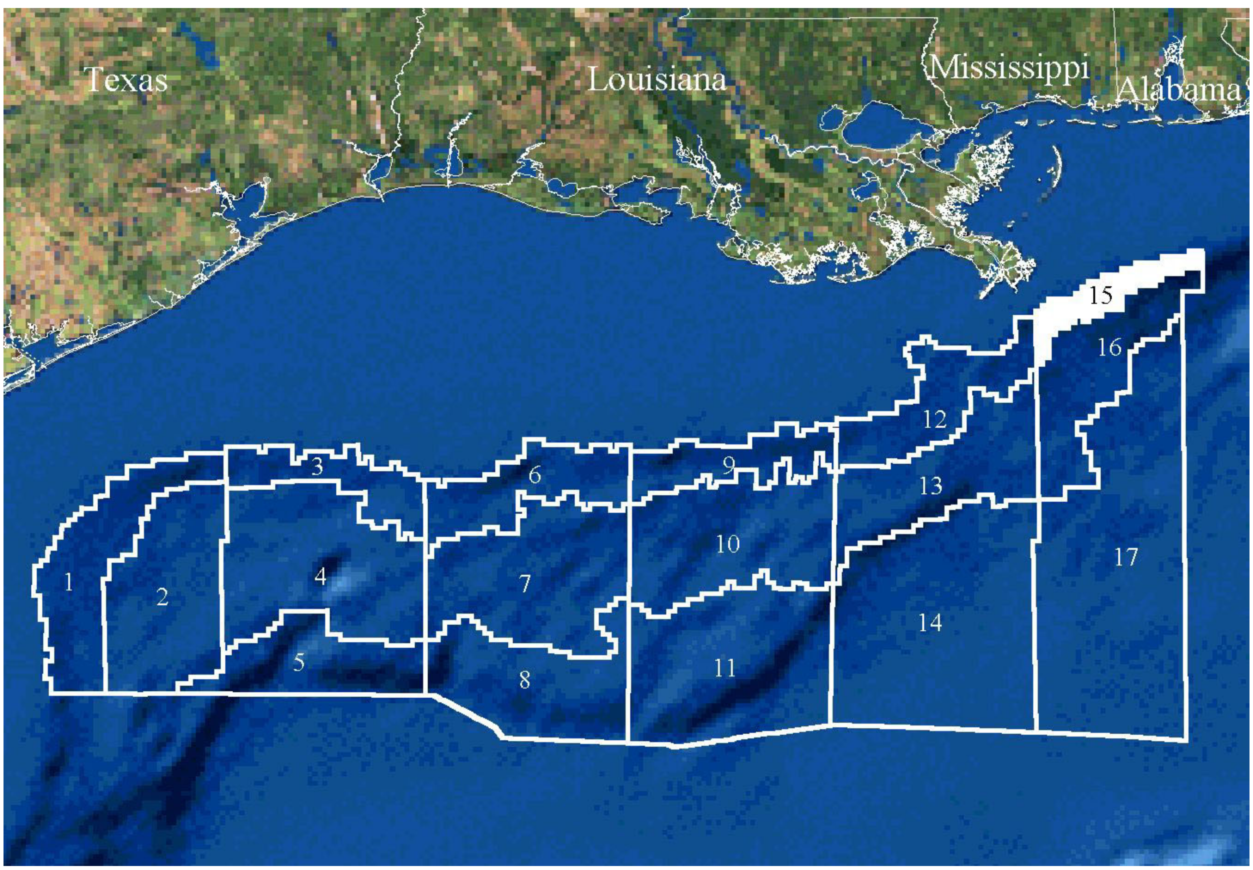
OCS EIS/EA
MMS 2002-042

Programmatic Environmental Assessment for Grid 15

Site-Specific Evaluation of TotalFinaElf Exploration and Production USA, Inc.'s Initial Development Operations Coordination Document, N-7249

Matterhorn Project
Mississippi Canyon Block 243



U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

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Matterhorn Project
Mississippi Canyon Block 243

Prepared by

Minerals Management Service
Gulf of Mexico OCS Region

Published by

U.S. Department of the Interior
Minerals Management Service
Gulf of Mexico OCS Region

New Orleans
March 2002

PROGRAMMATIC ENVIRONMENTAL ASSESSMENT FOR GRID 15 DETERMINATION

FINDING OF NO SIGNIFICANT IMPACT

TotalFinaElf Exploration and Production USA, Inc.'s Initial Development Operations Coordination Document (DOCD) and its amendments proposing to drill and complete 8 wells, reenter and complete an existing appraisal well, install a tension leg platform (TLP) structure, and commence production in Mississippi Canyon, Block 243 (OCS-G 11080), have been reviewed. Our programmatic environmental assessment (PEA) on the subject action (N-7249) is complete and results in a Finding of No Significant Impact (FONSI). Based on the conclusions of this PEA, there is no evidence that the proposed action will significantly (40 CFR 1508.27) affect the marine and human environments. Preparation of an environmental impact statement (EIS) is not required. The following mitigations will be required and included in the operator's approval letter to ensure environmental protection, consistent environmental policy, and safety as required by the National Environmental Policy Act (NEPA) of 1969, as amended; or as needed for compliance with 40 CFR 1500.2(f) regarding the requirement for Federal agencies to avoid or minimize any possible adverse effects of their actions upon the quality of the human environment.

1. A deviation from your DOCD (such as additional drilling time, changes in the drilling schedule, and/or use of higher horsepower equipment, especially for the drilling rig and construction barges) could potentially cause the annual emissions exemption level for NO_x to be exceeded. Therefore, if such a deviation occurs, please be advised that you will immediately prepare a revised DOCD pursuant to 30 CFR 250.204(q)(2) to include the recalculated emission amounts and the air quality modeling required by 30 CFR 250.303(e). You will not proceed with the actions that could cause the potential exceedance until the revised DOCD has been submitted to and approved by this office. (2.2)

2. The projected NO_x emissions amounts in your plan were calculated using historic (fuel consumption rates, run times). Therefore, please be advised that you will maintain records of the total monthly fuel consumption for the ENSCO 7500 semi-submersible drilling unit and provide the information to this office upon request. (2.5)

3. In accordance with NTL No. 2001-G04, the MMS has determined that you will need to conduct the ROV surveys you proposed in your plan for the facility location approved under this plan. Submit your pre- and post-installation survey reports within 60 days after the facility installation is completed. (19.2)

The use of low sulfur fuel and NO_x control measures are recommended to reduce impacts on the air quality in the Breton Sound National Wilderness Area.

3/7/02

J. Hammond Eve
Regional Supervisor, Leasing and Environment
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Date

3/7/02

Pat Roscigno
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Date

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ABBREVIATIONS AND ACRONYMS

AC	Alaminos Canyon
AHTS	anchor handling tug/supply
ASI	Airborne Support Inc.
BOD	biochemical oxygen demand
B.P.	before present
CEI	Coastal Environments, Inc.
CFR	Code of Federal Regulations
CPA	Central Planning Area
CSA	Continental Shelf Associates
DDT	Dichlorodiphenyltrichloroethane
DGoMB	Deepwater Program: Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology
DOCD	Development Operations Coordination Document
DO	dissolved oxygen
DOI	Department of the Interior (U.S.) (also: USDOI)
EB	East Breaks
E&D	Exploration and Development
EA	environmental assessment
EEZ	Exclusive Economic Zone
EFH	essential fish habitat
EIS	environmental impact statement
EP	Exploration Plan
EPA	Eastern Planning Area
et al.	and others
et seq.	and the following
FMC	Fishery Management Council
FMP	Fishery Management Plan
FONSI	Finding of No Significant Impact
FR	*Federal Register*
FWS	Fish and Wildlife Service
GB	Garden Banks
GERG	Geochemical and Environmental Research Group
GIS	geographical information system
GMFMC	Gulf of Mexico Fishery Management Council
GOM	Gulf of Mexico
H_2S	hydrogen sulfide
HMS	highly migratory species
HMWHC	high molecular weight hydrocarbons
ITC	Intertribal Council
LATEX	Texas-Louisiana Shelf Circulation and Transport Process Program (MMS-funded study)
MARPOL	International Convention for the Prevention of Pollution from Ships
MBO	million bbl of oil
MMS	Minerals Management Service
MSA	Metropolitan Statistical Area
MWA	military warning area
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act, as amended
NGMCS	Northern Gulf of Mexico Continental Slope Study
NMFS	National Marine Fisheries Service
NOEC	No observable effect concentration
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant and Discharge Elimination System
NRC	National Response Corporation
NS&T	National Status & Trends Program (NOAA)
NTL	Notice to Lessees and Operators
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act, as amended
OSRA	Oil Spill Risk Analysis
OSRO	Oil Spill Removal Organizations
P&A	plugged and abandoned
PAH	polynuclear aromatic hydrocarbon
PEA	Programmatic Environmental Assessment
P.L.	Public Law
PCB	polychlorinated biphenyl
PLEM	pipeline end manifold
ppb	parts per billion
ppt	parts per thousand
ROSRP	Regional Oil Spill Response Plan
SCR	steel catenary riser
SEA	site-specific environmental assessment
SIC	Standard Industrial Classification
SOP	suspension of production
TA	temporarily abandoned
TLP	tension leg platform
U.S.	United States
USCG	U.S. Coast Guard
USDOC	U.S. Department of Commerce
USDOI	U.S. Department of the Interior (also: DOI)
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compounds
WPA	Western Planning Area

INTRODUCTION

The Minerals Management Service (MMS) developed a comprehensive strategy to comply with the National Environmental Policy Act (NEPA) for postlease activities in deepwater areas (water depths of greater than 400 m) of the Central and Western Planning Areas of the Gulf of Mexico (GOM). You can find an in-depth discussion of this strategy on our Internet site at the following address:

www.gomr.mms.gov/homepg/regulate/environ/strategy/strategy.html.

The MMS's strategy led to the development of a biologically based grid system to ensure broad and systematic analysis of the GOM's deepwater region. The grid system divided the Gulf into 17 areas or "grids" of biological similarity. Under this strategy, the MMS will prepare a programmatic environmental assessment (PEA) to address a proposed development project within each of the 17 grids. These Grid PEA's will be comprehensive in terms of the impact-producing factors and environmental and socioeconomic resources described and analyzed.

Once a PEA for a grid has been completed, it will serve as a reference document to implement the "tiering" (40 CFR 1502.20) concept detailed in NEPA's implementing regulations. Future environmental evaluations may reference appropriate sections from the PEA to reduce reiteration of issues and effects previously addressed in the "grid" document. This will allow the subsequent environmental analyses to focus on specific issues and effects related to the proposals. This PEA has also addressed categorical exclusion criterion C.(10)(1) by summarizing information to characterize the environment of Grid 15.

