# 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:**
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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.

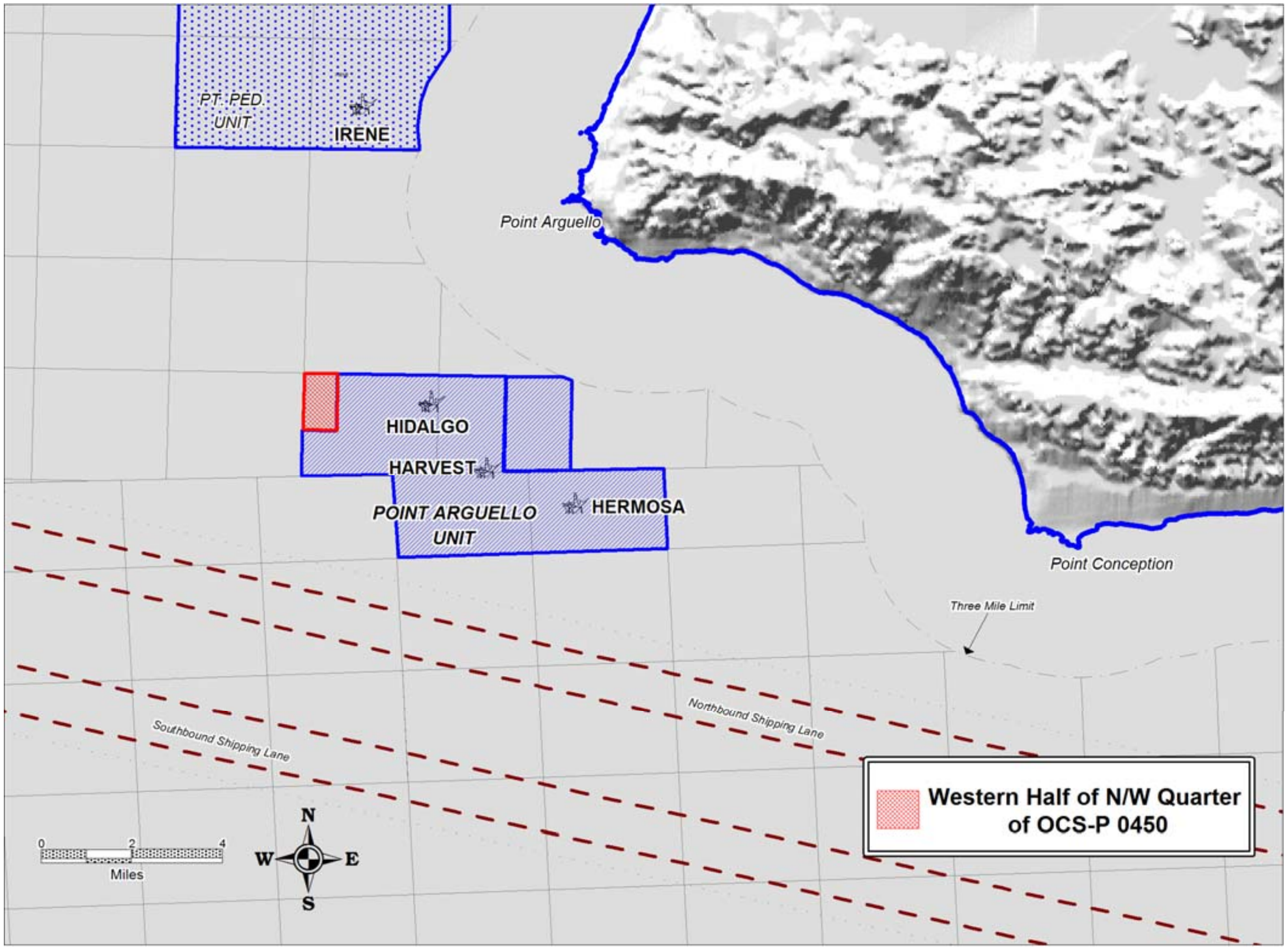
The proposed project is to develop the western half of OCS-P 0450 from Platform Hidalgo using two new development wells. No new offshore structures will be needed to develop the reserves on the western half of OCS-P 0450. Table 2.1 provides general information on the three Point Arguello platforms Figure 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)<br>X=664,622<br>Y=866,189 | Lambert Zone 6(ft)<br>X=674,783<br>Y=860,793 | UTM 10(m)<br>X=710,975<br>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'<br>8" to 438'<br>6" to 647'[a] | 647[a] | 675 |
| Hermosa | 72,000 | 27 | 85 | 82.8 | 10" to 159'<br>8" to 375' | 375 | 603 |
| Hidalgo | 16,500 | 29 | 85 | 81.6 | 10" to 100'<br>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 |

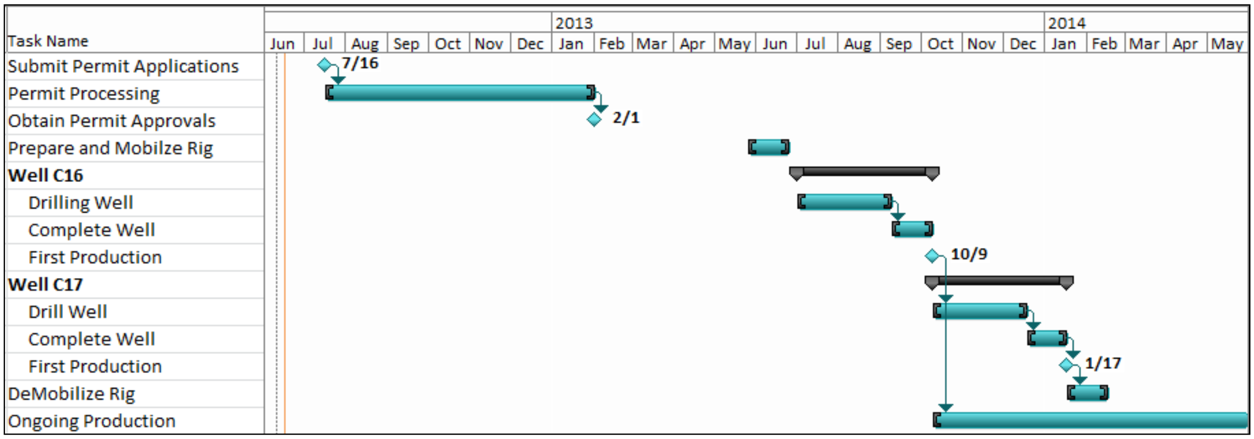
