing water disposal capability of the Point Arguello platforms is assessed as adequate for the combined development.

When Point Arguello Unit production has no further economic potential, the field abandonment process will likely commence, unless other uses for the platforms arise and are approved.

3.0 Scope and Approach to the Environmental Evaluation

The first step in the environmental evaluation is to determine what issue areas could be impacted by the development of the western half of OCS-P 0450. An initial screening of a range of issue areas was conducted to assess the potential for environmental impacts. The results of this screening analysis are presented in Table 3.1. In addition, the geographic scope associated with each issue area was evaluated along with the time frame over which the issue area could be impacted.

The development of the western half of OCS-P 0450 is a unique project in that it will utilize existing infrastructure. No new facilities will be required to develop the reserves on the western half of OCS-P 0450. The only new infrastructures that will be needed are the development wells, and possibly some limited oil processing equipment on Platform Hidalgo. Once the wells are drilled the infrastructure on the platforms will be used to process, ship and inject gas and dehydrate and stabilize the oil. The oil will then be sent though the PAPCO pipeline for metering and heating at the Gaviota Facility. A portion of the sweet gas from the platforms will be sent ashore to Gaviota via the PANGL pipeline for use as fuel at the Gaviota facility. No modifications will be needed to any of the Gaviota facilities to handle the production from the western half of OCS-P 0450.

The approach to the environmental evaluation was to identify issue areas where the development of the western half of OCS-P 0450 could lead to new environmental impacts above and beyond those identified for the Point Arguello Project. If the development of the western half of OCS-P 0450 was not found to increase an environmental impact that exists for the Point Arguello Project, it was assumed there was no impact since the impacts associated with the Point Arguello Project are considered part of the environmental baseline. Including the Point Arguello Project in the baseline is consistent with NEPA and CEQA guidelines since the project is approved and has been operating for a number of years and its impacts are reflected in the baseline data.

It is against this baseline that the impacts of the development of the western half of OCS-P 0450 have been assessed. It should be noted that for many of the issue areas, Point Arguello Project impacts were a result of the construction of the offshore and onshore infrastructure. Since limited infrastructure is needed for the development of the western half of OCS-P 0450, most of these impacts would not occur. In addition, many of the operational impacts of the Point Arguello Project result from the project facilities regardless of throughput. As such, the handling of the production from the western half of OCS-P 0450 will not increase many of the operational impacts identified for the Point Arguello Project.

A review of the data presented in Table 3.1 shows that the only issue areas where there is potential for new significant environmental impacts are marine resources, air quality, and oil spill risk. For all other issue areas, the impacts identified for the Point Arguello Project would remain the same, and would not be significantly affected by the development of the western half of OCS-P 0450. The reader is referred to the 1984 Point Arguello Project EIR/EIS and 1988 SEIR for additional information on the impacts associated with Point Arguello development.

The environmental evaluation has been based on the assumption that two (2) new wells will be needed to develop the western half of OCS-P 0450. It may be possible to sidetrack a number of the existing Point Arguello wells for development of the western half of OCS-P 0450 once some of the Point Arguello wells have reached the end of their productive life. Another possible option would be to use existing Point Arguello wellheads for some of the new wells, once some of the Point Arguello wells have reached the end of their productive life. The environmental evaluation has been conducted assuming that the two (2) wells developed for the project are new wells This represents a "worst case" for the environmental impacts.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
Marine Resources	Development of the Electra Field will result in increases of mud cuttings and drilling fluid discharges to the ocean during drilling operations, and increases in produced water discharges to the marine environment during production. Installation of the new wells will slightly increase the potential for an oil spill during drilling of the wells and throughout production. Drilling of the wells will temporarily increase supply boat trips which could result in impacts to marine mammals and seabirds from noise, lighting, and disturbance, and/or vessel strikes. The noise and lighting associated with drilling activities could also impact marine mammals and seabirds.	– Based on modeling done for the discharge of muds, cutting and produced water from the Point Arguello platforms, the impacts are limited to an area about 6.8 km (4.2 miles) around the platforms. – Impacts due to boat traffic would be limited to routes the boats travel. – Based on the OSRA model results, oil spill impacts would cover the southern Santa Maria Basin and the western part of the Santa Barbara Channel. This is consistent with the oil spill trajectories in the Oil Spill Contingency Plan. However, based on limited drifter data one cannot rule out the possibility of oil from a spill moving north into the Santa Maria Basin.	– ***Cuttings and drilling fluids –*** during the 5-month drilling program. – ***Produced water -*** during production. – ***Oil spill –*** during drilling and production – ***Noise, lighting and disturbance–*** during the 5-month drilling program
Air Quality	During the drilling of the production wells additional load will be placed on the turbine generators that provide electrical power to the platform. This increased load will result in an increase in air emissions during the drilling phase only. The turbine emissions have been offset and are permitted with the SBCAPCD. The drilling operations will also generate additional emissions due to a number of internal combustion engines that will be associated with the drill rig. There will also be an increase in air emissions associated with supply boats during drilling since additional supply boat trips will be needed. Supply boat emissions have been offset and are permitted with the SBCAPCD. The previous Rocky Point Project had a similar need for use of the supply boat for rig mobilization, drilling support, and rig demobilization. All of this occurred within the existing permitted use of the vessel. It is unlikely that this project would exceed the permit limits and require additional	The air quality impacts would be limited to the southern Santa Barbara County/Ventura County airshed.	Air quality impact due to the development of the western half of OCS-P 0450 would be limited to drilling and production.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
	offset emissions. However, additional offsets could be obtained if the combined Point Arguello and western half of OCS-P 0450 drilling supply boat needs exceed the current allowable maximum. The increase demand for supply boat trips is expected to last six-months. Once drilling is complete the additional supply boat trips will not be needed. During production there will be fugitive emissions associated with the new well heads and possibly the additional oil processing equipment on Platform Hidalgo. The air quality impacts would be less than what was analyzed for the Point Arguello Project since fewer wells will be drilled.		
Onshore Geology	There would be no geologic impacts associated with development of the western half of OCS-P 0450 since no new onshore infrastructure will be needed. For the Point Arguello Project the geologic impacts were associated with the construction of the pipelines and the Gaviota Facility.	This does not apply to the development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to the development of the western half of OCS-P 0450 since there are no impacts in this issue area.
Onshore Water Resources	There would be no onshore water impacts associated with the development of the western half of OCS-P 0450 since no new onshore infrastructure will be needed, and no new water supplies will be needed for handling the production. For the Point Arguello Project the onshore water impacts were associated with the construction of the pipelines and the Gaviota Facility, and the potential for impacts due to an oil spill from the pipelines or at the Gaviota Facility. Water use at the Gaviota Facility would not increase with these development. The development of the western half of OCS-P 0450 will not increase the onshore oil spill volumes over what is currently occurring for the Point Arguello Field, which is considered part of the environmental baseline. This is because the spill volumes are driven by the capacity of the pipeline and equipment at Gaviota and not the throughput.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
Cultural Resources	There would be no cultural resource impacts associated with development of the western half of OCS-P 0450 since no new infrastructure will be needed. For the Point Arguello Project the cultural resource impacts were associated with the construction of the pipelines and the Gaviota Facility. The development of the western half of OCS-P 0450will not result in any impacts to offshore cultural resources since no new infrastructure will be installed offshore other than development wells and possibly a number of new vessels on Platform Hidalgo. The development wells will only penetrate the seafloor in the area directly beneath the platforms, which are free of offshore cultural deposits based on surveys done as part of the original installation of the Point Arguello platforms.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.
Historic Resources	There would be no historic resource impacts associated with development of the western half of OCS-P 0450 since no new infrastructure will be needed. For the Point Arguello Project the historic resource impacts were associated with the construction of the pipelines and the Gaviota Facility.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.
Transportation	Development of the western half of OCS-P 0450 could generate an additional 10 truck trips per week, which are associated with the movement of drilling supplies and waste material to and from Port Hueneme during the drilling phase. There would be no net increase in the truck traffic over what is currently occurring for the Point Arguello Project once drilling is complete. For the Point Arguello Project the transportation impacts were associated with the construction of the pipelines and the Gaviota Facility. The 1984 EIR/EIS did not identify any transportation impacts associated with truck traffic servicing Port Hueneme. Attachment D provides truck traffic and level of service data, which shows the impacts would be insignificant.	The geographic scope of the transportation impacts for the western half of OCS-P 0450 would be limited to the area around Port Hueneme.	The time frame for the transportation impacts associated with development of the western half of OCS-P 0450 would be limited to the drilling phase only.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
Recreation	The major recreational impact from the Point Arguello Project was due to the impacts that could result from a potential oil spill. Development of the western half of OCS-P 0450 will increase the likelihood of an offshore oil spill over what is currently occurring for the Point Arguello Field due to the addition of up to two (2) new wells. The development wells for the western half of OCS-P 0450 would serve to increase the oil spill volumes on Platform Hidalgo during the first few years when the wells are flowing under natural pressure. Once the wells are placed on artificial lift the increased spill volume would be eliminated. Based on the analysis present in Section 4.3, Oil Spill Risk, the probability of a blowout during drilling and production from the western half of OCS-P 0450has been estimated to be less than 1%. Given this low level of probability, the incremental impacts on recreation from the proposed development are considered to be insignificant. In addition, while development of the western half of OCS-P 0450 would slightly increase the probability of an oil spill, the impacts would not change from what exists for the Point Arguello Platforms and pipeline. Therefore, there would be no new impacts.	Based on the OSRA model results, oil spill impacts would cover the southern Santa Maria Basin and the western part of the Santa Barbara Channel. This is consistent with the oil spill trajectories in the Oil Spill Contingency Plan. However, based on limited drifter data one cannot rule out the possibility of oil from a spill moving north into the Santa Maria Basin.	Oil spill impacts would be limited to drilling and the first few years of production when the wells are flowing on natural positive pressure.
Land Use	The oil production from the western half of OCS-P 0450 will be metered and heated at the Gaviota Facility , which is an allowed use under the County of Santa Barbara's local costal plan and zoning ordinance . The development of the western half of OCS-P 0450 would not change any of the current operations at the Gaviota Facility. Therefore, the project would not have any new land use impacts.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.
Energy Use	Development of the western half of OCS-P 0450will result in a beneficial impact to energy use since it will result in an increase in oil and gas production. The only increase in energy use associated with the project would be for drilling the production	Geographic scope is not applicable to energy use.	For the productive life of the western half of OCS-P 0450.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
	wells and for the increased supply boat trips needed during drilling. Therefore, there would be no adverse impacts to energy use associated with development of the western half of OCS-P 0450.		
Public Safety	Public safety impacts are related to impacts to the public associated with acute exposure to hazardous materials that could lead to injury or fatalities. For oil and gas development projects, public safety impacts can result from releases of toxic or flammable materials. The main issue associated with development of the western half of OCS-P 0450 is the injection of the produced gas. During the peak year of production, the western half of OCS-P 0450 will generate approximately 1.5 mmscfd of gas, of which a portion may be injected back into the reservoir. The existing gas injection capacity for Point Arguello is sufficient to handle increased gas production. Since development of the western half of OCS-P 0450 will not require any new infrastructure, the public safety impacts will not increase over what exists for the Point Arguello Project, which is considered part of the environmental baseline. Therefore, there will be no new public safety impacts associated with development of the western half of OCS-P 0450. It should be noted that with the shutdown of the gas plant at Gaviota, the majority of the risk to public safety has been eliminated.	Limited to an area of 600 feet from the platforms.	For the productive life of the western half of OCS-P 0450.
Oil Spills	Development of the western half of OCS-P 0450 will increase the likelihood and potential volume of an offshore oil spill over what is currently occurring for the Point Arguello Field due to the addition of two (2) new wells. This increase is due to the remote possibility of a well blowout during the first few years when the wells are flowing on natural positive pressure. Based on the analysis present in Section 4.3, Oil Spill Risk, the probability of a blowout during drilling and production from the	Based on the OSRA model results, oil spill impacts would cover the southern Santa Maria Basin and the western part of the Santa Barbara Channel. This is consistent with the oil spill trajectories in the Oil Spill Contingency Plan. However, based on limited drifter data one cannot rule out the possibility of oil from a spill moving north into the Santa Maria Basin.	Oil spill impacts would be limited to drilling and to the first few years of production when the wells are flowing on natural positive pressure.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
	western half of OCS-P 0450 has been estimated to be less than 1%.		
Public Services	There would be no public services impacts associated with development of the western half of OCS-P 0450 since no new onshore infrastructure will be needed. For the Point Arguello Project the public services impacts were associated with the operation of the pipelines and the Gaviota Facility. These public services impacts were primarily for fire protection and emergency response. These impacts were mitigated through the construction of Fire Station 18, which is located next to the Gaviota Facility. The impacts identified for the Point Arguello Project would not change with the addition of the western half of OCS-P 0450. The implementation of the Reconfiguration Project, which resulted in the elimination of gas processing at the Gaviota Facility, has substantially reduced the public services requirement from what was evaluated in the 1984 EIR/EIS for the Point Arguello Field.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.
Onshore Biology	The major onshore biological impact from the Point Arguello Project was due to the impacts that could result from a potential oil spill. Development of the western half of OCS-P 0450 will increase the likelihood and size of an offshore oil spill over what is currently occurring for the Point Arguello Field due to the addition of two (2) new wells. This increase is due to the remote possibility of a well blowout during the first few years when the wells are flowing on natural positive pressure. Based on the analysis present in Section 4.3, Oil Spill Risk, the probability of a blowout during drilling and production from the western half of OCS-P 0450 has been estimated to be less than 1%. Given this low level of probability, the incremental impacts on onshore biology from development of the western half of	Based on the OSRA model results, oil spill impacts would cover the southern Santa Maria Basin and the western part of the Santa Barbara Channel. This is consistent with the oil spill trajectories in the Oil Spill Contingency Plan. However, based on limited drifter data one cannot rule out the possibility of oil from a spill moving north into the Santa Maria Basin.	Oil spill impacts would be limited to drilling and the first few years of production when the wells are flowing on natural positive pressure.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
	OCS-P 0450 are considered to be insignificant. In addition, while development of the western half of OCS-P 0450 would slightly increase the probability of an offshore oil spill, the impacts would not change from what exists for the Point Arguello Platforms and pipeline. Therefore, there would be no new impacts. The onshore spill volumes would not change from what could occur today with the existing Point Arguello Field.		
Commercial Fishing	For the original Point Arguello Project, commercial fishing impacts were associated with the installation of the platform and offshore pipeline and the resulting preclusion of fishing areas around the platforms. These impacts would not occur with development of the Electra Field. However, development of the Electra Field will slightly increase the likelihood of an offshore oil spill over what is currently occurring for the Point Arguello Field due to the addition of two (2) new wells. Additionally, development of the Electra Field would result in a slight, temporary increase in vessel traffic during drilling that could result in impacts to commercial fishing operations through gear loss and collisions. Although development of the Electra Field would slightly increase the probability of an oil spill, and would temporarily increase vessel traffic over baseline conditions, the impacts would not change from what currently exists for the Point Arguello Platforms and pipeline. Therefore, there would be no new impacts.	Based on the OSRA model results, oil spill impacts would cover the southern Santa Maria Basin and the western part of the Santa Barbara Channel. This is consistent with the oil spill trajectories in the Oil Spill Contingency Plan. However, based on limited drifter data one cannot rule out the possibility of oil from a spill moving north into the Santa Maria Basin.	Vessel traffic impacts would be limited to the 5-month drilling period. Oil spill impacts would be limited to drilling and the period of production when the wells are flowing on natural positive pressure. Additional impacts may result after this period due to smaller spills from equipment failures.
Socioeconomic	Development of the western half of OCS-P 0450 will not have any socioeconomic impacts on Port Hueneme and the surrounding community. No new support infrastructure will be needed to support the proposed development. As discussed above, there will be some additional transportation requirements (10 truck trips per week for about 6 months).	The socioeconomic impacts would be limited to Port Hueneme and the surrounding community.	The duration of the impact would be for the six months of drilling.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
	With regard to workers, it has been estimated that only 36 additional workers will be needed during the drilling phase. , which is expected to last six months. Development of the western half of OCS-P 0450 is expected to generate one additional supply boat trips a week during the six months of drilling. No new helicopter trips will be needed to handle development of the western half of OCS-P 0450. Given the very low level of activity and the short duration of the project, the incremental socioeconomic impacts associated with development of the western half of OCS-P 0450 are considered insignificant.		
Environmental Justice	The only onshore area where there will be incremental onshore impacted associated with development of the western half of OCS-P 0450 is Port Hueneme. The project will increase activities at the port that are associates with the handling of supplies and wastes for drilling. No new infrastructure will be needed at Port Hueneme. This increase in activity will be limited to the drilling phase and will provide an economic benefit to the area. A review of the data shown in Attachment H shows that within a five mile radius of Port Hueneme the percent of the population that is considered a minority is 51% which is higher than the California state average of 38%. With regard to education, 37% of the population has some college experience, compared with 41% for the State. In the area of employment, the Port Hueneme area has an unemployment rate of 7%., which is lower than the State at 13%. The environmental impacts from the project in the area of Port Hueneme would be limited to a few truck trips per week and some additional supply boat trips over a six month period. Once	This does not apply to development of the western half of OCS-P 0450 since there are no impacts in this issue area.	This does not apply to development of the western half of OCS-P 0450since there are no impacts in this issue area.

Table 3.1 Results of Issue Area Screening Analysis

Issue Area	Environmental Impact Screening Analysis Results	Geographic Scope for Issue Area	Time Frame for Impact Analysis
	drilling is complete there would be no additional environmental impacts. Given the short duration and low level of activities, the development the western half of OCS-P 0450would not have any environmental justice impacts.		

4.0 Proposed Project Environmental Evaluation

This section of the document presents the environmental baseline, project-specific significant impacts for the issue areas that were identified as having the potential for new environmental impacts. For each issue area the potential impacts are discussed along with mitigation measures.

4.1 Marine Environment

This section covers the issue area for marine resources, which include marine biology and marine water quality.

4.1.1 Oceanographic Setting

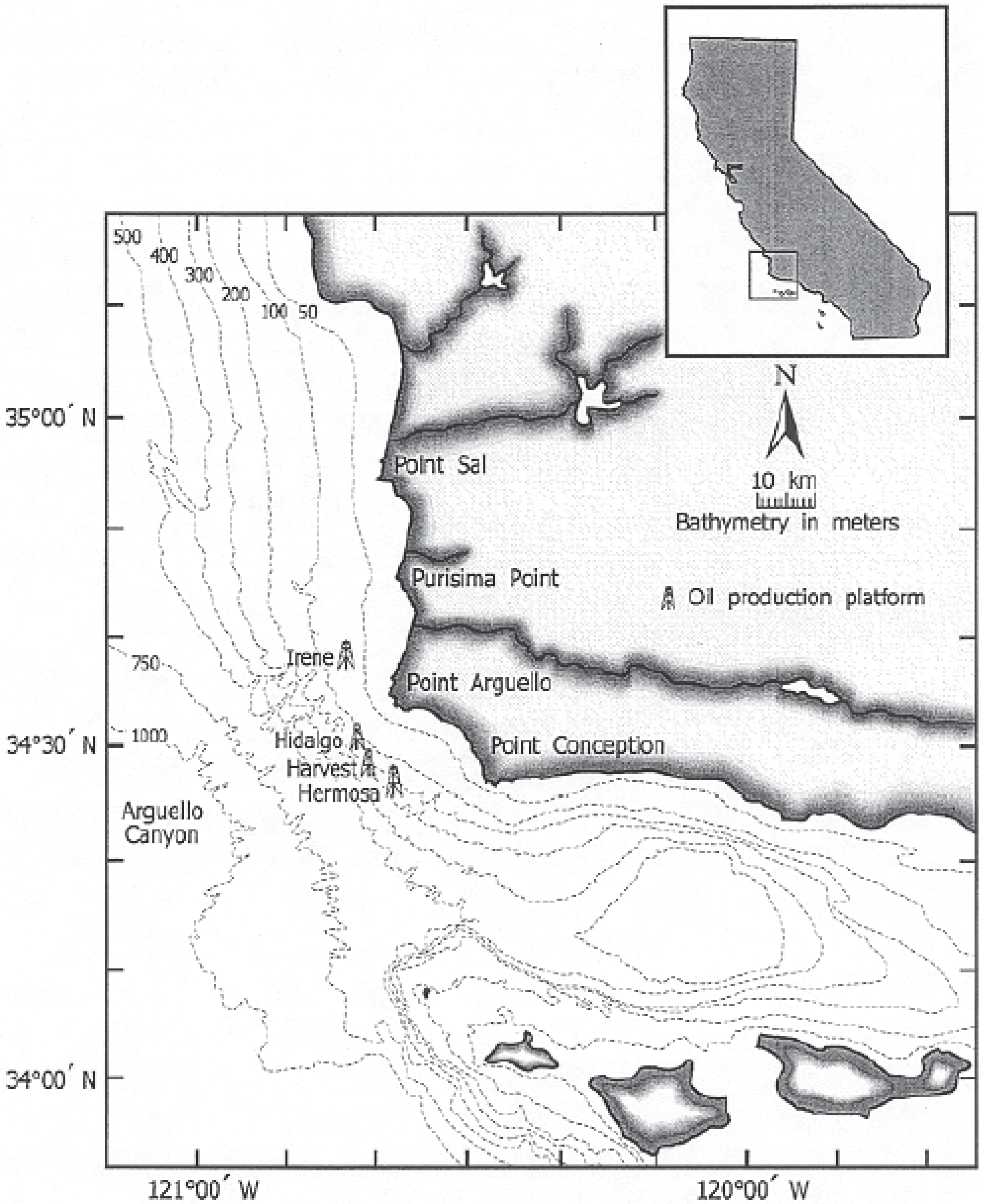
The project area is located in an oceanographically complex region off south-central California. . Specifically, the project area lies in the transition zone between the Santa Maria Basin (SMB) and the Santa Barbara Channel (SBC), where a sharp change in coastline orientation occurs between Point Arguello and Point Conception (Figure 4-1). Near the project area, isobaths are aligned along a northwest-southeast axis. However, immediately north of the project area, the coastal isobaths are aligned along a north-south axis. The SBC lies to the west of the project area where the coastline is oriented along an east-west axis.

The continental shelf in this region extends seaward to approximately 110 m and varies in width from approximately 4 km in the Point Conception area to approximately 20 km between Point Arguello and Point San Luis (Uchupi and Emery, 1963). In the Point Arguello area, the slope drops rapidly to approximately 1,000 m and is cut by the Arguello Canyon; northward, the slope is less steep and is interrupted by the Santa Lucia Bank (Uchupi and Emery, 1963). Eastward of the bank is a sea valley that acts as a depositional sink for fine-grained sediments (Hyland et al. 1990). Four offshore platforms (Platforms Harvest, Hermosa, Hidalgo, and Irene) are presently located in the area. Their locations are shown in Figure 4-1.

This large-scale change in coastal configuration induces much of the complexity in wind, wave, and oceanic flow fields near the project area. This coastal transition zone is influenced by markedly different physical processes than those that dominate within the two adjacent regions. Along the central California coast to the north, physical processes are strongly influenced by seasonally varying winds that blow uniformly to the south over a wide geographic area.

The large-scale oceanic flow field beyond the continental slope is dominated by the southward-directed California Current. Waves generated over a large fetch impinge on the coastline from directions that encompass an azimuth of effectively 180 degrees. In contrast, the SBC is sheltered from waves generated by distant storms to the north while the Channel Islands limit wave propagation from the south. Similarly, the east-west coastal configuration blocks the large-scale southward-directed winds that prevail outside the SBC. Finally, the California Current separates from the coast near Point Arguello leaving other processes to control the flow within the SBC.

Figure 4-1 Location of Offshore Platforms in the Study Region



Despite their complexity, it is important to quantify physical processes within the project area. Surface flow fields determine the transport of spilled oil and the likelihood of impingement on adjacent coastlines. Subsurface flows dictate the transport and dispersion of produced waters and drilling fluids that will be discharged from Platform Hidalgo during the proposed ERD drilling. Finally, the seastate, as determined by prevailing winds and waves, affects the efficacy of oil-spill contingency plans that rely on chemical dispersants or containment for cleanup.

4.1.1.1 Sources of Oceanographic Data

A number of major oceanographic studies have been conducted in the project area. This subsection describes the pertinent individual studies that have been conducted near the project area since the original Point Arguello Field Development Plans EIR/EIS was submitted (Anikouchine, 1984). Taken as a whole, these studies provide an accurate characterization of the regional oceanic processes as well as the oceanographic characteristics close to the project area.

Due to the oceanographic complexity of the project area, individual studies are not comprehensive enough for a complete environmental evaluation and their limitations are outlined below. Technical results from these individual studies, insofar as they pertain to the oceanographic issues concerning the development of the Electra Field, are assimilated in the subsections that follow.

Santa Barbara Channel – Santa Maria Basin Coastal Circulation Study (SBC-SMB CCS)
This multi-year observational study is conducted by Scripps Institution of Oceanography under the auspices of the BOEM. Measurements, which include current-meter moorings, surface drifters, and hydrographic transects, have emphasized a description of the surface circulation within the SBC. The results have been summarized by Dever et al. (1998), Harms and Winant (1994, 1998), Hendershott and Winant (1996), and Winant et al. (1999, 2003). Results from these measurements have been incorporated in the Oil Spill Risk Analysis (OSRA) numerical model used to compute oil-spill trajectories and risk of impingement on coastlines. As described in the following sections, there remain discrepancies between the model results and drifter data.

Santa Barbara Channel Circulation Model and Field Study (SBCCMFS)
As with the SBC-SMB CCS, this field and modeling investigation emphasized a determination of the flow regime within the SBC (Gunn et al. 1987). As such, results are not strictly applicable to the transition region where the project area lies. Nevertheless, oil spills associated with the proposed project could be transported into the SBC, so an understanding of the flow within the SBC is pertinent to this evaluation. Also, potential spills from the existing offshore oil facilities within the SBC could have a cumulative effect on the marine environment along the shorelines surrounding the proposed project. Fifteen current-meter moorings were deployed in the SBC during 1984 as part of the SBCCMFS. These data were augmented by five hydrographic surveys and three surface-drifter studies.

Wave Information Study (WIS)

In late 1976, the US Army Corps of Engineer's Waterways Experiment Station embarked upon a Wave Information Study (WIS) to establish the wave climatology for U.S. coastal waters. In March 1989, the seventeenth in a series of reports was published which presented hindcast shallow-water wave data for 134 shoreline segments north of Point Conception (Jensen et al. 1989). Coastline Section Numbers 133 and 134 extend between Point Arguello and Point Conception along the shoreline adjacent to the project area. Wave statistics were computed at a depth of 10 m from atmospheric pressure and wind velocity data collected over a 20-year period. These near-shore wave statistics were derived from offshore wave climatology that excluded waves generated by distant tropical storms and southern hemisphere swells.

Platform Harvest Directional Wave Gauge Array

A directional wave gauge array was installed on Platform Harvest in 1992. Although the wave record is limited compared to the WIS, it measures all incident waves regardless of origin, including those from tropical and southern hemisphere storms. The array is also capable of high directional resolution on the order of 1 degree (°). Seymour (1996) provided a deep-water summary of wave climatology based on data from this and other wave gauges.

NOAA Data Buoy Center (NDBC)

Several NOAA Data Buoy Center (NDBC) ocean buoys have collected long time series meteorological and oceanographic data near the project area. Historically, NDBC buoy 46063 was the closest buoy to the project area; however, this buoy was disestablished in 2009. The buoy was located offshore Point Conception, to the southeast of the Arguello platforms, in a water depth of about 600 m. Wind climatology from this and other buoys has been summarized by Caldwell et al. (1986), Miller et al. (1991), Dorman and Winant (1995), and Winant and Dorman (1997). Currently, NDBC buoy 46218 is the closest buoy to the project area. This buoy is located just southeast of Platform Harvest in approximately 549 m of water, and has been recording data since 2004.

California Cooperative Oceanic Fisheries Investigations Program (CalCOFI)

The California Cooperative Oceanic Fisheries Investigations (CalCOFI) program was organized in the late 1940s and provides one of the most extensive long-term hydrographic data sets in existence. CalCOFI Line 80 is a cross-shelf transect that extends offshore from the project area. Data on salinity, temperature, oxygen, nutrients (silicate, phosphate, nitrate, and nitrite), and primary productivity have been collected for decades at CalCOFI Stations 80.51 and 80.55 that are adjacent to the project area (SIO, 1990). Between 1955 and 1971, drift bottles were released in the vicinity of the project area and those data are summarized by Crowe and Schwartzlose (1972), Schwartzlose and Reid (1972), and Reid (1965). Later, the CalCOFI hydrographic data was used by Chelton (1984) and Hickey (1979) to describe the central-coast flow regime.

Organization of Persistent Upwelling Structures Program (OPUS)

The Organization of Persistent Upwelling Structures (OPUS) program was designed to synoptically sample the physical and biological processes associated with a localized persistent upwelling system near Point Arguello (Atkinson et al. 1986). Current meter moorings were deployed offshore of Purisima Point and hydrographic observations and current-velocity profiles were collected in the winter of 1983 when anomalous oceanographic conditions associated with an El Niño were extant (Brink and Muench, 1986; Brink et al. 1984; Barth and Brink, 1987; Dugdale and Wilkerson, 1989).

California Monitoring Program (CAMP)

The BOEM (formerly the Minerals Management Service, [MMS]) and the National Biological Service performed long-term oceanographic studies in the southern Santa Maria Basin between 1983 and 1995. This monitoring program investigated the fate and effects of petroleum development activities in the region between Point Arguello and Point Conception (Hyland et al. 1990). Long-term current-current meter moorings were deployed to augment water quality, sediment chemistry, and marine biological measurements. The influence of wind forcing and transient eddies on the local flow regime and upwelling was examined by SAIC and MEC (1995), Savoie et al. (1991), Bernstein et al. (1991), and Coats et al. (1991).

Central California Coastal Circulation Study (CCCCS)

The BOEM (MMS)-sponsored Central California Coastal Circulation Study (CCCCS; Chelton et al. 1987) was conducted along the central California continental shelf and slope between Point Conception and San Francisco Bay. Extensive hydrographic (water property) surveys were conducted over 18 months in 1984 and 1985 in conjunction with moored current meter and surface drifter deployments along the south central coast. Results from the CCCCS were presented by Chelton et al. (1988) and drifter data was presented by Chelton (1987).

California Current Ecosystem (CCE)

This multi-disciplinary project operates several surface moorings in the California Current. Currently two of the moorings are deployed off of Point Conception in conjunction with CalCOFI Line 80. The project's goals are resolution of event-scale ocean phenomena and understanding linkages between changes in the physical-chemical environment and the responses of ocean biota. One of the moorings was deployed in March 2012 on the shelf break, southwest of the Point Arguello Platforms. Data being collected include salinity, water temperature, oxygen, and nutrient levels, as well as air temperature, wind speed, and air pressure, and humidity.

4.1.1.2 Ocean Circulation

General Circulation

The flow field near the project area is influenced by a number of competing physical processes. Processes operating on the open-ocean flow field at distant locations exert their influence through the major ocean currents operating throughout the North Pacific Ocean. Beyond the continental slope (>100 km), the diffuse southward-flowing California Current represents the eastern limb of the clockwise-flowing gyre that covers much of the North Pacific Basin. Before turning south to form the California Current, subarctic water is carried along at high latitudes and is exposed to atmospheric cooling, nutrient regeneration, and precipitation. As a result, waters off the California Current are characterized by a seasonably-stable low salinity (32 to 34%), low temperature (13°C to 20°C), and high nutrient concentrations. They undergo less seasonal variation than surface waters at similar latitudes on the eastern seaboard.

Immediately shoreward of the California Current, along the central California continental slope and shelf, is a northward flowing counter current that carries water from the southern California Bight. These southern waters are warmer, more saline and less oxygenated than offshore waters. This northward-flowing Davidson counter current exhibits strong seasonal variability in intensity but maintains a sustained northward flow at depth near the project area despite reversals observed elsewhere along the California Coast (Chelton et al. 1988; Coats et al. 1991).

Seasonal variability in the Davidson Current near the project area coincides with large-scale fluctuations in coastal winds along the central California coast north of Point Conception. On average, winds are directed toward the south, parallel to the coast (Dorman and Winant, 1995). The northward-flowing Davidson Current is strongest when these southward winds relax between December and February. A rapid spring transition to stronger southward winds occurs between March and June when the Davidson Current weakens and can even turn southward near the sea surface. These strong southward winds in the spring induce intense upwelling near Point Arguello. During upwelling, surface water near the coast is transported offshore and is replace by cool, nutrient-rich water from deep offshore.

Significant interannual (year-to-year) variations in oceanographic properties and marine zoogeography also occur near the project area. These large amplitude variations are associated with the El Niño - Southern Oscillation, which cycles at a period of 3 to 5 years (Graham and White, 1988). During El Niño periods, such as between 1997 and 1998, basin-wide changes in the dynamic balance of wind-driven currents results in modified flow patterns along the coastline of western North and South America (Chelton et al. 1982).

Changes near the project area include an anomalous strengthening of Davidson Current outflow from the Southern California Bight. This increased outflow carries warm, saline sub-tropical waters northward into the SMB. It coincides with increased winter storm activity, reductions in zooplankton biomass, and the introduction of tropical marine organisms typically found much farther south.

Superimposed on these large-scale oceanic flows are a variety of transient phenomena including intense eddies, swirls, filaments, meanders, and narrow jets of flow. These turbulent features have been observed near the project area and are capable of transporting significant quantities of heat, nutrients, and pollutants to offshore waters (Savoie et al. 1991). Winds, tides, and waves also mix and transport nearshore waters within the surfzone. Tidal currents mix ocean waters near the project area, although they are not responsible for significant net transport. At shorter periods, shoaling internal and surface gravity waves also mix coastal water properties in both the horizontal and vertical directions.

Upwelling that is driven by southward directed winds in the spring and summer brings deep cool nutrient-rich water to the surface. Because of the semi-arid climate, substantial drainage from onshore is rare and regional water properties are largely determined by oceanographic processes. Nevertheless, river runoff during intense winter storms can significantly impact marine waters within localized areas along the California coast (Hickey, 2000).

Long-term current monitoring near Point Arguello has yielded a consistent picture of the flow near the project area (SAIC and MEC, 1995; Savoie et al. 1991; Bernstein et al. 1991; Coats et al. 1991). While subsurface currents are directed toward the northwest throughout the year, monthly-averaged surface currents reverse during spring upwelling when southward directed winds intensify.

Between about April and June, isolated two-to-five-day events of intense southward winds are followed, after about 17 hours, by southward current flow that has an offshore component (Savoie et al. 1991). The intensification of southward winds also causes upwelling that can be seen in satellite imagery as a cold-water plume extending offshore near Point Conception (Svejkovsky, 1988; Sheres and Kenyon, 1989). These distinct upwelling events increase the rate of new biological production (Dugdale and Wilkerson, 1989) and affect the distribution of water-mass properties (Reid, 1965).

The project-area flow regime differs from that along the central California coast to the north, where surface flows are predominantly southward throughout the year (Strub et al. 1987ab). It also differs from the counterclockwise flow within the SBC where weaker diurnal winds allow remote forcing, in the form of sea-level differences, to influence flow patterns (Caldwell et al. 1986; Brink and Muench, 1986; Harms and Winant, 1998). Sea-level differences are particularly important in determining flow within the SBC when southward-directed upwelling winds along the central coast relax (Hendershott, 2000).

Oil-Spill Transport

The trajectories of surface drifters released near the project area reflect the flow patterns measured by long-term current-meter moorings (Crowe and Schwarzlose, 1972; Schwartzlose and Reid, 1972; Chelton, 1987; Winant et al. 1999). Namely, northwestward transport is observed throughout much of the year except during strong upwelling events that are most prevalent between April and June. Prevailing winds between Point Arguello and Point Conception are directed to the southeast except during brief, three-to-four-day periods when winter storms disrupt the normal pattern as they pass through the region. Surface currents near the project area are generally directed to the northwest, in opposition to, and uncoupled with variation in the prevailing southeastward winds (Savoie et al. 1991; SAIC and MEC, 1995). During the spring and early summer, brief episodes of intensified southward-directed winds result in a reversal of surface currents. For periods of up to a week, near-surface flows turn toward the southeast in opposition to the northwestward current direction that is maintained throughout most of the water column at depth.

The opposing directions of the wind and surface currents between Point Arguello and Point Conception are evident in drifter studies. CalCOFI drifter bottles released north of the SBC in December 1969 migrated northward at speeds exceeding 15 cm s^{-1}. However at other times of the year, drift bottles released near Point Conception were recovered both to the north and to the south near San Diego. For release points near Point Arguello in 1984, many of the CCCCS surface drifters traveled south in response to strong southward directed winds (Chelton, 1987). It was only during a brief period of weak southward winds in July that the majority of drifters moved northward. However, the CCCCS drifter design is susceptible to a downwind motion of about 0.5% of the wind speed and thus may not accurately represent surface currents alone.

The drifters used in the SBC-SMB CCS were designed to minimize the influence of wind and wave drift in favor of tracking surface currents over a depth of about 1 m (Davis et al. 1982). As a result, flow statistics derived from the drifters compared well with that of the moored current meters (Dever et al. 1998). Beginning in January 1995, many of these drifters were deployed within the SMB, including locations near the project area. Few of the drifters released near the Point Arguello – Point Conception region beached before exiting the region (Dever et al. 2000; Winant et al. 1999). In a manner consistent with the long-term current meter data collected as part of CaMP, initial offshore movement was followed by northward movement into the SMB in fall and winter. Spring and summer deployments were more likely to show southward flow toward San Miguel Island. Few drifters moved westward to enter the SBC.

The complex interaction between winds and surface currents near Point Conception makes oil spill trajectory predictions difficult. During much of the year, but especially in the fall and winter, the northwestward surface flow is in direct opposition to the prevailing winds. Certainly surface flow, as determined by current meters and drifters, has a direct bearing on the fate and effects of potential oil spills resulting from the proposed project. However, winds also influence the spread and trajectory of oil slicks on the sea surface. Empirical data from the open ocean suggests that leading edge of an oil slick will drift at about 3% of the wind speed and oil-following drifters have been evaluated based on their ability to match this "*3% rule*" (Reed et al. 1988). However, there is no rigorously defensible theoretical basis or empirical data to support the application of this rule in coastal flow regimes such as near the project area.

The oil-spill risk analyses described in this evaluation were performed using the OSRA model for the SBC area. This model calculates probabilities of shoreline impact after applying a drift equivalent to 3.5% of the prevailing wind velocity in its trajectory computations. Because of the heavy influence of southward-directed winds near Point Conception, the model results indicate that the probability of shoreline impacts along the Channel Islands to the south is far higher than at sites along the central coast to the north. The influence of southward directed winds in the model effectively overcomes the northwestward surface currents observed over much of the year in the field programs. This contrasts with SBC-SMB CCS drifters which tend to travel toward the south only about 31% of the time and only about 15% of these intersect the shoreline (Browne, 2000). In Browne's analysis, northward transport has a slight edge with 32% of the trajectories traveling to the north and contacting the coast about 23% of the time.

Clearly, the complexity of opposing winds and currents near the project area makes the reconciliation between OSRA model results and observations difficult. Because the applicability of the "*3% wind rule*" in complex coastal flow regimes has not been rigorously quantified, this environmental evaluation entertains the possibility for spilled oil to travel from the project area toward the north and into the SMB.

Similarly, the environmental evaluation for the proposed project does not rely solely on shoreline impact probabilities determined exclusively from available drifter trajectories. Drifters, with their measurable mass and finite vertical profile below the sea surface, cannot capture the behavior of an oil slick that is typically only a few millimeters thick (Reed et al. 1988). Furthermore, dispersion and weathering affects the spread of oil on the sea surface, and buoys cannot capture the changing slick dynamics across a wide range of winds, waves, and currents. Goodman et al. (1995) and Simecek-Beatty (1994) tested the oil-tracking ability of several drifter designs, including the Davis et al. (1982) design used in the SBC-SMB CCS study. They found that Davis-type drifters lagged behind simulated oil slicks presumably because they are optimized to track surface currents with minimal influence by winds and waves. In cases where winds opposed surface currents, the Davis-type drifters moved into the prevailing wind and in a direction opposite of the simulated oil slicks made from wood chips. This is similar to the case in the project area where the northward-flowing Davidson current often opposes the prevailing southward-directed winds.

Drill Mud Transport

Drill-mud transport estimates are not subject to the same discrepancies between observations and modeling. The subsurface flow in the project area is predominantly toward the northwest, regardless of the intensity of the southward-directed upwelling winds (Savoie et al. 1991). Drilling mud discharged at depth from Platform Hidalgo will be preferentially transported to the northwest. This finding has been independently confirmed through a comparison of mud-trajectory modeling and drill-mud accumulations within seafloor sediment traps near the project area (Coats, 1991).

4.1.1.3 Wave Climatology

As with currents, the wave climatology of the project area represents a transition from the sheltered environment of the SBC and the exposed coastal region of the SMB. Maximum design wave heights for 100-year return periods along the central California are 60 feet compared to 45 feet in the SBC because of sheltering effects from the Channel Islands and the orientation of the coastline (API, 1987). Without the benefit of island sheltering, the project area is likely to experience a comparatively high flux of wave energy although the influence of intense winter storms to the north is limited by the orientation of the coastline. Along the adjacent shoreline, energetic wave action forms a harsh intertidal environment for benthic organisms. As a result, intertidal organisms tend to be burrowers adapted to high turbidity and mechanical disturbance.

The ambient sea state at the time of an oil spill determines the effectiveness of dispersants (Lunel, 1995) and booms deployed to contain the oil offshore. Upon reaching the coastline, high surf determines the intertidal distribution of oil and the ability of cleanup crews reach the affected area.

Deepwater Wave Climatology

Four primary meteorological sources generate waves offshore the project area: extratropical winter cyclones in the northern hemisphere, northwesterly winds during the spring transition and summer, tropical disturbances offshore Mexico, and extratropical storm swells generated in the southern hemisphere during summer. The first two are the primary sources for the wave climate along the central California coast, however the last two occasionally generate significant southerly swell events that can also impact the project area.

- **Winter Storm Waves.** These waves are generated by extratropical winter cyclones and are often accompanied by local rainfall along the coast. Extratropical storms are associated with low-pressure systems that develop along the polar front in the Pacific Ocean and propagate westward toward the central coast. Thus, major wave events often coincide with an increased marine discharge of terrestrial sediments eroded by heavy rainfall. These storms occur predominantly in winter (December through March; Noble Consultants, 1995).
- **Northwesterly Winds.** With the exception of major winter storm events, the predominant mechanism for generating waves over the central California continental shelf is prevailing northwesterly winds. These winds dominate during the spring and summer when a high-pressure system is established over the eastern North Pacific Ocean. The winds are highly coherent over the project area (Chelton et al. 1987) and generate wind waves over a large fetch. These locally generated waves tend to be of shorter period and smaller significant wave height than those generated by major winter storms.
- **Southerly Swells.** Occasionally, large southerly swells that originate offshore Mexico or in the southern hemisphere impact the project area during the summer months. One particularly large event resulting from a storm 400 miles south of Tahiti occurred in late July 1996. During this event, the wave gauge at Platform Harvest recorded significant wave heights of over 2 m. These long period waves (20-s significant period) arrived from directions ranging between 200 degrees T (degrees from true north) and 230 degrees T. Major wave events arriving from south are rare, however, so deepwater wave climatology in the project area is directionally bimodal with the majority of events arriving directly from the west (270 degrees T) or from the northwest (300 degrees T) (Seymour, 1996).

Coastal Wave Climatology
Deepwater waves arriving from certain directions never reach some coastal locations depending on the coastline orientation and the presence of major coastal promontories such as Point Arguello and Point Conception. Coastal WIS Stations 133 (Point Arguello) and 134 (Point Conception) are adjacent to the project area and have respective coastline orientations of 118 degrees T and 148 degrees T (Jensen et al. 1989). Blocking by the two adjacent major promontories limits the respective wave windows to 158 - 298 degrees T and 178 - 328 degrees T. In the project area, deepwater waves arriving from the northwest are blocked by the coastline so that almost all of the waves (>90%) arrive directly from west (about 270 degrees T). These waves impinge on the coastline at an oblique angle and drive much of the longshore circulation within the littoral zone.

Overall, about 10% of the waves in 30-foot water depths exceed 10 feet and have a dominant period of 14 seconds. For return periods between 5 and 20 years, maximum significant wave heights are close to 18 feet. Offshore oil-spill cleanup operations involving a boom and skimmer have been hampered in 8- to 10-foot seas (McDonald, 1995). This suggests that offshore cleanup operations will be limited about 10% of the time and on occasion, would be untenable.

4.1.2 Marine Resources

The offshore biological communities in the project area are described in detail in the original Development Plan EIR/EIS prepared for the Point Arguello Field and Gaviota Processing Facility (ADL, 1984). As such, the environmental descriptions provided below present the reader with an overview and supplement rather than an exhaustive literature review on biological topics pertaining to the region.

4.1.2.1 Plankton

Plankton are organisms that have limited or no swimming ability and generally drift or float with the ocean currents. The two broad categories of plankton are phytoplankton and zooplankton. Phytoplankton, or plant plankton, form the base of the food web by photosynthesizing organic matter from water, carbon dioxide, and light. They are usually comprised of unicellular or colonial algae and support zooplankton, fish, and through their decay, large quantities of marine bacteria. Zooplankton are the animal plankton, and form the primary link between phytoplankton and larger marine organisms in the marine food web. Plankton are also divided into groups based on their life histories. Holoplankton are organisms that spend their entire lives as plankton. Jellyfish, salps, copepods, and diatoms are all included in this category. In contrast, meroplankton spend only a portion of their life cycle, usually the larval or early stages, as plankton. Examples of meroplankton the larvae of sea urchins, starfish, sea squirts, most of the sea snails and slugs, crabs, lobsters, octopus, marine worms and most fishes. The larval, planktonic stages of fish and their eggs are referred to as ichthyoplankton.

Plankton distribution, abundance, and productivity are dependent on several environmental factors. Factors include light, nutrients, water quality, terrestrial runoff, and upwelling. Plankton distribution tends to be very patchy and characterized by high seasonal and inter-annual variability (Doyle et al. 2002). Because phytoplankton are photosynthetic, they are generally limited to the photic zone while zooplankton can occur throughout the water column from surface to bottom.

Phytoplankton

The phytoplankton community off the California coast primarily consists of diatoms, dinoflagellates, silicoflagellates, and coccolithophores (Hardy, 1993; Doyle et al. 2002; Handler, 2002). Standard measures for describing phytoplankton communities are productivity, standing crop, and species composition.

Productivity, which is a measure of growth or new plant material per unit time, is extremely variable off the California coast. Generally, the highest productivity levels occur within about 50 km of the coastline (Owen, 1974) and tend to be the highest or about six times higher in upwelling areas than the open ocean Riznyk (1974). Springtime primary production levels are approximately 5 times higher than summer and 10 times higher than winter (Oguri and Kanter, 1971).

Standing crop, or the amount of phytoplankton cells present in the water, is also extremely variable and heterogeneous off the California coast. Owen (1974) reports highest standing crop values during the summer (range of 2.50 to 3.00 mg/m^3) and lowest values during the winter months (range of 0.30 to 0.40 mg/m^3). Palaez and McGowan (1986) also report high densities of phytoplankton in spring and summer that lessen in the fall and become the lowest in the late fall and early winter. They attributed the seasonal differences to ocean circulation patterns and the low nutrient content of waters off the California coast during the winter months.

Phytoplankton biomass have been reported to be higher near Point Conception than in locations north or south because of greater upwelling off the Point (Owen, 1974). Biomass reached peak levels during summer (July to September) and decreased from October to December and with distance from shore. Highest biomass values were reported during August and in the upper 20 m of the water column (Owen and Sanchez, 1974).

Data from several studies indicate that the composition of the phytoplankton community is similar along the entire coast of California (e.g., Bolin and Abbott, 1963; Allen, 1945). The diatom *Chaetoceros* was the most abundant species found along the coast (Bolin and Abbott, 1963; Cupp, 1943). Other dominant species included the diatoms *Skeletonema*, *Nitzschia*, *Eucampia*, *Thalassionema*, *Rhizosolenia* and *Asterionella*, and the dinoflagellates *Ceratium*, *Peridinium*, *Noctiluca*, and *Gonyaulax* (Bolin and Abbott, 1963).

Zooplankton

Zooplankton are those animals that spend part (meroplankton) or all (holoplankton) of their life cycle as plankton. Their temporal and spatial distributions are dependent on a number of factors including currents, water temperature, and phytoplankton abundance (Loeb et al. 1983). Spring blooms occur for both meroplankton and holoplankton while fall blooms tend to be restricted to the holoplankton. The meroplankton include the larvae of many commercial species of fish, lobster, and crabs. Like phytoplankton, spatial distribution of zooplankton is extremely patchy.

Based on data collected by the California Cooperative Oceanic Fisheries Investigations (CalCOFI), McGowan and Miller (1980) reported a high degree of variability in species composition in offshore waters and that dominant species vary widely even from sample to sample. Fleminger (1964) reported 190 species and 65 genera of calanoid copepods. Kramer and Smith (1972), estimated that 546 invertebrate and 1,000 species of fish larvae occur in the California Current System. Major zooplankton groups off the California coast include copepods, euphausiids, chaetognaths, mollusks, thaliaceans, and fish larvae.

In studies conducted at Diablo Canyon, Icanberry and Warrick (1978) identified 94 taxonomic zooplankton categories. Dominant categories included calanoid copepod nauplii and copepodites, thalicians, *Oikopleura*, *Euphausia*, calyptopis, cyclopoid and harpacticoid copepodites, and the copepod *Acartia tonsa*. Seasonal studies at Diablo Canyon indicate that zooplankton production is highest during June and July and in early spring during periods that coincide with upwelling periods and increased levels of phytoplankton (Icanberry and Warrick, 1978; Smith, 1974).

Ichthyoplankton

Ichthyoplankton, or fish eggs and larvae, are an important component of the zooplankton community. With the exception of a few fish species (e.g., the embiotocidae or surfperches that bear live young), most fish that occur off south-central California are present as larvae or eggs in the plankton community. The spatial and temporal distribution and composition of the ichthyoplankton are generally due to the spawning habits and the requirements of the adults. Seasonal patterns of ichthyoplankton in nearshore waters are influenced by the spawning cycles of demersal fish species and the northern anchovy, *Engraulis mordax*, while further offshore, composition is influenced by pelagic and migratory species, and rockfish (*Sebastes* spp). Like phytoplankton and zooplankton, the spatial distribution of ichthyoplankton is patchy and influenced by several environmental factors.

In CalCOFI samples collected offshore California, ichthyoplankton were found to be at their highest densities from January to March (Loeb et al. 1983). This was due to the peak spawning season for the northern anchovy, Pacific hake, Pacific mackerel, and the Pacific sardine; larvae of these species comprised up to 84 percent of the samples. Generally, they found that ichthyoplankton densities decreased from north to south and inshore to offshore between San Francisco and Baja California.

In a summary of CalCOFI fish larvae data Ahlstrom (1965) found that twelve taxa made up over 90 percent of the larvae collected. The most abundant was the northern anchovy, *Engraulis mordax*. Other common larval species were the Pacific hake, *Merluccius productus*; rockfish, *Sebastes* spp.; flatfish, *Citharichthys spp*.; and the California smoothtongue, *Leuroglossas stilbius*. Anchovy and rockfish larvae were abundant from the winter to spring seasons. Spawning varied by season, but with no discernible pattern within the California Current system (Kramer and Ahlstrom, 1968; Ahlstrom et al. 1978). In a year-round study off of Point Arguello, the white croaker, *Genyonemus lineatus*, and the northern anchovy, *Engraulis mordax,* were the most abundant fish larvae collected (Chambers Consultants 1980).

4.1.2.2 Fishes

Fish resources in the project area consist of both year-round residents and seasonal migrants. Over 600 species of fish have been reported in the Pacific OCS region (MMS 1996). Large numbers of shellfish and other invertebrate species also occur in the area with the most important being crabs, shrimp, bivalves, and squid. A wide variety of habitats are available in the region for fish resources and the distribution of fishes in the area fluctuates in accordance with food availability, environmental conditions, and migration (MMS 1996). With respect to fish distribution in the area, the offshore environment can generally be divided into two zones. They are the benthic or shelf and pelagic zones. Demersal or benthic species are those that live on or near the sea floor while pelagic fish species occur in the water column.

Demersal Fish

The offshore benthic environment generally consists of sandy, muddy, or rocky substrates. Important commercial or recreational fish species found beyond the tidal and wave zone include flatfishes, rockfishes, lingcod, and cods. In shallower water, common fish species are the perches, smelts, skates, rays, and flatfishes. Several researchers (e.g., Bence et al. 1992; Wakefield 1990; Cailliet et al. 1992) have reported that demersal fish species distributions are based on depth or depth-related factors. General depth distributions for fish common to the project area are summarized in Table 4.1.

Table 4.1 Depth Distribution of Demersal Fish Common to the Project Area

Water Depth			
50 – 200 m	**200 – 500 m**	**500 – 1200 m**	**1200 – 3200 m**
Sand dabs *Citharichthys sordidus*	Sablefish *Anoplopoma fimbria*	Thornyheads *Sebastolobus* spp.	Rattails *Coryphaenoides filifer*
English sole *Pleuronectes vetulus*	Pacific hake *Merluccius productus*	Pacific hake *Merluccius productus*	Thornyheads *Sebastolobus* spp.
Rex sole *Errex zachirus*	Slickhead *Alepocephalus tenebrosus*	Slickhead *Alepocephalus tenebrosus*	Finescale codling *Antimora microlepis*
Rockfish *Sebastes* spp.	Eelpouts *Lycenchelys jordani*	Rattails *Coryphaenoides filifer*	Eelpouts *Lycenchelys jordani*
Pink surfperch *Zalembius rosaceus*	Rockfish *Sebastes* spp.		
Plainfin midshipman *Porichthys notatus*	Thornyheads *Sebastolobus* spp.		
White croakers *Genyonemus lineatus*			

Fish densities on the continental shelf between 50 and 200 m water depth are generally high, with flatfish densities being highest for species such as Pacific sanddabs and English and Dover sole. Rockfish, as a group, have historically been extremely abundant on the shelf and at depths to 270 m (Bence et al. 1992). However, significant declines have been reported for many rockfish species in recent years (Love et al. 1998; Ralston, 1998). While specific reasons for the decline have been debated, there is little doubt that rockfish biomass and commercial harvests have decreased since the 1960's (Bloeser, 1999). Fish densities and biomass on the upper and middle slope are relatively high with rockfish, sablefish, and flatfish such as Dover sole dominating (SAIC, 1992). At deeper depths (greater than 1,500 m), the numbers of fish species, densities, and biomass are typically low. Rattails and slickheads are the most common species at this depth (SAIC, 1992).

Offshore platforms provide habitat for marine organisms including a wide variety of fish. Results from fish surveys conducted by Love et al. (1999), at the four platforms (Hidalgo, Harvest, Hermosa, and Irene) in the Santa Maria basin indicate a large amount of spatial and temporal variability at each of the platforms. The number of species present at each of the platforms decreases from west to east. Of the four platforms, Irene, located north of Point Arguello was inhabited by the highest number of species. Of the 21 species, 44 percent were rockfish. Sardines were the only pelagic species observed at Irene. Twenty species were reported for Platform Hidalgo, 16 species at Platform Harvest, and 13 species at Platform Hermosa (Love et al. 1999).

Different fish communities are found at mid-water versus bottom habitats beneath the platforms (Love et al. 1999). Although rockfish was the dominant species at both depths, the mid-water community was comprised largely of young-of-the-year (YOY) or juveniles while the bottom assemblage consisted largely of adults or subadults. Fewer species were present in the mid-water than the bottom (Love et al. 1999).

Pelagic Fish

Pelagic fish are those species associated with the ocean surface or the water column. The distribution of pelagic fish is generally governed by water depth, distance from shore, and other environmental factors. Oceanic waters up to depths of approximately 200 m are referred to as the epipelagic zone. Epipelagic zone waters are typically well lit, well mixed, and support photosynthetic algal communities. Water depths from 200 to approximately 1,000 m are referred to as the mesopelagic zone, while depths greater than 1,000 m comprise the bathypelagic zone. With increasing depths, light, temperature, and dissolved oxygen concentrations decrease as pressure increases. Hence, the bathypelagic zone, is characterized by complete darkness, low temperature, low oxygen concentrations, and high pressure.

Pelagic fishes in the project area are a mix of year-round residents and migrants from several different habitats. Species include large predators (e.g., tunas, sharks, swordfish) as well as forage fish (e.g., northern anchovy, Pacific sardine, Pacific saury, Pacific whiting). The distributional ranges for pelagic fishes are generally quite extensive and cover much of the coastal California region. Many fish in the pelagic zone such as albacore tuna and Pacific salmon migrate over vast areas in the Pacific.

Common epipelagic fish in the region include mackerel (*Scomber japonicas*), salmon (*Onchorhyncus* spp.), and schooling fish such as Pacific herring (*Clupea pallasii*), northern anchovy (*Engraulis mordax*), and rockfish (*Sebastes* spp*.).* Bence et al. (1992) reported approximately 140 epipelagic species from midwater trawls. In those trawls, juvenile rockfish, Pacific herring, and northern anchovy were the dominant species. Other epipelagic species common to the area included medusafish (*Icichthys lockingtoni*) Pacific sardine (*Sardinops sagax)*, Pacific saury (*Cololabis saira)*, Pacific argentines (*Argentina sialis)*, and tunas (ARPA, 1995). Epipelagic species such as albacore tuna (*Thunnus alalunga*) and salmon are important commercial and recreational fish species.

Less is known of the pelagic fish in the mesopelagic and bathypelagic zones. Typical species in the area include the blacksmelt (*Bathylagus milleri*), northern lampfish, viperfish, and the lanternfish (Cross and Allen, 1993). Examples of bathypelagic fish include dragonfish, hatchetfish, and bristlemouth (Cross and Allen, 1993).

Endangered and Threatened Fish Species

There are currently two fish species listed under the U.S. Endangered Species Act that occur in the project area and could be impacted by the proposed project: the steelhead trout (*Oncorhynchus mykiss)* and the tidewater goby *(Eucylogobius newberryi.).*

Steelhead are anadromous rainbow trout that can migrate extensively at sea (Eschmeyer and Herald, 1983). Two distinct populations of west coast steelhead occur in the project area: the southern California population and south-central California coast population. In August, 1997, the southern California (from the Santa Maria River south to Malibu Creek) distinct population segment (DPS) was listed as an endangered species while the south-central coast population (Santa Cruz to the Santa Maria River) was listed as threatened (NMFS, 1999).

Steelhead hatch in fresh water streams and descend to the ocean where they spend much of their lives, but return to fresh water to spawn. Depending on the stream, steelhead can be either summer or winter migrators; however, all steelhead in the project area are considered winter steelhead. Regardless of migration period, steelhead spawning usually takes place from March to early May (NMFS, 1999). NMFS (1999) identified river reaches and estaurine areas near the project area, including the Santa Ynez River, as critical habitats for steelhead.

The tidewater goby is a small fish typically found in the uppermost brackish zone of larger estuaries and coastal lagoons. It is often found in waters of relatively low salinities (around 10 parts per thousand [ppt]) but can tolerate a wide range of salinities from fresh water (0 ppt) up to 42 ppt (Swift et al. 1989, 1997; Worcester 1992, Worcester and Lea 1996, Swenson 1995).

The species' tolerance of high salinities likely enables it to withstand exposure to the marine environment, allowing it to colonize or reestablish in lagoons and estuaries following flood events (Swift et al. 1989; Worcester and Lea 1996; Lafferty et al. 1999a).

The tidewater goby is discontinuously distributed along the California coastline. Its range extends from Del Norte County south to San Diego County. The tidewater goby has been extirpated from 50 percent of the lagoons within its historical range and 74 percent of the lagoons south of Morro Bay, and is currently listed as a federally endangered species. It has been

reported in several coastal lagoons and tidal streams at onshore locations adjacent to the project area (e.g., Santa Ynez River estuary and Goleta Slough) (USFWS, 1994).
. There is some data (Dawson et al. 2001) that suggests that tidewater gobies may disperse intermittently via the ocean; however, the extent and frequency of such migrations is uncertain.

Generally, tidewater gobies occur in loose aggregations consisting of a few to several hundred individuals in shallow water less than 1 m. Spawning activities occur in late April to May. The life span of a tidewater goby is generally only one year, although individuals in the northern range may live to three years (Lee et al. 1980).

4.1.2.3 Marine Mammals

Approximately 40 marine mammal species are known or have the potential to occur off south-central California (Dohl et al. 1983a,b; Bonnell and Dailey, 1993; and Takekawa, 2004). These can be broadly categorized as: 1) migrants that pass through the area on their way to calving or feeding grounds, 2) seasonal visitors that remain for a few weeks to feed on a particular food source, or 3) residents of the area.

The project area represents a region of overlap where populations of marine mammals having different biogeographic affinities (boreal and subtropical) intermingle. For example, boreal species, such as Dall's porpoises (*Phocoenoides dalli)*, harbor porpoises (*Phoecoena phoecoena*), and the northern fur seals (*Callorhinus ursinus)* inhabit the cooler waters of the North Pacific. For them, the project area represents the southern extent of their range. These species are typically found in areas of coastal upwelling and in the coolest waters of the California current. They are usually observed in the project area from winter through early summer.

Conversely, in late summer and autumn, marine mammals typically found in warmer, subtropical waters to the south may be encountered in the project area. Examples of these species include bottlenose dolphins, Guadalupe fur seals, and pilot whales. Other species, such as the southern sea otter (*Enhydra lutris nereis*), are endemic to coastal south-central California and occur in the project area year-round. Several species are largely restricted to the waters of the California Current and occur in high numbers off of south-central California. These species include the California sea lion, northern elephant seal, and during its migration, the California gray whale (Dohl et al. 1983a).

Cetaceans

Cetaceans (whales, dolphins, and porpoises) inhabit the project area waters year-round. The numbers and species vary from season to season and from year to year, but more than 30 species are known to utilize the waters offshore south-central California. A listing of these species, their expected occurrence in the project area waters, and current status under the U.S. Endangered Species Act is provided in Table 4.2 and Table 4.3. The tables separate the cetaceans into two main divisions (suborders), the toothed whales (Odontoceti), which also include dolphins and porpoises, and the baleen whales (Mysticeti). Cetacean population levels are generally at their lowest in spring and are at their highest during the autumn (Dohl et al. 1983a).

Table 4.2 Toothed Whales of the Eastern North Pacific and their Occurrence in the Project Area

Common Name	Scientific Name	Occurrence	Status
Sperm whale	*Physeter macrocephalus*	Uncommon. Occurs year-round, but typically far offshore	E
Dwarf sperm whale	*Kogia simus*	Rare. Occurs in tropical and warm temperate waters.	NA
Pygmy sperm whale	*Kogia breviceps*	Rare. Occurs in tropical and warm temperate waters.	NA
Short-finned pilot whale	*Globicephala macrorhynchus*	Small year-round population with increases during winter	NA
Killer whale	*Orcinus orca*	Uncommon. Occurs year-round.	NA
False killer whale	*Pseudorca crassidens*	Rare. Occurs primarily in tropical to warm temperate waters.	NA
Cuvier's beaked whale	*Ziphius cavirostris*	Rare. Occurs in tropical and warm temperate waters.	NA
Baird' beaked whale	*Berardius bairdii*	Rare. Endemic to Arctic and cool temperate waters	NA
Hubb's beaked whale	*Mesoplodon carhubbsi*	Rare. Known primarily from stranding records	NA
Ginkgo-toothed beaked whale	*Mesoplodon ginkgodens*	Rare. Known primarily from stranding records	NA
Hector's beaked whale	*Mesoplodon. hectori*	Rare. Known primarily from stranding records	NA
Blainville's beaked whale	*Mesoplodon densirostris*	Rare. Possible visitor to area	NA
Bering Sea beaked whale	*Mesoplodon stejnegeri*	Rare. Possible visitor to area	NA
Striped dolphin	*Stenella coeruleoalba*	Rare. Occasional visitor to area.	NA
Spinner dolphin	*Stenella longirostris*	Rare. Occurs in tropical waters; possible visitor to area	NA
Spotted dolphin	*Stenella. attenuata*	Rare. Occurs in tropical waters; possible visitor to area	NA
Rough-toothed dolphin	*Steno bredanensis*	Rare. Occurs in tropical waters; possible visitor to area	NA
Short-beaked common dolphin	*Delphinus delphis*	Common. Year-round resident	NA
Long-beaked common dolphin	*Delphinus capensis*	Common. Year-round resident	NA
Northern right-whale dolphin	*Lissodelphis borealis*	Uncommon.	NA
Pacific white-sided dolphin	*Lagenorhynchus obliquidens*	Common. Year-round resident	NA
Risso's dolphin	*Grampus griseus*	Common. Year-round resident with peak population in summer and autumn	NA

Table 4.2 Toothed Whales of the Eastern North Pacific and their Occurrence in the Project Area

Common Name	Scientific Name	Occurrence	Status
Dall's porpoise	*Phocoenoides dalli*	Common. Year-round resident with peak population in autumn and winter	NA
Bottlenose dolphin	*Tursiops truncatus*	Uncommon. Year-round resident	NA
Harbor porpoise	*Phocoena phocoena*	Uncommon. Year-round resident in waters north of Point Conception.	NA

Source: Adapted from Bonnell and Dailey 1993; Barlow et al. 1997; Forney et al. 1999; Takekawa 2004; and Caretta et al 2011
Notes: NA = Not Applicable; E = Federal Endangered;

Cetacean sightings off south-central California are dominated by two species of common dolphin. Short-beaked common dolphins (*Delphinus delphis*) are widely distributed between the coast and at least 300 nautical miles (nm) distance from shore, while the closely related long-beaked dolphin (*Delphinus capensis*) remains slightly nearer to shore at 50 nm (Bearzi et al. 2009). Both species inhabit the waters of the project area year-round, and often appear in large pods of several hundred individuals or more.

Smaller groups of Risso's dolphins (*Grampus griseus)*, Pacific white-sided dolphins (*Lagenorhynchus obliquidens)*, Dall's porpoises (*Phocoenoides dalli*) and harbor porpoises (*Phocoena phocoena)* can also be found in the project area. These species vary in their patterns of usage of the area and periods of peak abundances (Dohl et al. 1983a). In recent years, a growing number of killer whale (*Orcinus orca*) sightings have also occurred throughout central and southern California waters, primarily in conjunction with the gray whale (*Eschrichtius robustus)*, and humpback whale (*Megaptera novaeangliae)* migrations. Killer whales are a top predator in the ocean, and prey on a variety of marine mammals, including gray and humpback whales.

Numerically, baleen whales are not a major component of the area's cetacean fauna. However, substantial portions of the populations of four species frequent the project waters: the California gray whale the humpback whale, the blue whale (*Balaeoptera musculus)*, and the fin whale (*B. physalus)* (Dohl et al. 1983a) (See Table 4.3). The majority of these whales use the coastal waters in the project area as migratory routes twice a year.

The California gray whale is the most common baleen whale that passes through the area. Most of the world's population of this species conducts a biannual trip along the California coastline, with the majority found close to shore over continental shelf waters (Herzing and Mate, 1984; Reilly, 1984; Rice et al. 1984; Rugh, 1984; Dohl et al. 1983a; Sund and O'Connor, 1974). During the migrations from 1983 through 1985, the majority of the animals were 1.5 to 1.8 kilometers offshore (0.8 to 1 nautical miles) and less than 20 percent were as close as 0.9 kilometer (0.5 nautical miles).

Table 4.3 Baleen Whales (Mysticeti) of the Eastern North Pacific and their Status in the Project Area

Common Name	Scientific Name	Occurrence	Status
Blue whale	*Balaeoptera musculus*	Seasonally common. Population highest in summer.	E*
Fin whale	*Baleanoptera physalus*	Population highest in summer	E
Sei whale	*Baleanoptera borealis*	Rare. Seen only during summer months during migration	E
Bryde's whale	*Baleanoptera edeni*	Rare. Occurs in tropical and warm temperate waters.	NA
Minke whale	*Baleanoptera acutorostrata*	Resident population; peak abundance during summer and fall	NA
Gray whale	*Eschrichtius robustus*	Seasonally common. Population highest during winter and spring	NA
North Pacific right whale	*Eubalaena japonica*	Rare. Only two known sightings in southern CA.	E
Humpback whale	*Megaptera novaeangliae*	Seasonally common. Population highest in summer	E

Source: Adapted from Bonnell and Dailey 1993; Barlow et al. 1997; Forney et al. 1999; Caretta et al 2010, 2011
Notes: NA = Not Applicable; E = Federal Endangered;

Peak periods of abundance of baleen whales occur during the winter and spring migration seasons. However, as the overall populations of certain species increase (e.g., gray and humpback whales), larger numbers are becoming resident to areas offshore California (Dohl et al. 1983a). Since 1980, there is also an indication that the abundance of blue and fin whales has increased in California coastal waters. However, it is not certain if the increase is due to growth of the stock or an increased use of California waters as a feeding area (Barlow et al. 1997).

Blue and humpback whales often pause to feed along the coast during their migrations. Large concentrations of blue whales have been documented off California and Baja California and in the eastern tropical Pacific since the 1970s (Wade and Friedrichsen 1979, Calambokidis et al. 1990, Reilly and Thayer 1990, Calambokidis and Barlow 2004).

Pinnipeds

Four pinniped (eared seals, earless seals, and walruses) species currently occur and maintain regular breeding populations off south-central California: the California sea lion (*Zalophus californianus)* the northern fur seal (*Callorhinus ursinus)*, the northern elephant seal (*Mirounga angustirostris)*, and the harbor seal (*Phoca vitulina)* (Bonnell et al. 1983) (Table 4.4). Two additional species are occasional visitors to the area: the Steller sea lion (*Eumetopias jubatus)* and the Guadalupe fur seal (*Arctocephalus townsendi*). These species have historically bred on nearby offshore islands, but do not currently maintain breeding colonies in the region.

Table 4.4 Pinnipeds and Otters of the Eastern North Pacific and Their Status off California

Common Name	Scientific Name	Abundance	Status
Northern fur seal	*Callorhinus ursinus*	Common.Year-round resident.	NA
Northern elephant seal	*Mirounga angustirostris*	Common.Year-round resident.	NA
California sea lion	*Zalophus californianus*	Common.Year-round resident.	NA
Pacific harbor seal	*Phoca vitulina*	Common.Year-round resident.	NA
Steller sea lion	*Eumetopias jubatus*	Uncommon. Occasional visitor to area from northern latitudes.	T; proposed for delisting
Guadalupe fur seal	*Arctocephalus townsendi*	Uncommon. Occasional visitor to area from southern breeding grounds.	T
Southern sea otter	*Enhydra lutris nereis*	Common. Year-round resident.	T

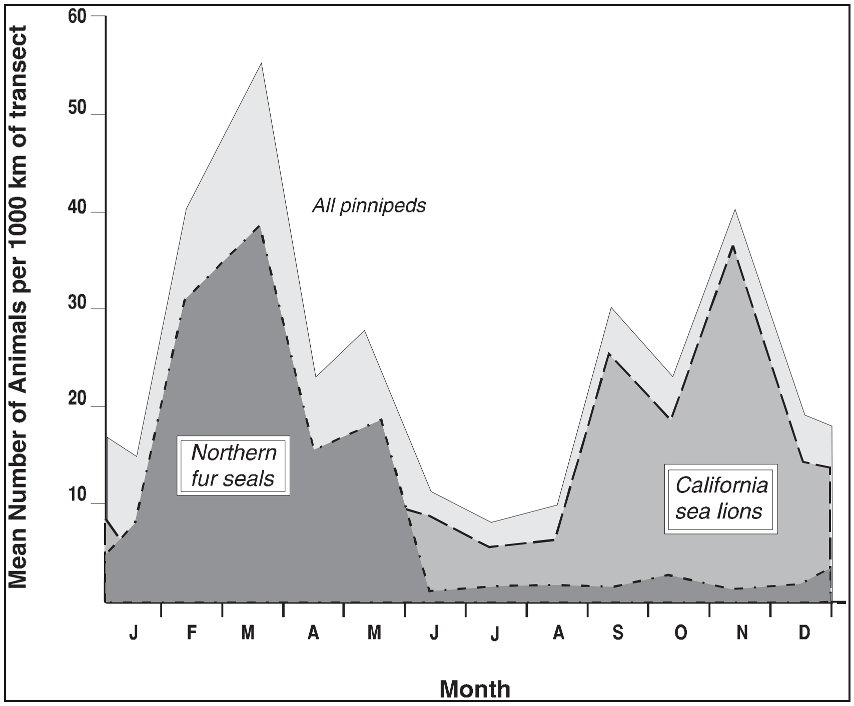
Adapted from Bonnell and Dailey 1993; Caretta et al. 2011Notes: T = Federal Threatened Species; NA = Not Applicable

The at-sea pinniped population in the project region is predominately composed of northern fur seals or California sea lions. When one population is at its peak, the other is at its low for the area (Bonnell et al. 1983). Northern fur seals numbers off California typically reach their peak in February, when several hundred thousand migrants from the Bering Sea arrive to overwinter in California waters. Conversely, California sea lions reach their peak in the region in fall (Figure 4-2), as the breeding population disperses northward from rookery islands in the northern Channel Islands and Southern California Bight.

Approximately half of the U.S. population on the west coast, currently comprising around 100,000 sea lions, breeds on the northern Channel Island of San Miguel. In the fall, following the breeding season, thousands of predominately immature and adult male sea lions disperse northward along the waters of the California Current. They winter along the coast as far north as British Columbia.

Northern elephant seals pup and breed on the Channel Islands as well as along the central coast of California. Breeding occurs from January to February, and pups are born the following winter (December through January). Harbor seals do not make extensive pelagic migrations, but do travel 300-500 km on occasion to find food or suitable breeding areas (Herder 1986; Harvey and Goley 2011). In California, approximately 400-600 harbor seal haulout sites are widely distributed along the mainland and on offshore islands, including intertidal sandbars, rocky shores and beaches (Hanan 1996; Lowry et al. 2008). The nearest breeding rookeries to the project area are located on San Miguel and Santa Rosa Islands and on the mainland at Carpinteria.

Figure 4-2 Seasonal Abundance of Pinnipeds in the Waters of Central and Northern California



Source: Bonnell et al. 1983

Sea Otters

Historically, sea otters (*Enhydra lutris*) in the northeast Pacific numbered around 150,000 animals and ranged from about Prince William Sound in Alaska to Morro Hermoso in Mexico (Kenyon, 1969). However, around two hundred years ago, demand for the sea otter's dense pelt nearly led to its extinction, and isolated the remaining populations from one another.

The present population of sea otters in California is actually descended from a small remnant population of around 50 animals that was rediscovered near Bixby Creek, along the Big Sur coastline of central California, and is classified as a distinct subspecies, the southern sea otter (*Enhydra lutris nereis*). Southern sea otters, a federally and state-protected species,
Currently, sea otters in California range from approximately Point Año Nuevo in the north to Coal Oil Point (Santa Barbara) in the south (USGS 2008).

Southern sea otters are a coastally dependent species, that rarely strays far (<2 km) from shore (Riedman and Estes 1990), foraging almost entirely on macroinvertebrates (Ebert, 1968; Estes et al. 1981). In rocky areas along the central California coast, major prey items include abalones, crabs, and sea urchins. In sandy areas, prey items include clams, snails, octopus, scallops, sea stars, and echiuroid worms (Boolootian, 1961; Ebert, 1968; Estes, 1980; Estes et. al., 1981; Wendell et al. 1986).

Sea otters maintain home ranges that generally consist of several heavily used areas connected by travel corridors. However the population also undergoes a seasonal migration twice a year in conjunction with breeding activities. During the breeding season (June to November), the size of the southernmost group of otters, near the project area, declines dramatically due to a northward movement of primarily male animals towards the center of the range (Bonnell et al. 1983; Estes and Jameson, 1983). This movement of males from the population fronts into the more established areas occupied by females during the summer and fall breeding season is a feature of the sea otter's annual cycle (Bonnell et al. 1983).

Substantial changes have occurred in the distribution and density of sea otters within the California range in the last 20 years. The changes have generally been unidirectional shifts in population distribution and indicate increases in the use of some areas and the decline in the use of others (Bonnell et al. 1983; Tinker et al. 2006). However, these changes are not unexpected for a resource-dependent species like the sea otter.

The most recently completed census, conducted in 2012, indicates that there are currently around 2,792 southern sea otters residing in the waters offshore central California (USGS, 2012). Over the past 20 years, range expansion to the south has brought an increasing number of otters into the proposed project area off of Point Arguello. For example, during the semi-annual census conducted in the spring of 2005, close to 200 otters were observed in the area extending from Point Purisma to Point Conception (USGS 2005). As such, otters seen south of Point Purisma comprised approximately 10 percent of the total population of 2,735 in 2005 (USGS 2005). Additionally, large numbers (>150) of predominately male otters are now regularly seen east of Point Conception during the winter and spring, with lone individuals observed as far south as Carpinteria and Ventura (USGS, 1999, 2005, 2010).

4.1.2.4 Marine Turtles

Although marine turtles are not common to the project area, four species are known to occur in the region: the green sea turtle (*Chelonia mydas)*, the Olive ridley sea turtle (*Lepidochelys olivacea)*, the leatherback sea turtle, (*Dermochelys coriacea)*, and the loggerhead sea turtle (*Caretta caretta)* (Hubbs 1977, Smith and Houck 1983). Within the eastern North Pacific, the populations of all four species that occur off the California coast are listed as endangered under the U.S. Endangered Species Act (Table 4.5).

Table 4.5 Sea Turtles of the Eastern North Pacific and Their Status in the Project Area

Common Name	Scientific Name	Occurrence in the Project Area	Status
Green Turtle	*Chelonia mydas*	Uncommon	E
Loggerhead Turtle	*Caretta caretta*	Uncommon	E
Olive Ridley Turtle	*Lepidochelys olivacea*	Uncommon	E
Leatherback Turtle	*Dermochelys coriacea*	Uncommon	E

Sources: NMFS and USFWS 1998a-d
Notes: E = Federal Endangered Species

According to the California Marine Mammal Stranding Network Database, NMFS, 1997 over the past eleven years (2001-2011) a total of only 3 marine turtle strandings were reported on Santa Barbara County beaches (NMFS 2012). Two of the strandings were identifiable as olive ridley turtles. In contrast, during the period spanning 1982-1995 a total of 14 marine turtles strandings were reported on Santa Barbara County beaches. Of these strandings, 9 were leatherbacks, 3 were loggerheads, and 2 were green turtles (NMFS, 1997). Within the entire southern California region, however, green turtles make up the bulk (61 percent) of reported strandings.

Leatherback sea turtles have the widest distribution of all sea turtles and are the most abundant sea turtle encountered off the central California coast. Although they nest exclusively on beaches in tropical and subtropical latitudes, leatherbacks are known to forage at latitudes as high as 71° N and 47° S, and appear to draw on a suite of physiological and behavioral adaptations to regulate their rates of heat loss and gain in these colder waters (Frair et al. 1972, MMS 1996).

Small numbers of approximately 150 to 170 leatherbacks appear annually off the California coast between Point Conception and Point Arena during the summer and fall. They are typically observed in deeper waters over the continental slope. Their arrival in the region is coincident with the development of seasonal aggregations of jellyfish, a key prey item (Shenker 1984; Suchman and Brodeur 2005; Benson et al. 2007; Graham 2009). Leatherback sea turtles are omnivorous, but feed principally on soft prey items as jellyfish and to a lesser extent, tunicates (Mager, 1984).

The turtles documented foraging off California originate from nesting beaches in Indonesia, undertaking a 12,000-mile round-trip journey that is the longest known migration of any living reptile. Unfortunately, the Pacific population of leatherbacks has declined by approximately 95 percent in the last 25 years, with estimates suggesting that as few as 2,100 adult female leatherback sea turtles remain. In light of the importance of California waters to the survival of Pacific leatherbacks, critical habitat for this species was designated off the U.S. west coast in January 2012, including 16,910 square miles off California's central coast. This area of critical habitat stretches from Point Arena to Point Arguello east (inshore) of the 3,000-meter depth contour (77 FR 4170).

Like leatherbacks, loggerhead sea turtles are also generally found over the continental shelf. However, loggerheads occur primarily in subtropical to temperate waters and Southern California is generally considered to be the northern limit of their distribution (Stebbins 2003, Mager 1984; MMS 1996). Loggerheads are omnivorous and feed on wide variety marine life including shellfish, jellyfish, squid, sea urchins, fish, and algae (Carr 1952; Mager 1984). The waters off Mexico and southern California appear to support important developmental habitat for juvenile loggerheads and are used as foraging grounds and migratory corridors for a wide range of juvenile size classes.

Most sightings of this species in California waters occurring during the summer, peaking from July to September; however, sightings may occur throughout much of the year during El Niño events when ocean temperatures rise (Guess 1982; NMFS and USFWS, 1998d). Sightings of loggerhead turtles off California generally consist of juveniles that originate from nesting beaches in southern Japan, which contain the only known nesting areas for loggerheads in the North Pacific (Stebbins 2003, Kamezaki et al. 2003).

In contrast, green sea turtles encountered off the southern and central California coast typically originate from nesting sites in the Revillagigedos Islands and the mainland coast of Michoacan, Mexico. Although two permanent colonies of green turtles are currently known to exist in association with thermal discharges in southern California, the only known nesting location in the continental U.S. is on the east coast of Florida. Recent studies have demonstrated that, in addition to feeding on algae and sea grasses, the diet of green turtles includes invertebrates such as jellyfish, sponges, sea pens, and pelagic prey (Heithaus et al. 2002, Seminoff et al 2002, Hatase et al. 2006, NMFS, 1997.

Generally, green sea turtles occur worldwide in waters above 20 degrees C. Central California represents the northern end of their range, although individuals have been reported as far north as Redwood Creek in Humboldt County and off the coast of Washington and Oregon (NMFS and USFWS 1998b, Green et al. 1991; Smith and Houck, 1983). At the Diablo Canyon Nuclear Power Plant off central California all sightings and strandings have been of green turtles (NMFS, 1997; Port San Luis Harbor District, 1997, PG&E 2009, 2011).

Finally, in the eastern North Pacific, the primary range of the olive ridley turtle extends from Columbia to Mexico (MMS 1996). Although strandings have been reported from as far north as Washington and Oregon, olive ridleys are infrequent visitors to the waters north of Mexico (Green et al. 1991; Houck and Joseph 1958; NMFS 1997). Major nesting beaches for this species are located on the Pacific coasts of Mexico and Costa Rica, although a few may nest as far north as Baja California (Mager, 1984; NMFS and USFWS, 1998c). The Pacific ridley sea turtle is omnivorous, foraging opportunistically in deep ocean waters crustaceans, fish, jellyfish, sea grasses and algae (Ernst and Barbour 1972; Plotkin et al. 1994).

4.1.2.5 Coastal and Marine Birds

Over the last 30 years, a variety of studies have been conducted which document the diversity of bird species present off various sections of the California coast (Jones et al 1981, Briggs et al. 1981, 1987, Dohl et al. 1983b). For example, in a three-year survey for seabirds conducted off of central and northern California, Dohl et al. (1983b) and Briggs et al. (1987) reported from 30 to 35 common or dominant species, and an additional 34 uncommon or rare species. More recently, aerial surveys were conducted (from 1999 to 2002) on the area extending from Cambria to the U.S. Mexico border (Mason et al. 2007). A total of 54 bird species were identified within this greater Southern California Bight region, which encompasses the project area, during these surveys.

Bird species within the project area can be generally categorized as belonging to one of three main groups: shorebirds, coastal seabirds, and pelagic seabirds. Shorebirds inhabit the tidal wetlands, sand beaches, and rocky shorelines along the mainland and island coasts. Coastal seabirds feed in the pelagic realm but tend to remain close, within approximately five miles (8 km), of the mainland shore. And finally, pelagic seabirds typically spend most of their time at sea, well offshore or in the waters near the islands where they nest. Many of these species are rarely, if ever, observed from the mainland shore. Much of the taxonomic diversity in the project area arises because it is located in a transition zone between zoogeographic provinces (Baird 1993, Lehman 1994). As such, the distribution of both migrant and resident taxa within the region exhibits substantial seasonal and spatial variation (Table 4.6) (Pierson et al. 1999, MMS 2001, Mason et al 2007, Lehman 1994).

Table 4.6 Common Coastal and Marine Bird Species and their Occurrence in the Project Area

Common Name	Primary Seasonal Occurrence
Shorebirds	
Western Snowy Plover	Winter visitor, summer resident
Sanderling	Common transient and winter visitor
Willet	Common transient and winter visitor
Coastal Seabirds	
Bonaparte's Gull	Common transient and winter visitor
California Gull	Common transient and winter visitor
Heerman's Gull	Common transient and winter visitor
Herring Gull	Common transient and winter visitor
Western Gull	Common year-round resident
Pacific Loon	Common transient and uncommon winter visitor
Common Loon	Common transient and winter visitor
Surf Scoter	Common transient and winter visitor
Western Grebe	Common transient and winter visitor
Common Murre	Common transient and winter visitor
Pigeon Guillemot	Common summer resident
Brandt's/Pelagic/Double-Crested Cormorants	Common transients and winter visitors; common summer residents
Brown Pelican	Year-round resident and summer transient
Red-necked Phalarope	Common transient
California Least Tern	Uncommon and local (spring and summer) resident
Pelagic Seabirds	
Sooty Shearwater	Common (spring through fall) visitor
Pink-Footed Shearwater	Common (spring through fall) offshore visitor
Black-Vented Shearwater	Common, but irregular fall and winter visitor
Ashy Storm-Petrel	Common (spring through fall) resident and visitor
Cassin's Auklet	Common, year-round resident and visitor
Rhinoceros Auklet	Common transient and winter visitor
Scripps's Murrelet	Common spring and summer resident

Sources: Adapted from Mason et al. 2007and Lehman 1994

Shorebirds

Because most shorebird research has been focused in wetland habitats, relatively little information exists on shorebird use of exposed sandy habitats such as those that predominate in the project area (McCrary & Pierson 2002). Nevertheless, high energy, ocean-fronting beaches are dynamic ecosystems with the potential to be important foraging habitats for a variety of shorebirds (Hubbard and Dugan 2003).

Typical shorebird species in the project area reflect the high percentage of sandy shoreline in the region and include sanderling (*Calidris alba*), willet (*Tringa semipalmata*), western snowy plover (Charadrius nivosus nivosus), black-bellied plover (*Pluvialis squatarola*), marbled godwit (*Limosa fedoa*), killdeer (*Charadrius vociferous*), and whimbrels (*Numenius phaeopus*) (McCrary and Pierson 2002, Collins 2011, Lehman 1994). In contrast, oystercatchers (*Haematopus* spp.) are one of the few shorebirds found in the project area that are typically more associated with rocky coastlines. During a recent multi-year study of sandy Ventura County beaches similar to those throughout the project area, sanderlings, willets and western snowy plovers together accounted for 78 percent of the shorebirds enumerated (Rodriguez 2011).