This PEA will characterize the environment of Grid 15 and also examine the effects that may result from TotalFinaElf Exploration and Production USA, Inc.'s (TotalFinaElf) Initial Development Operations Coordination Document (DOCD) for the Matterhorn Project (N-7249).

Figure 1 shows the relationship of Grid 15 to the Gulf's coastline and to the other 17 grids. Mississippi Canyon, Block 243 which is highlighted, is the proposed location for the Matterhorn Project.

Figure 2 depicts the protraction diagrams and blocks that are contained in Grid 15. Mississippi Canyon, Block 243 is highlighted.

CURRENT STATUS OF GRID 15

The purpose of this section is to provide the reader with a "state of the grid." Information in this section is based on current MMS data and publicly announced prospects that are projected for Grid 15. See Appendix F for additional information and supportive data.

Grid 15 includes portions of two Outer Continental Shelf (OCS) protraction diagrams. Table 1 provides information on the protraction diagrams, blocks, leases, and acreage in Grid 15.

Table 1

Protraction Diagrams, Blocks, Leases, and Acreage in Grid 15

Protraction Diagrams	No. of Grid Blocks	Approximate Acreage in Grid	No. of Grid Blocks Leased	Percentage of Grid Blocks Leased
Mississippi Canyon	64	368,640	42	52.5
Viosca Knoll	54	311,040	38	47.5
Grid Totals	118	679,680	80	67.8

Mississippi Canyon constitutes approximately 54 percent of the total number of blocks in the grid. It also contains about 52.5 percent of the total number of leases in the grid. Viosca Knoll contains approximately 46 percent of the total number of blocks in the grid and has about 47.5 percent of the total leases.

Figure 3 depicts the bathymetry of Grid 15 in 10-m contour intervals.

Military Warning Area (MWA) W-155B is located within Grid 15. Figure 4 shows the boundary of the MWA. All leased blocks within the Grid and that are contained within the MWA will have stipulations included within their leases regarding specific Department of Defense mitigative measures, i.e., hold and save harmless, electromagnetic emissions, and operational considerations. For additional information regarding these stipulations, see the Final Environmental Impact Statement (EIS) for Central GOM Lease Sales 169, 172, 175, 178, and 182 (USDOI, MMS, 1997).

Figure 4 also shows that an ordnance disposal area is located in the southeastern part of Grid 15 covering Mississippi Canyon Block 504 and portion of Mississippi Canyon Blocks 460 and 461. Though this disposal area is inactive, it may contain unexploded munitions and other ordnance. Pipeline routes from the Grid may require the operator to deviate their course to avoid this area. No known concentration of hydrogen sulfide (H_2S) is reported in the area.

Grid 15 contains a total of 118 blocks. Of these blocks, 80 (67.8%) were leased as of March 2002.

At present, there are 20 operators with leases in Grid 15. These operators include

Agip	Exxon Asset Management	Shell Offshore Inc.
Amerada-Hess	Exxon-Mobil	Spinnaker Exploration
Amoco	GasNewfield Exploration	Texaco
BP	Kerr-McGee	TotalFinaElf
Devon Energy	McMoran	Vastar Resources
Devon SFS	Mobil Oil	Walter Oil & Gas
Dominion	Samedan Oil	

Figure 5 geographically depicts the leasehold position of these operators within Grid 15.

The Grid's active lease status and plans submitted data are portrayed in Figure 6. No other DOCD's have been submitted besides TotalFinaElf's Matterhorn Project in the Grid since the inception of MMS's Grid PEA strategy. Eleven leased blocks are currently producing within the Grid. There are 16 blocks within the Grid which are included in a unit.

Figure 7 shows the locations of publicly announced prospects and fields within Grid 15. Drilled well locations within the Grid and its surrounding area are also shown on Figure 7.

Figure 8 depicts the number and percentage of wells drilled, sidetracked, completed, temporarily abandoned, and/or permanently abandoned within Grid 15. There are six existing platform structures in the Grid at this time.

There are 46 active and 4 proposed right-of-way pipeline routes contained within the Grid. There are also 3 out-of-service pipelines within the Grid 15. Figure 9 shows these routes in relationship to the Grid.

There are numerous onshore support bases that are available along the Gulf Coast that could serve as logistical infrastructure for Grid 15. TotalFinaElf has chosen Fourchon and Venice, Louisiana, as its onshore bases to support the proposed operations. Figure 10 shows the relationship of Grid 15 to this shore base. The distance in miles from the Grid to the shore base is also depicted on Figure 10.

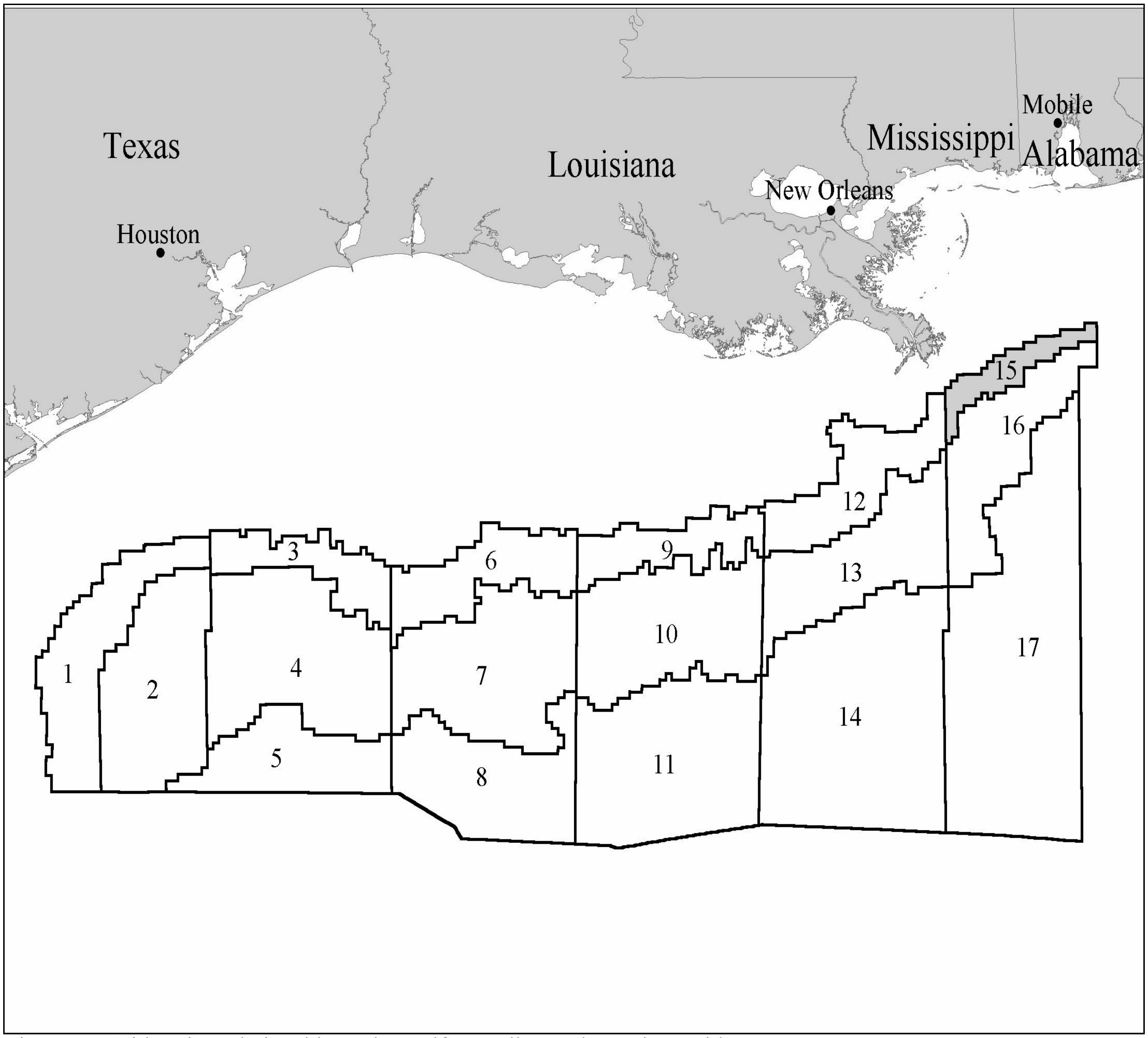

Figure 1. Grid 15 in Relationship to the Gulf Coastline and to Other Grids.

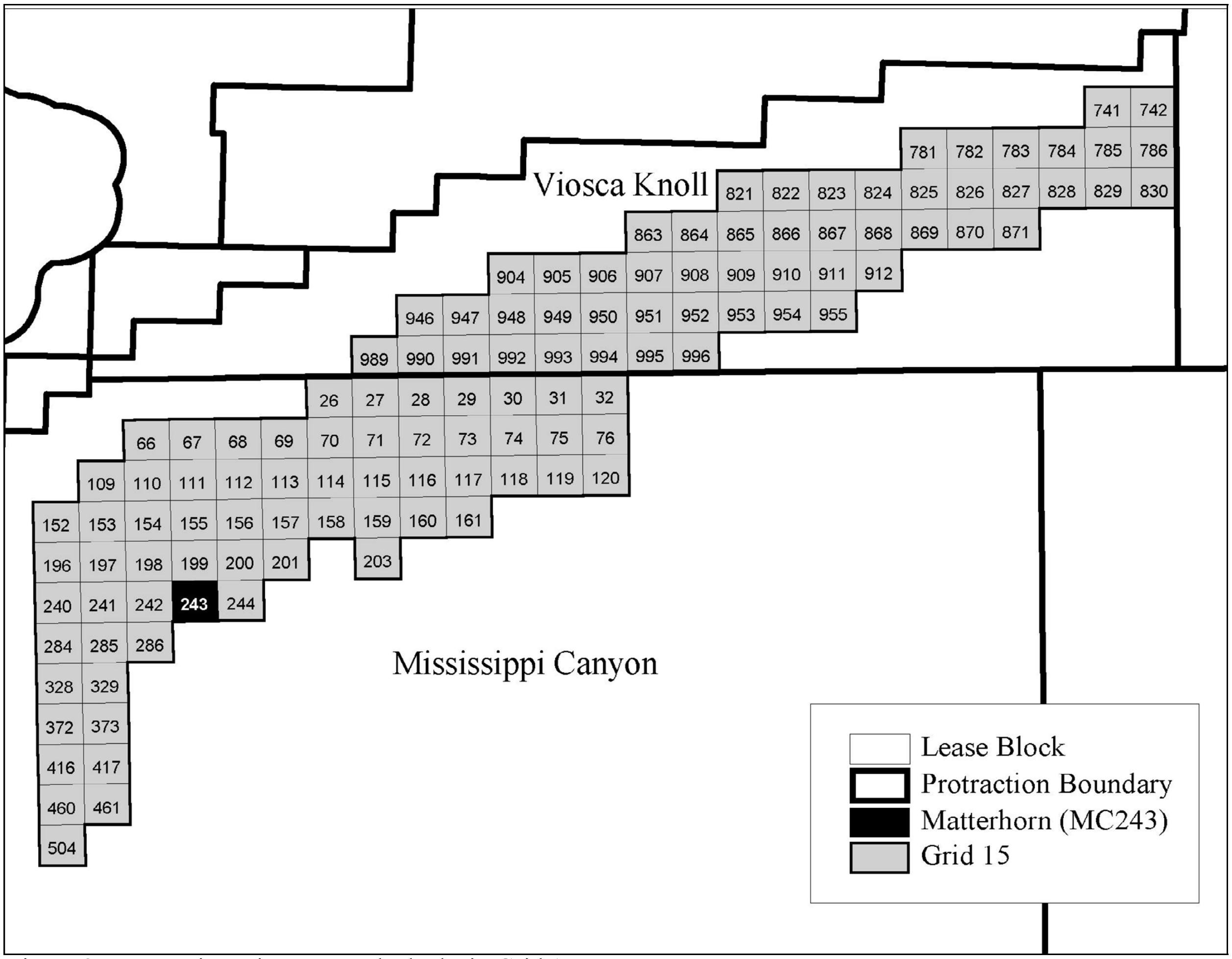

Figure 2. Protraction Diagrams and Blocks in Grid 15.