These values are estimates based on data collected from Point Arguello producing wells. The actual production data may be different. Actual hydrogen sulfide measurements of produced gas from well OCS-P 0449 #1 during the exploratory DST's indicated significantly lower levels than that shown above, including 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.<br><br>Installation of the new wells will slightly increase the potential for an oil spill during drilling of the wells and throughout production.<br><br>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.<br><br>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.<br>• Impacts due to boat traffic would be limited to routes the boats travel.<br>• 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.<br>• ***Produced water -*** during production.<br>• ***Oil spill –*** during drilling and production<br>• ***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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>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.<br><br>No new helicopter trips will be needed to handle development of the western half of OCS-P 0450.<br><br>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%.<br><br>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

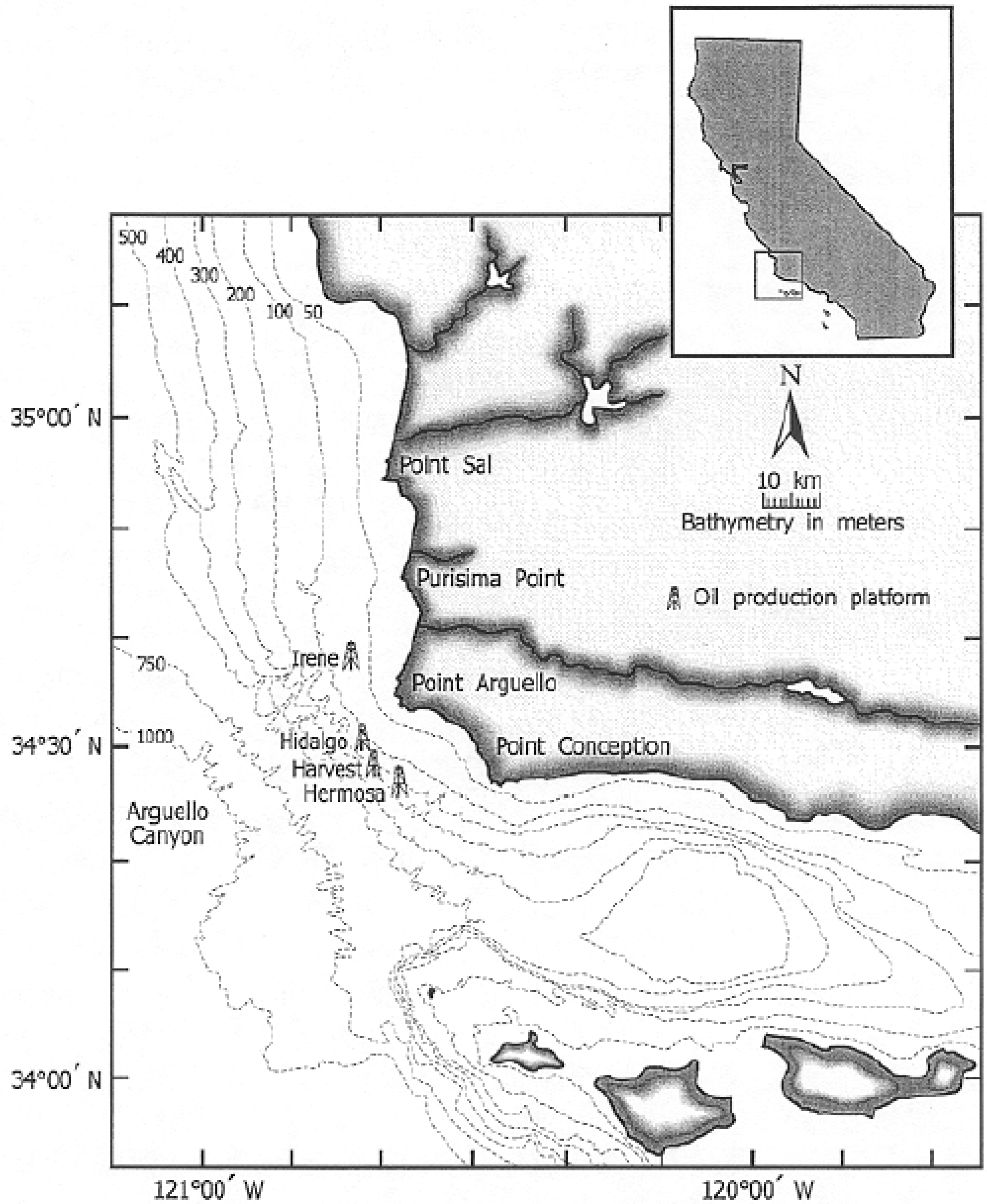