Most shorebird species in the project region are migratory, with seasonal peaks in population occurring in both fall (primary) and spring (secondary). Overall shorebird numbers are typically at their spring maximum in the project area between mid-April and late May as flocks of northbound migrants including stilts, avocets, and terns arrive (Lehman 1994). Southbound transient shorebirds begin to arrive, however, by late June, and several species (e.g., Western sandpiper, short-billed dowitcher) are relatively numerous by early July.

Shorebirds typically are visual foragers that often utilize a run-stop-peck method of feeding within the upper intertidal zone. Additionally, many shorebirds forage on tidally influenced mud or sandflats, where habitat use varies between high and low tides.

Coastal and Pelagic Seabirds

Common coastal seabirds include Western and Clark's grebes, surf scoters (*Melanitta perspicillata*), cormorants (*Phalacrocorax* spp.), Pacific and common loons (*Gavia* spp.), California brown pelicans (*Pelecanus occidentalis californicus*), and several species of gulls (Laridae) (Mason et al 2007).

The spring coastal seabird migration, which begins in late February, peaks between late March and early May (Lehman 1994). However, the California brown pelican populations generally peak slightly later, during the summer months, as birds from larger Mexican colonies migrate northward, swelling the population in the project area (Mason et al 2007). Similarly, Heermann's gulls (*Larus heermanni*) arrive from Mexico beginning in the second half of June and elegant terns (*Thalasseus elegans*) typically first appear along the Santa Barbara coast in early July. The fall migration occurs mostly between early October and late December with many birds staying slightly farther offshore than during their northbound journey (Lehman 1994).

Some of the most common pelagic seabirds in the region include: shearwaters (*Puffinus* spp.), northern fulmars (*Fulmarus glacialis*), phalaropes (*Phalaropus* spp.), jaegers (*Stercorarius* spp.), and common murres (*Uria aalge*). Storm-petrels (*Oceanodroma* spp.), puffins (*Fratercula* spp.), and auklets (Family Alcidae) also frequent the offshore waters of the project area.

Pelagic species such as albatross, shearwaters, storm-petrels, phalaropes, jaegers, and alcids become common in the project area in mid-May to early June (Lehman 1994) but are most numerous between August and mid-October when large numbers of sooty shearwaters, storm-petrels, and jaegers are present (Mason et al 2007). For example, millions of sooty shearwaters originating in the waters off New Zealand visit foraging grounds off the California coast where they feed on fish, squid, and shrimplike krill, which they take from the surface or pursue underwater. This species may form aggregations of up to tens of thousands of birds, and are often seen in nearshore waters. During the late summer and fall, warm-water species such as the least storm-petrel (*Halocyptena microsoma*) and Guadalupe and Craveri's murrelets are also likely to occur in the offshore waters of the project area.

Coastal upwelling zones, the upwelling frontal zone, and the stratified waters of the California Current constitute the three main open water habitats off California and each support different bird assemblages (Briggs et al. 1987). For example, gulls, terns, and storm petrels have been reported over large distances within the California Current System; western gulls are known to occur regularly at sea out to about 50 miles west of Point Conception and seaward of the Channel Islands. Similarly, murres, auklets, and phalaropes tend to aggregate in coastal upwelling areas, such as offshore Point Conception.

Common nearshore species reported off Point Conception and Point Arguello are the California gull, herring gull, western gull, Bonaparte’s gull, Brandt’s cormorant, surf scoter, western grebe, and red-necked phalarope. An overview of some of the most dominant species and their occurrence in the project area is provided in Table 4.6. Overall, western gulls are the most abundant of the nearshore species in the project area. Additionally, seabird densities are greater along mainland coasts than the island coasts primarily due to the presence of western grebes, sooty shearwaters, and surf scoters (Mason et al. 2007).

A variety of different feeding strategies are employed by coastal and pelagic seabirds to capture prey. For example, California brown pelicans and terns typically plunge dive into the water from height to catch fish, while cormorants, murres, puffins, and auklets dive from the sea surface in pursuit of fish and zooplankton. In contrast, red-necked phalaropes (*Phalaropus lobatus*) feed at the sea surface by swimming in a characteristic spinning pattern that causes fish eggs and other planktonic species to accumulate immediately beneath them.

The most numerous of the nesting residents along the central and northern California coastline are the murre, Cassin’s auklet, Brandt’s cormorant, and the Western gull. The largest nesting sites are located in northern California with the Farallon Islands being the most important location. In central California, Souls et al. (1980) estimated that about 7 percent of the seabird population breeds between Ventura and Monterey counties, with the majority of breeding occurring on the Channel Islands. In the area from Morro Bay south to Point Conception, very few seabirds breed in coastal mainland habitats due to human disturbances (Chambers 1980).

Carter et al. (1992) estimated that approximately 15 percent of the total seabird breeding population of California occurs on San Miguel, Santa Barbara, Anacapa, and San Nicolas Islands.). Coastal and marine bird species that currently nest on the four northern Channel islands of San Miguel, Santa Rosa, Santa Cruz, and Anacapa are listed in Table 4.7.

Table 4.7 Coastal and Marine Bird Species that Nest on the Northern Channel Islands

Common name	San Miguel	Santa Rosa	Santa Cruz	Anacapa
Shorebirds				
Killdeer	X	X	X	
Western snowy plover		X		
Black Oystercatcher	X	X	X	X
Coastal Seabirds				
Common Murre	X			
Pigeon Guillemot	X	X	X	X
Double-Crested Cormorant	X		X	X
Brandt's Cormorant	X	X	X	X
Pelagic Cormorant	X	X	X	X
Brown Pelican	X		X	X
Western Gull	X	X	X	X
Bald Eagle		X	X	X
Pelagic Seabirds				
Ashy Storm-Petrel	X		X	X
Leach's Storm-Petrel	X			
Scripps's Murrelet	X	X		X
Cassin's Auklet	X		X	X

Sources: Adapted from Collins 2011, Whitworth et al 2009, Lehman 1994

The Channel Islands are home to nearly half of the world's populations of ashy storm-petrels and western gulls and support approximately 80 percent of the U.S. breeding population of Scripps's murrelets. Additionally, the islands host the only major breeding population of California brown pelicans in the western U.S. and support the largest concentration of double-crested cormorant colonies in southern California. The islands are also host to one of the largest breeding colonies of Cassin's auklets within the state.

Of the islands, San Miguel Island hosts the greatest diversity of nesting bird species. Together with its islets, particularly Prince Island and Castle Rock, it provides the most important nesting sites for the Cassin's auklet in the entirety of the Southern California bight. Although rhinoceros auklets and tufted puffins have also previously bred on San Miguel, neither of these species has been observed nesting there since the mid-1990s.

Sensitive Bird Species

There are currently five bird species listed under the Federal Endangered Species Act that occur in the project area and could be impacted by the proposed project. These species are listed in Table 4.8 and described briefly below. Table 4.8 also lists five additional bird species that occur in the project area and warrant particular mention due to a combination of their limited population size or distribution, and unique behavior patterns that contribute to making them particularly susceptible to oil spills or disturbance from the proposed project activities.

Table 4.8 Sensitive Bird Species Occurring in the Project Area

Common Name	Scientific Name	Occurrence in the Project Area	Status
California Least Tern	*Sternula antillarum browni*	Seasonally common	E*
Western Snowy Plover	*Charadrius nivosus nivosus*	Seasonally common	T
Marbled Murrelet	*Brachyramphus marmoratus*	Rare, seasonal	T
Light-Footed Clapper Rail	*Rallus longirostris levipes*	Rare	E
Short-Tailed Albatross	*Phoebastria albatrus*	Rare	E
Ashy Storm-Petrel	*Oceanodroma homochroa*	Seasonally common	BCC
Cassin's Auklet	*Ptychorarnphus aleuticus*	Common	SSC
Scripps's Murrelet	*Synthliboramphus scrippsi*	Common	ST, FC
Guadalupe Murrelet	*Synthliboramphus hypoleucus*	Uncommon	ST, FC
California Brown Pelican	*Pelecanus occidentalis californicus*	Common	DE

Sources: NMFS and USFWS 1998a-d, Lehman 1994, Mason et al. 2007
Notes: E = Federal Endangered Species; T = Federal Threatened Species; DE = delisted; BCC= Federal Bird of Conservation Concern; SSC = State Species of Special Concern; ST = State Threatened; FC= Federal Candidate for listing; *= currently recommended for downlisting to 'threatened'

Specifically, four of the species listed in Table 4.8 (Ashy storm-petrel, Cassin's auklet, and Scripps's and Guadalupe murrelets) are pelagic, nocturnal, cavity-nesting birds that spend most of their time at sea, and come ashore primarily for breeding-related activities on the Channel Islands. The nocturnal behaviors of these species are thought to be an evolutionary adaptation to limit predation by traditional diurnal predators such as western gulls; however, it also makes them particularly susceptible to impacts from artificial nighttime lighting. Additionally, as these species often aggregate in the nearshore waters off nesting islands during the breeding season, large portions of the populations of these species may be especially vulnerable to impacts from oil spills.

California least tern *(Sternula antillarum browni*). The California least tern is a federally listed endangered species that occurs on coastal beaches and near estuaries ranging from San Francisco Bay to Baja California, and is usually present in the project area from May to September. It is a coastal inhabitant that forages in nearshore marine waters and estuaries. Least terns typically feed by skimming the nearshore sea surface as they fly and by periodically plunge diving for small fish, making them are highly susceptible to impacts from oil spills.

The California least tern nests in coastal foredune habitats and has historically been reported in the Point Arguello region on Vandenberg Air Force Base (AFB) in northern Santa Barbara County. During 2010, slightly more than 30 breeding pairs utilized the Vandenberg AFB lands for nesting. This species was recently recommended for downlisting to ‘threatened’.

Western snowy plover (*Charadrius nivosus nivosus*). The coastal population of this species occurs primarily on beaches from southern Washington to southern Baja California and is currently listed as threatened under the U.S. Endangered Species Act. The Pacific Coast population is defined as those individuals nesting adjacent to tidal waters of the Pacific Ocean, and includes all nesting birds on the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries and coastal rivers. Declines in this species have been attributed to loss of nesting habitat, human disturbance, encroachment of European beach grass (*Ammophila arenaria*) on nesting grounds, and predation.

The USFWS designated critical habitat for this species on December 7, 1999, and again on September 29, 2005. However, the 2005 designation was challenged in U.S. District Court in October 2008 (Center for Biological Diversity v. Kempthorne, et al. No. C-08-4594 PJH). The USFWS subsequently proposed revised critical habitat on March 22, 2011. A further revision to critical habitat was recently finalized in July 2012.

Western snowy plovers can occur year-round in coastal California. Biologists estimate that no more than 2,270 western snowy plovers currently breed along the Pacific Coast of the United States. The largest number of breeding birds occurs from south of San Francisco Bay to southern Baja California. Breeding sites near the project area include Morro Bay, the Callendar-Mussel Rock Dunes area, the Point Sal to Point Conception area, the Oxnard lowlands (e.g., Ormond Beach and Point Mugu), Santa Rosa Island, and San Nicolas Island (USFWS, 2000a).

The onshore area adjacent to the project area between Point Sal and Point Conception is an important western snowy plover breeding site within California with approximately 200 plover estimated to nest and winter in this area (USFWS 1997). Since 1997, a management plan has been implemented at the Vandenberg AFB beaches to protect this species and their habitat. The plan involves seasonal closures of portions of key nesting beaches to limit disturbance to nesting birds. During 2010, 255 nests were recorded, and 409 snowy plover chicks were hatched on Vandenberg AFB lands.

Marbled murrelet (*Brachyramphus marmoratus*). The marbled murrelet is a small, secretive, seabird that nests in old-growth forests along the Pacific coast and forages in nearshore coastal and inland waters (Ainley et al 1995, Strachan et al. 1995). The nearest breeding population of marbled murrelets is located in the Santa Cruz mountains of central California and consists of approximately 631 individuals (Peery and Henry 2010). The next closest population is located an additional 300 kilometers further north, in Humboldt County. This species has suffered substantial population declines from loss of nesting habitat through logging and fragmentation of old-growth forests, oil spills, gill net fishing and predation and is considered federally endangered (Marshall 1988).

Small numbers of marbled murrelets are known to occur along the northern Santa Barbara County coastline from summer into winter. However, sightings of marbled murrelets along the Santa Barbara coastline are infrequent, and generally consist of less than 5 birds at a time. Recent sightings have typically occurred near the Santa Maria river mouth and Point Sal (Lehman 1994). Occasional winter sightings have also occurred along the northern portions of Vandenberg AFB (Lion's Head).

Light-footed clapper rail *(Rallus longirostris levipes)*. The light-footed clapper rail is normally found in estuarine habitats, particularly salt marshes with well-developed tidal channels. This species forages on small crabs and other crustaceans, slugs, insects, small fish, and eggs mainly by shallow probing of sediment or surface gleaning (Edelman and Conway, 1998). Small numbers of clapper rails are present at Mugu Lagoon in Ventura County; with more than 16 pairs counted in 2011 (Zembal et al 2011). Additionally, although they have not been seen there since 2004, clapper rails also have the potential to inhabit Carpinteria Salt Marsh in Santa Barbara County. These two marshes represent the northern extent of the clapper rail's range; the majority of individuals of this species reside well to the south, in Orange and San Diego counties

Short-tailed albatross (*Phoebastria albatrus)*. The short-tailed albatross is a large, federally endangered seabird with a wingspan that can exceed 2 m (>7 ft) across. Before 1900, short-tailed albatross were considered common in the nearshore waters off the California coast. However, this wide-ranging species nests almost exclusively on a few islands in Japan, and was hunted to near extinction during the late 1800s and into the 1930s. From a small, remnant breeding population of approximately ten pairs, the world population of this species has now grown to about 2,700 individuals. As the population has increased, sightings of this species in California waters have begun to occur again.

Ashy storm-petrels (*Oceanodroma homochroa*). Ashy storm-petrels are pelagic, nocturnal, cavity-nesting birds that spend most of their time at sea, and come ashore primarily for breeding-related activities. They typically nest in rock crevices along cliffs, offshore rocks, and in sea caves. After breeding season, this species disperses to forage in the productive waters of the California Current.

Within the project area, this species occurs year-round and is most commonly observed well beyond the shelf break, in areas adjacent to submarine canyons and other deep water features, or around the islands on which they breed (Ainley 1995, Mason et al. 2007, Adams and Takekawa 2008). Breeding of this species is nearly endemic (>95 percent) to California, although in recent evidence suggests that breeding may occur to a greater extent in northwestern Mexico than previously known. Nevertheless, the largest breeding colony is located at the Farallon Islands while approximately half of the world's population breeds on San Miguel, Santa Barbara, Santa Cruz and Anacapa islands (McIver et al 2011, Ainley et al 1990).

The ashy storm-petrel is a federal bird of conservation concern and is considered particularly sensitive due to its small population size of approximately 10,000 individuals, restricted breeding populations, and risks resulting from threats such as predation and degradation of nesting habitat, and oil spills (Shuford et al. 2008, Ainley et al. 1995). Because of its nocturnal tendencies, this species is also considered to be highly susceptible to potential impacts from artificial lighting.

Ashy storm-petrels have been recovered dead on at-sea oil platforms and at mainland locations with bright lights in Santa Barbara and Ventura counties (Carter et al. 2000) and San Francisco Bay (Ainley et al. 1990)

Cassin's Auklet (*Ptychorarnphus aleuticus*). This small, stout, non-descript auklet is another pelagic, nocturnal, cavity-nesting species that spends the daylight hours resting and feeding on the open ocean, coming ashore only during the breeding season, and typically arriving and departing the colony under the cover of darkness.

The breeding range of the Cassin's auklet extends along the Pacific coast of North America from the Aleutian Islands, Alaska, to northern Baja California Sur, Mexico. The total estimated population of Cassin's auklets is at least 3.6 million individuals, with the bulk of the population located in British Columbia, Canada (>2.7 million). Triangle Island, B.C. hosts the largest colony in the world with approximately 1.1 million breeding birds.

Within California, most Cassin's auklets breed at the South Farallon and Channel Islands (Sowls et al. 1980, Carter et al. 1992). The largest colonies in the project area occur on two islets off of San Miguel Island that together host more than 11,000 birds, comprising approximately 16 percent of the total California population (Carter et al. 1992). Cassin's auklets also nest on other small islets scattered throughout the northern Channel Islands

The Cassin's auklet occurs in California waters year-round, but the population peaks from September through February (non-breeding season) when the local population is swelled by migrants from more northerly climes (Briggs et al. 1987). Although the species is abundant in portions of its overall range (i.e., British Columbia) it is recognized by the CDFG as a Bird Species of Special Concern due to its naturally small local breeding population and high susceptibility to risk factors including oil spills, predation, and lighting impacts (Adams et al. 2000, 2004; Adams 2008).

Scripps's and Guadalupe Murrelets (*Synthliboramphus scrippsi* and *Synthliboramphus hypoleucus*). Scripps's and Guadalupe murrelets are both small, black and white diving birds of the family Alcidae, which includes puffins and murres. As with ashy storm-petrels and Cassin's auklets, both of these species spend most of their lives at sea, far from the mainland, and come ashore on isolated islands only to breed, under the cover of darkness. They subsist on zooplankton and small fish including northern anchovies, sardines, rockfish, Pacific saury, and crustaceans.

These species were considered conspecific and were known collectively as Xantus's murrelet until 2012. They were listed as threatened by the state of California on December 22, 2004, and are candidates for listing under the U.S. Endangered Species Act because of their limited breeding range, small and declining global population size, and vulnerability to multiple threats, including predation, oil spills, and loss of habitat (Wolf et al. 2005, USFWS 2010). When listed, the entire global population (for both species) was estimated at between 5,000 and 10,000 breeding pairs.

The Channel Islands currently support more than 80 percent of the U.S. breeding population (33.5 percent of the world's population) of Scripps's murrelets and comprise the only breeding grounds for this species north of Mexico; the Mexican portion of the population nests primarily offshore Baja California on the isolated islands of San Benito, Coronado, and San Jeronimo. The largest Scripps's murrelet colony in the U.S. (and world) is located on Santa Barbara Island (500 to 750 breeding pairs), with nesting also taking place on Anacapa (200 to 600 pairs), Santa Cruz, and San Clemente Islands (10 to 50 pairs) (USFWS 2010, Whitworth et al. 2005, Whitworth et al. 2009). In contrast, the Guadalupe murrelet breeds almost entirely on Guadalupe Island (offshore Mexico) with some additional nesting taking place on the San Benito Islands.

The nesting period for the Scripps's murrelet extends from February through July, but may vary depending on food supplies. During recent monitoring of murrelets on Anacapa Island, peak egg laying occurred from mid-March to early April (Whitworth et al 2009). During the nesting season, murrelets forage in the immediate vicinity of the colony and congregate on the water adjacent to nesting colonies at night throughout the breeding season (Hunt et al. 1979, Murray et al. 1983). The purpose of these nocturnal at-sea congregations may be for socialization, courtship, pairing, and pair-bond maintenance, (Carter et al. 1995). The majority of murrelets in these congregations are likely non-incubating, because incubating murrelets may only briefly attend congregations before flying to nests after return from foraging trips, or during chick departures from the nest (Whitworth et al. 1997). Nests are typically bare rock located in natural rock crevices or under shrubs, especially along or near cliffs.

Both species of murrelets are nocturnal when attending to their eggs and chicks, complicating efforts to monitor their populations (Whitworth et al. 1997). They lay only one to two eggs per year, and usually return to the same nest site to breed each year. Females lay up to two large eggs which are incubated for approximately one month. Unlike many bird species, which are born naked and remain in the nest for some time, murrelet chicks emerge from their eggs fully feathered and well developed. The chicks spend fewer than 48 hours at the nest site before leaving the nests to join their parents at sea. The young birds are flightless and slow moving at this time. Rearing of the chicks continues at sea for several additional months.

Following the breeding season, the majority of the populations of both species disperse northward, wintering well offshore (20 to 60 miles [32 to 96 km]) in the waters of the California Current (Karnovsky et al 2005). Murrelets are usually seen traveling in pairs or small family groups while at sea. Most Scripps's murrelets disperse northward off the coast of central California, although some are occasionally seen as far north as Washington and southern British Columbia. The Guadalupe murrelet likewise disperses locally at sea, but its range typically only extends up to southern California.

Current threats to the populations of both the Scripps's and Guadalupe murrelets include native and non-native predators and competitors, oil pollution, changes in oceanography and prey availability, and by-catch in fisheries (Carter et al 2000). Over the past decade, concerns have also arisen over the effects of artificial light pollution from fishing and other vessels that overnight near the island colonies, potentially attracting birds to their death by collision or contamination aboard ships. Predation by introduced mammals, especially black rats, feral cats, and deer mice have taken a particular toll on murrelets over the last century, resulting in their extirpation from a number of islands (Whitworth and Carter 2002). However, recent efforts at habitat restoration and predator control appear promising. For example, following the final eradication of black rats from Anacapa Island in 2002, the number of Scripps's murrelet clutches on the island has increased dramatically; hatching success has doubled, and significant colony expansion (additional nesting sites) has also occurred.

California brown pelican (*Pelecanus occidentalis californicus*). This coastal seabird ranges from British Columbia to southwestern Mexico and feeds primarily on small schooling fish (e.g., anchovies) by plunge diving from heights of up to 15 to 20 m above the ocean surface (USFWS, 1982). The during the latter half of the last century, the California brown pelican suffered serious population declines due to bioaccumulation of chlorinated hydrocarbon pesticides (DDT, DDE, dieldrin, and endrin) in the pelican's food chain which resulted in eggshell thinning and poor reproductive success (MMS 1996, Schreiber and Risebrough 1972). Food scarcity also contributed to the species' decline (Keith et al. 1971). Under the protections provided by the U.S. Endangered Species Act, however, and following the banning of DDT in 1972, this species began to recover. In 2009, the recovery was determined to be robust enough that this species was removed from both the federal and state endangered species lists. However, the brown pelican is still a state-fully protected species, as well as having protection under the Migratory Bird Treaty Act.

The breeding season for the California brown pelican extends from March through early August. Preferred nesting habitat is on offshore islands. Specifically, the entirety of the U.S. breeding population nests exclusively on the Channel Islands (predominately Anacapa and Santa Barbara Islands). In 1991, approximately 12,000 breeding birds were reported at two colonies on Anacapa and Santa Barbara Islands (Carter et al. 1992).

Pelicans typically return to specific roosts each day and do not normally remain at sea overnight. These roosts are usually in regions of high oceanic productivity and isolated from predation pressure and human disturbances. Within the project area, offshore rocks, rocky shorelines, sandy beaches, and piers provide important roost sites for brown pelicans.

The concentration of the U.S. breeding population on the Channel Islands, combined with the predominately nearshore distribution of this species and its foraging style (i.e. plunge diving) make the pelican highly susceptible to impacts from oil spills on the Pacific OCS.

4.1.2.6 Benthic Invertebrates

The benthos consists of organisms that live in or on the ocean floor. Benthic habitats are often classified according to substrate type, either unconsolidated sediments (e.g., gravel, sand, or mud) or rock. The former category is often referred to as soft bottom and the latter hard bottom or rocky substrate. Each supports their own characteristic biological community. In addition to substrate type, water depth and water temperature play important roles in the distribution of benthic organisms. Distance from shore, food availability, and water quality are also important factors which influence the distribution of benthic organisms. Benthic organisms can be epifaunal (attached or motile species that inhabit rock or sediment surfaces) or infaunal (live in rock or soft sediments) (Thompson et al. 1993). Generally, more is known about intertidal and shallow subtidal benthic species (<30 m) than those of deeper areas (>30 m).

Intertidal and Shallow Subtidal – Soft Substrate

Sandy beaches occur along shoreline segments of the project area. Because of the inherent difficulties in conducting ecological studies in sand, far less is known about invertebrate communities that live there than those found on rocky substrates. Sand dwelling organisms are very motile, difficult to mark, and cannot be easily monitored over time. Immigration and emigration rates are high and contribute to the high level of temporal and spatial patchiness in density that is often reported (Thompson et al. 1993). Studies are also difficult to conduct in unstable sediments in a high-energy environment.

Although not obvious, vertical zonation of invertebrates occurs on sandy beaches. The invertebrates that live in sand (infauna) are quite motile and change position with respect to tidal level. Also, certain species will be found higher or lower than others. Common invertebrates in the upper intertidal are several species of amphipods in the genus *Orchestoidea*; the predatory isopod, *Excirolana chiltoni*; and several species of polychaetes (e.g., *Excirolana chiltoni*, *Euzonus mucronata*, and *Hemipodus borealis*). The middle intertidal is characterized by species such as the sand crab, *Emerita analoga* and the polychaete *Nephtys californiensis*. *Emerita* is generally the most abundant of the common middle intertidal organisms often comprising over 99 percent of the individuals on a given beach (Straughan 1982).

In the low intertidal, polychaetes and nemerteans dominate (Straughan 1982). Also, the large sand crab, *Blepharipoda occidentalis*, and the Pismo clam, *Tivela stultorum* can be found. *Tivela*, however, was once more abundant in the intertidal. Its present reduction in population is probably the result of overharvesting and predation.

In shallow water <10 m, epifaunal (organisms which live on the sediment or rock surfaces) communities are generally well developed (Thompson et al. 1993). With increasing depth, the density of epifaunal species decline while that of infauna increases probably because of the greater stability of sediments (Barnard 1963). Also, with depth, polychaetes become more dominant over crustaceans (Oliver et al. 1980). Physical changes to nearshore subtidal habitats are associated with increasing depth. One of the most important is a decrease in wave surge and as a result, finer sediments which influences the distribution of epifaunal species in nearshore environments (Thompson et al. 1993). Merrill and Hobson (1970) have shown that shoreward limit of the sand dollars (*Dendraster excentricus*) occurs near the break line with the inner most population consisting of small juveniles. Seaward, they found that sand dollars become progressively larger and more abundant.

The effects of wave action on benthic infauna are not well known. However, several studies indicate the declines in the abundance of tube-building polychaetes in shallow water (< 10 m) to increasing substrate disturbance (Oliver et al. 1980; Davis and VanBlaricom, 1978).

The composition of invertebrate assemblages on sandy beaches correlates to slope and sand texture. Within a beach, crustaceans and molluscs tend to be more common on steeper, coarser, and dryer upper intertidal zone. Polychaetes and nemerteans are the dominant invertebrates in the lower intertidal where slope is not as steep and the sand usually finer and wetter (Wenner 1988; McLachlan and Hesp 1984; Straughan 1982).

Straughan (1982) conducted comprehensive intertidal surveys in central and southern California over a 12-year period. At a sampling site in northern Santa Barbara County, annelids and crustaceans dominated along a transect extending from the supratidal to intertidal areas. Common species she reported are listed in Table 4.9.

Table 4.9 List of Intertidal Species Collected at a Northern Santa Barbara Location

Annelida	*Annelida (con't)*	Insecta/Arachnida
Cerebratulus californiensis	*Scoloplos armiger*	Anthomyiidae
Dispio uncinata	*S. acmeceps*	Calliphoridae larvae
Eteone dilatae	*Zygeupolia rubens*	Cyclorrhapha larvae
Euzonus dillonensis		Ephydridae larvae
E. mucronata	Crustacea	Sarcophagidae pupae
Hemipodus californiensis	*Archaeomysis grebnitzki*	
Lumbrineris zonata	*A. maculata*	Mollusca
Lumbrineridae	*Emerita analoga*	*Collisella strigatella*
Nemertea sp.	*Eohaustorius sawyeri*	*Siliqua patula*
Nephtys californiensis	*E. washingtonianus*	
Nephtys sp.	*Excirolana chiltoni*	
Opheliidae	*Lepidopa californica*	
Orbinia johnsoni	*Orchestoidea benedicti*	
Orbiniidae	*O. columbiana*	
Paranemertes californica	*O. corniculata*	
Pygospio californica	*Synchelidium sp.*	

Source: Straughan, 1982

At offshore monitoring stations located at 18 m water depth in central California, approximately 97 benthic infaunal species were found (ABC, 1995). Rank order and the relative abundance of these species which are commonly found in central California are listed in Table 4.10. Annelid worms were the most abundant group found at the stations. Epifaunal species collected at these stations include the echinoderms, *Amphiodia occidentalis* and *Dendraster excentricus*; the arthropod, *Heterocrypta occidentalis*; and the molluscs, *Nassarius fossata*, *N. perpinguis*, *Olivella baetica*, and *Polinices lewisii* (ABC, 1995).

Intertidal and Shallow Subtidal – Rocky Substrate

California rocky intertidal areas are characterized by diverse assemblages of algae, invertebrates, and fish (Ricketts et al. 1985; Foster et al. 1991). The majority of intertidal species are restricted to certain elevations along the shoreline (Figure 4-3). These vertical distributions are largely determined by a species' ability to withstand desiccation; however, other important factors that determine vertical zonation include competition, predation, and available microhabitats. For example, on wave-exposed shores, wave run-up and splash enable species to survive at higher elevations than those normally found in protected, non-splash areas.

The diversity of algae and invertebrate species tends to increase from high to low elevations. Generally, because the high intertidal is only occasionally wet, it is sparsely covered by species such as the blue-green algae, *Bangia* sp. and *Enteromorpha* sp. In these areas, *Littorina* sp. (periwinkle snail) can be found in rock crevices and *Tegula funebralis* (turban snail) and *Pachygrapsus* (shore crab) can be found in the shade or crevices. The rock lice, *Ligia occidentalis* can be found even higher up, in the splash zone.

Table 4.10 Dominant Infauna Species Reported From Five Monitoring Stations Located in Central California

Species	Total	Percent of Total
Carinoma mutabilis (N)	407	13.9
Lumbrineris tetraura (A)	377	12.9
Tellina modesta (M)	372	12.7
Magelona sacculata (A)	292	10.0
Prionospio pygmaea (A)	281	9.6
Glycera capitata (A)	144	4.9
Glycinde picta (A)	109	3.7
Nephtys caecoides (A)	74	2.5
Odostomia sp. (M)	74	2.5
Leitoscoloplos pugettensis (A)	57	1.9
Chaetozone setosa (A)	55	1.8
Chione undatella (M)	51	1.7
Typosyllis fastigiata (A)	46	1.5
Nemertea sp. (N)	32	1.0
Macoma secta (M)	30	1.0
Mediomastus californiensis (A)	30	1.0
Spiophanes bombyx (A)	30	1.0
Chone magna (A)	27	1.0
Onuphis vexillaria (A)	22	1.0
Photis macinerreyi (Ar)	21	1.0
Thalenessa spinosa (A)	21	1.0

Source: ABC, 1995
Notes: N = Nemertea, A = Annelida, M = Mollusca, Ar = Arthropoda

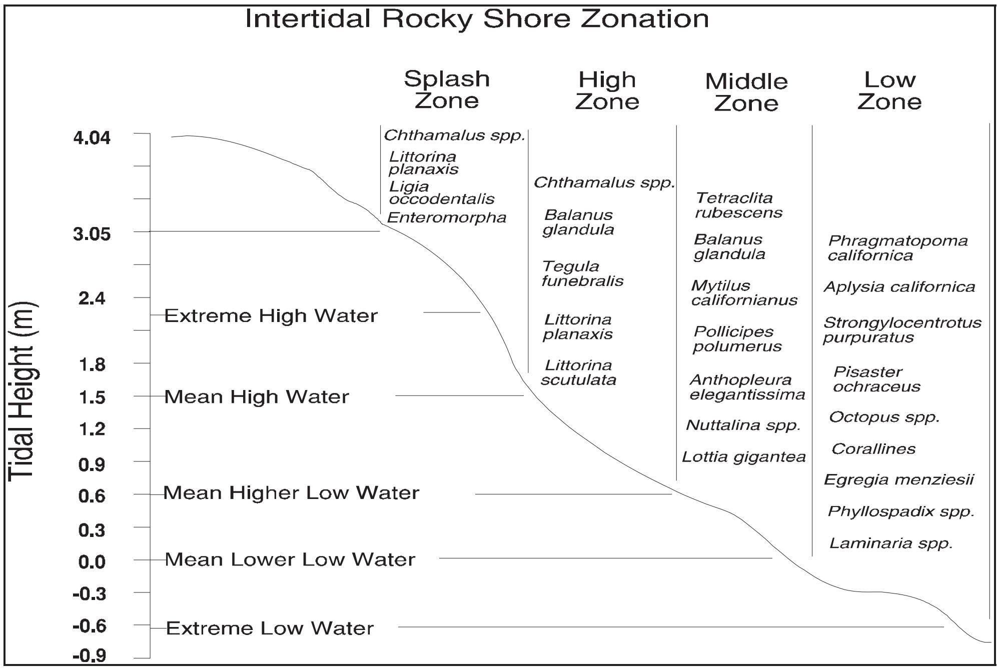
In the middle intertidal zone, algal cover is more conspicuous with clumps of *Fucus* and *Pelvetia* (rockweeds) and *Endocladia* (red algae). The middle intertidal can also be inhabited by a variety of limpets, *Chthamalus* sp. (acorn barnacle), *Mytilus californianus (*mussels), *Pisaster ocraceus* (starfish), and various encrusting algae. In the lower intertidal, species such as *Mazzaella flaccida* and *Mastocarpus papillatus* are present. Beneath the blades of upright algae, rock-encrusting algae, *Pagurus* (hermit crab), snails, motile and tube-forming worms, encrusting bryozoans, sponges, tunicates, and *Strongylocentrus* sp. (urchins) can be very abundant. In the past, *Haliotus cracherodii* (black abalone) were also very abundant in the lower intertidal zone.

In the low intertidal, fish species such as *Xiphister* sp. (prickleback) can be found under cobbles, in pockets of water, and under dense algal cover. In the lower intertidal, red algae increase and species such as *M. flaccida*, *M. papillatus*, *Gastroclonium subarticulatum* and *Chondracanthus canaliculatus* are common. *Phyllospadix* sp. (surfgrass) can fringe the shoreline at the lower boundary of the intertidal zone.

Deep-Benthic Assemblages – Soft Bottom

In a comprehensive three-year benthic infauna study conducted offshore Point Conception (CAMP Phase II), Hyland et al. (1991) reported over 886 species representing 15 phyla. The 10 most abundant species reported by Hyland et al. (1991) for a transect located just north of the Point Arguello platforms are provided in Table 4.11.

Figure 4-3 Intertidal Zonation of a Rocky Shore in Southern California



Source: Modified from Dailey et al. 1993
Notes: A = Amphipoda, O = Oligochaeta, P = Polychaeta, T = Tanaidacea

Table 4.11 Ten Most Abundant Infauna Species, by Water Depth, off the Coast of Point Arguello

Station R-4 (90 m)	Station R-5 (180 m)	Station R-6 (410 m)
Photis lacia (A)	*Mediomastus ambiseta (P)*	*Chloeia pinnata (P)*
Mediomastus ambiseta (P)	*Chloeia pinnata (P)*	*Nephtys cornuta (P)*
Myriochele sp. M (P)	*Tharyx spp. (P)*	*Tectidrilus diversus (O)*
Chloeia pinnata (P)	*Photis californica (A)*	*Chaetozone nr. setosa (P)*
Photis spp. (A)	*Minuspio lighti (P)*	*Huxleyia munita (P)*
Photis californica (A)	*Spiophanes berkeleyorum (P)*	*Cossura rostrata (P)*
Typhlotanais sp. A (T)	*Photis lacia (A)*	*Maldane sarsi (P)*
Sphiophanes missionensis (P)	*Prochelator sp. A (I)*	*Minuspio sp. A (A)*
Praxillella pacifica (P)	*Spiophanes missionensis (P)*	*Cossura candida (P)*
Minuspio lighti (P)	*Levinsenia gracilis (P)*	*Cossura pygodactyla (P)*
All Fauna (419 species)	**All Fauna (358 species)**	**All fauna (215 species)**

Source: Hyland et al. 1991
Notes: A = Amphipoda, O = Oligochaeta, P = Polychaeta, T = Tanaidacea

Amphipods (34 percent) and polychaete worms (31 percent) were the most dominant taxa followed by gastropods (10 percent) and bivalves (8 percent). Together these four classes accounted for 83 percent of all taxa. Hyland et al. (1991) revealed patterns of decreasing infaunal abundances and diversity with increased water depth. Similar patterns have also been reported by Fauchald and Jones (1978) and SAIC (1986) in the CAMP Phase I reconnaissance study.

The project area is located in the southern Santa Maria Basin, at the boundary separating the Oregonian and Californian Provinces. Therefore, the composition of the infauna found in the CAMP Phase II Monitoring Program show affinities with each province (Hyland et al. 1990). The majority of species (67 percent) occurring in the project area have northern faunal affinities (Oregonian Province), 27 percent exhibit primarily southern affinities (Californian Province), and 31 percent are endemic to the region (Hyland et al. 1990).

Deep-Benthic Assemblages – Hard Substrate

Hard-bottom habitats in the project area near Platforms Hidalgo, Harvest, and Hermosa are rare. Generally, they are discontinuous patches of exposed rock separated by soft bottom composed of mud and fine sands (BBA/ROS 1986; Steinhauer and Imamura 1990; SAIC and MEC 1995). Several qualitative surveys of hard-bottom communities in this region of the Santa Maria Basin have been conducted over the years (e.g., Nekton 1981; Dames and Moore 1982; 1983; Nekton and Kinnetic Laboratories 1983; and SAIC 1986). However, during the comprehensive MMS sponsored California Offshore Monitoring Program (CAMP), Phases II and III, nine rocky reefs were quantitatively surveyed for 10 years from 1986 to 1995. The goal of the hard-bottom studies was to determine the cumulative effects of offshore drilling and production activities on the hard-substrate communities. Impacts to hard-bottom communities, especially epifauna, were of particular interest, because of the greater sensitivity of many of these species to increased particulate flux, the importance of their trophic role, and the general rarity of these communities in the area.

From CAMP Phase II, Hardin et al. (1994) reported 263 taxa from low-relief (<0.5 m) and 222 taxa from high-relief (>1.0 m) structures. The ten most dominant species (mean percent cover), are provided in Table 4.12.

No one taxon dominates in percent cover on the hard-substrate in the project area. However, most of the cover that was found consists of a turf composed of komokoiacea foraminerferans and hydroids. The turf varies in percent cover depending on structure but generally, it occupies most of the rock surfaces that were absent megafauna. The 15 most abundant taxa in low-relief habitats totaled about 19.3 percent cover, and the 15 most abundant taxa in high-relief habitat total about 26.6 percent cover (Hardin et al. 1994). Despite the lack of dominance by any one taxa, of the 22 taxa comprising the 15 most abundant species, 10 were anthozoans. Anthozoans were followed by poriferans, ophiuroids, polychaetes, and urochordates.

Table 4.12 The Ten Most Abundant Hard-Bottom Taxa in Low Relief (0.2-0.5 m) and High Relief (>1.0 m) Habitats Near Platform Hidalgo

Taxa	Taxon Group	Mean Percent Cover
Low Relief		
Ophiuroidea, unidentified	Ophiuroidea	5.8
Florometra serratissima	Crinoidea	2.7
Paracyathus stearnsii	Anthozoa	1.5
Metridium giganteum	Anthozoa	1.2
Sabellidae, unidentified	Polychaeta	1.1
Ophiacantha diplasia	Ophiuroidea	1.1
Caryophyllia sp.	Anthozoa	1.0
Pyura haustor	Urochordata	0.8
Terebellidae, unidentified	Polychaeta	0.8
Sponge, white encrusting	Porifera	0.7
High Relief		
Amphianthus californicus	Anthozoa	4.6
Ophiuroidea, unidentified	Ophiuroidea	3.5
Sabellidae, unidentified	Polychaeta	2.4
Desmophyllum cristagalli	Anthozoa	2.1
Galatheidae, unidentified	Decapoda	1.7
Metridium giganteum	Anthozoa	1.7
Lophelia californica	Anthozoa	1,6
Sponge, white encrusting	Porifera	1.5
Stomphia didemon	Anthozoa	1.6
Florometra serratissima	Crinoidea	1.3

Source: Adapted from Hardin et al. 1994

Two surveys of hard-bottom habitats in the northern Santa Maria Basin off the coast of the Point San Luis - Montana de Oro area were conducted in 1999. The goal of the surveys was to characterize hard-bottom communities in submarine cable corridors proposed for installation in 2000. The more extensive of the two surveys was conducted by MRS for five proposed MCI/Worldcom cables. Twenty-two transects were photo-surveyed at water depths ranging from 35 to 125 m. Relief height ranged from 0.5 m to more than 35 m.

Generally, the species in the survey area bear similarities to those found near Platform Hidalgo in the CAMP Phase II. However, there are substantial differences in both the dominant species and epifaunal percent cover. While anthozoans were the most common taxa, as found in CAMP Phase II, percent cover of species such as *Stylantheca porphyra* (purple encrusting hydrocorals), *Balanophyllia elegans* (orange cup coral), *Paracyathus stearnsii* (brown cup coral), *Corynactis california* (club-tipped anemone), *Epizoanthus* sp. (zoanthid anemones) typically approaches 100 percent. At higher relief locations, these species (especially *Corynactis*) form solid carpets that extend for hundreds of meters. California hydrocoral *(Stylaster californicus)*, which was responsible for tracts deletions offered for lease in previous OCS Sales, commonly occurs at water depths <45 m.

4.1.3 Project Impacts and Mitigation Measures

The sections below present the incremental marine resource impacts and mitigation measures associated with development of the Electra Field.

4.1.3.1 Project Impacts

Impacts described in the Development Plan EIR/EIS for the Point Arguello Field and Gaviota Process Facility (ADL 1984) were evaluated with respect to their applicability to the proposed development of the Electra Field. The category of impacts described in the Point Arguello EIR/EIS and those anticipated from the proposed project are compared in Table 4.13.

Table 4.13 Comparison of Impacts Contained in the Arguello Project DP EIR/S and Additional Impacts Potentially Caused by the Proposed Project

Impact/Issue	Addressed in Arguello Project EIR/S	Additional Impact Caused by Development of the Electra Field
Impacts to marine biological communities resulting from construction activities (pipeline installation, processing facility, trenching, and platform installation)	Yes	No construction activities are proposed for development of the Electra Field
Impacts to biological communities resulting from discharge of drilling mud and drill cuttings	Yes	No additional impacts caused by drilling mud or drill cuttings discharges are anticipated. Additional information pertaining to drilling mud and drill cuttings discharges in hard-bottom areas and the implications of these discharges to nearby National Marine Sanctuary waters is provided as Impact No. 1.
Impacts to biological communities resulting from oil spills	Yes	No additional impacts caused by oil spills are anticipated. Updated information is provided for potential impacts to marine organisms as Impact No. 2.
Impacts to marine biota caused by noise and disturbance	Yes	No geophysical surveys are proposed for the project. Impacts caused by noise and disturbance from supply vessels and drilling were included in the Point Arguello Project EIR/S. Updated information is provided as Impact No. 3.
Impacts to marine biota caused by produced water discharges	Yes	No additional impacts caused by produced water discharges are anticipated. The volume proposed for discharge is below estimates provided in the Point Arguello Project EIR/S. Additional information is provided as Impact No. 4.
Impacts to marine biota caused by artificial lighting	No	Increases to nighttime lighting from drilling operations and vessel traffic could impact marine biota. Updated information is provided as Impact No. 5.

Table 4.13 Comparison of Impacts Contained in the Arguello Project DP EIR/S and Additional Impacts Potentially Caused by the Proposed Project

Impact/Issue	Addressed in Arguello Project EIR/S	Additional Impact Caused by Development of the Electra Field

Impact No. 1. Impact of drilling mud and drill cutting discharges on hard-bottom communities and the implications of discharges to the Monterey Bay National Marine Sanctuary.

Thirty-nine development wells were drilled from the platforms residing on the Point Arguello Field between 1986 and 1989 (Table 4.14). The effects of water-based drilling mud and drill cuttings discharged as a result of these wells on neighboring hard-bottom epifauna were studied in detail during the comprehensive California Monitoring Program (CAMP) Phases II and III, which lasted from 1986 to 1995. The final conclusion provided in the Phase III report was that platform discharges have not caused changes to nearby hard-bottom communities (Diener and Lissner, 1995).

Table 4.14 Historical and Proposed Volumes of Drilling Fluid and Drill Cuttings Discharges from Point Arguello Platforms

Platform	Historical (1986 to 1989)[1]			Electra Field1[2]		
	No. Wells	Drilling Fluid (bbl)	Cuttings (bbl)	No. Wells	Drilling Fluid (bbl)	Cuttings (bbl)
Harvest	19	102,780	NA	0	0	0
Hermosa	13	102,990	19,590	0	0	0
Hidalgo	7	50,090	14,430	2	27,611	11,209
Total	39	255,860	34,020[3]	2	27,611	11,209

1.From: Steinhauer, Imamura, Barminski, Neff; Oil and Gas Journal, May 4, 1992.
2. Based on data provided in Table 2.2 of this Environmental Evaluation.
3. The total for cutting does not include the 19 wells drilled from Platform Harvest.

Equal numbers of positive and negative effects were indicated for dominant taxa, and there was no consistent pattern of response for a single taxon over the three habitat types analyzed (deep high and low relief, and shallow low relief). Statistical tests concluded that the cumulative distribution of responses could have been due to chance alone (Diener and Lissner, 1995).

Based on the results of CAMP Phases II and III, adverse impacts to hard-bottom epibiota as a result of discharges of drilling mud and drill cuttings from the proposed project are not expected to occur, particularly as the total quantities to be discharged are substantially smaller than the historic discharge amounts.

Discharges for the proposed project will occur from Platform Hidalgo in accordance with the current NPDES General Permit for Offshore Oil and Gas Exploration, Development, and Production Operations for Southern California (Permit No. CAG280000).

The cumulative depositional patterns and transport of drilling fluid discharged from Platforms Harvest, Hermosa, and Hidalgo were also examined during CAMP Phase II. The deposition of drilling fluid releases was computed for four time periods as described in Coats (1994). The first time span encompassed two years of nearly continuous drilling from February 1987 through January 1989. Throughout this time, at least one of the three platforms was actively drilling. The trajectory computations included calculations of plume dynamics, current transport, wave-current resuspension, and utilized the drilling fluid discharge volumes reported on daily log sheets by each platform's mud engineer.

Because drilling-fluid discharge volumes and energetic short-term currents exhibit substantial daily variability, stochastic trajectories for individual plumes over several months were examined to provide depositional patterns (e.g., Figure 4-4). The calculations were supported by depositional patterns that were measured in sediment traps that were deployed throughout the CAMP study area.

The trajectory computations revealed a general transport of drilling fluid plumes toward the northwest; hence, high particulate flux was observed at Platform Hidalgo. Prevailing currents alone transport the majority of drilling fluids to the northwest of Platform Hidalgo as supported by sediment-trap observations (Coats, 1994).

The cumulative patterns reported in Coats (1994) cannot be used to provide absolute measures of drilling-fluid transport distances. However, it provides a statistical measure of the depositional pattern of drilling-fluid discharges. Transport of drilling-fluid plumes to distances of 6.8 km for the discharges from the three Point Arguello Field platforms was reported by Coats (1994). Based on these calculations, drilling-fluid discharges are not likely to impinge on either Channel Islands National Marine Sanctuary waters or Monterey Bay National Marine Sanctuary waters.

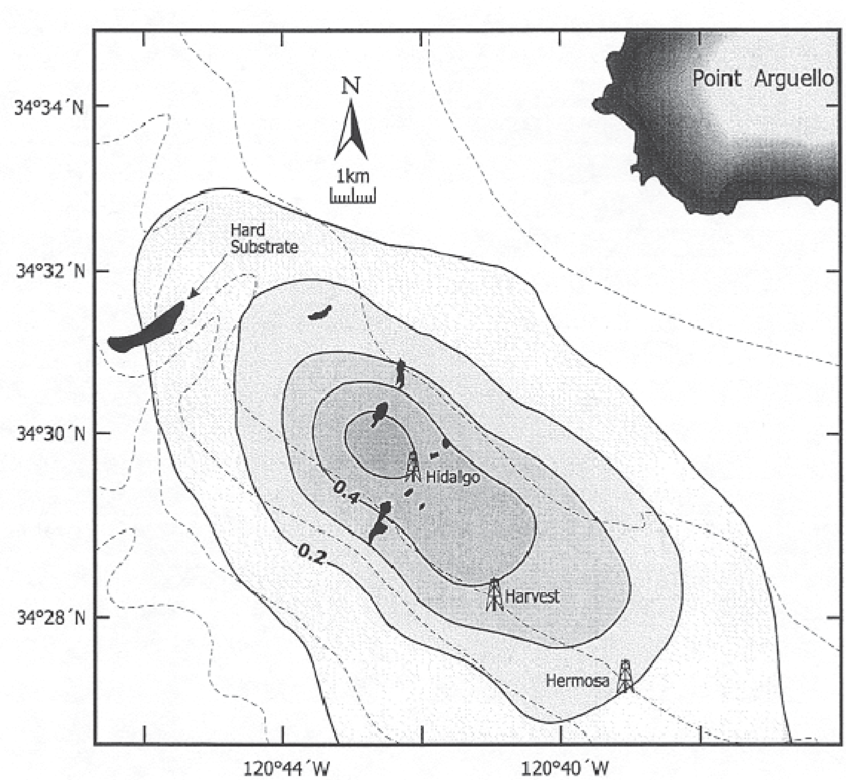
Impact No. 2. Oil spill impacts to the marine environment and biota.

Oil spill trajectories and probabilities for shoreline impacts along various locations north and east of Point Conception, and including the Channel Islands were analyzed in the original Point Arguello Project EIR/EIS (ADL 1984). Updated probabilities from OSRA are provided in an earlier section of this document and the results are presented in Attachment F.

An oil spill could occur as a result of a well blowout, pipeline rupture, or from other accidental events. The significance of any impacts from the spill will be a function of the type and quantity of oil spilled, trajectory and location of oil landfall, and the effectiveness of response measures.

The natural degradation processes that are responsible for removal of oil from the marine environment after a spill are spreading, drift, evaporation, dissolution, dispersion, emulsification, sedimentation, biodegradation, and photooxidation (Wheeler, 1978). These degradation processes, also called weathering, contribute to decreases in oil-spill volume and increases in viscosity and specific gravity of the oil and influence the significance and duration of impacts from a spill.

Figure 4-4 Depositional Pattern of Drilling Fluid Discharges from the Point Arguello Platforms (February 1987 to January 1989)



Oil may induce sublethal or lethal effects in marine organisms through exposure and accumulation of toxic oil components or through coating and smothering. Fatalities or risk from exposure to toxic oil components is higher during the early stages of a spill and decrease in time due to the degradation process that occurs in the marine environment. Fatalities due to coating and smothering are a primary concern from oil impacting intertidal areas or where birds and marine mammals are present.

Toxic components of crude oil generally occur in the low molecular weight aromatic compounds. These compounds make up about 20 to 50 percent of crude oils. They tend to be soluble in seawater but due to their high volatility, the majority can be lost to evaporation within 24 to 48 hours (Jordan and Payne, 1980). Oil that is not removed by evaporation or dissolution undergoes further physical, chemical, and biological change. Oil that is not physically removed will remain for extended periods of time and eventually form tar balls which may float or sink, or wash ashore. Oil in such asphaltic form may remain in the environment for many years but will gradually be removed by weathering processes.

Based on wind and current conditions that can cause spilled oil to reach shore, releases from the Point Arguello Field project area were computed by the OSRA model. Trajectory results indicate the possibility of shoreline contact for San Miguel Island and portions of Santa Rosa and Santa Cruz Islands to the southeast. Under certain conditions, a slight probability of shoreline contact is also indicated from to the Point Arguello/Point Conception area to just south of the Point Sal region in the north.. Drifter data obtained from an ongoing study in the Santa Maria Basin area indicate that under certain conditions and times of the year, spilled oil may impact shorelines north of the Point Arguello area. Impacts from oil spills are described in detail in the original Point Arguello Project EIR/EIS. A summary utilizing updated information follows.

Studies have shown that spilled oil can have measurable effects on marine phytoplankton and zooplankton communities. Effects noted in phytoplankton include reduced growth and reduced photosynthesis and impacts on zooplankton include mortality and a variety of sublethal effects such as lowered feeding and reproductive rates and altered metabolism (Spies, 1985). Early life stages of zooplankton (e.g., eggs, embryos, and larvae) are considered to be more vulnerable to oil spills than adults because of their higher sensitivity to toxicants and prolonged exposure to oil at the air-water interface. Lethal and sublethal effects on plankton depend on the occurrence and persistence of high concentrations of oil in the water column. Effects are likely to be short-lived because of the limited residence time of oil in the open ocean environment.

Fish populations can be affected by oil spills due to ingestion of oil, uptake through gills or epithelia, effects on their embryonic or larval stages, or due to mortality of prey species (NRC, 1985). Both lethal and sublethal effects of oil have been studied in the laboratory. Typical responses to toxic hydrocarbon concentrations include a period of increased activity, followed by reduced activity, twitching, narcosis, and death (NRC, 1985). Among fishes, benthic species are apparently more sensitive than pelagic species, and intertidal species are the more tolerant (Rice et al. 1979, Brewer, 1984). Toxicity tests indicate that early life stages of fish (embryos and larvae) are more sensitive to oil than later life stages such as juveniles or adults (Fucik et al. 1994).

Despite the apparent sensitivity of fish to oil, few effects have been observed following major oil spills. In a few instances, large fish kills have been associated with an oil spill. Examples include the *Florida* spill at West Falmouth, MA, and the *Amoco Cadiz* spill of the coast of Brittany. Sublethal responses were also documented. Following the *Florida* spill, killifishes from contaminated marshes had a lower rate of lipogenesis than those from uncontaminated marshes and following the *Amoco Cadiz* spill, a large number of histological abnormalities were noted in estuarine flatfish (*Pleuronectes platessa*) (Sabo and Stegeman, 1977; Haensley et al. 1982). There was no indication of fish kills or other evidence of deleterious effects on fishes following the 1969 Santa Barbara Channel oil spill or the smaller Torch oil spill in 1997 (Straughan 1971, Torch).

Should oil contact coastal estuaries and lagoons inhabited by the endangered tidewater goby, high mortality could occur. Populations of tidewater gobies are restricted to shallow and enclosed marsh or lagoon systems where oil can become entrapped if contaminated by oil. Since tidewater gobies are generally also restricted to low-salinity water, few avoidance opportunities are available to this species. Cleanup of fragile marsh habitats may also cause impacts to this species.

Marine mammals that could be affected by oil spills in the project area include cetaceans, pinnipeds, and sea otters. Marine mammals have varying sensitivities to oil contamination depending on their mode of thermoregulation, activity patterns, and food items (Geraci and St. Aubin, 1990). Marine mammals unable to avoid contact with oil could suffer from fouling, inhalation, or ingestion. Indirect impacts of oil include contamination of food items or reduction of habitat. Detailed reviews of the effects of oil on marine mammals have been provided by Geraci and St. Aubin (1982, 1985, 1990), Englehardt (1983), and the NRC (1985).

The impacts to sea otters in the project area as described in the original Point Arguello EIR/EIS have not changed substantially. However, because sea otter populations have steadily increased in numbers and have extended their range southward, an oil spill could potentially impact a higher number of individuals in the Point Sal and Point Conception regions. The OSRA model shows a shoreline contact probability in this area of up to 3.3 percent during fall and winter. In a report prepared for BOEM (formerly MMS), Ford (2000) modeled oil spill events and identified various probabilities of southern sea otters coming into contract with oil. This study estimated a 1 in 1,000 chance that seven southern sea otters would be contacted by oil in the event of a spill from the Point Arguello Platforms or pipeline. The USFWS estimated that up to 90 sea otters could be oiled by a springtime spill from the Point Arguello Platforms or pipeline (USFWS 2000). The USFWS also determined that there would be a low probability of a large spill occurring in the spring in combination with strong wind wave and currents. Spills during other seasons would potentially oil fewer sea otters.

Although otters have expanded their range further into the project area since the Ford modeling was conducted, densities along the south central coast have not changed significantly. If 90 sea otters were oiled this would represent slightly more than 3.2 percent of the total southern sea otter population based on the 2012 spring census data.

Oil spill impacts to sea otters are well documented (Costa and Kooyman, 1982; Siniff, 1982; Davis et al. 1988). After exposure to oil, death usually results from either an increase in metabolic rate or inhalation of volatile vapors (Geraci and Williams, 1990). An oil spill that occurs during the non-breeding season (November to May), will most likely kill more sea otters than an oil spill that occurs during the breeding season (June to November). This is because during the non-breeding season, sea otters extend their range. In particular, groups of bachelor males typically migrate from the center to the periphery of the main breeding range. In recent years, large groups of otters have been reported east of Carpinteria. These wandering males retract to the center of the range north of Point Arguello during the breeding season (i.e. from June to November).

Regardless of their seasonal variability in the region, sea otters residing or transiting through the waters of the project area are highly vulnerable to oil spills. Transport of spilled oil to the north of Point Arguello and Point Conception can be expected to impact a higher number of sea otters where a larger number of animals reside than previously.

No sea otter fatalities were reported in the project area from the September 1997 Torch oil spill. Although field observations from the marine mammal injury assessment survey suggested possible oil exposure to sea otters, were no direct observations of oiled sea otters or otter deaths, nor any indication of anomalies or change in the number of sea otters in the area. It is likely, however, that sea otters in the proximity of the spill were exposed to oil and may have experienced sub-lethal effects, but did not experience acute effects or death as a result of the spill (CDFG et al. 1998).Of the 364 oiled otters that were processed at oiling centers following the *Exxon Valdez* oil spill, only 53 percent were rehabilitated (Geraci and Williams, 1990). Nearly 1,000 sea otter carcasses were recovered within a few months of the *Exxon Valdez* spill (Loughlin et al. 1996), and total sea otter fatalities were estimated at approximately 2,800 individuals (Garrott et al. 1993).

Although laboratory studies indicate that oil is highly toxic to pinnipeds resulting in death, large scale mortality has seldom been observed after an oil spill (St. Aubin, 1990). Investigators such as Davis and Anderson (1976) and LeBoeuf (1971) found no difference in the growth and mortality of oiled and unoiled seal pups following exposure to oil. Also, marine mammal deaths could not be linked to the Santa Barbara blowout (Brownell, 1971; Geraci and Smith, 1977). Geraci and Smith (1977) have reported that surface contact with oil has a much greater effect on seals than absorption of the petroleum. Following experiments in which seals were exposed to floating oil resulted in reversible eye damage. Brief periods of exposure in clean seawater eliminated indications of irritation or damage to sensitive eye tissue. However, following the *Exxon Valdez* oil spill, several investigators recorded deaths of harbor seals attributable to the spill (Loughlin et al. 1996). Population declines for both species were noted in Prince William Sound after the oil spill, and four different types of lesions characteristic of hydrocarbon toxicity were found in the brains of oiled seals (Loughlin et al. 1996). For pinnipeds that are furred, experimental studies indicate that surface fouling will decrease the insulative value of the pelt, and possibly lead to thermal and energetic stress and eventual death (St. Aubin, 1990).

Secondary impacts to seals could also result from response activities following a spill. DeLong (1975) found that seals disturbed on land retreated into the sea and did not return for several days. Such impacts could be significant during the breeding season (Davis and Anderson, 1976). Abandonment of seal hauling or rookery sites would be expected with the level of disturbance associated with oil spill cleanup activities in the Point Arguello and Point Conception area and the offshore Channel Islands. Due to the proximity of several harbor seal haul-out or rookery sites in the area, an oil spill could have deleterious effect on harbor seals that could be present. Animals could be exposed to recently released oil and unweathered oil containing a high percentage of volatile and toxic components. Onshore cleanup would also be extremely disruptive resulting in very significant impacts.

It is unlikely that spilled oil will substantially impact cetaceans. Some observations and studies suggest that cetaceans may detect and avoid surfacing in oil slicks or change their respiratory pattern and stay submerged when traveling through oil slicks (Geraci and St. Aubin, 1982). However, contact with oil can result in fouling of the baleen, toxicity from ingestion, respiratory difficulties, and irritation of the eyes, skin, and mucous membranes. Unless a cetacean was confined within an oil spill area, it would sustain only minor impacts from oil contact and would recover from these effects (MMS 1983). Oil does not tend to adhere to and foul cetacean skin as it does with the pelage of sea otters and seals. Studies indicate that the levels of oil fouling by skin contact and ingestion would not reach toxic levels and irritation would likely be temporary (Geraci and St. Aubin, 1982).

Oil spills pose a significant threat to marine and shore birds. The effects of oil on seabirds have been extensively reviewed (e.g., Bourne 1976; Fry 1987; Leighton 1995; Burger and Fry 1983). Because of the migratory nature of many bird species in the region, the significance of any impacts from a spill will depend on the time of year, species present, and the numbers of birds.

The immediate danger of oil most birds is to clog or mat the fine structure of the feathers that are responsible for maintaining water repellency and heat insulation. Oiled birds are subject to hypothermia, loss of buoyancy, impaired ability to fly, and reduction in foraging ability. In addition to coating by oil, birds are also subject to chronic, long-term effects from oil that remains in the environment (Laffon et al. 2006; Alonso-Alvarez and Ferrer 2001). Small amounts of oil on a bird's plumage that were transferred to eggs during incubation have been shown to kill developing embryos (Albers 1978; Szaro et al. 1978). Birds can also accumulate oil in the diet and through preening. Holmes and Cronshaw (1977) and Brown (1982) have reviewed physiological stresses that can result from ingestion. An oil spill that affects important bird habitats (e.g., coastal marshes, intertidal foraging areas), even during periods of low use, may pose long-lasting problems. Birds have been observed to leave an area that has been affected by a spill (Hope et al. 1978; Chapman, 1981; Albers, 1984). Albers (1984) suggests that such movements would cause severe impacts during the breeding season.

The endangered California least tern and the threatened western snowy plover are both present in the project area and may suffer mortality in the event of an oil spill. The California least tern is highly susceptible to oiling because its feeding behavior includes skimming over the ocean surface for prey and occasional diving.

Should an oil spill reach the tern's coastal habitats, significant mortality could occur. This would also be true for the western snowy plover which forages along shoreline habitats. Both the western snowy plover and the least tern would also be adversely affected if cleanup activities were to occur on nesting or wintering beaches. Nesting locations for the endangered California least tern and threatened snowy plover occur in the coastal dunes in northern Santa Barbara County in areas that have been identified by OSRA modeling as locations where the shoreline may be impacted by oil spills from the proposed project.

The endangered marbled murrelet is also exceedingly vulnerable to oil spills due to its predominately at-sea existence. Although, given the low numbers of murrelets observed to occur within the project area, their seasonality, and the substantial distance to any known breeding area, marbled murrelets would not be expected to suffer significant mortality due to a spill from the proposed project.

Another species that forages in nearshore waters that would be highly susceptible to oil ingestion and fouling in the event of an oil spill from the proposed project is the California brown pelican. Although no longer listed as an endangered species, the California brown pelican is protected under the Migratory Bird Treaty Act of 1918. Effects of oil contamination on the U.S. breeding population of brown pelicans could be significant as this species is sensitive to disturbance, breeding success is highly variable, and the U.S. breeding population is centered at the Channel Islands. Similarly, Scripps's and Guadalupe murrelets, Cassin's auklets, and ashy storm-petrels would all likewise be expected to suffer substantial impacts in the event of a spill reaching the Channel Islands. Not only would direct impacts from an oil spill result in mortality to these birds, but cleanup and rehabilitation efforts could be complicated due to the cryptic (e.g. nocturnal, pelagic) nature of these species and the complications inherent in accessing the islands where they nest.

Rocky intertidal habitats could be smothered by oil if a spill were to occur in the project area. Exposure to volatile toxic components released from the oil and shoreline remediation methods may also severely impact intertidal organisms. Recovery times for rocky intertidal areas damaged by oil and cleanup vary according to the species present and the intertidal zone that are impacted. The intertidal community in Prince William Sound, Alaska, recovered in two to three years following the *Exxon Valdez* oil spill (Coats et al. 1999); however, mussel bed assemblages may require up to 10 years for full recovery (MMS 1984).

The impact from oil spills on a sandy beach community depends on the residence time of oil in the area. Oil spill cleanup activities could also potentially destroy sandy intertidal communities. Impacts on sandy beaches from oiling and cleanup, however, are not considered to be long-lasting, with full recovery occurring in two to three years (Coats et al. 1999).

Impact No. 3. Project-generated noise, and marine traffic impacts to marine biological resources.

Noise caused by supply and support vessels may potentially disturb marine mammals and seabirds. Increases in vessel traffic would also heighten the potential for negative vessel interactions, including vessel strikes or physical disturbance to marine species (e.g. marine mammals, marine turtles, seabirds). For example, bird species such as the ashy storm-petrel and sooty shearwater utilize the waters of the Project area for resting and foraging, often forming large aggregations of several hundreds to thousands of birds. Repeated disturbance or startling of such aggregations can have a negative impact on the viability of individual birds. Similarly, noise from vessels has been shown to elicit a startled reaction from gray whales or mask their sound reception capabilities.

The degree of noise impacts to individual species will depend on the emitted sound level and the proximity to the animals. Although sensitivity varies with whale activity, avoidance and approach responses have been observed in field studies (Watkins, 1986; Malme et al. 1989; Richardson et al. 1991). Migrating gray whales have been observed to avoid the approach of vessels to within 200-300 m (Wyrick, 1954) or to within 350-550 m (Bogoslovskaya et al. 1981). There is very little data on the sound levels involved but effects on gray whales from vessels are hence expected to be limited to within 200-550 m of the vessel, to be sublethal, and temporary in nature.

Few authors have described responses of regional pinnipeds to offshore noise generated by boats or ships. Johnson et al. (1989) report that northern fur seals show avoidance at distances of up to one mile. Wickens (1994), however, reported that fur seals can be attracted to fishing vessels to feed. Sea lions in the water can tolerate close and frequent approaches by vessels, especially around fishing vessels. Sea lions hauled-out on land are more responsive and react when boats approach within 100-200 m (Peterson and Bartholomew 1967). Harbor seals often move into the water in response to boats. Even small boats that approach within 100 m displace harbor seals from haulouts; less severe disturbance can cause alert reactions without departure (Bowles and Stewart 1980; Allen et al. 1984; Osborn 1985).

Dolphins of many species often tolerate or even approach vessels, but members of the same species show avoidance at other times. Reactions to boats often appear related to the dolphins' activity; resting dolphins tend to avoid boats, foraging dolphins ignore them, and socializing dolphins may approach them (Richardson et al. 1995).

Sea otters often allow close approaches by small boats but avoid high activity areas (Riedman, 1983). Riedman also noted that some rafting sea otters exhibit mild interest in boats passing at a distance of a few hundred meters and were not alarmed. Garshelis and Garshelis (1984) reported that sea otters in Alaska tend to avoid waters with frequent boat traffic. Udevitz et al. (1995) reported that sea otters tend to move away from approaching boats.

The literature indicates that while marine mammals hear man-made noises and sounds generated by vessels, there is no indication that they are affected deleteriously by the noise (Richardson et al. 1995). Because noise and vessel sounds generated from this project are highly localized and short-term in nature, adverse impacts to marine mammals from noise are not expected. The literature indicates that some species such as dolphins may be attracted to vessels, but the majority will maintain distances of 100-200 m. As described in the original Point Arguello Project EIR/EIS, supply vessels, although unlikely, may collide with marine mammals.

Richardson et al. (1995) cite only a single source of information on the levels of noise produced by platform-based drilling activities. Gales (1982) recorded noise produced by one drilling and three drilling and production platforms offshore California. The noise produced was so weak that they were nearly undetectable even alongside the platform in sea states of Beaufort 3 or better. No sound levels were computed, but the strongest received tones were very low frequency, about 5 Hz, at 119-127 dB re 1 micro Pa. The highest frequency recorded was about 1.2 Hz. Richardson et al. (1995) predicted that the radii of audibility for baleen whales for production platform noise would be about 2.5 km in nearshore waters and 2 km near the shelf break (MMS 2000).

For gray whales of the coast of central California, Malme et al. (1984) recorded a 50-percent response threshold to playback at 123 dB re 1 micro Pa. This is well within 100m in both the nearshore and shelf-break waters. Therefore, the predicted radius of response for gray whales, and most likely other baleen whales, would also be less than 100m. Richardson predicted similar radii of response for odontocetes and pinnipeds (MMS 2000). As such, noise impacts to marine mammals would be sublethal and limited to within 100m of the platform. Impacts caused by noise to other marine species are as described in the original Point Arguello Project EIR/EIS.

Impact No. 4. Produced water impacts to marine biological resources.

Produced water refers to the total water discharged from the oil and gas extraction process. It is the largest single source of material discharged during oil and gas operations. Typically, produced water consists of formation water, injection water, and chemicals used in the oil and water separation process (MMS 1996).

Produced water generally represents a small portion of the initial fluid extracted from a well. As a reservoir becomes depleted, however, the amount of formation water extracted generally increases. Constituents found in produced water include iron, calcium, magnesium, sodium, bicarbonate, sulfates, and chloride. Produced water can also contain entrained petroleum hydrocarbons and measurable trace metal concentrations. Relative to ambient water, produced water contains increased organic salts and trace metals, decreased dissolved oxygen, and is higher in temperature. These same properties may adversely affect the marine environment (MMS, 1996).

Produced water from the project will be discharged in accordance with the existing general NPDES permit (Permit No. CAG280000). Under the permit, Platform Hidalgo is authorized to discharge up to 18,250,000 bbl of produced water per year, which is an average of 50,000 bbl/d. Currently, Platform Hidalgo has a peak produced water discharge of 10,000 bbl/d. The development and production of the Electra Field is anticipated to generate an additional 6,500 bbl/d of produced water. With the addition of the Electra Field, total produced water discharges will still remain well below the permitted levels. At the maximum produced water discharge rate for the proposed project, the current NPDES permit limits are met well within the 100 meter mixing zone. On this basis, because of rapid initial dilution, adverse impacts to marine biota in the region are not expected to occur.

Under Section 402 of the Clean Water Act, the Environmental Protection Agency (EPA) is authorized to issue National Pollutant Discharge Elimination System (NPDES) permits to regulate the discharges of pollutants to waters of the U.S., the territorial sea, contiguous zone, and ocean (EPA 1976). The use of the General Permit streamlines the permitting process for facilities that are not anticipated to significantly affect marine environments. In 2000, EPA prepared a Biological Evaluation and conducted an EFH assessment for the re-issuance of a

NPDES General Permit for offshore oil and gas facilities in southern California (SAIC 2000a,b,c). The overall conclusions of the Biological Evaluation and the EFH assessment were that the continued discharge from the 22 platforms located in federal waters offshore California will not adversely affect biological resources outside the mixing zones, described as a 100 m radius from the discharge point.

Within the 100 m radius mixing zone, discharges from oil and gas exploration, development, and production may have localized effects on water quality and resident marine organisms, including EFH and fish. The assessment further concluded that while there may be effects on EFH from certain discharges, such as drilling fluids and produced water within the mixing zone near an outfall, these effects should be minor overall given the very small area which may be affected relative to the size of the EFH off the Pacific Coast, and the mitigation provided by the various effluent limitations proposed for the permit.

The EPA provided a copy of the EFH assessment to the National Marine Fisheries Service (NMFS), and the biological Evaluation to the US Fish and Wildlife Service (USFWS) to initiate the consultations. As a result of the consultation, the NPDES General Permit incorporated a requirement that the permittees conduct a study of the direct lethal, sublethal, and bioaccumulative effects of produced water on federally managed fish species on the Pacific OCS at key life stages that occupy the mixing zone of produced-water discharges. The permit further requires that the permittees model results describing the dilution and dispersion plumes from each point of discharge of produced water (for all platforms covered by the permit) to determine the extent of the area in which federally managed fish species may be adversely affected. The permit also requires the permittees to propose mitigation measures if either of the studies indicates substantial adverse effects to federally managed fish species or EFH occur.

In response, a single comprehensive report was submitted by the permittees (MRS 2005). It provided a detailed quantitative assessment of potential impacts from produced-water discharges on federally managed fish species from each of the California OCS dischargers, including Platform Hidalgo. Although maximum contaminant concentrations beyond the 100-m mixing zone are usually well within NPDES permit limits, the study focused on the toxicity and bioaccumulation potential of produced-water discharges to the fish populations that reside within the 100-m mixing zone beneath the platforms. These fish populations consist mostly of rockfish that utilize the platforms as habitat, rarely venturing far from the protection of the structure. Consequently, contaminant concentrations at locations 100-m from the platform have little bearing on the potential impacts experienced by these fish.

Nevertheless, the quantitative exposure assessment found a general absence of impacts from most of the major produced-water constituents. Most produced-water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents (benzene, cyanide, silver, and ammonia) had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, the produced-water discharges achieve high dilution almost immediately upon discharge. As a result, the plume volumes containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zones.

In September 2005, EPA concurred with the overall conclusions of the study and forwarded them to NMFS as part of the EFH consultation required by the General Permit. In October 2005, NMFS notified EPA that the study met the intent of the conservation recommendations incorporated in the General Permit and that the EFH consultation was complete. Revisions to the NPDES General Permit, which included new compliance criteria for several of the platforms and a revision to the undissociated sulfide criterion, were approved in November 2009 (Weston Solutions Inc. and MRS 2006). Thus, potential impacts to finfish within the 100-m mixing zone around Platform Hidalgo are not likely to be significant.

Impact No. 5. Lighting impacts to marine biological resources.

Artificial lighting at oil platforms may have adverse effects on marine organisms, including zooplankton, fishes, and nocturnal seabirds (De Robertis 2002, Burkett et al 2003). For example, lighting may interfere with the light intensity cues of vertically migrating fishes and zooplankton, preventing some species which typically remain at depth during the daytime from migrating to feed in the nutrient and phytoplankton-rich surface waters at night (De Robertis 2002). Lighting may also have the reverse effect; wherein some plankton species, and forage fishes (including squid), may be unduly attracted to the artificial lights of the platform, thereby making them more vulnerable to predation. Sea lions, barn owls, and western gulls have all been documented using the illumination of artificial lights to exploit prey sources that are either themselves attracted by the light or are merely better illuminated (e.g., salmon at fish ladders, smaller seabirds).

Table 4.15 details the amount of existing lighting on Platform Hidalgo. All exterior lighting conforms to the platform lighting standards required by BOEM, Occupational Safety and Health Administration (OSHA), and the Coast Guard.

Table 4.15 Existing Exterior Lighting on Platform Hidalgo

Platform Area	Number of Lights	Watts per Light	Total Watts
Sump Deck	8	70	560
	25	100	2,500
	3	150	450
	6	400	2,400
Well Head Deck	88	70	6,160
	17	100	1,700
	7	150	1,050
Mezzanine Deck	60	70	4,200
	34	100	3,400
	15	150	2,250
Main Deck	7	70	490
	13	100	1,300
	36	150	5,400
	10	250	2,500

Table 4.15 Existing Exterior Lighting on Platform Hidalgo

Platform Area	Number of Lights	Watts per Light	Total Watts
Pipe Rack / Quarters / Cranes	18	70	1,260
	9	100	900
	12	250	3,000
Totals	**368**		**39,520**

No changes to existing levels of platform lighting are proposed or needed for the Electra project; however during drilling operations, additional lighting will be associated with the drilling rig (Table 4.16). Minor, temporary increases in lighting from additional vessel traffic will also occur during drilling.

Table 4.16 Estimated Exterior Lighting for Drilling Rig

Platform Area	Number of Lights	Watts per Light	Total Watts
Substructure	6	200	1,200
Rig Floor	4	200	800
Mud Pump & Pits	8	200	1,600
Derrick	10	140	1,400
Totals	**28**		**5,000**

Impacts from artificial lighting to plankton and marine fishes would be limited to the approximately 100 meter illuminated area around the platform. Because of the limited spatial effects of the lighting compared to the widespread distribution of zooplankton and pelagic fishes, lighting impacts on zooplankton and fish are considered to be adverse but not significant.

The use of bright lights at the oil platforms or on vessels transiting traveling to the platforms may also negatively impact seabird species. Specifically, artificial lighting can result in disruption of the normal breeding and foraging activities of nocturnal seabirds (e.g., certain species of alcids, storm-petrels and shearwaters) (Burkett et al. 2003; Wolf 2007) and increase the risk to seabirds from predation and injury and/or mortality from collisions, entanglement, and exhaustion.

The attraction to light by some nocturnal feeding seabirds is thought to result from their exploitation of vertically migrating bioluminescent prey and from a predilection to orient to star patterns (Montevecchi, 2006). Regardless of its cause, however, seabirds have been known to circle oil platforms and flares and to fly directly into lights (Wiese et al. 2001, Burkett et al 2003). Continuous circling within the illumination of, or around bright, artificial lights by birds is known as light entrapment.

The holding or trapping effect of bright, artificial lighting can deplete the energy reserves of migrating birds, resulting in diminished survival and reproduction. For example, light entrapment may delay migrating birds from reaching breeding or foraging grounds, or leave them too weak to forage or escape predation. Seabirds have been observed to continuously circle platforms until exhausted, whereupon they fall to the ocean or land on the platforms (Montevecchi 2006; Wolf 2007). Similarly, light entrapment may negatively affect breeding seabirds by increasing their time away from their nests, leaving the nests vulnerable to predation for longer periods of time, as well as causing parent chick separation of at-sea birds. In addition, time and energy spent circling lights may impede a bird's ability to successfully forage for enough food to feed their young.

Although lights associated with offshore oil platforms do appear to attract seabirds it is not known whether or to what extent such attraction disrupts migration or foraging behavior. Specifically, although the Point Arguello platforms have been operating for 20 years or longer, there has been no indication that platform lighting has significantly affected any seabird species. However, during its 2007 review of a proposal for renewed drilling from nearby Platform Irene, the CDFG determined that "…there is potential for impacts to (Scripps's and Guadalupe) murrelets" (CDFG, 2007). In light of this potential, the CDFG recommended certain measures be taken when murrelets are present in the area to minimize the potential impacts to these species and gather documentation of lighting impacts, if any. These measures include:

1. Minimization of use and wattage of night lighting to the extent feasible while not compromising safety, spill detection capabilities, or platform operations.

2. Shielding of lights, covering of filaments, and directing lighting downward as much as feasible.

3. Requiring that all vessels associated with the platform also comply with low wattage / shielding / filament-covering measures.

4. Developing a comprehensive monitoring program for the waters around the platform that includes Scripps's and Guadalupe murrelets, the ashy storm petrel, and Cassin's auklet.

Artificial night lighting on Platform Hidalgo could potentially have an adverse effect on individual sea birds and potentially on populations of several sensitive bird species. Specifically the State-threatened Scripps's murrelet, the Guadalupe murrelet, Cassin's auklet, and the ashy storm-petrel, a California Species of Special Concern could be impacted by night lighting associated with the proposed project. These species are all known to occur in the vicinity of Platform Hidalgo during both the breeding and non-breeding seasons, and are nocturnal foragers known to be attracted to artificial lighting. Scripps's murrelets and ashy storm-petrels primarily nest on the northern Channel Islands, and are found within the project area waters year-round. Although Guadalupe murrelets breed primarily on offshore islands in Mexico, substantial numbers frequent the project area waters during their post-breeding dispersal. Cassin's auklets have a larger global population and are more widespread, but also have a substantial presence in the project area.

Therefore, although the proposed increase in lighting associated with the project is only one-eighth the total wattage that currently exists on the platform, and would only occur during drilling operations, application of the above measures to would minimize the potential for impacts to sensitive seabird species.

4.1.3.2 Mitigation Measures

Impact No. 1. Impact of drilling mud and drill cutting discharges on hard-bottom communities and implication of discharges to the National Marine Sanctuary waters.
Mitigating Measure: Maintain shunt depth for discharge of drilling mud and drill cuttings at 97 m above bottom. The implemented shunt depth has minimized drilling mud and drill cuttings dispersal, and regional impacts to hard-bottom biota have not been identified.

Impact No. 2. Oil spill impacts to marine biota and the marine environment.
Mitigating Measure: Maintain immediate oil spill response and cleanup capabilities at the Point Arguello Field platforms. Initiate immediate capture of fouled wildlife for care and cleanup at local rehabilitation centers in accordance with established protocols by trained personnel.

Impact No. 3. Project-generated noise, disturbance, and traffic impacts to marine biological resources.
Mitigating Measure: Mitigation measures are not needed.

Impact No. 4. Produced water impacts to marine biological resources.
Mitigating Measure: All produced water discharges will occur in accordance with the guidelines provided in the general NPDES permit.

Impact No. 5. Lighting impacts to marine biological resources.
Mitigating Measure:
Implement lighting reduction and shielding measures, and a seabird monitoring and recovery program to minimize impacts to nocturnal seabird species.

1. Minimization of use and wattage of night lighting to the extent feasible while not compromising safety, spill detection capabilities, or platform operations.

2. Shield exterior lights, cover filaments, and direct lighting downward as much as feasible to reduce the potential for birds to be attracted to work areas.

3. All vessels associated with the platform will also comply with low wattage / shielding / filament-covering measures.

4. In conjunction with CDFG and USFWS, develop a comprehensive monitoring program for the waters around the platform that includes Scripps's and Guadalupe murrelets, ashy storm-petrels, and Cassin's auklets. The plan should provide for documentation/monitoring, recovery and transportation of seabirds injured from lighting impacts to an approved wildlife care facility, and reporting of monitoring and recovery results to BSEE.

4.2 Air Quality

This section addresses air quality. The first part covers the environmental setting. The second part discusses the incremental air quality impacts and mitigation measures associated with the proposed development project.

4.2.1 Air Quality Setting

Development of the western half of OCS-P 0450 would utilize one of the Point Arguello platforms (Hidalgo) which is located offshore the South Central Coast Air Basin (SCCAB) (Figure 4-5).

Emissions that would result from this project are subject to the rules and regulations of the Santa Barbara County Air Pollution Control District (SBCAPCD). Rules and Regulations of the SBCAPCD are designed to achieve air quality standards defined to protect public health. To that purpose they limit the emissions and the permissible impacts from projects, and they specify emission controls and control technologies for each type of emitting source in order to ultimately achieve the air quality standards.

This section describes the climate and meteorology of the study area, the existing ambient air quality, and the regulatory framework for impact evaluation.

4.2.1.1 Climate and Meteorology of the Study Region

Santa Barbara County has a Mediterranean climate characterized by mild winters when most rainfall occurs and warm, dry summers. The regional climate is dominated by a strong and persistent high pressure system that frequently lies off the Pacific coast (generally referred to as the Pacific High). The Pacific High shifts northward or southward in response to seasonal changes or the presence of cyclonic storms. In its usual position to the west of Santa Barbara County, the High produces an elevated temperature inversion.

Coastal areas are characterized by early morning southeast winds, which generally shift to northwest later in the day. Transport of cool, humid marine air onshore by these northwest winds causes frequent fog and low clouds near the coast, particularly during night and morning hours in the late spring and early summer months. Figure 4-6 displays typical prevailing afternoon wind flow during summer months (Aspen, 1992).

Temperature Inversion. Atmospheric stability is a primary factor that affects air quality in the study region. Atmospheric stability regulates the amount of air exchange (referred to as mixing), both horizontally and vertically. Restricted mixing (that is, a high degree of stability) and low wind speeds are generally associated with higher pollutant concentrations. These conditions are typically related to temperature inversions that cap the pollutants emitted below or within them. An inversion is characterized by a layer of warmer air above cooler air near the ground surface. Normally, air temperature decreases with altitude. In an inversion, the temperature of a layer of air increases with altitude. The inversion acts like a lid on the cooler air mass near the ground, preventing pollutants in the lower air mass from dispersing upward beyond the inversion "lid." This results in higher concentrations of pollutants trapped below the inversion.

Because of its coastal location and the adjacent mountains and inland valleys, the coastal strip (south of the Santa Ynez Mountains) is susceptible to sea-land temperature variations and compressional heating that are often associated with inversion conditions. The Southern California coastal region has some of the lowest daytime and nighttime mixing heights in the United States (Holzworth, 1972).