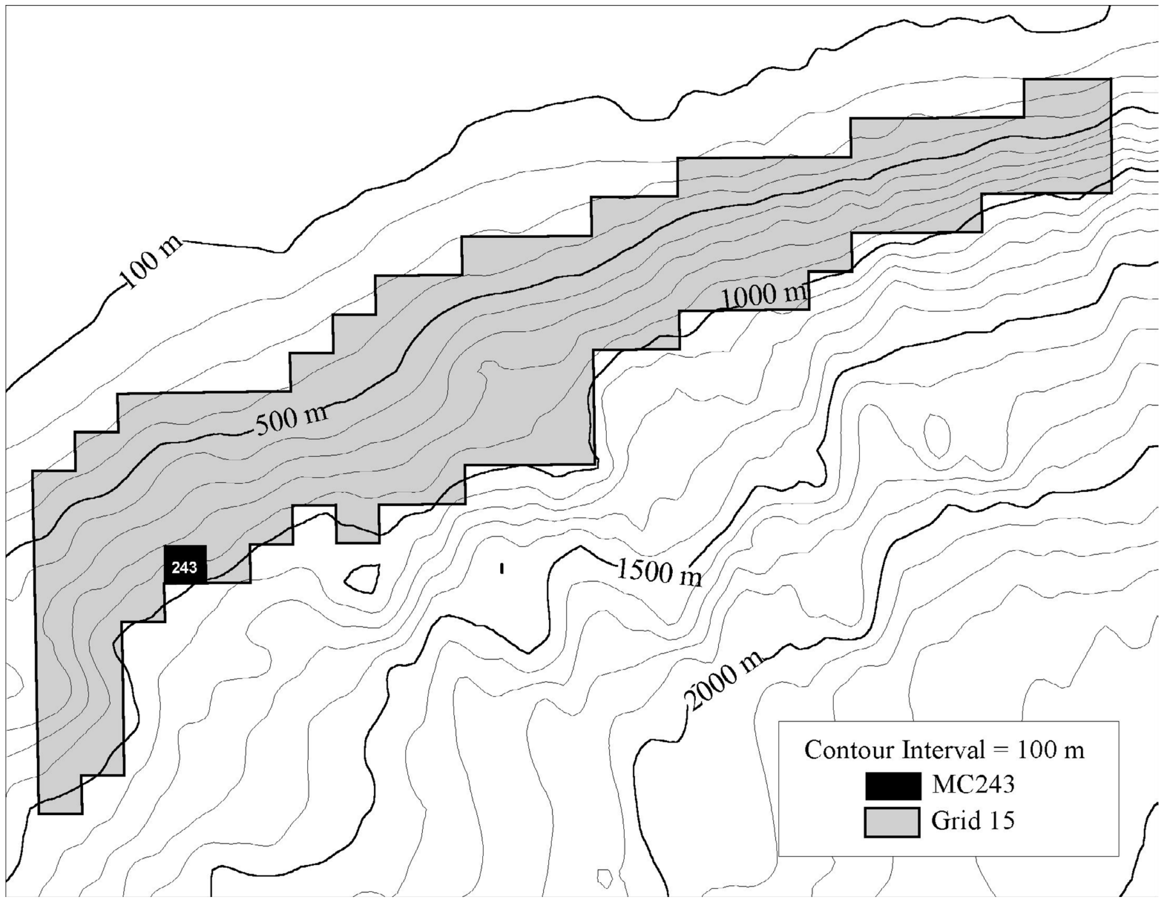

Figure 3. Bathymetry of Grid 15.

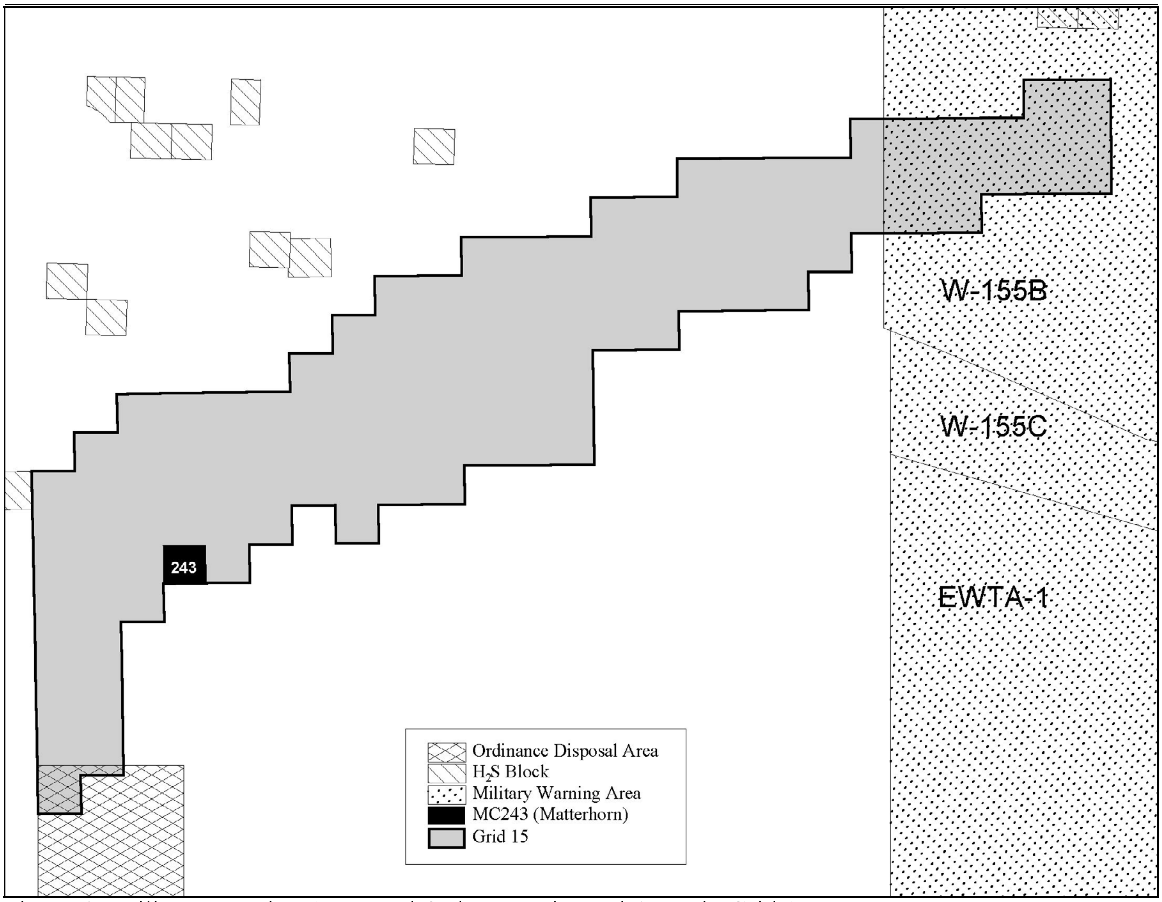

Figure 4. Military Warning Areas and Ordnance Disposal Areas in Grid 15.