The project area is located in an oceanographically complex region off south-central California. . Specifically, the project area lies in the transition zone between the Santa Maria Basin (SMB) and the Santa Barbara Channel (SBC), where a sharp change in coastline orientation occurs between Point Arguello 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°T (degrees from true north) and 230°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°T) or from the northwest (300°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°T and 148°T (Jensen et al. 1989). Blocking by the two adjacent major promontories limits the respective wave windows to 158 - 298°T and 178 - 328°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°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<br>*Citharichthys sordidus* | Sablefish<br>*Anoplopoma fimbria* | Thornyheads<br>*Sebastolobus* spp. | Rattails<br>*Coryphaenoides filifer* |
| English sole<br>*Pleuronectes vetulus* | Pacific hake<br>*Merluccius productus* | Pacific hake<br>*Merluccius productus* | Thornyheads<br>*Sebastolobus* spp. |
| Rex sole<br>*Errex zachirus* | Slickhead<br>*Alepocephalus tenebrosus* | Slickhead<br>*Alepocephalus tenebrosus* | Finescale codling<br>*Antimora microlepis* |
| Rockfish<br>*Sebastes* spp. | Eelpouts<br>*Lycenchelys jordani* | Rattails<br>*Coryphaenoides filifer* | Eelpouts<br>*Lycenchelys jordani* |
| Pink surfperch<br>*Zalembius rosaceus* | Rockfish<br>*Sebastes* spp. | | |
| Plainfin midshipman<br>*Porichthys notatus* | Thornyheads<br>*Sebastolobus* spp. | | |
| White croakers<br>*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 |

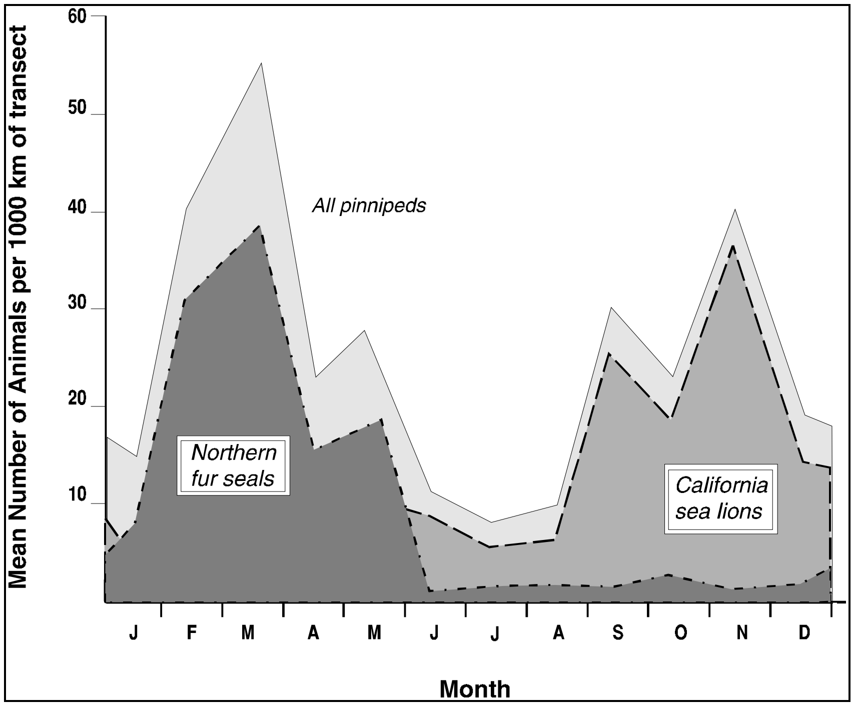
Adapted from Bonnell and Dailey 1993; Caretta et al. 2011Notes: T = Federal Threatened Species; NA = Not Applicable

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°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

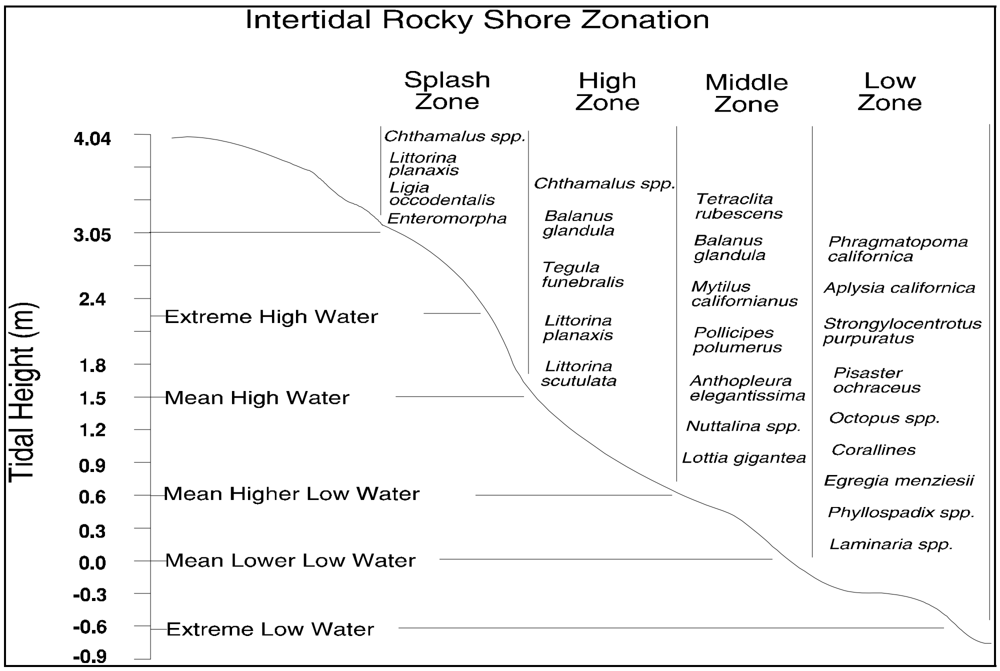
In the middle intertidal zone, algal cover is more conspicuous with clumps of *Fucus* and *Pelvetia* (rockweeds) and *Endocladia* (red algae). The middle intertidal can also be inhabited by a variety of limpets, *Chthamalus* sp. (acorn barnacle), *Mytilus californianus (*mussels), *Pisaster ocraceus* (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.