Figure 4-5 Affected Air Basins

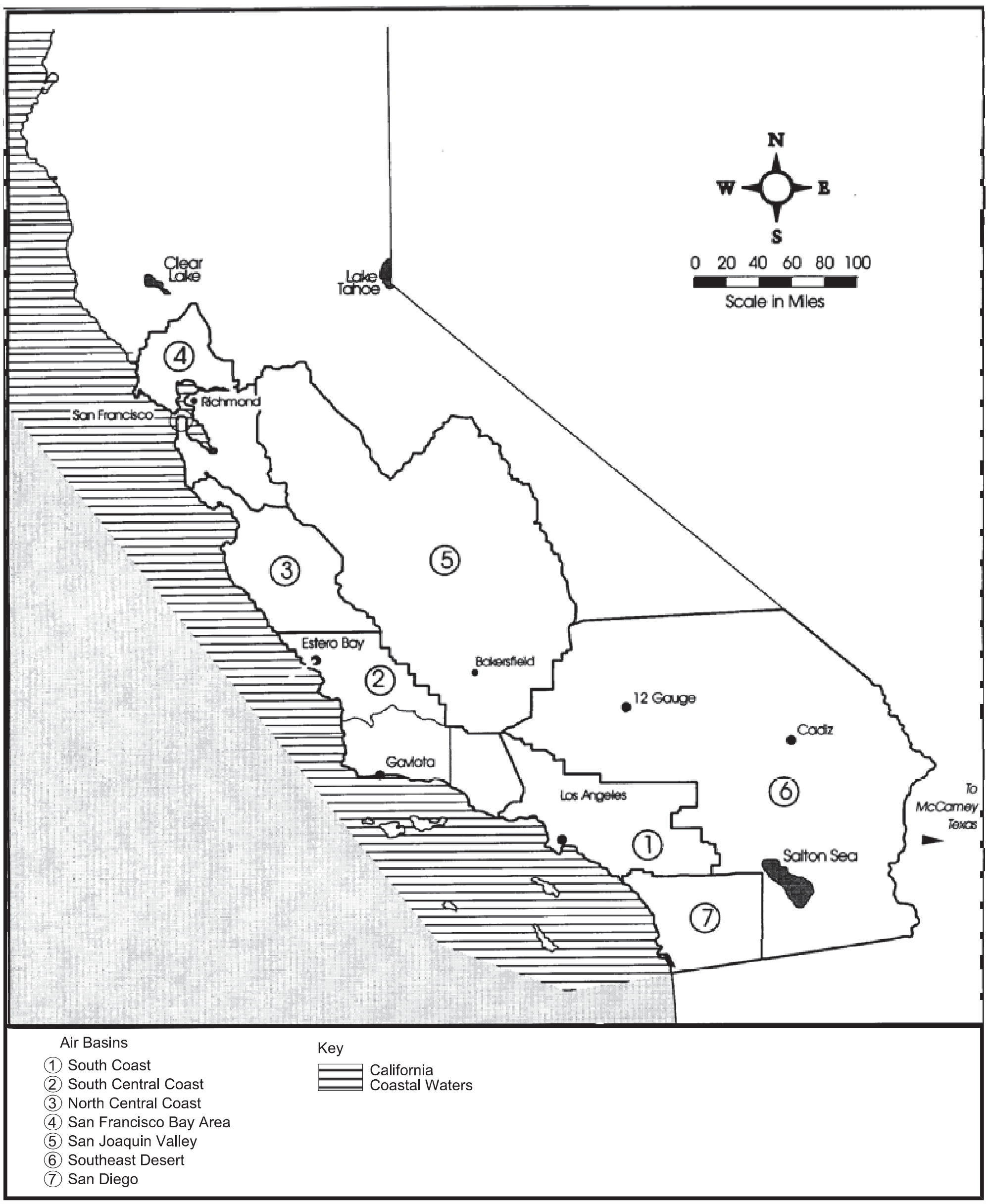
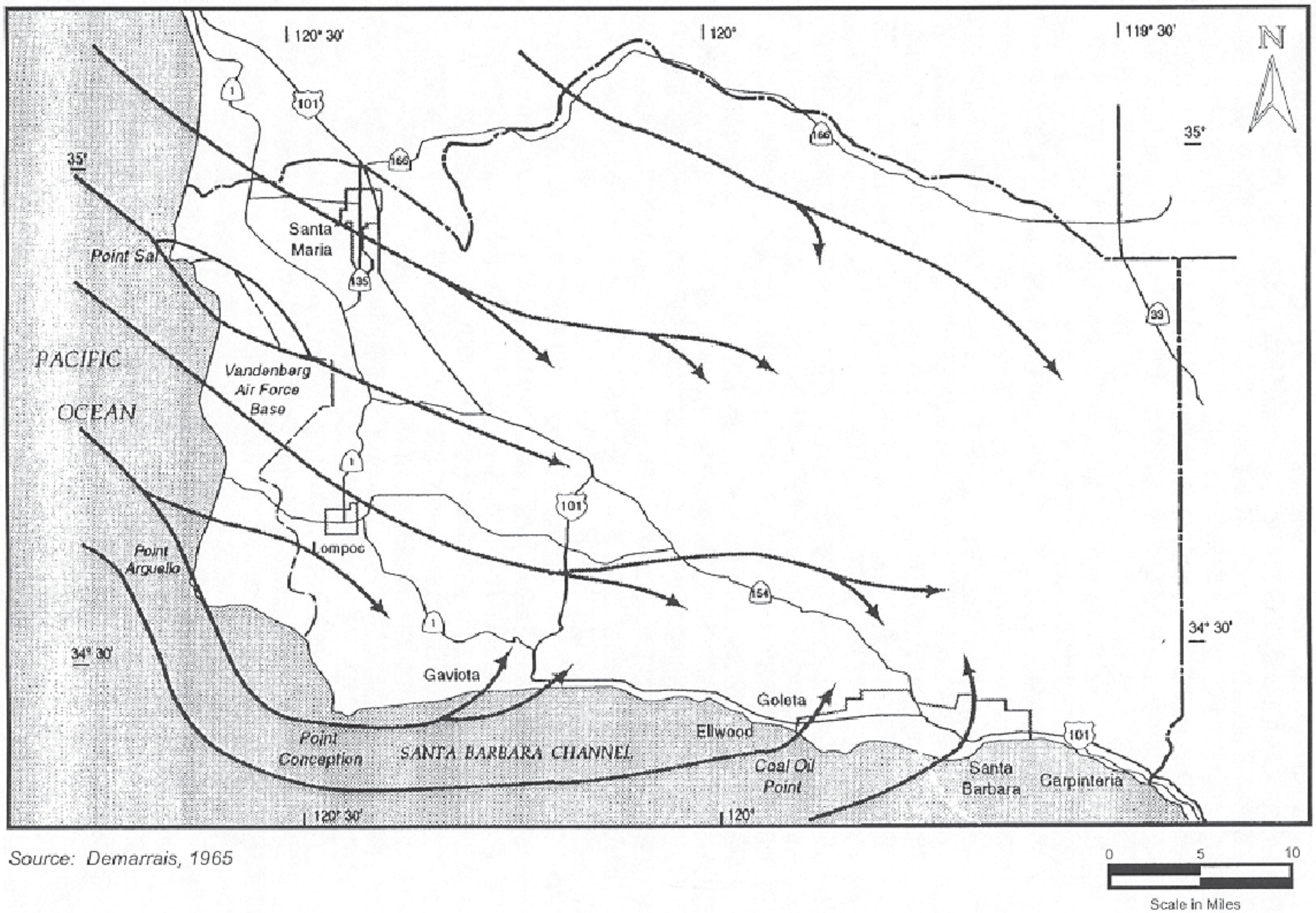


Figure 4-6 Surface Wind Streamlines



Source: Demarrais, 1965

Wind Speed And Direction. The airflow around the County plays an important role in the movement of pollutants. Wind speeds typical of the region are generally light, another factor that tends to cause higher levels of pollution since low wind speeds minimize dispersion of pollutants. The sea breeze is typically northwesterly throughout the year; however, local topography causes variations. During summer months, these northwesterly winds are stronger and persist later into the night, as illustrated in Figure 4-6.

Upper level air flow also affects air quality. The winds at 1,000 feet and 3,000 feet are generally from the north or northwest. Southerly and easterly winds occur frequently in winter and occasionally in the summer. As with surface winds, upper level winds can transport pollutants to or from other regions or air basins.

During the fall and winter months, the County is subject to Santa Ana winds, the warm, dry, strong, and gusty winds that blow northeasterly from the inland desert basins through the mountain valleys and out to sea. Wind speeds associated with Santa Ana's are generally 15 to 20 mph, though they can reach speeds in excess of 60 mph. During Santa Ana conditions, pollutants emitted in Santa Barbara, Ventura County, and the South Coast Air Basin (SCAB, which includes the Los Angeles region) are moved out to sea. These pollutants can then move back onshore into Santa Barbara County in what is called a "post Santa Ana condition."

"Sundowner" winds are a local phenomenon on the coastal strip below the canyons. Similar to Santa Ana conditions, warm, gusty winds blow sometimes with great intensity down canyons toward the sea. However in contrast, these winds are local and caused by land-sea and diurnal temperature variations.

Topography. Topography plays a significant role in direction and speed of winds throughout the County. During the day, the sea breeze (from sea to land) is normally dominant. Winds reverse in the evening as the air mass over land cools, gets heavier, and flows down the coastal mountains and mountain valleys back towards the ocean as land breezes (from land to sea). This diurnal "sloshing" effect can further aggravate pollution by continually recycling an air mass over pollution sources. This effect is exacerbated during periods when wind speeds are low.

Topography also plays another role in the pattern of winds in the County. The terrain around Point Conception, combined with the change in orientation of the coastline from north-south to east-west, can cause counterclockwise circulation's (eddies) to form east of the Point Conception. These eddies fluctuate from time to time and from place to place, leading to highly variable winds along the southern coastal strip. Point Conception also marks the change in the prevailing surface winds from northwesterly to southwesterly, as illustrated in Figure 4-6.

Sunlight. Sunlight is also prevalent in the County. Although fog occurs along the coast and in inland valleys in the late spring to mid-summer period, and cloudy conditions occur during winter storms, there is frequent sunlight. The prevalence of sunlight is yet another contributor to photochemical smog, as it drives the photochemical reactions that produce ozone.

4.2.1.2 Air Quality

Air quality is determined by measuring ambient concentrations of pollutants that are known to have deleterious effects. The degree of air quality degradation is then compared to health-based standards. The current California and National Ambient Air Quality Standard (CAAQS and NAAQS) are listed in Table 4.17. A summary of the attainment status of all the air basins affected by the proposed project is provided in Table 4.18. Ambient air quality in Santa Barbara County is generally good (i.e., within applicable ambient air quality standards), with the exception of ozone (0_3) fine particulates (PM_{10}).

Photochemical Pollutants. Ozone is formed in the atmosphere through a series of complex photochemical reactions involving oxides of nitrogen (NO_x), reactive organic compounds (ROC), and sunlight occurring over a period of several hours. Since ozone is not emitted directly into the atmosphere but is formed as a result of photochemical reactions, it is classified as a secondary or regional pollutant. Because these ozone-forming reactions take time, peak ozone levels are often found downwind of major source areas.

The CAAQS have been violated in South and North County in recent years. The South Coast Central Air Basin is composed of San Luis Obispo, Santa Barbara and Ventura Counties. Currently, Santa Barbara, and Ventura Counties are designated non-attainment for the State ozone standard. San Luis Obispo County is in attainment for the state ozone standard.

Inert Pollutants. Carbon monoxide is formed primarily by the incomplete combustion of organic fuels. Santa Barbara County is in attainment of the California and National one-hour carbon monoxide (CO) standards. High values are generally measured during winter when dispersion is limited by morning surface inversions. Summer values are much lower due to increased mixing. The County is in attainment of the California and National 8-hour CO standard, the last recorded violation having occurred in 1985.

Nitric oxide (NO) is a colorless gas formed during combustion processes which rapidly oxidizes (within minutes) to form nitrogen dioxide (NO_2), a brownish gas. Santa Barbara County is in attainment for all the California and National nitrogen dioxide standards. The highest nitrogen dioxide values are generally measured in urbanized areas with heavy traffic. Downtown measurements are well below the California and National standards.

Sulfur dioxide (SO_2) is a gas produced primarily from the combustion of sulfurous fuels by stationary sources and by mobile sources. Santa Barbara County has been in attainment of the California and National 1-hour, 3-hour, 24-hour and annual sulfur dioxide standards over the past 10 years.

PM_{10} is particulate matter with an aerodynamic diameter of ten microns or less. The largest PM_{10} emissions in the County appears to originate from soils (via roads, construction, agriculture, and natural windblown dust). Other sources of PM_{10} include sea salt, particulate matter released during combustion processes such as those in gasoline and diesel vehicles, and wood burning. Also, nitrogen oxides (NO_x) and sulfur oxides (SO_x) are precursors in the formation of secondary PM_{10}. While the County is in attainment for the National annual PM_{10} standard, both the California 24 hour and annual PM_{10} standards are exceeded in the County.

Table 4.17 National and California Ambient Air Quality Standards

Air Pollutant	State Standard (concentration, averaging time)	Federal Primary Standard (concentration, averaging time)	Most Relevant Effects
Ozone	0.09 ppm, 1-hour average 0.070 ppm, 8-hour	0.075 ppm, 8-hour average*	(a) Short-term exposures: (1) Pulmonary function decrements and localized lung edema in humans and animals (2) Risk to public health implied by alterations in pulmonary morphology and host defense in animals; (b) Long-term exposures: Risk to public health implied by altered connective tissue metabolism and altered pulmonary morphology in animals after long-term exposures and pulmonary function decrements in chronically exposed humans; (c) Vegetation damage; (d) Property damage.
Carbon Monoxide	9.0 ppm, 8-hour average 20 ppm, 1-hour average	9 ppm, 8-hour average 35 ppm, 1-hour average	(a) Aggravation of angina pectoris and other aspects of coronary heart disease; (b) Decreased exercise tolerance in persons with peripheral vascular disease and lung disease; (c) Impairment of central nervous system functions; (d) Possible increased risk to fetuses.
Nitrogen Dioxide	0.18 ppm, 1-hour average, 0.03 ppm, annual average	0.053 ppm 0.10 ppm 98th percentile, 3-year average	(a) Potential to aggravate chronic respiratory disease and respiratory symptoms in sensitive groups; (b) Risk to public health implied by pulmonary and extra-pulmonary biochemical and cellular changes and pulmonary structural changes; (c) Contribution to atmospheric discoloration.
Sulfur Dioxide	0.04 ppm, 24-hour average 0.25 ppm, 1-hour average	0.075 ppm, 1-hour, 99th percentile 3-year average 0.14 ppm24-hour 0.03 ppm annual arithmetic mean	Bronchoconstriction accompanied by symptoms which may include wheezing, shortness of breath and chest tightness, during exercise or physical activity in persons with asthma.
Suspended Particulate Matter (PM_{10})	20 µg/m^3, annual arithmetic mean 50 µg/m^3, 24-hour average	150 µg/m^3, 24-hour average	(a) Excess deaths from short-term exposures and exacerbation of symptoms in sensitive patients with respiratory disease; (b) Excess seasonal declines in pulmonary function, especially in children.
Suspended Particulate Matter ($PM_{2.5}$)	12 µg/m^3, annual arithmetic mean	15 µg/m^3, annual arithmetic mean 35 µg/m^3, 24-hour average	Decreased lung function from exposures and exacerbation of symptoms in sensitive patients with respiratory disease, elderly, children.
Sulfates	25 µg/m^3, 24-hour average	No federal standard	(a) Decrease in ventilatory function; (b) Aggravation of asthmatic symptoms; (c) Aggravation of cardio-pulmonary disease; (d) Vegetation damage; (e) Degradation of visibility; (f) Property damage due to corrosion.
Lead	1.5 µg/m^3, 30-day average	0.15 µg/m^3, roll 3-month average 1.5 µg/m^3, calendar quarter	(a) Increased body burden; (b) Impairment of blood formation and nerve conduction.

Table 4.17 National and California Ambient Air Quality Standards

Air Pollutant	State Standard (concentration, averaging time)	Federal Primary Standard (concentration, averaging time)	Most Relevant Effects
Visibility-Reducing Particles	In sufficient amount to give an extinction coefficient of 0.23 per kilometers (visual range of 10 miles or more) with relative humidity less than 70%, 8-hour average (10 a.m. to 6 p.m. PST)	No federal standard	Reduction of visibility, aesthetic impact and impacts due to particulates (see above)
Hydrogen Sulfide	0.03 ppm, 1-hour average	No federal standard	Odor annoyance.
Vinyl Chloride	0.01 ppm, 24-hour average	No federal standard	Known carcinogen.

ppm = Parts per million
Note: µg/m3 = micrograms per cubic meter.
* Effective May 27, 2008. Was 0.08 ppm prior
Source: CARB

Table 4.18 Attainment Status of Affected Air Basins

Pollutant	State	Federal
O_3 – 1-hour	Non-attainment	Pending
O_3 – 8-hour	Non-attainment	Attainment
PM_{10}	Non-attainment	Attainment
$PM_{2.5}$	Attainment	Attainment
CO	Attainment	Attainment
NO_2	Attainment	Attainment
SO_2	Attainment	Attainment
Lead	Attainment	Attainment
All others	Attainment/Unclassified	Attainment/Unclassified

Source: CARB

Lead is a heavy metal that in ambient air occurs as a lead oxide aerosol or dust. Primary sources of this pollutant are automotive emissions, lead processing, and the manufacturing of lead products. There are few lead emissions in Santa Barbara and, as a result, the County is in attainment for the California and National lead standards.

Sulfates are aerosols (i.e., wet particulates) that are formed by sulfur oxides in moist environments. They exist in the atmosphere as sulfuric acid and sulfate salts. The primary source of sulfate is sulfur oxide precursors from the combustion of sulfurous fuels. Santa Barbara County is in attainment for the California sulfate standard, and there has been a steady decrease since the last violation in 1984.

Hydrogen sulfide (H_2S) is an odorous, toxic, gaseous compound that can be detected by humans at low concentrations. The gas is produced during the decay of organic material and is also found naturally in petroleum. The County is in attainment of the H_2S standard.

Toxic Air Contaminants. Toxic air contaminants (TAC) are hazardous air pollutants that are known or suspected to cause cancer, genetic mutations, birth defects, or other serious illness to people. TACs come from three basic types of sources: industrial facilities, internal combustion engines (stationary and mobile), and small "area sources" (such as solvent use).

Generally, TACs behave in the atmosphere in the same way as inert pollutants (those that do not react chemically, but preserve the same chemical composition from point of emission to point of impact). The concentrations of inert and toxic pollutants are therefore determined by the concentrations emitted at the source and the meteorological conditions encountered as those pollutants are transported away from the source. Thus, impacts from toxic pollutant emissions tend to be site-specific and their intensity is subject to constantly changing meteorological conditions. The worst meteorological conditions that affect short-term impacts (low wind speeds, highly stable air mass, and constant wind direction) occur relatively infrequently.

Greenhouse Gas (GHG) Emissions. Greenhouse gases (GHGs) are defined as any gas that absorbs infrared radiation in the atmosphere, including water vapor, carbon dioxide (CO2), methane (CH4), nitrous oxide (N2O) and fluorocarbons. These GHGs lead to the trapping and buildup of heat in the atmosphere near the earth's surface, commonly known as the "greenhouse effect". The accumulation of GHGs in the atmosphere regulates the earth's temperature. Emissions from human activities, such as electricity production and vehicles, could potentially elevate the concentration of these gases in the atmosphere, leading to global warming and climate change.

4.2.1.3 Applicable Regulations, Plans, and Standards

National and State Regulations. National, state, and regional agencies have established standards and regulations that affect the proposed project. The following National and State regulatory considerations apply to the project and to all alternatives:

- Federal Clean Air Act of 1970 directs the attainment and maintenance of National Ambient Air Quality Standards (NAAQS). The 1990 Amendments to this Act affect attainment and maintenance of NAAQS (Title I), motor vehicles and fuel reformulation (Title II), hazardous air pollutants (Title III), acid deposition (Title IV), facility operating permits (Title V), stratospheric ozone protection (Title VI), and enforcement (Title VII).

- The U.S. Environmental Protection Agency (EPA) implements the Federal Clean Air Act and established the NAAQS for criteria pollutants.

- California Air Resources Board (CARB) has established the California Ambient Air Quality Standard (CAAQS), which determine State attainment status for criteria pollutants.

- The California Clean Air Act (CCAA) went into effect on January 1, 1989 and was amended in 1992. The CCAA mandates achieving the health-based CAAQS at the earliest practicable date.

- Air Toxics "Hot Spots" Information and Assessment Act of 1987 (AB 2588) requires an inventory of air toxics emissions from individual facilities, an assessment of health risk, and a notification of potential significant health risk.

- The Calderon Bill (SB 1731) alters AB 2588. The bill sets forth changes in the following four areas: providing guidelines to identify a more realistic health risk, requiring high risk facilities to submit an air toxic emission reduction plan, holding air pollution control districts accountable for ensuring that the plans will achieve their objectives, and requiring high risk facilities to achieve their planned emissions reduction.

- The new Tanner Bill (AB 2728) amends the existing Tanner Bill (AB 1807) by setting forth provisions to implement the National program for hazardous air pollutants.

- Toxic Emissions Near Schools (AB 3205). This bill requires new or modified sources of air contaminants located within 1,000 feet from the outer boundary of a school to give public notice to the parents of school children before an air pollution permit is granted.

- Section 21151.4 of the California Environmental Quality Act discusses Hazardous Air Pollutant releases within one-fourth mile of a school site.

- The Global Warming Solutions Act caps California's GHG emissions at 1990 levels by 2020. This legislation represents the first enforceable State-wide program in the U.S. to cap all GHG emissions from major industries that includes penalties for non-compliance. It requires the CARB to establish a program for State-wide greenhouse gas emissions reporting and to monitor and enforce compliance with this program. The Act authorizes the CARB to adopt market-based compliance mechanisms including cap-and-trade, and allows a one-year extension of the targets under extraordinary circumstances.

- The 2005 California Executive Order S-3-05 established the following GHG emission-reduction targets for California: By 2010, reduce GHG emissions to 2000 levels; By 2020, reduce GHG emissions to 1990 levels; and By 2050, reduce GHG emissions to 80 percent below 1990 levels.

- AB 32 codifies California's GHG emissions target and requires the state to reduce global warming emissions to 1990 levels by 2020. It further directs the CARB to enforce the statewide cap that would begin phasing in by 2012. AB 32 was signed and passed into law by Governor Arnold Schwarzenegger on September 27, 2006.

- The California Air Resource Board has recently adopted a rule to develop a cap-and-trade type system applicable to specific industries that emit more than 25,000 metric tonnes of GHG CO2 equivalent per year. The AB 32 Scoping Plan identifies a cap-and-trade program as one of the strategies California will employ to reduce the greenhouse gas (GHG) emissions that cause climate change. Under cap-and-trade, an overall limit on GHG emissions from capped sectors will be established by the cap-and-trade program and facilities subject to the cap will be able to trade permits (allowances) to emit GHGs. The program started on January 1, 2012, with an enforceable compliance obligation beginning with the 2013 GHG emissions for GHG emissions from stationary sources.

Santa Barbara County APCD Rules and Regulations. The SBCAPCD has jurisdiction over air quality attainment in the Santa Barbara County portion of the SCCAB. The SBCAPCD was the principal author of the 2010 Clean Air Plan (CAP) which contains strategies for locally attaining State and National ozone standards.

The Clean Air Plans are written to conform with requirements set forth in the California Clean Air Act. The SBCAPCD has adopted an extensive list of emission control measures to demonstrate that the California ozone standard will be attained at the earliest feasible time. These measures include both ROC and NO_x controls for stationary sources, and methods called Transportation Control Measures (TCMs), to reduce emissions from motor vehicles.

The SBCAPCD (District) has 13 regulations, each of which includes a number of rules. District permit requirements are given in Regulation II. Persons constructing or modifying sources of air contaminants are required to obtain (1) an Authority to Construct permit (ATC) before initiating construction or modification of a source and (2) a Permit to Operate (PTO) prior to beginning operations. See Table 4.19 for Best Available Control Technology (BACT), Air Quality Impact Analysis (AQIA), and offset threshold requirements.

The SBCAPCD has adopted Rule 331 to control emissions of fugitive hydrocarbons from oil extraction, processing, and pipeline facilities. Operators must make visual inspections of pumps and compressors every eight hours of operation. Quarterly inspections of all components, including flanges, fittings, and valves, are also required. Inspection of these components is intended to reduce fugitive ROC emissions that result from oil and gas leakage.

Table 4.19 BACT, AQIA, and Offset Requirements

BACT Requirements	> 25 lbs/day Any nonattainment pollutant or its precursors except Carbon Monoxide > 150 lbs/day Carbon Monoxide - if designated nonattainment
AQIA Requirements	≥ 80 lbs/day PM_{10} ≥ 550 lbs/day Carbon Monoxide -- if designated nonattainment ≥ 120 lbs/day All other nonattainment pollutants and precursors
Offsets Requirements	PM_{10} – ≥ 80 lbs/day or 15 tons/year Carbon Monoxide -- if designated nonattainment – ≥ 150 lbs/day or 25 tons/year All other nonattainment pollutants and precursors – ≥ 55 lbs/day or 10 tons/year

Source: SBCAPCD Rule 802

4.2.1.4 Point Arguello Project Emissions

The Point Arguello Project is an existing emission source within Santa Barbara County, and the emissions are reflected in the ambient air quality. Table 4.20 provides a summary of the current permitted emissions associated with the Point Arguello platforms and supply boats. The actual year 2011 emissions for the Point Arguello platforms and the supply boats (Table 4.21) are considerably less than the permitted values from the PTOs issued by the SBCAPCD.

Table 4.20 Permitted Emissions for Point Arguello Platforms (tons/yr)

Location	NOx	ROC	CO	SOx	PM	PM10	CH4	N2O	CO2
Platform Harvest	367.58	85.26	204.18	43.61	26.11	25.71	88.54	0.42	215,424
Platform Hermosa	198.80	76.25	114.48	36.87	17.64	17.16	61.78	0.17	77,498
Platform Hidalgo	204.15	61.36	94.54	26.49	17.77	17.34	37.36	0.17	76,821

1. Platform emissions include supply, crew and emergency response vessel emissions.
2. Supply boats are for all three platforms and cover emissions from the SB County line to the platforms, consistent with the PTO.
3. Data from SBCAPCD PTOs 9103, 9104, and 9015 (October, 2008). GHG emissions calculated separately.

Table 4.21 2011 Actual Emissions from Point Arguello Platforms (tons/yr)

Location	NOx	ROC	CO	SOx	PM	PM10	CH4	N2O	CO2
Platform Harvest	87.06	45.73	63.27	9.73	9.35	9.32	1.63	0.18	101225
Platform Hermosa	51.15	40.98	36.39	5.3	1.72	1.66	0.58	0.07	32923
Platform Hidalgo	51.36	24.9	33.84	6.3	1.85	1.82	0.61	0.07	37771

1. Platform emissions include supply, crew and emergency response vessel emissions.
2. Supply boats are for all three platforms and cover emissions from the SB County line to the platforms, consistent with PTO.
3. Data from Arguello Inc. 2011 APCD Annual Emission Report.

These emission levels are considerably less than what was analyzed in the Point Arguello Field EIR/EIS and less than the allowable emissions.

GHG emissions are produced from combustion sources on the platforms (turbines, diesel engines), combustion of diesel on supply and crew boats as well as from fugitive emissions containing methane. Emissions of GHG are tabulated in Attachment D. GHG emissions in 2011 totaled 154,870 metric tonnes CO2e, including boats.

4.2.2 Project-Specific Impacts and Mitigation Measures

The sections below present the incremental marine resource impacts associated with the development of the western half of OCS-P 0450 and mitigation measures.

4.2.2.1 Project Impacts

Impacts described in the Development Plan EIR/EIS for the Point Arguello Field and Gaviota Process Facility were evaluated with respect to their applicability to the proposed project. The category of impacts described in the Point Arguello EIR/EIS and those anticipated from development of the western half of OCS-P 0450 are compared in Table 4.22.

Table 4.22 Comparison of Impacts Contained in the Arguello Project DP EIR/S and Additional Impacts Potentially Caused by the Proposed Project

Impact/Issue	Addressed in Arguello Project EIR/S	Additional Impact Caused by Development of the Western Half of OCS-P 0450
NO_X and ROC emissions from offshore platforms and support activities may contribute to violations of the ozone standard and hinder reasonable further progress of attaining the State ozone standard.	Yes	During drilling there will be an increased load placed on the offshore turbines which will result in an increase in emissions. There will also be an increase in emissions from internal combustion engines that are used to support the drilling operations. During drilling there will be an increase in the number of supply boat trips that will be needed for servicing the platforms. Drilling will last about two years. The 1984 EIR/EIS assumed 13 supply boat trips per week for drilling and 4.5 per week for production. For the proposed project it is estimated that one additional supply boat trip will be needed per week. When this is added to the current number of supply boat trips (approximately one per week), the total would be around two per week, which is less than the level estimated for production in the 1984 EIR/EIS. During the production phase there will be an increase in emissions associated with the proposed development project due to fugitive emissions from the well heads and possibly additional oil processing equipment on

Table 4.22 Comparison of Impacts Contained in the Arguello Project DP EIR/S and Additional Impacts Potentially Caused by the Proposed Project

Impact/Issue	Addressed in Arguello Project EIR/S	Additional Impact Caused by Development of the Western Half of OCS-P 0450
		Platform Hidalgo.
GHG Emissions from offshore platforms and support activities may contribute to climate change impacts	No	During drilling, there will be an increase in emissions of GHG. Impacts are considered less than significant in the SBC if emissions of GHG are less than 10,000 metric tonnes of CO2e. Emissions from the project would be less than these thresholds.

Impact No. 1. NO_x and ROC emissions from offshore platforms and support activities may contribute to violations of the ozone standard.

During the drilling phase of the project there will be an increased load placed on the Hidalgo turbines due to the drill rig and mud handling equipment. The estimated emissions associated with this increase load are presented in Table 4.23.

Table 4.23 Estimated Turbine Emission Increase from the Proposed Drilling Operations

Turbine Drilling Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}
Platform Hidalgo						
lbs./hr	4.39	1.38	5.43	0.09	1.08	1.08
lbs./day	105.27	33.02	130.33	2.25	25.86	25.86
tons/qr	3.80	1.51	5.95	0.10	1.18	1.18
tons/yr	7.68	2.41	9.51	0.16	1.89	1.89

Notes:
1. Tons/yr assumes drilling occurs for 100 days per well (70 days drilling, 30 days completions) on Platform Hidalgo (2 wells).
2. Assumes 2 wells at Hidalgo.
3. Assumes that increased turbine emissions as associated with diesel combustion
See Attachment D for the detailed emission calculations and assumptions.

All of these emissions are already permitted and offset per SBCAPCD rules, since the offshore turbines are a permitted source for the Point Arguello Field. It appears that the turbines have sufficient capacity to provide the power requirements for the proposed drilling program. However, the exact electrical load for the drilling program will not be known until a rig is chosen. The electrical loads used in this analysis have been based upon data collected for a number of potential rigs that could be used for the drilling program.

All of the drilling equipment will be electrically driven with the exception of the well logging unit, the cement pump, the acidizing pump, and an emergency generator. The emergency generator will only be used if power is lost on the platform to assure a safe shut down of the drilling equipment. Attachment D contains detailed emission calculations for the additional drilling operations equipment, and includes emission factors, usage factors, hourly, daily, quarterly and annual emission estimates. Table 4.24 provides an estimate of the emissions associated with these support engines.

No new air permitting should be needed to operate the drill rig since emissions associated with drilling operations as the emissions are within the current permitted levels (personal communication with Mike Goldman, ABCAPCD).

Table 4.25 provides an estimate of the hydrocarbon emissions that would be expected from the mud handling system. The bases for these estimates is provided in Attachment D. Hydrocarbon emissions can be emitted from the drilling muds and cuttings only while drilling through an interval that contains gas. The majority of the entrained gas will be removed in the mud-gas separator, and mud degasser (98%). The remaining hydrocarbon vapors will be released as fugitive emissions from the mud pits. For this analysis it has been estimated that drilling through intervals that contain gas will occur for 20 days for each well. During this time a total of 85,000 scf of gas will be absorbed into the muds and cuttings. Based on the current Point Arguello produced gas composition the gas would contain 20% reactive organic compounds (ROCs). The hydrocarbon emissions from the mud system are released from a vent at the top of the derrick, which is the process that was used for drilling all of the Point Arguello wells.

In addition, supply boat trips during the drilling phase would increase during drilling. For this analysis it has been assumed that an additional one trip per week would be needed over the entire drilling period. Table 4.26 provides an estimate of the increased air emissions for the supply boat trips.

The boats that will be used are all permitted with the SBCAPCD, and are currently available for use in the Point Arguello project. Transporting of the drill rig will take approximately 20 supply boat round trips. The rig will be moved from Port Hueneme to Platform Hidalgo. Once the wells have been drilled at Hidalgo, the drill rig would be transported back to shore. This will take approximately 20 round trips between the platforms.

Table 4.24 Estimated Emissions from Drilling Operation Support Equipment Engines

Support Equipment Drilling Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}
lbs/hr						
Well Logging Unit	1.85	0.25	0.67	0.00	0.22	0.22
Acidizing Pump	1.85	0.25	0.67	0.00	0.22	0.22
Emergency Generator	25.00	3.39	9.02	0.02	2.98	2.98
Cement Pump	3.70	0.50	1.34	0.00	0.44	0.44
Total Hourly Emissions	***32.41***	***4.40***	***11.69***	***0.02***	***3.86***	***3.86***
lbs/day						
Well Logging Unit	44.45	6.03	16.03	0.03	5.29	5.29
Acidizing Pump	14.82	2.01	5.34	0.01	1.76	1.76
Emergency Generator	50.00	6.79	18.04	0.04	5.95	5.95
Cement Pump	29.63	4.02	10.69	0.02	3.53	3.53
Total Daily Emissions	***138.89***	***18.85***	***50.10***	***0.10***	***16.53***	***16.53***
tons/qr						
Well Logging Unit	0.67	0.09	0.24	0.00	0.08	0.08
Acidizing Pump	0.07	0.01	0.03	0.00	0.01	0.01
Emergency Generator	0.08	0.01	0.03	0.00	0.01	0.01
Cement Pump	0.09	0.01	0.03	0.00	0.01	0.01

Table 4.24 Estimated Emissions from Drilling Operation Support Equipment Engines

Support Equipment Drilling Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}
Total Quarterly Emissions	***0.90***	***0.12***	***0.33***	***0.00***	***0.11***	***0.11***
tons/yr or tons						
Well Logging Unit	1.48	0.20	0.53	0.00	0.18	0.18
Acidizing Pump	0.16	0.02	0.06	0.00	0.02	0.02
Emergency Generator	0.17	0.02	0.06	0.00	0.02	0.02
Cement Pump	0.20	0.03	0.07	0.00	0.02	0.02
Total Emissions	2.01	0.27	0.73	0.00	0.24	0.24

Notes:
1. Muds would be discharged to the ocean or transported back to shore.
2. Assumes 2 wells at Hidalgo.
3. Assumes each well takes 2 months to complete.

Table 4.25 Estimated Emissions from the Mud Handling Equipment

Source	ROC Emissions				
	lbs/hr	lbs/day	lbs/well	lbs/yr	Total[1] (lbs)
Mud-gas Separator/Mud Degasser Vent	0.041	0.980	19.590	39.180	39.180
Fugitives from Mud Tanks	0.001	0.020	0.400	0.800	0.800
Total Emissions	0.042	0.999	19.990	39.980	39.980

1. Assumes 2 wells at Hidalgo.
See Attachment D for detailed emission calculations.

Table 4.26 Estimated Emissions from Drilling Supply Boat Trips

Estimated Supply Boat Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}
Drill Rig Transport from Port Hueneme to the Platform (round-trip) [1]						
lbs./hr[2]	96.55	4.19	15.38	0.04	5.97	5.73
lbs./day[3]	1,187.57	43.38	177.22	0.44	71.59	68.73
tons/qr[4].	5.71	0.30	1.24	0.00	0.50	0.48
tons/yr[4]	11.41	0.61	2.48	0.01	1.00	0.96
Additional Supply Boat Usage During Drilling(round-trip)[5]						
lbs./hr[2]	96.55	4.19	15.38	0.04	5.97	5.73
lbs./day[3]	1,187.57	43.38	177.22	0.44	71.59	68.73
tons/qr[4].	3.67	0.20	0.80	0.00	0.32	0.31
tons/yr[4]	8.15	0.43	1.77	0.00	0.72	0.69
Total Drilling Operations[6]						
lbs./hr[2]	96.55	4.19	15.38	0.04	5.97	5.73
lbs./day[3]	1,187.57	43.38	177.22	0.44	71.59	68.73
tons/qr[4].	9.37	0.50	2.04	0.01	0.82	0.79
tons/yr[4]	19.56	1.04	4.25	0.01	1.72	1.65

1. Drill rig transport based on 28 round trips total, 14 to deliver and 14 to remove.
2. lbs/hr maximum based on all engines running simultaneously, and assumes uncontrolled main engines.
3. Assumes one round trip per day, and assumes uncontrolled main engines.
4. Assumes that uncontrolled main engines are used 10% of the time. (Same assumption as PTOs 9103, 9104, and 9105.)
5. Supply boat trips for operations assume 1 round trip per week during drilling.

Numbers may not add up due to rounding.
See Attachment D for the basis and detailed emission calculations.

The SBCAPCD regulates the fuel use, hp limit on the main and auxiliary engines and the emission factors for the engines. The Point Arguello Project is permitted to consume 90,269 gallons per quarter of fuel on supply boat main engines within Santa Barbara County. Even with the additional supply boat trips, the quarterly fuel use should be below the permitted levels, estimated to peak at 54,583 gallons per quarter (including emissions to transport the drilling rig). The SBCAPCD also limits the daily fuel use by the supply boat main engines to 1,967 gallons. This represents one round trip per day. With the development of the western half of OCS-P 0450, it is not expected that more than one supply boat will service the platforms in any one day. Therefore, it does not appear that any new permitting will be required for the supply boat trips associated with the proposed project.

Once the wells are brought into production, there will be fugitive emissions associated with the components on each of the wells on Platform Hidalgo. For this analysis it has been assumed that two (2) wells will be drilled and that each well has 229 leak-paths. The number of leak paths per well was estimated for existing well data. Table 4.27 provides an estimate of the fugitive emissions associated with the proposed project.

Table 4.27 Estimated Fugitive Emission Increase from Proposed Project

Component Type	Quantity[1]	Emission Factor[2] (lbs/day-clp)	ROC Emissions			
			lbs/hr	lbs/day	tons/qr	tons/yr
Oil – controlled[3]	216	0.0009	0.008	0.194	0.009	0.035
Oil - unsafe	0	0.0044	0.000	0.000	0.000	0.000
Gas – controlled[4]	242	0.0147	0.148	3.557	0.162	0.649
Gas - unsafe	0	0.0736	0.000	0.000	0.000	0.000
Total Western Half of OCS-P 0450[5]	***458***		***0.156***	***3.752***	***0.171***	***0.685***

1. Component counts are estimates only. Actual counts will be developed when wells are installed.
2. Emission Factors from SBCAPCD PTOs 9103, 9104, and 9105.

Includes 108 oil leak paths and 121 gas leak paths per wellNumbers may not add up due to rounding.
See Attachment D for the basis and detailed emission calculations.

The fugitive emissions are relatively small when compared with the entire project ROC emissions. The peak daily ROC emissions are estimated to be less than 5 lbs, which is below the deminimus level of 24 lbs/day. Therefore, these wells will not have to be offset assuming that the total deminimus ROC emissions for the Point Arguello Facilities are below 24 lbs/day. In addition, the wells should not need BACT since the total ROC emissions are below 25 lbs/day. If the new wells plus any other Point Arguello Field deminimus emissions result in fugitive ROC emissions of 24 lbs/day or greater, then offset would be required. In addition, if the wells result in new fugitive ROC emissions of 25 lbs/day or greater, then BACT requirements would have to be met (personal communication with Mike Goldman, SBCAPCD). All of the well drilling and operational activities will be conducted consistent with the applicable requirements of the SBCAPCD.

Each well is expected to have a life of approximately seven years. Therefore, after the first seven years of production the fugitive emissions will begin to decline as wells are taken out of service.

Table 4.28 provides an estimate of the proposed project's peak annual emissions for each of the platforms and the supply boats. This table also shows the annual permitted emission levels and the 2011 actual emissions for each Point Arguello platform and the supply boats.

Table 4.28 Comparison of Proposed Project's Peak Annual Emissions to Total Permitted Emissions

Platform/Emission Category	NO_X	ROC	CO	SO_X	PM	PM_{10}
Platform Hidalgo[1]						
Total Permitted Emissions (tons/yr) [PTO 9105]	204.15	61.36	94.54	26.49	17.77	17.34
2011 Actual Emissions (tons/yr)	51.36	24.9	33.84	6.3	1.85	1.82
Estimated Peak Project Emissions (tons/yr)[4]	24.73	4.19	13.51	0.17	3.44	3.39
Excess Permitted Emissions (tons/yr)[3]	128.06	32.27	47.19	20.02	12.48	12.13

Notes:
1. Supply, Crew and Emergency Response vessel emissions included.
2. Peak Year at Hidalgo would include 200 days of drilling.
3. The excess permitted emissions = total permitted emissions minus the 2011 actual emissions minus the estimated peak emissions from the project.
4. Boat emissions are from SB County line to the platforms, consistent with Total Permitted Emissions from the PTOs.

See Attachment D for the basis and detailed emission calculations

When the peak annual emissions for the proposed project are combined with the 2011 actual emissions they do not exceed any of the permitted level, specified in the SBCAPCD PTOs 9103, 9104, and 9105 for the Point Arguello platforms.

The peak annual emissions from the proposed project would occur during drilling, which is expected to last about 4 months. Since drilling will only occur at one platform at a time, the peak emissions would be the sum of one platform's emissions plus the supply boat emissions. Once the drilling is complete, the only emissions would be associated with fugitive components.
During the drilling phase of the project there will be offsite truck emissions associated with the delivery of drilling supplies to Port Hueneme. In addition, if drilling muds and cuttings are sent ashore for disposal, there would be truck trips associated with these activities. Table 4.29 provides an estimate of the truck emissions associated with the project.

Table 4.29 Estimated Offsite Truck Emissions Associated with the Proposed Project

Source	Tons					
	NO_x	ROC	CO	SO_x	PM	PM_{10}
Truck Trips for Drill Rig Delivery/Removal	0.38	0.02	0.09	0.00	0.01	0.01
Truck Trips for Drilling Supplies	1.21	0.06	0.28	0.00	0.05	0.05
Truck Trips for misc materials	0.08	0.00	0.02	0.00	0.00	0.00
Total Tons	**1.66**	**0.08**	**0.38**	**0.00**	**0.06**	**0.06**

1. Assumes all wells use water based muds.
2. Assumes 2 wells at Hidalgo.

See Attachment D for the basis and detailed emission calculations.

Emissions of GHG would be associated with the combustion of gas/diesel in the Hidalgo turbines to supply electricity for the drilling rig, as well as the combustion of diesel fuel in equipment associated with drilling. An increase in the use of supply boats would also contribute to GHG emissions. Some minor GHG emissions would occur during operations due to the fugitive emissions from additional wellhead components. GHG emissions associated with the project would be 9,175 metric tonnes CO2e associated with drilling within Santa Barbara County and 9,509 metric tonnes CO2e in all counties. Emissions of GHG were not examined in the EIR as GHG were not an issue at that time. However, in order to examine the significance, the SBC APCD has established preliminary thresholds of significance of 10,000 metric tonnes per year for stationary sources. The emissions from the project are below that level, particularly if amortized over a period of time as might be the case with short-duration, construction projects, and would therefore be considered less than significant.

Operational GHG emissions associated with increased fugitive emissions at the additional wellheads would total a nominal 63 metric tonnes per year.

4.2.2.2 Mitigation Measures

Impact No. 1. NO_x and ROC emissions from offshore platforms and support activities may contribute to violations of the ozone standard.

Mitigating Measure: The existing Point Arguello Project provides emission offsets for the maximum allowable project emissions. The increase in emissions due to the drilling rig operations for the proposed project would be covered by the existing emission offsets in place for the offshore turbines on the Point Arguello platforms. No additional emission offsets should be needed for these incremental emissions. It also appears that the increased supply boat trip emissions can be covered by the existing offsets that are in place for the supply boats. Additional offsets and BACT do not appear to be need for the fugitive emissions associated with the two (2) proposed wells.

4.3 Oil Spill Risk

Oil spill risks described in the Development Plan EIR/EIS for the Point Arguello Field and Gaviota Process Facility were evaluated with respect to their applicability to the proposed project. The category of impacts described in the Point Arguello Field EIR/EIS and those anticipated from proposed project are compared in Table 4.30. Activities that are proposed for the western half of OCS-P 0450 have essentially been analyzed in the Point Arguello Field DP.

Table 4.30 Comparison of Oil Spill Risk Contained in the Arguello Project EIR/EIS and Additional Risks Potentially Caused by the Proposed Project

Impact/Issue	Addressed in Arguello Project EIR/EIS	Additional Impact Caused by Development of the Western Half of OCS-P 0450
Potential for offshore oil spill from platform and offshore pipeline.	Yes	Development of the western half of OCS-P 0450 will increase the likelihood of an offshore oil spill over what is currently occurring for the Point Arguello Field due to the addition of up to 2 new wells. The proposed project would also increase the maximum spill size on Platforms Hidalgo due to higher flowing wells and the addition of oil processing equipment on Platform Hidalgo.

Table 4.30 Comparison of Oil Spill Risk Contained in the Arguello Project EIR/EIS and Additional Risks Potentially Caused by the Proposed Project

Impact/Issue	Addressed in Arguello Project EIR/EIS	Additional Impact Caused by Development of the Western Half of OCS-P 0450
		The 1984 EIR/EIS evaluated production rates of up to 250,000 bbls per day, and estimated a total production level of approximately 500 million barrels of oil. With the addition of the western half of OCS-P 0450, peak production levels will be around 6,300 bbls per day, and the total recovered reserves from the combined Point Arguello and western half of OCS-P 0450 will be somewhere around 15 million barrels between 2011 and the projected project life. Therefore, the addition of the western half of OCS-P 0450 is well within what was analyzed in the 1984 EIR/EIS for the Point Arguello Field. In addition, the 1984 EIR/EIS evaluated the drilling of 154 wells on the three Point Arguello platforms. With the proposed development the total number of wells drilled will be less than 100. Here again, the number of wells to be drilled for the combined Point Arguello Unit and the western half of OCS-P 0450, is well under what was evaluated in the 1984 EIR/EIS.

The remainder of this section discusses the likelihood of an oil spill occurring, the expected range of spill volumes, and the probability of spilled oil impacting various land segments. The first part of this section presents the oil spill setting, which covers the existing Point Arguello platforms and pipeline. The second part discusses the incremental oil spill risks associated with the development of the western half of OCS-P 0450. The impacts from a spill are discussed in the Marine Resources Section.

4.3.1 Oil Spill Risk Setting

This section is broken down into two parts. The first part discusses the oil spill probability for the Point Arguello Field. The second part discusses the estimated worst-case oil spill volume for the Point Arguello Field.

Oil Spill Probability

The BOEM has developed an approach for estimating the oil spill occurrence, normalized as a function of total oil handled (Anderson, *et al.*, 1994). This analysis is based on the actual spills that have occurred for offshore platforms and pipelines for the period 1964-2010. Table 4.31 provides the OCS platform and pipeline spill rates for the period 1996-2010.

Table 4.31 OCS Platform and Pipeline Spill Rate, 1996-2010

US OCS Spills	Median Spill Size (bbls)	Spill Rate (spills per 10^9 bbls)
Platforms, >1,000 bbls	7,000	0.4
Pipelines, >1,000 bbls	1,720	0.9
Small Spills, 50-1000 bbls	-	13
Small Spills, 1-50 bbls	-	75

Source: Comparative Occurrence Rate for Offshore Oil Spills, Anderson and La Belle, MMS and BOEM, 2012-2017 OCS Oil and Gas Leasing Program Draft Programmatic EIS Table 4.4.2-1

Using the data provided in Table 4.31 estimated oil spill probabilities were generated for the Point Arguello Field. These spill probability estimates are shown in Table 4.32, and are based on the estimated remaining life of the Point Arguello Field. From the beginning of the year 2011 until the end of the field productive life, it is expected to produce approximately 15 million barrels of oil with the proposed two wells included.

Table 4.32 Oil Spill Probability Estimates for the Point Arguello Unit

Location	Oil Spill Probability (chance of one or more spills)
Platforms, >1,000 bbls	0.6%
Pipelines, >1,000 bbls	1.4%
Small Spills, 50-1000 bbls	18%
Small Spills, 1-50 bbls	69%

See Attachment G for detailed calculations of oil spill probabilities.

These oil spill probability estimates are based on historical data of oil spills from OCS facilities and the total production from these facilities. This data is combined to generate a spill rate as a function of total oil production. This method of estimating spill rates is useful to evaluate the likelihood of an oil spill in general from OCS facilities. However, when looking at a specific project, spill probabilities are typically generated based on equipment failure rate, which allow one to account for variations in project-specific designs. For example, projects that have a large number of oil handling vessels on a platform would have a higher probability of an oil spill since there is more equipment that could fail. The 1984 EIR/EIS for the Point Arguello Field developed project-specific estimates of the frequency of an oil spill release greater than or equal to 1,000 barrel from the platform equipment. Using this data, the probability of an oil spill would be 4.7%.

The 1984 EIR/EIS for the Point Arguello Field developed a specific failure rate for the offshore portion of the PAPCO pipeline. The EIR/EIS estimated the failure rate for this pipeline at 4.8×10^{-3}/yr. This would give a probability of an oil spill over the estimated remaining life of 3.4%.

Worst-Case Oil Spill Volume

In estimating the worst-case oil spill from the Point Arguello platforms, the three spill categories described in 30 CFR 254.47 were used. These three categories include the following:

- The maximum capacity of all oil tanks and flow lines;

– The volume of oil from a break in a pipeline connected to the facility considering factors which may affect amount; and
- The daily production volume of oil that would flow from the highest capacity well at the facility. The scenario must discuss how to respond to this well flowing for 30 days as required by §254.26(d)(1).

Table 4.33 provides a summary of the worst-case oil spill volumes for the existing Point Arguello platforms. Attachment F contains the detailed calculations for these spill volume estimates.

Table 4.33 Point Arguello Platform Worst-Case Oil Spill Volumes – Point Arguello Unit

Source	Worst-Case Spill Volume (barrels of dry oil)		
	Platform Hermosa	Platform Harvest	Platform Hidalgo
Oil Vessels and Piping on the Platform	3,760	3,820	2,478
Offshore Pipelines	2,502	221	489
Well Blowout	0	0	0
Maximum Oil Spill Volume	6,262	4,041	2,967

Notes: Attachment F provides the detailed calculations for the worst-case oil spill volumes.

The worst case spills volumes for Hermosa and Harvest would not change with the proposed two new wells. The worst case spill volume would increase for Hidalgo and for the pipelines connecting to Hidalgo with the inclusion of the additional wells.

An additional scenario was included which assumes that a blowout release associated with drilling would require the drilling of a relief well. PXP estimates that a relief well could take as long as 111 days to drill for the new wells, with the blowout release occurring over that timeframe. Release volumes under the relief-well scenario are also shown in the subsequent sections as the current operations would not produce a sustained well blowout. The 1984 EIR/EIS for the Point Arguello Field estimated worst-case spill volume at 100,000 bbls for a well blowout.

The largest oil spill volume for the offshore pipelines would be associated with the PAPCO pipeline from Platform Hermosa to shore. The 1984 EIR/EIS for the Point Arguello Field estimated the PAPCO worst-case spill volume at 7,600 bbls of dry oil. The estimated worst-case spill volume for the PAPCO pipeline has been reduced due to a number of factors.

– The 1984 EIR/EIS assumed a throughput for the PAPCO pipeline of 200,000 bbls per day of dry oil. The current maximum throughput is approximately 46,570 bbls per day of dry oil based on the maximum capacity of one oil shipping pump at Platforms Hermosa and Harvest. Throughout over the last 2 years has been substantially less. This reduces the discharge rate of a spill.

– The 1984 EIR/EIS assumed a 10-minute pumping time between when the pipeline rupture occurred and when the oil shipping pumps were shut down. The EIR/EIS analysis was based on the assumption that operator intervention was required to shut down the oil shipping pumps in the event of a pipeline rupture. The actual PAPCO oil spill leak detection system will automatically shut down the oil shipping pumps and close the valves at the platforms, with no operator intervention, in the event of a pipeline rupture. This reduces the shut down time for the oil shipping pumps from 10 minutes to 5.75 minutes. This change reduces the pumping discharge volume of a spill. The shut down time is based on five minutes to detect the rupture, and 45 seconds to shut the pumps down and close the valves. It is a regulatory requirement that the pumps shut down and valves close within 45 seconds of being activated.

– The 1984 EIR/EIS assumed an operating pressure for the PAPCO pipeline of 1,480 psig. The current maximum operating pressure of the PAPCO pipeline is 413 psig. This change reduced the losses due to compressibility (i.e., density change) and pipeline diameter change. Another factor that affects compressibility is the amount of gas dissolved in the oil. The 1984 EIR/EIS assumed the oil has some level of dissolved gas, which increases the compressibility of the oil. However, today the oil is stabilized offshore before entering the PAPCO pipeline, which serves to reduce the amount of dissolved gas in the oil. The 1984 EIR/EIS estimated this value to be equal to the pumping losses (1,390 bbls of dry oil). For this analysis the oil losses due to compressibility and pipeline diameter were calculated to be 191 bbls of dry oil.

– The 1984 EIR/EIS estimated the perculation and hydrostatic head losses from the PAPCO pipeline due to density differences between the seawater and the oil to be 4,800 bbls of dry oil. This number was based on a preliminary elevation profile of the pipeline and assumed a water cut in the oil of 20 percent. Based on the actual elevation profile of the PAPCO pipeline and the actual water cut of approximately one percent, the perculation and hydrostatic head losses have been estimated to be 2,279 bbls of dry oil.

4.3.1.3 Oil Spill Trajectory Models

The BOEM developed the Oil Spill Risk Analysis (OSRA) model in 1975 as a tool to evaluate offshore spill risks (Smith *et al.*, 1982). This model is used to develop probabilistic estimates of oil spill occurrences and contact with land. The results from the OSRA model show that an oil spill from the Point Arguello platforms or the PAPCO pipeline would most likely travel to the southeast or west, with lower probabilities of the oil going west or north. Attachment F provides the output from the OSRA model for each of the Point Arguello platforms and the PAPCO pipeline. This attachment presents 10 day and 30 day probabilities of shoreline impact. The results of the updated OSRA model agree with the trajectories presented in the Oil Spill Contingency and Emergency Response Plan for Point Arguello.

The oil spill risk analyses described in this evaluation were performed using the BOEM numerical (OSRA) model for the SBC area. It calculates probabilities of shoreline impact after applying a drift equivalent to 3% of the prevailing wind velocity in its trajectory computations. Because of the heavy influence of southward-directed winds near Point Conception, the model results indicate that the probability of shoreline impacts along the Channel Islands to the south is far higher than at sites along the central coast to the north. The influence of southward directed winds in the model effectively overcomes the northwestward surface currents observed over much of the year in the field programs. This contrasts with SBC-SMB CCS drifters which tend to travel toward the south only about 31% of the time and only about 15% of these intersect the shoreline (Browne, 2000). In Browne's analysis, northward transport has a slight edge with 32% of the trajectories traveling to the north and contacting the coast about 23% of the time.

Clearly, the complexity of opposing winds and currents near the project area makes the reconciliation between OSRA model results and observations difficult. Because the applicability of the "*3% wind rule*" in complex coastal flow regimes has not been rigorously quantified, this environmental evaluation should entertain the possibility for spilled oil to travel from the project area toward the north and into the SMB.

Similarly, the environmental evaluation for the proposed project should not rely solely on shoreline impact probabilities determined exclusively from available drifter trajectories. Drifters, with their measurable mass and finite vertical profile below the sea surface, cannot capture the behavior of an oil slick that is typically only a few millimeters thick (Reed *et al*., 1988). Furthermore, dispersion and weathering affects the spread of oil on the sea surface, and buoys cannot capture the changing slick dynamics across a wide range of winds, waves, and currents. Goodman *et al.* (1995) and Simecek-Beatty (1994) tested the oil-tracking ability of several drifter designs, including the Davis *et al.* (1982) design used in the SBC-SMB CCS study. They found that Davis-type drifters lagged behind simulated oil slicks presumably because they are optimized to track surface currents with minimal influence by winds and waves. In cases where winds opposed surface currents, the Davis-type drifters moved into the prevailing wind and in a direction opposite of the simulated oil slicks made from wood chips. This is similar to the case in the project area where the northward-flowing Davidson current often opposes the prevailing southward-directed winds.

Since the Point Arguello Project is an existing operation, these oil spill risks are considered to be part of the baseline.

4.3.2 Project Oil Spill Risk

This section of the document discusses the oil spill probability and worst-case oil spill volumes associated with the development of the western portion of OCS-P 0450, including the current operations at all three platforms. The impacts associated with these spills and any associated mitigation measures are discussed in the Marine Resource section of the document.

4.3.2.1 Oil Spill Probability

Using the data provided in Table 4.34 estimated oil spill probabilities were generated for the proposed development.

Development of the western half of OCS-P 0450 will increase the likelihood of an oil spill over what is currently occurring for the Point Arguello Field due to the addition of two (2) new wells and the increase production volume that will be handled by the Hidalgo platform and the corresponding pipelines. These represent a minor increase in oil spill risk for the Point Arguello platforms and the PAPCO pipeline.

Table 4.34 Oil Spill Probability Estimates for the Proposed Project

Location	Oil Spill Probability (chance of one or more spills)
Platforms, >1,000 bbls	0.1%
Pipelines, >1,000 bbls	0.3%
Small Spills, 50-1000 bbls	4.4%
Small Spills, 1-50 bbls	23.1%

Based on a total production of 3.5 million barrels of oil.
See Attachment G for detailed calculations of oil spill probabilities.

It is also questionable whether this increase in oil production would really increase the probability of an oil spill once the risk of a well blowout is gone. As discussed above for the Point Arguello Field, failure rates for pipelines and equipment is typically based on failures per year, which for the most part are independent of throughput. If one used the failure rate analysis contained in the 1984 EIR/EIS for the Point Arguello Field to estimate the probability of an oil spill from the proposed project development, the only increase would be associated with a well blowout. All oil processing equipment on Platform Hidalgo would remain the same. All other platform equipment and pipeline failure rates are independent of throughput.

The 1984 EIR/EIS estimated that a well blowout during drilling, which led to an oil spill, would occur at a rate of 1 per 1,162 wells drilled (1 blowout per 200 wells drilled, with 17.2% of blowouts leading to an oil spill). This would translate into a probability of blowout that leads to an oil spill during drilling of 0.2% for the proposed project. For well blowouts that lead to an oil spill during production, the 1984 EIR/EIS used an estimated value of 1 per 11,628 well-years (1 blowout per 2,000 well-years, with 17.2% of blowouts leading to an oil spill). This would give a probability of a blowout that leads to an oil spill during production of 0.2% for the proposed project.

4.3.2.2 Worst-Case Oil Spill Volume

Using the same methodology discussed above for the Point Arguello platforms, the new worst-case oil spill volumes that could be generated by development of the western half of OCS-P 0450 are associated with a well blowout during the drilling phase when the wells are flowing under natural pressure. It has been estimated (see Attachment F) that wells from development of the western half of OCS-P 0450 will have a maximum flowrate of 1,190 bbls per day of dry oil. 30 CFR 254.47 states that the maximum spill volume from a well is based on the daily production from the highest flowing well. Additional information related to the spill volumes associated with a blowout that would require drilling a relief well have also been included (estimated to take up to 111 days). Table 4.35 provides a summary of the worst-case oil spill volumes for the Point Arguello platforms with the proposed project. Attachment F contains the detailed calculations for these spill volume estimates.

Table 4.35 Point Arguello Platform Worst-Case Oil Spill Volumes – Point Arguello Unit and Proposed Project

Source	Worst-Case Spill Volume (barrels of dry oil)		
	Platform Hermosa	Platform Harvest	Platform Hidalgo
Oil Vessels and Piping on the Platform	3,760	3,820	2,478
New Oil Vessels on the Platform	0	0	10
Offshore Pipelines	2,511	221	498
Well Blowout[1]	0	0	1,190
Well Blowout requiring a relief well[1]	0	0	132,090
Maximum Oil Spill Volume with no relief well	6,271	4,041	4,176
Maximum Oil Spill Volume with relief well	6,271	4,041	135,076
Increase	+9	0	+132,109

1. This represents the daily production volume of oil that would flow from the highest capacity well on each of the platforms (30 CFR 254.47). Drilling a relief well assumes 111 days of blowout spill for well C-16 (highest flowing well of the two wells drilled).
2. Attachment F provides the detailed calculations for the worst-case oil spill volumes.

Development of the western half of OCS-P 0450 would increase the maximum oil spill volume of Platforms Hidalgo and from associated pipelines (with a small increase along the Hermosa pipeline due to increase flow rates). The increase due to a well blowout would only last during the drilling period, when the wells are flowing under natural pressure. After the drilling period, the maximum oil spill volume for Platform Hidalgo would be slightly more than their current values due to increased flow rates.

The worst-case spill volume for the offshore portion of the PAPCO pipeline would increase marinally with development of the western half of OCS-P 0450. Most of the elements that make-up the worst-case oil spill volume from the PAPCO pipeline (aside from the continued pumping) are based on the volume of the pipeline and the density of the oil, which will not change as a result of the proposed project.

The oil spill trajectory analysis discussed above for the Point Arguello project would be the same with the proposed development since the release locations are the same (see Attachment F).

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PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume Biological Evaluation of Threatened and Endangered Species

Submitted to:
The Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
Plains Exploration & Production Company

October 2012

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1.0 Purpose and Overview

This document has been prepared by Plains Exploration and Production (PXP) to assist the Bureau of Ocean Energy Management (BOEM) in fulfilling its requirements under Section 7(c) of the Endangered Species Act (ESA) to solicit a Biological Opinion from both the U.S. Fish and Wildlife Service (USFWS) and National Marine Fisheries Service (NMFS). Section 7(c) of the Endangered Species Act (ESA), as amended, requires that a federal agency request from the appropriate authority a list of threatened and/or endangered species present in an area of a proposed major federal action. When such species are believed to be present, and the proposed action is a "major construction activity," the federal agency prepares a Biological Assessment to evaluate the potential effects and determines whether they are likely to be adversely affected by the proposed action. This biological evaluation describes the proposed project, identifies those threatened and endangered species most likely to be affected by the action, identifies potentially significant impact sources, and analyzes potential effects, including cumulative effects.

2.0 Project Description and Location

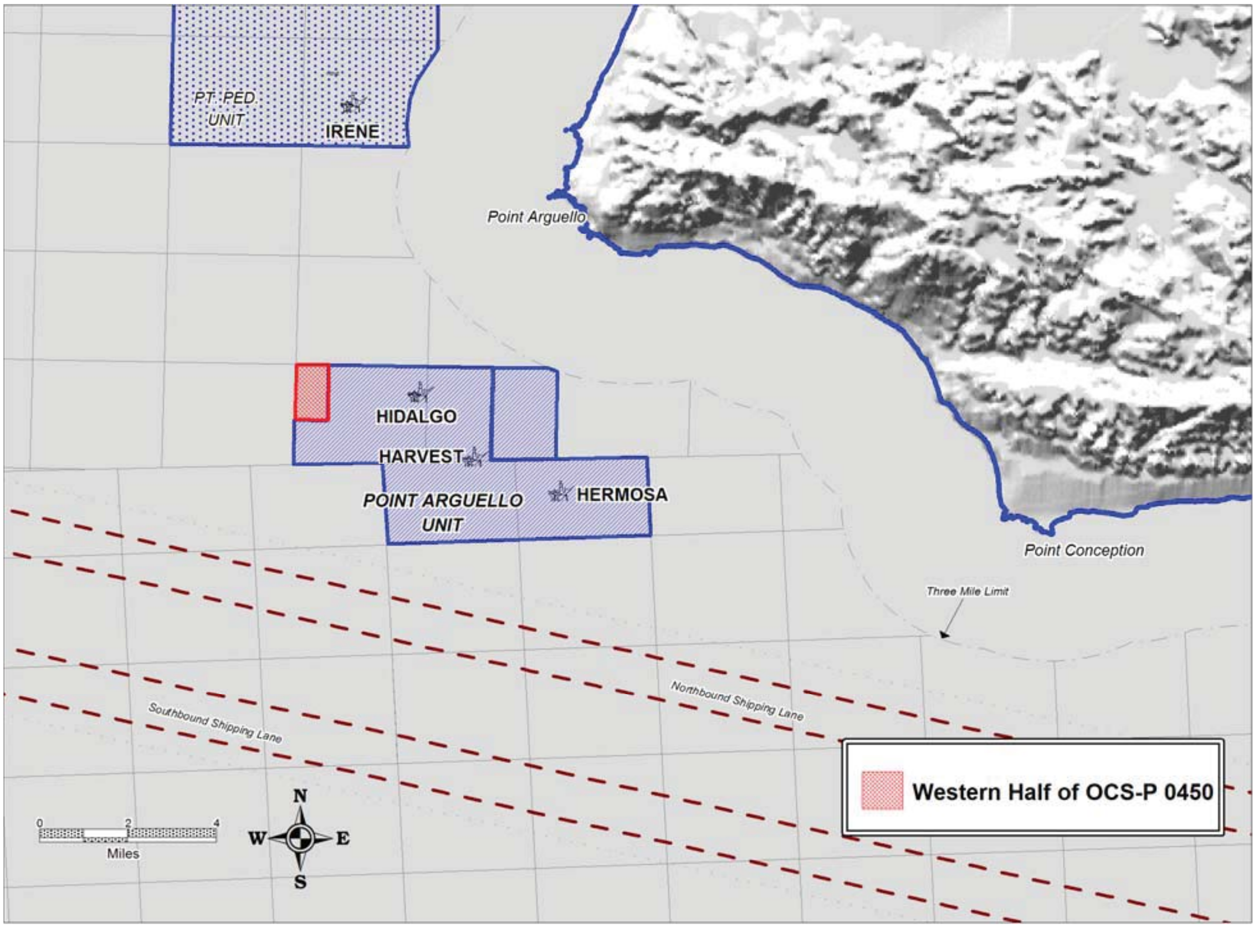
PXP currently operates the Point Arguello Field, which includes the development of all or portions of Federal Outer Continental Shelf (OCS) Leases OCS-P 0315, 0316, 0450, and 0451. Production and development of the unit takes place from three drilling and production platforms located in the southern Santa Maria Basin: Hermosa, Harvest and Hidalgo (ADL 1984). PXP is proposing to revise the Point Arguello Field Development and Production Plans (DPPs) to incorporate the development of hydrocarbon reserves located in the western half of the northwestern quarter (NW/4) of Federal Lease OCS-P 0450 (Electra Field). The subject reserves, known as the Electra Field, lie approximately three miles west of the Point Arguello Field.

The development and production of the Electra Field oil and gas reserves will be accomplished by drilling two extended-reach wells from Platform Hidalgo using existing well slots, pipelines, equipment and facilities. The Electra Field lies due west of Platform Hidalgo, which is located in 131 m (430 ft) of water on the eastern portion of Federal Lease OCS-P450 (34^{o}29'42.06" N, 120^{o}42'08.44" W) (Figure 2-1). The proposed wells (C-16 and C-17) will utilize a combination of electrical submersible pumps and gas-lift technology. No seismic surveys are planned, and no new equipment or facilities will be needed to develop and produce the Field under this proposal.

All production from the Electra Field will be combined with the Point Arguello Field oil and gas production. Oil would be dehydrated and stabilized on the platforms using existing crude stabilizer vessels and reboilers to strip the light hydrocarbons and hydrogen sulfide (H_2S) out of the production stream. The resulting pipeline quality crude would be transported to the Gaviota facility via the existing PAPCO (Hermosa-to-shore) pipeline. At Gaviota, the oil will be metered and heated, stored temporarily in the Gaviota Terminal Company storage tanks, then transported via the All-American Pipeline to various refining destinations.

Gas from the Electra Field will be combined with Point Arguello Unit gas on the production platforms. The combined gas will be sweetened for platform use or sale to shore via the existing Point Arguello Natural Gas Line (PANGL) pipeline. A portion of the gas will also be used for gas lift operations. Gas volumes in excess of platform needs or sales to shore will be injected into the producing reservoir for later recovery and use or sales.

Figure 2.1 Location of Electra Field in Relation to Other OCS Units Off Point Arguello.



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2.1 Proposed Drilling Activities

The two proposed wells (C-16 and C-17) would be drilled from Platform Hidalgo using existing well slots on the platform. The wells will utilize a combination of electrical submersible pumps and gas-lift technology. No seismic surveys are planned, and no new equipment or facilities will be needed to develop and produce the Field under this proposal. Total measured well lengths for the two wells will range in depth from 432,206 m (1,418,000 ft) to approximately 676,656 m (2,220,000 ft), depending on bottom hole displacement from the platform.

The proposed drilling program sequence includes rig installation and necessary platform modifications, drilling and tripping operations, setting the well casing, well logging, and well completion and testing. Total well drilling and completion times are estimated at approximately 70 days to drill, and 20 to 30 days for well completion (i.e., ~100 days total) per well. PXP anticipates that drilling of the first well will begin in July 2013, with production beginning in October 2013. The second well will be drilled immediately following completion of the first well, with production from the second well beginning by January 2014. Overall, drilling activities are projected to take approximately six months.

Overall production from the Electra Field (assuming development begins in 2013) is estimated to peak in 2014, resulting in an annualized rate for the entire Point Arguello Unit of just over 6,300 bbl/d and slightly less than 9.0 mmscfd of gas. Based on PXP's estimates, each of the Electra wells is expected to recover between 2.5 to 3.5 million bbl of oil over lifetime of the project.

2.1.1 Drill Muds and Cuttings

During drilling operations, a mud system is used to control formation pressure, lubricate the drill pipe and bit, and return drill cuttings to the surface. The discharge of drilling muds to be used for the proposed Electra Field drilling program will comply with the National Pollution Discharge Elimination System (NPDES) General Permit (Permit No. CAG280000) currently in effect for the OCS platforms (EPA 2000a,b).

Under this discharge permit, Platform Hidalgo is authorized to discharge up to 6,000 bbl of cuttings, 23,000 bbl of drilling fluids, and 2,000 bbl of excess cement annually per well. Over the anticipated 5-month drilling program for the proposed project, a total of 5,697 bbl of water-based cuttings and 14,036 bbl of drilling fluids are expected to be produced for well C-16. Similarly, 5,512 bbl of water-based cuttings and 13,575 bbl of drilling fluids are expected to be produced for well C-17. Detailed information on the mud system equipment and the estimated mud composition for the Electra Field drilling program is provided in other accompanying information documents.

2.1.2 Produced Water

Produced water generated from the proposed project would also be discharged in accordance with the existing NPDES General Permit. Under the general permit, Platform Hidalgo is authorized to discharge up to 18,250,000 bbl of produced water per year (an average of 50,000 bbl/d). Currently, Platform Hidalgo has a peak produced water discharge of 10,000 bbl/d. The development and production of the Electra Field is anticipated to generate an additional 6,500 bbl/d of produced water. With the addition of the Electra Field, total produced water discharges will still remain well below the permitted levels. Produced water may also be reinjected back into the reservoir.

2.1.3 Support Activities

The drilling rig, heavy drilling equipment, rig supplies, and bulk drilling mud and cement materials for the project will be transported to the Platform Hidalgo by supply boat from Port Hueneme. All support boats will travel along the vessel corridors specified in the Santa Barbara Channel/Santa Maria Basin Oil Service Vessel Traffic Corridor Program (see Section 5.1.1).

Currently, six supply boat trips occur per month. During drilling, vessel traffic to and from the platforms is projected to consist of an additional four round trips per month (an increase of 1 trip per week). During rig installation and removal, supply boats will also make 28 round trips to the platform for rig transport. Manpower requirements and boat schedules can vary depending on the workload. Following the completion of drilling activities, which are anticipated to last for approximately five months, supply vessel traffic is expected to return to current baseline levels (i.e. 6 supply boat trips per month).

Personnel for the Electra Field development will be transported via helicopter from the Santa Maria Airport, the current departure point for personnel working offshore at the Point Arguello Field. No new helicopter trips will be required for the Electra Field development.

3.0 Protected Species

More than 50 federally threatened and endangered species are known to occur or may occur in coastal Ventura, Santa Barbara, and San Luis Obispo counties and the surrounding waters. Of these, PXP has identified 45 species that may occur in the project area and be affected by activities and accidental events associated with the proposed development of the Electra Field. Table 3.1 contains a listing of threatened and endangered species potentially occurring within the project area, their status, agency of oversight, and the expected impact level from the proposed project (see also Section 4.0).

Table 3.1 Special Status Species Occurring Within or Near the Project Area

Common Name	Scientific Name	Listing Status	Oversight Agency	Project Impact Level
Mammals				
Southern sea otter	*Enhydra lutris nereis*	E	USFWS	**Moderate**
Steller sea lion	*Eumetopias jubatus*	T	NMFS	None
Guadalupe fur seal	*Arctocephalus townsendi*	T	NMFS	None
Northern right whale	*Eubaleana glacialis*	E	NMFS	None
Blue whale	*Baleanoptera musculus*	E	NMFS	None
Humpback whale	*Megaptera novaeangliae*	E	NMFS	None
Sei whale	*Balaenoptera borealis*	E	NMFS	None
Fin whale	*Balaenoptera physalus*	E	NMFS	None
Sperm whale	*Physeter macrocephalus*	E	NMFS	None
Morro Kangaroo rat	*Dipodomys ingens*	E	USFWS	None
Santa Cruz Island fox	*Urocyon littoralis santacruzae*	E	USFWS	None
Santa Rosa Island fox	*Urocyon littoralis santarosae*	E	USFWS	None
San Miguel Island fox	*Urocyon littoralis littoralis*	E	USFWS	None
Birds				
California least tern	*Sternula antillarum browni*	T	USFWS	**Low**
Western snowy plover	*Charadrius nivosus nivosus*	T	USFWS	**Moderate**
Light-footed clapper rail	*Rallus longirostrus levipes*	E	USFWS	None
Marbled murrelet	*Brachyramphus marmoratus*	E	USFWS	**Low**
Coastal California gnatcatcher	*Polioptila californica californica*	T	USFWS	None
Short-tailed albatross	*Phoebastria albatrus*	E	USFWS	None
Reptiles				
Leatherback sea turtle	*Dermochelys coriacea*	E	NMFS	None
Green sea turtle	*Chelonia mydas*	E	NMFS	None
Olive Ridley sea turtle	*Lepidochelys olivacea*	E	NMFS	None
Loggerhead sea turtle	*Caretta caretta*	E	NMFS	None
Island night lizard	*Xantusia riversiana*	E	USFWS	None
Amphibians				
California red-legged frog	*Rana draytonii*	E	USFWS	None
Invertebrates				
Black abalone	*Haliotis cracherodii*	E	NMFS	**Low**

Table 3.1 Special Status Species Occurring Within or Near the Project Area

Common Name	Scientific Name	Listing Status	Oversight Agency	Project Impact Level
White abalone	*Haliotis sorenseni*	E	NMFS	None
Morro shoulderband snail	*Helminthoglypta walkeriana*	E	USFWS	None
El Segundo blue butterfly	*Euphilotes battoides allyni)*	E	USFWS	None
Fish				
Steelhead trout	*Oncorhynchus mykiss*	E	USFWS	**Low**
Tidewater goby	*Eucyclogobius newberryi*	E	USFWS	**Low**
Unarmored threespine stickleback	*Gasterosteus aculeatus williamsoni*	E	USFWS	None
Santa Ana sucker	*Catostomus santaanae*	T	USFWS	None
Green sturgeon	*Acipenser medirostris*	T	NMFS	None
Terrestrial Plants				
Salt marsh bird's-beak	*Cordylanthus maritimus*	E	USFWS	None
California sea-blite	*Suaeda californica*	E	USFWS	None
Beach layia	*Layia carnosa*	E	USFWS	None
Gaviota tarplant	(*Deinandra increscens ssp. villosa*)	E	USFWS	None
La Graciosa thistle	(*Cirsium loncholepis*)	E	USFWS	None
Lompoc yerba santa	(*Eriodictyon capitatum*)	E	USFWS	None
Morro manzanita	(*Arctostaphylos morroensis*)	T	USFWS	None
Marsh sandwort	(*Arenaria paludicola*)	E	USFWS	None
Nipomo Mesa lupine	(*Lupinus nipomensis*)	E	USFWS	None
Pismo Clarkia	(*Clarkia speciosa* ssp. *immaculata*)	E	USFWS	None
Ventura marsh milk-vetch	(*Astragalus pycnostachyus var. lanosissimus*)	E	USFWS	None

Notes: E= Endangered; T= Threatened;

Species Likely to Be Adversely Affected by the Proposed Project

The proposed development of the Electra Field is likely to have adverse impacts on the following seven listed species:

Southern Sea Otter: Oil spills associated with the proposed Electra Field development project are likely to result in moderate impacts to the southern sea otter, including limited mortality. Impacts to otters would be most likely to occur from a rupture in the Hermosa-to-shore pipeline during fall or winter, and could affect otters in the area from Point Purisima to Point Conception. During winter and spring seasonal migration brings large rafts of (predominately male) otters to the southern extent of their current range, off Point Conception. Additionally, as southward range expansion by the southern sea otter continues, increasing numbers of both male and female otters are expected to occur off Point Arguello and Point Conception that could be affected in the event of an oil spill.

California Least Tern: Oil spills associated with the proposed Electra Field development project are likely to result in low impacts to the California least tern. Impacts would be limited to colonies along the mainland coast at Vandenberg Air Force Base (AFB) (between Purisima Point and Point Conception)

Western Snowy Plover: Oil spills associated with the proposed Electra Field development project are likely to result in moderate impacts to the western snowy plover, including limited mortality. Impacts are likely to be limited to the mainland coastal area between Point Purisima and Point Conception, San Miguel and Santa Rosa Islands, and the western portion of Santa Cruz Island. Impacts to the nesting or wintering populations at any of these locations could include loss of adults, disruption of nesting activity, and abandonment of nesting or overwintering beaches. The remoteness of the islands could also impede cleanup and rehabilitation efforts.

Marbled Murrelet: Oil spills associated with the proposed Electra Field development project are likely to result in low impacts to the marbled murrelet. Impacts would be limited to individual birds that occur seasonally along the mainland coast at Point Sal and Vandenberg Air Force Base (AFB).

Black abalone: Oil spills associated with the proposed Electra Field development project are likely to result in low impacts to the black abalone. Impacts would be limited to colonies from Point Sal to Point Conception, as well as the few remaining colonies on San Miguel, Santa Rosa, and Santa Cruz Islands.

Steelhead trout: Oil spills associated with the proposed Electra Field development project are likely to result in low impacts to southern steelhead trout. These impacts would be most likely associated with a nearshore rupture of the Hermosa-to-shore pipeline, rather than a spill originating at Platform Hidalgo. Impacts to steelhead would be most severe if an oil spill occurred during the months of November to April when the anadromous fish are migrating upstream to breed, and juveniles are migrating down to sea. However, impacts to winter steelhead would likely be limited to the area from Point Purisima to Point Conception. Therefore, impacts to this species are likely to be low.

Tidewater Goby: Oil spills associated with the proposed Electra Field development project are likely to result in low impacts to the tidewater goby. These impacts would be most likely associated with a rupture of the Hermosa-to-shore pipeline, rather than a spill originating at Platform Hidalgo. However, tidewater goby are fairly resilient and have shown the ability to disperse and re-colonize areas where they were previously extirpated. Therefore, impacts to this species are likely to be low.

Species Excluded from Further Analysis

A number of the species listed in Table 3.1 are unlikely to be affected by any of the activities associated with the proposed development of the Electra Field. Therefore, after reviewing the relevant literature and consulting with area experts, we have identified the following federally listed species for exclusion from further analysis:

Plants

The following plants are being excluded from this analysis because no onshore facilities are proposed for this project, and their current habitats would not be subject to either direct or indirect effects from a project-related oil spill:

- Beach layia (*Layia carnosa*),
- Gaviota tarplant (*Deinandra increscens ssp. villosa*),
- La Graciosa thistle (*Cirsium loncholepis*),
- Lompoc yerba santa (*Eriodictyon capitatum*),
- Morro manzanita (*Arctostaphylos morroensis*),
- Marsh sandwort (*Arenaria paludicola*),

Nipomo Mesa lupine (*Lupinus nipomensis*),
Pismo Clarkia (*Clarkia speciosa* ssp. *immaculata*), and
Ventura marsh milk-vetch (*Astragalus pycnostachyus var. lanosissimus*).

Similarly, the habitats of the following Channel Islands endemic plants, which were not included in Table 3.1, would not be subject to either direct or indirect effects from a project-related oil spill:

Hoffmann's rock-cress (*Arabis hoffmannii*),
Santa Rosa Island manzanita (*Arctostaphylos confertiflora*),
Island barberry (*Berberis pinnata* ssp. *insularis*),
Soft-leaved paintbrush (*Castilleja mollis*),
Santa Cruz Island live-forever (*Dudleya nesiotica*),
Santa Barbara Island live-forever (*Dudleya traskiae*),
Sea-cliff bedstraw (*Galium buxifolium*),
Hoffmann's slender-flowered gilia (*Gilia tenuiflora* ssp. *hoffmannii*),
Island rush-rose (*Helianthemum greenei*),
Santa Cruz Island bushmallow (*Malacothamnus fasciculatus* ssp. *nesioticus*),
Santa Cruz Island chicory (*Malacothrix indecora*),
Island malacothrix (*Malacothrix squalida*),
Northern island phacelia (*Phacelia insularis* ssp. *insularis*), and
Santa Cruz Island fringepod (*Thysanocarpus conchuliferus*).

Wildlife

The following wildlife species are being excluded from further analysis because their current habitats would not be subject to either direct or indirect effects from project-related activities, including an oil spill:

- Morro Bay kangaroo rat (*Dipodomys ingens*)
- San Miguel Island fox (*Urocyon littoralis littoralis*),
- Santa Rosa Island Fox (*Urocyon littoralis santarosae*),
- Santa Cruz Island Fox (*Urocyon littoralis santacruzae*),
- Coastal California gnatcatcher (*Polioptila californica californica*),
- Island night lizard (*Xantusia riversiana*),
- Morro shoulderband snail (*Helminthoglypta walkeriana*),
- El Segundo blue butterfly (*Euphilotes battoides allyni*),
- Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*),
- Santa Ana sucker (*Catostomus santaanae*), and
- North American green sturgeon (*Ambystoma medirostris*).

A brief description of each of these wildlife species follows.

Morro Bay kangaroo rat (*Dipodomys heermanni morroensis*). This species, endemic to the Los Osos-Baywood Park coastal area of San Luis Obispo County, California, was listed as endangered in 1970. Its range is thought to be limited to a small area (<40 acres) of stabilized sand dunes and coastal scrub located south of the community of Los Osos. This species has not been seen in the wild since 1986, however, and the last individual in captivity died in 1993. Nevertheless, no onshore facilities are proposed for this project, and this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

Island Fox (*Urocyon littoralis*). There are six recognized subspecies of island fox, with each subspecies being endemic to one of the Channel Islands off the coast of Southern California. Following sharp population declines in the 1990s, four subspecies of the island fox were listed as endangered in 2004, including the San Miguel Island fox (*Urocyon littoralis littoralis*), Santa Rosa Island Fox (*Urocyon littoralis santarosae*), and Santa Cruz Island Fox (*Urocyon littoralis santacruzae*). The primary cause of decline was predation by golden eagles; extirpation of the bald eagle and the introduction of feral pigs to the islands (providing a prey base for the golden eagle) may have led to colonization of the islands by golden eagles. However, no onshore facilities are proposed for this project, and this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

Coastal California gnatcatcher (*Polioptila californica californica*). This small gray songbird was listed as threatened in 1993. This species range includes coastal sage scrub habitats extending from southern Ventura County to Baja California, Mexico. No onshore facilities are proposed for this project, and this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

Island night lizard (*Xantusia riversiana*). This species is an island endemic found on three of the southern Channel Islands (San Clemente, San Nicolas, and Santa Barbara Islands) where its preferred habitat is coastal scrub made up of dense boxthorn and cacti thickets. It was listed as threatened in 1977. No onshore facilities are proposed for this project, and this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

Morro shoulderband snail (*Helminthoglypta walkeriana*). The Morro shoulderband snail was listed as endangered on January 17, 1995. It is found in the Los Osos area near Morro Bay, usually within or near coastal dune scrub vegetation. However, an oil spill would not impact the habitat of this species, and any clean-up efforts would avoid the established coastal dunes and scrub vegetation that make up its habitat.

El Segundo blue butterfly (*Euphilotes battoides allyni*). The El Segundo blue butterfly was listed as endangered in 1976. Until recently, the El Segundo blue butterfly was only known to exist at three restricted locations on the southeastern shores of the Santa Monica Bay, near El Segundo, California. It typically resides on coastal dune habitats in association with its obligate host plant, the seacliff buckwheat. However, in recent years, the population has expanded and colonized new areas. In 2005 this species was also identified at Vandenberg AFB. Subsequent surveys in 2006 and 2007 confirmed their presence and expanded their known distribution at that site. The El Segundo blue butterflies at Vandenberg AFB are found not only in coastal dune habitats but also on slopes and rocky areas occupied by coast buckwheat. Nevertheless, an oil spill would not impact the habitat of this species, and any clean-up efforts would avoid the established coastal dunes and vegetation that comprise its habitat.

Unarmored threespine stickleback (*Gasterosteus aculeatus williamsoni*). The unarmored threespine stickleback was listed as endangered under the Endangered Species Act in 1970. It is a small, scaleless, fish that resides in slow water creeks along the California coast. Populations within the project area are located in San Antonio and Cañada Honda Creeks on the Vandenberg AFB, and above Piru Creek in the Santa Clara River system. This species' current range is not in the area of concern for the Electra Field project activities because although most species of stickleback can adapt to salt, brackish, or fresh water, unarmored threespine sticklebacks appear to be limited to fresh water. Therefore, this species' current habitat would not be subject to either direct or indirect effects from a project-related oil spill.

Santa Ana sucker (*Catostomus santaanae*). The Santa Ana sucker was listed as threatened on April 12, 2000. However, the listed portions of this species' population are not in the area of concern for the proposed project activities. Although the Santa Clara River and estuary system in Ventura County supports a population of Santa Ana suckers; this population was not included in the ESA listing because the population is both outside the species' native range and regarded as being introduced. Therefore, the proposed project activities are not likely to affect the listed populations of this species.

North American green sturgeon (*Ambystoma medirostris*). The southern distinct population (SDP) of the North American green sturgeon was listed as threatened in July 2006 (70 FR 17386, NMFS 2004). This population is comprised of sturgeon that spawn in rivers and estuaries south of the Eel River in Mendocino County, California. Green sturgeon are an anadromous fish that ranges from Mexico to Alaska in marine waters, and is observed in bays and estuaries up and down the west coast of North America (Moyle et al. 1995). Although they spend much of their lives in marine waters, green sturgeon return to fresh water (rivers) to spawn. Additionally, young green sturgeon may remain in freshwater rivers and streams for the first few years of their lives before traveling out to sea. Within the southern population segment, the majority of spawning adults are concentrated in the Sacramento River. Although green sturgeon are a highly migratory species and travel widely at sea, they are most commonly encountered north of Point Conception. Additionally, critical areas of their habitat, such as the rivers and estuaries where they spawn and gather, do not occur within the project area. Therefore, the proposed project activities are not likely to affect this species.

The remaining listed species, which could be impacted by the proposed project are described in the following sections.

3.1 Marine Mammals

3.1.1 Southern Sea Otter (Threatened)

Status. Southern sea otters (*Enhydra lutris nereis)* are among the smallest of the marine mammals. This species was listed as a federal threatened species on January 14, 1977 (42 FR 2968). The original recovery plan was finalized in 1982 (USFWS 1982). A revised recovery plan was finalized in 2003 (USFWS 2003). No critical habitat has been identified for this species. The main reasons for listing the southern sea otter were its small population size and limited distribution, and the threat of oil spills, pollution, and resource competition with humans.

Range and Habitat. Historically, sea otters inhabited coastal waters of the North Pacific in an almost continuous band stretching from central Baja California, Mexico, across the Aleutians to the northern islands of Japan (Kenyon 1969). However, commercial hunting in the late 18th century quickly decimated the otter population, which was heavily targeted for its dense fur. By 1911, when sea otters were afforded protection under the North Pacific Fur Seal Convention, only 13 isolated colonies remained throughout the species' range; most of these eventually became extinct (Kenyon 1969; Estes 1980). At that time, otters were no longer found off the Oregon or Washington coasts, and were assumed have been extirpated from California waters as well.

From that low point, however, the species began slowly to recover. Several surviving Alaskan populations began reoccupying former habitats from Prince William Sound southwest across the Aleutian Islands (Kenyon 1969). Several decades later, in 1938, a small remnant California population of approximately 50 otters was rediscovered at Bixby Creek, near Big Sur (Bryant 1915; Riedman 1987). Over the intervening years, the California sea otter population grew steadily at a rate of about 5 percent annually until the mid-1970s, when it was estimated to contain nearly 1,800 animals (Riedman 1987; Riedman and Estes 1990). Then, the population began declining due to increased mortality from entanglement in set nets (Wendell et al. 1985), reaching an estimated low of fewer than 1,400 animals in 1984. A series of restrictions on nearshore net fisheries culminated in 1991, when the State of California closed waters less than 30 fathoms deep to fishing with nets.