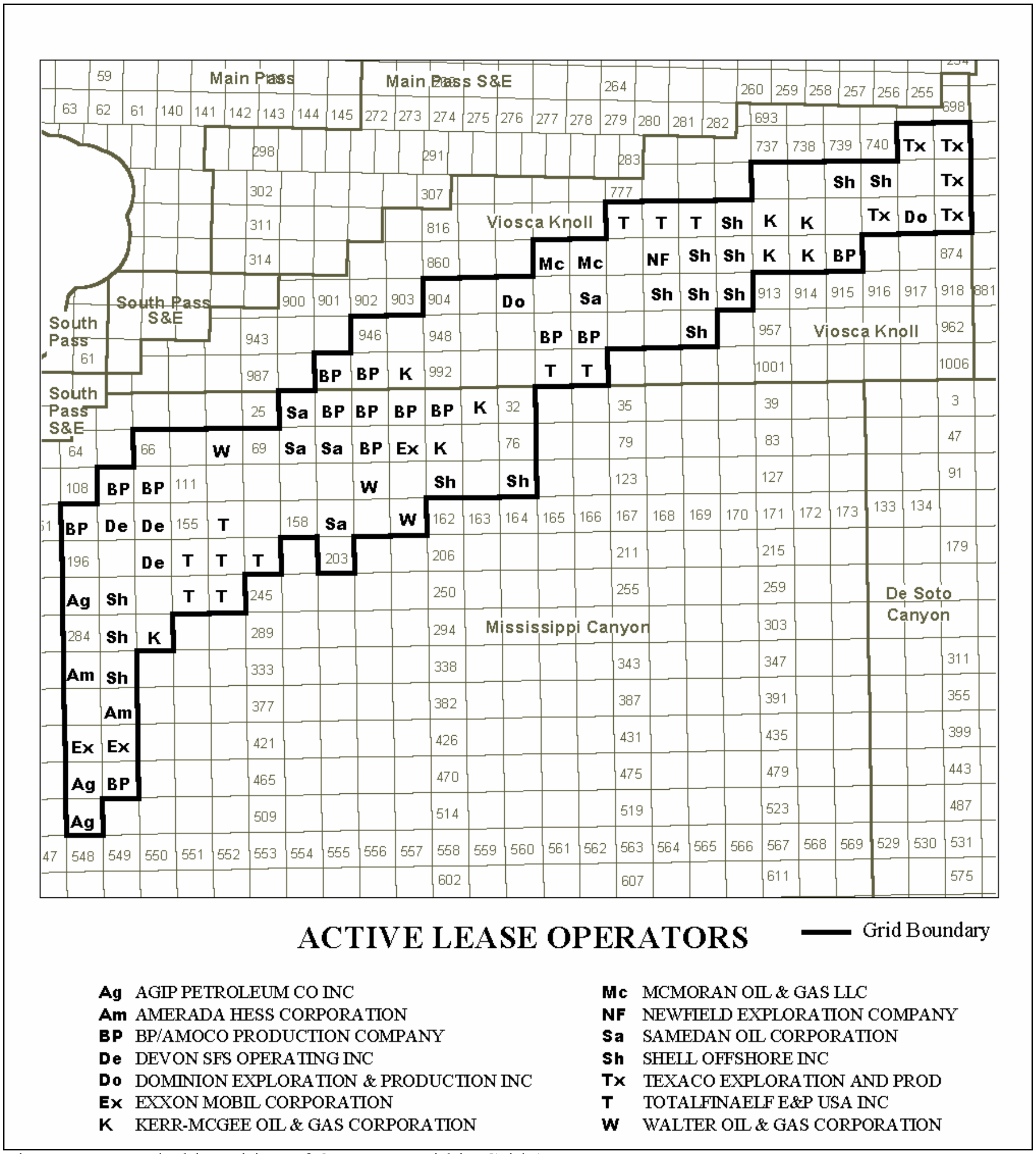

Figure 5. Leasehold Position of Operators within Grid 15.

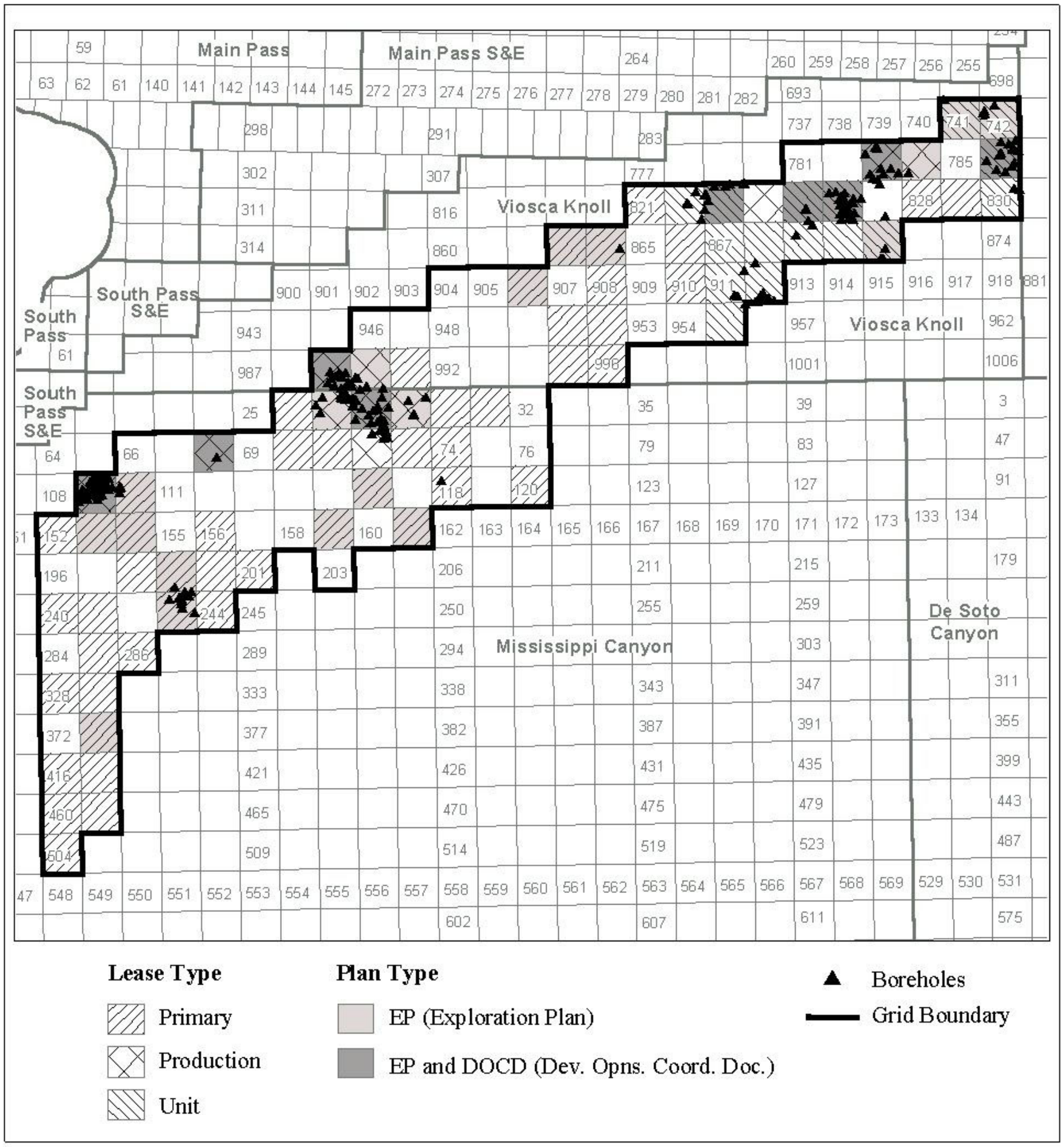

Figure 6. Active Lease Status and Plans Submitted.

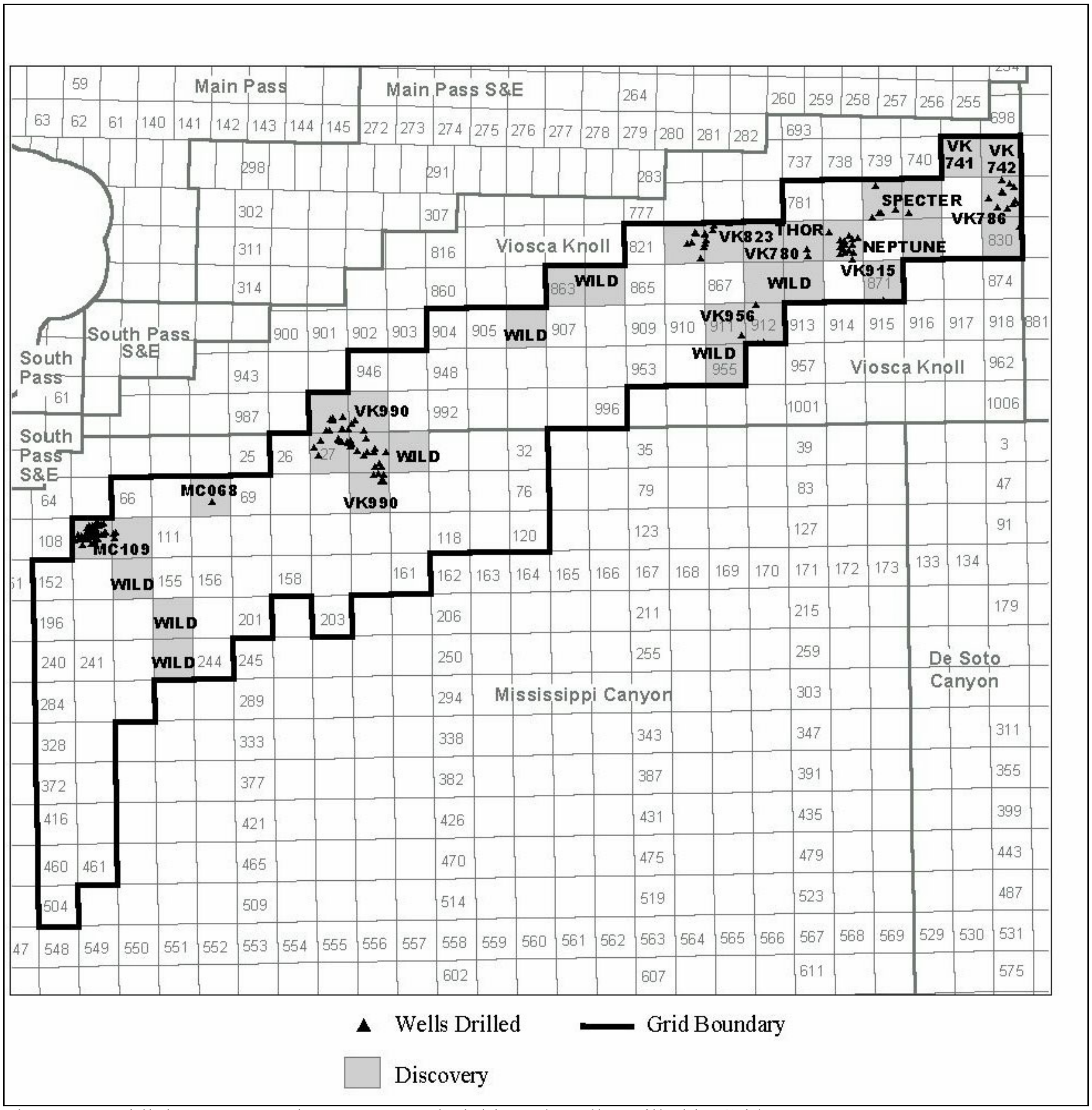

Figure 7. Publicly Announced Prospects and Fields and Wells Drilled in Grid 15.