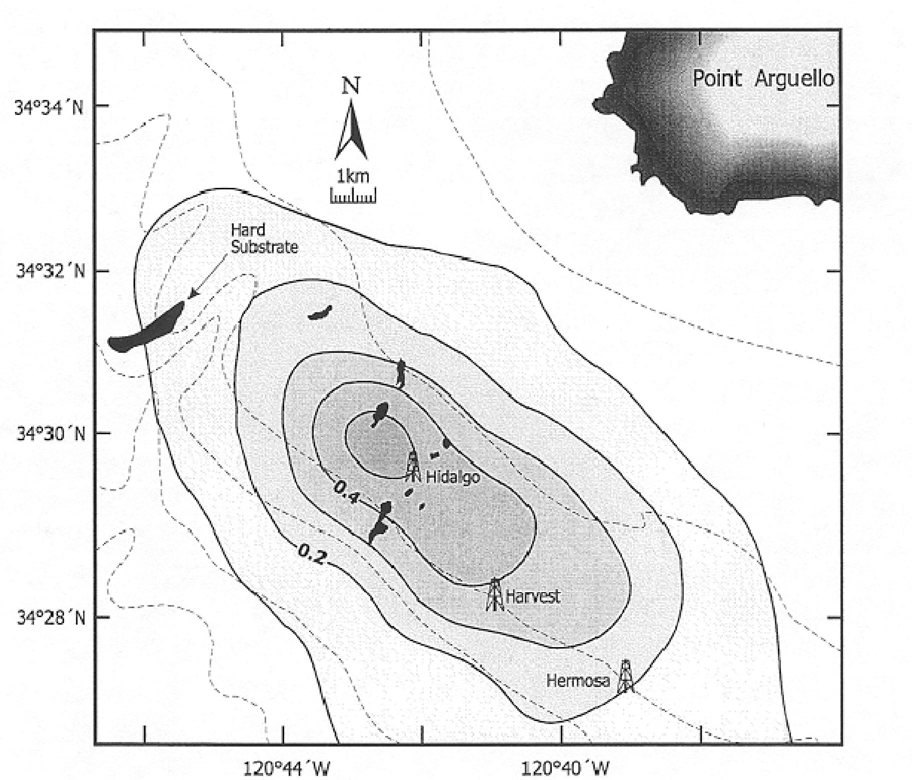
**Impact No. 2. Oil spill impacts to the marine environment and biota.**

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 1μPa. 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 1μPa. 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**

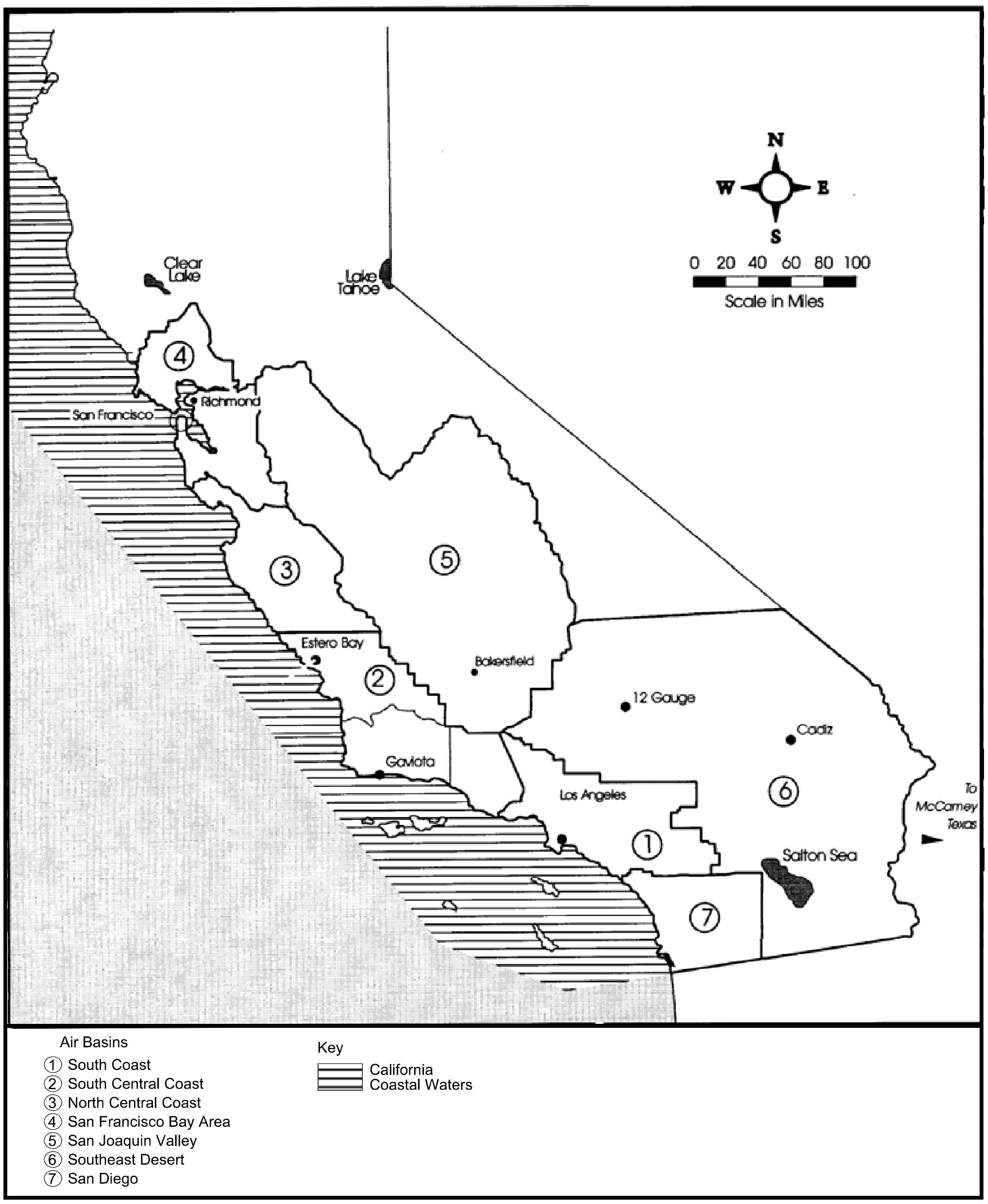
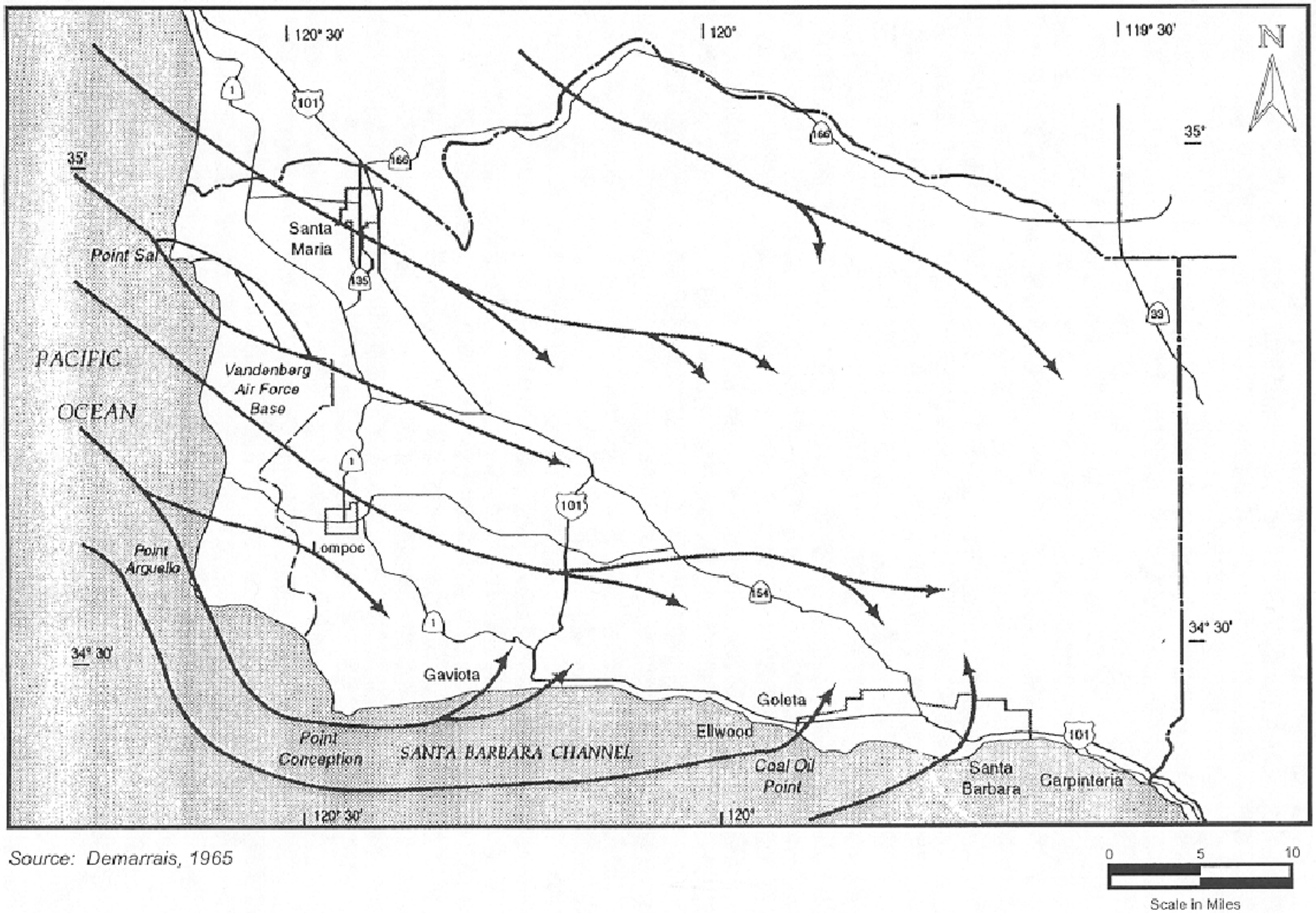


**Figure 4-6 Surface Wind Streamlines**




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<br>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<br>20 ppm, 1-hour average | 9 ppm, 8-hour average<br>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,<br>0.03 ppm, annual average | 0.053 ppm<br>0.10 ppm<br>98$^{th}$ 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<br>0.25 ppm, 1-hour average | 0.075 ppm, 1-hour,<br>99$^{th}$ percentile 3-year average<br>0.14 ppm24-hour<br>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<br>50 µg/m$^3$, 24-hour average | 150 µg/m$^3$,<br>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$^3$,<br>annual arithmetic mean | 15 µg/m$^3$, annual arithmetic mean<br>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<br>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<br>> 150 lbs/day Carbon Monoxide - if designated nonattainment |
| AQIA Requirements | ≥ 80 lbs/day $PM_{10}$<br>≥ 550 lbs/day Carbon Monoxide -- if designated nonattainment<br>≥ 120 lbs/day All other nonattainment pollutants and precursors |
| Offsets Requirements | $PM_{10}$ – ≥ 80 lbs/day or 15 tons/year<br>Carbon Monoxide -- if designated nonattainment – ≥ 150 lbs/day or 25 tons/year<br>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.<br><br>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.<br><br>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 $4.8 \times 10^{-3}$/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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