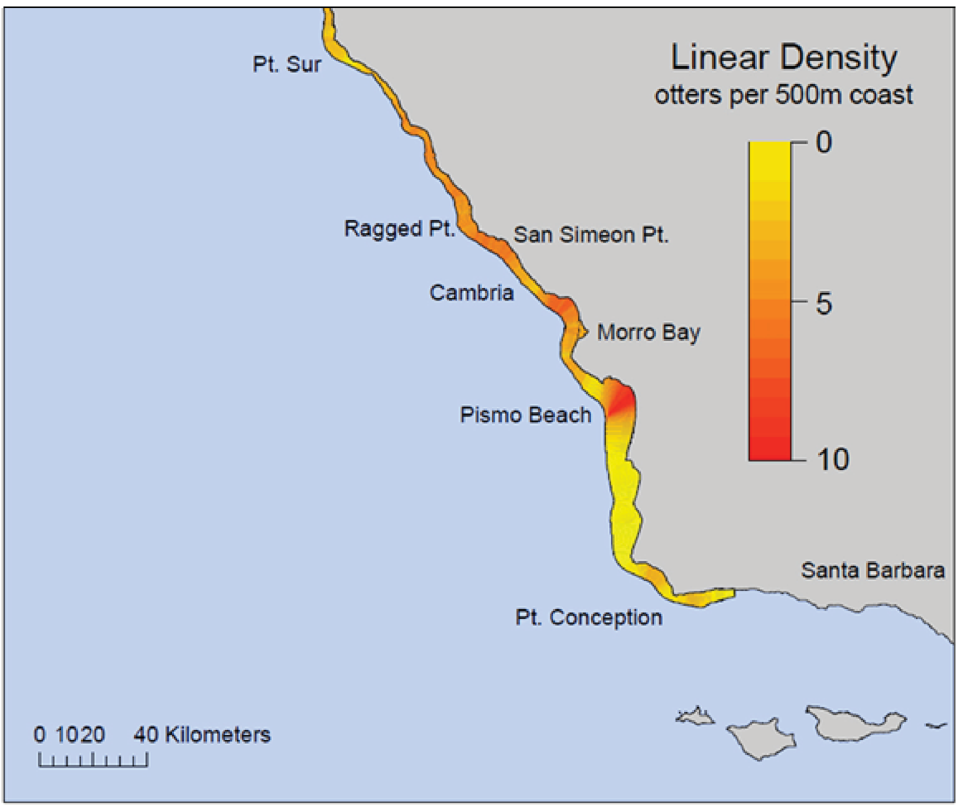
The population fluctuated throughout much of the 1990s, but resumed a slow rate of increase in 1999. However, this growth is primarily attributable to increases in male-dominated portions of the population, particularly near the range peripheries, while female-dominated portions of the population in the center of the range have grown very slowly or remained approximately stable. The southern sea otter's current range spans the central coast of California from Half Moon Bay in the north to approximately Coal Oil Point in the south (Riedman 1987; U.S. Geological Service [USGS] 2010, 2012).

In California, otters typically inhabit shallow (<18 m deep), nearshore (<2 km) waters with rocky or sandy bottoms supporting large populations of benthic invertebrates (Riedman 1987). Observed densities are generally higher over rocky (about 5/km^2) than sandy habitats (about 0.8/km^2) (Riedman and Estes 1990).

Sea otters maintain home ranges that generally consist of several heavily used areas connected by travel corridors (Riedman and Estes, 1990). Female otters are generally more sedentary than males, but are also known to travel long distances (Riedman and Estes, 1990). Males generally have larger home ranges, due in part to regular, seasonal movements they make to either end of the parent range (Bonnell et al. 1983). These migrations coincide with the breeding season (June to November) and the non-breeding season (November to May). During the breeding season mature males maintain territories in core female areas (typically near the center of their range), and excluding juvenile and subordinate males from these areas (Garshelis and Garshelis 1984; Ralls and Siniff 1990; Tinker et al. 2006). In the winter and spring (non-breeding season), however, they generally join male 'bachelor' groups which often range along the population fronts (Riedman and Estes 1990; USFWS 2000). Recent studies also suggest that resource limitations near the center of the otter's range may be influencing these migration movements (Tinker et al. 2006).

Range expansion to the south has brought an increasing number of otters into the proposed project area off of Point Arguello (Figure 3-1). In the spring of 2005, close to 200 otters were observed in the area extending from Point Purisma to Point Conception during the semi-annual census (USGS 2005; As such, otters seen south of Point Purisma comprised approximately 10 percent of the total 2005 population of 2,735 (USGS 2005). Additionally, during this same survey, a large raft of over 88 otters was observed to the east of Point Conception.

Figure 3-1 Sea Otter Range Expansion into Santa Barbara Channel



Source: Adapted from www.werc.usgs.gov/seaottercount.

In addition to the mainland population, there is also a small population of otters that resides in the waters off San Nicolas Island. Between August 1987 and July 1990, the U.S. Fish and Wildlife Service (USFWS) translocated 139 sea otters from the central California range to San Nicolas Island (USFWS 2000). The purpose of the translocation program was to improve recovery of the southern sea otter population. The program sought to establish a colony of southern sea otters outside their then-existing range to protect against the possibility that a natural or human-caused event, such as an oil spill, would devastate the limited mainland population.

The translocation program specified that there would be a specific area, a "translocation zone" into which sea otters would be moved, as well as a "no-otter" management zone that included all California waters south of Point Conception which would be kept otter-free. In practice, the goals of the translocation program proved difficult to achieve. Thirty-six of the originally translocated otters returned to the parent population range, 10 were captured in the management zone and returned to the parent range, and 15 are known to have died. Over the following years the population at San Nicolas fluctuated, but remained small; in 2002, the translocated colony contained only about 27 individuals, including pups. Additionally, by the turn of the century, the "no otter" management zone had also come into conflict with the natural expansion of the mainland population into its historic range south of Point Conception (Figure 3-1). Subsequently, in 2011 the USFWS proposed an end to the program.

Reproduction. Southern sea otters breed and pup throughout the year in all parts of the range, but there appear to be one or more peaks in most areas (Riedman, 1987; Rotterman and Simon-Jackson, 1988). In California, peak pupping occurs from January through March (Riedman and Estes, 1990). Females typically give birth to a single pup (Jameson and Bodkin, 1986; Riedman, 1987), and births occur both on land and in the water (Kenyon, 1969; Jameson, 1983). Although the time between fertilization and implantation of the embryo may vary substantially, the period between copulation and parturition appears to last about 6 months (Riedman 1987; Rotterman and Simon-Jackson 1988; Jameson and Johnson 1993). Pups remain with their mothers for approximately 6 months, and the normal pupping interval for females that successfully raise pups to independence appears to be a little over a year (Wendell et al. 1984). Sea otters may live for 15 to20 years in the wild.

Diet. Sea otters have high metabolic demands and may consume up to 23 to33 percent of their body weight per day (Riedman and Estes, 1990). Ralls and Siniff (1990) estimated that California otters spend 35 to 50 percent of their time foraging. They found that sea otters in California tend to be crepuscular in activity, resting mainly in the middle of the day..

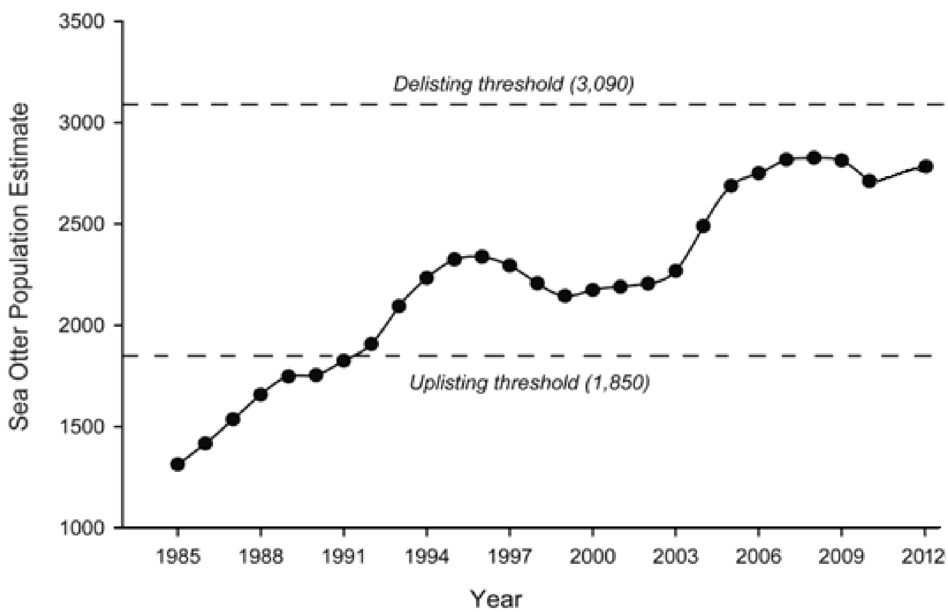
California sea otters feed almost entirely on macroinvertebrates (Ebert, 1968; Wild and Ames, 1974; Estes et al. 1981). In rocky areas along the central California coast, major prey items include abalones (*Haliotis* spp.), rock crabs (*Cancer* spp.), and sea urchins (*Strongylocentrotus* spp.), and, in areas where populations of principal prey species have been reduced, kelp crabs (*Pugettia* spp.), clams (various spp.), turban snails (*Tegula* spp.), mussels (*Mytilus* spp.), octopus (*Octopus* spp.), barnacles (*Balanus* spp.), scallops (*Hinnites* spp.), sea stars (*Pisaster* spp.), chitons (*Cryptochiton* stelleri), and echiuroid worms (*Urechis caupo*) (Boolootian, 1961; Ebert, 1968; Estes, 1980; Estes et. al., 1981; Wendell et al. 1986, USFW 2003, Tinker et al., 2006). These species occur at water depths ranging from the littoral zone to approximately 100 m (328 feet). Not surprisingly, most otters occur between shore and the 20 m (65 feet) water depth (USFWS, 2000).

In sandy areas, sea otters prey primarily on bivalve mollusks, such as Pismo clams (*Tivela stultorum*), which are a principal prey item in sandy areas in Monterey and Morro Bays, gaper clams (*Tresus nuttalii*), and Washington clams (*Saxidomus nuttali*) (Wade, 1975; Stephenson, 1977; Wendell et al. 1986; Riedman and Estes, 1987). Sea otters in California have also occasionally been observed to prey on seabirds (VanWagenen et al. 1981) and fish, although predation on fish is very rare (Hall and Schaller, 1964; Miller, 1974). Diet and foraging strategies apparently differ significantly among individuals; individual females tend to specialize in one to three types of prey (Estes et al. 2003; Lyons, 1989).

Population Status. Before the onset of commercial hunting, the southern sea otter population is estimated to have numbered around 14,000 individuals (USFWS 1995). The most recently completed census, conducted in 2012, indicates that there are currently around 2,792 southern sea otters residing in the waters offshore central California (USGS 2012) (Figure 3-1). In addition, about 42 sea otters reside in the waters off San Nicolas Island (USGS 2008).

Although the population has increased over time (See Figure 3-2), this species' recovery has not been as rapid or robust as expected, and high mortality rates within the population continue to trouble scientists. Challenges to the species' recovery include infections related to coastal pollution, predation by sharks, and depletion of food resources.

Figure 3-2 Sea Otter Population Trends and Recovery Criteria



Note: Population estimates are calculated as three-year running averages of the annual survey counts.

Recent studies suggest that resource limitations near the center of the otter's range may be influencing migration movements (Tinker et al. 2006). These same stressors may also be contributing to high mortality levels within the population as undernourished otters are more susceptible to other stressors in the environment. Competition for, and depletion of, preferred prey items such as sea urchins and abalone, within their home range requires them to spend more time and energy on foraging. Poor nutrition may also be compromising their ability to battle disease, parasites, and other threats.

Finally, predator-prey interactions with other species have increased in recent years. Specifically, white shark attacks on otters have become a leading cause of otter mortality. Although the sharks do not appear to eat the otters, during 2011, nearly 30 percent of stranded otters showed evidence of shark bites, making shark attacks the largest single cause of otter deaths.

3.1.2 Steller Sea Lion (Threatened)

Status. The Steller, or northern sea lion (*Eumetopias jubatus*) was listed as a federal threatened species on December 4, 1990 (55 FR 50006). Critical habitat identified for this species includes the major California rookeries at Año Nuevo and the Farallon Islands. The Steller sea lion recovery plan was finalized in 1992 and revised in 2008 (NMFS 1992, 2008). The main reason for listing was a severe (>75 percent) decline in the Steller sea lion population, particularly in the western (Alaskan) portions of its range (Calkins et al. 1999). Although the reasons for this decline are still unclear, recent research indicates that a major factor may have been nutritional stress (Merrick et al. 1987; Calkins et al. 1998) resulting from a reduction in the abundance or availability of prey and/or a change in prey composition to less nutritious species (Calkins et al. 1998) As this decline continued into the 1990s, NMFS divided the species into two distinct population segments (DPS), eastern and western, and listed the western DPS as endangered in 1997. Meanwhile, the eastern DPS of this species, which includes the portion of the population inhabiting the waters off California, Oregon and Washington, was proposed for delisting in April 2012.

Range and Habitat. The species' range extends along the North American coast from the Bering Strait in Alaska to southern California. At least 90 percent of the species' world population is centered in the Gulf of Alaska, the Bering Sea, and the Sea of Okhotsk (Loughlin et al. 1984). Steller sea lions breed during the summer on rookery islands from the Pribilof Islands, Alaska, south to Año Nuevo Island in central California (Green et al. 1989). Following the breeding season, adult males in California and Oregon move northward into Washington, British Columbia, and Alaska; by the end of October, no adult males are found along the Oregon Coast (Bartholomew and Boolootian, 1960; Gentry, 1970; Mate, 1975; 1981). Female and immature Steller sea lions may not disperse as widely following the breeding season (Green et al. 1989).

Steller sea lions are presently uncommon in southern California waters (Bonnell and Dailey 1993, Pitcher et al. 2007). A few adult or subadult males occasionally may occupy territories on relict rookeries at the west end of San Miguel Island and adjacent rocks in the summer months, but the last reported pups on San Miguel Island were seen in the summer of 1980 (Bonnell and Dailey, 1993; DeLong and Melin, 2000). North of Point Conception, a few animals have been sighted in on offshore rocks at Point Sal, at Diablo Canyon near Point Buchon, and at Point Piedras Blancas (Bonnell et al. 1983). Off California, Steller sea lion sightings at sea have been concentrated in shallow waters over the shelf and upper slope (<400 m) and within 50 km from land (Bonnell et al. 1983).

Reproduction. The timing of the Steller breeding season is uniform throughout the species' range (Gentry 1970; Sandegren 1970; Calkins and Pitcher 1982). Adult males begin arriving on the rookeries first, in mid-May, and establish territories. Pregnant females arrive in late May and give birth to a single pup (Gentry 1970; Higgins et al. 1988). Females and pups begin leaving the rookeries in September (Orr and Poulter 1967), and pups typically remain with their mother through the first year (Le Boeuf 1981).

Diet. Steller sea lions are known to feed on a variety of nearshore, sublittoral prey in estuarine and marine waters. Jones (1981) reported that Steller sea lions feed mainly on bottom-dwelling fishes, and that all the prey items normally eaten by this species inhabit waters less than about 200 m deep. Common prey of the Steller sea lion includes lamprey, rockfishes, herring, anchovy, salmon, smelts, whiting, pollock, tomcod, greenlings, sculpins, sand lance, flatfishes, midshipman, sharks, skates, squid, octopus, shellfish, and shrimp (Wilke and Kenyon 1952; Spalding, 1964; Fiscus and Baines 1966; Jameson and Kenyon 1977; Antonelis and Fiscus 1980; Jones 1981; Roffe and Mate 1984). Stellers are also known to prey upon the pups of several other species of pinnipeds and on sea otters (Gentry and Johnson, 1981; Pitcher, 1981; Pitcher and Fay 1982; Hoover 1988; Byrnes and Hood 1994).

Population Status During the early 1900s, Steller sea lions were the most abundant sea lion found off California, and bred as far south as the Channel Islands (San Miguel Island); however, the Steller sea lion has declined in numbers off California since the 1940s and the overall distribution for this species appears to have shifted northward (Hill et al. 1997; Bonnot 1928; Bartholomew 1967; Le Boeuf and Bonnell 1980; and Bonnell et al. 1981).

Ainley and Lewis (1974) hypothesized that the Steller sea lion decline in California might have been connected with the collapse of the Pacific sardine (*Sardinops sagax*) fishery in California in the 1940s and 1950s. Regardless of its cause, however, Steller sea lions have not been sighted at the Channel Islands since the 1980s. Año Nuevo Island is now the southernmost Steller sea lion rookery in the species' range and the largest rookery in California (Bonnell et al. 1983). Smaller rookeries exist at Cape Mendocino, the Farallon Islands, and the Point St. George Reef (Bonnell et al.1983, NMFS 2008). Total numbers in the eastern DPS have been relatively stable in recent decades, and the population is currently around 44,500-48,000. Between 1990 and 1993, pup counts at Año Nuevo dropped from about 310 to 230 (Westlake et al. 1997), while in 2004 there were 243 pups and 462 non-pups counted at Año Nuevo Island and the Farallon Islands combined.

3.1.3 Guadalupe Fur Seal (Threatened)

Status. The Guadalupe fur seal (*Arctocephalus townsendi*) was listed as a federal threatened species on December 16, 1985 (50 FR 51252). No recovery plan has been prepared for this species. The main reason for listing was the reduction of the population to near extinction by commercial hunting in the nineteenth century.

Range and Habitat. The Guadalupe fur seal is the only representative of the genus *Arctocephalus* in the Northern Hemisphere (Repenning et al. 1971). Historically, the Guadalupe fur seal apparently ranged northward from Islas Revillagigedo off the coast of Mexico to at least Point Conception (Repenning et al. 1971; Fleischer 1978; Walker and Craig 1979). Like the other species of *Arctocephalus*, its numbers were severely reduced by commercial hunting in the nineteenth century, and for many years it was considered extinct (Hubbs 1956). At present, the species breeds only on Isla de Guadalupe off the coast of Baja California, Mexico, although individual animals appear regularly in the California Channel Islands (Stewart et al. 1987b; Bonnell and Dailey 1993). A single pup was born on San Miguel Island in 1997; however no pupping since then has been documented on the Channel Islands (DeLong and Melin 2000).

Little is known about the distribution of Guadalupe fur seals at sea (Gallo 1994), but recent strandings have been reported from as far north on the California coast as Sonoma County (Antonelis and Fiscus 1980; Hanni et al. 1993).

Reproduction. Guadalupe fur seals breed during the summer (Peterson et al. 1968; Pierson, 1987; Figueroa 1994; Gallo 1994). Adult males arrive on Isla de Guadalupe in late May or early June and establish territories, while females begin arriving on the rookery in June, with the major influx occurring during the last two weeks of the month. Pupping apparently peaks in late July. Females alternate from foraging trips to sea with stays on land to nurse their pups; nursing probably continues for at least 8 months. Territorial males leave the rookery by mid-August.

Diet. Limited analysis of Guadalupe fur seal scats and stomach contents indicates that they feed on pelagic squid and schooling fishes such as mackerel and sardine (Hanni et al. 1993; Gallo 1994).

Population Status. The Guadalupe fur seal population remains small, but is increasing; Gallo (1994) calculated the growth rate between 1955 and 1993 at 13.7 percent per year and estimated the 1993 population at approximately 7,400 animals. The current population is approximately 10,000 animals (Wickens and York 1997).

3.1.4 Blue Whale (Endangered)

Status. The blue whale (*Balaenoptera musculus*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The blue whale recovery plan was finalized in 1998, (Reeves et al. 1998a), and NMFS has noticed its intent to update the plan in 2012. The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. The largest of all animals, blue whales are distributed worldwide in circumpolar and temperate waters and inhabit both coastal and pelagic environments (Leatherwood et al. 1982; Reeves et al. 1998a). Like most baleen whales, they migrate between warmer waters used for breeding and calving in winter and high-latitude feeding grounds where food is plentiful in the summer. In the eastern North Pacific, blue whales are found from the Gulf of Alaska south to at least Costa Rica (Reeves et al. 1998a; Mate et al. 1999). Rice (1992) concluded that the California population is separate from that in the Gulf of Alaska and the eastern Aleutians, and this view is supported by other recent work (Barlow 1995; Calambokidis and Steiger 1995; Calambokidis et al. 1995).

The eastern North Pacific stock of blue whales feeds off California in summer and fall, and migrates to Mexico to breed and calve in winter and spring. Blue whales occur along the west coast of Baja California from March through July (Gendron and Zavala-Hernández 1995). They are first observed in Monterey Bay, around the Channel Islands, and in the Gulf of the Farallones in June-July, and are present on the continental shelf in these areas from August to November (Calambokidis et al. 1990; Calambokidis 1995; Larkman and Veit 1998; Mate et al. 1999). Based on sighting data collected off southern California from 1992 through 1999 by Cascadia Research Collective (Cascadia Research, unpubl. data), blue whales tend to aggregate in the Santa Barbara Channel along the shelf break (seaward of the 200-m line). Sighting frequencies were highest west of San Miguel Island and along the north sides of San Miguel, Santa Rosa, and the western half of Santa Cruz Island.

It is known that some blue whales do migrate south to Mexican waters in the fall, reaching waters off Baja California in October; calving may occur in subtropical waters farther to the south or offshore (Rice, 1974; Reeves et al. 1998a). Some blue whales apparently remain in lower latitudes, such as waters off Central America and in the Gulf of California, year-round (Leatherwood et al. 1987; Bonnell and Dailey, 1993). Data from radio-tracking experiments indicate that blue whales feeding off California in the summer winter in the vicinity of the Costa Rican Dome (Mate et al. 1999; Stafford et al. 1999), supporting the hypothesis of Reilly and Thayer (1990) that blue whales may select winter habitat suitable for feeding. Mate et al. (1999) hypothesize that, given their larger size and higher absolute energy requirements, blues whales may not be able to fast through the winter reproductive season (as gray and humpback whales do).

Reproduction. In the North Pacific, mating occurs on the wintering grounds from October-November through February or March (Mizroch et al. 1984a). Gestation lasts approximately 10-12 months, and calves are weaned at 6-7 months of age (Leatherwood et al. 1982; Reeves et al. 1998a). Females may calve as often as every 2 to 3 years (Mizroch et al. 1984a). Age at sexual maturity is thought to be 5-15 years (Mizroch et al. 1984a; Yochem and Leatherwood 1985).

Diet. Blue whales are filter feeders that feed primarily on a variety of euphausiids. In the North Pacific, predominant prey species include *Euphausia pacifica* and *Thysanoessa spinifera* (Rice, 1986; Schoenherr, 1991). *Thysanoessa inermis*, *T. longipes*, *T. raschii*, and *Nematoscelis megalops* also have been reported as prey in the North Pacific (Kawamura, 1980; Yochem and Leatherwood, 1985; Reeves et al. 1998a). Off Baja California, blue whales have also been observed to eat pelagic red crabs (*Pleuroncodes planipes*) (Leatherwood et al. 1982; Rice 1986). In the Santa Barbara Channel, Croll et al. (1998) recorded blue whales diving to depths where krill concentrations were most dense (mean = 68.1 ± 57.5 m).

Population Status. Blue whales were heavily exploited by commercial whalers following the introduction of modern whaling equipment and techniques in the late19th century. Worldwide, the blue whale population was reduced from a pre-exploitation estimate of 228,000 animals to less than 10,000 (Brownell et al. 1989). The pre-exploitation population of blue whales in the North Pacific has been estimated at 4,500 to 5,000 animals (Braham 1984; Leatherwood et al. 1987).

The current population worldwide remains unknown; however, the eastern pacific population, which frequents the waters off California, is currently estimated at slightly over 2,490 individuals (Reeves et al. 1998a; Caretta et al. 2010). Mate et al. (1999) hypothesized that these animals may constitute the largest remnant blue whale population in the world. Although the population appears to be growing, the observed increase in blue whale abundance off California during the past two decades is considered to have been too large to be explained by population growth alone and may be due to a shift in their distribution (Barlow et al. 1997; Reeves et al. 1998a, Carretta et al. 2005, Calambokidis 2009).

3.1.5 Fin Whale (Endangered)

Status. The fin whale (*Balaenoptera physalus*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The draft fin and sei whale recovery plan was issued in 1998, (Reeves et al. 1998b). A final recovery plan was issued in July 2010 (NMFS 2010a). The primary reason for listing was due to a severe worldwide population decline resulting from intensive commercial whaling.

Range and Habitat. Second in size only to the blue whale, fin whales are distributed worldwide. NMFS recognizes three stocks in U.S. Pacific waters: Alaska; California, Oregon, and Washington; and Hawaii (Mizroch et al. 1984b; Barlow et al. 1997; Hill et al. 1997; Reeves et al. 1998b). According to Rice (1974), the summer distribution of fin whales includes immediate offshore waters throughout the North Pacific, from central Baja to Japan and north to the Chukchi Sea. Numbers in these areas peak in late May to early July. In recent years, fin whales have occurred year-round off central and southern California, with peak numbers in summer and fall (Dohl et al. 1981, 1983; Barlow, 1995; Forney et al. 1995). In the Southern California Bight, summer distribution is generally offshore and south of the northern Channel Island chain, particularly over the Santa Rosa-San Nicolas Ridge (Leatherwood et al. 1987; Bonnell and Dailey, 1993). Since fin whale abundance decreases in winter and spring off California (Dohl et al. 1981, 1983; Forney et al. 1995) and Oregon (Green et al. 1992), the distribution of this stock probably extends outside these waters seasonally.

Fin whale migratory behavior in the eastern North Pacific appears to be complex, with either inshore-offshore or north to south movements depending on individual's age, reproductive status, or "stock" affinity (Reeves et al. 1998b). Evidence from serological studies (Fujino, 1960) and field observations (Brueggeman et al. 1987; Stewart et al. 1987a) indicates that fin whales migrate back to the same feeding areas each year. Analysis of data from several studies of humpback whale distribution (Nasu, 1974; Dohl et al. 1983; Brueggeman et al. 1987) shows the relationship of fin whales to the continental shelf, particularly near submarine canyons in Alaska and the shelfbreak in California and Alaska. These are areas that presumably feature seasonal convergence zones where upwelling occurs, resulting in high prey concentrations for feeding whales (Green et al. 1989).

Reproduction. Fin whales breed during the winter, from November through March, in lower latitude oceanic waters (generally between 20° and 40°N), although wintering grounds have not been precisely defined (Rice, 1974; Haug, 1981). The gestation period lasts about 11 months, and calves are usually weaned on the feeding grounds at 6 to7 months of age (Leatherwood et al. 1982; Bonnell and Dailey, 1993). Although apparently capable of calving every year, females often rest one or more years between pregnancies (Leatherwood et al. 1982). Sexual maturity apparently occurs at 10 years of age or greater in populations near carrying capacity, and possibly as early as 6 to 7 years of age in exploited populations (Gambell, 1985b; Reeves et al. 1998b).

Diet. In the North Pacific, fin whales feed primarily on euphausiids (including *Euphausia pacifica*, *Thysanoessa longipes*, *T. spinifera*, and *T. inermis*) and large copepods (mainly *Calanus cristatus*). They also feed to a lesser extent on schooling fish such as herring, walleye pollock, capelin, and lanternfish, and occasionally on squid (Nemoto 1970; Kawamura, 1982;

Leatherwood et al. 1982). Several euphausiid species known to be important to North Pacific fin whales occur only in waters less than 300 m deep (Nemoto and Kayusa 1965, cited in Green et al. 1989).

Population Status. The world population of fin whales before exploitation may have been as high as 500,000 animals (Gambell, 1985a). Due to their strength and speed, fin whales were not effectively harvested by early whalers, but came to be intensively hunted with the development of modern whaling equipment and techniques in the late 1800's (Tonnesson and Johnsen 1982; Webb, 1988). By 1976, when fin whales were protected from commercial harvest, the world population had been reduced to approximately 103,000-122,000 animals (Gambell 1985a).

The pre-exploitation population of fin whales in the North Pacific has been estimated at 42,000-50,000 animals (Ohsumi and Wada, 1974; Tillman, 1975; Allen, 1980). Recent estimates range between 7,890 and 20,000 animals (Ohsumi and Wada, 1974; Rice, 1974; Wada, 1976; Allen, 1980), with approximately 60 percent occurring in the eastern half of the North Pacific (Ohsumi and Wada, 1974). Allen (1980) argued that it would take 25 to 30 years for the eastern North Pacific population to recover to 90 percent of its original levels. Current estimates place the California-Oregon-Washington population at about 750 to 930 animals (Barlow and Gerrodette, 1996; Barlow et al. 1997). Shipboard sighting surveys in the summer and autumn of 1991, 1993, 1996, and 2001 produced California population estimates of 1,600 to 3,200 fin whales (Barlow 2003). The most recent estimate for the entire California/Oregon/Washington population is about 2,636 (NMFS 2010a).

3.1.6 Sei Whale (Endangered)

Status. The sei whale (*Balaenoptera borealis*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The draft fin and sei whale recovery plan was issued in 1998, (Reeves et al. 1998b). A final recovery plan for the sei whale was issued in December 2011 (NMFS 2011). The primary reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. Sei whales are distributed worldwide and are primarily a pelagic, temperate-water species (Leatherwood et al. 1982; Barlow et al. 1997; Reeves et al. 1998b). There are believed to be three stocks in the North Pacific (Mizroch et al. 1984c). In the eastern North Pacific, sei whales migrate northward from wintering grounds in temperate and subtropical waters to feeding grounds that extend from west of the California Channel Islands as far north as the Gulf of Alaska and the Aleutians in the summer (Leatherwood et al. 1982; Mizroch et al. 1984c). Evidence from tag recoveries indicates movement between central California and Vancouver Island (Rice, 1977; Reeves et al. 1998b). Unlike fin whales, sei whales seldom enter the Bering Sea (Leatherwood et al. 1982). The winter range stretches from about 18°30'N latitude off Baja California to near 35°30'N off the central California coast (Leatherwood et al. 1982), but may be centered between 20° and 23°N (Mizroch et al. 1984c). Some individuals apparently approach the equator (Leatherwood et al. 1982).

Reproduction. Sei whales breed mainly on the wintering grounds, from September through March. Gestation lasts approximately 12 months (Rice, 1977; Leatherwood et al. 1982). Calves are born in wintering areas and are weaned on summer feeding grounds, approximately 6 to 9 months later (Rice, 1977; Mizroch et al. 1984c). Females most often give birth at 3-year intervals (Rice, 1977; Leatherwood et al. 1982). The mean age at sexual maturity is 10 years.

Diet. Sei whales are generally skimming feeders. They are known to prefer copepods, but also take a variety of prey, including euphausiids, small schooling fishes, and squid (Nemoto and Kawamura, 1977; Leatherwood et al. 1982; Bonnell and Dailey, 1993). Off central California, within the California Current, sei whales have been known to consume northern anchovy, Pacific saury, and jack mackerel (Perry et al. 1999, Leatherwood et al. 1982). The dominant food for sei whales off California during June through August is the northern anchovy, while in September and October they eat mainly krill (Horwood 2009; Rice 1977).

Population Status. Sei whales were heavily exploited by commercial whalers in the 1960s, following the decline of the fin whale populations; their numbers were reduced from an estimated pre-exploitation world population of 256,000 to about 50,000 whales (Brownell et al. 1989). Pre-whaling abundance in the North Pacific was estimated at 58,000 to 62,000 by Ohsumi and Wada (1974). Tillman (1977) revised this estimate to 42,000 and further estimated the existing population in 1974 at 7,260 to 12,620 individuals.

Sei whales are now rare in California waters (Dohl et al. 1981, 1983; Bonnell and Dailey 1993; Mangels and Gerodette1994; Barlow 1995; Forney et al. 1995; Barlow et al. 1997). The number of sei whales in the California, Oregon, and Washington waters of the Eastern North Pacific is currently estimated at about 126 individuals (Carretta et al 2010).

3.1.7 Humpback Whale (Endangered)

Status. The humpback whale (*Megaptera novaeangliae*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). No critical habitat has been identified for this species. The humpback whale recovery plan was finalized in 1991, (NMFS, 1991a), and a status review is currently being conducted for this species. The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. Humpback whales are distributed worldwide and undertake extensive migrations in parts of their range (Leatherwood et al. 1982). They aggregate from late spring through fall to feed in productive waters of temperate and high latitudes and migrate in winter months to lower latitudes for breeding and calving, which often occur near tropical islands and in shallow coastal waters. In the eastern North Pacific, humpbacks range from arctic waters south to central California in the summer. On their feeding grounds, humpback whales are found primarily on the continental shelf near shallow banks and inshore marine waters (Rice, 1974; Wolman, 1986). Humpback whales winter in three areas: waters off Mexico (Rice, 1974); Hawaii (Baker et al. 1986); and the Marianas, Bonin, and Ryukyu Islands and Taiwan (Nishiwaki, 1959). Whales from all three wintering grounds apparently intermingle during the summer months in Alaskan waters (Baker et al. 1986).

Based on photo-identification work, Calambokidis et al. (1996) concluded that humpback whales off California, Oregon, and Washington form a single, intermixing population, with very little interchange with areas farther north. Whales from this population feed off California through summer and fall (Dohl et al. 1983; Calambokidis et al. 1996). Based on sighting data collected off southern California from 1992 through 1999 by Cascadia Research Collective (Cascadia Research, unpubl. data), humpback whales occur throughout the western two-thirds of the Santa Barbara Channel and, to a lesser extent, in the Santa Maria Basin. As was the case for blue whales, there appears to be a tendency for humpback whales to concentrate along the shelfbreak north of the Channel Islands.

Reproduction. Breeding activity occurs year-round, with a strong winter-spring peak (Leatherwood et al. 1982; NMFS, 1991a). Most calves are born on the wintering grounds between January and March, following a 12-month gestation period (Leatherwood et al. 1982; DOC, 1989), and are weaned after approximately 11 months (Johnson and Wolman, 1984). Female humpbacks give birth approximately every other year, although annual and multi-year calving has been reported (Glockner-Ferrari and Ferrari, 1984; Clapham and Mayo, 1987; Baker et al. 1988; NMFS, 1991a).

Diet. Humpback whales exhibit a variety of feeding behaviors and appear to feed whenever and wherever sufficient concentrations of suitable-sized prey are encountered (Winn and Reichley, 1985; NMFS, 1991a). Major humpback whale prey includes a number of species of small schooling fishes and large zooplankton, mainly euphausiids (Tomilin, 1967; Nemoto, 1970; Wolman, 1986). Fish species eaten by humpbacks in the North Pacific include Pacific herring, capelin, walleye pollock, northern anchovy, eulachon, mackerel, sand lance, cod, salmon, and rockfishes (Rice, 1963, 1977; Frost and Lowry, 1981). Important invertebrate prey includes euphausiids (*Euphausia pacifica*, *Thysanoessa raschii*, *T. spinifera*, *T. longipes*), mysids (*Mysis oculata*), pelagic amphipods (*Parathemisto libellula*), shrimps (*Eualus gaimardii*, *Pandalus goniurus*), and copepods (*Calanus* spp.) (Rice 1963; Tomilin 1967; Bryant et al. 1981; Frost and Lowry 1981).

Population Status. The pre-exploitation world population of the humpback whale has been estimated at about 115,000 animals (Brownell et al. 1989). Made vulnerable by their coastal distribution and gregariousness, however, humpback whale populations were greatly depleted at the beginning of this century by both land station and pelagic whaling operations (Rice, 1974, 1978; Tønnessen and Johnsen, 1982; Brownell et al. 1989). Based on whaling statistics, the pre-1905 population of humpback whales in the North Pacific was estimated to be 15,000 (Rice 1978), and was reduced by whaling to approximately 1,200 by 1966 (Johnson and Wolman 1984). A photo-identification study from 2004 to 2006 estimated the abundance of humpback whales in the entire Pacific Basin to be approximately 18,000 to 20,000 individuals (Calambokidis et al. 2008). The best estimate for the population in the waters off California and Oregon is currently 2,043 individuals (Carreta et al 2010).

3.1.8 North Pacific Right Whale (Endangered)

Status. The northern right whale (*Eubalaena glacialis*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495) and a recovery plan was finalized in 1991, (NMFS 1991b). Revised recovery plans were completed in 2001, 2004 and 2005. At the time it was listed, the overall range of the northern right whale extended from about 40ºN to 60ºN. The main reason for listing was a severe worldwide population decline due to intensive commercial whaling. Subsequently, NMFS recognized that there were actually two separate species, the North Pacific right whale (*E. japonica*) and North Atlantic right whale (*E. glacialis*) (73 FR 12024). Critical habitat for the North Pacific right whale, encompassing a total of approximately 36,750 square nautical miles within the Gulf of Alaska and the Bering Sea, became effective on 7 August 2006.

Range and Habitat. North Pacific right whales apparently migrate from high-latitude feeding grounds toward more temperate waters in the fall and winter. The location of calving grounds is unknown; summer feeding grounds may generally stretch across the North Pacific from about 50° to 63°N (Omura, 1958; Omura et al. 1969). In the northeastern Pacific, the major northern right whale whaling ground was the "Kodiak Ground," which encompassed essentially the Gulf of Alaska and was a major summer feeding ground for the species (Leatherwood et al. 1982). Waters off the eastern Aleutian Islands and in the southern Bering Sea were apparently also important areas of concentration (Braham and Rice, 1984; NMFS, 1991b). Catches of right whales on the summer feeding grounds were widespread on the continental margin, generally away from shore (Townsend, 1935; Brueggeman et al. 1985).

The scarcity of sightings along the west coast of North America suggests that right whales migrate to summer grounds from the western or central North Pacific or well offshore in the eastern North Pacific (Braham and Rice, 1984), although the location of seasonal migration routes is unknown (Scarff, 1986). Reeves and Brownell (1982) concluded that the usual wintering ground of northern right whales extended from northern California to Washington, although sightings have been recorded as far south as 23°N off Baja California and near the Hawaiian Islands (Scarff, 1986; NMFS, 1991b; Gendron et al. 1999). However, Scarff (1986) reviewed the literature and whaling records and concluded that right whales overwinter in the western or mid-North Pacific.

Although right whales have, on rare occasions, been recorded off California, there is no evidence that this region was ever an important habitat for right whales (NMFS 2006). Since 1955, only five sightings of right whales have been recorded in waters off southern California. All of the sightings were of individuals, and were recorded between February and May (Scarff, 1991; Carretta et al. 1994).

Reproduction. Little is known about the reproductive biology of right whales in the Pacific, although productivity is obviously very low (Leatherwood et al. 1982). However, the gestation period for North Atlantic right whales is thought to be around 16 months (NMFS, 1991b), and females in that population give birth once every 3 to 5 years (Knowlton and Kraus, 1989). Sexual maturity apparently occurs between ages 5 and 9 (Knowlton and Kraus, 1989).

Diet. Northern right whales are not known to eat fish; their primary prey includes calanoid copepods, particularly *Calanus cristatus* and *C. plumchrus*, and euphausiids (Omura, 1958; 1986; Omura et al. 1969; Nemoto, 1970; Leatherwood et al. 1982).

Population Status. Northern right whales are the rarest of the endangered cetaceans. In the North Pacific, the population is currently believed to number 100-200 animals, which is considerably below the estimated pre-exploitation size of 15,000 animals (Braham, 1984; NMFS, 1991b). Although northern right whales were hunted for centuries in temperate coastal waters, the major cause for their population decline was 19th-century whaling (Rice, 1974; Scarff, 1986; Brownell et al. 1989). These large, slow moving whales have a thick layer of blubber; attributes which made them a particularly attractive target for the whaling industry in the early 1900s.

From 1855 to 1982, only 23 reliable sightings of Northern Pacific right whale were noted (Scarff 1986). Two of these sightings were made in the Santa Barbara Channel. More recently, since 1996, NMFS and other surveys (directed or otherwise) have detected small numbers of right whales in the southeastern Bering Sea, including an estimated 24 animals in the summer of 2004 (NMFS 2006, Carretta 2011). This aggregation included three sets of cows with calves, and nearly doubled the currently known population of this species. The southernmost sighting in recent years was made in 1998 off Cabo San Lucas, Baja California, Mexico (Gendron et al. 1999).

3.1.9 Sperm Whale (Endangered)

Status. The sperm whale (*Physeter macrocephalus*) was listed as a federal endangered species on June 2, 1970 (35 FR 8495). A recovery plan has been prepared and was finalized for this species in December 2010 (NMFS 2010b). The main reason for listing was a severe worldwide population decline due to intensive commercial whaling.

Range and Habitat. The largest of the toothed whales found in the project region, sperm whales are found predominantly in temperate to tropical waters in both hemispheres (Gosho et al. 1984). In the North Pacific, females and juveniles generally remain south of about 45 degrees N latitude year-round, while adult males range northward as far as the Bering Sea in the summer (Gosho et al. 1984). During the winter, most of the population is distributed south of 40 degrees N (Gosho et al. 1984). Off California, sperm whales are present in offshore waters year-round, with peak abundance occurring from April to mid-June and again from late August through November as they pass by during migration (Dohl et al. 1981, 1983; Gosho et al. 1984; Barlow et al. 1997, Carretta et al 2010.).

Sperm whales are primarily a pelagic species and are generally found in waters with depths of greater than 1,000 m (Watkins, 1977), although their distribution does suggest a preference for continental shelf margins and seamounts, areas of upwelling and high productivity (Leatherwood and Reeves, 1986). The majority of sightings by Dohl et al. (1983) in their three-year study off central and northern California were in waters deeper than 1,800 m, but near the continental shelf edge.

Reproduction. Sperm whale groups generally fall into two categories: breeding schools (also called harems), and bachelor schools. One or more mature males may be associated with the breeding schools, which form in early spring (Gosho et al. 1984) and consist of females and juvenile males. Bachelor schools consist almost entirely of younger, but sexually mature, males. Older males are generally solitary and join breeding schools only during the mating season.

The sperm whale mating season lasts from April through August (Rice et al. 1986). Gestation lasts 14 to 15 months, and calves are normally born between June and November (Leatherwood et al. 1982; Rice et al. 1986). Calves are weaned at 1 to 2 years of age, and females give birth at 3- to 5-year intervals (Leatherwood et al. 1982).

Diet. Sperm whales are deep divers and feed primarily on large squid and deepwater fishes (Leatherwood and Reeves, 1986; Rice, 1988). Stomachs of whales taken or stranded off Oregon, Washington, and British Columbia contained predominantly squid and octopus, with some deepwater rockfish and ragfish (Pike and MacAskie, 1969; Mate, 1981).

Population Status. Prized for the high quality of its spermaceti oil, the species was subjected to two major phases of commercial whaling: during the mid-18th to mid-19th centuries; and in the modern whaling era, particularly between 1946 and 1980 (Gosho et al. 1984; Brownell et al. 1989). Between 1958 and 1975, the annual world catch rose to more than 20,000 animals, with a peak of 27,000 in 1966 (Gosho et al. 1984; Brownell et al. 1989). The eastern North Pacific stock was given protective status from commercial whaling in 1980 (Leatherwood and Reeves, 1986; IWC, 1988). The current world population of sperm whales has been estimated at 1,950,000 animals, down from an estimated pre-exploitation population of 2,400,000 (Brownell et al. 1989). The initial population size for the eastern North Pacific (mature animals only) was estimated at 311,000 animals, and the population is currently estimated at 274,000 animals (Braham 1984).

Using acoustic methods, Barlow and Taylor (1998) estimated 39,200 sperm whales in a 7.8 million-km^2 study area encompassing waters between the U.S. west coast and Hawaii. The sperm whale population off California has previously been estimated between about 900 and 1,200 animals (Forney et al. 1995; Barlow and Gerrodette, 1996) and is considered to be relatively stable (Barlow and Taylor, 1998). The best available estimate of the current abundance for the California, Oregon, and Washington stock is 971 individuals (Carretta et al. 2010).

3.2 Birds

3.2.1 California Least Tern (Endangered)

Status. The California least tern (*Sternula antillarum browni*) was listed as endangered on October 13, 1970 (35 FR 16047). The main reasons for listing this species were loss of habitat, human disturbance, and predation. A recovery plan for the species was published in 1980 (USFWS 1980b), but critical habitat has not been designated. On October 2, 2006, the USFWS completed a 5-year review of the status of the California least tern, wherein they recommended it for downlisting from endangered to threatened (USFWS 2006).

Range and Habitat. The breeding range of the California least tern, which the population occupies from about April to September each year, extends from San Francisco Bay south to northern Baja California, Mexico. Least terns usually begin arriving in southern California in April. Early arrival dates include April 8, 1978 for San Diego (Garrett and Dunn 1981) and April 27, 1976 for Santa Barbara (Lehman 1994). The southward migration of least terns may begin as early as August and few, if any, terns remain in California after late September (Garrett and Dunn 1981). The migration route and winter distribution of these birds remains mostly unknown, although they probably winter along the Pacific coast of southern Mexico and Central America.

During the last 20 to 25 years, about 50 sites in California have been occupied by nesting least terns at some time (Fancher 1992; Caffrey 1995). These range from Pittsburg in northern California to the Tijuana River mouth at the south end of the state. However, the number of sites actually used fluctuates from year to year, as potential nesting areas become available naturally or through site preparation efforts, or unavailable due to natural or human disturbance and/or predation. Fewer sites have been used in recent years; for example, only 35 sites were used in 1996 (Caffrey 1998). Furthermore, the number of nesting pairs is concentrated at only a few locations. In 1996, 7 of the 35 sites used that year accounted for 58 percent of the breeding pairs (Caffrey 1998). These seven sites were Naval Air Station (NAS) Alameda, Venice Beach, Huntington Beach, Santa Margarita River/North Beach, Mission Bay/FAA Island and Mariner's Point, and Delta Beach/North.

Nesting colonies are usually located on open expanses of sand, dirt, or dried mud, typically in areas with sparse or no vegetation. Colonies are also usually in close proximity to a lagoon or estuary where they obtain most of the small fish they consume, although they may also forage up to 3 to 5 km (2 to 3 miles) offshore. Least terns are fairly faithful to breeding sites and return year after year regardless of past nesting success.

Reproduction. Nests consist of a shallow scrape in the sand, sometimes surrounded by shell fragments. Eggs (usually two per clutch) are laid from mid-May to early August. Incubation takes 20 to 28 days, and young fledge in about 20 days (USFWS 1980b). Least terns breed after their second year, and first-time breeders are more likely to nest later in the breeding season (Massey and Atwood 1981; Thompson et al. 1997).

Diet. Least terns are opportunistic feeders known to capture more than 50 species of fish. Prey species include the northern anchovy (*Engraulis mordax*), deepbody anchovy (*Anchoa compressa*), jacksmelt *(Atherinopsis californiensis)*, topsmelt *(Atherinopsis affinis)*, California grunion *(Leuresthes tenuis)*, shiner surfperch *(Cymatogaster aggregata),* California killifish *(Fundulus parvipinnis)*, and mosquitofish *(Gambusia affinis)*.

Reasons for Decline. Although loss of habitat and human disturbance were the primary reasons for the decline of least terns in California, predation continues to be an ongoing problem for the species. Least tern chicks are preyed on by several mammalian and avian species, including coyotes (*Canis latrans*), red fox (*Vulpes vulpes*), domestic cats (*Felis domesticus*), American kestrels (*Falco sparverius*), northern harriers (*Circus cyaneus*), red-tailed hawks (*Buteo jamaicensis*), and western gulls (*Larus occidentalis*). One predator, the American crow (*Corvus brachyrynchus*), has become a major problem in recent years. With the increasing urbanization of American crows, this species is now occupying many coastal areas of southern California, and preys on least tern nestlings. During the 1999 breeding season, all the nests at the Venice Beach colony were lost to crows

Population Status. In 1970, when California least terns were listed as endangered by the federal government and California, there were only an estimated 300 pairs distributed among 14 nesting sites in San Diego and Orange Counties, and at a single northern California site at Bair Island in San Mateo County (Craig 1971). Population growth rates have increased, especially since the mid-1980s, when active management for least terns was initiated. Management of California least tern colonies has included intensive monitoring of nesting colonies, site preparation to reduce vegetative cover, protection of sites by means of reduced access to humans, and predator management. Although the increase in the breeding population has not been consistent from year to year (there were only about 2,598 pairs in 1995 compared to 2,792 in 1994; Caffrey 1995, 1997, 1998; Keene 2000), the long-term trends have shown steady population growth. This, despite a decline of more than 10 percent occurred from the 1998 to 1999 when the population dropped from a peak of 4,141 to 4,182 pairs down to only 3,493 to 3,711 pairs. By 2004, however, the population was back up, with an estimated 6354 to 6805 pairs establishing nests (Marschalek 2005). In 2010, a population estimate of 6,568 was recorded (Marshalek 2011). Fluctuations in the least tern population are thought to be attributable to a combination of high levels of predation and low prey availability.

In the general area of concern for the proposed project, from 1994 onward, as many as 12 sites have been used for nesting by least terns, depending to some degree on how some sites have been lumped or split in different years (Caffrey 1995, 1997, 1998; Keane 1998, 2000; Marschalek 2005). Nesting site fidelity among least terns appears to be patchy, and may depend heavily on local prey availability and predation. Only 7 to 9 of these sites were in use in any one year, again depending on how they were tabulated. The general locations of these sites are: Oceano Dunes, Guadalupe Dunes, Mussel Rock Dunes, Vandenberg AFB (Beach 2 and Purisima Point), Santa Clara River mouth, Ormond Beach (3 sites), Point Mugu, and Venice Beach.

The number of pairs at most of these locations has generally been low (<50); however, both Venice Beach and Point Mugu have periodically hosted large numbers of nesting terns. Currently, Mt. Mugu is one of the largest colonies in California, with a total of 640-642 breeding pairs, 708 nests, and at least 98 fledglings produced in 2010. Venice Beach was formerly one of the larger colonies in California, but populations at this site have fluctuated dramatically in response to prey availability and predation. Although it hosted many as 383 pairs in 1998, a food (anchovy) shortage, was believed to account why only 17 pairs attempted nesting at this location in 2004 (Keane 2000, Marschalek 2005). In 2010, 148-164 breeding pairs establish 164 nests at Venice Beach, but predation by crows was extremely high and resulted in 100 percent failure of nesting attempts for a second consecutive year. Low anchovy numbers may result adults spending more time away from nests foraging for food, leaving nests vulnerable to predators.

At the two Vandenberg AFB sites 32-33 breeding pairs established 34 nests and produced 29 fledglings in 2010. This represents the second consecutive year of higher fledgling counts following poorer productivity at Vandenberg AFB sites in 2004-2006. (Marschalek 2005, 2011).

The implementation of protected beach areas for the western snowy plover at Coal Oil Point Reserve in Goleta has had the added benefit of increasing the appeal of this location for least tern nesting. Beginning in 2004, small numbers of terns attempted to nest there. In 2006, five chicks were successfully hatched at this location; however, following two successive years of unsuccessful nesting due to predation, no attempts were recorded in 2009 or 2010 (Marschalek 2011).

3.2.2 Marbled Murrelet (Threatened)

Status. The marbled murrelet (*Brachyramphus marmoratus*) is an unusual member of the auk family, nesting up to 70 km (44 miles) inland in old growth forests and staying close to shore when at sea. This small, secretive seabird was listed as threatened in 1992 (57 FR 45328). The main reasons for listing were population decline resulting from loss and degradation of the old-growth forest habitats that the murrelet uses for nesting (USFWS 2009).

Range and Habitat. The marbled murrelet inhabits the Pacific coast of North America from the Bering Sea south to the Santa Cruz mountains. The southern limit of the species' breeding range is along the coast of northern Santa Cruz and southern San Mateo counties, in the vicinity of Point Año Nuevo (Ainley et al. 1995). The next closest population is located more than 300 kilometers further north, off the Humboldt County coast.

Although the foraging range of breeding marbled murrelets is generally less than 25 km, radio-telemetry studies have tracked several birds nearly 200 km south, to the southern end of the Monterey Bay National Marine Sanctuary near Point Piedras Blancas. These birds were assumed to have traveling such a considerable distance for some predictable food source. At sea, the most birds are observed alone or in pairs and are typically sighted within 1.2 miles of the shoreline (Marshall 1988, Strachan et al. 1995).

Marbled murrelets generally nest in old-growth forests, characterized by large trees, multiple canopy layers, and moderate to high canopy closure. In the non-forested portions of Alaska however, murrelets can also nest on the ground or in rock cavities. It is likely that western hemlock and Sitka spruce constitute the most important nesting trees for this species, with Douglas-fir becoming important south of British Columbia. In California, nests are typically found in coastal redwood and Douglas-fir forests. Nesting forests are located close enough to the marine environment for the birds to fly to and from the nesting sites on a daily basis.

Reproduction. Marbled murrelets do not typically build nests, but instead lay their eggs in small depressions or cups made in moss or other debris on large tree limbs. They typically only nest once per year, and produce only one egg per nesting cycle. Incubation of the egg lasts approximately one month, with both sexes taking turns incubating the egg in alternating 24-hour shifts. After hatching, the chick is fed up to eight times daily, and is usually fed only one fish at a time. The young are semiprecocial, and are capable of walking but not leaving the nest. Fledging occurs approximately 28 days after hatching, and fledglings will fly unaided, directly from the nest to the ocean.

Diet. Marbled murrelets are opportunistic foragers in shallow, nearshore waters as well as at in protected bays and fjords (Strachan et al. 1995). They subsist primarily on small forage fish (e.g., herring, seaperch) and invertebrates (e.g., amphipods, mysids), and seasonally shift between prey based on oceanographic conditions (Burkett 1995, Strachan et al. 1995). For example, the fish portion of the murrelet's diet was most important in the summer and coincided with the nestling and fledgling period.

Reasons for Decline. The primary reasons for the decline in the marbled murrelet population are habitat loss, predation, gill-net fishing operations, oil spills, marine pollution, and disease. Habitat loss has resulted from logging and fragmentation of the old-growth forests that murrelets utilize for nesting. Recent reviews have also concluded that the risk of predation, particularly from crows and gulls, is a larger threat than previously considered (USFWS 2009).

Population Status. Although there are an estimated 270,000 marbled murrelets in Alaska and another 54,000 to 92,000 in British Columbia, within the lower 48 states (Washington, Oregon and California) only 15,000 to 35,000 marbled murrelets exist. Despite ESA protection, this population has continued to shrink and fragment over the last ten years at a rate of up to 7 percent per year. The nearest breeding population of marbled murrelets, located in the Santa Cruz mountains of central California, currently consists of approximately 631 individuals (Peery and Henry 2010).

Small numbers of marbled murrelets are known to occur sporadically along the northern Santa Barbara County coastline where it is considered a very rare late-summer, fall, and winter visitor. (Lehman 2012). Recent sightings (within the last 20 years) have typically occurred near the Santa Maria river mouth, Point Sal, and northern Vandenberg Air Force Base (Lion's Head). However, sightings of marbled murrelets along the Santa Barbara coastline are infrequent, and generally consist of only 2 to 4 birds at a time (Lehman 2012).

3.2.3 Western Snowy Plover (Threatened)

Status. The coastal population of the western snowy plover (*Charadrius nivosus nivosus*) was listed as threatened in the Federal Register on March 5, 1993 (58 FR 12864). The main reasons for listing this population were loss and degradation of habitat from human disturbance. On December 7, 1999, a designation of critical habitat was published in the Federal Register (64 FR 68507). This designation was updated on September 9, 2005 (70 FR 56970) (USFWS 2005b), and revised again on July 16, 2012 (77 FR 36727). A Draft Recovery Plan for this species was published in the Federal Register on August 14, 2001 (66 FR 42676); and finalized in September 2007 (USFWS 2007).

Range and Habitat. Western snowy plovers are found in several western states including Washington, Oregon, California, Nevada, Utah, and Arizona as well as Baja California and mainland Mexico. However the range of the Pacific coast population is much more limited. This population is defined as those individuals that nest adjacent to tidal waters, and includes all nesting birds on the mainland coast, peninsulas, offshore islands, adjacent bays, estuaries, and coastal rivers (58 FR 12864).

The coastal population consists of both resident and migratory birds. Some birds winter in the breeding areas, while others migrate north or south to wintering areas (Page et al. 1986; Warriner et al. 1986). The breeding range of the coastal population extends along Pacific coast of North America from southern Washington to southern Baja California, Mexico. The winter range is somewhat broader and may extend to Central America (Page et al. 1995); however, most plovers winter south of Bodega Bay, California (Page et al. 1986).

The nesting habitat of the coastal population consists mainly of dune-backed beaches, barrier beaches, salt flats, and salt evaporation ponds (Page and Stenzel, 1981; Palacios and Alfaro, 1994). Habitat of wintering birds includes beaches where nesting is not known to occur. In the U.S., over 150 currently used or historical nesting and/or wintering areas have been identified (64 FR 68507), most of which (about 85 percent) are found in California. Additionally, at least four major nesting areas are known to exist in Baja, California. In coastal California, plovers historically nested at 53 locations prior to 1970 (Page and Stenzel, 1981). Currently, 44 of these sites are no longer used by nesting plovers (50 CFR 20607). Declines in the overall number of nesting sites have also occurred in Oregon and Washington (see 35 FR 16047).

The largest number of breeding birds occurs from South San Francisco Bay to southern Baja California. Major breeding areas within the project area include the Callendar-Mussel Rock Dunes area, the Point Sal to Point Conception area, and the Oxnard Lowlands (Ormond Beach and Point Mugu). Most of these areas and many others have been designated as critical habitat for the western snowy plover (77 FR 36727). Designated critical habitat areas in the general area of concern for the proposed project include Devereux Beach (Coal Oil Point in Santa Barbara County), a stretch of beachfront adjacent to downtown Santa Barbara; Santa Rosa Island, San Buenaventura beach in Ventura, Mandalay Beach, the Santa Clara River area, and Ormond Beach (in Ventura County).

Reproduction. Snowy plovers breed in loose colonies of up to 150 pairs. Site fidelity is high, and birds often nest in the exact same location as the previous year (Warriner et al. 1986). The breeding season for western snowy plovers extends from early March to late September, with birds at more southerly locations beginning to nest earlier in the season than birds at more northerly locations (64 FR 68507). In most years, the earliest nests on the California coast occur during the first to third week of March. Peak nesting in California occurs from mid-April to mid-June, while hatching lasts from early April through mid-August.

During courtship, males defend territories and may make multiple scrapes (slight depressions) in flat, open areas with sandy or saline substrates. The male constructs the scrapes by leaning forward on his breast and scratching his feet while rotating his body. Females choose which scrape becomes the nest site by laying eggs in one of them. Plovers lay between 2 to 6 eggs in a nest (Page et al. 1995). The nest is increasingly lined with beach debris (e.g. small pebbles, shell fragments, plant debris, and mud chips) as incubation progresses. Both sexes incubate the eggs, with the female tending to incubate during the day and the male at night. Both nest initiation and egg laying take place from mid-March through mid-July (Wilson, 1980; Warriner et al. 1986).

Snowy plover chicks are precocial, leaving the nest within hours after hatching to search for food. Adult plovers do not feed their chicks, but lead them to suitable feeding areas. Females generally desert both mates and broods by the sixth day after hatching, leaving the males to continue rearing the brood, while the females move on to obtain new mates and initiate new nests. The chicks reach fledging age approximately one month after hatching; however, broods rarely remain in the nesting area throughout this time. Plover broods may travel along the beach as far as 6.4 kilometers (4 miles) from their natal area.

Diet. Snowy plovers are primarily visual foragers whose diet consists primarily of molluscs, worms crabs, sandhoppers, and insects (Soothill and Soothill, 1982; Page et al. 1995). They forage for invertebrates across sandy beaches from the swash zone to the macrophyte wrack line of the dry upper beach. They also forage in dry sandy areas above the high tide, on salt flats, and along the edges of salt marshes and salt ponds (58 FR 12864). Plovers may also sometimes probe for prey in the sand and pick insects from low-growing plants.

Reasons for Decline. The primary reasons for the decline in the coastal population of the western snowy plover are habitat loss, human disturbance, and predation. Habitat loss has resulted from both the urbanization (construction of residential, commercial, and recreation facilities, harbors, roads, campgrounds, etc.) of the Pacific coast, especially in southern California, and the spread of introduced beach grasses (e.g., marram grass) used for the stabilization of coastal sand dunes. Introduced grasses are particularly a problem in the northern portion of the plover's range.

Plovers are highly susceptible to human disturbance, and human activity (walking, jogging, dog walking, off-road vehicle use, beach raking, etc.) has also played an important role in the decline of the coastal population. The breeding season of the western snowy plover (mid-March to mid-September) coincides with the time of greatest beach use by people, and Page et al. (1977) found that snowy plovers were disturbed more than twice as often by human activities than all other natural causes combined. If the level of disturbance is sufficiently high, plovers may abandon their nests, and eggs have been stepped on and run over by vehicles. Chicks that become separated from adults through human disturbance may die of exposure. At one site in coastal California, humans were directly responsible for the loss of at least 14 percent of nests over a 6-year period (Warriner et al. 1986).

Loss of eggs, chicks, and adults to a variety of predators including gulls (*Larus* spp.), American crows (*Corvus brachyrynchus*), common raven (*Corvus corax*), red fox (*Vulpes vulpes*), skunk (*Mephitis mephitis*), raccoon (*Procyon lotor*), and coyote (*Canis latrans*) is a major concern at a number of nesting sites. Accumulation of trash at beaches attracts these as well as other predators (Stern et al. 1990; Hogan, 1991).

Population Status. The first reliable information on the abundance of snowy plovers along the California coast came from surveys conducted during the 1977 to 1980 breeding seasons by Point Reyes Bird Observatory (PRBO). The surveys suggested that the snowy plover had disappeared from significant parts of its coastal California breeding range by 1980. When these surveys were initially conducted, the breeding population had been estimated at 1,565 birds (Page and Stenzel, 1981). However, based on the number of historical nesting sites that are no longer occupied, the number of plovers nesting along the coast was likely much higher.

The breeding population continued to decline after the 1981 surveys, and subsequent surveys estimated the number of breeding birds at 1,386 in 1989 (Page et al. 1991), 1,180 in 1991, and 967 in 1995 (G. Page, Point Reyes Bird Observatory, Stinson Beach, California, unpublished data). Based on Christmas Bird Counts from 1962 to 1984, the number of wintering birds had also declined, at least in southern California (Page et al. 1986). The current population estimate for the U.S. portion of the Pacific Coast Western Snowy Plover is approximately 2,270 breeding individuals.

Within the project area, the snowy plover populations have fluctuated substantially over the years. Currently, one of the largest active breeding areas is located on Vandenberg AFB in northern Santa Barbara County where the western snowy plover occupies approximately 12.5 miles (20 km) of beach and dune habitat. Vandenberg AFB has previously supported up to 20 percent of the entire Pacific coast population of western snowy plovers. However, during the late 1990s, severe declines in the number of nesting plovers at this location occurred. In 1997, the breeding population on the base was estimated at 240 birds, but by 1999 the count had declined to only 78. at this location resulted in a beach closure was put into effect beginning in spring 2000 for all but about 2 miles of beach. Following the institution of the beach closure, however, the population rebounded significantly, with breeding populations of 259 and 245 birds in 2005 and 2006 respectively. During 2010, a total of 255 nests and 409 chicks were hatched at Vandenberg AFB sites (USFWS 2010a,b).

Declines on the nearby islands of Santa Rosa and San Miguel in the Channel Islands National Park have also occurred in the last decade, although numbers are difficult to assess due to their remoteness. A total of 72 snowy plovers were counted on eastern end of Santa Rosa Island (Skunk Point) during the 1998 breeding season, but only 41 the following year. In 2005, 37 birds were enumerated, however, during the latest breeding season (2010) only eight birds were counted on the island (USFWS 2010b). Although the breeding population has declined, Santa Rosa Island still supports a substantial wintering population of plovers, with over 242 birds counted in January 2010 (USFWS 2010a). A limited breeding population was also known to occur on San Miguel Island in the early 1990s; however, no breeding plovers have been observed at this island in the last decade. In recent years one to two snowy plovers have been documented utilizing the western portions of Santa Cruz Island during winter, but no breeding has taken place here.

In contrast to declines at the northern Channel Islands locations, increases in nesting at two other nearby mainland colonies have occurred in recent years: Coal Oil Point and Ormond Beach. Although plovers historically bred at University of California, Santa Barbara (UCSB)'s Coal Oil Point Reserve, the site produced no snowy plover chicks from the time it opened to the public in 1970 until the summer of 2001. Implementation of an aggressive management plan including predator management, public outreach, and protective fencing resulted in re-establishment of a small, but viable plover breeding population beginning in 2002. Over the last decade, this location has supported a small number of breeding plovers, culminating in 2009 when a total of 65 plover nests were counted and 61 chicks were hatched. Severe storms and predation affected the site in 2010, resulting in only 15 documented nesting attempts. Coal Oil Point also supports a substantial population (100-400) of wintering snowy plovers. In January 2006, 325 wintering plovers were observed at this location. During the annual survey conducted in January 2010, 174 wintering plovers were observed (USFWS 2010a).

Since 2000, the breeding population at Ormond Beach has remained between 10 and 35 birds. In 2005, a total of 22 nesting attempts resulted in 15 hatchings at this location. Numbers have increased slightly since then, with 33 nests and 18 successfully hatchings recorded in 2009. In 2010, 27 nests and 19 successfully hatchings were documented (USFWS 2010b, USFWS 2011).

3.2.4 Short-tailed Albatross (Endangered)

Status. With a wingspan of over 2 meters (>7 feet) the short-tailed albatross (*Phoebastria albatrus*) is the largest of the three albatross species that inhabit the North Pacific Ocean. It is best distinguished from other albatrosses by its large, bubblegum-pink bill. This species was listed as endangered throughout its range in July 2000 (65 FR 46643). A recovery plan was circulated in 2005 and finalized in 2008 (USFWS, 2008), however, critical habitat has not been designated for this species. Overharvesting and habitat loss were the primary reasons for the original listing of the short-tailed albatross; however, habitat loss from volcanism and storms are the current main threats.

Range and Habitat. The short-tailed albatross ranges widely throughout the North Pacific Ocean, including waters off China, Japan, Russia, the Bering Strait, the west coast of Canada and the United States, and Mexico's Baja Peninsula. Short-tailed albatrosses forage widely across the temperate and subarctic North Pacific, traveling to the waters of the California Current and the Gulf of Alaska to take advantage of the nutrient-rich upwellings in these regions. Historically, millions of short-tailed albatrosses bred in the western North Pacific on several islands south of the main islands of Japan. However, following a complete population collapse due to overharvesting, today there are only two active breeding colonies: Torishima Island and Minami-kojima Island, Japan. In addition, a single nest was recently found on Yomejima Island of the Ogasawara Island group in Japan. Single nests have also begun to occur on Midway Island, Hawaii.

Reproduction. Like many seabirds, short-tailed albatrosses are long-lived, with some known to be over 40 years old. However, they are also slow to reproduce. They begin breeding at about 7 or 8 years old, and mate for life, although they have been known to create a new pair bond if their original mate disappears or dies. Short-tailed albatrosses nest almost exclusively on the sloping grassy terraces of the isolated volcanic island of Torishima, Japan and exhibit high nesting site fidelity. Pairs lay a single egg each year in October or November. Eggs hatch in late December through early January. Chicks remain near the nest for about 5 months, fledging in June. After breeding, short-tailed albatrosses move to feeding areas in the North Pacific.

Diet. Prey items for this species include flying fish eggs, shrimp, squid, and crustaceans. Short-tailed albatross feed primarily during daybreak and twilight hours and have been known to forage as far as 3,200 km (1,988 miles) from their breeding grounds. They feed largely on squid and fish on the surface of the ocean, as well as on the offal discharged by fishing boats. Recent telemetry studies indicate that this species seems to prefer foraging areas of ocean that are less than 1,000 meters where deep, fertile waters well up into shallower areas.

Population Status. Prior to the 20th century, the short-tailed albatross was the most abundant of the North Pacific albatross species, with a population numbering more than a million birds. The species was considered "fairly common at sea, irrespective of season" in the waters off California, and was thought to be the most common albatross encountered in inshore waters as indicated by the predominance of its bones in shellmounds at locations such as Point Mugu (Grinnell & Miller 1994).

During the late 1800s and early 1900s, however, the species was nearly driven to extinction by feather hunters and egg collectors who sought their long, white wing and tail feathers to make pen plumes and their downy body feathers to stuff feather beds. Between approximately 1885 and 1903, an estimated five million short-tailed albatrosses were harvested from the main breeding colony on Torishima. Although a ban on the collection of short-tailed albatross feathers was instituted in 1906, it was not very effective and illegal feather collection continued until the 1930's, when the species was no longer economically significant because its numbers had been reduced so drastically. Then in 1939, the last remaining breeding grounds on the island of Torishima were buried under 10-30 meters of lava as a result of a massive volcanic eruption.

In 1949, the species was mistakenly declared extinct, but in the early 1950s, ten pairs were discovered breeding on Torishima. Over the last half century, this remnant population has slowly re-established, and in the last several years has begun to expand rapidly, increasing in size at a rate of 6 to 8 percent annually. The current world population of short-tailed albatross is currently estimated at 2,700 birds,

As its population increases, individuals have slowly started to reappear in California waters, with the first recorded sighting since 1900 observed 40 miles west of San Clemente Island on 28 August 1977. Since that date there have been a total of more than 33 records in California waters, 15 of which have occurred since 2007. As the population continues to rebound, a heightened presence off the California coast is expected, particularly in areas of upwelling.

3.2.5 Light-footed Clapper Rail (Endangered)

Status. The light-footed clapper rail (*Rallus longirostris levipes*) is a coastal marsh dwelling species that was listed as endangered on October 13, 1970 (35 FR 8320). There are currently believed to be only 250-350 pairs left in California, with most found in Upper Newport Bay and the Tijuana Marsh. A recovery plan was approved in 1979 (USFWS, 1979), however, critical habitat has not been designated for this species. Population declines related to habitat loss were the primary reason for listing this species.

Range and Habitat. The current and historic range of the light-footed clapper rail extends from Bahia de San Quintin, Baja California, Mexico to Santa Barbara County, California where they are restricted to coastal salt marshes. Although, historically, most of the salt marshes in this region were probably occupied by rails, no more than 24 marshes have been occupied since about 1980 (Zembal and Hoffman, 1999). Only a portion of these marshes are used each year. For example, from 1997 to 1999, 16, 17, and 14 marshes were occupied, respectively (Zembal and Hoffman, 1999). The vast majority (more than 95 percent) of the remaining rails are in Orange and San Diego counties. For example, of the 222 pairs recorded in 1998, 189 (85 percent) of these occurred at only three sites: Upper Newport Bay and Seal Beach and Tijuana marsh National Wildlife Refuges. In the general area of concern for the proposed development of the Electra Field, there are presently only two marshes that are, or have the potential to be, occupied by rails. These are Carpinteria Marsh in Santa Barbara County and Mugu Lagoon in Ventura County. The next closest location for rails is the Seal Beach National Wildlife Refuge in Orange County.

The light-footed clapper rail is normally found in estuarine habitats, particularly salt marshes with well-developed tidal channels. Dense growths of cordgrass (*Spartina foliosa*) and pickleweed (*Salicornia* sp.) are conspicuous components of rail habitat, and nests are located most frequently in cordgrass. In a radio-telemetry study conducted in Newport Back Bay, radio-tagged rails spent about 90 percent of their time in cordgrass, in the lower marsh (Zembal et al. 1989). At low tides they also hunted along creek banks. When water covered the lower marsh, radio-tagged rails foraged on higher ground in sparser vegetation.

Reproduction. Clapper rails construct loose nests of plant stems, either directly on the ground when in pickleweed or somewhat elevated when in cordgrass (USFWS, 1979). Although nests are usually located in the higher portions of the marsh, they are buoyant and will float up with the tide. Eggs are laid from mid-March to the end of June, but most are laid from early April to early May. Clutch size ranges from 3-11, with clutches of 5-9 most common. The incubation period is about 23 days, and young can swim soon after hatching.

Diet. Clapper rails forage mainly by shallow probing of sediment or surface gleaning. Their diet includes small crabs, other crustaceans, slugs, insects, small fish, and eggs (Edelman and Conway, 1998).

Reasons for Decline. Rails may have suffered declines originally in the early 1900s due to overhunting. By far, however, the main reason for the decline has been habitat destruction and degradation. Of the approximate 26,000 acres of historic coastal wetlands, less than 8,500 acres remain (Speth, 1971), and only a fraction of the remaining acreage provides suitable habitat for the light-footed clapper rail. Also, the remaining coastal wetlands often lack important "buffers" where species can retreat during high water and where pollutants and sediments can be filtered before entering the wetland itself, as well as good connections to uplands and to the ocean. Predation has also played a role in the decline of the species. With the implementation of active management, there is hope for improving the health of this species. Ongoing management efforts include habitat restoration through the reestablishment or enhancement of tidal action to historic habitat; predator management, research, and control; nest site enhancement; captive breeding; translocation; and continuing research into the life history of the species.

Population Status. Based on the first statewide survey, the California population was estimated at about 500 birds (Wilbur, 1974), although this estimate is believed to be somewhat high (USFWS, 1979). Since 1980, the California population has ranged from a low of 284 birds in 1985 to a high of 882 in 2011(Zembal and Hoffman 1999; Zembal et al 2006, Zembal et al 2011). The number of marshes occupied has also varied from a low of 8 in 1989 to a high of 21 in 2011. In 2011, a total of 441 pairs of light-footed clapper rails exhibited breeding behavior in 21 marshes in southern California (Zembal et al 2011). This is the second largest statewide breeding population detected since the counts began in 1980. Although surveys have not been conducted in Baja California for several years, the Baja population is thought to consist of at least 400-500 pairs.

Upper Newport Bay currently comprises the largest subpopulation in California, with 137 pairs (31 percent of the state population) in 2011. Together with the subpopulation in the Tijuana Marsh, these two marshes contain a total of 250 pairs, comprising 57 percent of the breeding population in California.

In the general area of concern for the Electra Field project, two marshes have historically been occupied by clapper rails, Carpinteria Marsh and Mugu Lagoon (Zembal et al 2011). These wetlands represent the northernmost habitat for the light-footed clapper rail. Although as many as 26 pairs have been known to occur at Carpinteria Marsh, the rail population of the marsh declined sharply in 1985, and no rails were found during annual surveys from 1989 to about 1994. From 1995 to 2002, there were approximately 1-5 nesting pairs, along with a few apparently unmated birds. However, the last know clapper rail call from Carpinteria Marsh was heard from an unmated female in 2003. In April 2004, two males were released in the marsh in the hope they would find and mate with the previously heard female; however, recent surveys have not detected the presence of rails at this marsh (Zembal et al 2011). The chances for a viable subpopulation of light-footed clapper rail to become re-established in Carpinteria Marsh are currently considered non-existent without improvements in predator and habitat management at this location (Zembal et al 2006).

The rail subpopulation at Mugu Lagoon fluctuated between 3 and 7 pairs for nearly 20 years until recent augmentations fostered its growth. A captive breeding program for the light-footed clapper rail was first established in 1998. Although the first several years of the program were unproductive, since 2000, over 100 rails have been released into the wild, including several at Mugu Lagoon. Additionally, there have been occasional re-sightings of banded rails at Point Mugu, indicating that some of the captive-bred rails remained local after being released into the marsh (Zembal et al 2006). The increased population at this location appears to have led to an expansion of habitat use within the lagoon. For example, in 2004, a pair of rails was observed attempting to breed in the eastern arm of the lagoon for the first time in many years (Zembal et al 2006). Following a population crash in 2008 the clapper rail population at Point Mugu quickly rebounded to 12 pairs in 2010, and more than 16 pairs in 2011 (Zembal et al 2011).

3.3 Reptiles

Historically, four species of sea turtles have been recorded in the eastern North Pacific: the leatherback sea turtle (*Dermochelys coriacea*), the green sea turtle *(Chelonia mydas*), the Olive ridley sea turtle (*Lepidochelys olivacea*), and the loggerhead sea turtle (*Caretta caretta*) (Caldwell, 1962; Márquez, 1969; Hubbs, 1977). Populations of all species have been greatly reduced by overharvesting, incidental bycatch by the fishing industry, and, to a lesser extent, coastal development of nesting beaches in developed countries (Ross, 1982).

3.3.1 Leatherback Sea Turtle (Endangered)

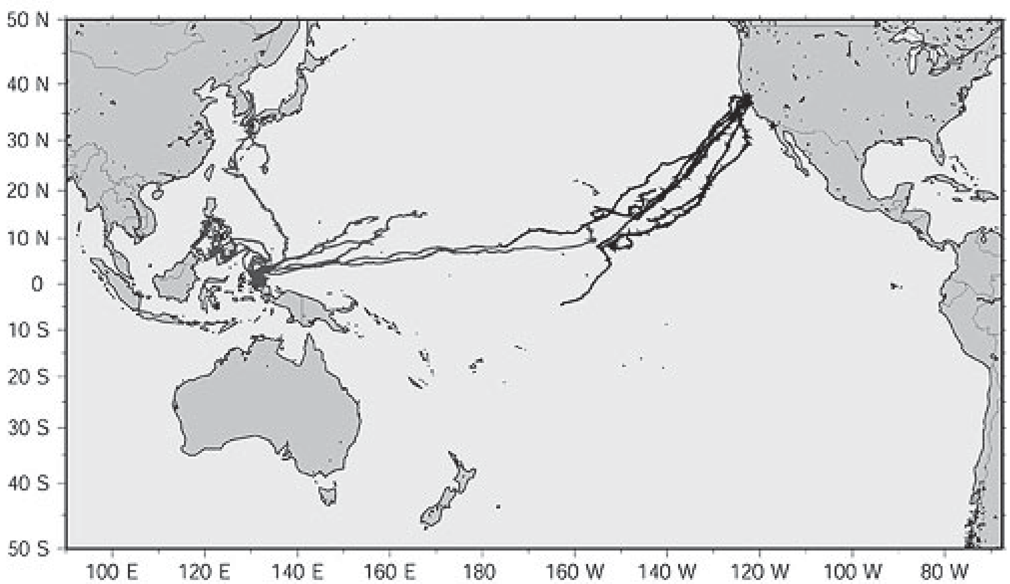
Status. The leatherback sea turtle (*Dermochelys coriacea*), was listed as endangered on June 2, 1970 (35 FR 8495), and a recovery plan was finalized in 1998 (NMFS and USFWS, 1998a-d). Critical habitat was designated for the leatherback turtle along the western U.S coast in January 2012, including 16,910 square miles off California's central coast (77 FR 4170). This area of critical habitat stretches from Point Arena to Point Arguello east of the 3,000-meter depth contour.

Range and Habitat. Leatherback sea turtles, the largest of the sea turtles, occur throughout the Atlantic, Indian, and Pacific Oceans (Mager, 1984). Full-grown specimens reach average lengths of 7 feet, have a span of 8.9 feet from flipper to flipper, and can weigh as much as 650 to 1200 lbs (Eckert, 1997). Leatherbacks commonly range farther north than other sea turtles, probably because of their ability to maintain warmer body temperatures over longer time periods (Frair et al. 1972). They have been sighted in the eastern north Pacific as far north as Alaska (Mager, 1984), and small numbers forage seasonally off the central California coast (Figure 4-1).

Leatherbacks nest at beaches in tropical latitudes, and it was long thought that the local visitors observed off the Pacific coast of the United States originated from the western Mexico, Central America, and northern Peru breeding populations (Mager, 1984). However, genetic analyses of individuals sampled off Monterey, California, and from turtles stranded on California beaches, indicate that the majority of these animals originate from western Pacific nesting stocks, most likely North Papua, Papua New Guinea, or the Solomon Islands (Dutton et al 2001). Satellite telemetry studies, shown in Figure 3-3, support this revised interpretation of the leatherback origins (MBNMS 2002, Paladino 2012). Turtles tagged after nesting in July at Jamursba-Medi arrived in waters off California and Oregon during July-August (Benson et al. 2007a; 2011) coincident with the development of seasonal aggregations of jellyfish (Shenker, 1984; Suchman and Brodeur, 2005; Graham, 2009).

Additional tagging efforts have revealed that leatherbacks in the western Pacific region, although considered a single genetic stock, comprise multiple foraging populations. Turtles that nest during the winter months undertake migrations to the south, while those that nest during summer months move to northern foraging grounds, including the western coast of North America. In contrast, leatherbacks originating from the eastern Pacific nesting grounds off Mexico and Costa Rica tend to migrate south from their nesting beaches to forage areas located off South America and the Galapagos Islands (Morreale et al. 1996, Eckert and Sarti 1997).

Figure 3-3 Satellite-Tracked Leatherback Movements from Nesting Beaches in the Western Pacific and Foraging Areas off the California Coast in 2003-2004.



Source: http://www.montereybay.noaa.gov/reports/2005/eco/openocean.html

In light of the importance of foraging habitats off central and northern California waters to the survival of Pacific leatherbacks, in January 2012 the NMFS designated critical habitat for this species off the U.S. west coast, including 16,910 square miles off California's central coast (77 FR 4170). This area of critical habitat stretches from Point Arena to Point Arguello east of the 3,000-meter depth contour.

Reproduction. Leatherbacks are believed to reach sexual maturity in about 16 years. Female leatherbacks migrate between temperate foraging grounds and subtropical and tropical nesting beaches at 2 to 3-year intervals (NMFS and USFWS, 1998a). Nesting females seem to prefer high energy beaches (beaches immediately adjacent to deep water). Female leatherbacks nest an average of 5 to 7 times within a nesting season. The nests are constructed at night in large clutches harboring an average of 80 to 85 eggs. Typically incubation takes from 55 to 75 days, and emergence of the hatchlings occurs at night. Once hatched, the young instinctively make for the sea.

Diet. Although considered omnivorous (feeding on sea urchins, crustaceans, fish, and floating seaweed), leatherbacks feed principally on soft foods such as jellyfish (scyphomedusae) and tunicates (salps, pyrosomas) (Mager, 1984; NMFS and USFWS, 1998a). Dense swarms of jellyfish can contain nearly 80 percent as much carbon as the densest copepod populations (Shenker 1984), providing a rich food source for predators such as the leatherback. Leatherbacks also may forage nocturnally at depth on siphonophores and salps in the deep scattering layer (Eckert et al. 1989; NMFS and USFWS, 1998a).

Population Status. Pritchard (1971) estimated that there were at least 8,000 nesting females in the eastern Pacific, and later estimated a total world population of 115,000 mature females (Pritchard, 1982). However, by 1995 the worldwide population estimate had dropped to between 26,200 and 42,900 adult females (Spotila et al. 1996, Spotila et al. 2000).

The Pacific portion of the population, in particular, continued to undergo dramatic decline. Between 1996 and 2000, the number of female leatherbacks in the eastern Pacific population dropped from 4,638 to about 1,690. Meanwhile, the western Pacific population also underwent substantial declines. The entire Pacific Ocean is currently thought to contain perhaps as few as 2,300 breeding females.

In the western Pacific, the major nesting beaches occur in Papua New Guinea, Papua-Indonesia, and the Solomon Islands, with lesser nesting reported on Vanuatu; compiled nesting data estimated approximately 5,000 to 9,200 nests annually since 1999, with 75 percent of the nests being laid in Papua-Indonesia.

Inshore waters off California, between Point Conception and Point Arena, are visited annually by approximately 150 to 170 leatherback turtles, with the greatest numbers occurring during summer and early fall when large aggregations of jellyfish form (Bowlby, 1994; Starbird et al. 1993; Benson et al. 2007b; Graham, 2009). Most (83 percent) of the sea turtles sighted off northern and central California by Dohl et al. (1983) during their 3-year survey were leatherbacks, and nearly 90 percent of these sightings were made during the summer and fall. Sightings were widely distributed from 10 to 185 km offshore, and most were recorded in waters over the continental slope.

3.3.2 Green Sea Turtle (Endangered)

Status. The green sea turtle (*Chelonia mydas*) was listed as endangered on July 28, 1978 (43 FR 32808). The recovery plan for the Pacific population of this species was finalized in 1998 (NMFS and USFWS, 1998a-d). No critical habitat has been designated for this species in western U.S. waters.

Range and Habitat. Green turtles (*Chelonia mydas*) occur in temperate and tropical waters worldwide (Seminoff 2004), although the population of this species has declined approximately 90 percent in the last 50 years (Stebbins 2003). Prior to commercial exploitation green turtles were abundant in the eastern Pacific from Baja California south to Peru and west to the Galapagos Islands (NMFS and USFWS, 1998b). Although typically found in waters that remain above 20°C during the coldest months, sightings and strandings have been recorded off the Pacific coast as far north as British Columbia. Most sightings, however, have been reported from northern Baja California and southern California (Mager 1984, NMFS and USFWS 1998b, Smith and Houck 1984, Green et al. 1991).

The green sea turtles that are periodically encountered off the southern California typically originate from nesting sites in the Revillagigedos Islands and the mainland coast of Michoacan, Mexico (NMFS and FWS 2007). Although uncommon north of Mexico, green turtles can be sighted year-round in southern California waters, with the highest concentrations occurring from July through September

Additionally, two small, permanent colonies of green turtles are currently known to exist in southern California, although the only known nesting location for green turtles in the continental U.S. is on the east coast of Florida. One colony of 60 to 100 turtles resides in the southern end of San Diego Bay, while another group of approximately 30 turtles is now recognized as residing where warm water is discharged into the brackish mouth of the San Gabriel River from a Long Beach power plant (the Los Angeles Department of Water and Power's Haynes Generating Station). Green sea turtles are also occasionally seen elsewhere along the California coast, usually in El Niño years when the ocean temperature is higher than normal.

Reproduction. As with other marine turtle species, mating takes place at sea. Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way. While nesting season varies from location to location, in the southeastern U.S., females generally nest in the summer between June and September; peak nesting occurs in June and July. During the nesting season, females nest at approximately two-week intervals. They lay an average of five nests, or "clutches." In Florida, green turtle nests contain an average of 135 eggs, which will incubate for approximately 2 months before hatching.

After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years, feeding close to the surface on a variety of pelagic plants and animals. Eventually, they leave the pelagic habitat and travel to nearshore foraging grounds.

Diet. Recent studies have demonstrated that green sea turtles are not the obligate herbivores they were once thought to be. In addition to feeding on algae and sea grasses, their diet also consists of invertebrates such as jellyfish, sponges, sea pens, and pelagic prey (Godley et al. 1998, Heithaus et al. 2002, Seminoff et al 2002b, Hatase et al. 2006).

Population Status. As stated previously, turtles encountered off the California coast typically originate from nesting sites in the Revillagigedos Islands and the mainland coast of Michoacan, Mexico (NMFS and FWS 2007). Approximately 90 turtles nest annually at the Revillagigedos Islands while the mainland coast of Michoacan, Mexico hosts approximately 1,375 nesting female turtles annually (NMFS and FWS 2007).

3.3.3 Olive Ridley Sea Turtle (Threatened)

Status. Olive ridley sea turtles (*Lepidochelys olivacea*) are the smallest of the sea turtles to occur in the Pacific Ocean (Mager, 1984). They were listed as threatened on July 28, 1978 (43 FR 32808). The recovery plan for the Pacific population of this species was finalized in 1998

(NMFS and USFWS, 1998a-d). No critical habitat has been designated for this species in western U.S. waters.

Range and Habitat. Olive ridleys occur worldwide in tropical to warm temperate waters and are considered to be the most abundant sea turtle in the world (NMFS and USFWS, 1998c). In the eastern North Pacific, the species' main foraging areas extend between Colombia and Mexico. Major nesting beaches are, as with many other eastern Pacific sea turtles, on the Pacific coasts of Mexico and Costa Rica, although a few may nest as far north as Baja California (Mager, 1984; NMFS and USFWS, 1998c).