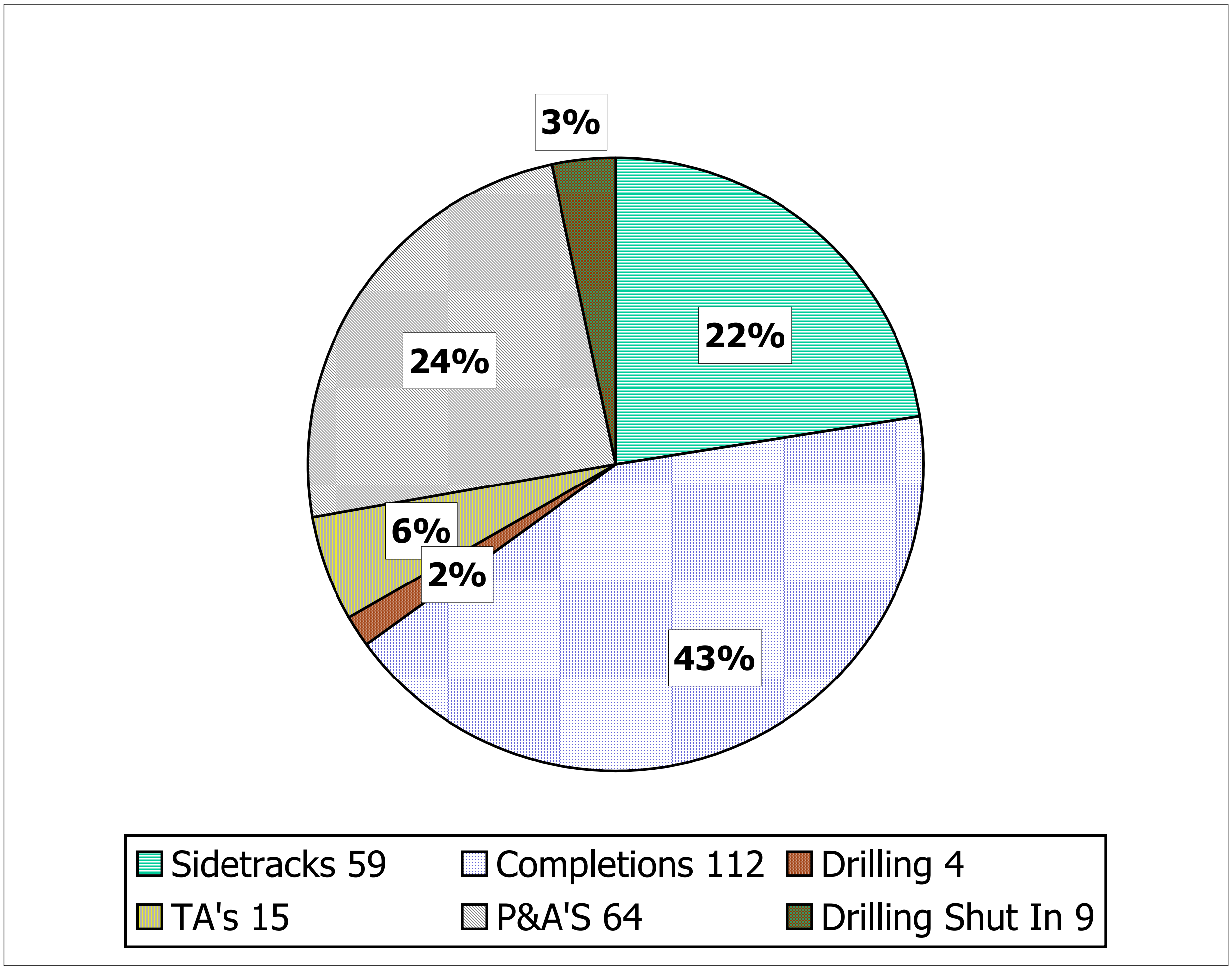

Figure 8. Exploration and Development Drilling Activities Conducted in Grid 15.

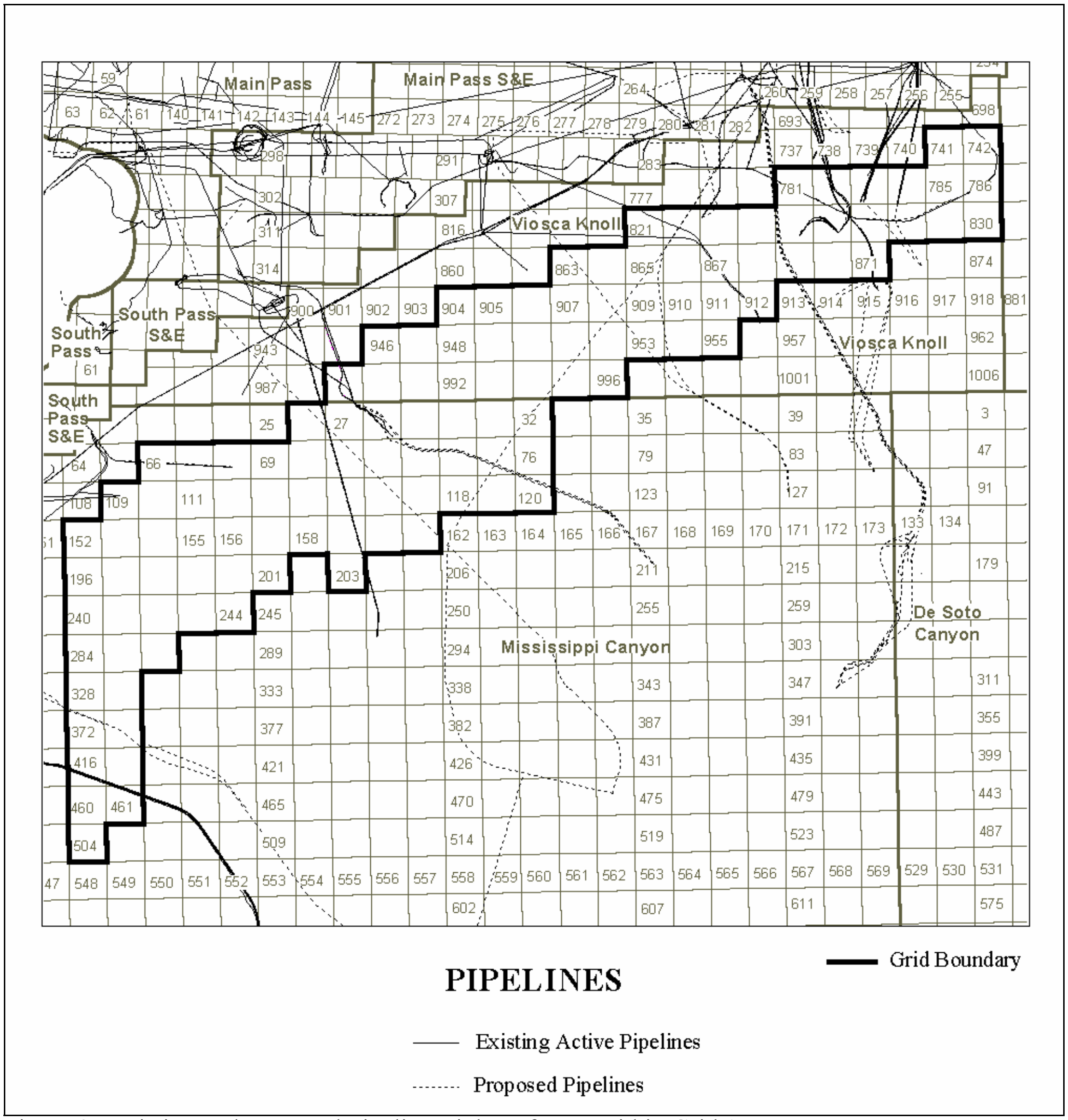

Figure 9. Existing and Proposed Pipeline Rights-of-Way within Grid 15.

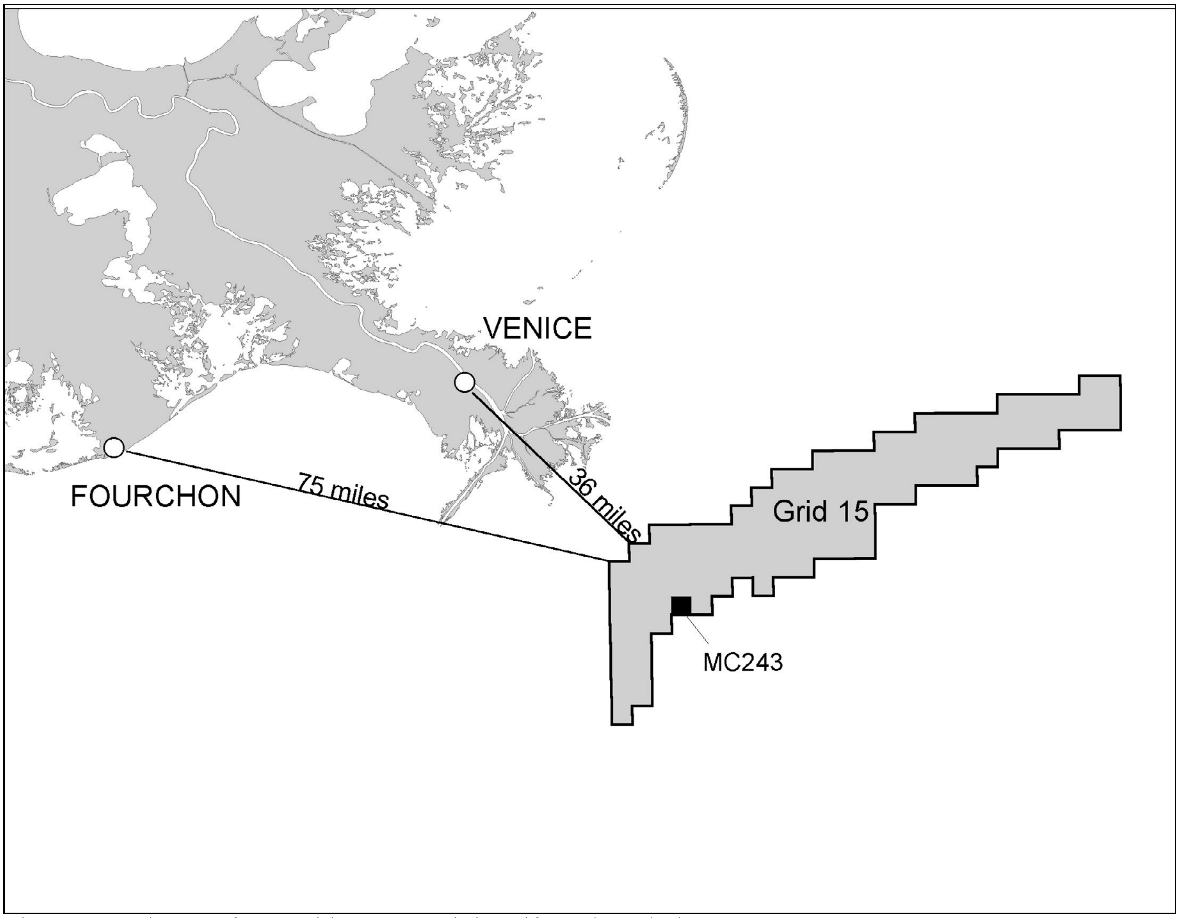

Figure 10. Distance from Grid 15 to TotalFinaElf's Selected Shore Bases.

1. THE PROPOSED ACTION

1.1. PURPOSE AND NEED FOR THE PROPOSED ACTION

Under the Outer Continental Shelf Lands Act (OCSLA), as amended, the U.S. Department of the Interior (DOI) is required to manage the leasing, exploration, development, and production of oil and gas resources on the Federal OCS. The Secretary of the Interior oversees the OCS oil and gas program and is required to balance orderly resource development with protection of the human, marine, and coastal environments while simultaneously ensuring that the public receives an equitable return for these resources and that free-market competition is maintained.

TotalFinaElf Exploration and Production USA, Inc's (TotalFinaElf) Initial Development Operations Coordination Document (DOCD) represents an action that cannot be categorically excluded because it represents activities in relatively untested deep water [516 DM Chapter 6, Appendix 10, C. (10)(1)].

This Programmatic Environmental Assessment (PEA) of the Grid implements the "tiering" process outlined in 40 CFR 1502.20, which encourages agencies to tier environmental documents, eliminating repetitive discussions of the same issue. By use of tiering from the most recent Final Environmental Impact Statement (EIS) for Central Gulf of Mexico (GOM) Lease Sales 169, 172, 175, 178, and 182 (USDOI, MMS, 1997), and by referencing related environmental documents, this PEA concentrates on environmental effects and issues specific to the proposed action and other activities within the Grid.

Purpose

The purpose of this PEA is two-fold. It assesses the specific and cumulative impacts associated with TotalFinaElf 's proposed action and also provides information on the deepwater area within Grid 15. The document can be used as a basis to allow most subsequent activities proposed in the Grid to be processed via a categorical exclusion review. However, if it is determined that a subsequent proposal will require preparation of a site-specific environmental assessment (SEA), the PEA provides information that can be referenced in the SEA. The SEA would be then focus on selected key issues. The grid area was determined by the MMS's implementing regulations for the National Environmental Policy Act (NEPA) to be an area of "relatively untested deep water" [516 DM Chapter 6, Appendix 10, C. (10) (1)]. To properly characterize the grid, the PEA captures all of the available environmental and operational information for the area. Chapter 3 describes the environment at the specific site of the proposed activities and in the broader grid area. Analyses within Chapter 4 examine the potential effects of the proposed action and other reasonably foreseeable activities within the grid on the environment in the vicinity of the proposal and on the broader grid area.

Need for the Proposed Action

Consistent with its obligation to the Federal Government, TotalFinaElf filed a DOCD. Listed below are some of the reasons TotalFinaElf submitted this proposal to MMS:

- commercial quantities of hydrocarbons have been encountered;
- leaseholders have a legal right to secure development of the resources;
- leaseholders are obligated by lease terms to diligently develop the resources; and
- limited lease terms and failure to develop the resources could lead to loss of lease.

1.2. DESCRIPTION OF THE PROPOSED ACTION

The MMS GOM Region, Office of Field Operations, received an Initial DOCD from TotalFinaElf. The DOCD proposes to drill and complete 8 wells, reenter and complete an existing appraisal well, install a tension-leg platform (TLP) structure, and commence hydrocarbon production in Mississippi Canyon, Block 243 Lease Number OCS-G 11080 (TotalFinaElf E&P USA, Inc., 2001). This proposal is also known as the Matterhorn Project. Previous plans on these leases include N-6263 (Exploration Plan) and

R-3298 (Revised Exploration Plan). The planned wells will share a common surface location (TLP structure) in Mississippi Canyon, Block 243. Table 1-1 depicts the TLP structure's proposed location.

Table 1-1

Proposed Location of the Matterhorn Tension-Leg Platform (TLP) Structure in Mississippi Canyon, Block 243

Surface Location	Distance from Lease Lines	Lambert X-Y Coordinates	Latitude/Longitude
Matterhorn TLP Structure	FNL 3,484 ft FEL 5,753 ft	X = 1,055,527 Y = 10,435,076	Lat. 28° 44' 31.99" N. Long. 88° 49′ 32.44" W.

Note: FNL is from the north line of the lease.
FEL is from the south line of the lease.

The Matterhorn TLP structure will be a three-deck design, with the drilling deck dedicated to the platform workover rig, quarters, and compressor; and the production and cellar decks dedicated to the production processing and utility systems. The structure will host a 22-man permanent living quarters, with temporary quarters for 48 people to accommodate the completion/workover crews. A helicopter deck will be installed above the permanent living quarters. The subject wells will be drilled with the Ensco 7500 semisubmersible rig and will be completed with a 750-HP, platform-type rig.

Table 1-2 shows the activity schedule proposed by TotalFinaElf for their Matterhorn Project.

Table 1-2

Proposed Activity Schedule for the Matterhorn Project

Activity	Start Date	End Date
Batch drill and abandon well locations AA through HH	12/01/01	10/01/02
Install lease pipeline from subsea water injector well to Platform A	01/01/03	01/31/03
Complete subsea water injector well location	01/01/03	01/31/03
Install Platform A (TLP)	04/15/03	05/15/03
Tie-back and complete hydrocarbon producing wellbores	06/15/03	11/15/03
Commence production	08/01/03	08/31/18

The water depth at the TLP location is approximately 858 m (2,816 ft). The deepwater development is located approximately 40 km (25 mi) from the nearest Louisiana shoreline. The project will use existing onshore support bases in Fourchon and Venice, Louisiana, to support the proposed activities. These support bases are located approximately 148 km (92 mi) and 72 km (45 mi) away from the proposed TLP structure location, respectively.

Oil and gas produced at the Matterhorn Project will be processed on the platform and then will be transported via pipelines to existing pipeline infrastructures. A lease-term pipeline will be installed from the subsea water injection well to Platform A. All export right-of-way pipelines will be connected to the platform by a steel catenary riser. Also, as a part of the proposal, TotalFinaElf proposes to transport gas production via a proposed 10-in right-of-way pipeline, approximately 6 mi in length, to the existing shelf network at Mississippi Canyon Block 20. Liquid hydrocarbon production will also be transported via a proposed 8-in, right-of-way pipeline, approximately 16 mi in length, linking Matterhorn to the existing 10-in shelf pipeline network operated by Chevron Pipeline System on South Pass Block 50 (TotalFinaElf E&P USA Inc., 2001). The final export pipeline routes will be determined following final selection of the pipeline termination and performing a pipeline pre-lay hazards survey. Once the pipeline route and the associated pre-lay surveys are submitted, environmental effects resulting from these proposed pipeline routes will be assessed by MMS.

2. ALTERNATIVES TO THE PROPOSED ACTION

2.1. NONAPPROVAL OF THE PROPOSAL

TotalFinaElf would not be allowed to drill, complete, and produce the 8 wells proposed in its Initial DOCD. This alternative would result in no impact from the proposed action but could discourage the development of much needed hydrocarbon resources, and thereby result in a loss of royalty income for the United States and energy for America. Considering these aspects and the fact that we anticipate very minor environmental and human effects resulting from the proposed action, this alternative was not selected for further analysis.

2.2. APPROVAL OF THE PROPOSAL WITH EXISTING MITIGATION

The measures that TotalFinaElf proposes to implement to limit potential environmental effects are discussed in the Initial DOCD. The MMS's lease stipulations, Outer Continental Shelf Operating Regulations, Notices to Lessees and Operators, and other regulations and laws were identified throughout this environmental assessment as existing mitigation to minimize potential environmental effects associated with the proposed action. Additional information can be found in the Final EIS for Central GOM Lease Sales 169, 172, 175, 178, and 182 (USDOI, MMS, 1997). Since additional mitigations and recommendations were identified to avoid or mitigate potential impacts associated with the proposed action, this alternative was not selected.

2.3. APPROVAL OF THE PROPOSAL WITH EXISTING AND ADDITIONAL MITIGATION

Approval of the proposal with existing and additional mitigation is the selected alternative. The following additional mitigations and recommendations have been identified in the Potential Environmental Effects section (Chapter 4.1.2) of this PEA.

Mitigation 2.2 (Advisory) - Potential to exceed exemption level, DOCD

A deviation from your DOCD (such as additional drilling time, changes in the drilling schedule, and/or use of higher horsepower equipment, especially for the drilling rig and construction barges) could potentially cause the annual emissions exemption level for NO_x to be exceeded. Therefore, if such a deviation occurs, please be advised that you will immediately prepare a revised DOCD pursuant to 30 CFR 250.204(q)(2) to include the recalculated emission amounts and the air quality modeling required by 30 CFR 250.303(e). You will not proceed with the actions that could cause the potential exceedance until the revised DOCD has been submitted to and approved by this office.

Mitigation 2.5 (Advisory) - Fuel usage or run time documentation

The projected NO_x emissions amounts in your plan were calculated using historic (fuel consumption rates, run times). Therefore, please be advised that you will maintain records of the (total monthly fuel consumption, actual run times) for the ENSCO 7500 semisubmersible drilling unit and provide the information to this office (upon request, annually, upon project completion).

Mitigation 19.2 (Advisory) - ROV Survey Requirement

In accordance with NTL 2001-G04, the MMS has determined that you will need to conduct the ROV surveys you proposed in your plan for the facility location approved under this plan. Submit your pre- and post-installation survey reports within 60 days after the facility installation is completed.

Recommendation

The use of low sulfur fuel and NO_x control measures are recommended to reduce impacts on the air quality in the Breton Sound National Wilderness Area.

3. DESCRIPTION OF THE AFFECTED ENVIRONMENT

3.1. PHYSICAL ELEMENTS OF THE ENVIRONMENT

3.1.1. Water Quality

3.1.1.1. Coastal Water Quality

Nearshore water quality along the Gulf north-central coast is addressed because the Matterhorn Project is located off the mouth of the Mississippi River, offshore the Louisiana coast, and because accidental spills may make landfall in this region. The service bases for the development are located on or near the coast, and marine transportation to and from the site will traverse coastal waters.

The bays, estuaries, and nearshore coastal waters of the Gulf are highly important in that they provide important feeding, breeding, and/or nursery habitat for many important invertebrates, fishes, sea turtles, birds, and mammals. Water quality governs the suitability of these waters for animal as well as human use. Furthermore, the egg, larval, and juvenile stages of marine biota dependent upon these areas are typically more sensitive to water quality than adult stages. The quality of coastal waters is, therefore, an important issue.

A comprehensive assessment of water quality in coastal and estuarine waters of the GOM is contained in USEPA (1999a) and is not repeated here. The following material briefly highlights some of the key points concerning water quality in this region and is incorporated by reference.

Water quality in coastal waters of the GOM is highly influenced by season. For example, salinity in open water near the coast may vary between 29 and 32 ppt during fall and winter but fall to 20 ppt during spring and summer due to increased runoff (USDOI, MMS, 2001a). Oxygen and nutrient concentrations also vary seasonally.