These sea turtles are infrequent visitors to the waters north of Mexico. According to Green et al. (1991) Pacific ridleys have stranded on the Washington and Oregon coasts during the past decade, and strandings have also been recorded from northern California (Houck and Joseph, 1958; Smith and Houck, 1984). According to the California Marine Mammal Stranding Network Database, of the three marine turtle strandings reported on Santa Barbara County beaches over the past eleven years (2001-2011), two were of olive ridley turtles. Hubbs (1977) observed a pair of Pacific ridleys mating in the water off La Jolla, San Diego County, California, in August 1973.

Reproduction. As with other marine turtle species, mating takes place at sea. Adult females migrate from foraging areas to mainland or island nesting beaches and may travel hundreds or thousands of kilometers each way. While nesting season varies from location to location, in the southeastern U.S., females generally nest in the summer between June and September; peak nesting occurs in June and July. In the eastern Pacific, ridleys nest throughout the year, with peaks occurring from September through December (NMFS and USFWS, 1998c). During the nesting season, females nest at approximately two-week intervals. They lay an average of five nests, or "clutches." In Florida, green turtle nests contain an average of 135 eggs, which will incubate for approximately 2 months before hatching.

After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years, feeding close to the surface on a variety of pelagic plants and animals. Eventually, they leave the pelagic habitat and travel to nearshore foraging grounds.

Diet. Olive ridley turtles are considered omnivorous, feeding on a variety of benthic and some pelagic items. USFWS identified prey include fish, crabs, shrimp, snails, oysters, sea urchins, jellyfish, salps, fish eggs, and vegetation (Ernst and Barbour, 1972; NMFS and USFWS, 1998c). Pacific ridleys may also scavenge USFWS.

Population Status. Currently, as many as 200,000 females are estimated to nest in Mexico each year (Márquez, 1990; NMFS and USFWS, 1998c).

3.3.4 Loggerhead Sea Turtle (Endangered)

Status. Loggerhead sea turtles (*Caretta caretta*) are the second largest of the sea turtles after leatherbacks, and are so named for their large heads which support blunt jaws. Loggerhead turtles were listed as endangered on July 28, 1978 (43 FR 32808). The recovery plan for the Pacific population of this species was finalized in 1998 (NMFS and USFWS, 1998a-d).

Although the loggerhead turtle was originally listed as threatened, a status review conducted for this species in 2009 elevated the status of the stock occurring off the western U.S. coast to endangered (Conant et al. 2009). No critical habitat has been designated for this species.

Range and Habitat. Loggerhead sea turtles inhabit subtropical to temperate waters worldwide, and are generally found in waters over the continental shelf (Carr, 1952; Mager, 1984). Following completion of a status review in 2009, the NMFS subsequently published a Final Rule recognizing nine Distinct Population Segments (DPSs) of loggerhead seat turtles under the ESA (76 FR 58868). In this rule, the NMFS recognized The North Pacific population of the loggerhead turtle as distinct from other population segments, and reclassified its status from threatened to endangered.

Stebbins (1966) listed southern California as the northern limit of the loggerhead range; however, these sea turtles are generally infrequent visitors to the waters north of Mexico. The waters off Mexico and southern California appear to support important developmental habitat for juvenile loggerheads and are used as foraging grounds and migratory corridors for a wide range of juvenile size classes. Most sightings of this species in California waters occur during the summer, peaking from July to September (Guess, 1982; NMFS and USFWS, 1998d). However, sightings may occur throughout much of the year during El Niño events when ocean temperatures rise. Although Smith and Houck (1984) reported no sightings of this species for northern California, Green et al. (1991) state that this species has stranded on the Washington and Oregon coasts during the past two decades.

Reproduction. Loggerheads nest on beaches and occasionally on estuarine shorelines in tropical and subtropical areas worldwide. Females instinctively return to their natal beaches to lay eggs. Nests are typically laid between the high tide line and the dune front (Routa 1968, Witherington 1986, Hailman and Elowson 1992).

Diet. Loggerhead sea turtles are omnivorous, feeding on a variety of benthic prey including shellfish, crabs, barnacles, oysters, jellyfish, squid, sea urchins, and occasionally on fish, algae, and seaweed (Carr, 1952; Mager, 1984; NMFS and USFWS, 1998d). Their powerful jaws also enable them to feed on hard-shelled prey, such as whelks and conch. Sexual maturity ranges between 25 and 35 years.

Population Status. Loggerhead turtles are the most abundant of all the marine turtle species in U.S. waters, with substantial breeding areas occurring on the Atlantic and Gulf Coasts. Loggerheads nest within the U.S. from Texas to Virginia, although the largest nesting concentrations are found in Florida, Georgia, South Carolina, and North Carolina. However, the majority of loggerhead nesting is at the western rims of the Atlantic and Indian Oceans. The most recent reviews show that only two loggerhead nesting aggregations have greater than 10,000 females nesting per year: South Florida (U.S.) and Masirah (Oman).

Sightings of loggerhead turtles off California generally consist of juveniles that have crossed the Pacific Ocean after hatching on beaches in southern Japan, which contains the only known nesting areas for loggerheads in the North Pacific (Stebbins 2003, Kamezaki et al. 2003), although low level nesting may also occur in areas surrounding the South China Sea (Chan et al.

2007). Nesting aggregations in Japan are small, with perhaps 100 to1,000 females nesting annually.

3.4 Invertebrates

3.4.1 White Abalone (Endangered)

Status. The white abalone (*Haliotis sorenseni*) was listed by NMFS as an endangered species on May 29, 2001, effective June 28, 2001, after a comprehensive status review of the species was completed (NOAA 2001; 66 FR 29054). A draft recovery plan for the species was published on November 2, 2006 (NMFS 2006). This comprehensive document is the primary source of information from which the following subsections were drawn. No critical habitat has been designated for this species due to concerns that identifying critical habitat areas would increase the threat of poaching (66 FR 29048).

Overexploitation leading to a lack of reproductive success was the most significant factor in the listing of this species. White abalone in California were subject to serial depletion by the commercial fishery during the early 1970s. Due to their life history characteristics as long-lived, slow moving bottom dwellers with external fertilization, abalone are particularly susceptible to local and subsequent serial depletion. If male and female abalone are not within a few meters of one another when they both spawn, the sperm will be too diluted by diffusion to fertilize the eggs. As local abalone densities declined with overfishing, the probability of successful fertilization and subsequent recruitment also declined. Regulatory measures instituted at the time also proved inadequate to conserve the species.

Range and Habitat. The historic range of white abalone extended from Point Conception, California, USA to Punta Abreojos, Baja California, Mexico with the historical population center located at the California Channel Islands (NMFS 2006). In the northern part of the California range, white abalone were reported as being more common along the mainland coast, while in the middle portion of the California range, they were noted to occur more frequently at the offshore islands (especially San Clemente and Santa Catalina Islands). At the southern end of the range, in Baja California, Mexico, white abalone were reported to occur more commonly along the mainland coast, but were also found at a number of islands. It remains unknown whether this distribution pattern resulted because of lack of suitable habitat along the mainland coast in the middle portion of the range, or was due to overfishing in the more accessible mainland regions (NMFS 2006).

Since the mid-1990s, extremely low numbers of isolated survivors have been identified along the mainland coast in Santa Barbara County and at some of the offshore islands and banks in the middle portion of the range. This information indicates that the current range of white abalone in California may be similar to what it was historically. No recent information on current range is available for Baja California.

Adult white abalone occur in open, low relief rocky reefs or boulder habitat surrounded by sand. They are usually found between 20-60 m depths, but were most common historically between 25-30m deep. A recent survey found the highest densities of white abalone at 40-50m depth.

Suitable habitat for the white abalone is inherently patchy, thus, the distribution of white abalone is likewise patchy.

Factors controlling the depth distribution of white abalone are poorly known. Biological factors, such as competition and predation, have been implicated as factors controlling the upper limit, while water temperature and food availability have been implicated as factors controlling the lower limit. Speculation has also occurred over whether white abalone may have been restricted to deeper waters (> 25 m) as a result of sea otter predation or competition from pink abalone. There is also some evidence that abalone may shift to increasing depths as they age.

Reproduction. White abalone are dioecious, with separate sexes occurring in approximately a1:1 ratio. They reproduce through broadcast spawning (i.e. directly releasing gametes into the water column for external fertilization). Factors known to affect fecundity in abalone include organism size and food availability.

Synchronization of gonadal maturation and spawning are critical to successful fertilization in abalone. Gonads of white abalone mature on an annual cycle, and the spawning season of white abalone is of limited duration. Spawning in white abalone occurs in winter months, but sometimes extends into the spring. The duration of an individual spawning event is unknown. Experimental evidence suggests that fertilization rates are maximized when substantially more than one sperm contacts an egg, and the probability of this occurring decreases significantly with increasing distance between individuals (Leighton 2000).

Adult abalone of intermediate size are capable of spawning over two million viable eggs. In the laboratory, fertilization success rates of 96-100 percent have been achieved. Fertilized white abalone eggs are about 190-200 microns in diameter and are negatively buoyant.

Diet. The specific dietary preferences of white abalone are not well established. Like other abalone species, white abalone are herbivorous. Small individuals generally scrape bacteria and diatoms from the rocky bottom using their radula, while larger abalone depend on drift algae, especially deteriorating kelp. Laminaria and Macrocystis (brown algae) are believed to make up a large portion of the diet. The reddish brown color of the shell indicates that white abalone also consume some type of red algae throughout their life (NMFS 2006).

Population Status. At least a 99 percent reduction in white abalone density has occurred between the 1970s, when the last successful white abalone recruitment is thought to have occurred, and today. Current information on white abalone population size structure suggests that no evidence of recent recruitment exists, and that any ongoing recruitment is negligible throughout most of its former range. Data on density from areas where they have been located suggest that the remaining abalone are not close enough together to spawn (85 percent of the animals identified in 2002 were separated by linear distances that exceeded 10 m).

During the 1990s the combined estimate for both California and Mexico was approximately 2,600 animals. A 1999 survey of white abalone habitat in U.S. waters found only 157 live white abalone, an average density of only 2.7 per hectare of habitat. However ROV and multi-beam sonar surveys of two shallow banks off of the southern California coast conducted since 2000 have revealed that the white abalone population may be higher (approximately 12,820 for Tanner

Bank and approximately 7,360 for Cortes Bank) than previously thought. Regardless, the viability of animals in the wild remains uncertain because mostly large (>13 cm in shell length) animals were detected on the two offshore banks, and most animals observed were >2 m apart from their nearest neighbor, making successful reproduction unlikely (NMFS 2006).

3.4.2 Black Abalone (Endangered)

Status. Black abalone (*Haliotis cracherodii*) was listed as endangered On January 14, 2009 (74 FR 1937). The NMFS designated critical habitat for black abalone in October 2011 (76 FR 66806). The designated critical habitat encompasses approximately 360 km^2, extending along most of the California coast from the Del Mar Ecological Reserve in Sonoma County south to Point Conception. It also includes the waters around the Channel Islands and the Palos Verdes Peninsula.

Impacts from withering syndrome combined with overexploitation were the most significant factors in the listing of this species. Over-harvesting along the southern California coast decimated black abalone populations until, by the mid-1980s, black abalone were found primarily on offshore islands and inaccessible sections of the coast north of Santa Barbara. At around the same time, however, black abalone on the Channel Islands began to suffered massive local die-offs with losses in excess of 90 percent of the population as a result of ‘withering syndrome’, a fatal wasting disease where the foot of the abalone shrinks until it can no longer adhere to the substratum. Due to concerns about the species’ decline, California's black abalone fishery closed in 1993.

Withering syndrome is caused by a prokaryote that invades the digestive tract of abalone, impairing the production of digestive enzymes and effectively starving the abalone to death. The tell-tale symptom of the disease is atrophy or ‘shrinking’ of the muscular foot of the abalone. This also impairs the abalone's ability to adhere to substrate, making it far more vulnerable to predation. Withering syndrome spread from the Channel Islands to the mainland coast in 1992, where it proceeded to eradicate most black abalone populations in the waters south of Point Conception and now continues to spread northward along the central coast.

For reasons not fully understood, some abalone can be infected with the bacterium without developing the disease. It is believed, however, that changes in environmental conditions, such as warmer than normal water temperatures, may induce the disease in abalone that already harbor the bacterium, such as during El Nino events, or when the ocean temperature rises above 65° Fahrenheit (18°C).

Range and Habitat. The range of black abalone historically extended from about Point Arena in northern California to Bahia Tortugas and Isla Guadalupe, Mexico. Black abalone are typically rare north of San Francisco and south of Punta Eugenia, although unconfirmed sightings have been reported as far north as Coos Bay, Oregon.

Black abalone reside on rocky relief areas extending from the high intertidal zone out to 6 m depth, though they are most abundant intertidally. They appear to tolerate water temperatures ranging between 7-24°C (45-75°F). Black abalone are often found in a clumped distribution in preferred microhabitats. Smaller individuals (<90 mm) tend to stay within the protective confines of crevices, under rocks, and in boulder fields, while larger individuals may occupy more exposed rocks and surge channels. Black abalone larvae settle into areas characterized by bare rock and crustose coralline red algae. In areas where the density of large adult black abalone (or other grazers) has declined drastically, formerly suitable settlement habitat can become overgrown with encrusting sessile invertebrates (e.g. tube worms and tube snails) and may prevent settlement of black abalone larvae.

Reproduction. Black abalone live for approximately 20 to 30 years. As with other abalone species, black abalone reproduce through broadcast spawning. Spawning occurs in spring and early summer, although, occasionally a second spawning event in the fall. The abalone reach maturity at about 3 years old, or when they reach 1.5 inches (4 cm) length. Black abalone have short larval durations and limited dispersal capability; larvae are free-swimming for approximately 4 to 10 days before they settle onto hard substrate, usually near larger individuals. Analysis of the genetic structure of black abalone populations on the central California coast indicates that these populations are composed predominantly of individuals that were spawned locally (i.e. black abalone larvae do not tend to travel very far along the coast).

Diet. Like other abalone species, black abalone are herbivorous. Small individuals generally scrape bacteria and diatoms from the rocky bottom using their radula, while larger abalone depend on drift algae, especially deteriorating kelp. The primary food species are thought to be giant kelp and feather boa kelp in southern California (i.e., south of Point Conception) habitats, and bull kelp in central and northern California habitats.

Population Status. In most locations south of Point Conception, black abalone have gone locally extinct, while populations along the central coast are now in substantial decline as a result of withering syndrome. This disease has now decimated the populations south of San Simeon, and continues to expand northward. In most areas south of and including Cayucos, adult densities have dropped below the average minimum density where recruitment failure occurs. Recent surveys indicate that there has been no recruitment, and habitats once having abalone have been altered, making re-colonization increasingly less likely. The last extant large and healthy populations of black abalone on the central coast exist in the Monterey Bay National Marine (Bell et al 2009).

Pre-disease, the population between Half Moon Bay and Santa Barbara has been estimated at approximately 1.9 million. Overall, the population has declined by 85 to 99 percent where withering syndrome is present. As of 2008, all known black abalone populations south of Monterey County, California, have experienced major losses, thought largely to be due to withering syndrome. The best estimate of the remaining black abalone population within the study area is approximately 1.3 million (+/-500,000), with 92 percent of those individuals residing within the waters of the Monterey Bay National Marine Sanctuary (Bell et al 2009). However, available evidence indicates that mass mortalities associated with the disease continue to expand northward along the California coast.

Although black abalone populations at select sites on two of the Channel Islands (San Nicolas and Santa Rosa) have shown evidence of successful recruitment, populations in all other areas that have been affected by withering syndrome remain at or near extirpation and have not experienced successful recruitment in recent years. Estimates suggest that with no change, the species could become extinct in 30 years.

3.5 Amphibians

3.5.1 California Red-legged Frog (Threatened)

Status. The California red-legged frog (*Rana draytonii*) was listed as threatened on May 23, 1996 (61 FR 25813). A final recovery plan for the species was published in September 2002, and on April 13, 2006, the U.S. Fish and Wildlife Service issued its final designation of critical habitat for this species (FWS 2002, FWS 2006). This final designation included 450,288 acres in 20 California counties. Critical habitat for this species was subsequently revised and expanded in a final rule issued in March 2010 to encompass approximately 1,636,609 acres in 27 counties. The California red-legged frog has been extirpated from 70 percent of its former range and is threatened in its remaining range by a wide variety of human impacts, including urban encroachment, construction of reservoirs and water diversions, introduction of exotic predators and competitors, livestock grazing, and habitat fragmentation.

Range and Habitat. The historical range of the California red-legged frog extended coastally from the vicinity of Point Reyes National Seashore, Marin County, and inland from the vicinity of Redding, Shasta County, southward to northwestern Baja California, Mexico (Jennings and Hayes, 1985; Hayes and Krempels, 1986).

The following recovery units within the historical range of the California red-legged frog have been established: (1) the western foothills and Sierran foothills to 5,000 feet in elevation in the Central Valley Hydrographic Basin; (2) the central coast ranges from San Mateo and Santa Clara counties south to Ventura and Los Angeles counties; (3) the San Francisco Bay/Suisun Bay hydrologic basin; (4) southern California, south of the Tehachapi Mountains; and (5) the northern coast range in Marin and Sonoma counties. These five units are essential to the survival and recovery of the California red-legged frog. Designation of recovery units assists the USFWS and other agencies in identifying priority areas for conservation planning under the consultation (Section 7) and recovery (Section 4) programs.

The California red-legged frog occupies a fairly distinct habitat, combining both specific aquatic and riparian components (Hayes and Jennings, 1988; Jennings, 1988). Adults require dense, shrubby or emergent riparian vegetation closely associated with deep (>0.7 m) still or slow moving water (Hayes and Jennings, 1988). The largest densities of California red-legged frogs are associated with deep-water pools with dense stands of overhanging willows (*Salix* spp.) and an intermixed fringe of cattails (*Typha latifolia*) (Jennings, 1988). Well-vegetated terrestrial areas within the riparian corridor may provide important sheltering habitat during winter. Adult frogs may be found seasonally in the coastal lagoons of the central California coast. They move upstream to freshwater when sand berms are breached by seawater from storms or high tides.

California red-legged frogs disperse upstream and downstream of their breeding habitat to forage and seek estivation habitat. Estivation habitat is essential for the survival of California red-legged frogs within a watershed. Estivation habitat and the ability to reach estivation habitat can be limiting factors in California red-legged frog population numbers and survival.

Estivation habitat for the California red-legged frog is potentially all aquatic and riparian areas within the range of the species and includes any landscape features that provide cover and moisture during the dry season within 300 feet of a riparian area. This could include boulders or rocks and organic debris such as downed trees or logs; industrial debris; and agricultural features, such as drains, watering troughs, spring boxes, abandoned sheds, or hay-ricks. Incised stream channels with portions narrower than 18 inches and depths greater than 18 inches may also provide estivation habitat.

Two designated critical habitat units exist in the general project area. At Jalama Creek, about 4.4 miles south of the City of Lompoc, 7,662 acres along the coast were designated, while at Gaviota Creek 11,328 acres were designated (FWS, 2006).

Reproduction. California red-legged frogs breed from November through March, with earlier breeding records occurring in southern localities (Storer, 1925). Egg masses that contain about 2,000-5,000 eggs are typically attached to vertical emergent vegetation, such as bulrushes or cattails. California red-legged frogs are often prolific breeders, laying their eggs during or shortly after large rainfall events in late winter and early spring (Hayes and Miyamoto, 1984). Eggs hatch in 6-14 days (Jennings, 1988). Larvae undergo metamorphosis 3.5 to 7 months after hatching (Storer, 1925; Wright and Wright, 1949). Sexual maturity normally is reached at 3-4 years of age (Storer, 1925; Jennings and Hayes, 1985).

Diet. The diet of California red-legged frogs is highly variable. Hayes and Tennant (1985) found invertebrates to be the most common food items of adult frogs. Vertebrates, such as Pacific tree frogs (*Hyla regilla*) and California mice (*Peromyscus californicus*), represented over half of the prey mass eaten by larger frogs (Hayes and Tennant, 1985). Hayes and Tennant (1985) found juvenile frogs to be active diurnally and nocturnally, whereas adult frogs were largely nocturnal. Feeding activity likely occurs along the shoreline and on the surface of the water (Hayes and Tennant, 1985).

Population Status. The California red-legged frog has sustained a 70-percent reduction in its geographic range in California as a result of several factors acting singly or in combination (Jennings et al. 1993). Habitat loss and alteration, overexploitation, and introduction of exotic predators were significant factors in the California red-legged frog's decline in the early to mid 1900s.

Historically the California red-legged frog was known from 46 counties, but is now extirpated from 24 of those counties. It is estimated that California red-legged frogs were extirpated from the Central Valley floor before 1960. Remaining aggregations (assemblages of one or more individuals, not necessarily a viable population) of California red-legged frogs in the Sierran foothills became fragmented and were later eliminated by reservoir construction, continued expansion of exotic predators, grazing, and prolonged drought. The pattern of disappearance of California red-legged frogs in southern California is similar to that in the Central Valley, except that urbanization and associated roadway, large reservoir (introduction of exotic predators), and stream channelization projects were the primary factors causing population declines. In southern California, California red-legged frogs are known from only five locations south of the Tehachapi Mountains, compared to over 80 historic locality records for this region (a reduction of 94 percent).

California red-legged frogs are known to occur in 243 streams or drainages, primarily in the central coastal region of California. A single occurrence of California red-legged frog is sufficient to designate a drainage as occupied by, or supporting California red-legged frogs. Monterey, San Luis Obispo, and Santa Barbara counties support the greatest number of currently occupied drainages. The most secure aggregations of California red-legged frogs are found in aquatic sites that support substantial riparian and aquatic vegetation and lack exotic predators (e.g., bullfrogs (*Rana catesbeiana*), bass (*Micropterus* spp.), and sunfish (*Lepomis* spp.)). Only three areas within the entire historic range of the California red-legged frog may currently support more than 350 adults, Pescadero Marsh Nature Preserve (San Mateo County), Point Reyes National Seashore (Marin County), and Rancho San Carlos (Monterey County). Threats, such as expansion of exotic predators, proposed residential development, and water storage projects, occur in the majority of drainages known to support California red-legged frogs.

Within the project area, red-legged frogs inhabit the lower drainage basin of San Antonio Creek, the adjacent San Antonio Terrace, and San Antonio Lagoon (Christopher 1996). On Vandenberg AFB, red-legged frogs are often found in association with dune swale ponds. Further south, Jalama Lagoon also supports a relatively large population of frogs (Christopher 1996). Smaller, more patchily distributed populations of red-legged frogs inhabit the lower Santa Ynez River Basin. Additionally, small coastal drainages between Gaviota and Goleta and west to Point Conception also support California red-legged frogs.

3.6 Fish

3.6.1 Tidewater Goby (Endangered)

Status. The tidewater goby (*Eucyclogobius newberryi*) was listed as endangered on February 4, 1994 (59 FR 5498). On June 24, 1999, USFWS published a proposed rule to remove the northern populations of the tidewater goby from the endangered species list; the proposed rule was withdrawn on November 7, 2002. Critical habitat for this species was designated on November 20, 2000 (65 FR 69693), and a final recovery plan was published on December 7, 2005 (USFWS 2005). The tidewater goby is threatened primarily by modification and loss of habitat as a result of coastal development, channelization of habitat, diversions of water flows, groundwater overdrafting, and alteration of water flows.

Range and Habitat. The tidewater goby is a small fish that inhabits coastal areas ranging from Del Norte County (near the Oregon border) south to Agua Hedionda Lagoon in northern San Diego County. Gobies are primarily coastal lagoon fishes that prefer shallow, usually brackish water (Love, 1996).Most are found very close to the coast, though a few have been found as much as 8 km (5 mi) inland.

Primary tidewater goby habitat is found in small, shallow coastal lagoons that are separated from the ocean most of the year by beach barriers. They are typically found in water less than 1 meter (3.3 feet) deep (USFWS 2005). This includes shallow areas of bays and areas near stream mouths in uppermost brackish portions of larger bays. Tidewater gobies are absent from areas where the coastline is steep and streams do not form lagoons or estuaries. Although tidewater gobies can tolerate full seawater, they are most common in waters with salinities of less than 12 parts per thousand. Adults are benthic, and larvae are briefly pelagic (Love, 1996).

Reproduction. Reproduction occurs year-round, although distinct peaks in spawning, often in early spring and late summer, do occur. Tidwater gobies exhibit a female-dominant breeding system that is unusual in vertebrates, whereby female tidewater gobies aggressively spar with each other for access to males with burrows for laying their eggs. Females are oviparous and generally produce between about 300 to 500 eggs per clutch, and between 6 to 12 clutches per year. After the male goby has excavated a vertical burrow in coarse sand, a female will lay the eggs on the roof and sides of the burrow, suspending them one at a time. The males guard the eggs until they hatch in 9-10 days (Love, 1996).

Diet. At all sizes examined, tidewater gobies feed on small invertebrates, usually mysids, amphipods, ostracods, snails, and aquatic insect larvae, particularly dipterans. The food items of the smallest tidewater gobies (4-8 mm) have not been examined, but these gobies, like many other early stage larval fishes, probably feed on unicellular phytoplankton or zooplankton (64 FR 33816).

Population Status. At the time of listing in 1994, tidewater gobies were known to have occurred in at least 87 of California's coastal lagoons, but were considered extirpated in approximately half of these (USFWS 2005). These assessments, however, followed a prolonged period of drought, when conditions in many habitats were at extremely low levels. Subsequent surveys found that populations in several locations had become re-established, or had been overlooked in the initial surveys. Additionally, new populations continue to be discovered. As a result, presently only 23 of the known historic populations are considered extirpated. However, many of the localities are naturally so small, or have been degraded over time, that their long-term persistence is uncertain. Currently, the goby is found in approximately 46 localities within the general project area (San Luis Obispo, Santa Barbara, and Ventura counties).

Tidewater goby populations may fluctuate seasonally. In Aliso Creek Lagoon in Orange County, the winter-early spring population was estimated at 1,000 to 1,500 fish; after the summer-fall spawning, the population rose to 10,000-15,000 individuals. They are found in small groups or in aggregations of hundreds. The tidewater goby is typically an annual species, with few individuals living longer than a year.

3.6.2 Steelhead Trout (Endangered)

Status. A native trout species, "steelhead" is the term used to distinguish anadromous populations of *Oncorhynchus mykiss* from freshwater resident populations, which are known as "rainbow trout". Southern steelhead are one of several related species that exhibit considerable life history plasticity (Boughton et al 2006).

Two distinct populations of west coast steelhead occur in the project area: the southern California population and south-central California coast population. Both populations were listed for protection under the Endangered Species Act on October 17, 1997 (63 FR 32996). The southern population was listed as endangered, while the south-central coast population was listed as threatened. Critical habitat for this species was designated in September 2005 (70 FR-52488). Following a status review in 2005 (Good et al. 2005), a final ESA listing determination for the endangered Southern California Steelhead distinct population segment was issued on January 5, 2006 (71 FR 834). Another status review occurred in 2011, however, no changes to the status of either population occurred.

Range and Habitat. Steelhead, like all salmon, need clean, cool water with plenty of oxygen and low amounts of suspended solids and contaminants. They also need gravel and rocks to spawn. Fine sediment is lethal to steelhead as it clogs the spaces between the rocks and gravel, buries the eggs, and prevents oxygen and flowing water from reaching the eggs. Sediment can also damage the gills of adult steelhead. Steelhead also require large, woody debris and deep pools in the river, which provide refuge from predators and resting places during storms. Deep pools give steelhead cool water when shallow areas warm up in the summer.

Critical habitat has been designated for this species which includes all river reaches and estuarine areas accessible to listed steelhead in coastal river basins from the Santa Maria River south to Malibu Creek (inclusive). Also included are adjacent riparian zones. Excluded are tribal lands and areas above specific dams or above longstanding, naturally impassable barriers (i.e., natural waterfalls in existence for at least several hundred years). Major river basins containing spawning and rearing habitat for this ESU comprise approximately 3,967 square miles in California. The following counties lie partially or wholly within these basins (or contain migration habitat for the species): Los Angeles, San Luis Obispo, Santa Barbara, and Ventura.

Southern California distinct population segment (DPS) – this population segment occupies rivers from the Santa Maria River to the southern extent of the species' range. Historically, steelhead occurred at least as far south as Rio del Presidio, in Mexico (Behnke, 1992; Burgner et al. 1992). At the time of listing, however, the southernmost stream used by steelhead for spawning was generally thought to be Malibu Creek (Behnke, 1992; Burgner et al. 1992), though, in years of substantial rainfall, spawning steelhead were found as far south as the Santa Margarita River in San Diego County (Barnhart, 1986). However, in 1999 and 2000, new information became available which indicated that steelhead were also present in Topanga and San Mateo creeks. This new information included observations of juvenile O. mykiss in Topanga Creek and field and laboratory investigations conducted by the CDFG which demonstrated the presence and spawning of anadromous *O. mykiss* in San Mateo Creek (67 FR 21586). In 2002, NMFS published a notification of this extension of the known range, south to the U.S. - Mexico Border (67 FR 21586).

South-central California Coast DPS – this population segment occupies rivers from the Pajaro River, Santa Cruz County, to, but not including, the Santa Maria River. The southern boundary of this ESU is near Point Conception. Most rivers of this region drain the Santa Lucia Range, the southernmost unit of the California Coast Ranges. The climate is drier and warmer than in the north, which is reflected in the vegetational change from coniferous forest to chaparral and coastal scrub. The mouths of many rivers and streams in this area are seasonally closed by sand berms that form during periods of low flow in the summer.

Migration and life history patterns of southern California steelhead depend strongly on rainfall and streamflow levels (Moore, 1980). Average rainfall is substantially lower and more variable in southern California than in regions to the north, resulting in increased duration of sand berms across the mouths of streams and rivers and, in some cases, complete dewatering of the lower reaches of these streams from late spring through fall.

Reproduction. Stocks of steelhead in southern and south-central California are comprised entirely of winter steelhead. Winter Steelhead are generally in an advanced stage of sexual maturity when they approach the coastline and enter their home streams, which occurs from about November to April. Spawning takes place from March to early May. In contrast, summer steelhead enter rivers between June and November in a relatively immature stage and overwinter in fresh water prior to spawning.

Unlike the other salmonids, steelhead are not pre-determined to die after spawning and may live to spawn multiple times throughout their lives. Females produce 200-12,000 eggs, which hatch in about 50 days (Love, 1996). The fry emerge in summer and may spend the next one to three years in fresh water prior to migrating to the ocean.

Young steelhead remain in fresh water anywhere from less than 1 year to 3 years. Juveniles migrate to sea usually in spring, but throughout their range steelhead are entering the ocean during every month, where they spend 1-4 years before maturing and ascending streams for the first time.

Diet. Fry initially feed on zooplankton and other microorganisms (Barnhart 1991). Juveniles feed on a wide range of items, primarily those associated with the stream bottom such as aquatic insects, amphipods, aquatic worms, fish eggs, and occasionally smaller fish (Wydoski and Whitney 1979). Juveniles may also feed on spiders, mollusks, and fish, including smaller steelhead (Roelofs 1985). Age 0+ steelhead prefer benthic invertebrates (Johnson and Ringler 1980); larger steelhead, having larger mouths, can consume a broader range of foods (Fausch 1991). In the ocean, steelhead feed on juvenile greenling, squids, amphipods, and other organisms (Barnhart 1991).

Population status. In southern California, at the southern limit of the range for anadromous O. mykiss in North America, it is estimated that annual runs have declined dramatically from 32,000-46,000 returning adults historically, to less than 500 returning adults today (Good et al. 2005).

Steelhead from the Southern DPS have been extirpated from much of their historical range. Estimates of historical (pre-1960s) abundance are available for several rivers in the Southern DPS: Santa Ynez River, before 1950, 20,000-30,000; Ventura River, pre-1960, 4,000-6,000; Santa Clara River, pre-1960, 7,000-9,000; Malibu Creek, pre-1960, 1,000. In the mid-1960s, the California Department of Fish and Game (CDFG) estimated steelhead spawning populations for smaller tributaries in San Luis Obispo County to be 20,000, but they provided no estimates for streams farther south.

Recent total run sizes for six streams in this DPS were all were less than 200 adults. Steelhead are still occasionally reported in streams where stocks were identified previously as being extirpated, however. This includes the rediscovery of the presence of *O. mykiss* in Topanga and San Mateo Creeks in 1999 and 2000 (67 FR 21586).

Total abundance of steelhead in the South-Central Coast DPS is also extremely low and declining. Historical estimates of steelhead abundance are available for only a few streams in this region. For example, the California Advisory Committee on Salmon and Steelhead (CACSS,

1988) cited an estimate of 20,000 steelhead in the Carmel River in 1928. In the mid-1960s, CDFG estimated a total of 27,750 steelhead spawning in the rivers of this DPS. However, comparisons with recent estimates for these rivers show a substantial decline during the past 30 years. In contrast to the CDFG estimates, McEwan and Jackson (1996) reported runs ranging from 1,000 to 2,000 in the Pajaro River in the early 1960s, and escapement of about 3,200 steelhead for the Carmel River for the 1964 to 1975 period. Populations have declined from annual runs totaling 25,000 spawning adults to less than 500. Risk factors for this DPS are habitat deterioration due to sedimentation, and flooding related to land management practices and potential genetic interaction with hatchery rainbow trout.

3.7 Plants

3.7.1 Salt Marsh Bird's-Beak (Endangered)

Status. The salt marsh bird's-beak (*Cordylanthus maritimus* ssp.*maritimus*), an annual semiparasitic herb in the figwort family (Scrophulariaceae), was listed as endangered on September 28, 1978 (43 FR 44812). A recovery plan for this species was approved in 1984 (USFWS, 1984b). Critical habitat has not been designated for this species. The main reason for listing this species was due to habitat loss.

Range and Habitat. This plant is generally restricted to coastal salt marshes. Although there has been some confusion in the past over the range of this subspecies and the similar Point Reyes bird's-beak (*Cordylanthus maritimus* ssp. *palustris*), this plant occurs in salt marshes from Morro Bay in San Luis Obispo County south to San Diego County and Northern Baja California, Mexico. Herbarium records indicate that it was formerly found in at least 10 marshes in California (USFWS, 1984b), and up to five marshes in Baja. The current distribution of this species includes Carpinteria Marsh, Ormond Beach, the Ventura County Game Preserve, Mugu Lagoon, Anaheim Bay, Upper Newport Bay, Sweetwater Marsh, and the Tijuana River estuary (USFWS, 1984b). Within the project area, salt marsh bird's-beak is currently known to occur at Ormond Beach and Mugu Lagoon in Ventura County, at Carpinteria Salt Marsh in Santa Barbara County, and at Morro Bay in San Luis Obispo County (CNDDB 2004).

The primary habitat for this plant is the upper salt marsh that is inundated by tides on a regular basis, but above areas that receive daily salt flooding. Plants may also occur behind barrier dunes, on dunes, mounds, and occasionally in areas with no tidal influence. The plant forms root connections with other plant species such as salt grass (*Distichlis* sp.), pickleweed (*Salicornia* sp.), and cattail (*Typha latifolia*), which may be especially important for plants growing on drier sites (USFWS, 1984b).

Population Status. Population data are not available for most of the salt marsh bird's-beak sites. Destruction and modification of the coastal marshes is the primary reason for this plant's decline. The plants have been directly affected by a host of man-caused activities, including off-road vehicles, construction equipment, cattle grazing, and flood control levees. Even minor alterations of the marsh that result in permanent changes in the natural tidal dynamics can make previously suitable habitat unsuitable. Changes in tidal inundation have affected plants by: smothering them with increased debris deposited by high tide, encouraging other marsh vegetation which shades out plants, or decreasing germination of seeds by lowering or increasing soil salinity (USFWS, 1984b).

3.7.2 California Sea-Blite (Endangered)

Status. The California sea-blite (*Suaeda californica*), a succulent-leaved perennial plant of the goosefoot family (Chenopodiaceae), was listed as endangered on December 15, 1994 (59 FR 64623). A recovery plan is not available for this species, and critical habitat has not been designated. The main reason for listing this species was due to habitat loss.

Range and Habitat. Some confusion has occurred over the historical range of this plant. Munz (1959) described the range as extending from San Francisco Bay south to southern Baja California, Mexico. However, Ferren and Whitmore (1983) separated the plant into two species. The plant they separated out, Estuary seablite (*Suaeda esteroa)*, occurs from Santa Barbara County south to Baja. The historical range of the California sea-blite, therefore, includes the San Francisco Bay area and Morro Bay.

The only remaining, naturally existing population of this species is along the perimeter of Morro Bay in San Luis Obispo County, where it occurs in a very narrow band in the upper intertidal zone (Walgren 2006). The distribution of California sea-blite around Morro Bay was mapped in the early 1990s (see 59 FR 64623). On the east side of the bay, colonies occur adjacent to the communities of Morro Bay, Baywood Park, and Cuesta by-the-Sea, although it apparently is absent from the more interior portion of the marshlands created by Chorro Creek runoff. On the west side of the bay, it is found along most of the spit, excepting the northern flank adjacent to the mouth of the bay.

California Sea-blite occurs in association with other marsh plants including *Salicornia* sp. (pickleweed), *Distichlis spicata* (saltgrass), *Juncus acutus* (rush), *Jaumea carnosa* (Jaumea), and *Frankenia salina* (Frankenia) and the federally endangered *Cordylanthus maritimus* ssp. *maritimus* (salt marsh bird's-beak) (59 FR 64623). Because the California sea-blite occupies such a narrow band in the intertidal zone, it is threatened by any natural processes or human activities that even slightly alter this habitat. Such threats include: increased sedimentation of Morro Bay, the encroachment of sand on the east side of the spit, and dredging projects within the channel of the bay (59 FR 64623).

Population Status. The sea-blite's colonial habits make it difficult to estimate the population. While there is no comprehensive field census estimate for the total number of individual plants along the central coast prior to 1999, the total number of individuals was estimated to be between 200 and 300 individuals in 1999 (P. Baye, Service biologist, unpubl. data 1991-1999).

Additionally, during the spring of 2002, the CDPR initiated a project to restore, enhance, and augment occurrences of sea-blite that included the translocation of individual plants to six State Park sites: Villa Creek, Old Creek, Morro Strand State Beach, and three sites in Morro Bay (Walgren 2006). Current re-introduction projects are also on-going in Golden Gate National Recreation Area, where a small population was successfully re-established in 2003 at the Crissy Field marsh at San Francisco Bay, near Pier 98.

4.0 Potentially Significant Impacts Sources

The primary impact-producing activities associated with the proposed project include drilling and production operations with associated support activities. The major impact agents expected from these proposed activities are noise, lighting and disturbance; platform discharges; and potential oil spills. The following sections describe the sources and types of these potential impacts.

4.1 Noise, Lighting, and Disturbance

The proposed activities associated with the development of the Electra Field, including drilling and transportation, will marginally increase the amount of nighttime lighting in the project area. Additionally, drilling and marine vessel traffic are among the most common sources of man-made, low frequency noise that could affect protected species. The source level of a sound produced by activities such as these is described as the amount of radiated sound at a particular frequency and distance, usually 1 m from the source, and is commonly expressed in dB re 1 µPa. Much of the following discussion is derived from the detailed review of the sounds produced by offshore activities in Richardson et al. (1995).

4.1.1 Vessel Traffic

Current Levels of Activity. Crew and supply boats are used daily to transport personnel and supplies to platforms offshore southern California. Support vessels for activities in the Santa Maria Basin operate out of bases in the Santa Barbara Channel. During the past decade, support vessels in the Pacific Region, including both crew and supply boats, have averaged approximately 16 trips per week per platform (Bornholdt and Lear, 1995). However, actual vessel traffic in the Region varies among the units. As discussed in Section 3.1, the Point Arguello platforms average as few as six supply trips per month, while crew and supply boat trips in the eastern Santa Barbara Channel are much more frequent.

Currently, an average of six supply boat trips occurs per month. During drilling for the proposed project, vessel traffic to and from the platforms is projected to consist of an additional four round trips per month (1 round trip per week). Rig installation and removal activities (rig transport) will necessitate approximately 28 round trips to Platform Hidalgo by supply boats. Manpower requirements and boat schedules can vary depending on the workload. Following the completion of drilling activities, which are anticipated to last for approximately five months, supply vessel traffic is expected to return to current baseline levels (i.e. 6 supply boat trips per month).

The Santa Barbara Channel/Santa Maria Basin Oil Service Vessel Traffic Corridor Program is intended to minimize interactions between oil industry operations and commercial fishing operations. It was developed cooperatively by the two industries through the Joint Oil/Fisheries Liaison Office. In addition to providing transit corridors in and out of area ports, the program routes support traffic along the Channel seaward of an outer boundary line. East of Gaviota, the outer boundary is defined by the 30-fathom line; west of Gaviota, and north of Point Conception as far as Pedernales Point, it follows the 50-fathom line. In the area west of Gaviota, the 50-fathom line is 4 km (2 nm) or more offshore.

Potential Impact Sources. Vessels are the major contributors to overall background noise in the sea (Richardson et al. 1995). Sound levels and frequency characteristics are roughly related to ship size and speed. The dominant sound source is propeller cavitation, although propeller "singing," propulsion machinery, and other sources (auxiliary, flow noise, wake bubbles) also contribute. Vessel noise is a combination of narrowband tones at specific frequencies and broadband noise. For vessels the approximate size of crew and supply boats, tones dominate up to about 50 Hz. Broadband components may extend up to 100 kHz, but they peak much lower, at 50-150 Hz.

Richardson et al. (1995) give estimated source levels of 156 dB for a 16-m crew boat (with a 90-Hz dominant tone) and 159 dB for a 34-m twin diesel (630 Hz, 1/3 octave). Broadband source levels for small, supply boat-sized ships (55-85 m) are about 170-180 dB. Most of the sound energy produced by vessels of this size is at frequencies below 500 Hz. Many of the larger commercial fishing vessels that operate off southern California fall into this class.

4.1.2 Aircraft Traffic

Current Levels of Activity. Offshore southern California, helicopters are a primary means of crew transport to and from the OCS platforms, and helicopter traffic is a daily occurrence in the Point Conception area. During the past decade, helicopter trips on the Pacific OCS have averaged approximately 3 to 5 trips per week, per platform (Bornholdt and Lear, 1995).

OCS helicopter traffic in the Pacific Region operates primarily out of Santa Maria, Lompoc, and Santa Barbara airports. Helicopter traffic associated with the proposed project will occur between Platform Hidalgo and the Santa Maria airport, however, no increases in helicopter traffic are proposed for this project. Nevertheless, the following information is included to summarize the existing impacts and conditions.

Beginning in the 1980s, a standard Information to Lessees (ITL) issued in conjunction with OCS lease sales off southern California provided offshore operators with guidelines for protecting marine mammals and birds from aircraft impacts (Bornholdt and Lear, 1995). The ITL stated that,

"Aircraft should operate to reduce effects of aircraft disturbances on seabird colonies and marine mammals, including migrating gray whales, consistent with aircraft safety, at distances from the coastline and at altitudes for specific areas identified by the U.S. Fish and Wildlife Service (USFWS), National Marine Fisheries Service (NMFS), and California Department of Fish and Game (CDFG). A minimum altitude of 1,000 feet is recommended near the Channel Islands Marine Sanctuary to minimize potential disturbances. The CDFG and USFWS recommend minimum altitude restrictions over many of the colonies and rookeries."

More recently, the 1,000-foot minimum altitude restriction was extended to air traffic passing the vicinity of the Santa Maria River mouth, to address concerns over possible disturbance of marine bird nesting habitats there. Although the original ITL is no longer in force, operators in the southern Santa Maria Basin still comply with these restrictions (P. Schroeder, BOEM, pers. comm.).

Potential Impact Sources. Air-to-water transmission of sound is very complex (Richardson et al. 1995). An understanding of underwater sound from any aircraft depends on 1) the receiver depth, and 2) the altitude, aspect, and strength of the source.

The concept of a one-meter sound source means very little when discussing aircraft sound production, and an altitude of 300 m is the usual reference distance (Richardson et al. 1995). The angle of incidence at the water surface is very important—much incident sound is reflected at angles greater than 13 degrees from the vertical. This 26-degree "cone" of sound is defined physically by Snell's Law and influenced by sea conditions. Water depth and bottom conditions also strongly influence the propagation and levels of underwater sound from passing aircraft; propagation is attenuated in shallow water, especially when the bottom is reflective (Richardson et al. 1995).

The rotors are the primary sources of sound from helicopters (Richardson et al. 1995). The rotation rate and the number of blades determine the fundamental frequencies. Fundamental frequencies are usually below 100 Hz, with most dominant tones below 500Hz. These are primarily harmonics of the main and tail rotor blade rates, although other tones associated with engines and other rotating parts may also be present.

Richardson et al. (1995) present an estimated source level for a Bell 212 helicopter of about 150 dB at altitudes of 150-600 m, with the dominant frequency a 22-Hz tone with harmonics. Elsewhere a source level of 165 dB is presented for broadband helicopter noise (frequencies 45-7070 Hz). Source levels of the Sykorski Model 76A helicopters that are used to transport crew on Platform Hidalgo from the Santa Maria airport have been estimated at about 150 dB at altitudes of about 100 m.

Generally, peak received levels occur as the aircraft passes directly overhead and are directly related to altitude and depth. However, when the aircraft is not passing directly overhead, received levels may be stronger at "midwater" depths. Helicopters tend to radiate more sound forward. Duration is variable. For example, a Bell 214 was audible in air for 4 minutes before passing, for 38 seconds at 3-m depth, and for 11 seconds at 18 m.

4.1.3 Offshore Drilling

Current Levels of Activity**.** As of 2009, more than 1,354 wells had been drilled in the Pacific OCS Region. This number includes 1,026 oil and gas development wells drilled from platforms and 328 exploratory wells drilled from a variety of rigs, including mobile offshore drilling units (MODUs), jack-ups, barges, and drill ships.

Potential Impact Sources. Richardson et al. (1995) cite only a single source of information on the levels of noise produced by platform-based drilling activities. Gales (1982) recorded noise produced by one drilling and three drilling and production platforms off California. The noises produced were so weak that they were nearly undetectable "even alongside the platform" in sea states of Beaufort 3 or better. No source levels were computed, but the strongest received tones were very low frequency, about 5 Hz, at 119-127 dB re 1 micro Pa. The highest frequencies recorded were at about 1.2 kHz.

4.1.4 Offshore Production

Current Levels of Activity. There currently are 23 offshore platforms in the Pacific OCS Region. Of these, 4 are in the Santa Maria Basin, 15 are in the Santa Barbara Channel, and 4 are in San Pedro Bay.

Potential Impact Sources. Noise produced by metal production platforms is expected to be relatively weak, because a small surface area is actually in contact with the water and because the machinery is placed on decks well above the water line (Richardson et al. 1995). Gales (1982) measured noise from 11 production platforms off California. Sounds recorded from four platforms were very low in frequency, about 4.5-38 Hz measured 9-61 m. Platforms powered by gas turbines produced more tones than platforms with at least partial shore power. Peak recorded sound spectra were between 50-200 or 100-500 Hz.

4.1.5 Lighting

Current Levels of Activity. All 23 offshore platforms in the Pacific OCS Region have exterior lighting which is required to conform with platform lighting standards required by BOEM, Occupational Safety and Health Administration (OSHA), and the Coast Guard. Platform Hidalgo currently operates approximately 368 exterior lights, with a combined total wattage of approximately 39,520 watts.

Potential Impact Sources. Artificial lighting at oil platforms may have adverse impacts on a variety of marine organisms including localized interference with the light intensity cues of vertically migrating fishes and zooplankton, and attraction of predator species (e.g., marine mammals and large predatory fishes) that use the illumination of the lights to feed on readily available prey sources. However, if impacts from artificial lighting on fishes and zooplankton occur, they would be limited to the approximately 100 meter illuminated area around the platform.

The use of bright lights at the oil platforms or on vessels transiting traveling to the platforms may also negatively impact certain seabird species. Specifically, artificial lighting can result in disruption of the normal breeding and foraging activities of nocturnal seabirds (e.g., certain species of alcids, storm-petrels and shearwaters) (Wolf 2007). The attraction to light by some nocturnal feeding seabirds is thought to result from their use of vertically migrating bioluminescent prey and from a predilection to orient to star patterns (Montevecchi 2006). Regardless of its cause, seabirds have been known to circle oil platforms and flares and to fly directly into lights (Wiese et al. 2001). Continuous circling within the illumination of, or around bright, artificial lights by birds is known as light entrapment.

The holding or trapping effect of bright, artificial lighting can deplete the energy reserves of migrating birds, resulting in diminished survival and reproduction. For example, light entrapment may delay migrating birds from reaching breeding or foraging grounds, or leave them too weak to forage or escape predation. Migrating passerines and seabirds have been observed to continuously circle platforms until exhausted, whereupon they fall to the ocean or land on the platforms (Montevecchi 2006; Wolf 2007). Similarly, light entrapment may impact breeding seabirds by increasing their time away from their nests, leaving the nests vulnerable to predation for longer periods of time. In addition, time and energy spent circling lights may impede a bird's ability to successfully forage for enough food to feed their young.

4.2 Effluent Discharges

Platform discharges with the potential to affect protected species include drilling muds and cuttings, produced waters, and sanitary effluents. All platform effluents are regulated by the requirements of the U.S. EPA's National Pollution Discharge Elimination System (NPDES) General Permit (Permit No. CAG280000; EPA 2000a and b). The biological assessment prepared for the General Permit evaluates 22 types of discharges resulting from normal OCS oil and gas operations (SAIC, 2000a and b). There are specific permit requirements for five of the discharge types: drilling fluids and cuttings; produced water; well treatment, completion, and workover fluids; deck drainage; and domestic and sanitary waste. The requirements for the remaining discharges are combined. Monitoring is conducted in accordance with 40 CFR Part 136, unless other procedures are specified. Monitoring results are summarized monthly on Discharge Monitoring Report (DMR) forms and reported to the EPA quarterly.

4.2.1 Drilling Fluids

The discharge of drilling muds to be used for the proposed Electra Field drilling program will comply with the General Permit requirements. Under the permit, Platform Hidalgo is authorized to discharge up to 6,000 bbl of cuttings and 23,000 bbl of drilling fluids annually per well. Over the anticipated 5-month drilling program for the proposed project, a total of 5,697 bbl of water-based cuttings and 14,036 bbl of drilling fluids are expected to be produced for well C-16. Similarly, 5,512 bbl of water-based cuttings and 13,575 bbl of drilling fluids are expected to be produced for well C-17.

The dispersion of drill muds and cuttings depends on the depth of the discharge (shunt depth), the prevailing flow field, and the physical characteristics of the drill muds and the receiving waters (see Attachment D). On Platform Hidalgo, spent drill muds and cuttings would be discharged approximately 112 ft (34 m) below the sea surface. The temperature and density of drill muds generally increase with increasing drilling depth. Even after dilution with seawater at the shale shaker, the discharged material would be a few degrees warmer than ambient seawater temperatures.

Heavier discharge material tends to settle out, with most of the heavier muds aggregates deposited on the seafloor in the general vicinity of the drilling rig. Similarly, heavier rock cuttings are not expected to be transported more than 200 m beyond the discharge point (de Margerie 1989; MMS 1996). However, in water deeper than about 80 m, settling of some heavier materials may be temporarily delayed when encountering neutral buoyancy conditions within the water column (NAS 1983; MMS 1996). During a study to monitor the environmental effects of drilling discharges from Platform Harvest (Battelle, 1991), heavier particles fell directly below the platform, distributing over an area of about 2.75 km2, while silts were widely and thinly dispersed over a larger area. Approximately 80 percent of the particulates are removed by these near-field depositional processes (CSA 1985).

Lightweight floccules formed from the remaining suspended particulates would be carried upward toward the sea surface by the buoyant plume of warm water associated with the discharge. Lighter particulate- and soluble-discharge components associated with the upper or visible plume are generally dispersed or diluted to ambient levels within approximately 200 to 2,000 m of the discharge (MMS 1996). They can be carried over four miles from the platform before being deposited on the seafloor (Coats 1994; Pickens 1992; Attachment D).

4.2.2 Produced Water

Produced water from the generated by the Electra Field development would also be discharged in accordance with the existing NPDES General Permit. Under the permit, Platform Hidalgo is authorized to discharge up to 18,250,000 bbl of produced water per year, which equates to an average of 50,000 bbl/d. Currently, Platform Hidalgo has a peak produced water discharge of 10,000 bbl/d. The development and production of the Electra Field is anticipated to generate an additional 6,500 bbl/d of produced water. With the addition of the Electra Field, total produced water discharges will still remain well below the permitted levels. Produced water may also be reinjected back into the reservoir.

Initial mixing and dispersion govern the fate of produced water discharged into the marine environment. Initial mixing occurs immediately after discharge. It is driven by the turbulence caused by the momentum of the discharge jet and instability of the buoyant effluent plume as it rises through the water column. EPA's allowed mixing zone for produced-water discharges (not applied to oil and grease) is the larger of 100 m measured laterally around the discharge point from the sea surface to the sea floor, or to the boundary of the zone of initial dilution as calculated by a plume model.

Produced water discharged off the California coast is generally less saline and warmer than ambient seawater. This results in a buoyant discharge plume that aids in the initial mixing of the effluent. Modeling suggests that initial mixing occurs rapidly and results in dilutions of 30- to 100-fold within a few tens of meters from the outfall (Neff 1997). Slower-paced dispersion further reduces the concentration of contaminants as the oceanic flow field transports the produced-water plume.

As part of the General Permit requirements, permittees generated a detailed quantitative assessment of potential impacts from produced-water discharges on federally managed fish species from each of the California OCS dischargers, including Platform Hidalgo (MRS 2005). The study focused on the toxicity and bioaccumulation potential of produced-water discharges to the fish populations that reside within the 100-m mixing zone beneath the platforms. These fish populations consist mostly of rockfish that utilize the platforms as habitat, rarely venturing far from the protection of the structure. Consequently, contaminant concentrations at locations 100-m from the platform have little bearing on the potential impacts experienced by these fish.

Nevertheless, the quantitative exposure assessment found a general absence of impacts from most of the major produced-water constituents. Many of the produced-water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents (benzene, cyanide, silver, and ammonia) had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, the produced-water discharges achieve high dilution almost immediately upon discharge. As a result, the plume volumes containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zones.

In September 2005, EPA concurred with the overall conclusions of the study and forwarded them to NMFS as part of the EFH consultation required by the General Permit. In October 2005, NMFS notified EPA that the study met the intent of the conservation recommendations incorporated in the General Permit and that the EFH consultation was complete. Revisions to the NPDES General Permit, which included new compliance criteria for several of the platforms and a revision to the undissociated sulfide criterion, were approved in November 2009 (EPA 2009).

4.3 Oil Spills

4.3.1 Oil Spill Risk Assessment

A major environmental concern with offshore oil and gas activities is the potential for oil spills and the resulting effects on biological resources, such as listed species. The largest oil spill in the Pacific OCS Region occurred in 1969, when a well blowout on Platform A off Santa Barbara spilled an estimated 80,000 bbl into the Santa Barbara Channel (Van Horn et al. 1988). As discussed in Section 5.3.2, a number of preventive measures have been initiated since that time, including stringent regulations covering OCS operational and environmental safety, a rigorous inspection program in the Pacific Region, continuous evaluation and improvement in OCS facilities' oil spill response, and the development of a highly organized oil spill response structure (Bornholdt and Lear 1997). Following the 2010 *Deepwater Horizon* well blowout and oil spill in the Gulf of Mexico, additional extensive reforms to offshore oil and gas regulation and oversight were enacted which strengthened requirements for everything from well design and workplace safety to corporate accountability.

Table 4.1 lists the hydrocarbon spills that occurred in the Pacific OCS Region from 1969 through 1999. During that period, a total of 843 oil spills were recorded. The total volume of oil spilled in the region is dominated by the 1969 Santa Barbara spill—since then, these spills have ranged in size from less than 1 bbl to 163 bbl, for a total of slightly less than 830 bbl. For comparison, natural oil seeps at Coal Oil Point in the Santa Barbara Channel are estimated to discharge approximately 100-170 bbl of oil per day (Hornafius et al. 1999).

Table 4.1 Hydrocarbon Spills Recorded in the Pacific OCS Region, 1969-1999 (volumes in barrels)

Year	Spill Size						Total	
	less than or equal to 1 bbl		>1 bbl to less than or equal to 50 bbl		greater than or equal to 50 bbl			
	No.	Volume	No.	Volume	No.	Volume	No.	Volume
1969	0		0		2	80,900	2	80,900.0
1970	0		0		0		0	
1971	0		0		0		0	
1972	0		0		0		0	
1973	0		0		0		0	
1974	0		0		0		0	

Table 4.1 Hydrocarbon Spills Recorded in the Pacific OCS Region, 1969-1999 (volumes in barrels)

Year	Spill Size						Total	
	less than or equal to 1 bbl		>1 bbl to less than or equal to 50 bbl		greater than or equal to 50 bbl			
	No.	Volume	No.	Volume	No.	Volume	No.	Volume
1975	1	0.1	0		0		1	0.1
1976	3	1.1	1	2	0		4	3.1
1977	11	2.2	1	4	0		12	6.2
1978	4	1.2	0		0		4	1.2
1979	5	1.7	1	2	0		6	3.7
1980	11	4.9	2	7	0		13	11.9
1981	21	6.0	10	75	0		31	81.0
1982	24	3.2	1	3	0		25	6.2
1983	56	7.7	3	6	0		59	13.7
1984	65	4.7	3	36	0		68	40.7
1985	55	9.3	3	9	0		58	18.3
1986	39	5.5	3	12	0		42	17.5
1987	67	7.5	2	11	0		69	18.5
1988	47	3.7	1	2	0		48	5.7
1989	69	4.1	3	8	0		72	12.1
1990	43	3.6	0		1	100	44	103.6
1991	51	5.8	1	10	1	50	53	65.8
1992	39	1.2	0		0		39	1.2
1993	32	0.7	0		0		32	0.7
1994	18	0.4	2	33	1	50	21	83.4
1995	25	0.9	1	1.4	0		26	2.3
1996	39	0.9	1	5	1	150	41	155.9
1997	20	2.5	0		1	163	21	165.5
1998	29	1.0	0		0		29	1.0
1999	22	0.5	1	10	0		23	10.5
Total	**796**	**80.4**	**40**	**236.4**	**7**	**81,413.0**	**843**	**81,729.8**

In the course of normal, day-to-day platform operations, occasional accidental discharges of hydrocarbons may occur. Such accidents are typically limited to discharges of quantities of less than 1 bbl of crude oil. As shown in Table 4.1, 836 spills of less than 50 bbl (99 percent of the total) occurred on the Pacific OCS between 1969 and 1999, resulting in slightly less than 320 bbl of oil being discharged into the ocean. Due to the infrequency and small volumes of these accidental discharges, and their location (generally away from sensitive species), spills of less than 50 bbl are not considered an impact-producing agent for the protected species discussed in this biological evaluation.

Larger oil spills may occur from loss of well control (if wells are free flowing), pipeline breaks, operational errors, or vessel-platform collisions. However, only 5 of the 45 spills of greater than 1 bbl measured 50 bbl or more in volume (Table 4.1); the largest of these was the 163-bbl Platform Irene (Torch) pipeline spill in September 1997. Additionally, since 1999, no spills greater than 50 bbl have occurred in the region.

For the purposes of this biological evaluation, BOEM has estimated that one oil spill of 50 to 1,000 bbl could occur as a result of the proposed action over the approximately year life of the proposed project. This number represents oil spill occurrence, not oil spill probability, and is based solely on the oil spill accident rates and oil resource volume estimate. The estimated probability that one or more spills of this size will occur is 4.4 percent.

An effort also was made to estimate the likely size of such a spill. The BOEM U.S. Oil Spill Database includes Pacific and Gulf of Mexico OCS spills of greater than 1.5 bbl recorded between 1971 and 1999. The database contains platform and pipeline spills, but no barge or tanker spills. Of the 2,125 total spills in the database, 106 are in the range of 50-999 bbl. The mean volume of these spills is 158.6 bbl, and 75 percent (79) are of less than 200 bbl. More than 95 percent (101) are of less than 500 bbl. Given these data and the experience in the Pacific Region over the last 40 years, the most likely spill volume from the Electra Field development would probably be less than 200 bbl in volume.

BOEM also has estimated the number of major oil spills (i.e. spills of equal to or greater than 1,000 bbl) that could occur as a result of the proposed action. The major spill estimate is based on the estimated production of oil over the life of the proposed project, including the subsea pipeline transport of hydrocarbons to shore. Based on the BOEM Accident Spill Rates from all U.S. platforms and pipelines (Anderson and LaBelle, 1994; Anderson, 2000, unpubl.), the estimated probability that one or more large spills (greater than or equal to 1,000 bbl) will occur in association with the proposed project is 0.3 percent.

Finally, federal regulations concerning oil spill response plans for OCS facilities require operators to calculate worst-case discharge volumes using the criteria specified in 30 CFR §254.47. These include 1) the maximum capacity of all oil storage tanks and flow lines on the facility, 2) the volume of oil calculated to leak from a break in any pipelines connected to the facility, and 3) the daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility. Since these are worst-case estimates, intended to insure that an operator has the capacity to respond to the largest imaginable spills, they are based on unlikely events.

This is particularly true of the estimates for the first and third spill types described above. A catastrophic event would be required to empty all storage tanks and flow lines on the production platform. Similarly, with the implementation of modern blowout prevention equipment, operating procedures, and the current inspection program, blowouts have become rare. As discussed above, no blowout resulting in the release of substantial quantities (>1,000 bbl) of oil has occurred on the Pacific OCS since the 1969 Santa Barbara spill. Nevertheless, as was evident in the case of the 2010 *Deepwater Horizon* event, accidents can and do occur.

In the wake of the 2010 *Deepwater Horizon* well blowout and oil spill in the Gulf of Mexico, the BOEM substantially revised and increased the requirements for worst case discharge scenario calculations. Among the changes included was the incorporation of the time to drill a relief well and an added level of conservatism in assumptions regarding the operational ability of blow out preventer equipment following a catastrophic event.

The BOEM estimates that the most likely maximum size of a major oil spill from the Electra Field development is the maximum volume of oil calculated to be spilled from a well blow out that occurs at well C-16 (which has the higher estimated flow rate of the two proposed wells), "after the well reaches total depth with the drill pipe out of the well, before installing the 7 inch liner". Under these conditions, the scenario results in an estimated spill rate of 1,190 bbl/d.

However, as in the case of the *Deepwater Horizon* event, the worst-case scenario also assumes that there is no functioning blow out prevention equipment in place, requiring the drilling of a relief well to stem the flow of oil into the environment. For the Electra Field and Platform Hidalgo, it has been conservatively estimated that it will require 80 to 111 days to drill a relief well, bringing the total worst-case spill size to 95,200 to 132,090 bbl of oil. This blowout spill size is similar in size to what was addressed in the 1984 EIR/EIS for the Point Arguello Field that use a 100,000 barrel spill for a severe blowout.

The most likely scenario, however, as discussed above, is that one oil spill in the 50-1,000 bbl range would occur over the life of the proposed project (with approximately a 4.4 percent chance of occurrence), and that such a spill would be less than 200 bbl in volume.

The level of impacts from such a spill will depend on many factors, including the type, rate, and volume of oil spilled and the weather and oceanographic conditions at the time of the spill. These parameters would determine the quantity of oil that is dispersed into the water column; the degree of weathering, evaporation, and dispersion of the oil before it contacts a shoreline; the actual amount, concentration, and composition of the oil at the time of shoreline or habitat contact; and a measure of the toxicity of the oil.

Oil Spill Risk Assessment (OSRA) Model

The analyses described below provide possibilities of oil spill trajectory and landfall or resource impact based on an Oil Spill Risk Assessment (OSRA) model calculation. The OSRA model analysis is the traditional BOEM method of determining probabilities of oil spill landfall and impacts to resources. It calculates numerous trajectories from a pre-designated launch point by varying the wind over a static, seasonally-averaged ocean current field and applying the deep ocean 3.5-percent wind rule to project the assumed movement of oil over the surface layer of the water. Shoreline segments are partitioned into their USGS Quad maps, and probabilities of oil spill landfall for each shoreline segment are calculated.

These analyses provide important insights that help present a more complete picture of what may occur when oil is spilled and represent the best available information the BOEM currently has to offer on possible oil spill trajectories in the Santa Barbara Channel-Santa Maria Basin area.

In order to determine the areas that might be contacted by proposal-generated oil spills, BOEM has generated conditional oil spill probability data. Conditional oil spill probabilities are independent of both the accident spill rates and resource estimates; they are based solely on the OSRA model simulation trajectories and assume that a spill has occurred. Attachment F describes the OSRA model and provides graphical depictions of the results of the conditional model runs for southern California. Four launch points were included in the analysis for the proposed Electra Field project: Platform Hidalgo, Platform Harvest, Platform Hermosa, and the Hermosa-to-shore pipeline.

The following paragraphs present seasonal synopses of the conditional OSRA model runs conducted for the proposed development of the Electra Field. For each season, the OSRA model calculated probabilities of contact to shoreline segments for spills from each of the four launch points over 10-, and 30-day periods. The results of each of these conditional model runs are included in Attachment F. The effects of weathering on oil make the first 10 days of the oil spill trajectory the most important in a risk analysis assessment, and have been focused on here. Additionally, containment measures are generally in place well before 30 days have elapsed.

Spring (March-May). Based on the spring OSRA model runs, the probabilities that oil spilled from the Electra Field development would contact San Miguel and Santa Rosa Islands range up to 24.2 percent by day 10, but do not change over the 30-day period. No contact with the mainland is predicted.

The spring conditional runs show predominantly south and southeastward movement of an oil spill during this season, with the highest probabilities of contact occurring on the western portions of San Miguel and Santa Rosa Islands from a spill along the Hermosa-to-shore pipeline.

Summer (June-August). The OSRA model runs for summer indicate an even smaller probability of contact to the northern Channel Islands than in spring. Contact would be limited to San Miguel Island, with probabilities of contact ranging from 0.3 to 16.7 percent by day 10. As was the case for spring, the model runs predict no mainland contacts, north or south, from a spill during this season.

The summer conditional runs show predominantly southward movement of an oil spill, with the highest probabilities of contact confined to the western half of San Miguel Island. As in spring, the highest probabilities of contact were associated with a spill from the Hermosa-to-shore pipeline.

Fall (September-November). The fall OSRA model runs indicate relatively low probabilities of contact, up to 6.3 percent, to the western portions of San Miguel and Santa Rosa Islands after 10 days. The contact probabilities do not increase over the 30-day period. Additionally, a slight (0.3 percent) probability of a spill reaching the western portion of Santa Cruz Island by day 30 exists in the event of a spill originating at Platform Hermosa.

The fall model runs also indicate a low probability (less than or equal to 3.3 percent) that an oil spill from the Electra Field would contact the mainland shore at, and just north of, Point Arguello within 10 days. Additionally, low shoreline contact probabilities (less than or equal to 0.3 percent) are recorded along the northern coast until just below Point Sal. These probabilities do not change over the 30-day period.

The fall runs indicate movement to both north and south and considerable spreading throughout the 10-day model period. Relatively greater movement to the south results in low contact probabilities to the southern and eastern portions of Santa Rosa Island. As before, the highest probabilities of contact were associated with a spill from the Hermosa-to-shore pipeline.

Winter (December-February). The conditional OSRA model runs for winter give probabilities of up to 19.7 percent that an oil spill from the proposed project would contact San Miguel Island within 10 days. By the end of the 30-day period, these probabilities increase only slightly, to

21.1 percent. Chances of contact to Santa Rosa Island are much slighter, reaching only 2.8 percent by day 30. Additionally, a slight (less than or equal to 0.3 percent) probability of a spill reaching the northern and western portions of Santa Cruz Island by day 10 exists in the event of a spill originating from the Hermosa-to-shore pipeline. These probabilities do not change over the 30-day period.

North of Point Conception, the model runs show low probabilities of up to 3.3 percent that the Point Arguello area would be contacted by a spill within 10 days. These probabilities do not change over the 30-day period.

The winter runs indicate some spreading to the north and northwest. Movement to the south appears comparable to that of the fall season. The highest probabilities of contact were again associated with a spill from the Hermosa-to-shore pipeline.

4.3.2 Oil Spill Prevention and Response

Platform Inspections and Drills. The Bureau of Safety and Environmental Enforcement (BSEE) is the new federal agency that oversees the safe and environmentally sound exploration and production of oil and gas on the OCS. On October 1, 2011, the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), formerly the Minerals Management Service (MMS), was replaced by the Bureau of Ocean Energy Management (BOEM) and the Bureau of Safety and Environmental Enforcement (BSEE) as part of a major reorganization effort aimed at addressing the inherently conflicted missions of MMS, which was charged with resource management, safety and environmental protection, and revenue collection.

In the Pacific OCS Region, BSEE inspectors and engineers visit the offshore platforms 365 days a year to ensure that safety, maintenance, and operational standards are being maintained and to prevent oil spills from occurring. Unannounced, partial production and drilling inspections of every offshore facility in the Region are conducted at least once per month, in addition to thorough annual inspections of each facility. Three or four times a year, the BSEE also conducts intensive, multi-day inspections, known as focused facility inspections (FFIs), rotating among the offshore facilities.

In order to test offshore operators' states of readiness and response capabilities, as well as their knowledge and understanding of their individual oil spill response plans (OSRPs), the BSEE also conducts frequent oil spill response exercises at OCS facilities. Appropriate federal, state, and local agencies are notified of, and frequently take part in, these exercises. Two types of exercises are conducted: 1) equipment deployment exercises (EDEs), and 2) table-top exercises (TTEs).

EDEs can be minor or major, and the exercises conducted in the Pacific OCS Region are unannounced. A minor EDE requires the successful deployment and operation of primary response equipment at the platform. A major EDE requires the establishment of an onshore incident command center, as well as the successful deployment and operation of primary and, to some degree, secondary response equipment. Minor EDEs are conducted at least once per year per offshore facility. The BSEE also schedules one major drill every year, rotating among the facilities.

A TTE is an exercise of an operator's spill management team response while simulating deployment of response equipment. An intended EDE may become a TTE if for some reason (e.g., weather or damage to equipment) response equipment cannot be deployed without unacceptable risk to personnel and the EDE cannot be rescheduled.

When BSEE inspectors conduct drills at the OCS facilities, the operators are judged, in part, by their ability to show containment of the simulated spill within 1 hour and skimming operations within 2 hours. If these guidelines are not met, the BSEE inspector can issue an Incident of Non-Compliance (INC) that will indicate how the operator failed in the drill and give them some time to remedy the failure. A retest will be conducted at some later time to ensure that the operator has corrected the fault. During a drill, various records, including training certifications and equipment inspections, are also checked. INCs may also be issued for failure in these areas.

Pipeline Inspection. The Pacific OCS Region also has a rigorous offshore pipeline inspection policy. The policy specifies several types of regular inspections. The operator is required to conduct weekly inspections by boat or aircraft of the ocean surface along the pipeline route for leakage. The records of these inspections must be submitted annually to the BSEE.

External and internal inspections of all oil and gas pipelines by a third party are also required in alternating years. Plans for these inspections must be submitted to the BSEE at least 30 days before the survey; inspection results must be submitted within 60 days of survey completion. The external inspections, which must be conducted using ROV or side-scan sonar, are intended to identify burial and spanning conditions, protrusions, structural integrity, damage, and corrosion to the pipeline. The internal inspections involve the use of internal survey tools to identify corrosion and/or damage.

If an inspection reveals a potential problem with a pipeline, the BSEE requires the operator to develop a remediation plan to address the problem. The plan is submitted to the BSEE for review and approval. If the BSEE is unsatisfied with the plan, or if an inspection has identified a problem requiring immediate action, the BSEE has the authority to shut down the pipeline. This is accomplished by de-rating the pipeline to a lower maximum volume and pressure, by shutting in the pipeline directly, or by suspending the operator's approval to transport OCS oil through the pipeline until the problem is resolved.

BSEE regulations state that operators may be required to equip oil pipelines with a metering system to provide a continuous volumetric comparison between the input to the line at the structure(s) and the deliveries onshore. Such a system must include an alarm system and be sensitive enough to detect variations between input and discharge volumes. Alternately, an operator may, with approval from the BSEE, install a system capable of detecting leaks in the pipeline. The majority of the oil pipelines in the Pacific OCS Region have continuous volumetric comparison-type leak detection systems. All oil pipeline leak detection systems must be installed and tested to demonstrate indicated design performance levels.

The Platform Hermosa-to-shore pipeline, which would transport production from the Electra Field development, went into operation in June 1991. The pipeline is equipped with a continuous volumetric comparison-type leak detection system (Chevron 1997).

Oil Spill Response. As discussed above, BSEE regulations require that each OCS facility have a comprehensive OSRP. Federal regulations (30 CFR Part 254) specify oil-spill response requirements for offshore oil and gas facilities. Operators of oil handling, storage, or transportation facilities must submit a spill-response plan to the BSEE to demonstrate their ability to respond quickly and effectively whenever oil is discharged from their facility. Response plans consist of an emergency response action plan, and supporting information that includes an equipment inventory, contractual agreements with subcontractors, a worst-case discharge scenario, a dispersant use plan, an in-situ burning plan, and details on training and drills (Chevron 1997). Each response plan must be reviewed by the operator at least every 2 years and submitted with modifications to the BSEE for review and approval.

Since 1970, oil companies operating in the Santa Barbara Channel and Santa Maria Basin have funded and operated a non-profit oil spill response cooperative called Clean Seas (Clean Seas, 2000). Clean Seas acts as a resource to its member companies by providing an inventory of state-of-the-art oil spill response equipment, trained personnel, training, and expertise in planning and executing response techniques. Clean Seas personnel and equipment are on standby, ready to respond to an oil spill, 24 hours a day, 365 days a year (Chevron 1997).

Clean Seas' area of responsibility stretches from Point Dume north to approximately Cape San Martin, and includes the northern Channel Islands. To provide spill response coverage in the area, Clean Seas maintains two large Oil Spill Response Vessels (OSRVs), several smaller response vessels, and pre-positioned equipment at strategic locations.

In conjunction with the Ventura County Commercial Fishermen's Association, Clean Seas founded the Fishermen's Oil-spill Response Team (FORT) in 1990. More than 300 area fishermen have been trained to respond to spill situations as members of FORT. FORT vessels have acted in support of Clean Seas' response efforts both in drills and at a number of offshore spills, where they have deployed booms, assisted logistics, and served as wildlife rescue platforms.

The primary oil spill response for the Point Arguello Unit facilities is provided by Clean Seas' OSRV *Mr. Clean III*. *Mr. Clean III* normally is moored adjacent to Platform Harvest or in Cojo Anchorage near Point Conception. Response time from Cojo Anchorage to the Point Arguello facilities is estimated to be approximately one hour. *Mr. Clean III* is equipped with two Lori Five Brush advancing skimmer units, one stationary skimmer, and one DOP 250 Skimmer, plus accessory equipment; 1500 feet of 70-inch Expandi Boom on a hydraulic reel and 1500 feet of 43-inch containment boom; a fast response boom boat, a dispersant application system, an 18-ton crane, 10 bags each of absorbent boom and pads, and an onboard oil storage capacity of 1400 bbl.

Secondary oil spill response from an OSRV would come from *Mr. Clean*, moored outside Santa Barbara harbor along with Clean Seas' oil-recovery barge. *Mr. Clean* could arrive at the Point Conception area in about 5 to 6 hours. This vessel would be used in the case of a spill that was larger than the primary OSRV could handle.

In addition to the OSRVs, Clean Seas maintains smaller response vessels, including two 32-foot Spill Response Vessels (SRVs), Fast Response Support Boats (FRSB), and miscellaneous small boats. These vessels are based in Santa Barbara Harbor and at Clean Seas' Carpinteria facility. If needed in support of *Mr. Clean III*, they could reach the Point Arguello facilities in 3 to 4 hours.

Clean Seas also is equipped and prepared to respond to oil spill threats to sensitive shoreline areas within its area of responsibility. Detailed and up-to-date information on sensitive areas and response strategies in the Clean Seas' area is provided in the Northern Sector, Los Angeles/Long Beach Area Contingency Plan prepared by the U.S. Coast Guard and the California Office of Oil Spill Prevention and Response, and in the Clean Seas Regional Response Manual. Based on Clean Seas cascadable agreements, additional levels of oil spill response to the Point Arguello facilities are provided by Marine Spill Response Corporation (MSRC), and Advanced Cleanup Technology, Inc**.**

The Marine Spill Response Corporation (MSRC) is a nation-wide spill response cooperative, established by the oil industry in the wake of the *Exxon Valdez* spill. Founded in 1990, it is the largest dedicated standby oil spill response organization in the United States. MSRC operates four OSRVs in Southern California and two in the San Francisco Bay. The OSRVs are approximately 210 feet long, have temporary storage for 4,000 barrels of recovered oil, and have the ability to separate oil and water aboard ship using two oil-water separation systems.

To enable the OSRV to sustain cleanup operations, recovered oil is transferred into other vessels or barges. The MSRC's southern California response vessel is the OSRV *California Responder*, which is currently based in Port Hueneme, approximately 8 to 10 hours response time from the Point Arguello facilities. MRSC also maintains a 32,000 bbl capacity barge at Port Hueneme. Originally, it was intended that the *California Responder* only be deployed in response to oil spills of 1,200 bbl or greater. However, due to the superior operating record and lack of large spills in this region, the *Responder* now responds to smaller spills on an on-call basis.

Advanced Cleanup Technologies, Inc. (ACTI) is a primary contractor for onshore and shoreline cleanup. ACTI has sufficient resources and trained personnel to satisfy all federal and state shoreline response planning requirements. In the event an onshore or shoreline response is required, ACTI personnel and equipment can respond in under a few hours.

The BSEE also routinely inspects and can write INCs to the oil spill cooperatives and ACTI.

5.0 Impacts to Threatened and Endangered Species

5.1 Marine Mammals

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on marine mammals. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on threatened and endangered marine mammal species in the project area.

Noise, Lighting, and Disturbance

Aircraft Traffic. No increases in helicopter traffic are proposed for the Electra Field development project. Therefore, no impacts to marine mammals are expected from aircraft operations. Nevertheless, the following information has been included herein for reference.

There have been few systematic studies on the reactions of pinnipeds to aircraft (Richardson et al. 1995). Most documented observations of the reactions of pinnipeds to aircraft noise related to animals hauled out on land. Under these circumstances, recorded reactions range from increased alertness to headlong rushes into the water. In open water, pinnipeds sometimes respond to low-flying aircraft by diving (Richardson et al. 1995; M.O. Pierson, pers. obs.).

There are no data on the received levels at which toothed whales, or odontocetes, react to aircraft (Richardson et al. 1995). Observed reactions include diving, slapping the water with flukes or flippers, and swimming away. Information on the reactions of sperm whales to aircraft has been mixed. Sperm whales have not been observed to exhibit obvious reactions to low-flying helicopters (Richardson et al. 1995). However, sperm whales have been observed to dive immediately in response to a Twin Otter passing 150-230 m overhead (Mullin et al. 1991).

Baleen whales vary in their responses to the approach of aircraft. Richardson et al. (1995; pp. 249-252) review the recorded behavior of several baleen whale species, including bowhead, right, gray, humpback, and minke whales. They conclude that response depends on the whales' activities and situations, with foraging or socializing groups less likely to react to the approach of aircraft than individual animals. Observed responses include hasty dives, turns, and other changes in behavior. To date, there is no evidence that aircraft disturbance has resulted in long-term displacement of baleen whales.

Marine Vessel Traffic. Off California, collisions between vessels and whales have occurred frequently. Between 1975 and 1980, twelve collisions occurred off southern California, resulting in the deaths of six gray whales (Patten et al. 1980). However, fin and blue whales are also highly susceptible to ship strikes.

During the fall of 2007 there were five confirmed blue whale fatalities within the SCB within a two month period. At least two of these fatalities were attributed to ship strikes: a 15-foot (4.6-m) long bruise was found on the side of a juvenile whale that washed up in Ventura County in September 2007 after initially being sighted from a plane near San Miguel Island; and a second whale thought to have been hit by a freighter was found floating in Long Beach Harbor a week earlier. This spate of fatalities was designated as an "unusual mortality event" by NOAA.

Four additional fatalities have occurred to fin and blue whales in the region as a result of ship strikes since then. The most recent event, in April 2009, involved a 60-foot (18.3-m) fin whale that was struck and impaled upon the bow of a 900-foot container ship transiting between the Santa Barbara Channel and San Pedro Bay; it was the third fin whale mortality within the SCB from a known ship strike in less than one year.

There have been specific studies of reactions to vessels by several species of baleen whales, including gray (e.g., Wyrick, 1954; Dahlheim et al. 1984; Jones and Swartz, 1987), humpback (e.g., Bauer and Herman, 1986; Watkins, 1986; Baker and Herman, 1989), bowhead (e.g., Richardson and Malme, 1993), and right whales (e.g., Robinson, 1979; Payne et al. 1983). There is limited information on other species.

Low-level sounds from distant or stationary vessels often seem to be ignored by baleen whales (Richardson et al. 1995). The level of avoidance exhibited appears related to the speed and direction of the approaching vessel. For example, right whales are often approachable by a slowly moving boat, but will move away from a rapidly moving vessel (Watkins, 1986). Observed reactions can range from slow and inconspicuous avoidance maneuvers to instantaneous and rapid evasive movements. Baleen whales have been observed to travel several kilometers from their original position in response to a straight-line pass by a vessel (Richardson et al. 1995).

Odontocetes often tolerate vessel traffic, but may react at long distances if confined (e.g., in shallow water) or previously harassed (Richardson et al. 1995). Depending on the circumstances, reactions may vary greatly, even within species. Although the avoidance of vessels by odontocetes has been demonstrated to result in temporary displacement, there is no evidence that long-term or permanent abandonment of areas has occurred. Sperm whales may react to the approach of vessels with course changes and shallow dives (Reeves, 1992), and startle reactions have been observed (Whitehead et al. 1990; Richardson et al. 1995).

Amongst the pinnipeds, seals often show considerable tolerance of vessels. Sea lions, in particular, are known to tolerate close and frequent approaches by boats (Richardson et al. 1995).

Offshore Drilling and Production. As discussed in Section 5.1.3, the sound levels produced by drilling from conventional, bottom-founded platforms are relatively low and are similar to levels generated by production activities (Gales, 1982). Richardson et al. (1995) predict that the radii of audibility for baleen whales for production platform noise would be about 2.5 km in nearshore waters and 2 km near the shelf break.

For gray whales off the coast of central California, Malme et al. (1984) recorded a 50-percent response threshold to playbacks at 123 dB re 1 micro Pa (and about 117 dB re 1 micro Pa in the 1/3-octave band). This is well within 100 m in both nearshore and shelf-break waters; therefore, the predicted radius of response for grays, and probably other baleen whales as well, would also be less than 100 m. Richardson et al. (1995) predicted similar radii of response for odontocetes and pinnipeds.

Lighting. Lighting associated with this project is not expected to have measurable effects on any of the subject marine mammal species. Although artificial lighting may act as an attractant for certain marine mammals (e.g., sea lions) that use the illumination to feed on readily available prey sources that are either themselves attracted by the light (forage fish, squid), or are merely better illuminated (e.g., salmon at fish ladders), impacts from artificial lighting would be limited to the approximately 100 meter illuminated area around the platforms.

Effluent Discharges

The potential effects of OCS platform discharges on marine mammals include 1) direct toxicity (acute or sublethal), through exposure in the waters or ingestion of prey that have bioaccumulated pollutants; and 2) a reduction in prey through direct or indirect mortality or habitat alteration caused by the deposition of muds and cuttings (SAIC, 2000a, b). However, there is no toxicity information on the effects of muds and cuttings and produced-water discharges on marine mammals. Comprehensive reviews by the National Academy of Sciences (1983), the U.S. Environmental Protection Agency (1985), and Neff (1987) do not address the potential effects of routine OCS discharges on these groups of animals (MMS 1996). Additionally, significant impacts from routine OCS discharges have not been associated with marine mammals, because they are highly mobile and capable of avoiding such discharges, and their ranges far exceed the extent of the discharge plumes.

The EPA's biological assessment for the proposed reissuance of its general NPDES permit for offshore OCS facilities in southern California waters concluded that direct toxicity to listed marine mammals, or their food base, should be minimal (SAIC, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the mixing zone. Therefore, any contact with OCS discharges likely would be extremely limited. Potential impacts to listed marine mammals would most likely occur through the bioaccumulation of toxins in prey, or through the displacement or reduction of prey species (MMS 1996; SAIC 2000a, b). The potential impacts of OCS effluents on individual listed species are discussed below.

Oil Spills

Marine mammals vary in their susceptibility to the effects of oiling (Geraci and St. Aubin 1990; Williams 1990; Loughlin 1994a). Oil may affect marine mammals through various pathways: surface contact, oil inhalation, oil ingestion, and baleen fouling (Geraci and St. Aubin 1990). Cetaceans risk a number of toxic effects from accidental oil spills at sea (Geraci 1990). Since cetaceans (like most adult pinnipeds) rely on layers of body fat and vascular control rather than pelage to retain body heat, they are generally resistant to the thermal stresses associated with oil contact. However, exposure to oil can cause damage to skin, mucous, and eye tissues. The membranes of the eyes, mouth, and respiratory tract can be irritated and damaged by light oil fractions and the resulting vapors. If oil compounds are absorbed into the circulatory system, they attack the liver, nervous system, and blood-forming tissues. Oil can collect in baleen plates, temporarily obstructing the flow of water between the plates and thereby reducing feeding efficiency. Reduction of food sources from acute or chronic hydrocarbon pollution could be an indirect effect of oil and gas activities.

It has been suggested that cetaceans could consume damaging quantities of oil while feeding, although Geraci (1990) believes it is unlikely that a whale or dolphin would ingest much floating oil. However, during the *Exxon Valdez* oil spill in 1989, killer whales were not observed to avoid oiled sections of Prince William Sound, and the potential existed for them to consume oil or oiled prey (Matkin et al. 1994). Fourteen whales disappeared from one of the resident pods in 1989-90, and although there was spatial and temporal correlation between the loss of whales and the spill, no clear cause-and-effect relationship was established (Dahlheim and Matkin 1994). Fin, humpback, and gray whales were observed entering areas of the Sound and nearby waters with oil and swimming and behaving normally; no mortality involving these species was documented (Harvey and Dahlheim 1994; Loughlin 1994b; von Ziegesar et al. 1994; Loughlin et al. 1996).

Baleen whales in the vicinity of a spill may ingest oil-contaminated food (especially zooplankters, which actively consume oil particles) (Geraci 1990). However, since the principal prey of most baleen whales (euphausiids and copepods) have a patchy distribution and a high turnover rate, an oil spill would have to persist over a very large area to have more than a local, temporary effect.

Since oil can destroy the insulating qualities of hair or fur, resulting in hypothermia, marine mammals that depend on hair or fur for insulation are most likely to suffer mortality from exposure (Geraci and St. Aubin, 1990). Among the pinnipeds, fur seals and newborn pups are the most vulnerable to the direct effects of oiling. Frost et al. (1994) estimated that more than 300 harbor seals died in Prince William Sound as a result of the *Exxon Valdez* oil spill and concluded that pup production and survival were also affected. In contrast, although Steller sea lions and their rookeries in the area were exposed to oil, none of the data collected provided conclusive evidence of an effect on their population (Calkins et al. 1994).

Sea otters, which rely almost entirely on maintaining a layer of warm, dry air in their dense underfur as insulation against the cold, are among the most sensitive marine mammals to the effects of oil contamination (Kooyman et al. 1977; Geraci and St. Aubin 1980; Geraci and Williams 1990; Williams and Davis 1995). Even a partial fouling of an otter's fur, equivalent to about 30 percent of the total body surface, can result in death (Kooyman and Costa 1979). This was clearly demonstrated by the *Exxon Valdez* oil spill (Davis 1990; Ballachey et al. 1994; Lipscomb et al. 1994). Earlier experimental studies had indicated that sea otters would not avoid oil (Barabash-Nikiforov 1947; Kenyon 1969; Williams 1978; Siniff et al. 1982), and many otters were fouled by oil during the Alaskan spill. Approximately 360 oiled otters were captured and taken to treatment centers over a 4-month period, and more than 1,000 dead sea otters were recovered (Geraci and Williams 1990; Zimmerman et al. 1994). Ballachey et al. (1994) concluded that several thousand otters died within months of the spill, and that there was evidence of chronic effects occurring for at least 3 years.

The critical factors involved in sea otter mortality in Alaska, as identified by Williams (1990), were: 1) hypothermia, directly due to the decrease in insulation resulting from fouling of the pelage; 2) pulmonary emphysema, which was thought to be due to the inhalation of toxic fumes and was more or less limited to the first 2 weeks; 3) hypoglycemia, which was possibly due to poor gastrointestinal function; and 4) lesions in other organs (liver, heart, spleen, kidney, brain), which were probably due to ingestion of oil, as well as to stress. Williams felt that stress due to the effects of captivity contributed to tissue damage in otters brought into the treatment centers for cleaning, and that pulmonary emphysema was probably the most serious problem, since it was untreatable.

Potential indirect effects on sea otters resulting from an oil spill include a reduction in available food resources due to mortality or unpalatability of prey organisms and the loss of appropriate habitat available to sea otters as kelp forest communities become contaminated (Riedman 1987).

Impacts of Past and Present OCS Activities

OCS oil and gas activities began off southern California in the late 1960s (Galloway 1997). Section 4.0 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear, 1995, 1997; MMS 1996).

Noise and disturbance associated with OCS activities in the Pacific Region have resulted in few documented impacts to marine mammals. Van Horn et al. (1988) concluded that seismic surveys and support vessel traffic had resulted in temporary, localized disturbances to some marine mammals, primarily gray whales. However, despite hypothesizing that increased vessel traffic off southern California might be causing greater numbers of gray whales to migrate farther offshore (Wolman and Rice, 1979; MBC Applied Environmental Services, 1989), the gray whale population does not appear to have been unduly affected by such activity as no alterations have been observed in their migration routes.

Based on experiences in southern California, and the temporary nature of the slight increase in traffic associated with the proposed project, the BOEM believes that accidental collisions between endangered whales and support vessel traffic are highly unlikely. Although large cetaceans are occasionally struck by freighters or tankers, and sometimes by small recreational boats, no such incidents have been reported with crew or supply boats off California (BOEM, unpubl. data). The same is true for southern sea otters.

Pinnipeds and otters are very nimble and are also considered very unlikely to be struck by vessels. However, the single documented instance of a collision between a marine mammal and a support vessel on the Pacific OCS involved a pinniped—an adult male elephant seal was struck and presumably killed by a supply vessel in the Santa Barbara Channel in June 1999.

The only OCS-related spill in the Pacific Region known to have contacted marine mammals was the 1969 Santa Barbara Channel spill. Although the entire northward migration of California gray whales passed through the Santa Barbara Channel while it was contaminated, Brownell (1971) found no evidence that any cetacean mortality had occurred due to the spill. Similarly, studies of elephant seals and California sea lions contacted by the 1969 spill reported no evidence of pinniped mortality from this event (Brownell and Le Boeuf, 1971; Le Boeuf, 1971). Although, the 1997 Torch oil spill off Point Pedernales contacted the shoreline at the southern end of the sea otter range, no otters are known to have been oiled as a result (M.D. McCrary, BOEM, pers. comm.).

5.1.1 Southern Sea Otter (Threatened)

Although no direct information is available on the potential impacts of exploratory and development drilling operations on sea otters, Riedman (1983; 1984) did observe sea otter behavior during underwater playbacks of drillship, semi-submersible, and production platform sounds and reported no changes in behavior or use of the area. Most of the otters observed by Riedman (1983) were at least 400 m from the projector; all observed by Riedman (1984) were at least 1.2 km away. Although sea otters at the surface were probably receiving little or no underwater noise, some otters continued to dive and feed below the surface during the playbacks. At 1.2 km, the received sound levels of the strongest sounds were usually at least 10 dB above the ambient noise level (Malme et al. 1983; 1984). Drilling activities associated with the proposed action would occur more than 11 km (7 mi) offshore. California sea otters, except for juvenile males, rarely move more than 2 km offshore (Riedman, 1987; Ralls et al. 1988), and thus could be expected to be at least 9 km away from the nearest drilling activity. Because of this distance and the evidence from the playback experiments described above, no effects on sea otters from these activities are expected.

No systematic studies have been made of the reaction of sea otters to aircraft and helicopters (Richardson et al. 1995). During aerial surveys of the California sea otter range conducted at an altitude of about 90 m (Bonnell et al. 1983), no reactions to the two-engine survey aircraft were - observed. . Helicopter traffic is not expected to affect sea otters.

Although sea otters will often allow close approaches by boats, they will sometimes avoid heavily disturbed areas (Richardson et al. 1995). Garshelis and Garshelis (1984) reported that sea otters in southern Alaska tend to avoid areas with frequent boat traffic, but will reoccupy those areas in seasons with less traffic. The vessel traffic corridors between Port Hueneme, the support base, and Platform Hidalgo pass 4 km (2.5 miles) or more offshore while most sea otters remain within 1.6 km (1 mile) of shore. Therefore, no effects on sea otters from service vessel traffic are expected.

As discussed previously, the most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. Further, based on the distribution of past spill sizes, it is estimated that such a spill would probably be less than 200 bbl in volume. The probability that an oil spill of equal to or greater than 1,000 bbl would occur also exists but is extremely low (0.3 percent).

The conditional OSRA model runs indicate that a spill from the Point Arguello Unit (Platforms Hidalgo, Harvest, Hermosa, and the Hermosa-to-shore pipeline) during fall or winter has up to a 3.3-percent chance of contacting the Point Arguello area within 10 days. Slight (<1 percent) chances of contact to mainland areas north of Point Arguello, along Vandenberg AFB, also appear over the 10-day model run period.

Thus, there is a slight possibility that a spill of 50-1,000 bbl would contact the shoreline at the southern end of the southern sea otter's current range. However, predicting the length of coastline affected by an oil spill that comes ashore is extremely difficult due to the complexity of the process, which depends on factors such as nearshore wind patterns and currents, coastal bathymetry, tidal movements, and turbulent flow processes.

Ford and Bonnell (1995), in their analysis of the potential impacts of an *Exxon Valdez*-sized spill on the southern sea otter, concluded that oil spills occurring at the southern end of the otter range present the smallest risk to the population. However, since 1995, southern sea otter range expansion to the south has continued, and seasonal densities at the southern end of their range have increased. During both semiannual surveys (spring and fall) conducted in 2005, close to 200 otters were observed between Point Sal and Point Conception, comprising 5 percent and 7 percent of the total population at that time respectively.

If a spill were to occur, the magnitude of expected sea otter mortality would vary with a number of factors, including the time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of the spill from shore, volume of oil contacting the shoreline, condition of the oil contacting the shoreline, the success of containment operations, number of animals contacted, and the effectiveness of otter cleaning and rehabilitation.

In its Final Revised Recovery Plan for the Southern Sea Otter (USFWS 2003), the USFWS makes the assumption that, lacking reliable data on the survivability of oiled sea otters in the wild, all sea otters coming into contact with oil within 21 days of a spill will die. However, the USFWS recognizes that activation of the California Department of Fish and Game's wildlife care facilities and oil spill response protocols would mitigate these impacts to some extent, and that this assumption is probably conservative. Rapid and effective oil spill cleanup response (as discussed in Section 5.3.2) would also lessen impacts on otters in the spill area.

Nevertheless, it is expected that one 50-1000 bbl spill will occur over the lifetime of the project, and it is estimated that this spill will likely be 200 bbl in size. Given the likelihood of such a spill making landfall along the mainland coast, there is a reasonable probability for sea otter contacts between Purisima Point and Point Conception as a result of a spill occurring during the fall or winter. Although the seasonal nature of the otter migration and the oil spill prevention and response capabilities in place, may act to reduce the number of affected otters, due to the increasing number of otters expanding into the project area, moderate impacts to the southern sea otter from the proposed Electra Field development project are expected, including mortality in the tens of animals.

5.1.2 Steller Sea Lion (Threatened)

As discussed in Section 3.2.2, Steller sea lions are now uncommon in southern California waters; their southernmost active rookery, Año Nuevo Island, is approximately 400 km north of the project area. They would not be affected by routine activities or discharges associated with the proposed action, and it is very unlikely that any Steller sea lions would come in contact with the one spill of about 200 bbl that could occur during the life of the Electra Field development. Therefore, no impacts on Steller sea lions from the proposed project are expected.

5.1.3 Guadalupe Fur Seal (Threatened)

Although a few Guadalupe fur seals appear on the Channel Islands each year (Bonnell and Dailey, 1993; DeLong and Melin, 2000), the Mexico-based population is still quite small (Gallo, 1994). They are almost never sighted at sea off California (Bonnell and Dailey, 1993). As is the case with the Steller sea lion, it is extremely unlikely that any routine activities or accidental oil spills associated with proposed Electra Field development would affect more than one or two individuals of this species. As such, no impacts on Guadalupe fur seals are expected from the proposed project.

5.1.4 Blue Whale (Endangered)

The proposed Electra Field drilling operations and rig installation and removal, would result in slight but temporary increases in supply boat traffic. However, following the completion of drilling activities, which are anticipated to last for approximately five months, supply vessel traffic is expected to return to current baseline levels (six supply boat trips per month). Vessel traffic would be relatively close to shore and would remain in the established traffic corridors. Additionally, as no new helicopter trips will be required for the Electra Field development, beyond the 3 to 5 trips per week per platform currently estimated to occur in the Pacific Region, no impacts from aircraft noise and disturbance are expected.

There have been few detailed studies of the reactions to vessels by rorqual species other than humpback whales (Richardson et al. 1995). Blue and fin whales summering in the St. Lawrence Estuary have been observed to react most strongly to rapid or erratic approaches by vessels (Edds and McFarlane, 1987). As discussed in Section 5.1 above, blue whales would be likely to react to the close approach of crew or supply boats, and some temporary displacement could occur under these circumstances. However, the temporary increase in surface traffic to and from Platform Hidalgo associated with the proposed project is unlikely to have a detectable effect on blue whales during their summer and fall presence in southern California waters.

Similarly, neither the minor and temporary increases in sound levels produced during the drilling activities on Platform Hidalgo, nor the continuing noises produced by production activities, are likely to affect blue whale movements through the project area waters. Blue whales are frequently sighted from Platform Hidalgo, during the summer and fall months.

Although blue whales pass Platform Hidalgo on their way to and from foraging areas in the Santa Barbara Channel, they are unlikely to swim near enough to pass through the platform's effluent mixing zones. In addition, the zooplankton that form the blue whale's primary prey would be unlikely to remain in the vicinity of the platform long enough to bioaccumulate any toxins. Based on limited data, the impacts of effluents, particularly muds, cuttings, and produced water, on plankton generally appear to be limited to the several hundred to several thousand meters extent of the discharge plume for the brief period (perhaps several hours) that the organisms are in the plume (Raimondi and Schmitt 1992; MMS 1996). This could result in some mortality in the immediate vicinity (tens of meters) of the discharge and perhaps some reduced productivity farther away, to the extent of the plume. However, given their short generation time, on the order of hours or days, populations of plankton over broader areas should remain unaffected. For these reasons, the EPA's biological assessment for Section 7 consultation on the reissuance of their general NPDES permit for OCS facilities (SAIC 2000a) concluded that whales off southern California would not be impacted by OCS platform discharges. Thus, no impacts on blue whales are expected from the effluent discharges associated with the proposed action.

The most likely oil spill scenario for the development of the Electra Field reserves is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. Further, based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. This level of spillage would be unlikely to have a detectable effect on the California blue whale population.

The probability that an oil spill of equal to or greater than 1,000 bbl would occur as a result of the proposed project is very low, about 0.3 percent. However, if an oil spill of this size did occur, it would be very likely to contact the waters at the western end of the Santa Barbara Channel. Therefore, if a spill were to occur during summer or fall, when blue whales were in southern California waters to feed, at least part of their local foraging area could be affected.

Based on experiences from past spills, it is unlikely that any direct blue whale mortality would result from such a spill, and there is no evidence that blue whales would avoid oiled areas. However, blue whales could be temporarily displaced from a portion of their foraging area by the cleanup activities associated with the response to a spill of this size. Such displacement could be a source of physical stress for whales in the affected area and might also increase population congestion in areas unaffected by the spill. Nevertheless, these effects would not, in themselves, represent a serious threat to the portion of the California blue whale stock that feeds seasonally in the Southern California Bight.

In conclusion, considering all impact sources, only oil spills are likely to have an effect on blue whales in the project area. However, given the likelihood that a spill occurring as a result of the proposed project would likely be less than 200 bbl in volume, and with the current the oil spill prevention and response capabilities in place, no impacts on blue whales are expected from the proposed development of the Electra Field reserves.

5.1.5 Fin Whale (Endangered)

As discussed in Section 4.2.2, fin whales are present in greatest numbers off southern California in summer and fall (Dohl et al. 1981, 1983; Barlow, 1995; Forney et al. 1995). Fin whales are sighted in the Santa Barbara Channel, although they generally occur farther offshore and in waters south of the northern Channel Island chain (Leatherwood et al. 1987; Bonnell and Dailey, 1993). They are less common than blue or humpback whales in the project area and, therefore, unlikely to be affected by any of the routine activities associated with the proposed development of the Electra Field.

Similarly, fin whales are unlikely to be affected by an accidental oil spill from Point Arguello facilities, were one to occur. Therefore, no impacts to fin whales are expected from the proposed project.

5.1.6 Sei Whale (Endangered)

Due to the low numbers of sei whales estimated to frequent California waters, routine activities associated with the proposed development of the Electra Field reserves are not expected to affect this species. Similarly, sei whales are unlikely to be affected by an accidental oil spill from Point Arguello facilities, were one to occur. Therefore, no impacts to sei whales are expected from the proposed project.

5.1.7 Humpback Whale (Endangered)

Like blue whales, humpbacks are frequently sighted from area platforms during the summer and fall, and the sound levels produced by the drilling and production activities associated with the development of the Electra Field reserves are not expected to affect humpback whales in the project area.

The reactions of humpback whales to vessels vary considerably. Humpbacks often move away when vessels are within several kilometers, (Baker and Herman, 1989; Baker et al. 1992), but may show little or no reaction when much closer (Richardson et al. 1995). They appear less likely to react overtly when feeding. As discussed for blue whales, humpbacks would be likely to react to the close approach of crew or supply boats, resulting in some temporary displacement and, possibly, disruption of feeding activity. However, given the short duration of the anticipated, modest increases in surface traffic to and from Platform Hidalgo associated with the proposed project, it is unlikely to have a detectable effect on humpback whales during their summer and fall presence in southern California waters.

Additionally, although humpback whales do occur near Platform Hidalgo, they are unlikely to swim near enough to pass through platform effluent mixing zones. In addition, as was discussed for blue whales, the zooplankton and small schooling fishes that form their primary prey would be unlikely to remain in the vicinity of the platforms long enough to bioaccumulate toxins. For these reasons, the EPA's biological assessment for Section 7 consultation on the reissuance of their general NPDES permit for OCS facilities (SAIC, 2000a) concluded that humpback whales off southern California would not be impacted by OCS platform discharges. Thus, no impacts on humpback whales are expected from the effluent discharges associated with the proposed action.

However, in Prince William Sound following the 1989 *Exxon Valdez* oil spill, humpbacks were observed feeding in areas that had been heavily oiled, although none were observed feeding in oil (von Ziegesar et al. 1994). The whales did not appear to preferentially favor areas that had not been oiled. No humpback whale deaths or strandings were observed in Prince William Sound in 1989-1990 (Loughlin et al. 1996).

It is estimated that one oil spill of approximately 200 bbl in size could occur during the life of the proposed project. If a spill of this size were to occur from the Point Arguello offshore facilities during the summer or fall, it would be likely to contact part of the area used for feeding by humpback whales in the Santa Barbara Channel and, to a lesser extent, in the southern Santa Maria Basin. Such an event would be unlikely to result in any humpback whale mortality, but could result in the temporary displacement of some animals from local foraging areas, primarily as the result of clean-up activities.

In conclusion, considering all impact sources, only oil spills are likely to have an effect on humpback whales in the project area. However, given the likelihood that a spill occurring as a result of the proposed project would be less than 200 bbl in volume, and the oil spill prevention and response capabilities in place, no impacts on humpback whales are expected from the proposed development of the Electra Field reserves.

5.1.8 North Pacific Right Whale (Endangered)

Due to the low numbers of North Pacific right whales estimated to frequent California waters, neither routine activities nor accidental events associated with the proposed project are expected to affect this species.

In waters off the Atlantic coast, ship strikes are a major source of mortality for these slow-moving whales (Kenney and Kraus, 1993). However, the right whale population in the North Pacific is very small, and right whales are very rarely seen off southern California (Carretta et al. 1994). Therefore, the probability that a right whale would be affected by vessel traffic or noise and disturbance associated with the proposed project is extremely low. It is also highly unlikely that effluent discharges or oil spills from the Point Arguello facilities would impact right whales. Therefore, no impacts on the North Pacific right whale from the proposed action are expected.

5.1.9 Sperm Whale (Endangered)

Although they are occasionally sighted in the Southern California Bight, sperm whales are a pelagic species with a preference for deep waters (Watkins, 1977; Gosho et al. 1984), and are generally found farther offshore (Dohl et al. 1981, 1983; Bonnell and Dailey, 1993). In addition, the squid that comprise their primary prey are deep-water species not known to be abundant near OCS platforms. Thus, sperm whales are unlikely to be present near enough to Platform Hidalgo or traffic corridors to be disturbed by routine activities or accidental discharges associated with the proposed project. Therefore, no impacts on sperm whales are expected from the proposed project.

5.2 Birds

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on coastal and marine birds. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on threatened and endangered bird species in the project area.

Threatened or endangered bird species occurring in the general area of concern for the Point Arguello Unit that were considered in this analysis include: the California least tern, marbled murrelet, western snowy plover, light-footed clapper rail, and the short-tailed albatross.

Noise, Lighting, and Disturbance
Aircraft Traffic. . No increases in helicopter traffic are proposed for the Electra Field development project. Therefore, no impacts to listed bird species are expected from aircraft operations.

Marine Vessel Traffic. No adverse impacts to listed bird species are expected from the temporary increase in vessel traffic associated with the proposed project.

Offshore Drilling and Production. Because all drilling activities would occur about 11 km (6 mi) from the nearest land, noise and disturbance associated with this project are not expected to have measurable effects on any of the subject bird species.

Lighting. Artificial lighting is not expected to have a measurable effect on any of the five listed bird species. Although marbled murrelets may actively forage at night, they occur in very low numbers in the project area, and are typically found only in nearshore waters (<1.2 miles from shore) where they would not be expected to be impacted by night lighting at the offshore platform or along the vessel transport routes. Sightings of murrelets in the project area have also generally occurred well north of the platform and vessel transport routes.

Effluent Discharges

Platform discharges are also not expected to have a measurable effect on threatened or endangered bird species due to the platform's distance to shore and the high degree of dilution that would occur upon discharge (SAIC 2000b; Weston Solutions Inc. and MRS 2006).

Oil spills

Spilled oil may affect birds in several ways: 1) direct contact with floating or beached oil; 2) toxic reactions; 3) damage to bird habitat; and 4) damage to food organisms. Disturbance from cleanup efforts to remove spilled oil may also affect birds.

The principal cause of mortality from oil contact in birds is from feather matting, which destroys the insulating properties of the feathers (Erasmus et al. 1981) and leads to death from hypothermia. Oiling can also result in a loss of buoyancy, which inhibits a bird's ability to rest or sleep on the water (Hawkes, 1961), and can diminish swimming and flying ability (Clark, 1984). Also, an oiled bird's natural tendency is to preen itself in an attempt to remove oil from the plumage. The acute toxicity of such ingested oil (crude or refined) depends on many factors, including the amount of weathering and amount of oil ingested.

Oil-related mortality is therefore highly dependent on the life histories of the bird species involved. For example, birds that spend much of their time feeding or resting on the surface of the water are typically more vulnerable to oil spills (King and Sanger 1979, Carter and Kuletz 1995). Direct contact with even small amounts of oil can be fatal, depending on the species involved. Studies by Dr. Michael Fry (Nero and Associates 1987) have found that exposure to as little as 3 ml of oil (which amounts to just less than a teaspoon) spread evenly on the wings and breast of Cassin's auklets caused severely matted plumage and was a lethal dose. Acute (short-term) mortality, as well as sublethal effects, can also result from toxicity after birds ingest or inhale oil. Chronic (long-term) effects of oiling likely include reduced reproduction and survivability.

Birds that receive lethal doses succumb to a host of physiologic dysfunctions (e.g., inflammation of the digestive tract, liver dysfunction, kidney failure, lipid pneumonia and dehydration) (Hartung and Hunt 1966). Oil that is ingested as a result of preening or eating contaminated prey can cause abnormalities in reproductive physiology, including adverse effects on egg production (Ainley et al. 1981; Holmes 1984; Nero and Associates 1987). In addition, the transfer of oil from adults to eggs can result in reduced hatchability, increased incidence of deformities, and reduced growth rates in young (Patten and Patten 1977; Stickel and Dieter 1979). Growth reduction may also be the indirect result of an oiled parent's inability to deliver sufficient food to nestlings (Trivelpiece et al. 1984).

Cleanup efforts to remove spilled oil may have impacts of their own. Oil spill response and cleanup activities may involve intrusion into sensitive areas. Human presence while booming off an area, cleaning oil off beaches, or attempting to capture oiled wildlife for rehabilitation near seabird colonies may cause flushing from nests or temporary abandonment. Additionally, many seabirds react to disturbance by leaving their roosts or nests to go sit on the water somewhere nearby. In other words, disturbance of the colony may have the effect of flushing the birds into oiled water. This potential should be evaluated on a case-by-case basis in the event of a spill, prior to a decision to approach a roost or breeding colony.

Impacts of Past and Present OCS Activities

Section 4.0 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear 1995, 1997; MMS 1996).

The level of OCS-related helicopter traffic in the Pacific Region is described in Section 4.1. Although helicopter traffic can cause disturbances to birds, especially in largely unpopulated areas (e.g., Alaska), there is no evidence that OCS-related helicopter traffic has affected endangered birds in the Pacific Region (Bornholdt and Lear, 1995). No new helicopter trips are proposed in conjunction with the Electra Field development, beyond the 3 to 5 trips per week per platform currently estimated to occur in the Pacific Region (Bornholdt and Lear, 1995). Several international and numerous smaller airports occur along the southern California coast along with several military airports, and air traffic is a constant daily and even hourly occurrence. Additionally, BOEM provides OCS lessees with guidelines for protecting birds from aircraft.

The largest OCS-related oil spill in the Pacific Region was the 1969 Santa Barbara spill, which resulted in the loss of thousands of birds (Straughn 1971). Between 1971, when formal tracking of all OCS spills was initiated, and 1999, 843 OCS-related oil spills have occurred in the Pacific Region. However, almost all of these (99 percent) have been very small (less than 50 bbl). No impacts to endangered birds or birds in general have been reported from these very small spills. Five OCS-related spills equal to or larger than 50 bbl have also occurred in the Pacific Region since 1971 (less than 1 percent of the total 841 spills). These spills ranged in size from 50-163 bbl. Four of these spills did not contact shore, and no impacts to endangered birds or any birds were reported from them. One spill, however, did contact the shoreline and resulted in the mortality of an estimated 635 to 815 birds (Torch/Platform Irene Trustee Council 2007)

On September 28, 1997, a rupture in the Torch pipeline from Platform Irene to the shoreline occurred releasing an estimated 162 to over 1,242 bbl of crude oil (Santa Barbara County 2001). The rupture resulted in the oiling of approximately 64 km (40 miles) of coastline, stretching from the northern end of Minuteman Beach to Boat House in Santa Barbara County. Approximately 100 acres (40 hectares) of sandy beach were disturbed by oiling and cleanup operations. The cleanup of these beaches required the use of heavy equipment which resulted in extensive physical disturbance of the sandy beach habitat, as well as the removal of marine plants and other matter constituting the “wrack line,” an important source of food and cover for numerous shore species. In addition, another 263 acres (106 hectares) of sandy beach were very lightly oiled (less than or equal to 10 percent oiling by area), but were relatively undisturbed by heavy equipment during cleaning operations (OSPR 1999).

Surveys for dead or live oiled seabirds that were beached were conducted from September 29 to October 5, 1997. Of the 140 birds that were collected during the surveys, 122 were either dead or died after sampling. The primary affected species were coots, cormorants and gulls. However, the survey numbers did not include birds that may have been missed by the surveyors, dead or oiled birds were outside the survey area or did not reach the shoreline, and birds that reached the shoreline in the survey area but were removed by scavengers or predators, such as vultures and coyotes. In total, Ford Consulting (1998) estimated that approximately 353 birds died from oiling that were not recovered during the surveys, bringing the total number of impacted birds to nearly 500. Additionally, although no deaths from oiling were reported for the brown pelican or western snowy plover, Ford Consulting (1998) estimated that 14 California brown pelicans and 13 western snowy plovers were fouled by oil from the pipeline rupture.

A subsequent revision to these numbers occurred in 2007, when the Final Restoration Plan and Environmental Assessment for this spill was published. This analysis determined that a total of between 635 and 815 seabirds and shorebirds were adversely impacted by the Torch spill (Torch/Platform Irene Trustee Council 2007).

The OSRA model provides information on where an oil spill associated with the proposed project might be expected to travel during different seasons. Based on OSRA results, an oil spill from this project would most likely move toward the south or west, potentially impacting San Miguel and Santa Rosa Islands in the spring and summer, but there is a slight probability (up to 3.3 percent) that a spill could contact portions of the mainland shore from Purisima Point to Point Conception if a spill occurred during fall or winter.

5.2.1 California Least Tern (Endangered)

Least terns are at risk from an oil spill because they dive into the water to catch their fish prey. They also nest and roost on beaches and mud flats that may be contacted by an oil spill or are in close proximity to the ocean or an estuary. Additionally, any cleanup processes, if not conducted with respect to Federal and State regulations, could exacerbate the effects of an oil spill on least terns.

The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. Further, based on the distribution of past spill sizes, it is estimated that such a spill would probably be less than 200 bbl in size.

If a spill of 200 bbl were to occur during the spring or summer, when terns are present in California, and move north, contacting the shoreline along Vandenberg AFB, impacts to tern colonies could occur, including some mortality. The severity of these impacts would depend on the size of the spill, the length of shoreline contacted, and the number of terns present in the area. Over the last several years, tern usage at sites on Vandenberg AFB has fluctuated; however, 32-33 breeding pairs established 34 nests and produced 29 fledglings in 2010. This represents the second consecutive year of higher fledgling counts following poorer productivity in 2004-2006 (Marschalek 2005, 2011). The colonies are generally widely spaced, so impacts from a spill would probably be limited to a single colony.

Nevertheless, based on the OSRA model results, a spill from the proposed project would not impact the mainland shoreline during spring or summer when terns are expected to be present in California (See Appendix E). The possibility of contact along the mainland shore from an oil spill is only anticipated with spills during the fall and winter months, when terns are not expected to be present in the region. Additionally, during the remainder of the year, the probability of contact with the mainland shore is very low (less than or equal to 3.3 percent). Nevertheless, if a spill occurred at any time which reached the shoreline, temporary, sublethal impacts to least terns from degraded nesting and foraging areas or resulting from disturbance from cleanup activities could still occur.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in size, and that that any impacts would be temporary and sublethal, restricted to the small colonies north of Point Conception and south of Point Sal, and the comprehensive oil spill prevention and response capabilities in place, impacts to least terns are expected to be low.

5.2.2 Marbled Murrelet (Threatened)

Marbled murrelets are typically at high risk from oil spill impacts due to their utilization of nearshore areas and surface waters, and general habit of ranging a short distance from nesting areas (Carter and Kuletz 1995, Marshall 1988). This, combined with their limited population along the central California coast, makes them extremely vulnerable to impacts from an oil spill from the proposed project.

Although murrelets are not known to breed in the project area, they occur in very low numbers along the northern coast of Santa Barbara county, particularly during the late summer and early fall (Peery and Henry 2010, Lehman 1994). They have also been documented in small numbers in the region during winter. Sightings in recent years, however, have typically been of less than 5 individuals, and have been concentrated near the Santa Maria river mouth and at Point Sal (Lehman 1994). Recent winter sightings have taken place as far south as northern Vandenberg AFB (Lion's Head). If a spill were to occur and move north, contacting the shoreline near or north of Point Sal, impacts to murrelets could potentially occur. The severity of these impacts would depend on the size of the spill, the length of shoreline contacted, and the number of murrelets present in the area at the time.

The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. However, based on the distribution of past spill sizes, it is estimated that such a spill would probably be less than 200 bbl in size.

Based on the OSRA model results, the possibility of contact occurring anywhere along the mainland shore from a 200 bbl oil spill from the proposed project is very low (less than or equal to 3.3 percent), and is only anticipated with spills that occur during the fall or winter season. The probability of a spill from the proposed project impacting the mainland shoreline north of Point Arguello, where most recent (within the last 20 years) sightings of murrelets in the region have been recorded, is an even lower (less than or equal to 0.3 percent) and would only occur in the fall (See Appendix E).

Nevertheless, if a spill occurred at any time which reached the shoreline where murrelets were present, temporary, but potentially lethal impacts to marbled murrelets could occur. Additionally, temporary, sublethal impacts resulting from disturbance from cleanup activities could also occur.

Given the low numbers of marbled murrelets estimated to frequent south-central California waters, and their nearshore distribution when at sea (within 1.2 miles of the shoreline), routine activities associated with the proposed development of the Electra Field reserves are not expected to affect this species. Additionally, given the extremely low probability of a spill from the proposed project reaching the mainland shore, that such a spill would probably be less than 200 bbl in size, that any impacts from such a spill would be restricted to areas south of Point Sal, the comprehensive oil spill prevention and response capabilities in place, and the limited occurrence and seasonality of murrelets in the region, impacts to marbled murrelets from accidental events (i.e., oil spills) associated with the proposed development of the Electra Field reserves are expected to are expected to be low.

5.2.3 Western Snowy Plover (Threatened)

Western snowy plovers are highly vulnerable to oil spills because of their small population size and dependence on sandy beach habitats, which can be contacted by spills. Additionally, oil spill cleanup operations could exacerbate the effects of an oil spill on snowy plovers.

The most likely oil spill scenario for the Electra Field development project, is that one spill of approximately 200 bbl in size could occur during the life of the project. If such an oil spill were to occur from this project, the probability of oil contacting important snowy plover areas, including critical nesting and wintering habitats, is shown in Table 5.1.

Based on the OSRA results, there is a moderate probability (>16 percent) during most seasons of the year that snowy plover areas on San Miguel and western Santa Rosa Island could be contacted in the event of a spill (Appendix E). There is a much smaller probability (less than or equal to 3.3 percent) that areas of the mainland coast, including Vandenberg AFB would be contacted. Vandenberg AFB currently acts as a breeding area for more than 10 percent of the plover population while both Vandenberg AFB and the Channel Islands host several hundred wintering plovers.

Table 5.1 Conditional Probability of Oil Spill Contact with Important Western Snowy Plover Use Areas

Location and Season	Conditional Probabilities[1]	
	10-Day	30-Day
Point Purisima to Point Conception		
Winter	0-3.3	0-3.3
Spring	0-0	0-0
Summer	0-0	0-0
Fall	0-3.3	0-3.3
San Miguel Island		
Winter	0.8-21.1	0.3-21.1
Spring	0-24.2	0-24.2
Summer	0-16.3	0-16.7
Fall	0.3-6.3	0.3-6.1
Santa Rosa Island		
Winter	0-2.2	0-2.8
Spring	0-22.2	0-22.2
Summer	0	0
Fall	0-0.6	0-1.1
Santa Cruz Island		
Winter	0-0.3	0-0.3
Spring	0	0
Summer	0	0
Fall	0	0-0.3

[1]Percent range based on four launch points for the Point Arguello Unit.

The highest probabilities for landfall (>20 percent) occur at the Channel Islands (San Miguel Island and western Santa Rosa Island) during winter and spring and are associated with a spill from the Hermosa-to-shore pipeline. Critical habitat on the southwestern portion of Santa Rosa Island could potentially be impacted at these times. In contrast, there is no likelihood of contact with the mainland coast during the spring breeding season, and only limited potential for contact (<3.3 percent) between Point Sal and Point Conception (including Vandenberg AFB) during the fall and winter.

If a spill were to occur, the magnitude of plover impacts would vary with a number of factors, including the time of year, volume of oil spilled, wind speed and direction, current speed and direction, distance of the spill from shore, volume of oil contacting the shoreline, length of shoreline contacted, condition of the oil contacting the shoreline, the success of containment operations, number of animals contacted, and the effectiveness of plover cleaning and rehabilitation. Although the outcome of containment efforts cannot be predicted, response at the site of a potential spill should be rapid. Impacts to snowy plovers could, however, be exacerbated by beach cleanup efforts.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the likelihood of oil contacting various nesting and wintering areas, and the oil spill prevention and response capabilities in place, impacts on snowy plovers would probably be limited to San Miguel and Santa Rosa Islands, and to the mainland coast between Point Sal and Point Conception. Impacts to the wintering or nesting populations at all of these locations could include mortality of adults, disruption of nesting activity, abandonment of nesting or overwintering beaches.

While spills affecting the area between Point Sal and Point Conception, could potentially impact larger numbers of plovers, cleanup operations and rehabilitation efforts at the Channel Islands could be impeded by weather or sea conditions and the remoteness of the locations. Overall, although the seasonal nature of the plover's presence in the region, combined with the oil spill prevention and response capabilities in place, may act to reduce the number of affected plovers, moderate impacts to the southern western snowy plover from the proposed Electra Field development project are expected, including mortality in the tens of animals.

5.2.4 Light-footed Clapper Rail (Endangered)

The range of light-footed clapper rails is limited to only a very few salt marshes along the California coast, and this, combined with their already low numbers, makes them extremely vulnerable to impacts from an oil spill. Additionally, oil spill cleanup processes, if not conducted in accordance with federal and state regulations, could exacerbate the effects of an oil spill on the rail's habitat.

The nearest marsh to the project area known to be inhabited by light-footed clapper rails is Mugu Lagoon. Although rails have previously inhabited Carpinteria salt marsh, they are not anticipated to re-establish in this location in the near future.

There is a 4.4 percent chance that a 50-1,000-bbl spill would occur from the Electra Field. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than

200 bbl in volume. Further, based on OSRA model results, no contact from such a spill would occur along the southern Santa Barbara and Ventura County coastlines, where Carpinteria salt marsh and Mugu Lagoon are located. In the highly unlikely event that a large (>1,000-bbl) oil spill were to occur from this project and approach a salt marsh occupied by rails, the mouths of marshes are more easily protected than the open coast, which affords the rails a greater degree of safety.

Given that a spill occurring as a result of the proposed project would probably be less than 200 bbl in volume, the likelihood that no contact to an occupied salt marsh will occur, and the oil spill prevention and response capabilities in place, no impacts to light-footed clapper rails are expected from the proposed project.

5.2.5 Short-tailed Albatross (Endangered)

Due to the low numbers of short-tailed albatross estimated to frequent California waters, neither routine activities nor accidental events associated with the proposed development of the Electra Field reserves are expected to affect this species. Therefore, no impacts to this species are expected from the proposed project.

5.3 Reptiles

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on sea turtles. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on threatened and endangered sea turtle species in the project area.

Noise, Lighting, and Disturbance
Aircraft Traffic. . No impacts to marine turtles are expected from aircraft operations associated with the proposed project.

Marine Vessel Traffic. In the Gulf of Mexico, sea turtles are known to be attracted to and feed around offshore platforms (MMS 1996). Although no systematic studies have been conducted on the effects of manmade noise on sea turtles (MMS 1996), noise from service-vessel traffic may elicit a startle reaction from marine turtles and produce a temporary sublethal stress. Service vessels could also collide with and injure marine turtles at the sea surface. However, sea turtles are estimated to be at the sea surface less than 4 percent of the time (Byles, 1989; Lohoefener et al. 1990) and are generally infrequent visitors to the project area. Therefore, collisions with vessel traffic are unlikely.

Additionally, although vessel-related injuries have been reported in the Gulf of Mexico, only one has been known to occur in project waters. In 2004, an olive ridley was found stranded on Ellwood Beach near Santa Barbara with a cracked carapace that was consistent with injury from a boat collision (NMFS 2012). Comparatively, in the Gulf of Mexico, 9 percent of stranded turtles examined showed signs of vessel injuries.

Although marine turtles could be harmed or killed by project-related vessels, due to the limited and temporary increase in vessel traffic associated with the project, the probability of an encounter is low and collision impacts are considered to be adverse but not significant.

Offshore Drilling and Production. No impacts to marine turtles are expected from drilling and production operations associated with the proposed project.

Lighting. No impacts to marine turtles from artificial lighting are expected from the proposed project.

Effluent Discharges

The potential effects of OCS platform discharges on sea turtles include 1) direct toxicity (acute or sublethal), through exposure in the waters or ingestion of prey that have bioaccumulated pollutants; and 2) a reduction in prey through direct or indirect mortality or habitat alteration caused by the deposition of muds and cuttings (SAIC, 2000a, b). However, there is no toxicity information on the effects of muds and cuttings and produced-water discharges on sea turtles. Comprehensive reviews by the National Academy of Sciences (1983), the U.S. Environmental Protection Agency (1985a), and Neff (1987) do not address the potential effects of routine OCS discharges on this group of animals (MMS 1996).

No significant impacts have been associated with these animals, in part, because they are highly mobile and their range far exceeds the extent of a platform discharge plume. An indirect effect related to the displacement or reduction of food/prey species is more likely (MMS 1996).

Oil Spills

If a sea turtle comes into direct contact with oil, a number of physiological effects may occur (MMS 1996). Oil exposure has been observed to adversely affect sea turtle skin tissues, respiration, blood chemistry, and salt gland function. However, test animals exposed to sublethal doses have been observed to recover from oil contact within a month (Lutz 1985; MMS 1996).

Oil spills can adversely affect sea turtles by toxic external contact, toxic ingestion or blockage of the digestive tract, disruption of salt gland function, asphyxiation, and displacement from preferred habitats (Lutz and Lutcavage, 1989; Vargo et al. 1986). Sea turtles are known to ingest oil (Gramanetz, 1988); this may occur during feeding (tar balls may be confused with food) or while attempting to clean oil from flippers. Oil ingestion frequently results in blockage of the respiratory system or digestive tract (Vargo et al. 1986). Some fractions of ingested oil may also be retained in the animal's tissues, as was detected in turtles collected after the *Ixtoc* spill in the Gulf of Mexico (Hall et al. 1983).

It is unclear whether adult sea turtles actively avoid spilled oil (MMS 1996). In some instances, turtles have appeared to avoid oil by increasing dive times and swimming away (Maxwell, 1979; Vargo et al. 1986). Other observers have suggested that sea turtles actually may be attracted to some of the components found in crude oil (Kleerekoper and Bennett, 1976).

Impacts of Past and Present OCS Activities

Section 4.0 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear, 1995, 1997; MMS 1996).

No impacts on sea turtles from past and present OCS oil and gas activities in the Pacific Region have been identified.

5.3.1 Leatherback Sea Turtle (Endangered)

Although leatherbacks are the most commonly observed sea turtles off the west coast of the U.S. (Dohl et al. 1983; Green et al., 1989; NMFS and USFWS, 1998a), their presence is seasonal, peaking during late summer and fall. Additionally, the project area is at the southern end of their expected range, which is centered around foraging grounds offshore Monterey Bay. Given their limited, seasonal presence, in the project area, it is unlikely that routine activities or accidental oil spills associated with the Electra Field development would have a detectable effect on this species. Therefore, no impacts on leatherback sea turtles from the proposed project are expected.

5.3.2 Green Sea Turtle (Endangered)

Off California, green sea turtles are uncommon in waters north of the San Diego area (NMFS and USFWS, 1998b) and are rarely seen in the vicinity of the project area (Dohl et al. 1983). Given their limited, presence in the project area, it is unlikely that routine activities or accidental oil spills associated with the Electra Field development would have a detectable effect on this species. Therefore, no impacts on green sea turtles from the proposed project are expected.

5.3.3 Pacific Ridley Sea Turtle (Endangered)

Pacific ridley sea turtles are infrequent visitors to waters north of Mexico and are unlikely to occur in the vicinity of the project area. Therefore, no impacts on Pacific ridleys from the proposed project are expected.

5.3.4 Loggerhead Sea Turtle (Threatened)

Like Pacific ridley turtles, loggerhead sea turtles are near the northern limit of their range off southern California and are likely to be infrequent visitors to the project area (Stebbins, 1966; NMFS and USFWS, 1998d). Given their limited, presence in the project area, it is unlikely that routine activities or accidental oil spills associated with the Electra Field development would have a detectable effect on this species. Therefore, no impacts on loggerhead sea turtles from the proposed project are expected.

5.4 Marine Invertebrates

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on marine invertebrates. The following section analyzes the potential impacts of activities and accidental events associated with the proposed project on endangered white and black abalone in the project area.

Noise, Lighting, and Disturbance
Aircraft Traffic. . No impacts to invertebrate species are expected from the proposed project.

Marine Vessel Traffic. No impacts to invertebrate species are expected from vessel traffic associated with the proposed project.

Offshore Drilling and Production. No impacts to invertebrate species are expected from drilling and production operations associated with the proposed project.

Lighting. No impacts to invertebrate species are expected from artificial lighting associated with the proposed project. Effluent Discharges

The drilling muds and cuttings and produced waters of OCS oil and gas facilities could potentially affect abalone through direct toxicity by exposure in the water. The EPA biological assessment for the proposed reissuance of its general NPDES permit for offshore OCS facilities in southern California waters concludes that direct toxicity to listed fish species, or their food base, should be minimal (EPA, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the mixing zone. Significant impacts from routine OCS discharges generally have not been associated with fish or marine invertebrates. For example, a successful mariculture operation previously sold mussels collected from OCS platform legs to local restaurants for over a decade. The mussels consistently passed all FDA criteria for marketing shellfish.

Oil Spills

Oil may affect marine invertebrates through various pathways, including direct contact (e.g. smothering), ingestion of petroleum contaminated water, and lingering sublethal impacts due to oil becoming sequestered in sediments and persisting in some cases for years in low energy environments (NRC 1985). The level of impacts and the persistence of the oil in the environment will depend on the volume of oil that reaches the habitat and the amount of mixing and weathering the oil has undergone before reaching the habitat. An at-sea oil spill would likely disperse sufficiently prior to any deposition at depth, that it would not impact white abalone habitat. However if an oil spill made landfall on the mainland or Channel Islands, impacts to black abalone (e.g. smothering) could occur.

Impacts of Past and Present OCS Activities

Section 4.0 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear, 1995; MMS 1996).

Following the 1997 Torch spill (163 bbl) at Point Arguello, large amounts of fresh oil and tar were observed on rocks throughout the middle to lower intertidal zone just north of the Boat House. Tar was observed on sea stars and obscuring the respiratory holes of black abalone, leading observers to conclude that some mortality may have occurred (Raimondi et al. 1999, OSPR, 1998).

5.4.1 White Abalone (Endangered)

Due to NPDES discharge permit requirements and the rapid dilution of the discharges, contaminants from effluent discharges associated with OCS activities should not be measurable in the coastal waters and sediments known to harbor white abalone. Thus, no impacts on white abalone are expected from effluent discharges associated with the proposed project.

Although it is unlikely that white abalone exist within the project area since it is north of Point Conception, areas where white abalone or suitable white abalone habitat exist could be affected by a spill from the project area that exhibits a southward trajectory.

The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. Given the oil spill prevention and response capabilities in place, however, an oil spill of this size would likely weather, mix, and break up to the point where no impacts would occur to white abalone or their habitat. Therefore, no impacts to white abalone or its habitat would be expected from an oil spill associated with the proposed project.

5.4.2 Black Abalone (Endangered)

Due to NPDES discharge permit requirements and the rapid dilution of the discharges, contaminants from effluent discharges associated with OCS activities should not be measurable in the coastal waters and sediments known to harbor black abalone. Thus, no impacts on black abalone are expected from effluent discharges associated with the proposed project.

Oil spill impacts to black abalone are not well known, but smothering and ingestion of toxic compounds are both likely. The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. The most probably points of impact for a spill from the project facilities are along the mainland coast between Point Sal and Point Conception, and on the offshore islands of San Miguel, and Santa Rosa.

Black abalone populations south of San Simeon have been decimated by withering syndrome, experiencing losses of up to 99 percent of the population. Most areas no longer support the densities of adults thought adequate for successful recruitment to occur. Impacts from an oil spill to these already struggling populations could further reduce the chances of recovery for this species. However, the level of impacts to black abalone and the persistence of the oil in the environment will depend on the volume of oil that reaches the habitat and the amount of mixing and weathering the oil has undergone before reaching the habitat.

An oil spill of 200 bbl would probably result in light to heavy tarring of the intertidal zone if oceanographic conditions carried the oil to shore. However, due to the openness of the south-central coast and the high-energy environment of the area, a spill of about 200 bbl originating at Platform Hermosa or along the Hermosa-to-shore pipeline would likely break into smaller slicks, and some of the oil would disperse into the water column before reaching the nearshore waters where black abalone reside. Thus, concentrated oiling of black abalone habitat would not be expected.

Given the low probability of a spill from the Electra Field development project contacting the mainland, and the oil spill prevention and response plans in place, adverse impacts to the remaining black abalone on the mainland are likely to be low. Similarly, although there is a moderate probability of an oil spill reaching San Miguel, Santa Rosa and Santa Cruz islands in the event of a spill exhibiting a southward trajectory, impacts to the black abalone on the islands are likely to be low.

5.5 Amphibians

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on amphibians. The following section analyzes the potential impacts of activities and accidental events associated with the proposed project on the threatened California red-legged frog in the project area.

Noise, Lighting and Disturbance
Aircraft Traffic. .Loud noises such as those produced by a low-flying helicopter would be expected to cause a startle response in some species. Depending on the frequency of the flights and the altitude of the helicopter, disruption of feeding or breeding behaviors can occur.

Marine Vessel Traffic. No impacts to amphibians are expected from the marine vessel traffic associated with the proposed project.

Offshore Drilling and Production. No impacts to amphibians are expected from drilling and production operations associated with the proposed project.

Lighting. No impacts to amphibians are expected from artificial lighting associated with the proposed project. Effluent Discharges
No impacts to amphibians are expected from marine discharges associated with the proposed project.

Oil Spills
Oil may affect amphibians through various pathways, including direct contact, ingestion of contaminated prey, and lingering sublethal impacts due to oil becoming sequestered in sediments and persisting in some cases for years in low energy environments (NRC 1985). The level of impacts and the persistence of the oil in the environment will depend on the volume of oil that reaches the habitat and the amount of mixing and weathering the oil has undergone before reaching the habitat. An at-sea oil spill would not be expected to impact breeding or estivation habitat of red-legged frogs, which occur well upstream of the coast.

Impacts of Past and Present OCS Activities
Section 4.0 provides information on current offshore infrastructure, and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear, 1995; MMS 1996).

No impacts on threatened or endangered amphibians from past and present OCS-related oil and gas activities in the Pacific Region have been reported.

5.5.1 California Red-legged Frog (Threatened)

No new helicopter trips will be required for the Electra Field development, beyond the 3 to 5 trips per week per platform currently estimated to occur in the Pacific Region (Bornholdt and Lear, 1995). Regardless, aircraft noise is temporary in nature and altitude restrictions placed on OCS helicopter flights make it unlikely that the helicopter flights would result in an adverse behavioral effect on red-legged frogs. Thus, no impacts on red-legged frogs are expected from helicopter traffic.

The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl could occur during the life of the project. Based on the distribution of past spill sizes, it is estimated that such a spill would be less than 200 bbl in volume. An oil spill of this size would weather, mix, and break up to the point where only limited tarring would be expected to occur to coastal lagoons in the Point Arguello area. Such a level of spillage would be unlikely to have a detectable effect on the California red-legged frog or the coastal lagoons it uses as seasonal habitat.

If a spill were to occur during the fall or winter season, the OSRA model runs predict up to a 3.3 percent probability that the Point Arguello area would be contacted by oil within 10 days. The coastal rivers and streams in the Point Arguello area support populations of red-legged frogs. Tadpoles have been reported in Jalama and Cañada Honda creeks, and adult frogs can be found seasonally in the coastal lagoons of the central California coast. Eggs and tadpoles are not found in the coastal lagoons.

Adult red-legged frogs move down to the brackish coastal lagoons formed seasonally behind sand berms that close the mouths of rivers and streams along the south central coast. Red-legged frogs cannot tolerate salinities in excess of 9 ppm and leave the coastal lagoons for fresher waters when storms or tides breach these natural berms. There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms have been breached. Although no direct oil contact with frogs is expected from such an event, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. If the sand berms reform and conditions become favorable, some red-legged frogs may return to the lagoons before the contaminated sediments are flushed into the ocean. The level of toxicity of these sediments would be dependent on the weathering of the oil and the volume of oil that reaches the lagoon. However, oil spill of about 200 bbl that contacted the mainland along this section of the California coast would be unlikely to result in red-legged frog mortality or sub-lethal effects. Although habitat destruction could result from clean-up efforts, proper preparation and execution of the oil spill contingency plan should protect these areas during an oil spill response.

In conclusion, given the low probability (less than or equal to 3.3 percent) that an oil spill of about 200 bbl would contact seasonal red-legged frog habitats in the coastal lagoons between Point Sal and Point Conception, and the oil spill prevention and response capabilities in place, no impacts to the California red-legged frog or its habitat would be expected from an oil spill associated with the proposed project.

5.6 Fish

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on fish. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on endangered fish species in the project area.

Noise, Lighting, and Disturbance

Aircraft Traffic. No adverse impacts to fish are expected from daily helicopter flights associated with the proposed project.

Marine Vessel Traffic. No adverse impacts to fish are expected from vessel traffic associated with the proposed project.

Offshore Drilling and Production. No adverse impacts to fish are expected from offshore drilling and production noise associated with the proposed project.

Lighting. Artificial lighting at oil platforms may result in localized interference with the light intensity cues of vertically migrating fishes and zooplankton, and attraction of predator species (e.g., marine mammals and large predatory fishes) that use the illumination of the lights to feed on readily available prey sources. However, if impacts from artificial lighting on fishes and zooplankton occur, they would be limited to the approximately 100 meter illuminated area around the platform. These impacts are considered to be adverse but not significant.

Effluent Discharges

The drilling muds and cuttings and produced waters of OCS oil and gas facilities could potentially affect fish species through direct toxicity by exposure in the water or ingestion of prey that have bioaccumulated toxins from the discharges. The EPA biological assessment for the proposed reissuance of its general NPDES permit for offshore OCS facilities in southern California waters concludes that direct toxicity to listed fish species, or their food base, should be minimal (EPA, 2000a, b). All such discharges are required to meet NPDES water quality criteria, which were established to protect biological resources outside the mixing zone. Significant impacts from routine OCS discharges generally have not been associated with fish. In fact, offshore platforms may provide nursery grounds for some species of rockfish (Love et al. 1999a,b, 2000, 2001).

Currently there are eight generic water-based muds that have been approved for use by EPA. The EPA does not authorize discharge of oil-based drilling fluids into marine waters. The major toxic constituents of drilling muds are trace metals including arsenic, cadmium, chromium, lead, mercury, and zinc. The toxicity of water-based drilling mud to juvenile lobster and flounder was investigated by Neff et al. (1989). They found that both species accumulated small amounts of barium, but no detectable chromium during 99 days of exposure to sandy sediment heavily contaminated with the settleable fraction of a used water-based lignosulfonate drilling mud. There was some physiological and biochemical evidence of stress in both species, but growth was not significantly affected. The authors concluded that, for the species and life stages tested, there is little evidence for toxicity of water-based drilling mud.

Cuttings are generally not highly toxic, but depending on the subsurface formations being penetrated, they may contain toxic metals, naturally occurring radioactive elements, or petroleum. Cuttings generally do not disperse far from the discharge point, and instead accumulate on the seafloor below the platform. Several thresholds (contaminant concentrations at which ecological and toxicological effects rise to a level of concern) have been proposed for marine sediments. The most widely used thresholds for sediments are the “Effects Range-Low” and “Effects Range-Median” guidelines developed by NOAA (Long and Morgan, 1990; Long, 1992; Long et al. 1995). Effects thresholds were ranked, using laboratory and field tests, and the 90^{th} and 50^{th} percentiles were determined. The 90^{th} percentile (i.e., the contaminant concentration at which 90 percent of the studies found no effect) is referred to as ERL and is considered to be a concentration below which adverse impacts are unlikely. The 50^{th} percentile is referred to as ERM and is interpreted as the concentration at which effects are frequently observed. Neff and Sauer (1996) examined PAH concentrations near four petroleum production platforms in the Gulf of Mexico with large produced water discharges. Although PAH concentrations were 2- to 10-fold above background in sediments at 20 m from discharge points, and were at background by 200 m, the PAH concentrations in sediments were generally below the ERL levels determined by Long et al. (1995).

"Produced water" is the water present in the source petroleum. The major constituents are carboxylic acids and phenols, single-ring aromatics, and polycyclic aromatic hydrocarbons. Acute toxicity correlates strongly with the phenol concentration. The contaminants from produced water are rapidly diluted and removed by volatilization and biodegradation (SAIC, 2000a, b). These findings are consistent with the assessment of essential fish habitat that was prepared for the re-issuance of a NPDES General Permit for offshore oil and gas facilities in southern California (SAIC, 2000c). The overall conclusions of the assessment were that the continued discharge from the 22 platforms offshore California will not adversely affect fish outside the mixing zones. Within the 100-m radius mixing zone, discharges from oil and gas exploration, development, and production may have localized effects on water quality and resident marine organisms, including fish. The assessment further concluded that while there may be effects on fish from certain discharges such as drilling fluids and produced water within the mixing zone near an outfall, these effects should be minor and localized.

As a result of NMFS consultation, the NPDES General Permit required a study of the direct lethal, sublethal, and bioaccumulative effects of produced water on federally managed fish species that occupy the mixing zone of produced-water discharges (MRS 2005). That study included site-specific modeling of the dispersion plumes from each platform covered by the permit, including Platform Hidalgo. The study found that fish populations around Platform Hidalgo consist mostly of rockfish that utilize the platform as habitat, rarely venturing far from the protection of the structure. A quantitative exposure assessment found a general absence of impacts from most of the major produced-water constituents. Many of the produced-water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents (benzene, cyanide, silver, and ammonia) had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, because the produced-water discharge achieves high dilution almost immediately upon discharge, the plume volume containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zone.

In September 2005, EPA concurred with the overall conclusions of the study and forwarded them to NMFS as part of the EFH consultation required by the General Permit. In October 2005, NMFS notified EPA that the study met the intent of the conservation recommendations incorporated in the General Permit and that the EFH consultation was complete. Revisions to the NPDES General Permit, which included new compliance criteria for several of the platforms and a revision to the undissociated sulfide criterion, were approved in November 2009 (EPA 2009). Thus, potential impacts to finfish within the 100-m mixing zone around Platform Hidalgo are not likely to be significant.

Oil Spills

Research shows that hydrocarbons and other constituents of petroleum spills can, in sufficient concentrations, cause adverse impacts to fish (NRC, 1985; GESAMP, 1993). The effects can range from mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal communities can be heavily impacted, as well as intertidal communities that provide food and cover for fishes.

Although fish can accumulate hydrocarbons from contaminated food, there is no evidence of food web magnification in fish. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver. Nevertheless, oil effects in fish can occur in many ways: histological damage, physiological and metabolic perturbations, and altered reproductive potential (NRC, 1985). Many of these sublethal effects are symptomatic of stress and may be transient and only slightly debilitating. However, all repair or recovery requires energy, and this may ultimately lead to increased vulnerability to disease or to decreased growth and reproductive success.

The egg, early embryonic, and larval-to-juvenile stages of fish seem to be the most sensitive to oil. Damage may not be realized until the fish fails to hatch, dies upon hatching, or exhibits some abnormality as a larva, such as an inability to swim (Malins and Hodgins, 1981). There are several reasons for this vulnerability of early life stages. First, embryos and larvae lack the organs found in adults that can detoxify hydrocarbons. Second, most do not have sufficient mobility to avoid or escape spilled oil. Finally, the egg and larval stages of many species are concentrated at the surface of the water, where they are more likely to be exposed to the most toxic components of an oil slick.

Impacts of Past and Present OCS Activities

Section 4.0 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear, 1995, 1997; MMS 1996).

No impacts on threatened or endangered fish from past and present OCS-related oil and gas activities in the Pacific Region have been reported.

5.6.1 Tidewater Goby (Endangered)

Tidewater gobies, which are found in shallow coastal lagoons, stream mouths, and shallow areas of bays are not expected to impacted by offshore platform noise and vessel traffic.

Likewise, would not be impacted by effluent discharges. Over the distance from Platform Hidalgo to the shore, any pollutants discharged would be diluted to background levels.

There is some risk that an oil spill might reach the coastal lagoons during a high tide or storm when the sand berms blocking the stream mouths from the ocean have been breached. However, breaches usually occur during the winter and spring months, and tidewater gobies often move upstream out of the lagoons during this time.

Although direct oil contact with gobies would be unlikely, oil can become sequestered in the sediments and persist until rains flush the sediments from the lagoon. When the gobies returned, short-term sublethal effects would also be expected, since gobies burrow into and feed in the sediment and rely on macrofaunal and intertidal communities for food and shelter from predators. The level of impacts, however, would be dependent on the volume of oil that reached their habitat and the amount of weathering and mixing the oil had undergone before reaching the habitat.

The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl would occur during the life of the project. Based on the distribution of past spill sizes, it is estimated that such a spill would probably be less than 200 bbl. An oil spill of this size would weather, mix, and break up to the point where only limited tarring would be expected to coastal lagoons in the Point Arguello area. Such a level of spillage would be unlikely to have a detectable effect on tidewater gobies.

Additionally, oil spill response teams would be expected to boom the mouths of creeks and rivers or enhance the existing berms in the event of a spill, thus minimizing the chance of oil reaching the lagoons.

Based on OSRA model runs, the greatest threat is to goby populations north of Point Conception from a spill occurring during fall or winter. The modes show that during these months there is a low (less than or equal to 3.3percent) probability that an oil spill from Platform Hermosa or the Hermosa-to-shore pipeline would contact the Point Arguello area within 10 days. The probability of contact with Point Arguello drops to zero slightly during spring and summer.

Most goby habitat during fall will be separated from the ocean by sand berms and thus would be protected to some degree. However, tides, heavy surf, or early seasonal rains could breach these barriers. Oil spill response teams would be expected to protect these habitats further with booms and enhancement of the natural berms. During winter months, after rains and storms have breached the natural sand barriers, protection of goby habitat that is within the contact zone of a spill would rely on the speed and effectiveness of the oil spill response team. A spill of about 200 bbl that hit the mainland coast in the Point Arguello area would in all likelihood contact and impact one or two tidewater goby habitats, possibly resulting in some mortality and likely short-term sub-lethal effects. This would depend on the amount spilled and the weathering of the oil.

However, tidewater gobies along the south-central California coast are quite resilient and have a great ability to disperse and re-colonize areas from which they were previously eliminated (USFWS, 1999a). Given the moderate probability that an oil spill would contact the mainland, the oil spill prevention and response capabilities in place, and the ability of tidewater gobies to re-colonize their habitat, expected impacts to tidewater gobies from the proposed Electra Field project are low.

5.6.2 Steelhead Trout (Endangered)

Winter steelhead occur along the south-central coast, entering their home streams from November to April to spawn, while juveniles usually migrate to sea in the spring.

Platform noise and vessel traffic are not expected to impact steelhead trout.

Direct toxicity to this species from effluent discharges associated with the Electra Field development project is unlikely due to discharge requirements and rapid dilution of the discharges. Additionally, heavy metals and hydrocarbons are not expected to be accumulated by their prey to toxic levels due to cellular mechanisms for removal of these substances. Thus, no impacts on steelhead trout are expected from effluent discharges.

The most likely oil spill scenario for the Electra Field development project, based on OCS spill data for California, is that one spill of a volume ranging between 50 and 1,000 bbl would occur during the life of the project. Based on the distribution of past spill sizes, it is estimated that such a spill would probably be less than 200 bbl in volume.

Based on OSRA model runs, the greatest threat is to steelhead populations north of Point Conception during fall and winter. If a spill from the Hermosa-to-shore pipeline were to occur during this time, the OSRA model runs predict a slight (up to a 3.3-percent) probability of contact with the Point Arguello area within 10 days.

During winter months, after rains and storms have breached the natural sand barriers, protection of steelhead habitat that is within the contact zone of a spill would rely on the speed and effectiveness of the oil spill response team. A spill of about 200 bbl that hit the mainland coast in the Point Arguello area would in all likelihood contact and impact one or two steelhead critical habitats. Specifically, a spill originating from Platform Hermosa or the Hermosa-to-shore pipeline during the fall season could potentially enter the Santa Ynez River, San Antonio Creek, and Jalama and Cañada Honda Creeks which are all designated critical habitat for steelhead. Historically, the Santa Ynez system supported the largest steelhead run in southern California.

Impacts to steelhead would be greatest if the spill occurred during adult or juvenile migration to or from spawning and rearing areas upstream of the project. Although little mortality would be expected from a spill of 200 bbl, short-term sublethal effects causing stress might lead to increased vulnerability to disease and perhaps reduced reproduction of impacted individuals. Migration could also be disrupted.

Oil avoidance reactions are well documented in salmon. Adults and juveniles can detect sublethal levels of hydrocarbons (Rice, 1973; Weber et al. 1981) and have been observed actively avoiding contaminated areas (Patten, 1977; Weber et al. 1981). However, these effects are expected to be short-term due to the weathering and mixing that would occur to the oil before it reached the shore. The high-energy environment of the south-central California coast would further minimize the toxicity and persistence of the oil in the environment. Also, in the event of a spill, oil spill response teams would identify river and stream mouths at risk of oil contact and would immediately boom or build protective berms at the river and stream mouths, which could further disrupt migration. Cleanup efforts could also adversely affect steelhead present through direct mortality or stress from harassment or capture and relocation.

In conclusion, oil spills associated with the Electra Field development project would be expected to have minor impacts on steelhead trout if a spill were to contact critical habitat (such as the Santa Ynez River) during a period when steelhead are migrating. Due to the openness of the south-central coast and the high-energy environment of the area, a spill of about 200 bbl originating at Platform Hermosa or along the Hermosa-to-shore pipeline would likely break into smaller slicks, and some of the oil would disperse into the water column. Thus, concentrated oiling of steelhead habitat would not be expected.

Given the low probability of a spill from the Electra Field development project contacting the mainland, and the oil spill prevention and response plans in place, adverse impacts to southern steelhead from the proposed project are likely to be low.

5.7 Terrestrial Plants

This section provides a general discussion of the potential effects of the identified impact factors, including noise and disturbance, effluent discharges, and oil spills, on terrestrial plants. The following sections analyze the potential impacts of activities and accidental events associated with the proposed project on endangered plant species in the project area.

There are two threatened or endangered species of plants in the general area of concern for the Electra Field development project: salt marsh bird's-beak and California sea-blite. Of the potential impact sources identified for this project, only an oil spill could adversely affect these species.

Noise, Lighting, and Disturbance
Aircraft Traffic. No impacts are expected to onshore species.

Marine Vessel Traffic. No impacts are expected to onshore species

Offshore Drilling and Production. No impacts are expected to onshore species.

Lighting. No impacts are expected to onshore species.

Effluent Discharges. No impacts are expected to onshore species.

Oil Spills
Plant mortality from oil spills can be caused by smothering and toxic reactions to hydrocarbon exposure, especially if oil reaches shore before much of the spill's lighter fractions have evaporated or dissolved. Generally, oiled marsh vegetation dies, but roots and rhizomes survive when oiling is not too severe (Burns and Teal, 1971). Research has shown that recovery to pre-oiling conditions usually occurs within a few growing seasons, depending on the magnitude of exposure (Holt et al. 1975; Lytle, 1975; Delaune, et al. 1979; Alexander and Webb, 1987).

Impacts of Past and Present OCS Activities
Section 4.0 provides information on current offshore infrastructure and levels and types of activities. Several reviews have been made of the possible cumulative impacts of these activities on biological resources in the region (Van Horn et al. 1988; Bornholdt and Lear, 1995, 1997; MMS 1996; MMS, 2001).

No impacts on threatened or endangered plants from past and present OCS-related oil and gas activities in the Pacific Region have been reported.

5.7.1 Salt Marsh Bird's-Beak (Endangered)

Salt marsh bird's-beak grows in the higher reaches of coastal salt marshes to intertidal and brackish areas influenced by freshwater input. However, the range of salt marsh bird's-beak is currently limited to a very few (<10) salt marshes along the coast of California and Baja California, Mexico, making this species highly vulnerable to impacts from an oil spill. Within the project area, marshes where this species occurs include Ormond Beach and Mugu Lagoon in Ventura County, Carpinteria Salt Marsh in Santa Barbara County, and Morro Bay in San Luis Obispo County.

Although, a large (>1,000-bbl) oil spill from the proposed project is highly unlikely, one 50-1,000-bbl spill might be expected to occur over the project lifetime. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. However, the OSRA model results (Attachment F) indicate that a spill from the Point Arguello Unit will remain south of Purisima Point, and will not contact the mainland near Morro Bay. Likewise, the OSRA model results indicate that an oil spill from the proposed project will not make landfall anywhere on the mainland south of Point Conception. Therefore, no impacts to salt marsh bird's-beak from the development of the Electra Field are expected.

5.7.2 California Sea-Blite (Endangered)

This plant is highly vulnerable to an oil spill, because its range in the project area is presently limited to a single coastal salt marsh (Morro Bay).

Although, a large (>1,000-bbl) oil spill from the proposed project is highly unlikely, one 50-1,000-bbl spill might be expected to occur over the project lifetime. Based on the distribution of past spill sizes, it is estimated that such a spill probably would be less than 200 bbl in volume. Based on the OSRA model results (Attachment F), however, an oil spill from the Point Arguello Unit will remain south of Purisima Point, and will not contact the mainland near Morro Bay. Therefore, no impacts to California sea-blite from the development of the Electra Field are expected.

6.0 Cumulative Effects

6.1 Introduction

Cumulative effects include the effects of future state, tribal, local, or private actions that are reasonably certain to occur in the action area considered in this biological 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 Act. Cumulative effects are usually viewed as those effects that impact the existing environment and remain to become part of the environment. These effects differ from those that may be attributed to past and ongoing actions within the area since they are considered part of the environmental baseline. The primary difference between project specific effects and cumulative effects is the definition of geographical and temporal boundaries.

Section 7.2 describes actions that are reasonably likely to occur and will be considered in the cumulative effects analysis. These actions include activities that could produce impacts on listed species in the project area during the expected life of the Tranquillon Ridge Unit development project (approximately 30 years).

Section 7.3 describes reasonably foreseeable future federal actions that will not be included in the analysis of cumulative effects, since these actions will be considered in separate consultations pursuant to Section 7 of the ESA. Descriptions of these activities are provided as baseline information.

Section 7.4 describes the cumulative effects that may occur to threatened and endangered species as a result of the listed activities.

6.2 Actions Reasonably Likely to Occur

Table 6.1 contains a list of projects in the region likely to occur which could contribute to cumulative effects on threatened or endangered species. A total of three proposed oil and gas development projects were evaluated. The three proposed projects were identified in State waters, near Coal Oil Point in the central Santa Barbara Channel, and offshore Carpinteria.

These projects are in various stages of environmental review and typically involve resumption or continuation of oil production, with two of the projects proposing the use of extended-reach drilling from existing platforms and the mainland, to access offshore reserves. Overall, these projects would be expected to contribute some increase in the oil spill risk in the Santa Barbara Channel and Santa Maria Basin. Oil spills originating in the central Santa Barbara Channel would be more likely to contact threatened and endangered species that occur along the mainland coast within the Santa Barbara Channel, including the California least tern, and western snowy plover.

Table 6.1 Relevant Cumulative Projects

	Project Name/Applicant	Description/Status
1	Carpinteria Field Redevelopment Project/Carone Petroleum Corp. and PACOPS	Redevelopment of State Leases PRC-4000, PRC-7911, and PRC 3133/Pending
2	Return to production of State Lease PRC-421/ Venoco	Continuation of offshore oil and gas reserves/Application submitted
3	Ellwood Oil Pipeline Installation and Field Improvements, Venoco	Development of offshore oil and gas reserves/Application submitted

Notes: LNG = liquefied natural gas; NG = natural gas;

Carpinteria Field Redevelopment Project, Carone Petroleum Corporation and Pacific Operators Offshore Inc.: Carone has applied to the CSLC to develop and produce existing State Oil and Gas Leases PRC-4000, PRC-7911, and PRC-3133 within the Carpinteria Field.

Specifically, Carone proposed to drill up to 25 new production or injection wells from Outer Continental Shelf (OCS) Platform Hogan. Oil and gas production from the State Leases would be commingled on Platform Hogan with existing production from the Federal lease and sent via existing pipelines to the La Conchita Facility. After processing, gas and oil are sold to The Gas Company and other third parties at the La Conchita sales meters, and shipped via existing pipelines. A Draft EIR/EIS for this project is currently being prepared.

Paredon Project PRC-3150, Venoco: Venoco applied to the CSLC (application received in February 2005) and to the city of Carpinteria to develop existing State Oil and Gas Lease PRC-3150.1 by conducting extended-reach drilling from an onshore site located within Venoco's existing Carpinteria Oil and Gas Processing Facility (Venoco Carpinteria Facility), in the city of Carpinteria. Venoco estimates that this project could produce up to 10,000 bbl/d of crude oil and 10 mmscfd of gas. After processing, oil would enter an existing 16-inch-diameter (41 cm) pipeline to the Rincon Onshore Separation Facility for connection with the existing pipeline system extending to Los Angeles refineries. Processed gas would be delivered via the existing 6-inch-diameter (15 cm) pipeline connection to Southern California Gas Company's existing regional 12-inch-diameter (30 cm) pipeline that passes near the Venoco Carpinteria Facility. The application was found complete in October 2005.

Return to Production of State Lease 421, Venoco: Venoco is proposing to return State Lease PRC-421 to production. The plan for this project was received in May 2004, and it has been reviewed by the Santa Barbara County Energy Division, in consultation with the city of Goleta, as well as by the CSLC. The project includes the removal of old production equipment from oil piers 421-1 and 421-2 (which are California's last remaining surfzone oil piers); repairs to the access road, rock rip-rap wall, and caisson at the end of pier 421-1; installation of a drilling rig and new oil separation and processing equipment on pier 421-2; and reactivation of the oil well on pier 421-2 with a capacity to produce up to 700 bbl/d. The oil would be pumped to Line 96 through an existing pipeline and then to the EMT. The existing pipeline between Line 96 and the 421-1 pier would be upgraded. The CSLC, Santa Barbara County, and the City of Goleta provided comments on the proposed plan, including local permitting and policy concerns. The schedule of the project is unknown. The public scoping meeting for this project was held on June 23, 2005.

Ellwood Oil Pipeline Installation and Field Improvements, Venoco: In August 2005, Venoco submitted an application to the CSLC, Santa Barbara County, and the city of Goleta with a number of project components. The project would include drilling of up to 40 new wells on both the existing leases and the proposed project area, decommissioning and abandonment of the Ellwood marine terminal (EMT) and Line 96, replacement of the existing 2-inch (5-cm) utility pipeline and subsea power cable between the EOF and Platform Holly, and discontinuation of marine transportation via barge.

The offshore EMT abandonment process, including pipeline flushing and abandonment, and the removal of mooring equipment, will last approximately 9 weeks. Vessel traffic will follow the prescribed traffic corridors currently used by vessels supporting platform operations. A temporary vessel route and minimal construction work zone will be defined for removal of the offshore components of the EMT.

Oil production is expected to peak at 12,600 BPD (2,003 m3/day) and gas production at 20 MMSCFD (566,337 m3/day) after five years. The application was found incomplete and is being revised. Although the schedule for this project is unknown, if the project is implemented, it would result in the decommissioning and abandonment of the EMT since there would be no further need for barging.

Paredon, Development of State Leases 3150 and 3133, Venoco: Venoco has proposed to develop new oil and gas reserves from their existing Carpinteria Oil and Gas Processing Facility (CPF) (Venoco, 2000). The proposed project would consist of drilling up to 35 wells from a drilling pad located within Venoco's CPF to existing offshore State Leases PRC 3150 and 3133, as well as an onshore area east of the City of Carpinteria. Venoco estimates that the proposed project would produce up to 23.5 million bbl of oil and 43 billion cubic feet of gas over the life of the project. The project proposes to use existing pipelines to transport the oil and gas obtained from the leases.

Venoco proposes to drill an exploration well and test production through temporary facilities. If the exploratory well proves the development is commercially viable, then installation of permanent drilling facilities and modifications to the existing CPF would follow to allow for the processing of the new oil and gas production.

6.3 Foreseeable Future Federal Actions

Carpinteria Field Redevelopment Project, Carone Petroleum Corporation and Pacific Operators Offshore Inc.: This project proposes the development of State leases (Carpinteria Offshore Field) from within Federal waters (Platform Hogan). A Draft EIR/EIS for this project is currently being prepared jointly by CSLC and BOEM.

6.4 Cumulative Impacts

Given the relative distance between of the Platform Hogan project (Carone) and Platform Hidalgo and the limited drilling activities proposed at both locations, some potential cumulative impacts might be expected. These are discussed below.

Noise, Lighting, and Disturbance

The proposed Electra Field production is not expected to increase activity levels much above that of current operations. Vessel traffic and lighting are both expected to increase slightly during drilling operations, but will return to baseline conditions within about 5 months, following the completion of drilling.

The construction and operation activities associated with the Carone project are expected to be similar to current levels, except for during drilling operations. During drilling operations, temporary, localized increases in lighting, vessel traffic, and noise are anticipated with this project; however, Platform Hogan is located approximately 80 km (50 mi) to the east of Platform Hidalgo, and any impacts from this project or the other proposed projects in State waters are unlikely to contribute perceptibly to noise, lighting, and disturbance impacts on listed species in the project area.

Effluent Discharges
Localized increases in effluents associated with drilling and production would be expected from Platform Hogan if the proposed Carone project were approved.

Oil Spills
Production from PRC-421, Paredon, and increased production at Platform Hogan would increase the overall oil spill risk in the Santa Barbara Channel by some unknown amount, which cannot yet be quantified.

Thus, the overall effect of these three proposed projects would probably be an increased risk of oil contact to threatened and endangered species distributed south of Point Conception. An accidental oil spill associated with the proposed Pier 421, Paredon, or Carone projects would have impacts on threatened and endangered species similar to those described earlier for the proposed Electra Field development project.

However, an oil spill from Platform Hidalgo or its associated pipeline would be most likely to contact those species that occur along the coast of Vandenberg AFB or the northern Channel Islands of San Miguel and Santa Rosa, while spills associated with the three other projects would likely impact portions of the mainland and islands within the central and eastern portions of the Santa Barbara Channel. Species that could be impacted from these projects include the southern sea otter, California least tern, western snowy plover, red-legged frog, tidewater goby, black and white abalone, and southern steelhead.

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PXP

Plains Exploration & Production Company

Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of OCS-P 0450

Accompanying Information Volume
Essential Fish Habitat Assessment

Submitted to:
The Bureau of Ocean Energy Management
Pacific OCS Region

Submitted by:
Plains Exploration & Production Company

October 2012

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1.0 Overview

Global oil consumption during 2012 is projected at approximately 90 million barrels per day (bbl/d), nearly a quarter of which (20 million bbl/d) is attributable to the U.S. During 2012, the Energy Information Administration (EIA) expects U.S. total crude oil production to achieve an average 6.2 million bbl/d, the highest level of production since 1998. By 2020, the EIA anticipates production levels to reach 6.7 million bbl/d, while U.S. demand for oil is expected to reach 27 million bbl/d (EIA 2012). As the demand for energy resources continues to grow both domestically and abroad, the Bureau of Ocean Energy Management's (BOEM) role in striking an appropriate balance between the development of our nation's oil and gas resources, maintaining energy security, and providing adequate protection of the environment becomes harder to achieve.

The 49 active oil and gas leases offshore southern California produce approximately 24 million barrels of oil and 47 billion cubic feet of gas annually (BOEM 2012). Of this amount, the Point Arguello Field currently contributes approximately 5,000 bbl/d (1.8 million bbl annually). Although production from the southern California Outer Continental Shelf (OCS) comprises only a small fraction of the total domestic production, offshore exploration and development of natural gas and oil reserves have been, and continue to be, an important aspect of the U.S. economy.

2.0 Purpose

Essential Fish Habitat (EFH) is defined in the Sustainable Fisheries Act (1996) as those "waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity." Under Section 305 (b) (2) of the Magnuson Fishery Conservation and Management Act (16 U.S.C. 1801 *et seq*) as amended by the Sustainable Fisheries Act on October 11, 1996, Federal agencies are required to consult with the Secretary of Commerce on any actions that may adversely affect EFH. The Department of Commerce published an interim final rule (50 CFR Part 600) in the Federal Register (December 19, 1997, Volume 62, Number 244) that detailed the procedures under which Federal agencies would fulfill their consultation requirements. As set forth in the regulations, EFH Assessments must include: 1) a description of the proposed action; 2) an analysis of the effects, including cumulative effects, of the action on EFH, the managed species, and associated species by life history stage; 3) the Federal agency's views regarding the effects of the action on EFH; and 4) proposed mitigation if applicable.

Section 600.920 (h) describes the abbreviated consultation process the BOEM is following for the proposed Development of the Electra Field reserves described in the associated biological evaluation (BOEM 2012). The purpose of the abbreviated consultation process is to address specific Federal actions that may adversely affect EFH, but do not have the potential to cause substantial adverse impacts.

3.0 Project Description

Plains Exploration & Production Company (PXP) is proposing to develop hydrocarbon reserves in the western half of the northwestern quarter (NW/4) of Federal Lease OCS-P 0450, known as the Electra Field. The field is located in the southern portion of the Santa Maria Basin. The development and production of the Electra Field oil and gas reserves will be accomplished by drilling two extended-reach wells from Platform Hidalgo using existing well slots, pipelines, equipment and facilities. Platform Hidalgo, is located approximately six miles offshore of Point Arguello, California (Latitude 34°29'42.06" N, Longitude 120°42'08.44" W) on the eastern portion of Federal Lease OCS-P450 within the Point Arguello Field Unit. The proposed wells (C-16 and C-17) will utilize a combination of electrical submersible pumps and gas-lift technology. No new equipment or facilities will be needed to develop and produce the Electra Field under this proposal.

All the production from the Electra Field will be combined with the Point Arguello Field oil and gas production (MMS 2000, 2003; Whiting Petroleum Corporation 2000). The produced liquid from Platform Hidalgo is a combination of crude oil, gas, and water. The gas exists as free gas or is in solution in the oil, and the water exists both as free water and emulsion in the oil. Oil would be dehydrated and stabilized on the platforms using existing crude stabilizer vessels and reboilers to strip the light hydrocarbons and hydrogen sulfide (H_2S) out of the production stream. The resulting pipeline quality crude would be transported to the Gaviota facility via the existing PAPCO (Hermosa to shore) pipeline. At Gaviota, the oil will be metered and heated, stored temporarily in the Gaviota Terminal Company storage tanks, then transported via the All-American Pipeline to various refining destinations.

Gas from the Electra Field will be combined with Point Arguello Unit gas on the production platforms. The combined gas will be sweetened for platform use or sale to shore via the existing Point Arguello Natural Gas Line (PANGL) pipeline. A portion of the gas will also be used for gas lift operations. Gas volumes in excess of platform needs or sales to shore will be injected into the producing reservoir for later recovery and use or sales.

Development of the reserves from the Electra Field will be accomplished within the expected remaining lifetime of the Point Arguello Field. The two proposed wells, which will both be drilled from the Hidalgo platform, are expected to recover 2.5 to 3.5 million barrels of oil each. Even with the addition of the two proposed wells, the total number of development wells for the Point Arguello Field and Platform Hidalgo will be significantly less than the number of wells originally anticipated and approved for the Point Arguello Unit.

The proposed drilling program sequence includes rig installation and necessary minor platform modifications (i.e., switch gear and electrical distribution), drilling and tripping operations, setting the well casing, well logging, and well completion and testing. Total well drilling and completion times are estimated at approximately 70 days to drill and 20 to 30 days for well completion (i.e., ~100 days total) per well. PXP's project description anticipates that drilling of the first well will begin in July 2013, with production beginning in October 2013. The second well will be drilled immediately following completion of the first well, with production from the second well online in January 2014. Overall, drilling activities are projected to take approximately six months.

The discharge of drilling muds to be used for the proposed Electra Field drilling program will comply with the National Pollution Discharge Elimination System (NPDES) General Permit (Permit No. CAG280000) currently in force (EPA 2000a,b). Under this discharge permit, Platform Hidalgo is authorized to discharge up to 6,000 bbl of cuttings and 23,000 bbl of drilling fluids annually per well. Over the anticipated 6-month drilling program for the proposed project, a total of 5,697 bbl of water-based cuttings and 14,036 bbl of drilling fluids are expected to be produced for well C-16. Similarly, 5,512 bbl of water-based cuttings and 13,575 bbl of drilling fluids are expected to be produced for well C-17.

Produced water generated from the proposed project would be discharged in accordance with the existing NPDES General Permit. Under the permit, Platform Hidalgo is authorized to discharge up to 18,250,000 bbl of produced water per year, which is an average of 50,000 bbl/d. Currently, Platform Hidalgo has a peak produced water discharge of 10,000 bbl/d. The development and production of the Electra Field is anticipated to generate an additional 6,500 bbl/d of produced water. With the addition of the Electra Field, total produced water discharges will still remain well below the permitted levels. Produced water may also be reinjected back into the reservoir.

PXP estimates that production would begin in January 2014. Overall production from the Electra Field (assuming development of Electra in 2013) is estimated to peak in 2014, resulting in an annualized rate for the combined Electra Field and Point Arguello Field of just over 6,300 bbl/d and just under 9.0 mmscfd of gas. A more detailed project description can be found in the Environmental Evaluation document.

4.0 Managed Species

The Pacific Fishery Management Council (PFMC) manages over 100 species of fish under four Fishery Management Plans (FMPs): 1) Pacific Groundfish FMP; 2) Coastal Pelagics FMP; 3) Highly Migratory Species FMP; and 4) Pacific Salmon FMP (Tables 4.1 through Table 4.4) (Pacific Coast Fisheries Management Plan 2008, 2011a, b, and c). Of these, slightly more than 40 species have been identified as regularly present near oil platforms on the southern California OCS.

Table 4.1 Species Managed by the Pacific Groundfish Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Flatfish			
Butter sole	*Isopsetta isolepis*	Rex sole	*Glyptocephalus zachirus*
Curlfin sole	*Pleuronichthys decurrens*	Rock sole	*Lepidopsetta bilineata*
Dover sole	*Microstomus pacificus*	Sand sole	*Psettichthys melanostictus*
English sole	*Parophrys vetulus*	Arrowtooth flounder	*Atheresthes stomias*
Flathead sole	*Hippoglossoides elassodon*	Starry flounder	*Platichthys stellatus*
Petrale sole	*Eopsetta jordani*	Pacific sanddab	*Citharichthys sordidus*
Roundfish			
Cabezon	*Scorpaenichthys marmoratus*	Pacific cod	*Gadus macrocephalus*
Kelp greenling	*Hexagrammos decagrammus*	Pacific whiting (hake)	*Merluccius productus*
Lingcod	*Ophiodon elongatus*	Sablefish	*Anoplopoma fimbria*
Sharks and other species			
Big skate	*Raja binoculata*	Leopard shark	*Triakis semifasciata*
California skate	*Raja inornata*	Soupfin shark	*Galeorhinus zyopterus*
Longnose skate	*Raja rhina*	Spiny dogfish	*Squalus acanthias*
Finescale codling	*Antimora microlepis*	Ratfish	*Hydrolagus colliei*
Pacific rattail grenadier	*Coryphaenoides acrolepis*		
Rockfish			
Aurora rockfish	*Sebastes aurora*	Mexican rockfish	*Sebastes macdonaldi*
Bank rockfish	*Sebastes rufus*	Olive rockfish	*Sebastes serranoides*
Black rockfish	*Sebastes melanops*	Pink rockfish	*Sebastes eos*

Table 4.1 Species Managed by the Pacific Groundfish Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Black and yellow rockfish	*Sebastes chrysomelas*	Pinkrose rockfish	*Sebastes simulator*
Blackgill rockfish	*Sebastes melanostomus*	Pygmy rockfish	*Sebastes wilsoni*
Blue rockfish	*Sebastes mystinus*	Pacific ocean perch	*Sebastes alutus*
Bocaccio	*Sebastes paucispinus*	Quillback rockfish	*Sebastes maliger*
Bronzespotted rockfish	*Sebastes gilli*	Redbanded rockfish	*Sebastes babcocki*
Brown rockfish	*Sebastes auriculatus*	Redstripe rockfish	*Sebastes proriger*
Calico rockfish	*Sebastes dallii*	Rosethorn rockfish	*Sebastes helvomaculatus*
California Scorpionfish	*Scorpaena gutatta*	Rosy rockfish	*Sebastes rosaceus*
Canary rockfish	*Sebastes pinniger*	Rougheye rockfish	*Sebastes aleutianus*
Chilipepper rockfish	*Sebastes goodie*	Sharpchin rockfish	*Sebastes zacentrus*
China rockfish	*Sebastes nebulosus*	Shortbelly rockfish	*Sebastes jordani*
Copper rockfish	*Sebastes caurinus*	Shortraker rockfish	*Sebastes borealis*
Cowcod	*Sebastes levis*	Shortspine thornyhead	*Sebastolobus alascanus*
Darkblotched rockfish	*Sebastes crameri*	Silvergray rockfish	*Sebastes brevispinus*
Dusky rockfish	*Sebastes ciliatus*	Speckled rockfish	*Sebastes ovalis*
Dwarf-red rockfish	*Sebastes rufianus*	Splitnose rockfish	*Sebastes diploproa*
Flag rockfish	*Sebastes rubrivinctus*	Squarespot rockfish	*Sebastes hopkinsi*
Gopher rockfish	*Sebastes carnatus*	Starry rockfish	*Sebastes constellatus*
Grass rockfish	*Sebastes rastrelliger*	Stripetail rockfish	*Sebastes saxicola*
Greenblotched rockfish	*Sebastes rosenblatti*	Swordspine rockfish	*Sebastes ensifer*
Greenspotted rockfish	*Sebastes chlorostictus*	Tiger rockfish	*Sebastes nigrocinctus*
Greenstriped rockfish	*Sebastes elongatus*	Treefish	*Sebastes serriceps*
Harlequin rockfish	*Sebastes variegatus*	Vermilion rockfish	*Sebastes minatus*
Honeycomb rockfish	*Sebastes umbrosus*	Widow rockfish	*Sebastes entomelas*
Kelp rockfish	*Sebastes atrovirens*	Yelloweye rockfish	*Sebastes ruberrimus*
Bocaccio	*Sebastes paucispinus*	Yellowmouth rockfish	*Sebastes reedi*
Longspine thornyhead	*Sebastolobus altivelis*	Yellowtail rockfish	*Sebastes flavidus*

Most of the species observed near OCS platforms are groundfish, dominated by Sebastes (rockfish), which are managed by the Pacific Groundfish FMP. The remaining species are coastal pelagic species, namely, Pacific sardine, jack mackerel, and northern anchovy, which are managed under the Coastal Pelagics FMP. Video surveys of the bottom of Platform Hidalgo conducted between 1995 and 2002 recorded the presence of bocaccio (*Sebastes paucispinis*), flag rockfish (*Sebastes rubrivinctus*), greenspotted rockfish (*Sebastes chlorostictus*), pygmy rockfish (*Sebastes wilsoni*), starry rockfish (*Sebastes constellatus*), vermilion rockfish (*Sebastes miniatus*), yelloweye rockfish (*Sebastes ruberrimus*), and lingcod (*Ophiodon elongatus*) (Love and Schroeder 2003, Love et al 2006).