More than 30 percent of the estuaries along the Gulf have impaired water quality to the point that they cannot support beneficial uses such as aquatic life support, recreational and commercial fisheries, and so forth (USEPA, 1999). Some of the industries and activities contributing to water quality degradation include petrochemical, agricultural, power production, pulp and paper, fish processing, municipal waste, shipping, and dredging. There are over 3,700 point sources of contamination that flow into the Gulf (Weber et al., 1992 *in* USDOI, MMS, 2001a), with municipalities, refineries, and petrochemical plants accounting for the majority of these point sources (USDOI, MMS, 2001a). Most of the industrial sources are in Texas and Louisiana with much lesser numbers in the remaining Gulf States. Vessels from the shipping and fishing industries, as well as recreational boaters, add a significant amount of contaminants to coastal water in the form of bilge water, waste, spills, and leaching from antifouling paints. Many millions of cubic feet of sediments are moved each year in coastal areas due to channelization, dredging, dredged material disposal, and shoreline modification in support of shipping and oil and gas activities. Water quality may be affected by these activities as they can facilitate saltwater intrusion, increased turbidity, release of contaminants, and so forth. Point-source discharges are now regulated and water quality should improve.

Nonpoint sources of contamination such as forestry, agriculture, and urban runoff are difficult to regulate and probably have the greatest impact on coastal water quality (USDOI, MMS, 2001a). Inland cities, farms, ranches, and various industries drain into waterways that empty into the Gulf. About 80 percent of U.S. croplands are upstream of the Gulf. The Gulf coastal area alone used 10 million pounds of pesticides in 1987 (USDOI, MMS, 2001a). Nutrient enrichment (nitrogen and phosphorus), mostly from river runoff, is another major water quality problem that can lead to noxious algal blooms, reduced seagrasses, fish kills, and oxygen depletion. The Mississippi River alone has been estimated to contribute more than 341,000 pounds of phosphorus and 1.68 million pounds of nitrogen to the Gulf per day.

Biological indicators of poor coastal water quality are evident in that 50 percent of the largest U.S. fish kills between 1980 and 1989 occurred in Texas and 50 percent of shellfish beds in Louisiana are closed annually because of contamination (USDOI, MMS, 2001a). On the other hand, Gulf States, although they had a number of "hot spots" for certain locations and contaminants, did not fare that badly when compared to other U.S. coastal waters during the major NOAA National Status and Trends Mussel Watch Program (USDOI, MMS, 2001a).

Sediment contamination in U.S. coastal waters is highly related to proximity to large industrialized cities. High levels for certain contaminants have been reported for all Gulf States (O'Connor, 1990). At least some contaminants are bioavailable, as evidenced by the 1986-1999 Mussel Watch Program (USDOI, MMS, 2001a).

3.1.1.2. Offshore Water Quality

Offshore marine waters in the GOM characterized by higher salinity (36.0-36.5 ppt) than inshore waters (USDOI, MMS, 2001a). The five watermasses identified in Appendix D (Physical Oceanography) can be recognized by their chemical characteristics such as salinity, dissolved oxygen (DO), nitrate, phosphate, and silicate. The Mississippi River exerts considerable influence on the Gulf, including the offshore.

The depth distribution of nutrients and DO in the deep water of the Gulf is similar to that of the Atlantic Ocean. The DO is highest at the surface due to photosynthesis and exchange with the atmosphere, and it generally decreases with depth due to respiration by various organisms (including bacteria), although higher oxygen concentrations may be encountered in cold watermasses. Nutrient concentrations are lowest in the upper water layers where they become depleted by photosynthetic activity and are highest in deep water. Nutrient and oxygen concentrations in the open water of the deep Gulf are not usually measurably affected by anthropogenic inputs.

Two unusual water quality phenomena occur in the Gulf: (1) hypersaline basins (e.g., 250 ppt in Orca Basin) and (2) mid-shelf freshwater vents (e.g., southwest Florida shelf springs). Another feature is the nepheloid layer, a thin, near-bottom, highly turbid layer that may play a role in transporting material, including contaminants, from nearshore to offshore waters. Hypoxic or oxygen-depleted bottom waters may be present in the northern Gulf off the mouth of the Mississippi River. This hypoxic area may be very large (16,500 km^2) from the river delta to Freeport, Texas, and is probably exacerbated by human inputs (USDOI, MMS, 2001a). Near-hypoxic conditions, unrelated to the river plume, may also be observed in the oceanic oxygen minimum at depths between 200 and 400 m; these conditions are low enough (2.5-3.0 ml/l) to affect the biota (USDOI, MMS, 2001a).

Offshore areas, particularly over deep water, can be considered almost pristine compared to the coastal waters, particularly off southern Texas and Florida (USDOI, MMS, 2001a). However, petroleum-related volatile organic carbons have been detected at offshore locations. Offshore Texas, Louisiana, and Alabama show detectable levels of petroleum hydrocarbons, likely from natural seeps (USDOI, MMS, 2001a). Similarly, trace metal concentrations are low relative to coastal waters (Boyle et al., 1984 *in* USDOI, MMS, 2001a).

Deepwater sediments, with the exception of barium concentrations in the vicinity of previous drilling activity, do not appear to contain elevated levels of metal contaminants (USDOI, MMS, 2001a). Reported total hydrocarbons, including biogenic (e.g., from plankton and other biological sources) hydrocarbons, in sediments collected from the Gulf slope range from 5 to 86 ng/g (Kennicutt et al., 1987 *in* USDOI, MMS, 2001a). Petroleum hydrocarbons, including aromatic hydrocarbons (<5 ppb) were present at all sites sampled, apparently varying more by distance along an isopleth than by depth (one transect from 300 to 3,000 m) (Gallaway et al., 2002; USDOI, MMS, 2001a). Land-derived material is widespread in the Gulf due to large riverine inputs and transport across the shelf to the slope by slumping, slope failure (Gallaway et al., 2002), and other processes. Natural seepage is considered to be a major source of petroleum hydrocarbons in the Gulf slope area (Kennicutt et al., 1987; Gallaway et al., 2002; USDOI, MMS, 2001a). The Northern Gulf of Mexico Continental Slope (NGMCS) study found that the concentration of hydrocarbons in slope sediments (except in seep areas) was lower than previous reports for shelf and coastal sediments, but no consistent decrease with increasing water depth was apparent below 300 m (Gallaway et al., 2002). In general, the Central Gulf had higher levels of hydrocarbons, particularly those from terrestrial sources than the western and eastern Gulf (Gallaway and Kennicutt, 1988). Total organic carbon was also highest in the Central Gulf. Hydrocarbons in sediments have been determined to influence biological communities of the Gulf slope, even when present in trace amounts (Gallaway and Kennicutt, 1988).

3.1.2. Air Quality

The proposed operations would occur west of 87.5 degrees west longitude and hence fall under the MMS's jurisdiction for enforcement of the Clean Air Act. The air over the OCS water is not classified, but it is presumed to be better than the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. The area involved, Mississippi Canyon Block 243, is in offshore waters, southeast of Plaquemines and St. Bernard Parishes, Louisiana. Plaquemines and St. Bernard Parishes are in the attainment of the NAAQS (USEPA, 2002).

The primary meteorological influences upon air quality and the dispersion of emissions are the wind speed and direction, the atmospheric stability, and the mixing height. The general wind flow for this area is driven by the clockwise circulation around the Bermuda High, resulting in a prevailing southeasterly to southerly flow. Superimposed upon this circulation are smaller scale effects such as the sea breeze effect, tropical cyclones, and mid-latitude frontal systems. Because of the various factors, the winds blow from all directions in the area of concern (USDOI, MMS, 1988).

Not all of the Pasquill-Gifford stability classes are routinely found offshore in the GOM. Specifically, the F stability class is rare. This is the extremely stable condition that usually develops at night over land with rapid radiative cooling; the GOM is incapable of losing enough heat overnight to set up a strong radiative inversion. Likewise, the A stability class is also rare. It is the extremely unstable condition that requires a very rapid warming of the lower layer of the atmosphere, along with cold air aloft. This is normally brought about when cold air is advected in aloft and strong insolation rapidly warms the earth's surface that, in turn, warms the lowest layer of the atmosphere. Once again, the ocean surface is incapable of warming rapidly; therefore, you would not expect to find stability class A over the GOM. For the most part, the stability is slightly unstable to neutral.

The mixing heights offshore are quite shallow, generally 900 m (2,953 ft) or less. The exception to this is close to shore, where the influence of the land penetrates out over the water for a short distance. Transient cold fronts also have an impact on the mixing heights; some of the lowest heights can be expected to occur with frontal passages and on the cold air side of the fronts. This effect is caused by the frontal inversion.

The operator's estimated air emissions for this proposed project are summarized below in Table 3-1. These estimates represent the worst-case scenario for the proposed project. The MMS's exemption levels are also shown for comparison.

Table 3-1

Projected Emissions for the Matterhorn Project

Year	PM	SO_x	NO_x	VOC	CO
2001	2.74	12.57	94.14	2.82	20.54
2002	19.46	89.27	668.93	20.07	145.95
2003	22.07	100.45	773.74	40.85	210.43
2004-2010	1.45	4.75	90.72	44.09	125.29

Note: The MMS's exemption levels for PM, SO_x, NO_x, and VOC is 832.5 tons, while the exemption level for CO is 29,069.6 tons.

3.2. BIOLOGICAL RESOURCES

3.2.1. Sensitive Coastal Environments

3.2.1.1. Coastal Barrier Beaches and Associated Dunes

General information on the types and status of coastal landforms in the central and Western Gulf is contained in USDOI, MMS (2001a). A brief description of that information is summarized below.

Barrier landforms include islands, spits, dunes, and beaches. They are usually long and narrow in shape, having been formed by reworked sediment transported by waves, currents, storm surges, and winds. Barrier landforms are in a state of constant change and they can be classified into two main types:

- Transgressive—where shorelines move inland and marine sediment deposits overlay terrestrial sediments. This type is usually rapidly eroding, low profile, with numerous washover channels.
- Regressive—where shorelines move seaward and terrestrial sediment deposits overlay marine sediments. This type is characterized by higher profile dunes, with few if any washover channels (USDOI, MMS, 2001a).

Both types are important ecologically. Barrier systems, particularly vegetated ones with fresh- and/or saltwater pools, may serve as habitat for a variety of fairly specialized species, including birds. The islands and spits protect the bays, lagoons, estuaries, salt marshes, seagrass beds, and other wetlands, some of which may contain threatened or endangered species.

The shore bases to be used by the activity, Port Fourchon and Venice, Louisiana, are located in transgressive areas, where rates of shoreline retreat are the highest of those around the Gulf.

3.2.1.2. Wetlands

Wetlands are virtually continuous along the Gulf Coast, especially along the Louisiana coast. Wetlands include seagrass beds, mudflats, mangroves, marshes (fresh, intermediate, brackish, and salt), and hardwood and cypress-tupelo swamps. They may occur as isolated pockets, narrow bands, or large areas (USDOI, MMS, 2001a).

High-productivity, high-detritus input, and extensive nutrient recycling characterize coastal wetlands. They are important habitats for a large number of invertebrate, fish, reptile, bird, and mammal species, including rare and endangered species, and high-value commercial and recreational species for at least part of their life cycles.