Table 4.2 Species Managed by the Coastal Pelagics Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Northern anchovy	*Engraulis mordax*	Jack mackerel	*Trachurus symmetricus*
Pacific sardine	*Sardinops sagax*	Market squid	*Loligo opalescens*
Pacific (chub) mackerel	*Scomber japonicus*	Krill	*Euphausiacea*

Table 4.3 Species Managed by the Pacific Salmon Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
Chinook salmon	*Oncorhynchus tshawytscha*	Pink salmon	*Oncorhynchus gorbuscha*
Coho (silver) salmon	*Oncorhynchus kisutch*		

Table 4.4 Species Managed by the Highly Migratory Species Fishery Management Plan

Common name	Scientific name	Common name	Scientific name
North Pacific albacore tuna	*Thunnus alalunga*	Common thresher shark	*Alopius vulpinus*
Yellowfin tuna	*Thunnus albacares*	Shortfin mako shark	*Isurus oxyrinchus*
Bigeye tuna	*Thunnus obesus*	Blue shark	*Prionace glauca*
Skipjack tuna	*Katsuwonus pelamis*	Pacific swordfish	*Xiphias gladius*
Northern bluefin tuna	*Thunnus orientalis*	Striped marlin	*Tetrapturus audax*
Dorado (dolphinfish)	*Coryphaena hippurus*		

Most of the individuals observed near the platforms are adults, but older juveniles are also present. Density patterns at Platform Hidalgo and the other OCS platforms strongly imply that the platforms are major exporters of fish larvae, and that the platforms represent important regional sources of larvae and young-of year fish for regional fish production (Carr et al 2003; Carr 1990, Schroeder et al. 2000).

Notwithstanding the contribution of the individual platforms, the marine environment offshore Point Arguello is especially rich in fish species because this area constitutes a transition zone between southern warm-temperate, subtropical waters and northern cold-temperate waters. The area also provides a wide variety of habitats created by many banks, ridges, and deep-sea basins. Nearly all of the species managed by the PMFC can be found within the Project area at some point during their life cycle. Therefore, this analysis will be broad in scope and will discuss the effects of the identified impacting sources on a wide range of fish prey and forage, fish habitats, and fish species.

5.0 Potentially Significant Impact Sources

Three potential impacting sources associated with the routine operations of the proposed Development of the Electra Field reserves have been identified: 1) Noise and disturbance; 2) Effluent discharges; and 3) Oil spills. A summary description of each impacting source is included in the following section. A detailed description of each of these sources can be found in the Biological Assessment, which is part of the accompanying information volume.

6.0 Impacts to Essential Fish Habitat (EFH)

6.1 Noise and Disturbance

There is a long historic record of human awareness that fish produce and use sounds in a wide variety of behaviors (see Moulton 1963). However, studies of fish hearing and sound production (bioacoustics), and the importance of sounds to the lives of fish, were not begun until the early part of the 20th century (Moulton 1963 and Tavolga 1971). The level of investigation into fish hearing and sound production increased considerably in the second half of the 20th century (Zelick et al. 1999; Popper et al. 2003; Ladich and Popper 2004). We now know that fishes, as with most vertebrates, glean a great deal of information about their environment from the general sound field. Fish use sounds to detect predators and prey, as well as for schooling, mating, and navigating (Myerberg 1980; Popper et al. 2003).Whereas visual signals are very important and useful for things near the animal and in the line of sight, substantial information about the unseen part of an animal's world comes from acoustic signals.

Hearing and detection of vibrations are the best-developed senses in most fish, making good use of the efficient propagation of low frequency sound through water. The main sensory organs involved in this process are the lateral-line system, which detects low-frequency (<100 Hz) particle motion in the water contacting the flanks of the fish, and the inner ear, which is sensitive to frequencies of up to 1-3 kHz. The inner ear is thought to be the main sensory organ involved, while the lateral line organ is almost certainly involved in acoustic repulsion when the sound source is close at hand (within a few body lengths of the fish) such as when fish are seen schooling. The inner ear, which lies within the skull of the fish is sensitive to vibration rather than sound pressure. In teleost species (bony fishes) possessing a gas-filled swimbladder, this organ may also act as a transducer that converts sound pressure waves to vibrations, allowing the fish detect sound as well as vibration.

Current data suggest that most fish species detect sounds from 50 to 1,000 Hz, with a few fish hearing sounds above 4 kHz (Popper 2008, Yan et al 2010). It is believed that most fish have their best hearing sensitivity from 100 to 400 Hz (Popper 2003, Popper and Fay 2010). Additionally, some clupeids possess ultrasonic hearing (i.e., able to detect sounds above 100,000 Hz) (Astrup 1999). Not surprisingly, sensitivity to sound differs among fish species based on the level of development of their swimbladder and its connection to the inner ear.

Species with little or no swim bladder, or one that is not well connected to the ear generally have relatively poor auditory sensitivity (auditory generalists) and usually cannot hear sounds at frequencies above 1 kHz (See Table 6.1). Auditory generalists include elasmobranchs (e.g. sharks, skates, and rays), flatfish, salmonids, and tuna (Popper et al. 2003). In contrast, some fishes have swim bladders that are connected directly to the inner ear (e.g. herring, smelt), which substantially increases their hearing sensitivity (auditory specialists). Most auditory specialists can hear sounds up to around 3 kHz.

Table 6.1 Fish Auditory Thresholds

Noise Source	Frequency (Hertz)	Pressure (dB re 1 µPA)
Fish Hearing Thresholds		
Hearing generalists	up to ~1,000	>120
Hearing specialists	up to ~3,000	>60
Lateral line sensitivity	~ less than or equal to 100	–

Note: dB re 1 µPa (decibels measured relative to one microPascal) is a measure of underwater sound pressure. 20 dB re 1 µPa is about the hearing threshold, while 140 dB re 1 µPa is the pain threshold. dB re 1 $\mu Pa^2/Hz$ is a measure of sound-pressure density per unit frequency. It is used to describe sounds distributed across broad frequency bands.

Noise sources associated with the proposed Electra development project may generate sound pressure that can disrupt or damage marine life, including fishes. Additionally, increasing levels of background noise may also have a negative effect on fish in the form of auditory masking (Popper et al 2004, Popper and Hastings 2010). Auditory masking refers to the presence of noise that interferes with an organism's ability to hear biologically relevant sounds. The masking of sounds associated with behaviors such as schooling, predator and prey detection, and mating could have impacts to fish by reducing their ability to perform these key biological functions.

Additionally, it has been documented in the mammalian literature that temporary threshold shifts reach an asymptote after a specific duration of noise exposure. Recent studies have shown that similar shifts occur in fish, with hearing specialists more greatly affected by background noise exposure than hearing generalists (Smith et al. 2004).

Three noise and disturbance sources associated with the proposed Electra project have been identified: 1) offshore drilling, and offshore production, 2) vessel traffic, and 3) aircraft traffic (Table 6.1). However, the sound levels produced by these sources are unlikely to impact EFH. Table 6.2 contains a listing of ambient and project-related noise sources and levels on the Pacific OCS.

Table 6.2 Noise Sources on the Pacific OCS

Noise Source	Frequency (Hertz)	Pressure (dB re 1 µPA)
Ambient Ocean Noise		
Wind and waves	200–1000	66–95
Precipitation	>500	
Baleen whales	20–20,000	150–190
Other Biologicals (shrimp, fish, and marine mammals)	12–100,000	95–210
Platform Operations	5-500	146-169
Vessel Traffic		
Outboards and small boats	~100–1,000	150–160
Vessels 180 to 280 ft (55 to 85m) in length	<100–500	170–180
Large container ships/supertankers	<100–500	185–200
Helicopter traffic	~<100–500	150-165

Note: dB re 1 µPa (decibels measured relative to one microPascal) is a measure of underwater sound pressure. 20 dB re 1 µPa is about the hearing threshold, while 140 dB re 1 µPa is the pain threshold. dB re 1 $\mu Pa^2/Hz$ is a measure of sound-pressure density per unit frequency. It is used to describe sounds distributed across broad frequency bands.

In their Final Environmental Impact Statement (U.S. Department of Navy 2002) the U.S. Navy characterized the average baseline noise levels within the nearby portion of the Santa Barbara Channel (SB Channel) encompassing the area bordered by Anacapa Island, the south side of Santa Cruz Island to San Nicholas Island and Santa Barbara Island, at 50-55 decibels (dB).This level of ambient noise would be indicative of the background noise level in the Project area.

Noise associated with conventional drilling platforms remains relatively unstudied. Recently, noise from a semi-submersible drilling rig and its support vessels working in 114 m waters in the Bering Sea did not exceed ambient noise levels beyond a 1-km range (Sakhalin 2004). Broadband underwater noise from a drilling rig in the Timor Sea was measured at 146 dB re 1 uPA when not actively drilling, and 169 dB re 1 uPA during drilling. The noise dropped steadily and was not audible beyond 11 km from the rig under quiet ambient conditions (Woodside 2002; Pidcock et al. 2003). Other rigs were recorded at 154 dB re 1uPA for the frequency band 10-500 Hz (Woodside 2002).

Off the California coast, Richardson et al. (1995) cite only one example of recorded noise from drilling platforms (Gales 1982), which resulted in auditory levels that were nearly undetectable even alongside the platforms. No sound levels were computed, but the strongest received tones were very low frequency, below approximately 5 Hz. Therefore, no impacts to EFH are expected from this source.

No new helicopter trips will be required for the Electra Field development, beyond the 3 to 5 trips per week per platform currently estimated to occur in the Pacific Region (Bornholdt and Lear 1995). Regardless, aircraft noise is temporary in nature and not expected to impact EFH.

The rotors are the primary sources of sound from helicopters (Richardson et al., 1995). The rotation rate and the number of blades determine the fundamental frequencies which are usually below 100 Hz, with most dominant tones below 500Hz (see Table 6.2). Richardson et al. (1995) present an estimated source level for a Bell 212 helicopter of about 150 dB at altitudes of 150-600 m, with the dominant frequency a 22-Hz tone with harmonics. Elsewhere a source level of 165 dB is presented for broadband helicopter noise (frequencies 45-7070 Hz). Source levels of the Sykorski Model 76A helicopters that are used to transport crew on Platform Hidalgo from the Santa Maria airport have been estimated at about 150 dB at altitudes of about 100 m.

Finally, the drilling rig, heavy drilling equipment, rig supplies, and bulk drilling mud and cement materials for the project will be transported to Platform Hidalgo by supply boat from Port Hueneme. Vessels are the major contributors to overall background noise in the sea (Richardson et al., 1995). Sound levels and frequency characteristics are roughly related to ship size and speed. The dominant sound source is propeller cavitation, although propeller "singing," propulsion machinery, and other sources (auxiliary, flow noise, wake bubbles) also contribute.

Vessel noise is a combination of narrowband tones at specific frequencies and broadband noise (See Table 6.2). Richardson et al. (1995) give estimated source levels of 156 dB for a 16-m crew boat (with a 90-Hz dominant tone) and 159 dB for a 34-m twin diesel (630 Hz, 1/3 octave). Broadband source levels for small, supply boat-sized ships (55-85 m) are about 170-180 dB. Most of the sound energy produced by vessels of this size is at frequencies below 500 Hz. Many of the larger commercial fishing vessels that operate off southern California fall into this class.

Currently, six supply boat trips occur per month. During drilling, vessel traffic to and from the platforms is projected to consist of an additional four round trips per month (1 trip per week). During rig installation and removal, supply boats will also make 28 round trips to the platform for rig transport. Manpower requirements and boat schedules can vary depending on the workload. Following the completion of drilling activities, which are anticipated to last for approximately five months, supply vessel traffic is expected to return to current baseline levels (i.e. 6 supply boat trips per month). Therefore, no adverse effects to EFH are expected from the slight, temporary increase in vessel traffic that would occur with the proposed project.

6.2 Effluent Discharges

Under Section 402 of the Clean Water Act, the Environmental Protection Agency (EPA) is authorized to issue National Pollutant Discharge Elimination System (NPDES) permits to regulate the discharges of pollutants to waters of the U.S., the territorial sea, contiguous zone, and ocean (EPA 1976). The use of the General Permit streamlines the permitting process for facilities that are not anticipated to significantly affect marine environments. In 2000, EPA prepared Biological Evaluation and conducted an EFH assessment for the re-issuance of a NPDES General Permit for offshore oil and gas facilities in southern California (SAIC 2000a,b,c). The overall conclusions of the EFH assessment were that the continued discharge from the 22 platforms located in federal waters offshore California will not adversely affect EFH outside the mixing zones, described as a 100 m radius from the discharge point.

Within the 100 m radius mixing zone, discharges from oil and gas exploration, development, and production may have localized effects on water quality and resident marine organisms, including EFH and fish. The assessment further concluded that while there may be effects on EFH from certain discharges, such as drilling fluids and produced water within the mixing zone near an outfall, these effects should be minor overall given the very small area which may be affected relative to the size of the EFH off the Pacific Coast, and the mitigation provided by the various effluent limitations proposed for the permit.

The EPA provided a copy of the EFH assessment to the National Marine Fisheries Service (NMFS) to initiate the consultation. As a result of the consultation, the NPDES General Permit incorporated a requirement that the permittees conduct a study of the direct lethal, sublethal, and bioaccumulative effects of produced water on federally managed fish species on the Pacific OCS at key life stages that occupy the mixing zone of produced-water discharges. The permit further requires that the permittees model results describing the dilution and dispersion plumes from each point of discharge of produced water (for all platforms covered by the permit) to determine the extent of the area in which federally managed fish species may be adversely affected. The permit also requires the permittees to propose mitigation measures if either of the studies indicates substantial adverse effects to federally managed fish species or EFH occur.

In response, a single comprehensive report was submitted by the permittees (MRS 2005). It provided a detailed quantitative assessment of potential impacts from produced-water discharges on federally managed fish species from each of the California OCS dischargers, including Platform Hidalgo. Although maximum contaminant concentrations beyond the 100-m mixing zone are usually well within NPDES permit limits, the study focused on the toxicity and bioaccumulation potential of produced-water discharges to the fish populations that reside within the 100-m mixing zone beneath the platforms. These fish populations consist mostly of rockfish that utilize the platforms as habitat, rarely venturing far from the protection of the structure. Consequently, contaminant concentrations at locations 100-m from the platform have little bearing on the potential impacts experienced by these fish.

Nevertheless, the quantitative exposure assessment found a general absence of impacts from most of the major produced-water constituents. Most produced-water constituents that are normally of concern for the protection of marine organisms were below biological effects levels prior to discharge. Four constituents (benzene, cyanide, silver, and ammonia) had end-of-pipe concentrations that were slightly elevated in produced water compared to thresholds of potential effects in finfish. However, the produced-water discharges achieve high dilution almost immediately upon discharge. As a result, the plume volumes containing concentrations of potential biological significance were exceedingly small compared to the volume of habitat contained within the mixing zones.

In September 2005, EPA concurred with the overall conclusions of the study and forwarded them to NMFS as part of the EFH consultation required by the General Permit. In October 2005, NMFS notified EPA that the study met the intent of the conservation recommendations incorporated in the General Permit and that the EFH consultation was complete. Revisions to the NPDES General Permit, which included new compliance criteria for several of the platforms and a revision to the undissociated sulfide criterion, were approved in November 2009 (Weston Solutions Inc. and MRS 2006). Thus, potential impacts to finfish within the 100-m mixing zone around Platform Hidalgo are not likely to be significant.

6.3 Oil Spills

Risk Analysis. The following is a summary of the risk analysis associated with the proposed development of the Electra Field. In the course of normal, day-to-day platform operations, occasional accidental discharges of hydrocarbons may occur. However, such accidents are typically limited to discharges of quantities of less than 1 bbl of crude oil. See Appendix B for the complete risk analysis of an oil spill associated with the proposed project.

The BOEM's U.S. Oil Spill Database (C. Anderson, unpubl. data) includes all Pacific and Gulf of Mexico OCS spills of greater than 1 bbl recorded between 1964 and 2010. The database contains platform and pipeline spills, but does not include barge or tanker spills. Of the 2,161 total spills in the oil spill database, more than 92 percent (1,998) are of less than 50 bbl in size. The mean volume of the 143 spills that were over 50 bbl in size is 62 bbl for those spills (64) less than 100 bbl in size, and 259 bbl for those spills (82) between 100 and 999 bbl in size.

Between 1969 and 1999, a total of 836 spills of less than 50 bbl (99 percent of the total) occurred on the Pacific OCS, resulting in slightly less than 320 bbl of oil being discharged into the ocean (C. Anderson, unpubl. data). Due to the infrequency and small volumes of accidental discharges on the Pacific OCS, and their location (generally away from sensitive species and habitats), spills of less than 50 bbl were not considered an impact-producing agent for this evaluation. In contrast to these small spills, larger oil spills may occur from loss of well control (if wells are free flowing), pipeline breaks, operational errors, or vessel-platform collisions. The largest and most recent spill of more than 50 bbl in volume was the 163-bbl Platform Irene pipeline spill in September 1997.

On that occasion, a rupture in the Torch pipeline that extends from Platform Irene to the shoreline released an estimated 162 to over 1,242 bbl (26 to 197+ m^3) of crude oil into State waters (Torch/Platform Irene Trustee Council 2007). The rupture resulted in the oiling of approximately 40 miles (64 km) of coastline, stretching from the northern end of Minuteman Beach to Boat House in Santa Barbara County. Approximately 100 acres (40 hectares) of sandy beach were disturbed by oiling and cleanup operations. In addition, another 263 acres (106 hectares) of sandy beach were very lightly oiled (less than or equal to 10 percent oiling by area), but were relatively undisturbed by heavy equipment during cleaning operations (Torch/Platform Irene Trustee Council 2007).

The oil spill risk analysis predicts that over the life of the proposed project there is a 4.4 percent chance that one or more spills between 50 to 1,000 bbl in size could occur. For the purposes of the Biological Evaluation (BOEM 2012), BOEM assumed that one spill of greater than 50 bbl could occur over the life of the project. An effort was also made to estimate the likely size of such a spill. Given these data and the experience in the Pacific Region over the last nearly half century, BOEM expects that such a spill would probably be less than 200 bbl, and almost certainly less than 500 bbl in volume.

BOEM also has estimated the number of oil spills of equal to or greater than 1,000 bbl that could occur as a result of the proposed action. The major spill (less than or equal to 1,000 bbl) estimate is based on the estimated production of oil over the life of the proposed project, including the subsea pipeline transport of hydrocarbons to shore. Based on the accident spill rates from all U.S. platforms and pipelines (Anderson and LaBelle 2000), the estimated probability that one or more large spills (less than or equal to 1,000 bbl) will occur over the lifetime of the proposed Electra Field development project is 0.1 percent for a platform spill and 0.3 percent for a pipeline spill.

Federal regulations concerning oil spill response plans for OCS facilities also require operators to calculate worst-case discharge volumes using the criteria specified in 30 CFR §254.47. These include 1) the maximum capacity of all oil storage tanks and flow lines on the facility, 2) the volume of oil calculated to leak from a break in any pipelines connected to the facility, and 3) the daily production volume from an uncontrolled blowout of the highest capacity well associated with the facility. Since these are worst-case estimates, intended to insure that an operator has the capacity to respond to the largest imaginable spills, they are based on unlikely events.

This is particularly true of the estimates for the first and third spill types described above. A catastrophic event would be required to empty all storage tanks and flow lines on the production platform. Similarly, with the implementation of modern blowout prevention equipment, operating procedures, and the BSEE inspection program, blowouts are rare. As discussed above, no blowout resulting in the release of measurable quantities of oil has occurred on the Pacific OCS since the 1969 Santa Barbara spill. Nevertheless, as was evident in the case of the 2010 *Deepwater Horizon* event, accidents can and do occur.

In the wake of the 2010 *Deepwater Horizon* well blowout and oil spill in the Gulf of Mexico, the BOEM substantially revised and increased the requirements for worst case discharge scenario calculations. Among some of the changes were the incorporation of the time to drill a relief well and an added level of conservatism in assumptions regarding the operational ability of blow out preventer equipment following a catastrophic event.

Using the BOEM methodology, the most likely maximum size of a major oil spill from the Electra Field development is the maximum volume of oil calculated to be spilled from a well blow out that occurs at well C-16, “after the well reaches total depth with the drill pipe out of the well, before installing the 7 inch liner”. Under these conditions, the scenario results in an estimated spill rate of 1,190 bbl/d. However, the scenario also assumes that there is no functioning blow out prevention equipment in place, requiring the drilling of a relief well to stem the flow of oil into the environment. For the Electra Field and Platform Hidalgo, it has been conservatively estimated that it will require 80 to 111 days to drill a relief well, bringing the total worst-case spill size to 95,200 to 132,090 bbl of oil. This blowout spill size is similar in size to what was addressed in the 1984 EIR/EIS for the Point Arguello Field that use a 100,000 barrel spill for a severe blowout.

The most likely scenario, however, as discussed above, is that one oil spill in the 50-1,000 bbl range would occur over the life of the proposed project (with approximately a 4.4 percent chance of occurrence), and that such a spill or spills would be less than 200 bbl in volume.

Fate and Effects. When an oil spill occurs, many factors determine whether that oil spill will cause heavy, long lasting biological damage; comparatively little damage or no damage; or some intermediate degree of damage. Among these factors are the type, rate, and volume of oil spilled, geographic location, and the weather and oceanographic and meteorological conditions at the time of the spill. These parameters determine the quantity of oil that is dispersed into the water column; the degree of weathering, evaporation, and dispersion of the oil before it contacts a shoreline; the actual amount, concentration, and composition of the oil at the time of shoreline or habitat contact; and a measure of the toxicity of the oil. Additionally, the level of oil spill preparedness, rapidity of response, and the cleanup methods used can also greatly influence the overall impact levels of an oil spill.

A spill of 200 bbl could oil several kilometers of coastline along the south-central California coast. The likely result would be patches of light to heavy tarring of the intertidal zone resulting in localized changes to the community structure. The recovery time for these communities would depend on the environment. High energy rocky coast will be mostly self-cleaned within several months, while low energy lagoons and soft-sediment embayments can retain stranded oil residue for several years. The same impacts would be expected from a 132,090-bbl oil spill, but would be spread over a substantially larger area.

Oil in the marine environment can, in sufficient concentrations, cause adverse impacts to fish (NRC 1985; GESAMP 1993). The effects can range from mortality to sublethal effects that inhibit growth, longevity, and reproduction. Benthic macrofaunal communities can be heavily impacted, as well as intertidal communities that provide food and cover for fishes.

The field observations of oil spill impacts on the marine environment have generally been taken from very large oil spills (>1,000 bbl) that have occurred throughout the world over the past three decades. Table 6.3 contains a partial listing of some of the most notable maritime spills to occur during this timeframe, including the *Deepwater Horizon* spill, and the *Exxon Valdez* spill.

Table 6.3 Significant Maritime Oil Spills Since 1980

Event	Date	Location	Approximate Spill Size (bbl)	Spill Type
Kuwait oil spill	January 1991	Persian Gulf	4-6,000,000	Various
Deepwater Horizon	April-July 2010	Gulf of Mexico	5,000,000	Well blowout
Ixtoc I	June 1979-March 1980	Gulf of Mexico	3,000,000	Well blowout
Exxon Valdez	March 1989	Prince William Sound, Alaska	270,000	Vessel accident
Sea Empress	February 1996	Southwest Wales	540,000	Vessel accident
Mega Borg	June 1990	Gulf of Mexico	120,000	Vessel accident
MT Hebei Spirit	December 2007	South Korea	80,000	Vessel accident
Prestige	November 2002	Galicia, Spain	50,000	Vessel accident
Montara	August-November 2009	Timor Sea, Western Australia	30,000	Well blowout
American Trader	February 1990	Huntington Beach, California	10,000	Vessel accident
MV Pacific Adventurer	March 2009	Queensland, Australia	2,000	Vessel accident
MV Cosco Busan	November 2007	San Francisco, California	1,400	Vessel collision

Sources: NOAA Office of Response and Restoration 2012.

In contrast, the most recent spill greater than 50 bbl to occur in the Project area was in September 1997, when a rupture in a 20-inch offshore pipeline emanating from Platform Irene resulted in the discharge of at least 6,846 gallons (163 bbl) of crude oil off the Santa Barbara coast. The spill resulted in the fouling of approximately 17 miles of coastline, and caused impacts to a variety of natural resources, including seabirds, sandy and gravel beach habitats, rocky intertidal shoreline habitats, and use of beaches for human recreation. Similarly, in 2007 the freighter *Cosco Busan* collided with the San Francisco-Oakland Bay Bridge in San Francisco Bay resulting in the release of nearly 1,400 bbl (58,000 gallons) of fuel oil. Fouling associated with this spill was reported as far north as Pt. Reyes and as far south as Pacifica; approximately 2,083 birds were oiled, of which 1,381 were either recovered dead or later died.

Fishes. Fish can be affected directly by oil, either by ingestion of oil or oiled prey, through uptake of dissolved petroleum compounds through the gills and other body epithelia, through effects on fish eggs and larval survival, or through changes in the ecosystem that supports fish. Although fish can accumulate hydrocarbons from contaminated food, there is no evidence of food web magnification. Fish have the capability to metabolize hydrocarbons and can excrete both metabolites and parent hydrocarbons from the gills and the liver (NRC 1985). Nevertheless, oil effects in fish can occur in many ways: histological damage, physiological and metabolic perturbations, and altered reproductive potential (NRC 1985). Many of these sublethal effects are symptomatic of stress and may be transient and only slightly debilitating. However, all repair or recovery requires energy, and this may ultimately lead to increased vulnerability to disease or to decreased growth and reproductive success.

The egg, early embryonic, and larval-to-juvenile stages of fish seem to be the most sensitive to oil. Damage may not be realized until the fish fails to hatch, dies upon hatching, or exhibits some abnormality as a larva, such as an inability to swim (Malins and Hodgins 1981). There are several reasons for this vulnerability of early life stages. First, embryos and larvae lack the organs found in adults that can detoxify hydrocarbons. Second, most do not have sufficient mobility to avoid or escape spilled oil. Finally, the egg and larval stages of many species are concentrated at the surface of the water, where they are more likely to be exposed to the most toxic components of an oil slick.

Although sensitivity is demonstrated in laboratory studies, only in a few instances have adverse effects been observed on fish following major oil spills. Examples include the *Florida* spill off West Falmouth, Massachusetts, and the *Amoco Cadiz* spill off the coast of Brittany. In both cases, sublethal effects on fish were documented. In the *Florida* spill, killifishes from contaminated marshes had a lower rate of lipogenesis than their counterparts from uncontaminated sites (Sabo and Stegeman, 1977). In the *Amoco Cadiz* spill, a large number of histological abnormalities were noted in estuarine flatfish (*Pleuronectes platessa*) (Haensly et al. 1982). Additionally, NOAA scientists and collaborators reported Pacific herring embryos in shallow waters died in unexpectedly high numbers following the *Cosco Busan* oil spill in San Francisco Bay, and have suggested an interaction between sunlight and the oil's chemicals might be responsible (Incardona et al. 2011). However, mortality rates returned to pre-spill levels within 2 years. In contrast, Straughan (1971) found no indications of fish kills or other evidence of effects on fishes from the Santa Barbara Channel blowout in 1969.

The *Exxon Valdez* oil spill (~270,000 bbl) provides several examples of how oil affects fish. For the sensitive stages of fish (eggs, larvae, and juveniles) the *Exxon Valdez* spill could not have occurred at a worse time. Pacific herring spawned along the shores of Prince William Sound within weeks of the *Exxon Valdez* oil spill in March 1989, resulting in increased egg mortality and larval deformities. Also, fry from pink salmon emerged from their gravel spawning redds and entered the nearshore marine environment during the spill. Site-specific occurrences of instantaneous mortality suggest that a significant reduction in herring larval production occurred because of the oil spill. Brown et al. (1996) estimated that over 40 percent of the 1989 year-class was affected by *Exxon Valdez* oil at toxic levels. The herring population in Prince William Sound also suffered heavy losses in 1993 due to disease. However, it is not known what role, if any, exposure to oil may have played in the disease outbreak; natural variability and density-dependent effects could not be ruled out as the cause of the small year-class and disease. Despite the reduction in larval production, reduced abundance in the 1989 year-class recruiting as 4-year old adults in 1993 could not be determined because natural processes affecting herring recruitment are poorly understood (Brown et al. 1996).

Pink salmon, Dolly Varden, sockeye salmon, and cutthroat trout exposed to oil from the *Exxon Valdez* spill all showed reduced growth rates the season following the oil spill even though changes in food availability were not detected (Spies 1996). Pink salmon also showed increased egg mortality in oiled-versus-unoiled streams through the 1993 season (Rice et al. 1996). Exposure to oil was documented by oil in the stomachs of salmon fry, measurements of polynuclear aromatic hydrocarbons (PAH) in salmon fry, and by increases in P450 and bile hydrocarbon metabolites in Dolly Varden (*Salvelinus malva*) (Spies 1996). Geiger et al. (1996) estimated that 1.9 million adult pink salmon failed to return to Prince William Sound in 1990, primarily because of a lack of growth in the critical nearshore life stage when they entered seawater in spring 1989 during the height of the spill. By 1991, 60,000 wild adult pink salmon failed to return.

In perspective, in the years preceding the oil spill, returns of wild pink salmon in Prince William Sound varied from a maximum of 23.5 million fish in 1984 to a minimum of 2.1 million in 1988. The decade preceding the oil spill was a time of very high productivity for pink salmon in the sound, and, given the tremendous natural variation in adult returns, it was impossible to measure directly the extent to which wild salmon returns since 1989 were influenced by the oil spill. Based on intensive studies and mathematical models following the oil spill, however, researchers determined that wild adult pink salmon returns to the sound's Southwest District in 1991 and 1992 were most likely reduced by a total of 11 percent (Exxon Valdez Oil Spill Trustee Council 1999). However, the salmon were listed as recovered within a decade after the spill, and rockfish as very likely recovered (EVOSTOC 2010).

In 1990, after the *American Trader* spilled 416,000 gallons (~10,000 bbl) of North Slope crude oil offshore Huntington Beach, California, oil stranded along 22 km of coastline (Gorbics et al. 2000). The natural resource trustees (representatives from USFWS, CDFG, and NOAA) determined that post larval juvenile white sea bass were adversely impacted by the oil. Specifically, 10-15mm juvenile fish were killed by oil when it mixed with drift algae found near the surf line. The drift algae found in this area are the normal habitat for juvenile white sea bass and other croakers during and after the time of the spill (Gorbics et al. 2000).

Despite the fact that laboratory experiments and field observations indicate that fish are susceptible to adverse effects from hydrocarbons, with the exception of the *Exxon Valdez* and *American Trader* oil spills, direct impacts on fishery stocks have rarely been observed following catastrophic spills. This is due in part to the complexities involved with the natural process of recruitment, which produces tremendous natural variations in year-class abundance that bear little relation to the size of the parent stock. Thus, any impacts from catastrophic oiling on fish stocks are probably masked by the natural variations in abundance. Also, massive fish kills during oil spills have not occurred, or if they have it is only in the egg and larval stages found in the surface waters.

An estimated 40 to 50 percent of the egg biomass of the Pacific herring (*Clupea pallasi*) deposited within Prince William Sound was exposed to oil during developmental stages (Brown et al. 1996). The resulting 1989 year class of herring showed sublethal effects such as premature hatch, low weights, reduced growth, and increased morphologic and genetic abnormalities (Brown et al. 1996). The 1989 year class recruiting as 4-year old adults in 1993 was one of the smallest cohorts observed in Prince William Sound, and it returned to spawn with an adult herring population that was reduced by approximately 75 percent (Brown et al. 1996).

Adult fish, due to their mobility, may be able to avoid or minimize exposure to spilled oil. However, there is no conclusive evidence that fish will avoid spilled oil (NRC 1985). One of the worst spills in recent times, the tanker *Sea Empress*, released 72,000 tonnes (~540,000 bbl) of crude oil and 480 tonnes (~4000 bbl) of fuel oil into the sea off Milford Haven waterway in southwest Wales on February 15, 1996. Oil came ashore along 200 km of coastline, much of it in a National Park and an area of international scientific interest. The *Sea Empress* Environmental Evaluation Committee, an independent committee set up by the UK government, reported that

"Although tissue concentrations of oil components increased temporarily in some fish species, most fish were only affected to a small degree, if at all, and very few died" (SEEEC 1998). The study found that about 40 percent of the oil evaporated soon after the spill and around 52 percent dispersed into the water where it was broken down by microorganisms. Surveys at sea showed that the oil was not deposited in sediments in significant quantities. Between 5 percent and 7 percent (~36,000 bbl) of the oil stranded on shore; however, one year after the spill less than 1 percent remained on the shore.

Although many factors contribute to the overall impacts realized from an at-sea oil spill, fish are generally not adversely impacted at the population level. Given the high energy and high productivity environment of the Point Arguello area, the common meteorological and oceanographic conditions, and the oil spill preparedness and response capabilities in place, direct measurable effects to any fish stock abundance from a 200 bbl oil spill off the coast of Point Arguello, California are unlikely.

Food Web and Habitat. Fish can also be affected indirectly by oil through changes in the ecosystem that affect prey species and habitats. Perhaps the most important food on which all fish rely during their larval and juvenile stages is plankton. In general, the studies to date indicate that zooplankton are more susceptible to effects from oil spills than are phytoplankton. Even if a large number of algal cells were affected during a spill, regeneration time of the cells (9-12 hours), together with the rapid replacement by cells from adjacent waters, probably would obliterate any major impact on a pelagic phytoplankton community (NRC, 1985). After the *Tsesis* spill in the Baltic Sea, there was a decrease in zooplankton in the vicinity of the wreck. The quantity of phytoplankton increased briefly and it was concluded that the change was due to a decrease in the amount consumed by zooplankton. Similar results have been obtained in long-term oiling experiments.

Individual organisms in oil spills have been affected in a number of ways: direct mortality (fish eggs, copepods, mixed plankton), external contamination by oil (chorion of fish eggs, cuticles and feeding appendages of crustacea), tissue contamination by aromatic constituents, abnormal development of fish embryos, and altered metabolic rates (Longwell 1977; Samain et al. 1980). The effects appear to be short-lived and there are seldom prolonged changes in biomass or standing stocks of zooplankters in open water near spills, due largely to their wide distribution and rapid regeneration (Van Horn et al. 1988). During the *Exxon Valdez* spill, Celewycz and Wertheimer (1996) studied the impact of the spill on zooplankton and epibenthic crustaceans, potential prey species of pink salmon. They did not detect any reduction in abundance of either zooplankton or epibenthic crustaceans between the oiled and non-oiled locations in either 1989 or 1990. However, as of 2010, intertidal sediments and benthic communities were still listed as recovering (Exxon Valdez Oil Spill Trustee Council 2010).

Intertidal and subtidal macrophytes provide shelter and food for fish and for fish prey species at various life stages along the northern Santa Barbara County coast. The habitats involved here include both high energy rocky shorelines, sand and cobble beaches, and the nearshore subtidal environment. Intertidally, the red alga *Endocladia muricata* and the brown alga *Pelvetia* spp. are species common to the area, as is surf grass (*Phyllospadix spp.)*. Giant kelp, *Macrocystis pyrifera* is also common to the nearshore subtidal area. Intertidal macrophytes seem to be more vulnerable to oiling than subtidal macrophytes. Losses of intertidal algal cover have been described after several spills. However, recovery appears to occur quite readily (Topinka and Tucker 1981), though imbalances in the macrophyte community can persist for years. The proliferation of opportunistic intertidal algal species after a spill is invariably a direct result of the elimination, by the oil, of naturally occurring grazers--limpets and other intertidal herbivores (NRC 1985). Little evidence exists that kelp is harmed by oil (MMS 1992).

An oil spill of 200 bbl would probably result in light to heavy tarring of the intertidal zone if oceanographic conditions carried the oil to shore. For comparison, following the Torch spill (163 bbl) at Point Arguello, large amounts of fresh oil and tar were observed on rocks throughout the middle to lower intertidal zone just north of the Boat House. Tar was observed on sea stars and obscuring the respiratory holes of black abalone, leading observers to conclude that some mortality may have occurred (Raimondi et al. 1999).

Impacts to intertidal macrophytes would be minimal and patchy over an estimated 10 km or less of shoreline. Raimondi (1998) reported that species abundance at two research sites within the exposure zone of the 163 bbl Irene pipeline spill showed no significant changes that could be attributed to the oil spill. Barnacle abundance at one site decreased in the fall 1997 and spring 1998 surveys, however no fresh tar or oil was observed at the site. In spring 1998 surveys, the same site also showed decreases in mussels and surf grass cover, but these impacts were attributed to the effects of strong El Nino enhanced storms that ravaged the site in January and February of 1998. No measurable impacts would be expected to subtidal macrophytes from a 200 bbl oil spill.

Fluctuations of benthic and intertidal invertebrate populations may affect the fishes that normally feed on them. Considerable work has been done studying the effects of oil on macroinvertebrates. Most susceptible are those species inhabiting the intertidal zone, especially those found in lagoons, embayments, estuaries, marshes, and tidal flats. This risk derives from two factors: high oil concentrations and shallow depth of the water column.

Aside from the physiologically toxic effect, intertidal organisms may be entrapped or suffocated by oil. In fact, a major impact of the *Sea Empress* spill was to the intertidal invertebrate community. Heavy limpet mortalities were recorded, and periwinkles and topshells died, though in lesser numbers. Amphipod mortalities were extensive, although substantial recolonization was evident at most sites one year later (SEEEC, 1998). Gorbics et al. (2000) reported that overall mortality of bean clams as a result of the *American Trader* spill (~10,000 bbl of crude oil) in February 1990 was estimated to be 24 percent. Sand crabs showed an increase in the body burden of aliphatic hydrocarbons until June 1990. It can be assumed that the oil from the *American Trader* that stranded along 22 km of coastline near Huntington Beach resulted in a significant increase in the mortality of intertidal invertebrates (Gorbics et al., 2000).

It can take several years for limpet and other mollusc populations to recover completely at heavily impacted sites. A 200-bbl oil spill off Point Arguello that contacted shore would likely result in mortality to various intertidal macroinvertebrates, including barnacles, limpets, mussels, starfish, anemones, and black abalone. Smothering would be the most common cause of mortality and would be limited to direct contact with weathered tar balls from the oil spill. After the 163 bbl Irene pipeline spill in September 1997, sand crabs within the spill zone showed significant hydrocarbon contamination (J. Dugan, UCSB, pers. com.). Sand crabs are an important component of the diet of several fishes. Though fish can metabolize hydrocarbons they accumulate, this process requires energy and may lead to an increased vulnerability to disease and decreased growth or reproductive success. Since sand crabs were contaminated after the oil spill, one can also assume that other invertebrates such as myssids, amphipods, and polychaetes were also affected.

Coastal and offshore waters and benthic subtidal environments are important habitat for all of the fish species managed by the PFMC (Tables 4.1 to 4.4). The coastal and offshore waters are any areas seaward of the low tide level and include bays, open coastal waters, and the deep ocean. Oil spills in the open ocean do not appear to have as severe an effect on the biota as oil in coastal waters or in the shore zone (NRC 1985). This may be due to the fact that the shore zone and coastal waters are generally subject to serious effects from chronic pollution and an oil spill in such areas would be impacting an already stressed environment.

Benthic subtidal environments may be impacted when oil spilled onto the surface of the water column is transferred to bottom sediments through sorption on clay particles and subsequent sinking, sinking of dead organisms, uptake and packaging as fecal pellets by zooplankton, or direct mixing to the bottom in shallow water. This may impact fish both directly and indirectly. After the *Tsesis* oil spill, herring reproduction was significantly reduced in the spill area. Nellbring et al. (1980) reported that the reduced reproduction was due to a decrease in amphipod populations that graze on fungi growing on the fish eggs, leaving the eggs susceptible to fungal damage. Oiling of the sediments following the *Amoco Cadiz* spill had deleterious effects on plaice and sole, including reduced growth and increased incidence of fin and tail rot (Conan and Friha, 1981). In fact, flatfish may be particularly susceptible to oil spill impacts, since they spend a considerable amount of time lying on the bottom or even partially buried in the sediments.

Conclusion. An evaluation of the literature reveals that oil spills can cause mortality and sublethal effects on fish at all life stages, their prey, and their habitat. However, whether or not these impacts result in measurable adverse effects on essential fish habitat is more difficult to determine. In 1985, a National Research Council committee found “no irrevocable damage to marine resources on a broad oceanic scale” as a result of oil pollution from either chronic, routine sources or from occasional major spills. At the same time, however, it cautioned that further research is needed before an unequivocal assessment of the environmental impact of oil pollution can be made, particularly as it applies to specific locations and conditions. The size of the oil spills that were analyzed in the NRC study, and on which the above statement was made, ranged from 5,000 tons (~38,000-bbl) spilled from the tanker *Zoe Colocotroni* to 223,000 tons (~1.7 million-bbl) spilled from the tanker *Amoco Cadiz*.

Based on the amount of oil that would be handled from the Electra Field reserves, an oil spill risk analysis predicts there is a 4.4 percent chance that a 50 to 1000-bbl oil spill could occur over the projected life of the proposed project. As discussed earlier, an effort also was made to estimate the likely size of such a spill. Given the national oil spill data collected from the Gulf of Mexico and Pacific Region OCS programs over the last 48 years, BOEM expects that such a spill would probably be less than 200 bbl (Anderson et al. 2000).

Given the location, normal meteorological and oceanographic conditions, and oil spill response capabilities of the area, only minimal adverse effects are expected to EFH from an oil spill of

200 bbl in size. Direct mortality to fish would probably occur only in the egg and larval stages found in the surface waters in the immediate vicinity of the spill. Depending on the oceanographic conditions at the time of the spill, some oiling of the intertidal zone along the south central California coast or the northern Channel Islands is expected. Under normal conditions for the area, significant mixing and weathering of the oil would evaporate much of the toxic light-end hydrocarbons into the atmosphere, disperse the oil into the water column, and likely break the slick into smaller patches. The weathered tar balls would likely cause some mortality to intertidal macrophytes and invertebrates through smothering. Elevated hydrocarbon levels in nearshore invertebrates would be likely, leading to increased stress and potential decreases in growth and reproduction in fish feeding upon the invertebrates. These effects are expected to be short-term under normal conditions; however, oil may become sequestered in the sediments of low-energy embayments and persist for several years.

In the event of a larger spill from the proposed project, including a less than or equal 1000-bbl oil spill, for which there is only a 0.3 percent probability of occurrence over the life of the project, impacts to EFH would likely be similar to those of a 200 bbl spill. Direct mortality to fish would still likely be limited to the egg and larval stages found in the nearby surface waters; however, the spatial extent of the spill would likely be much greater and affect a larger area of ocean surface and coastline which could affect more shallow benthic habitats.

7.0 Cumulative Impacts

The three impacting sources identified for the proposed project are: 1) noise and disturbance, 2) effluent discharges, and 3) oil spills. Of these three sources, only the increased risk of an oil spill associated with the proposed project would substantially add to, or interact with, effects from related or unrelated actions or projects.

This cumulative impact analysis is based on the fact that the proposed project would occur from existing facilities, which were previously evaluated in the Point Arguello Field and Gaviota Processing Facility Area Study and Chevron/Texaco Development Plans EIR/EIS (ADL 1984) and the ESA Section 7 consultation for Point Arguello (FWS 1984; NMFS 1984). The proposed project will fall within the approved level of activity already scheduled to occur at Platform Hidalgo, and will not add spatially to the impacts caused by effluent discharges, and noise and disturbance sources that were scheduled to occur and are covered under existing permits at Platform Hidalgo. Additionally, the proposed project will not extend the productive life of the Point Arguello facilities.

Table 7.1 identifies three similar non-federal projects that are reasonably likely to occur and will be considered in the cumulative effects analysis. These actions include activities that could produce impacts on EFH in the project area during the expected life of the Point Arguello Unit development project. These projects include the resumption of production at Pier 421, development of State leases from Platform Hogan, and the development of the Paredon Field near Carpinteria. These projects would slightly increase the risk of an oil spill occurring. The projects will occur from existing facilities and within the levels of activity planned and analyzed for the facilities. Thus, none of the projects would add to the impacts caused by effluent discharges, and noise and disturbance sources that were scheduled to occur and are covered under permits at the respective platforms or onshore locations.

Table 7.1 Cumulative Offshore Energy Projects (Non-federal)

#	Project, Applicant	Description	Status
1	Resumption of State Lease PRC-421, Venoco	Oil and Gas Development Project	Under Review
2	Carpinteria Field Redevelopment, Carone and PACOPS	Oil and Gas Development Project	Under Review
3	Paredon Project, Venoco	Oil and Gas Development Project	Under Review

Resumption of State Lease PRC-421, Venoco. In May 2004, Venoco proposed to bring two idle Coastal Zone oil production wells within State Lease PRC-421 back into production. The wells are located in the City of Goleta on two adjacent piers. Pier 421-1 supports an idled water and gas injection well, while Pier 421-2 supports an idled oil production well. Venoco proposes to install new production equipment and reactivate the oil well on Pier 421-2, and reactivate the injection well on Pier 421-1 for disposal of wastewater and natural gas.

Based upon current projections, the estimated life of the proposed project would be twelve years of oil production; production would be expected to be no more than 700 bbl/d of oil in the first year, tapering off to approximately 100 bbl/d by year 12 (CSLC, 2005). On May 17, 2004, the City of Goleta went on record in opposition to resumed oil and gas production from SL 421. On May 19, 2004, Venoco re-submitted a recommissioning plan to the California State Lands Commission (CSLC), Santa Barbara County, and City of Goleta which is currently under environmental review, pending resolution of "vested rights" legal issues The proposed project would marginally increase the likelihood of an oil spill off the south-central California coast.

Carpinteria Field Development Project, Carone and PACOPS. This project includes directional drilling from Platform Hogan into existing State Leases PRC-4000, PRC-7911, and PRC-3133. The applicant has proposed to drill up to 25 wells. Estimated peak production from Platform Hogan would increase to approximately 6,000 bbl/d of oil and 6 mmscfd of gas after the first six years of production, and then would decline. The project would be expected to have a 12-year economic life. The resulting oil and gas production will be sent to La Conchita Facility for processing via the existing pipelines. Oil and gas produced from this project would flow through submerged pipelines to the CPF.

Previously, the environmental analysis process determined that the structural integrity of Platform Hogan needed to be verified to determine if the platform is capable to support a drilling rig needed to accomplish this project. Therefore, the project was placed on hold for several years until the determination was completed. If the structural integrity is not adequate, some construction work may be required at Platform Hogan to reinforce the platform's structure. The proposed project would marginally increase the likelihood of an oil spill off the south-central California coast. The environmental analysis for this proposed project is ongoing. The proposed project would marginally increase the likelihood of an oil spill off the south-central California coast.

The Paredon Prospect Development, Venoco. The project would utilize extended-reach drilling from an onshore site located within Venoco's Carpinteria Processing Facility (CPF), to develop and produce oil and gas from hydrocarbon-bearing reservoirs (the Paredon Prospect) lying primarily offshore of the Carpinteria area in State Leases PRC 3150 and PRC 3133. The Paredon

Prospect is estimated to contain recoverable reserves of approximately 23.5 million bbl of oil and 43 billion standard cubic feet (bscf) of natural gas (10,000 bbl/d of oil and 10 mmscfd of gas). An environmental impact report (EIR) was prepared for the project; and on May 19, 2008, the City of Carpinteria's Environmental Review Committee (ERD) held a public meeting on the Proposed Final EIR. The ERD voted to delay issuance of the project – thereby postponing the final decision regarding certification of the document.

The status of this project is therefore still pending. Venoco is currently reviewing both onshore and offshore alternatives for the location of the drilling rig and wells. Although Venoco stated that it intended to provide a proposal to the CSLC by February 2012, a proposal has not yet been received. Regardless, the proposed project would marginally increase the likelihood of an oil spill off the south-central California coast.

Oil and Gas Development. There are currently a total of 49 OCS oil and gas leases (43 producing leases and 6 non-producing leases) offshore of Southern California. Production from these OCS leases is expected to continue for up to the next 25 years.

Offshore oil and gas reserves are harvested via the 23 existing oil and gas platforms located in Federal waters and 4 platforms located in State waters. The cumulative effects of these structures and development activities on the OCS can be found in numerous reports, and environmental documents (MMS 1992, 1995, 1996). The proposed inclusion of the Development of the Electra Field reserves would add only minimally to the overall oil spill risk associated with ongoing OCS oil and gas activities in the Pacific Region (MMS 1996). The proposed Carpinteria Field Development and Paredon projects would incrementally increase the overall oil spill risk offshore southern California based on their larger recovery volumes.

The six undeveloped OCS leases were acquired between 1968 and 1982 but never developed primarily due to a combination of delays by regulators, the State's environmental and safety concerns, and various lawsuits. A lawsuit by the state of California prevented the federal government from allowing development on 36 federal leases issued before the congressional moratorium was instituted. In November 2005, a federal judge ordered the U.S. government to repay the original bonus bids, totaling just over $1.1 billion, to the oil and gas companies that hold these leases. The decision was affirmed by the U.S. Court of Appeals for the Federal Circuit and the government repaid the bonus bids. Additionally, the BOEM currently has no proposals for the decommissioning of offshore facilities.

Other Activities. NMFS (1998ab) has identified a variety of fishing and non-fishing activities that may cause adverse impacts to EFH along the Pacific Coast. These include dredging and discharge of dredged material, water intake structures, aquaculture, wastewater discharge, oil and hazardous waste spills, coastal development, agricultural runoff, commercial marine resource harvesting, and commercial fishing. Most of these activities occur throughout the California, Oregon, and Washington coastal habitat and all of these activities and impacting agents exist in the southern California coastal zone. As a result, marine water quality within much of the SCB has been impacted by municipal, industrial, and agricultural waste discharges and runoff (MMS 1992, Bight'98 Steering Committee 2003). However, the water quality from the Point Conception area north and offshore the Channel Islands generally remains very good.

The project area is very productive and is important habitat for many of the species covered under the Coastal Pelagics Fishery Management Plan (FMP), Highly Migratory Species FMP, Pacific Salmon FMP, and the Groundfish FMP. An oil spill resulting from the Electra project would impact the water quality of this habitat. Although only minimal adverse impacts to fish populations and their prey species would be likely result from such an event, EFH in the Southern California Bight is already stressed due to overfishing, and degraded water quality in estuaries south of Point Conception. Degradation of the water quality north of Point Conception due to an oil spill would cause further stress to EFH. However, impacts to water quality from an open ocean spill of less than 200 bbl would be short-term and not expected to last more than several days.

8.0 Mitigation

The mitigation measures and stipulations for the proposed development of the Electra Field reserves will not be finalized until the revised Development and Production Plan is approved.

BOEM has met the applicable recommended conservation measures for oil and gas production described in Amendment 11 to the Groundfish FMP and in Amendment 8 to the Coastal Pelagics FMP. This includes containment equipment and sufficient supplies to combat spills on-site at Platform Hidalgo. All offshore facilities are covered by oil spill response plans that are revised semi-annually.

Additionally, BOEM places mitigation measures and conditions of approval on all OCS activities when appropriate. BSEE monitors all lease operations to ensure that industry is in compliance with relevant requirements. This includes conducting scheduled and unscheduled inspections of facilities, and scheduled and unscheduled oil spill drills. The BSEE Pacific OCS Region also has a rigorous pipeline inspection program in place. Appendix B describes in detail the oil spill prevention and response programs in place for the Pacific Region and includes a description of BSEE's Pacific Region's platform inspection and oil spill drill program, pipeline inspection program, and the oil spill response and cleanup capabilities of the area.

9.0 Conclusions

Under routine operations, adverse impacts associated with the proposed project are not expected to affect EFH identified in the Coastal Pelagics FMP, Highly Migratory Species FMP, Salmon FMP, or the Groundfish FMP. Specifically, the proposed project would occur from existing facilities and will fall within the level of activity already planned to occur at Platform Hidalgo and associated Point Arguello facilities. Thus, the proposed project will not add to the impacts (spatially) caused by effluent discharges and noise and disturbance that were scheduled to occur, were analyzed in prior environmental documents, and are covered under permits at Platform Hidalgo or the associated facilities.

Under upset conditions, the proposed development of the Electra Field using extended reach drilling technology may cause minimal to moderate adverse impacts on EFH if an oil spill associated with the proposed project was to occur. It is estimated that there would be a 4.4 percent chance of an oil spill between 50 and 1,000 bbl occurring due to the proposed development of the Electra Field reserves. However, based upon historical data, such a spill would likely be less than 200 bbl in size. Minimal adverse impacts to EFH are expected from a spill this size, even if the spill were to contact land. Given the dynamic environment of the south-central coast, however, such a spill, while likely having a greater spatial footprint, would still likely result in only minimal to moderate adverse impacts on EFH.

Additionally, as little as 20 years ago, extended reach drilling from Platform Hidalgo to the Electra Field reserves would not have been feasible. In previous years, development of the Electra Field resources would have required the construction and placement of a new offshore platform structure to develop the reserves at much greater environmental risk and damage.

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Revisions to the Platform Hidalgo Development and Production Plan to Include Development of the Western Half NW/4 of Lease OCS-P 0450

Accompanying Information Volume
Coastal Zone Consistency Analysis and Findings

Submitted to:
Bureau of Ocean Energy Management
Pacific OCS Region

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COASTAL ZONE CONSISTENCY ANALYSIS AND FINDINGS FOR THE DEVELOPMENT OF THE WESTERN HALF OF LEASE OCS-P 0450

Plains Exploration and Production Company (PXP), operator of the Point Arguello Unit, is proposing to develop oil and gas resources on the and the western half of the northwest quarter (NW/4) of lease OCS-P 0450 (western half of OCS-P 0450). The proposal is to drill a maximum of two (2) wells for development of the reserves on the western half OCS-P 0450. The eastern half of lease OCS-P 0450 is already been developed as part of the Point Arguello Unit.

The oil and gas reserves from the western half of OCS-P 0450 will be developed from Platform Hidalgo, which is one of the existing Point Arguello platforms. The only new equipment that may be required for development of the western half of OCS-P 0450 is the possible addition of a crude oil stabilizer on Platform Hidalgo, and the installation of two (2) new production wells using existing well slots on Platform Hidalgo.

The two (2) wells will be directionally drilled using existing well slots on the platforms. Drilling of the wells on the western half of OCS-P 0450 is expected to last about six months with production lasting approximately six years. With drilling and production expected to be concluded in this timeframe, the reserves from the western half of OCS-P 0450 will be produced within the remaining productive life of Point Arguello platforms. This will maximize the reserves recovered in the shortest period of time and within the environmental time frame and footprint of the existing Point Arguello facilities as actually foreseen and evaluated in the Point Arguello/Southern Santa Maria Basin Area Study EIS/EIR.

Plains Exploration and Production Company (PXP), operator of both Point Arguello and the western half of OCS-P 0450, is proposing to drill development wells from Platform Hidalgo. The proposal is to drill a maximum of two (2) wells.

Oil production from the western half of OCS-P 0450 will be combined with Point Arguello Unit oil and transported to Gaviota in the existing PAPCO oil pipeline. From Gaviota, the combined oil production will be transported to refineries in the existing All America Pipeline.

Gas from the western half of OCS-P 0450 will be combined with Point Arguello Unit gas on the production platforms. The combined gas will be sweetened for platform use or sale to shore via the existing PANGL pipeline. Gas volumes in excess of platform needs or sales to shore will be re-injected into the producing reservoir for later recovery. Sweetened gas that is sent to shore will be used as fuel for the PAPCO turbine generators that produce steam for oil heating and electricity for facility use and sales to the grid.

In brief, the development and production of oil and gas reserves from the western half of OCS-P 0450 will be accomplished by drilling extended reach wells from the existing Point Arguello Unit platforms using existing wells slots, pipelines, equipment and facilities. Development of the reserves on the western half of OCS-P 0450 will be accomplished within the expected lifetime of the Point Arguello Field. The total number of wells drilled for the Point

Arguello Unit, Rocky Point, and the western half of OCS-P 0450 will be significantly less than the number of wells originally anticipated and approved for the Point Arguello Unit alone.

The proposed development activities for the western half of OCS-P 0450, which are described in detail in the Platform Hidalgo Development and Production Plan (DPP) Revision and the Accompanying Information Volume, are consistent with the policies of the California Coastal Management Program. The proposed activities will be conducted in a manner to ensure conformity with that program. The development of the western half of OCS-P 0450 will use existing onshore and offshore facilities. This will ensure minimum impact on the environment while producing a needed domestic energy source. Each of the applicable California Coastal Zone Management Plan policies, as set forth in the California Coastal Act, are hereinafter stated and evaluated relative to the development activities proposed for the western half of OCS-P 0450.

Based upon the evaluation included in this document, along with the information presented in the DPP revision document and the accompanying information, the proposed development activities complies with the State of California's approved coastal management program and will be conducted in a manner consistent with such program.

Section 30211-PUBLIC ACCESS

Development shall not interfere with the public's right of access to the sea where acquired through use or legislative authorization, including, but not limited to, the use of dry sand and rocky coastal beaches to the first line of terrestrial vegetation.

Assessment

Development of the western half of OCS-P 0450 will not involve the construction of any new onshore of offshore facilities. The drilling phases of the proposed project will contribute increased truck traffic in the coastal area associated with equipment transport. The truck traffic will be to and from Port Hueneme, which will serve as the port for moving drilling supplies to and from the existing Platform Hidalgo. It has been estimated that a maximum of 10 truck trips a week will be needed to support the drilling operations. None of the trucking activities to Port Hueneme will interfere with the public's right of access to the sea.

Finding

The proposed project would not provide new public access, nor will it interfere with existing access. The proposed project is consistent with this section of the Coastal Act because the project will not interfere with the public's right to access.

Section 30230-MARINE RESOURCES; MAINTANANCE, and 30231-BIOLOGICAL PRODUCTIVITY; WASTE WATER

30230. Marine resources shall be maintained, enhanced, and where feasible, restored. Special protection shall be given to areas and species of special biological or economical significance. Uses of the marine environment shall be carried out in a manner that will sustain the biological productivity of coastal waters and that will maintain healthy populations of all species of marine organisms adequate for long-term commercial, recreational, scientific, and educational purposes.

30231. The biological productivity and the quality of coastal waters, streams, wetlands, estuaries, and lakes appropriate to maintain optimum populations of marine organisms and for the protection of human health shall be maintained and, where feasible, restored through, among other means, minimizing adverse effects of waste water discharges and entrainment, controlling runoff, preventing depletion of ground water supplies and substantial interference with surface waterflow, encouraging waste water reclamation, maintaining natural vegetation buffer areas that protect riparian habitats, and minimizing alteration of natural streams.

Assessment
The entire Santa Barbara Channel area contains a large number of important marine resources. Section 4.1.2 of the Environmental Evaluation describes in detail the seabirds, marine mammals, fish resources, and other flora and fauna of the area.

The development of the western half of OCS-P 0450 will not require any new offshore structures or facilities. The development will occur from Platform Hidalgo, which is one of the existing Point Arguello Platforms. Platform Hidalgo has had a moderate biological impact, creating additional habitat and a localized increase in the number of fish and other marine organisms. The marine resources that have been documented at the Point Arguello Platforms are discussed in Section 4.1.2 of the Environmental Evaluation. The presence of Point Arguello platform structures has resulted in increased fish production and this effect is considered to be beneficial.

The development of the western half of OCS-P 0450 will not result in any increase in sanitary waste discharges or brine from the desalinization unit. Both of these discharges are subject to and comply with the existing EPA NPDES permit conditions. All discharge points on the Outer Continental Shelf are located further than 3,280 feet (1,000 m) seaward of the State 3-mile (5 km) boundary and will not affect the water quality or biological productivity of the State's waters.

The development of the western half of OCS-P 0450 will result in additional produced water discharges at the Point Arguello Platforms. However, the volume of produced water discharges associated with the western half of OCS-P 0450 will be less than the Point Arguello Unit discharge volumes (see Table 2.5 of the Environmental Evaluation). The peak produced water discharge for the Point Arguello Field is projected to be 150,000 bbls per day. The development of the western half of OCS-P 0450 is projected to increase the peak produced water discharge rate to156,500 bbls/day (a 4% increase). Produced water discharged from the Point Arguello Platforms creates a minor, localized impact in the vicinity of the discharge point by increasing the concentration of such constituents as suspended solids/turbidity, oxygen demand, oil and grease, and trace metals. Any concentration of materials above normal background levels is diluted rapidly by waves and currents. All produced water discharges are subject to and comply with the existing NPDES permit requirements.

All solid wastes generated aboard the platform, with the exception of washed drill cuttings and drilling muds, will be collected and disposed of at appropriate onshore facilities in accordance with EPA and local disposal permit conditions.

Oil contaminated solids, spent oils, solvents, etc. will be containerized, transported onshore and disposed of in an appropriate disposal site or as specified in the local disposal permit. Produced water, along with any other drainage water containing oil, will be processed in a flotation unit on the platform to remove free oil and suspended solids such that it will meet federal permit requirements prior to discharge to the ocean. Deck drainage from rain runoff and washdown is processed in either flotation units or gravity segregation units such that it complies with NPDES permit requirements prior to discharge to the ocean.

The U.S. EPA and The Bureau of Safety and Environmental Enforcement (BSEE) strictly regulate discharges into the marine environment, including the discharge of drilling muds and cuttings. The ocean disposal of oil contaminated waste is prohibited. The proposed well locations are beyond 3,280 feet (1,000 m) of State waters; according to a policy established by the Commission in 1980, discharges of drilling muds and cuttings from operations conducted more than 3,280 feet (1,000 m) from the State's 3-mile (5 km) boundary do not affect the coastal zone.

The drilling of the two wells will be done with water based muds. No oil based muds will be used as part of the development. A discussion of the impacts of washed mud and cuttings disposal is included in Section 4.1.3 of the Environmental Evaluation. In summary, there is much documentation that supports the fact that most water based drilling muds (the type anticipated for this project) are relatively nontoxic to marine organisms. The discharges of washed muds and cuttings will not result in any long-term adverse impacts to the biological productivity of communities within the area of discharge or nearby vicinity, with the exception of the burial of benthic organisms in the immediate area of discharge; however, the areas subject to burial should experience only short-term impacts.

Between 1986 and 1989 39 development wells were drilled from the platforms residing on the Point Arguello Field. The effects of drilling mud and drill cuttings discharged as a result of these wells on neighboring hard-bottom epifauna were studied in detail during the comprehensive California Monitoring Program (CAMP) Phases II and III, which lasted from 1986 to 1995. The final conclusion provided in the Phase III report was that platform discharges have not caused changes to nearby hard-bottom communities. Equal numbers of positive and negative effects were indicated for dominant taxa, and there was no consistent pattern of response for a single taxon over the three habitat types (deep high and low relief, and shallow low relief). Statistical tests concluded that the cumulative distribution of responses could have been due to chance alone. Based on the results of CAMP Phases II and III, adverse impacts to hard-bottom epibiota as a result of drilling mud and drill cuttings discharges from the proposed development of the western half of OCS-P 0450 are not expected to occur.

The release of drilling muds and cuttings will produce a displacement of sediment and localized turbidity in the vicinity of the platform. The sediment effects are physical in nature, as only "clean" cuttings and drilling muds are to be discharged into the surrounding waters in accordance with existing NPDES permits.

The literature indicates that while marine mammals hear man-made noises and sounds generated by vessels, there is no indication that they are affected deleteriously by the noise (Richardson *et al*., 1995). Because noise and vessel sounds generated from this project are highly localized and short-term in nature, adverse impacts to marine mammals from noise are not expected. The literature indicates that some species such as dolphins may be attracted to vessels, but the majority will maintain distances of 100-200 m. As described in the Point Arguello Project EIR/EIS, supply vessels, although unlikely, may collide with marine mammals.

Richardson et al. (1995) cite only a single source of information on the levels of noise produced by platform-based drilling activities. Gales (1982) recorded noise produced by one drilling and three drilling and production platforms offshore California. The noise produced was so weak that they were nearly undetectable even along side the platform in sea states of Beaufort 3 or better. No sound levels were computed, but the strongest received tones were very low frequency, about 5 Hz, at 119-127 dB re 1 micro Pa. The highest frequency recorded was about 1.2 Hz. Richardson et al. (1995) predicted that the radii of audibility for baleen whales for production platform noise would be about 2.5 km in nearshore waters and 2 km near the shelf break (MMS 2000).

For gray whales of the coast of central California, Malme et al. (1984) recorded a 50-percent response threshold to playback at 123 dB re 1 micro Pa. This is well within 100m in both the nearshore and shelf-break waters. Therefore, the predicted radius of response for gray whales, and most likely other baleen whales, would also be less then 100m. Richardson predicted similar radii of response for odontocetes and pinnipeds (MMS 2000). As such, noise impacts to marine mammals would be limited to within 100m of the platform.

Finding

The proposed activities are consistent with the enumerated policies for the following reasons:

1. Compliance with BSEE regulations (prohibiting ocean dumping of muds containing toxic compounds), EPA and Regional Water Quality Control Board NPDES permit requirements.

2. The effects of drill cuttings disposal are limited to: 1) localized smothering of less mobile elements of the benthic epifauna and infauna at the base of the drilling platforms and on the lower portions of the structures, and attendant reduction of available food to animals at higher trophic levels; and 2) a temporary increase in water turbidity and consequent reduction of light for plant photosynthesis. Based upon the marine surveys that have been conducted around the Point Arguello Platforms, the discharge of the cuttings associated with the drilling of the Point Arguello Unit wells does not appear to have affected the marine life. The discharge of drilling muds at the platform site will not affect marine resources and productivity within coastal State waters.

3. The produced water, separated from the crude oil, will be sent to water treatment facilities for oil removal at the platforms. The produced water cleanup facility allows the produced water to be discharged to the ocean. Treatment prior to disposal consists of a skim tank for removal of oil and suspended solids by gravity separation. The water is then passed through a

flotation cell to remove suspended oil. The clean water is then discharged to the ocean. The produced water discharged from the platform will meet EPA issued NPDES requirements.

Section 30232-OIL AND HAZARDOUS SUBSTANCE SPILLS

Protection against the spillage of crude oil, gas, petroleum products, or hazardous substances shall be provided in relation to any development or transportation of such materials. Effective containment and cleanup facilities and procedures shall be provided for accidental spills that do occur.

Assessment

The development of the western half of OCS-P 0450 will result in a slight increase in the risk of an oil spill originating in Federal and State waters and onshore locations over what exists today for the Point Arguello Unit production. Section 4.4.2 of the Environmental Evaluation provides a discussion of the oil spill risk associated with the proposed development project. Potential spills could be associated with the platform and the on and offshore pipelines. Protection against the spillage of crude oil is a routine part of PXP's operations. It should be noted that the risk of an oil spill from the Point Arguello Field Platforms and pipelines with the development of the western half of OCS-P 0450 is less than the oil spill risk projected as part of the 1984 EIR/EIS for the Point Arguello Field Development. The reduction in oil spill risk is primarily driven by a reduction in the number of wells drilled from the platforms, which has served to reduce the likelihood of a blowout. The1984 EIR/EIS evaluated the drilling of 154 wells on the three Point Arguello platforms. With the proposed development the total number of wells drilled will be less than 75. The other main driver in reducing the oil spill risk has been the lower production levels from the Point Arguello Platforms. The 1984 EIR/EIS evaluated production rates of up to 250,000 bbls per day, and estimated a total production level of approximately 500 million barrels of oil. With the addition of the western half of OCS-P 0450, peak production levels will be around 31,000 bbls per day, and the total recovered reserves from the combined Point Arguello and western half of OCS-P 0450 will be somewhere around 250 million barrels. Both of these factors have served to reduce the oil spill risk associated with the Point Arguello Platforms.

An Oil Spill Response Plan for each platform has been developed, and submitted to and approved by the BSEE, which describes the measures that will be taken in the event of an oil spill and the personnel and equipment available to implement spill containment and cleanup procedures. The basic procedure for a spill is to immediately ensure personnel safety, stop the pollutant flow, begin the containment and cleanup procedure, and contact designated company personnel and Government agencies. The platform personnel would conduct the initial response activity. For a spill beyond the capability of the platform personnel and equipment, the primary sources of assistance would be the industry-sponsored spill containment cooperative - Clean Seas.

Additional information on the oil spill equipment and response can be found in the Oil Spill Response Plans that have been submitted to and approved by the BSEE.

Finding
The proposed activities are consistent with the policy to protect against oil spills because: 1) all possible protective measures have taken to prevent accidental spills; and 2) in the unlikely event that an oil spill does occur, all available means will be implemented to mitigate its impacts and to ensure that it does not adversely impact the marine resources of the area.

Section 30234-COMMERCIAL FISIIING AND RECREATIONAL BOATING FACILITIES

Facilities serving the commercial fishing and recreational boating industries shall be protected and, where feasible, upgraded. Existing commercial fishing and recreational boating harbor space shall not be reduced unless the demand for those facilities no longer exists or adequate substitute space has been provided. Proposed recreational boating facilities shall, where feasible, be designed and located in such a fashion as not to interfere with the needs of the commercial fishing industry.

Assessment
The drilling phase for development of the western half of OCS-P 0450 will involve vessel movements to and from Platform Hidalgo and Port Hueneme. It is projected that one supply boat trips per week above and beyond what is currently required to support the Point Arguello Unit operations will be needed to support the drilling operations. The supply boats that will be used are the existing boats that service the Point Arguello Platforms. Therefore, the development of the western half of OCS-P 0450 will not reduce commercial fishing or recreational boating harbor space at Port Hueneme. No additional supply boat trips above what is required for the Point Arguello Unit project will be needed once drilling is complete.

Findings
The proposed project will not compete with commercial or recreational vessels for available dock space or ancillary facilities and is therefore consistent with the policy stated above.

Section 30240-ENVIRONMENTALLY SENSITIVE HABITAT AREAS; ADJACENT DEVELOPMENTS

Environmentally sensitive habitat areas shall be protected against any significant disruption of habitat values, and only uses dependent on those resources shall be allowed within those areas.

Development in areas adjacent to environmentally sensitive habitat areas and parks and recreation areas shall be sited and designed to prevent impacts which would significantly degrade those areas, and shall be compatible with the continuance of those habitat and recreation areas.

Assessment
The proposed development of the western half of OCS-P 0450 will occur from the existing Point Arguello Platforms. No new facilities will need to be built to accommodate the production. The

Point Arguello Field Platforms are not located within or reasonably near any identified environmentally sensitive habitat areas.

The proposed development could impact environmentally sensitive areas such as San Miguel Island and Point Conception in the unlikely event of a major oil spill occurring and reaching the shoreline. The impacts of an oil spill on sensitive biological communities in these areas are discussed in Section 4.2.3 of the Environmental Evaluation. The peak oil production from the Point Arguello Platforms with the development of the western half of OCS-P 0450 is estimated to be approximately 31,000 bbls per day. This is considerably less than the peak oil production from the Point Arguello Field, which was around 80,000 bbls per day, and well less than the 120,000 bbls per day that was estimated in the 1984 EIR/EIS for the Point Arguello Field. The Oil Spill Response Plan for the Point Arguello Platforms and pipelines defines the sensitive ecological areas within possible oil spill paths (determined from trajectory data) and delineates procedures to protect these areas from contamination.

Normal operation of seafloor pipelines would not impact sensitive habitat areas. Should an accidental spill occur, offshore kelp beds, rocky intertidal habitats and several public beaches could be adversely affected. Arguello Inc's Oil Spill Response Plan includes particular reference to these areas to help prevent spill impacts.

Findings
The proposed activities will be conducted so that adverse environmental impacts on important habitat areas will be avoided. The project is consistent with this policy because normal project activities will not impact any environmentally sensitive habitat areas in the general vicinity. Observing the requirements of The Bureau of Safety and Environmental Enforcement (BSEE), which require that immediate action be taken to minimize the impact on water and marine resources, would mitigate the impact of an oil spill or blowout.

Section 30244-ARCHAEOLOGICAL AND PALEONTOLOGICAL RESOURCES

Where development would adversely impact archaeological or paleontological resources as identified by the State Historic Preservation Officer, reasonable mitigation measures shall be required.

Assessment
The development of the western half of OCS-P 0450 will not require the construction of any new facilities. Development of the western half of OCS-P 0450 will be done using existing well slots on Platform Hidalgo. All oil and gas production will be handled in existing facilities. As such, no activities associated with the proposed development would impact archaeological or paleontological resources. The new wells will penetrate the seafloor underneath the platform, which is not sitting on any offshore archaeological sites.

Finding
The development of the western half of OCS-P 0450 is considered consistent with the enumerated policy because no new structures will be placed onshore or offshore, and as such, no offshore anomalies or onshore sites would be affected.

Section 30251- SCENIC AND VISUAL QUALITIES

The scenic and visual qualities of coastal areas shall be considered and protected as resource of public importance. Permitted development shall be sited and designed to protect views to and along the ocean and scenic coastal areas, to minimize the alteration of natural land forms, to be visually compatible with the character of surrounding areas, and, where feasible, to restore and enhance visual quality in visually degraded areas. New development in highly scenic areas such as those designated in the California Coastline Preservation and Recreation Plan prepared by the Department of Parks and Recreation and by local government shall be subordinate to the character of its setting.

Assessment
The development of the western half of OCS-P 0450 will not require the construction of any new facilities. The development of the western half of OCS-P 0450 will be done using existing well slots on Platform Hidalgo. All oil and gas production will be handled in existing facilities. As such, no activities associated with the development of the western half of OCS-P 0450 would change the existing scenic and visual qualities of the area.

Finding
The development of the western half of OCS-P 0450 is considered consistent with the enumerated policy because no new structures will be placed onshore or offshore, and therefore, there would be no change in the existing scenic and visual qualities of the area.

Section 30253-MINIMIZATION OF ADVERSE IMPACTS

New development shall:

1. Minimize risks to life and property in areas of high geologic, flood and fire hazard.

2. Assure stability and structural integrity, and neither create nor contribute significantly to erosion, geologic instability, or destruction of the site or surrounding area or in any way require the construction of protective devices that would substantially alter natural landforms along bluffs and cliffs.

3. Be consistent with requirements imposed by an air pollution control district or the State Air Resources Control Board as to each particular development.

4. Minimize energy consumption and vehicle miles traveled.

5. Where appropriate, protect special communities and neighborhoods which, because of their unique characteristics are popular visitor destination points for recreational uses.

Assessment
The development of the western half of OCS-P 0450 will not require the construction of any new facilities. The western half of OCS-P 0450 will be developed using existing well slots on Platform Hidalgo. All oil and gas production will be handled in existing facilities. As such, no activities associated with the proposed development would affect areas of high geologic, flood or fire hazard. Since no new facilities are being proposed as part of development of the western half of OCS-P 0450, there would be no new impacts to geologic stability, or the construction of protective devices that would alter natural landforms along bluffs and cliffs.

The proposed development of the western half of OCS-P 0450 will be covered by the existing Permits to Operate (PTOs) for the Point Arguello Facilities that have been issued by the Santa Barbara County Air Pollution Control District (SBCAPCD). Estimates of the emissions associated with the proposed development are provided in Section 4.2.2 of the Environmental Evaluation. All of the emissions associated with the development of the western half of OCS-P 0450 will be offset consistent with SBCAPCD rule and regulations.

Energy consumption will be minimized during the proposed activities by the use of recycled waste heat from the turbine generators for oil treatment, and utilization of treated produced gas generated from the Platform to help supply normal operating fuel requirements both for the Platform and the onshore facilities. Produced gas from the project will be used to generate electrical power, which may be sold to the grid. The project itself represents a net production of energy. As discussed in Section 4.0 of the Environmental Evaluation, the proposed project activities will not constitute a major impact to transportation systems in the area or create a substantial increase in vehicle trips per day. The proposed project activities will not disrupt or affect any special communities or neighborhoods.

Finding
The proposed development of the western half of OCS-P 0450 is consistent with the goals and intent of the above policy for the following reasons:

1. Since no new structures will be built as part of the proposed development, no project components will impact high geologic, flood or fire hazards.

2. The proposed development will occur from Platform Hidalgo, which is one of the existing Point Arguello Platforms. The platform structures have been designed to remain stable, even under maximum credible earthquake conditions. The platforms have also been designed to withstand extreme oceanographic conditions.

3. The BSEE drilling rules, the BSEE approved drilling procedures that will be developed for the proposed wells, and implementation of best available safety technology minimize the risk of blowout resulting from communication between a higher pressure strata and a lower pressure strata.

4. The development of the western half of OCS-P 0450 will use the existing pipelines associated with the Point Arguello Field. These pipelines have been designed to minimize the risk of damage from geologic hazards and to ensure their structural integrity. The onshore pipelines were installed within or near an existing right-of-way and did not require the construction of new protective devices that substantially alter natural landforms along bluffs or cliffs.

5. The development of the western half of OCS-P 0450 will be covered under the existing PTOs for the Point Arguello Facilities that have been issued by the SBCAPCD. Air emissions associated with the proposed development will be offset consistent with SBCAPCD rules and regulations.

6. Energy consumption will be minimized during the proposed activities by use of recycled waste heat and processed gas. Produced gas from the project will be used to generate electricity, which will be sold to the grid.

7. The Santa Barbara/Ventura Coastal areas provide a number of recreational opportunities that attract tourism to the region. The proposed project will be situated approximately 25 miles (40 km) from the Channel Islands National Park, which provides a popular visitor destination for limited recreational use. Project activities will occur at a sufficient distance from the park to preclude any adverse impacts during normal activities. Recreational resources along the coastline will not be disrupted since there is no construction activities associated with the proposed project. No long-term effects on recreational opportunities are expected as a result of the development of the western half of OCS-P 0450 since all activities will occur from existing oil and gas development facilities.

Section 30260-INDUSTRIAL DEVELOPMENT; LOCATION OR EXPANSION

Coastal-dependent industrial facilities shall been encouraged to locate or expand within existing sites and shall be permitted reasonable long-term growth where consistent with this division. However, where new or expanded coastal-dependent industrial facilities cannot feasibly be accommodated consistent with other policies of this division, they may nonetheless be permitted in accordance with this section and Sections 30261 and 30262 if: (1) alternative locations are infeasible or more environmentally damaging; (2) to do otherwise would adversely affect the public welfare; and (3) adverse environmental effects are mitigated to the maximum extent feasible.

Assessment
The development of the western half of OCS-P 0450 will not require the construction of any new facilities. The western half of OCS-P 0450 will be developed using existing well slots on Platform Hidalgo. All oil and gas production will be handled in existing facilities. None of the existing facilities that will be needed for the development will have to be expanded, with the exception of a possible new oil stabilizer on Platform Hidalgo. As such, the development of the western half of OCS-P 0450 will not result in and new or expanded industrial development over what exists today.

Finding
The development of the western half of OCS-P 0450 will not result in any new or expanded industrial development over what exists today.

Section 30262-OIL AND GAS DEVELOPMENT

Oil and gas development shall be permitted in accordance with Section 30260, if the following conditions are met:

a. The development is performed safely and consistently with the geologic conditions of the well site.

b. New or expanded facilities related to such development are consolidated, to the maximum extent feasible and legally permissible, unless consolidation will have adverse environmental consequences and will not significantly reduce the number of producing wells, support facilities, or sites required to produce the reservoir economically and with minimal environmental impacts.

c. Environmentally safe and feasible subsea completions are used when drilling platforms or islands would substantially degrade coastal visual qualities unless use of such structures will result in substantially less environmental risk.

d. Platforms or islands will not be sited where a substantial hazard of vessel traffic might result from the facility or related operations, determined in consultation with the USCG and the Army Corps of Engineers.

e. Such development will not cause or contribute to subsidence hazards unless it is determined that adequate measures will be undertaken to prevent damage from such subsidence.

f. With respect to new facilities, all oilfield brines are reinjected into oil producing zones unless the Division of Oil and Gas of the Department of Conservation determines to do so would adversely affect production of the reservoirs and unless injection into other subsurface zones will reduce environmental risks. Exceptions to reinjection will be granted consistent with the Ocean Waters Discharge Plan of the State Water Resources Control Board and where adequate provision is made for the elimination of petroleum odors and water quality problems.

Where appropriate, monitoring programs to record land surface and near-shore ocean floor movements shall be initiated in locations of new large scale fluid extraction on land or near shore before operations begin and shall continue until surface conditions have stabilized. Costs of monitoring and mitigation programs shall be borne by liquid and gas extraction operators.

Assessment
The development of the western half of OCS-P 0450 will not require the construction of any new facilities. The Western half of OCS-P 0450 will be developed using existing well slots on

Platform Hidalgo. All oil and gas production will be handled in existing facilities. The proposed development of the Western half of OCS-P 0450 will be fully integrated into existing oil and gas operating facilities. The only new items required for the project are the production wells and a possible new oil stabilizer on Platform Hidalgo. This represents that maximum possible use of consolidated facilities.

The use of subsea completions has been determined to be an infeasible alternative for the development of the western half of OCS-P 0450. The use of subsea completions would serve to increase visual impacts because a drilling vessel would be required onsite during the drilling phase and frequently during the production phase to accomplish well workovers; and testing. The introduction of additional seafloor obstructions would pose a greater impact to commercial fishermen than that resulting from the proposed use of existing offshore platforms. There is also more environmental risk associated with the use of subsea completions because they are not as accessible to control or service in case of a malfunction. In the case of the proposed project, artificial lift will be required to extract the resource, thus reducing the potential for using subsea completions.

Produced water from the western half of OCS-P 0450 will be discharged at the platforms, which is what is occurring today for the Point Arguello Unit produced water. The water treatment and discharge system has been designed to meet the existing NPDES discharge permit requirements that are in place for the Point Arguello Platforms.

Finding

The proposed activities are consistent with the enumerated policies for the following reasons:

The development of the western half of OCS-P 0450 will occur from the existing Point Arguello Platforms, which were designed and installed to meet all of the safety requirements. No new offshore or onshore structures will need to be built for the proposed development.

The casing and mud program for the project will use the best available safety technology to minimize the risk of a blowout resulting from communication between a higher pressure strata and a lower pressure strata. All wells will be drilled following BSEE approved drilling procedures.

The development of the western half of OCS-P 0450 will utilize existing facilities for the drilling, processing and transportation of the oil and gas production. This represents the maximum possible use of existing facilities.

Platform Hidalgo, which is one of the existing Point Arguello Platforms, will be used for the development of the western half of OCS-P 0450. This platform is located sufficiently clear of the northbound shipping lane of the designated VTSS. The platforms were sited in accordance with the requirements of the U.S. Army Corps of Engineers and the U.S. Coast Guard.

Produced water will be discharged at the existing Point Arguello Platforms in Federal Waters in accordance with the existing NPDES discharge permit requirements.

Attachment A – Typical Well Control Equipment

Attachment A – Typical Well Control Equipment

Well control equipment will provide for prevention, detection and control of undesired formation fluid entry into the wellbore. Described below is typical well control equipment.

A 20" diverter BOP system will be used as described in the following section. The BOP schematics are given in Figure 1 and 2 of this attachment. The diverter, BOP stack, and choke manifold will be designed in accordance with API RP 53" Recommended Practices for Blowout Prevention Equipment Systems for Drilling Wells".

I. Blowout Prevention Equipment

1. 20" Diverter Blowout Prevention System

A. Hydril 21-1/4" MSP 2,000 psi WT with H_2S trim studded top x hubbed down (CIW hub) RX73 ring groove.

B. 1 Diverter Spool 20-3/4" 3000-lb with CIW hubbed end connections and with 2 each 13-5/8" 3000-lb (12" bore) flanged outlets, manufactured to API 6A PSL-1, tempered class U, material class DD, by Woodco U.S.A.

C. 2 Blind Flange 13-5/8" 3000-lb manufactured to API 6A PSL-1 tempered class U, material class DD, Woodco U.S.A.

D. 2 Adapter Spool 13-5/8" 3000-lb x 12" ANSI 300-LB (12" bore) API flanges can be manufactures to 6A specification's but this spool cannot be monogrammed.

E. 1 Woodco Clamp

F. 2 Stud set for 13-5/8" 3000-lb
2 API ring gasket R-57
3 300-lb SS knife valves

G. One (1) drilling spool, 20-3/4 ", 3,000 psi WP hub, RX73 top and bottom, with one (1) 3" 5,000 psi side outlet flange, and one (1) 4" 5,000 psi side outlet flange.

H. One (1) 20-3/4" 3,000 psi WP riser spool, 30' long with hub RX73 up x 3,000 psi 20-3/4" flange down, with API stamp.

I. 20" 3,000 psi WP Hydril single gate preventer, hub x hub, CIW #17, RX73, H_2S trim with 3" side outlets (blind flanged), manual locking.

J. Double gate, 20-3/4" 3,000 psi WP Hydril double gate preventer, CIW #18 hub up, CIW #17 hub down, RX73 up and down, H_2S trim with 3" side outlets (blind flanged), manual locking.

K. Rams for 20-3/4" 3,000 psi stack:
1. One (1) set of blind rams.
2. Two (2) sets of 5" rams.
3. One (1) set of 13-3/8" rams.

L. Diverter Valves
Four (4) each SS 12" x 3000-lb knife valves hydraulic actuated with hose and valving.

M. 12" pipe and fittings to divert flow away from rig in two directions, in compliance with AOGC rules. All flanges to be 12” ANSI 300

2. 13-5/8” BOP

A. Annular BOP (Hub)

Hydril, GK, 13-5/8" ID, 5,000 psi WP, with top 13-5/8" - 5,000 psi stud connection and bottom 13-5/8" - 5,000 psi, hub connection complete with screw top bonnet connection. Includes:

1. One (1) HS trim chain sling lifting assembly.
2. Two (2) eyebolts to lift piston assembly.
3. Two (2) eyebolts to lift latched bonnet assembly.

B. Single Gate (Hub)

One (1) Hydril, 13-5/8" ID 5,000 psi WP, MPL (Multi-position Lock), 13-5/8" hub, 5,000 psi connection top and bottom, 4-1/16", 5,000 psi flanged side outlets H_2S trim.

C. Double Gate (Hub)

One (1) Hydril, 13-5/8" ID 5,000 psi WP, MPL (Multi-Position Lock), 13-5/8" hub 5,000 psi connection top and bottom, 4-1/16", 5,000 PSI flanged side outlets, H_2S trim.

D. Drilling Spool (Hub)

One (1) 13-5/8", 5,000 psi, top and bottom flanged side outlet and one (1) 3-1/16", 5,000 psi flanged side outlet 29" high.

E. Rams

1. One (1) set blind rams.
2. Two (2) sets 5" pipe rams.
3. Two (2) set variable bore rams 3 ½" to 6".
4. One (1) set 2-7/8" pipe rams.
5. One (1) set 9-5/8" pipe rams.
6. One (1) set 7" pipe rams.
7. One (1) set 3 ½" pipe rams.
8. One (1) set 3 ½" dual pipe rams.
9. One (1) set spare VBR element.

F. One (1) 13-5/8" 5,000 psi riser spool, approximately 27' long, flange x flange, with API stamp.

3. BOP Stack Handling System

A. One (1) each overhead crane system capable of picking either stack up while landing casing.

B. One (1) BOP platform which is capable of stumping up both the 13-5/8" stack and the 20" stack simultaneously for moving or other activity.

C. BOP work platform to facilitate ram changes, nipple up and nipple down. Platform height can be moved up and down easily.

4. Kill and Choke Lines System

A. Kill line valves to consist of two (2) 3-1/6" 10,000 psi, McEvoy type E gate valve, with one valve being manually operated and one being hydraulically activated.

B. Kill line is 3-1/6" 5,000 psi Coflexquip Hose 30' which comes off the standpipe manifold, all connections flanged.

C. Choke valves to consist of two (2) 4-1/6" 10,000 psi, McEvoy type E gate valve, one (1) valve being manually operated and one (1) being hydraulically activated.

D. Choke line is 4-1/6" 5,000 psi Coflexquip hose 30', which connects from choke line valves to floor mounted choke manifold. All hose connections flanged.

5. Degasser Vessel and Vent Line

A. Primary degasser built as per drawing, specifications.

B. Primary degasser vent line to be 10", extends to crown.

C. Straight through vent line 4", connects into degasser vent and proceeds to crown.

6. **Blowout Preventer Control System**

NL Koomey Model T40280-3S blowout preventer control unit with 375 gallon volume tank, main energy provided by a 40 HP electric motor driven triplex plunger pump rate at 20.2 GPM at 3,000 psi charging twenty-eight (28) each 11-gallon bladder-type separate accumulator bottles. Second energy charging system consists of Model FA-42 air pumps rated at a combined volume of 23 GPM at 1,200 psi, or 12 GPM at 3,000 psi. Above two energy systems BACKED UP by 12 - 220 cubic feet nitrogen bottles connected to the manifold system. All above system controlled by a Model SU2KB7S"S" series manifold with eight (8) manual control stations at the unit.

A. Includes two (2) Model MGBK7EH electrically operated remote control panel with two manifold pressure gauges and nine push button controls with lights. One (1) mounted on rig floor, one (1) mounted in pipe rack module.

Controls for:

One (1) annular BOP with pressure regulator control to decrease or increase annular pressure.

Three (3) gates BOP.

One (1) kill line HCR valve.
One (1) choke line HCR valve.
One (1) diverter flow selector valve.

B. BOP mounted in subbase module such that 1" coflexip, hoses can remain connected when skidding the rig and picking the stack up.

7. **Upper Kelly Cocks**

Two (2) each. One for top drive, one for conventional kelly drilling Hydril kelly guard, 10,000 psi W.P.

8. **Lower Kelly Cocks and D.P. Floor Valve**

A. One (1) for Varco Top Drive 4 ½ IF
B. One (1) for conventional drilling 4 ½ IF
C. Two (2) for floor valve-one (1) 4 ½ IF, one (1) 3 ½ IF
D. All to be Hydril Kelly Guard, 10,000 psi W.P.

9. **Inside BOP**

One (1) Flocon inside BOP 4 ½ IF
One (1) Flocon inside BOP 3 ½ IF

10. BOP Test Pump

Triton Model 3075 triplex plunger pump rated at 5000 psi working pressure at 6 GPM, driven by a top-mount 20 HP electric motor complete with make-up tank, adjustable relief pressure bypass valve, system gauges with four each 50-ft of 3/8" 5000 psi working pressure test hose with snap-type couplers. This unit is also designed to act as a low volume wash-down pump. Included with the unit are two each NGC 200-2 cleaning lances.

Figure 1 Example Class III BOPE Installation, API Arrangement SRRA or SRdA

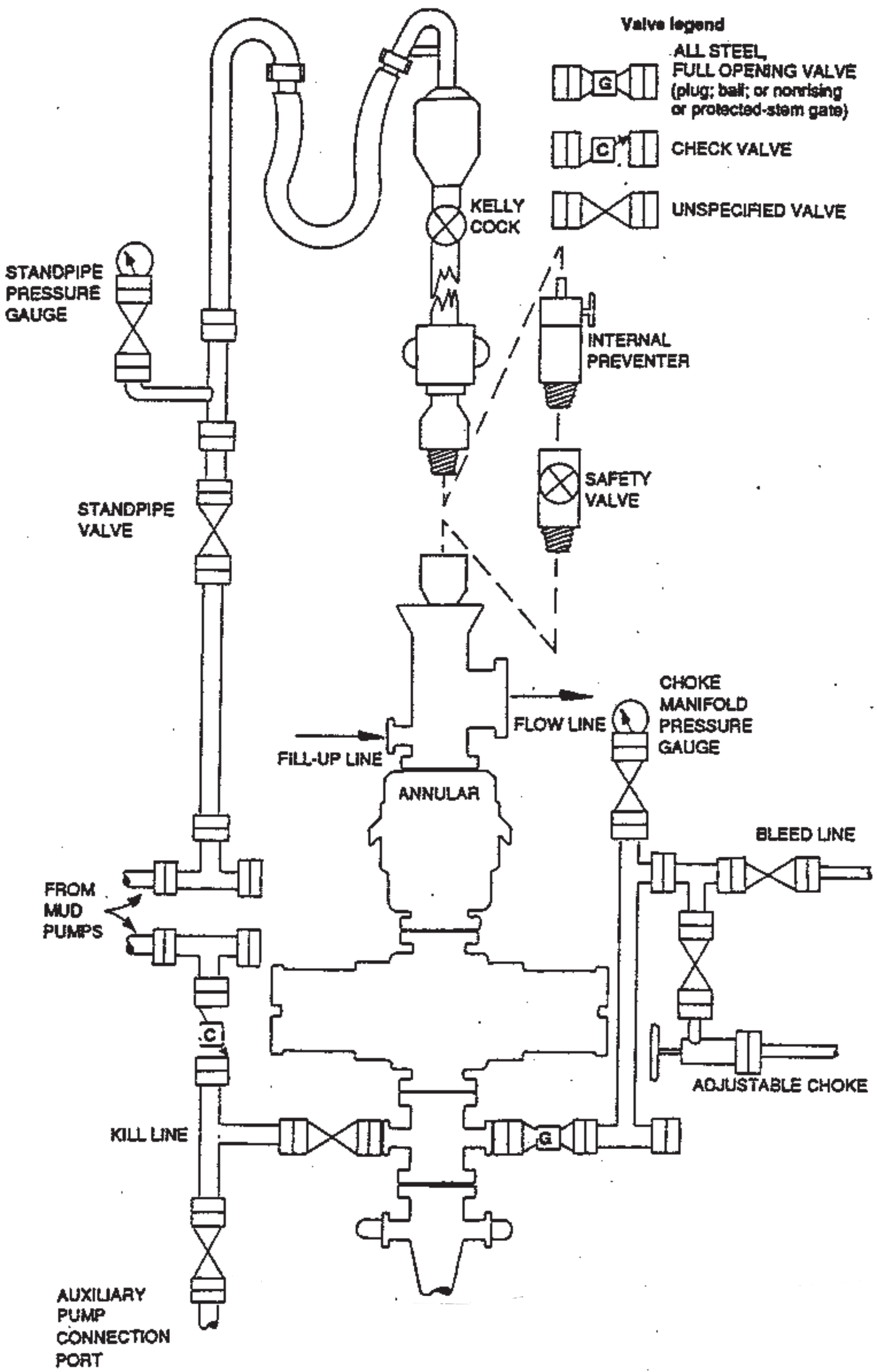
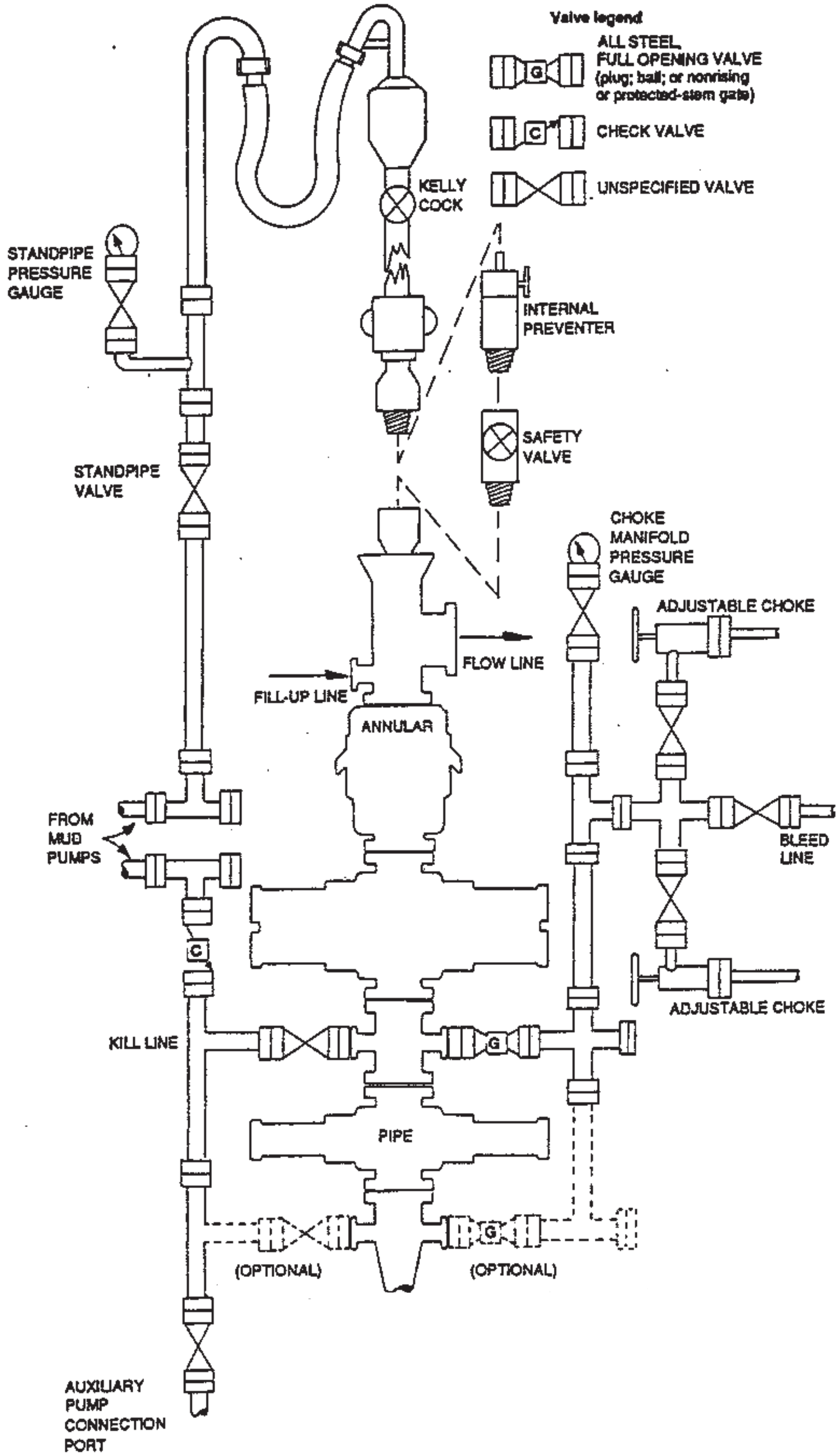


Figure 2 Example Class IV BOPE Installation, API Arrangement RSRRA or RSRdA



Attachment B – Typical Mud System

Attachment B – Typical Mud System

Described below is a typical mud system.

I. Mud Pumps and Equipment

1. Pumps

Two (2) Oil well, A- 1700-PT (triplex, single acting pistons), 7-3/4" bore and 12" stroke x 5,000 PSI fluid end discharge manifold system. Gear end equipped with electric-driven lube oil pump, filtration, Glycol heat exchanger thermostat controlled cooling system. Pistons and. liners are flushed cooled by electric suction charging pumps, engage a few moments prior to the pistons. Pumps are driven by two (2) each traction motors and torque team belts designed to stroke pumps at a maximum of 120 SPM under full load. Fluid ends are equipped with 611 liners and pistons which produce a nominal 530 GPM at a maximum of 120 rpm up to a nominal of 3,900 PSI.

A. 3 " Demco pressure relief valves.

B. 2" Oteco 0-6,000 psi mud gauge.

2. Pulsation Dampeners

Two (2) Hydril K20-5,000 pulsation dampeners.

3. Suction Dampeners

Oilwell 10" suction stabilizer.

4. Suction Strainers

Suction strainers mounted on mud tank suction piping, basket type, shop made.

5. Centrifugals

All pumps are 6" x 8" x 14" Mission Magnum with 12 ½" impellers, 1 7/8" diameter shaft. Rated at 900 gpm at 65 feet: of head. Mud system complete with the following charging pumps:

A. Two (2) pumps for charging two (2) triplex pumps - 1,200 rpm each.
B. One (1) pump for desander - 1,800 rpm.
C. One (1) pump for mud cleaner - 1,800 rpm.
D. One (1) pump for hopper and gun lines - 1,800 rpm.
E. One (1) pump for transfer to mud storage and back up for hopper and gun lines - 1,800 rpm.

F. All pumps powered by one (1) each 100 HP explosion-proof, 460 volt, three-phase, 60 Hz, electric motor with Dodge Paraflex coupling.

6. Trip Tank

Trip tank mounted in substructure tank, 40 bbl capacity, with one (1) 3" x 4" x 13" Mission Magnum pump with 10" impeller, rated at 300 gpm at 48 feet of head with 25 HP explosion proof motor.

7. Drains

Mud module constructed with integrated drains to consolidate all waste fluids from mud pump, processing area.

II. Mud Pits and Related Equipment

1. Active Tank

Processing tank 430 bbl nominal volume which consists of:

A. 30 bbl sand trap.
B. 105 bbl degasser tank.
C. 80 bbl desander tank.
D. 80 bbl mud cleaner tank.
E. 80 bbl centrifuge tank.
F. 55 bbl slugging and pill tank.

2. Auger

All solids control equipment located such that all solids can be easily consolidated, and moved to the center of the platform using a 16" auger. This system can be utilized on any leg by changing the screw direction. An 8" auger takes the mud cleaner underflow to the main 16' auger.

3. Solids Control Equipment

A. Three (3) each MI SWACO Mongoose PT flow line shale shaker screen angle adjustment from +3 degrees to -3 degrees. 120" long x 68.9" wide x 51" high.

B. One (1) Standard model 518 centrifuge and feed pump. 119" long x 70" wide x 50" high.

C. One (1) MI SWACO Mongoose PT Mud Cleaner, combination 8T4 de-silter [sixteen (16) each 4" cones]. The discard from the cones passes onto the pretensioned screens and the majority of the desired Barite passes through the screens and returns to the mud system. Undesirable solids are discarded. Unit is rated at a nominal flow of 900 gpm each.

D. Degasser - One (1) Drillco See-Flow Degasser, vented to outside at the mud module nominally rated at 800 gpm.

E. Agitators

One (1) 5-HP Brandt agitator for pill pit, 24" impeller.
Four (4) each 15 HP Brandt mud agitators for active mud tank, 32" impellers.

F. Mud Hopper - Geosource Model 8900 Sidewinder, rated at 900 gpm at 70' of head without back pressure. Hopper conveniently mounted on mud dock so that mud pallets can be placed by the crane and moved to the hopper with mud module in any drilling leg location.

4. Mud Logging

Mud logging unit to be set on platform main deck. Use Mud Logger from 3,500'+/- to TD

5. Cuttings Chute

16" x 50' auger incorporated into first floor of mud module, which allows the system to be run in a dry mode. This allows cuttings to be diverted to cuttings chute with rig over any leg.

III. Logging

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Gamma Ray / Resistivity Logging While Drilling (LWD) from 1800'+/- to TD

Attachment C – Estimated Mud Composition for C-16/C-17 Wells (Platform Hidalgo)

Attachment C - Estimated Drilling Mud Composition (C-16 Well)

Water Based Mud

INTERVAL (FT)	PRODUCTS	PACKAGE		UNITS sx	TOTAL Pounds
0 - 1,023' 675 bbl Starting Volume 1500 bbl of mud build for interval	DUROGEL	50	lb/sx	589	29,450
	Soda Ash	50	lb/sx	18	900
	Sodium Bicarbonate	50	lb/sx	30	1,500
	MI-GEL	100	lb/sx	295	29,500
1,023' - 1,800' 1900 bbl Starting Volume 2350 bbl of mud build for interval	DUROGEL	50	lb/sx	50	2,500
	Soda Ash	50	lb/sx	40	2,000
	POLYPAC	50	lb/sx	65	3,250
	DUOVIS	50	lb/sx	20	1,000
	GELITE	50	lb/sx	100	5,000
	SALT 96%	50	lb/sx	300	15,000
	TACKLE	5	gal	5	25
	M-I GEL	100	lb/sx	205	20,500
	MI-BAR	100	lb/sx	1425	142,500
	Sodium Bicarbonate	50	lb/sx	20	1,000
	SP 101	50	lb/sx	65	3,250
1,800' - 5,500' 1950 bbl Starting Volume 4600 bbl of mud build for interval	DUROGEL	50	lb/sx	50	2500
	Soda Ash	50	lb/sx	96	4800
	POLYPAC	50	lb/sx	185	9250
	DUOVIS	50	lb/sx	165	8250
	SALT 96%	50	lb/sx	750	37500
	TACKLE	5	gal	5	25
	Lube 167	55	Gal	10	11575
	GELITE	50	lb/sx	286	14300
	M-I GEL	100	lb/sx	143	14300
	Sodium Bicarbonate	50	lb/sx	30	1500
	MI-BAR	100	lb/sx	740	74000

INTERVAL (FT)	PRODUCTS	PACKAGE		UNITS sx	TOTAL Pounds
5,500' - 17,150'	SALT 96%	50	lb/sx	1500	75,000
	Citric Acid	50	lb/sx	10	500
2037 bbl Starting Volume	POLYPAC	50	lb/sx	150	7,500
8,000 bbl of mud build for interval	ULTRAFREE	55	gal	68	81,030
	ULTRAHIB	55	gal	95	113,204
	ULTRACAP	50	lb/sx	475	23,750
	Duovis	25	lb/sx	320	8,000
	MI-BAR	100	lb/sx	2490	249,000
	Sodium Bicarbonate	50	lb/sx	30	1,500

17,150' - 19,564'	SALT 96%	50	lb/sx	250	12,500
2470 bbl Starting Volume	POLYPAC	50	lb/sx	45	2,250
2100 bbl of mud build for interval	ULTRAFREE	55	gal	18	21,449
	ULTRAHIB	55	gal	25	29,790
	Duovis	25	lb/sx	85	2,125

Attachment C - Estimated Drilling Mud Composition (C-17 Well)

Water Based Mud

INTERVAL (FT)	PRODUCTS	PACKAGE		UNITS sx	TOTAL Pounds
0 - 1,023' 675 bbl Starting Volume 1500 bbl of mud build for interval	DUROGEL	50	lb/sx	589	29,450
	Soda Ash	50	lb/sx	18	900
	Sodium Bicarbonate	50	lb/sx	30	1,500
	MI-GEL	100	lb/sx	295	29,500
1,023' - 1,800' 1900 bbl Starting Volume 2350 bbl of mud build for interval	DUROGEL	50	lb/sx	50	2,500
	Soda Ash	50	lb/sx	40	2,000
	POLYPAC	50	lb/sx	65	3,250
	DUOVIS	50	lb/sx	20	1,000
	GELITE	50	lb/sx	100	5,000
	SALT 96%	50	lb/sx	300	15,000
	TACKLE	5	gal	5	25
	M-I GEL	100	lb/sx	205	20,500
	MI-BAR	100	lb/sx	1425	142,500
	Sodium Bicarbonate	50	lb/sx	20	1,000
	SP 101	50	lb/sx	65	3,250
1,800' - 5,500' 1950 bbl Starting Volume 4600 bbl of mud build for interval	DUROGEL	50	lb/sx	50	2500
	Soda Ash	50	lb/sx	96	4800
	POLYPAC	50	lb/sx	185	9250
	DUOVIS	50	lb/sx	165	8250
	SALT 96%	50	lb/sx	750	37500
	TACKLE	5	gal	5	25
	Lube 167	55	gal	10	11575
	GELITE	50	lb/sx	286	14300
	M-I GEL	100	lb/sx	143	14300
	Sodium Bicarbonate	50	lb/sx	30	1500
	MI-BAR	100	lb/sx	740	74000

5,500' - 16,314' 2031 bbl Starting Volume 7,431 bbl of mud build for interval	SALT 96%	50	lb/sx	1350	67,500
	Citric Acid	50	lb/sx	10	500
	POLYPAC	50	lb/sx	135	6,750
	ULTRAFREE	55	gal	62	81,030
	ULTRAHIB	55	gal	86	113,204
	ULTRACAP	50	lb/sx	435	21,750
	Duovis	25	lb/sx	290	7,250
	MI-BAR	100	lb/sx	2245	224,500
	Sodium Bicarbonate	50	lb/sx	30	1,500

17,150' - 18,473' 2415 bbl Starting Volume 1965 bbl of mud build for interval	SALT 96%	50	lb/sx	250	12,500
	POLYPAC	50	lb/sx	45	2,250
	ULTRAFREE	55	gal	18	21,449
	ULTRAHIB	55	gal	25	29,790
	Duovis	25	lb/sx	85	2,125

PXP

WESTERN HALF OCS-P 0450 EXTENDED REACH WELL

C16 WELL - HIDALGO PLATFORM

Estimate Cuttings and Liquid Volumes

Casing Size Inch.	Casing set at feet	Hole Size Inch
24	1023	30
18.625	1800	22
13.375	5500	17.5
9.625	17150	12.25
7	19564	8.5

Water Base Mud

INTERVAL FEET			EST. CUTTINGS BBL	EST. CUTTINGS TON	EST. LIQUID BBL	
0	-	1023	1288	533	3155	
1023	-	1800	483	200	1184	
1800	-	5500	1456	602	3567	
5500	-	17150	2246	929	5503	
17150	-	19564	224	93	627	
TOTAL			**5697**	**2357**	**14036**	19733

The values calculated are based on the following parameters:

Solids Removal Efficiency	70 - 99 %
Hole Washout %	0 - 10%
LGS %	< 7%
Cutting Water/Oil Retention	3.5 for WBM

PXP

WESTERN HALF OCS-P 0450 EXTENDED REACH WELL

C17 WELL - HIDALGO PLATFORM

Estimate Cuttings and Liquid Volumes

Casing Size Inch.	Casing set at feet	Hole Size Inch
24	1023	30
18.625	1800	22
13.375	5500	17.5
9.625	16314	12.25
7	18473	8.5

Water Base Mud

INTERVAL FEET			EST. CUTTINGS BBL	EST. CUTTINGS TON	EST. LIQUID BBL	
0	-	1023	1288	533	3155	
1023	-	1800	483	200	1184	
1800	-	5500	1456	602	3567	
5500	-	16314	2085	862	5108	
16314	-	18473	200	83	561	
TOTAL			**5512**	**2280**	**13575**	19087

The values calculated are based on the following parameters:

Solids Removal Efficiency	70 - 99 %
Hole Washout %	0 - 10%
Maximum LGS %	< 7%
Cutting Water/Oil Retention	3.5 for WBM

PXP.

WESTERN HALF OCS-P 0450 EXTENDED REACH WELL

Drilling Fluid and Cuttings Disposal Volumes

Water Base Mud

HOLE SIZE	CSG SIZE	CAP BBL/FT	SCE	LGS%	WASHOUT %	CUT FLUID RET	PIT VOL	MUD TYPE
30	24	0.5433	70%	7.0%	20%	3.5	400	WBM
22	18.625	0.3062	70%	7.0%	15%	3.5	400	WBM
17.5	13.375	0.1546	70%	7.0%	15%	3.5	400	WBM
12.25	9.625	0.0758	70%	7.0%	15%	3.5	400	WBM
8.5	7	0.0222	80%	7.0%	15%	3.5	400	WBM

		INITIAL DEPTH FT	FINAL DEPTH FT	CSG VOL BBL	HOLE SIZE DRILLED INCH	ESTIMATE CUT. DRILLED BBL	ESTIMATE CUT. DRILLED TON	CUTTINGS INCORPORED BBL	DILUTION BBL	CUTTINGS GENERATED BBL	LIQUID VOL GENERATED BBL	CUT+LIQ GENERATED BBL	TOTAL FLUID TO DRILL BBL
C-16	***HIDALGO***	0	1023	555.80	36.00	1288	533	386	5520	902	3155	4057	6306
		1023	1800	551.16	25.30	483	200	145	2071	338	1184	1522	3171
		1800	5500	850.30	20.13	1456	602	437	6239	1019	3567	4586	7627
		5500	17150	1299.97	14.09	2246	929	674	9626	1572	5503	7075	11550
		17150	19564	1358.00	9.78	224	93	45	640	179	627	807	2385
C-17	***HIDALGO***	0	1023	555.80	36.00	1288	533	386	5520	902	3155	4057	6306
		1023	1800	551.16	25.30	483	200	145	2071	338	1184	1522	3171
		1800	5500	850.30	20.13	1456	602	437	6239	1019	3567	4586	7627
		5500	16314	1236.60	14.09	2085	862	625	8935	1459	5108	6567	10811
		16314	18473	1288.97	9.78	200	83	40	573	160	561	721	2249

Attachment D – Air Emission and Traffic Data

Western Half of OCS-P 0450 Development Project
Summary of Emissions by Platform and Activity, tons/year

Platform/Emission Category	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2	CO_2e
Platform Hidalgo Drilling Emissions (All in SBC)										
Turbine Emissions	7.68	2.41	9.51	0.16	1.89	1.89	0.32	0.06	8775	7920
Other Drilling Equipment	2.01	0.27	0.73	0.00	0.24	0.24	0.00	0.00	125	113
Mud Emissions	0.00	0.01999	0.00	0.00	0.00	0.00	0.10	0.00	0	2
Drilling: Offsite Emissions										
Supply Boats - Total (all counties)	19.56	1.04	4.25	0.01	1.72	1.65	0.05	0.01	1136	1025
Supply Boats - SBC Only	15.04	0.81	3.27	0.01	1.32	1.26	0.04	0.01	869	785
Supply Boats - Ventura County Only	4.53	0.24	0.98	0.00	0.40	0.38	0.01	0.00	267	241
Trucks, Ventura County Only	1.66	0.08	0.38	0.00	0.06	0.06	0.00	0.00	245	221
Platform Hidalgo Operational Emissions										
Fugitive Emissions (SBC Only)	0.00	0.68	0.00	0.00	0.00	0.00	3.34	0.00	0	63
Total Emissions										
Total Emissions SBC	24.73	4.19	13.51	0.17	3.44	3.39	3.79	0.07	9769	8883
Total Emissions	29.26	4.43	14.49	0.18	3.85	3.78	3.80	0.07	10036	9123
Excess Emissions, SBC Permit	128.06	32.27	47.19	20.02	12.48	12.13	32.96	0.03	29281	26985

Notes: CO_2e emissions in metric tonnes per year. GHG not included in permit at this time

The excess permitted emissions = total permitted emissions minus the 2011 actual emissions minus the estimated peak emissions from the project with SBC

*CO_2e emissions=(CH_4 emissions*21 + $N_2$0 emissions*310+CO_2 emissions)*0.9*

Permitted Emissions

	NO_x	ROC	CO	SO_x	PM	PM_{10}	CH_4	N_2O	CO_2	CO_2e
Platform Harvest	367.58	85.26	204.18	43.61	26.11	25.71	88.54	0.42	215424	195672
Platform Hermosa	198.8	76.25	114.48	36.87	17.64	17.16	61.78	0.17	77498	70963
Platform Hidalgo	204.15	61.36	94.54	26.49	17.77	17.34	37.36	0.17	76821	69892
Supply Boats	76.25	3.99	16.67	0.04	6.79	6.51	0.13	0.03	3,280	2962

Notes

Criteria pollutants from PXP, Glenn Oliver, May 4, 2012 email (to Chittick on 5/8)

GHG Platform emissions from PXP email calculated, not part of permit

GHG Supply boat emissions calculated

Emissions for Platforms from PTOs include supply boats

2011 Emissions

Location	NOx	ROC	CO	SOx	PM	PM10	CH_4	N_2O	CO_2	CO_2e
Platform Harvest	87.06	45.73	63.27	9.73	9.35	9.32	1.63	0.18	101225	91184
Platform Hermosa	51.15	40.98	36.39	5.3	1.72	1.66	0.58	0.07	32923	29661
Platform Hidalgo	51.36	24.9	33.84	6.3	1.85	1.82	0.61	0.07	37771	34025
Total	189.57	111.61	133.5	21.33	12.92	12.8	2.82	0.32	171919	154870

Western Half of OCS-P 0450 Development Project
Drilling Emission Estimates - Turbines

Estimated Quantity, Size and Load Factors for Electrical Driven Drilling Equipment

Rocky Point Drill Rig Data	Quantity	Load (hp)	Load (kW)	Load Factor
Draw Works	2	1,000	1,492	0.25
Mud Pumps	2	1,000	1,492	0.6
Rotary Table	1	1,000	746	0.6
Top Drive	1	1,000	746	0.5

Notes:
Estimated data. Actual data for rig will not be known until a contract has been issued.

Platform Turbine Emission Factors, assumes all produced gas operations

Turbine Emission Factors	lbs/hr									
	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2	Size, kW
Hidalgo Emission Factors - G91g	6.89	0.72	4.54	0.28	0.10	0.10	0.10	0.01	5250.33	2800.00
Hidalgo Emission Factors - G92g	6.89	0.72	4.54	0.28	0.10	0.10	0.10	0.01	5250.33	2800.00
Hidalgo Emission Factors - G93g	6.89	0.72	4.54	0.28	0.10	0.10	0.10	0.01	5250.33	2800.00
Hidalgo Emission Factors - G94g	3.70	0.36	3.72	0.31	0.11	0.11	0.11	0.01	5729.14	3100.00
Hidalgo Emission Factors - G91d	6.90	2.46	8.86	0.06	1.99	1.99	0.30	0.06	7323.92	2800.00
Hidalgo Emission Factors - G92d	6.90	2.46	8.86	0.06	1.99	1.99	0.30	0.06	7323.92	2800.00
Hidalgo Emission Factors - G93d	6.90	2.46	8.86	0.06	1.99	1.99	0.30	0.06	7323.92	2800.00

Platform Turbine Emission Factors, weighted composite

Turbine Emission Factors	lbs/kW-hr								
	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Hidalgo Emission Factors-g	2.10E-03	2.17E-04	1.50E-03	1.00E-04	3.57E-05	3.57E-05	3.57E-05	3.48E-06	1.87E+00
Hidalgo Emission Factors-d	2.10E-03	6.59E-04	2.60E-03	4.49E-05	5.16E-04	5.16E-04	8.65E-05	1.62E-05	2.40E+00

Notes:
A composite emission factor was used for turbines in estimating the turbine emissions. Turbine G91 has hisotrically not been used, but was included
Emission factors taken from PTO 9105 for Hidalgo (October 2008)
PTO turbine emission factors are in lbs/hr. These were converted to lbs/kW-hr by dividing by the rating on each turbine.
GHG emission factors based on PXP part 70 permit

Peak Turbine Emissions from Drilling on the Western Half of OCS-P 0450

Turbine Drilling Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Platform Hidalgo									
lbs./hr	4.39	1.38	5.43	0.09	1.08	1.08	0.18	0.03	5009
lbs./day	105.27	33.02	130.33	2.25	25.86	25.86	4.34	0.81	120211
tons/qr	3.80	1.51	5.95	0.10	1.18	1.18	0.20	0.04	5485
tons/yr[B]	7.68	2.41	9.51	0.16	1.89	1.89	0.32	0.06	8775
Total Drilling Emissions (tons)									
Western Half of OCS-P 0450[C,D,E]	7.68	2.41	9.51	0.16	1.89	1.89	0.32	0.06	8775

Notes:
A. Tons/yr assumes drilling occurs for 100 days per well on Platform Hidalgo (2 wells).
C. Assumes 2 wells at Hidalgo, 70 days drilling, 30 days completion
D. Assumes completion is 10% the load of well drilling
E. Assumes emissions from diesel turbines
F. Assumes 91.25 days per quarter

Western Half of OCS-P 0450 Development Project
Drilling Emission Estimates - Other Equipment

Rocky Point Drill Rig Data	Quantity	Load (hp)	Fuel	Note
Well Logging Unit	1	100	Diesel	1
Acidizing Pump	1	100	Diesel	2
Emergency Generator	1	1,350	Diesel	3
Cement Pump	1	200	Diesel	4
Slurry Pump	1	1,000	Diesel	5

Notes:
Estimated data. Actual data for rig will not be known until a contract has been issued.
1. Well logging unit operates 10 days per month
2. Each acidizing pump is operated 5 days per well, 8 hours per day.
3. Each emergency generator tested 2 hours per month.
4. Cement pump operates 2 days per month, 8 hours per day.
5. Slurry Pump operates for 8 hrs per day, 70 days per well. This pump would only be needed if oil/synthetic based muds are injected offshore.

Emission Factors	g/hp-hr								
	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Well Logging Unit	8.4	1.14	3.03	0.0063	1	1	0.020	0.004	521.6
Acidizing Pump	8.4	1.14	3.03	0.0063	1	1	0.020	0.004	521.6
Emergency Generator	8.4	1.14	3.03	0.0063	1	1	0.020	0.004	521.6
Cement Pump	8.4	1.14	3.03	0.0063	1	1	0.020	0.004	521.6
Slurry Pump	8.4	1.14	3.03	0.0063	1	1	0.020	0.004	521.6

Notes:
Diesel I.C. Engines raw factors from AP-42, Table 3.3-1. NO_x reduced by 40% to reflect optimum injection timing retard.
SO_2 adjusted for 0.0015% sulfur in fuel. HC assumed to be 100% ROC. PM assumed to be 100% PM_{10}.
CO2 EF based on AP-42 Table 3.3-1. CH4 and N2O based on CARB Mandatory reporting requirements

Support Equipment Drilling Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
lbs/hr									
Well Logging Unit	1.85	0.25	0.67	0.00	0.22	0.22	0.00	0.00	115.00
Acidizing Pump	1.85	0.25	0.67	0.00	0.22	0.22	0.00	0.00	115.00
Emergency Generator	25.00	3.39	9.02	0.02	2.98	2.98	0.06	0.01	1552.50
Cement Pump	3.70	0.50	1.34	0.00	0.44	0.44	0.01	0.00	230.00
Total Hourly Emissions	***32.41***	***4.40***	***11.69***	***0.02***	***3.86***	***3.86***	***0.08***	***0.02***	***2012.50***
lbs/day									
Well Logging Unit	44.45	6.03	16.03	0.03	5.29	5.29	0.11	0.02	2760.00
Acidizing Pump	14.82	2.01	5.34	0.01	1.76	1.76	0.04	0.01	920.00
Emergency Generator	50.00	6.79	18.04	0.04	5.95	5.95	0.12	0.02	3105.00
Cement Pump	29.63	4.02	10.69	0.02	3.53	3.53	0.07	0.01	1840.00
Total Daily Emissions	***138.89***	***18.85***	***50.10***	***0.10***	***16.53***	***16.53***	***0.33***	***0.07***	***8625.00***
tons/qr									
Well Logging Unit	0.67	0.09	0.24	0.00	0.08	0.08	0.00	0.00	41.40
Acidizing Pump	0.07	0.01	0.03	0.00	0.01	0.01	0.00	0.00	4.60
Emergency Generator	0.08	0.01	0.03	0.00	0.01	0.01	0.00	0.00	4.66
Cement Pump	0.09	0.01	0.03	0.00	0.01	0.01	0.00	0.00	5.52
Total Quarterly Emissions	***0.90***	***0.12***	***0.33***	***0.00***	***0.11***	***0.11***	***0.00***	***0.00***	***56.18***
tons/yr									
Well Logging Unit	1.48	0.20	0.53	0.00	0.18	0.18	0.00	0.00	92.00
Acidizing Pump	0.16	0.02	0.06	0.00	0.02	0.02	0.00	0.00	10.22
Emergency Generator	0.17	0.02	0.06	0.00	0.02	0.02	0.00	0.00	10.35
Cement Pump	0.20	0.03	0.07	0.00	0.02	0.02	0.00	0.00	12.27
Total Annual Emissions	***2.01***	***0.27***	***0.73***	***0.00***	***0.24***	***0.24***	***0.00***	***0.00***	***124.84***
Total Drilling Emissions (tons)									
Western Half of OCS-P 0450[B,C]	2.01	0.27	0.73	0.00	0.24	0.24	0.00	0.00	124.84

Notes:
A. The slurry pump would only be needed if the oil/synthetic based muds are injected at the platforms.
B. Assumes 2 wells at Hidalgo 2 wells
C. Assumes each well takes months to finish --> 3.33 months

Western Half of OCS-P 0450 Development Project
Drilling Emission Estimates - ROC Emissions from Mud System

Assumptions

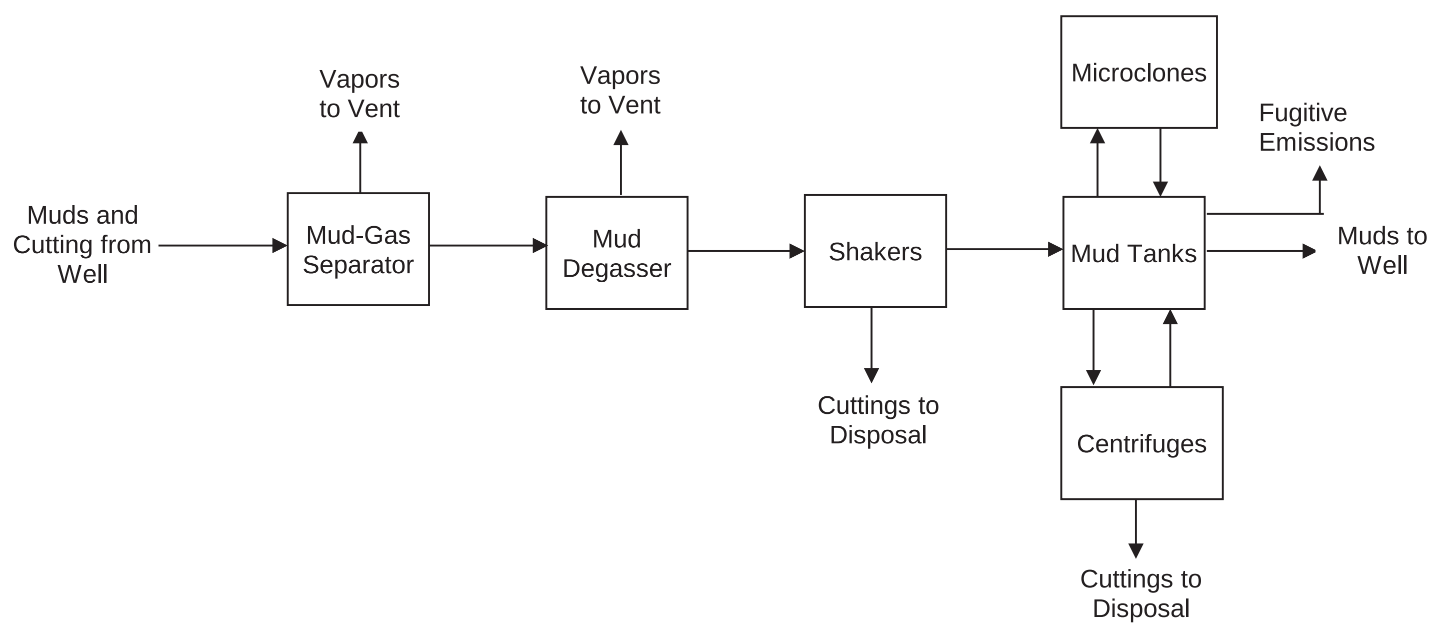
Volume of gas in drilling mud from one well = 85,000 scf
Density of gas =0.0056 lbs/scf
Fraction of gas that is reactive organic compounds=20.5%
Density of reactive organic compound gas = 0.00115 lbs/scf
Time required to drill one well = 100 days
Time when gas may be present in mud per well =20 days
The mud-gas separator and mud degasser removal efficiency = 98%
Mud-gas separator and mud degasser are vented at the top of the derrick

Emissions Estimates per Well

				ROC Emissions				
Source	SCF/hr	SCF/day	% ROC	lbs/hr	lbs/day	lbs/well	lbs/yr	Total[A] (lbs)
Mud-gas Separator/Mud Degasser Vent	174	4165	20.5%	0.041	0.980	19.590	39.180	39.180
Fugitives from Mud Tanks	4	85	20.5%	0.001	0.020	0.400	0.800	0.800
Total	177	4250		0.042	0.999	19.990	39.980	39.980

Note:
A. Assumes 2 wells at Hidalgo

Process Flow Diagram of Typical Mud Handling System



Western Half of OCS-P 0450 Development Project
Supply Boat Emission Estimates

Supply Boat Engine Data

Engine	Fuel	%S	Size (bhp)	Fuel Usage (gals/bhp-hr)	Load Factor	gals/hr
Main Engines-Controlled	D	0.0015	4,000	0.049	0.65	127.4
Main Engines-Uncontrolled	D	0.0015	4,000	0.049	0.65	127.4
Generator Engines	D	0.0015	490	0.055	0.5	13.5
Bow Thruster	D	0.0015	515	0.055	1.0	28.3

Notes:

Data taken from PTO 9104 for Hermosa, PTO 9105 for Hidalgo, and PTO 9103 for Harvest and PXP infomatioin/permits

Supply Boat Emission Factors

Emission Source	lbs/1,000 gals								
	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Main Engines-Controlled	337	16.80	78.30	0.21	33.00	31.68	0.910	0.180	22538
Main Engines-Uncontrolled	561	16.80	78.30	0.21	33.00	31.68	0.910	0.180	22538
Generator Engines	600	48.98	129.26	0.21	42.18	40.49	0.910	0.180	22538
Bow Thruster	600	48.98	129.26	0.21	42.18	40.49	0.910	0.180	22538

Notes:

Emission factors taken from PTO 9104 for Hermosa, PTO 9105 for Hidalgo, and PTO 9103 for Harvest (October 2008)

GHG EF based on CARB Mandatory Reporting

Supply Boat Fuel Usage, gallons

Fuel Usage	gals/hr	Port Hueneme to Platforms/trip		Platform Offload (gals/round trip)
		Total	SBC	
Main Engines-Controlled	127.4	1,847.30	1,401.40	0.00
Main Engines-UnControlled	127.4	1,847.30	1,401.40	0.00
Generator Engines	13.5	195.39	148.23	26.95
Bow Thruster	28.3	56.65	56.65	113.30

Notes:

A. Total is from Port Hueneme to the platforms (round trip assumes 14.5-hrs main engines and generator engines, 2-hrs bow thrusters).

B. SBC is from SB County line to the platforms (round trip assumes 11-hrs main engines and generator engines, 2-hrs bow thrusters).

C. PTO is within 25 miles of the platforms (round trip assumes 4-hrs main engines and generator engines, 2-hrs bow thrusters).

D. Platform offload at Platform Hidalgo (round trip assumes 2-hrs generator engines, 4-hrs bow thrusters).

E. Total qtr fuel use 54,583 all areas 41,763 SBC only

Western Half of OCS-P 0450 Development Project
Supply Boat Emission Estimates

Total Supply Boat Emissions (Port Hueneme to the Platforms)

Estimated Supply Boat Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Drill Rig Transport from Port Hueneme to the Platforms									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	1,187.57	43.38	177.22	0.44	71.59	68.73	1.91	0.38	47,315
tons/qr	5.71	0.30	1.24	0.00	0.50	0.48	0.01	0.00	331
tons/yr	11.41	0.61	2.48	0.01	1.00	0.96	0.03	0.01	662
Additional Supply Boat Useage During Drilling									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	1,187.57	43.38	177.22	0.44	71.59	68.73	1.91	0.38	47,315
tons/qr	3.67	0.20	0.80	0.00	0.32	0.31	0.01	0.00	473
tons/yr	8.15	0.43	1.77	0.00	0.72	0.69	0.02	0.00	473
Drilling Transport and Supply Boat Daily Useage									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	1,187.57	43.38	177.22	0.44	71.59	68.73	1.91	0.38	47,315
tons/qr	9.37	0.50	2.04	0.01	0.82	0.79	0.02	0.01	804
tons/yr	19.56	1.04	4.25	0.01	1.72	1.65	0.05	0.01	1,136

Notes:

A. lbs/hr maximum based on all engines running simultaneously, and assumes uncontrolled main engines.

B. Assumes one round trip per day, and assumes uncontrolled main engines.

C. Drill rig transport based on 20 round trips over a 30-day period.

D. Annual emissions assume 20 trips to deliver drill rig and 20 trips to remove drill rig

E. Supply boat trips for drilling assume 1 additional round trip per week over current operations for 16 weeks per year (2 wells).

F. Assumes that uncontrolled main engines are used 10% of the time. (Same assumption as PTOs 9103, 9104, and 9105.)

G. Total length of drilling project, weeks — 20 weeks, drilling only (not completions)

H. Time to transport drill rig, days — 14 days, one way

Santa Barbara County Supply Boat Emissions (SB County Line to the Platforms)

Estimated Supply Boat Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Drill Rig Transport from Port Hueneme to the Platforms									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	909.12	33.58	136.21	0.34	54.89	52.69	1.46	0.29	36,202
tons/qr	4.39	0.24	0.95	0.00	0.38	0.37	0.01	0.00	253
tons/yr	8.77	0.47	1.91	0.00	0.77	0.74	0.02	0.00	507
Additional Supply Boat Useage During Drilling									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	909.12	33.58	136.21	0.34	54.89	52.69	1.46	0.29	36,202
tons/qr	6.27	0.34	1.36	0.00	0.55	0.53	0.01	0.00	362
tons/yr	6.27	0.34	1.36	0.00	0.55	0.53	0.01	0.00	362
Drilling Operations									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	909.12	33.58	136.21	0.34	54.89	52.69	1.46	0.29	36,202
tons/qr	10.65	0.57	2.32	0.01	0.93	0.90	0.02	0.00	615
tons/yr	15.04	0.81	3.27	0.01	1.32	1.26	0.04	0.01	869

Ventura County Supply Boat Emissions (Port Hueneme to SB County Line)

Estimated Supply Boat Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Drill Rig Transport from Port Hueneme to the Platforms									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	278.45	9.80	41.01	0.10	16.70	16.04	0.45	0.09	11,113
tons/qr	1.32	0.07	0.29	0.00	0.12	0.11	0.00	0.00	78
tons/yr	2.64	0.14	0.57	0.00	0.23	0.22	0.01	0.00	156
Additional Supply Boat Useage During Drilling									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	278.45	9.80	41.01	0.10	16.70	16.04	0.45	0.09	11,113
tons/qr	-2.60	-0.14	-0.56	0.00	-0.23	-0.22	-0.01	0.00	111
tons/yr	1.89	0.10	0.41	0.00	0.17	0.16	0.00	0.00	111
Drilling Operations									
lbs/hr (max.)	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day	278.45	9.80	41.01	0.10	16.70	16.04	0.45	0.09	11,113
tons/qr	-1.28	-0.07	-0.28	0.00	-0.11	-0.11	0.00	0.00	189
tons/yr	4.53	0.24	0.98	0.00	0.40	0.38	0.01	0.00	267

Western Half of OCS-P 0450 Development Project
Supply Boat Emission Estimates - Permitted Emissions

Supply Boat Engine Data

Engine	Fuel	%S	Size (bhp)	Fuel Usage (gals/bhp-hr)	Load Factor	gals/hr
Main Engines-Controlled	D	0.0015	4,000	0.049	0.65	127.4
Main Engines-Uncontrolled	D	0.0015	4,000	0.049	0.65	127.4
Generator Engines	D	0.0015	490	0.055	0.5	13.475
Bow Thruster	D	0.0015	515	0.055	1.0	28.325

Notes:
Data taken from PTO 9104 for Hermosa, PTO 9105 for Hidalgo, and PTO 9103 for Harvest

Supply Boat Emission Factors

Emission Source	lbs/1,000 gals								
	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Main Engines-Controlled	337	16.80	78.30	0.21	33.00	31.68	0.910	0.180	22537.9
Main Engines-Uncontrolled	561	16.80	78.30	0.21	33.00	31.68	0.910	0.180	22537.9
Generator Engines	600	48.98	129.26	0.21	42.18	40.49	0.910	0.180	22537.9
Bow Thruster	600	48.98	129.26	0.21	42.18	40.49	0.910	0.180	22537.9

Notes:
Emission factors taken from PTO 9104 for Hermosa, PTO 9105 for Hidalgo, and PTO 9103 for Harvest (October 2008)
GHG EF based on CARB Mandatory Reporting

Supply Boat Usage, hours

Fuel Usage	Hrs	day	qtr	yr
Main Engines-Controlled	1	11	459	1,837
Main Engines-Uncontrolled	1	11	46	184
Generator Engines	1	11	459	1,837
Bow Thruster	1	2	78	312

Supply Boat Usage, hours

Fuel Usage	gals/hr
Main Engines-Controlled	127.4
Main Engines-Controlled	127.4
Generator Engines	13.5
Bow Thruster	28.3

Notes:
A. Total is from Port Hueneme to the platforms (round trip assumes 14.5-hrs main engines and generator engines, 2-hrs bow thrusters).
B. SBC is from SB County line to the platforms (round trip assumes 11-hrs main engines and generator engines, 2-hrs bow thrusters).
C. PTO is within 25 miles of the platforms (round trip assumes 4-hrs main engines and generator engines, 2-hrs bow thrusters).
D. Platform transfer at Platform Hidalgo (round trip assumes 2-hrs generator engines, 4-hrs bow thrusters).

Total Supply Boat Emissions (Port Hueneme to the Platforms)

Estimated Supply Boat Emissions	NO_X	ROC	CO	SO_X	PM	PM_{10}	CH_4	N_2O	CO_2
Drill Rig Transport from Port Hueneme to the Platforms [C]									
lbs/hr (max.)[A]	96.55	4.19	15.38	0.04	5.97	5.73	0.15	0.03	3,813
lbs/day[B]	909.12	33.58	136.21	0.34	54.89	52.69	1.46	0.29	36,202
tons/qr[F]	14.02	0.75	3.06	0.01	1.24	1.19	0.03	0.01	820
tons/yr[F]	56.09	2.99	12.25	0.03	4.96	4.76	0.13	0.03	3,280

Notes:
A. lbs/hr maximum based on all engines running simultaneously, and assumes uncontrolled main engines.
B. Assumes one round trip per day, and assumes uncontrolled main engines.
C. Drill rig transport based on 20 round trips over a 30-day period.
D. Annual emissions assume 20 trips to deliver drill rig and 20 trips to remove drill rig
E. Supply boat trips for drilling assume 1 additional round trip per week over current operations for 16 weeks per year (2 wells).
F. Assumes that uncontrolled main engines are used 10% of the time. (Same assumption as PTOs 9103, 9104, and 9105.)

Western Half of OCS-P 0450 Development Project
Fugitive Emission Estimates

Component Type	Quantity[A]	Emission Factor[B] (lbs/day-clp)	ROC Emissions			
			lbs/hr	lbs/day	tons/qr	tons/yr
Oil - 2 wells controlled[C]	216	0.0009	0.008	0.194	0.009	0.035
Oil - unsafe	0	0.0044	0.000	0.000	0.000	0.000
Gas - 2 wells controlled[D]	242	0.0147	0.148	3.557	0.162	0.649
Gas - unsafe	0	0.0736	0.000	0.000	0.000	0.000
Total	***458***		***0.156***	***3.752***	***0.171***	***0.685***

Notes:

A. Well component counts are estimates only and are based upon existing well data.
Actual counts will be developed when wells are installed.

B. Emission Factors from SBCAPCD PTOs 9103, 9104, and 9105.

C. Include 108 oil leak paths and 121 gas leak paths per well

Western Half of OCS-P 0450 Development Project
Offsite Truck Emissions

Truck Equipment List and Parameters

Source	Parameters					
	Vehicle Type	Number of Round Trips per Day	Number of Trips per Week	Number of Weeks per Year	Distance Round Trip (mi)	Total Round Trips
Truck Trips for Drill Rig Delivery/Removal	HHT Diesel	1	5	20	300	100
Truck Trips for Drilling Supplies	HHT Diesel	1	4	80	300	320
Truck Trips for Misc Wastes	HHT Diesel	1	1	20	300	20
	HHT Diesel	0	0	0	0	0

Notes:

A. Assumes all wells use water based muds, but some transported by truck.

B. These truck trips would not be needed if the cutting are injected at the platform.

Truck Emission Factors

	NO_x	ROC	CO	SO_x	PM	PM_{10}	CH_4	N_2O	CO_2
Exhaust Emission Factor (g/mile)	11.44	0.53	2.64	0.02	0.43	0.43	0.0051	0.0048	1686.50

Notes:

Emissions calculations based on EMFAC2011 for Ventura County, year 2013, T7 Tractor

GHG emissions based on CARB Mandatory reporting for diesel heavy duty trucks

Truck Emissions

Source	lbs/day[C]								
	NO_x	ROC	CO	SO_x	PM	PM_{10}			
Truck Trips for Drill Rig Delivery/Removal	7.57	0.35	1.74	0.01	0.28	0.29			
Truck Trips for Drilling Supplies	7.57	0.35	1.74	0.01	0.28	0.29			
Truck Trips for Misc Wastes	7.57	0.35	1.74	0.01	0.28	0.29			
Total[C]	**22.70**	**1.06**	**5.23**	**0.03**	**0.85**	**0.86**			
	tons								
	NO_x	ROC	CO	SO_x	PM	PM_{10}	CH_4	N_2O	CO_2
Truck Trips for Drill Rig Delivery/Removal	0.38	0.02	0.09	0.00	0.01	0.01	0.00	0.00	56
Truck Trips for Drilling Supplies	1.21	0.06	0.28	0.00	0.05	0.05	0.00	0.00	178
Truck Trips for Misc Wastes	0.08	0.00	0.02	0.00	0.00	0.00	0.00	0.00	11
Total[C]	**1.66**	**0.08**	**0.38**	**0.00**	**0.06**	**0.06**	**0.00**	**0.00**	**245**

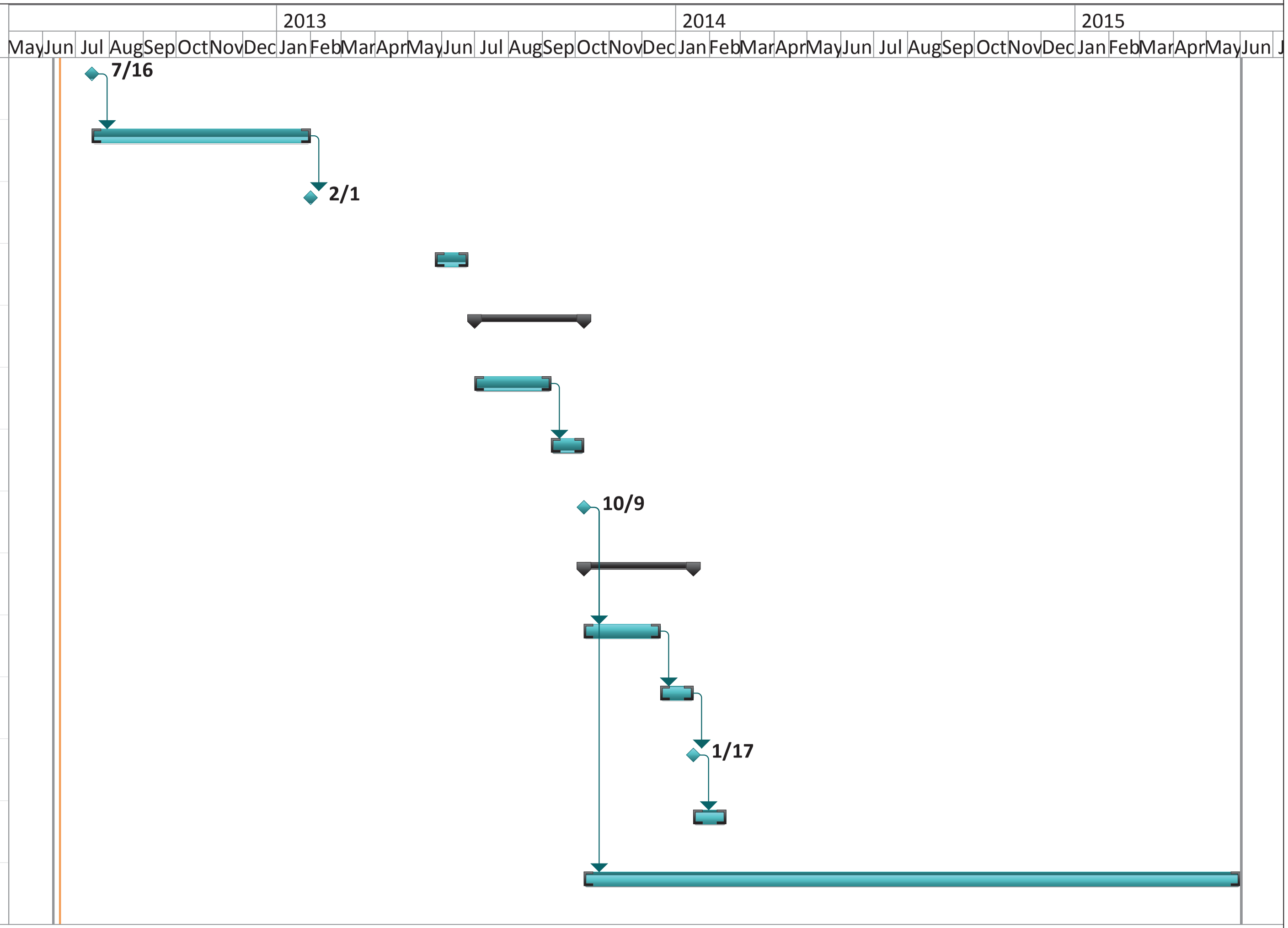
Notes:

A. Daily emission total based upon one round trip for drill drig delivery, drilling supplies and misc waste removal.

B. Assumes 2 wells at Hidalgo

Estimated Development Schedule for Western Half of OCS-P 0450

ID	Task Name
1	Submit Permit Applications
2	Permit Processing
3	Obtain Permit Approvals
4	Prepare and Mobilize Rig
5	**Well C16**
6	Drilling Well
7	Complete Well
8	First Production
9	**Well C17**
10	Drill Well
11	Complete Well
12	First Production
13	DeMobilize Rig
14	Ongoing Production



D-11

Traffic Impacts for Western Half of OCS-P 0450 Truck Trips in Ventura County

Roadway and Intersection Classification

Circulation conditions are often described in terms of levels of service (LOS). Level of service is a means of describing the amount of traffic on a roadway versus the design capacity of the roadways. The design capacity of a roadway is defined as the maximum rate of vehicle travel that can reasonably be expected along a section of roadway. Capacity is dependent on a number of variables including road classification and number of lanes, weather and driver characteristics. The LOS rating reflects qualitative measures that characterize operational conditions within a traffic stream and their perception by motorists. These measures include freedom of movement, speed and travel time, traffic interruptions, types of vehicle, comfort, and convenience. Ideal conditions for a roadway would include good lane widths and roadside clearances, the absence of trucks or other heavy vehicles and level terrain. LOS is generally computed as function of the ratio of traffic volume (V) to the capacity (C) of the roadway or intersection, which provides the V/C ratio (see the table below).

Trucks impact the LOS by occupying more roadway space and by having poorer operating qualities than passenger cars. Because heavy vehicles accelerate slower than passenger cars, gaps form in traffic flow that affect the efficiency of the roadway. Also, intersections present a number of variables that can influence LOS including curb parking, transit buses, turn lanes, signal spacing, pedestrians, and signal timing.

The Transportation Research Board has developed the Highway Capacity Manual, which details the procedures to be used in predicting LOS for a range of roadways and intersections. The LOS of a roadway is defined with scales ranging from A to F, with A indicating excellent traffic flow quality and F indicating stop-and-go traffic. Level E is normally associated with the maximum design capacity that a roadway can accommodate. The highest quality of traffic service occurs on roadways when motorists are able to drive their desired speed without strict enforcement and are not delayed by slow-moving vehicles more than 30 percent of the time. This condition is representative of LOS A. The classifications of LOS B and C are characterized when average drivers are delayed up to 45 and 60 percent of the time, respectively, by slow moving vehicles. The LOS of A, B, and C are generally considered satisfactory.

When an area drops to a LOS of E, the speed of traffic is restricted 71 to 100 percent of the time; and intersection signal cycles have one or more vehicles waiting through more than one signal cycle during peak traffic periods. The LOS of D is considered tolerable in urban areas, since during peak hours 31 to 70 percent of the signal cycles have one or more vehicles which wait through at least one signal cycle. Current design practices indicate that a LOS of D during peak hours is acceptable due to the cost of improving roadways up to a LOS of C.

D-12

Western Half of OCS-P 0450 Truck Traffic

Truck traffic in Ventura County for the Western Half of OCS-P 0450 project will originate in Port Hueneme. Trucks will exit the port at Hueneme Rd., heading east for several miles. They will turn left at Las Posas Rd. and enter the ramp of southbound Highway 101. The trucks will then take Highway 101 south to Los Angeles County.

The project will involve 10 truck trips per work week, or approximately 2 truck trips per week day. The project will result in traffic increases of 0.03%, 0.04%, 0.003%, and 0.0025% at Hueneme Rd., Las Posas Rd., Highway 101 at Las Posas Rd., and Highway 101 at Kanan Rd, respectively. These small increases will not affect the LOS of any of these roadways.

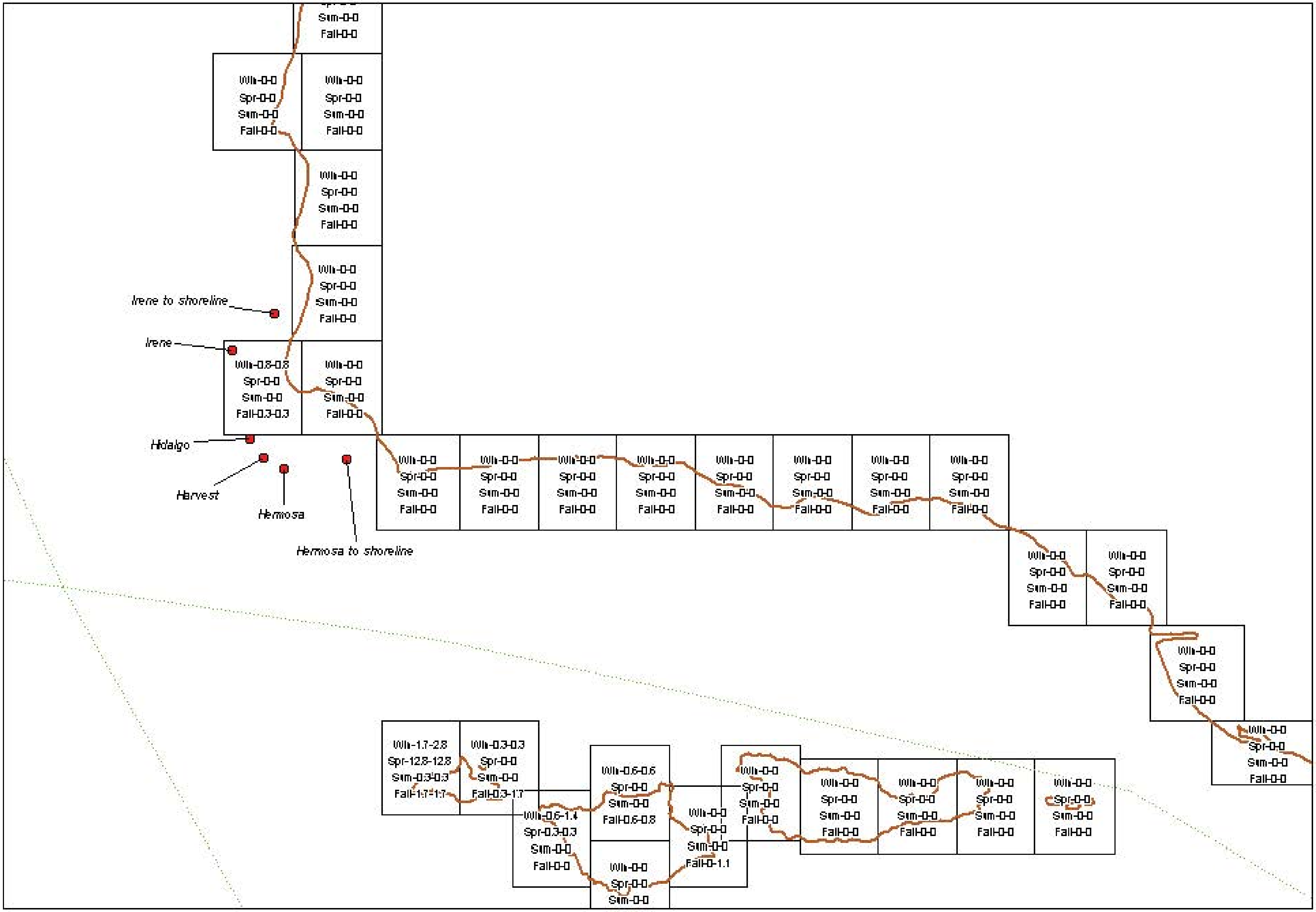
Road/ Route	Class	Current ADT	ADT LOS	Design Cap	V/C Ratio	Ref.
Port Hueneme to Ventura/L.A. County Border						
Hueneme Rd.	Major - 2 Lanes	11,900	C	16,000	0.74	1
Las Posas Rd.	Major - 2 Lanes	9,200	A	16,000	0.58	1
101 Southbound at Las Posas Rd.	Freeway 6 - Lanes	140,000	B	195,000	0.72	2
101 Southbound at Kanan Rd.	Freeway - 8 to 10 Lanes	163,000	B	292,500	0.56	2

References

1. *Traffic counts from Ventura County Department of Public Works – 2011 Traffic Volumes*
2. *Traffic counts and average design capacity of 32,500 vehicles per lane per day from CalTrans.*

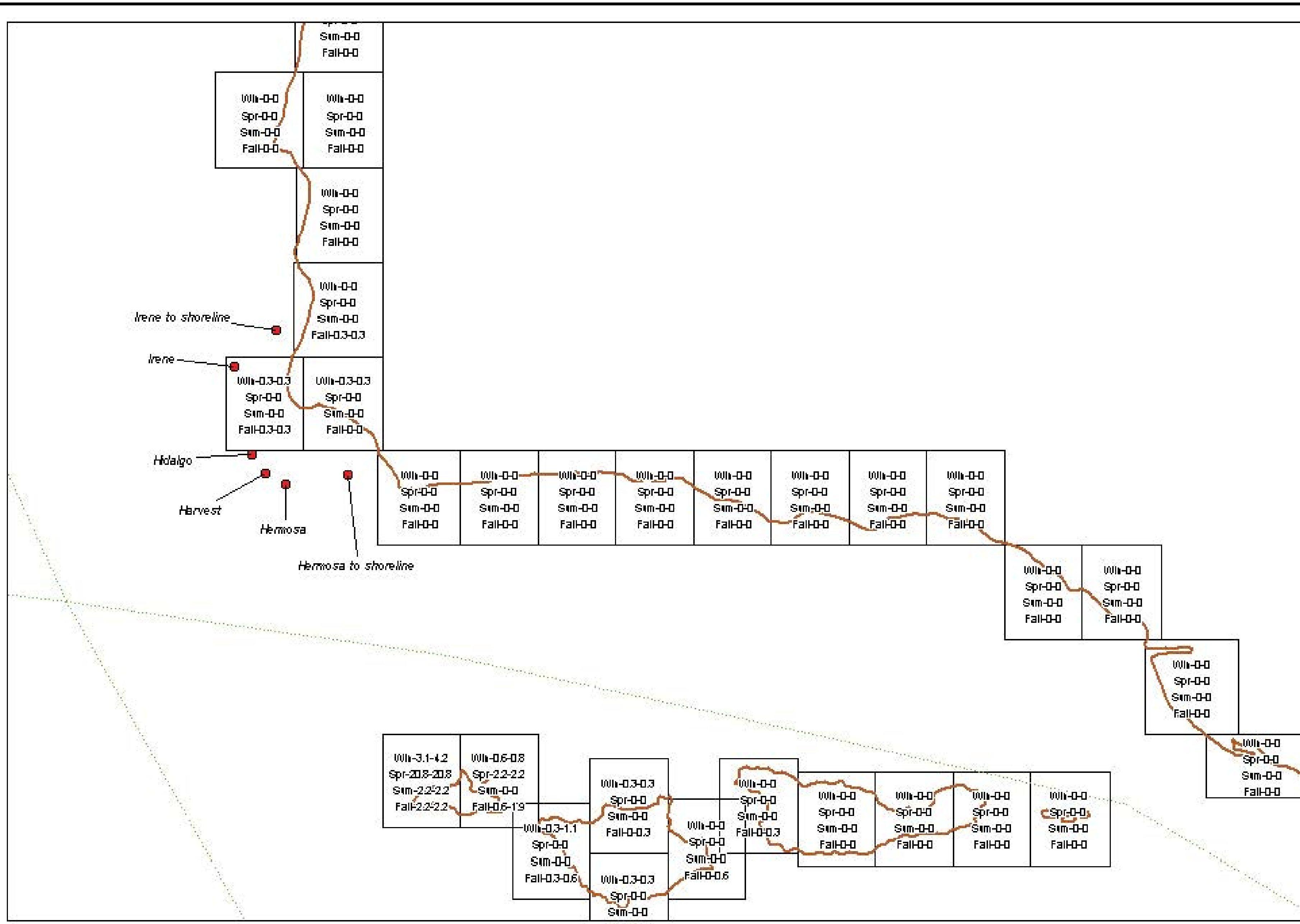
D-13

Attachment E – OSRA Oil Spill Trajectories



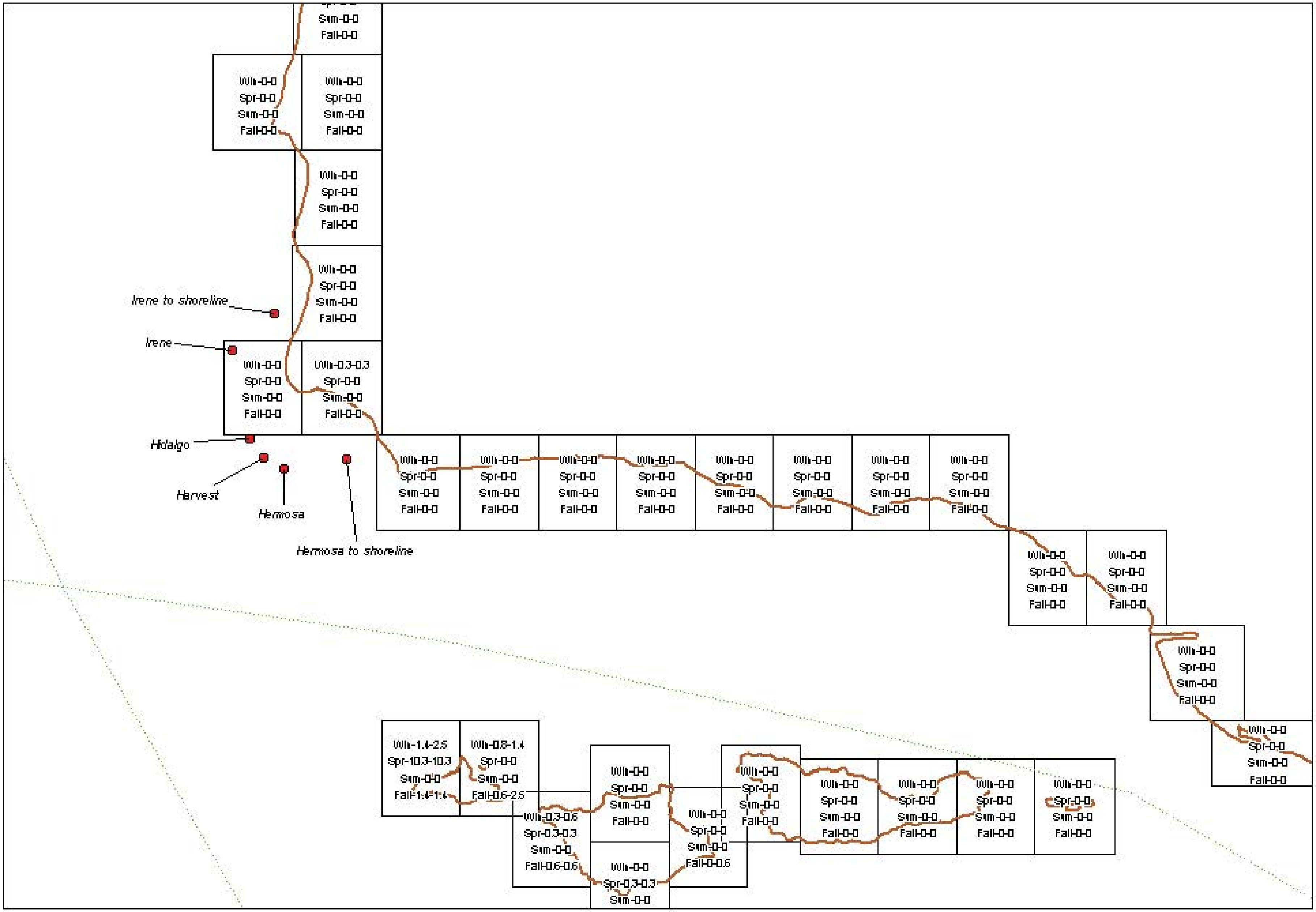
MMS OSRA Conditional Probabilities: Harvest

Text values in each box indicate conditional probabilities for the following sources:
Winter, Spring, Summer and Fall (as labeled) followed by the 10-day and 30-day levels



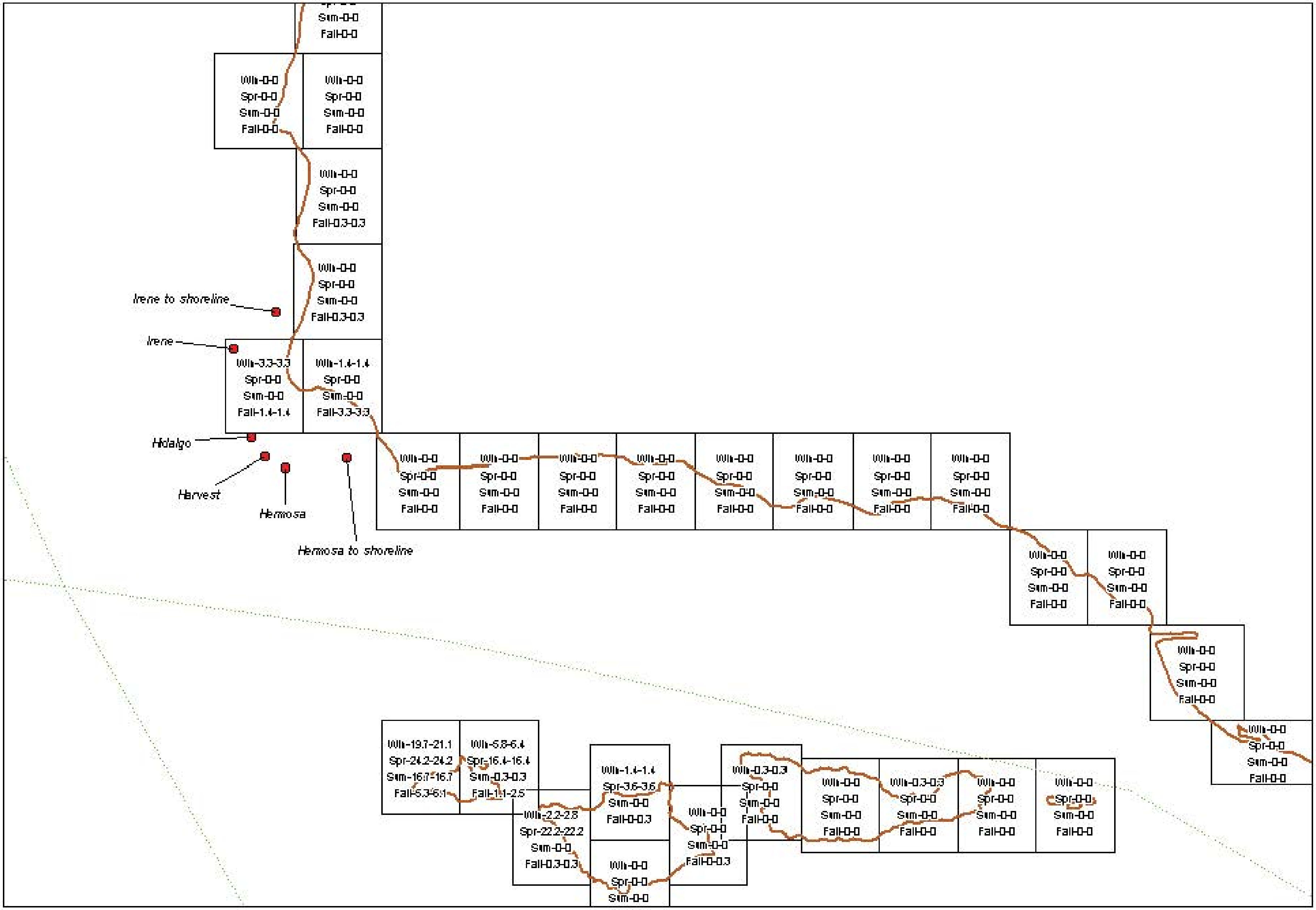
MMS OSRA Conditional Probabilities: Hermosa

Text values in each box indicate conditional probabilities for the following sources:
Winter, Spring, Summer and Fall (as labeled) followed by the 10-day and 30-day levels



MMS OSRA Conditional Probabilities: Hidalgo

Text values in each box indicate conditional probabilities for the following sources:
Winter, Spring, Summer and Fall (as labeled) followed by the 10-day and 30-day levels



MMS OSRA Conditional Probabilities: Point Arguello Pipeline

Text values in each box indicate conditional probabilities for the following sources:
Winter, Spring, Summer and Fall (as labeled) followed by the 10-day and 30-day levels

This attachment is only available in the proprietary copies

Information Redaction Statement

Pursuant to the Freedom of Information Act (5 U.S.C. 552) and its implementing regulations (43 CFR Part 2) and as provided in 30 CFR 550.199(b), some information has been redacted from this document and was deleted from the public information copy of this submission.

Proprietary Information Redacted

Not for Public Release

Attachment G – Oil Spill Risk Calculations

Oil Spill Risk Calculations
Point Arguello Unit Western Half NW/4 OF LEASE OCS-P 0450

Table 1 US OCS Spill Historical Spill Data

US OCS Spills	Number of Spills	Median Spill Size (bbls)	Spill Rate (spills per 10^9 bbls)
Platforms, >1,000 bbls	-	7,000	0.4
Pipelines, >1,000 bbls	-	1,720	0.9
Small Spills, 50-1000 bbls	-	-	13.0
Small Spills, 1-50 bbls	-	-	75.0

Source: Comparative Occurrence Rate for Offshore Oil Spills, Anderson and La Belle, MMS.
Source: BOEM, 2012-2017 OCS Oil and Gas Leasing Program Draft Programmatic EIS Table 4.4.2-1

Table 2 Calculation of Spill Probabilities for Point Arguello Field Only

Location	Spill Rate (spills per 10^9 bbls)	Total Oil Production (10^9 bbls)	Duration of Total Oil Production (years)	Estimated Number of Spills During the Duration	Probability of Zero Spills Occurring (P(0))	Probability of One or More Spills Occurring
All Platforms, spills >1,000 bbls	0.4	0.012	7	0.005	99.5%	0.5%
PAPCO Pipeline, spills >1,000 bbls	0.9	0.012	7	0.011	98.9%	1.1%
Small Spills, 50-1000 bbls	13.0	0.012	7	0.156	85.6%	14.4%
Small Spills, 1-50 bbls	75.0	0.012	7	0.900	40.7%	59.3%

Notes:
The platform numbers may not add-up due to rounding.
Duration of production is from the beginning of 2013 through the end of 2019.
Pt Arguello Production without Electra, bbls 12,000,000
Production from Hermosa and Harvest based upon data in Reservoir Evaluation.
Estimated number of spills during the duration=spill rate*total oil production.
P(0)=(number of spills during duration)^0 *e$^{(\text{-number of spills during duration})}$/1
The probability of one or more spills=1-P(0).

Table 3 Calculation of Spill Probabilities for Western Half NW/4 OF Lease OCS-P 0450 (Electra production only)

Location	Spill Rate (spills per 10^9 bbls)	Total Oil Production (10^9 bbls)	Duration of Total Oil Production (years)	Estimated Number of Spills During the Duration	Probability of Zero Spills Occurring (P(0))	Probability of One or More Spills Occurring
All Platforms, spills >1,000 bbls	0.4	0.0035	7	0.001	99.9%	0.1%
PAPCO Pipeline, spills >1,000 bbls	0.9	0.0035	7	0.003	99.7%	0.3%
Small Spills, 50-1000 bbls	13.0	0.0035	7	0.046	95.6%	4.4%
Small Spills, 1-50 bbls	75.0	0.0035	7	0.263	76.9%	23.1%

Notes:
The platform numbers may not add-up due to rounding.
Duration of production is from beginning of 2013 through the end of the four quarter 2019.
Estimated number of spills during the duration=spill rate*total oil production.
P(0)=(number of spills during duration)^0 *e$^{(\text{-number of spills during duration})}$/1
The probability of one or more spills=1-P(0).

Table 4 Calculation of Spill Probabilities for Point Arguello Field and Western Half NW/4 of Lease OCS-P 0450

Location	Spill Rate (spills per 10^9 bbls)	Total Oil Production (10^9 bbls)	Duration of Total Oil Production (years)	Estimated Number of Spills During the Duration	Probability of Zero Spills Occurring (P(0))	Probability of One or More Spills Occurring
All Platforms, spills >1,000 bbls	0.4	0.0155	7	0.006	99.4%	0.6%
PAPCO Pipeline, spills >1,000 bbls	0.9	0.0155	7	0.014	98.6%	1.4%
Small Spills, 50-1000 bbls	13.0	0.0155	7	0.202	81.8%	18.2%
Small Spills, 1-50 bbls	75.0	0.0155	7	1.163	31.3%	68.7%

Notes:
The platform numbers may not add-up due to rounding.
Duration of production is from the beginning of 2013 through the end of 2019.
Pt Arguello Production without Electra, bbls 12,000,000
Electra production total, bbls 3,500,000
Pt Aguello non-Electra production assumed to be spread evenly between 3 platforms
Production from additional 2 wells at hidalgo assumed to be a total of 3.5 million bbls
Production from Hermosa and Harvest assumed to be the same as in the 2003 DPP
Estimated number of spills during the duration=spill rate*total oil production.
P(0)=(number of spills during duration)^0 *e$^{(\text{-number of spills during duration})}$/1
The probability of one or more spills=1-P(0).

Attachment H – Environmental Justice Data

CENSUS Information on Port Hueneme, US Census Bureau, 2010 Data

Category	All of California		Ventura County CA		1 Mile radius		2 mile radius		5 mile radius	
	Data	Percent	Data	Percent	Data	Percent	Data	Percent	Data	Percent
Total Population	37,253,956		823,318		33,305		73,820		183,809	
Population/square mile	239		447		6,766		6,720		3,669	
Persons living in households	36,434,140	98	812,718	99	31,989	96	71,633	97	180,215	98
Persons in group quarters	819,816	2	10,600	1	1,316	4	2,187	3	3,594	2
Male	18,517,830	50	408,969	50	17,251	52	37,474	51	93,893	51
Female	18,736,126	50	414,349	50	16,054	48	36,346	49	89,916	49
Average age	35		36							
White	21,453,934	58	565,804	69	14,960	45	31,504	43	81,595	44
Black	2,299,072	6	15,163	2	1,375	4	2,506	3	6,746	4
American Indian & Alaska Native	362,801	1	8,068	1	472	1	781	1	2,032	1
Asian	4,861,007	13	55,446	7	2,373	7	7,085	10	13,019	7
Native Hawaiian & Other Pacific Islander	144,386	0	1,643	0	270	1	602	1	806	0
Other race	6,317,372	17	140,253	17	12,273	37	28,051	38	70,713	39
Total Minority	13,984,638	38	220,573	27	16,763	50	39,025	53	93,316	51
Hispanic origin (any race)	14,013,719	38	331,567	40	20,260	61	45,457	62	115,883	63
Persons 16+ years	29,159,527		640,277		23,308		52,776		132,918	
Not presently married	7,312,474	50	314,474	49	11,254	47	24,649	46	60,832	45
Now married	7,349,861	50	338,067	52	12,634	53	29,394	54	74,962	55
Persons 3+ years	10,648,332		230,361		31,393	94	69,823		174,208	
In preprimary/elemen./high sch.	7,493,643		172,241	21	7,738	25	17,277	25	42,012	24
In college	3,154,689	8	58,120	7	1,954	6	4,442	6	10,934	6
By Educational Attainment:										
Less than complete high school	4,650,042	19	95,254	12	7,027	21	16,575	41	40,428	39
High school graduate	5,012,413	21	99,667	12	3,591	11	8,581	21	21,020	20
Some college/college degree	9,962,682	41	232,478	28	6,204	19	11,956	35	38,367	37
By Employment Status:										
In Armed Forces	133,759	1	4,044	1	1,464	7	1,672	3	2,453	2
Civilian participation rate %	64		67		56		58		62	
Employed	16,243,172	56	387,454	61	12,975	56	30,415	58	81,709	62
Unemployed	2,382,343	8	44,133	7	927	7	2,298	8	6,051	7
Unemployment rate %	13		10		7		8		7	