The GOM coastal wetlands represent about half of the Nation's wetland area. These wetlands help support the exceptionally productive coastal fisheries (e.g., Gulf ports account for four of the top five ports in the U.S. in terms of landed weight) and about 75 percent of the migratory waterfowl traversing the country (Johnston et al., 1995). The USDOC, NOAA (1990) and Johnston et al. (1995) estimated that, although wetland area has decreased substantially over the last 30 years, about 1.3 million ha of marshes, estuarine shrub-scrub, and freshwater forested/shrub-scrub remain on the Gulf Coast. Of these three categories, 80 percent is marsh, 19 percent is estuarine scrub-shrub, and 1 percent is forested wetland. Louisiana has the greatest area with 55 percent of the total (representing 69% of total marsh) followed by Florida (18%) (including 97% of total scrub-shrub, mostly mangrove), Texas (14%), and Mississippi (2%) (Johnston et al., 1995).

The National Biological Service (NBS) provides calculations of wetland losses that are more recent than the NOAA data. The NBS updates its wetland loss data every three years. Based on satellite imagery, NBS suggests that wetland losses are greater than previously thought although the rate of loss appears to be declining (Johnston et al., 1995). Since the 1980's, wetland areas have declined significantly around the Gulf (USDOI, MMS, 2001a). For these reasons, wetlands are an important issue when assessing impacts of coastal developments and/or accidental spills, in situations where spills may impinge on the coast. The shore bases to be used by the proposed activity, Port Fourchon and Venice, Louisiana, are located in areas where rates of wetland loss are the highest around the Gulf.

3.2.1.3. Seagrasses

Seagrass ecosystems are extremely productive and provide important habitat for wintering waterfowl, and spawning and feeding habitat for several species of fish and shellfish, and some endangered and threatened species of manatee and sea turtles. Seagrass losses in the Gulf have been extensive over the last 50 years. Although found in isolated patches and narrow bands along the entire Gulf Coast in shallow, clear, estuarine areas, seagrasses mostly occur in the eastern portion of the GOM between Mobile Bay and Florida Bay. Florida contains about 693,000 ha (about 68%) of the 1.02 million ha estimated for all the Gulf States (Handley, 1995).

Louisiana has a large amount of submerged vegetation but only a small area of seagrass (about 5,657 ha in 1988) (Handley, 1995). The shore bases to be used by the activity, Port Fourchon and Venice, Louisiana, are located in areas where seagrasses are very uncommon.

3.2.2. Deepwater Benthic Communities/Organisms

3.2.2.1. Chemosynthetic Communities

Chemosynthetic communities are defined as persistent, largely sessile assemblages of marine organisms dependent upon symbiotic chemosynthetic bacteria as their primary food source (MacDonald, 1992). Chemosynthetic clams, mussels, and tube worms, similar to (but not identical with) the hydrothermal vent communities of the eastern Pacific (Corliss et al., 1979) have been discovered in association with hydrocarbon seeps in the northern Gulf of Mexico. Bacteria live within specialized cells in these invertebrate organisms and are supplied with oxygen and chemosynthetic compounds by the host via specialized blood chemistry (Fisher, 1990). The host, in turn, lives off the organic products subsequently released by the chemosynthetic bacteria and may even feed on the bacteria themselves. Free-living chemosynthetic bacteria may also live in the substrate within the invertebrate communities and may compete with their symbionts for sulfide and methane energy sources. Initial discoveries of cold-water seep communities indicated that they are primarily associated with hydrocarbon and H_2S seep areas (Kennicutt et al., 1985; Brooks et al., 1986a). Since the initial discovery in 1984 of chemosynthetic communities dependent on hydrocarbon seepage in the GOM off the west coast of Florida, their geographic range has been found to include the Texas, Louisiana, and Alabama continental slope with a depth range varying from less than 500 m to 2,200 m (MacDonald, 1992). Four general community types have been described by MacDonald et al. (1990). These are communities dominated by vestimentiferan tube worms, mytilid mussels, and vesicomyid and infaunal lucinid or thyasirid clams. These faunal groups tend to display distinctive characteristics in terms of how they aggregate, the size of aggregations, the geological and chemical properties of the habitats in which they occur and, to some degree, the heterotrophic fauna that occur with them.

The reliance of deep-sea chemosynthetic communities on nonphotosynthetic carbon sources limits their distribution in the Gulf to areas where hydrocarbon sources are available. Within the northern Gulf, chemosynthetic communities are generally associated with slow oil and gas seeps, rapid expulsion mud volcanoes, and mineral seeps (Roberts and Carney, 1997). The most common hydrocarbon source is associated with seeps. Oil reservoirs beneath the Gulf include faults within source rock that have allowed oil and gas to migrate upward to the seafloor over the past several million years (Sassen et al., 1993). Hydrocarbons seeping to the surface diffuse through overlying sediments where bacterial degradation creates the chemosynthetic substrate taken up by symbiotic invertebrates. Vestimentiferan tube worms and lucinid and vesicomyid clams rely on H_2S, whereas mytilid mussels used dissolved CH_4. Mud volcanoes and mineral seeps provide similar chemosynthetic source material, but their occurrence in the Gulf is far less extensive than oil and gas seeps.

Hydrocarbon seep communities in the Central Gulf have been reported to occur at water depths between 290 and 2,200 m (Roberts et al., 1990; MacDonald, 1992). To date, there are 45 sites (in 42 blocks) across the northern Gulf of Mexico continental slope where the presence of chemosynthetic metazoans (dependent on hydrocarbon seepage) have been definitively documented (MacDonald, 1992; Boland, personal observations, 2000). One known community is located in Grid 15 in Viosca Knoll Block 826, which is more than 58 nmi to the northeast of the Matterhorn site. The total number of these communities in the Gulf is now known to exceed 50 (Gallaway et al., 2001). Future identification of chemosynthetic communities will likely rely on a combination of broad-scale geophysical sensing surveys followed by more detailed site-specific protocols including visual surveys by submersibles or remotely-operated vehicles (ROV's). A review for the potential occurrence of chemosynthetic communities was performed for the proposed Matterhorn Project. The conclusion of this analysis determined that all impacting factors related to the Matterhorn development in MC Block 243 are well removed from any area with potential for the existence of chemosynthetic communities.

3.2.2.2. Coral Reefs

Topographic features, along with their associated coral reef communities, are typically located on the shelf edge, shelf, and mid-shelf of the Western and Central Planning Areas of the GOM. These hard-bottom benthic communities support areas of high biomass, high diversity, and high numbers of plant and animal species. Additionally, topographic features support, either as shelter or food or both, large numbers of commercially and recreationally important fishes; and they provide a relatively pristine area suitable for scientific research. Shallow-water coral reefs are associated with topographic highs such as the well-known East and West Flower Gardens and a number of others in the Central Planning Area, but none of them are located in Grid 15. Deepwater coral reefs appear to be vary rare in the Gulf, albeit little studied (USDOI, MMS, 2000).

3.2.2.3. Deepwater Benthos

Marine benthic communities consist of a wide variety of single-celled organisms, plants, bacteria, invertebrates, and to some extent, even fish. Their lifestyles are extremely varied as well and can include absorption of dissolved organic material, symbiosis (e.g., chemosynthetic communities), collection of food through filtering, mucous webs, seizing, or other mechanisms.

It is convention in the Gulf region to classify benthic animals according to size as megafauna (large, usually mobile animals on the surface), macrofauna (retained on 0.25- to 0.50-mm mesh size sieve), meiofauna (0.063-mm screen; mostly nematode worms), and microfauna (protists and bacteria). The four types are discussed briefly below.

3.2.2.3.1. Megafauna

Animals of a size typically caught in trawls and large enough to be easily visible (e.g., crabs, shrimp, benthic fish, etc.) are called megafauna. In the Gulf, most are crustaceans, echinoderms, or benthic fish.

Megafaunal invertebrate and benthic fish densities appear to decline with depth between the upper slope and the abyssal plain (Pequegnat 1983; Pequegnat et al., 1990). This phenomenon is generally believed to be related to the low productivity in deep, offshore Gulf waters (USDOI, MMS, 2001a). Megafaunal communities in the offshore Gulf have historically been zoned by depth strata which are typified by certain species assemblages (Menzies et al., 1973; Pequegnat, 1983; Gallaway et al., 1988; Gallaway, 1988; Pequegnat et al., 1990; and USDOI, MMS, 2001a). These zones include the following:

- Shelf/Slope Transition Zone (100-500 m) — Echinoderms, crustaceans, and several species of abundant fish.
- Archibenthal Zone (Horizon A) (500-775m) — Galatheid crabs, rat tail fishes, large sea cucumbers, and sea stars are abundant.
- Archibenthal Zone (Horizon B) (800-1,000 m) — Galatheid crabs and rat tail fishes are abundant; fishes, echinoderms, and crustaceans decline; characterized by the red crab, Chaceon quinquedens.
- Upper Abyssal Zone (1,000-2,000 m) — Number of fish species decline while the number of invertebrate species appear to increase; sea cucumbers, Mesothuria lactea and Benthodytes sanguinolenta are common; galatheid crabs include 12 species of the deep-sea genera Munida and Munidopsis, while the shallow brachyuran crabs decline.
- Mesoabyssal Zone (2,300-3,000 m) — Fish species are few and echinoderms continue to dominate the megafauna.
- Lower Abyssal Zone (3,200-3,800 m) — Large asteroid, Dytaster insignis, is the most common megafaunal species.

Carney et al. (1983) postulated a simpler system of zonation having three zones: (1) a distinct shelf assemblage in the upper 1,000 m; (2) indistinct fauna between 1,000 and 2,000 m; and (3) a distinct slope fauna between 2,000 and 3,000 m.

The baseline NGMCS Study conducted in the mid- to late 1980's trawled 5,751 individual fish and 33,695 invertebrates, representing 153 and 538 taxa, respectively. That study also collected 56,052 photographic observations, which included 76 fish taxa and 193 non-fish taxa. Interestingly, the photographic observations were dominated by holothurians, bivalves, and sea pens, groups that were not sampled effectively (if at all) by trawling. Decapod crustaceans dominated the trawls and were fourth in the photos from an abundance perspective. Decapod density generally declined with depth but with peaks at 500 m and between 1,100 and 1,200 m, after which depth abundance was; quite low. Fish density, while variable, was generally high at depths between 300 and 1,200 m; then declined substantially.

Gallaway et al. (2002, submitted) concluded that megafaunal composition changes continually with depth such that a distinct upper slope fauna penetrates to about 1,200 m depths and a distinct deep-slope fauna is present below 2,500 m. A broad transition zone characterized by low abundance and diversity occurs between depths of 1,200 and 2,500 m. The proposed Matterhorn development, at depths ranging from 760 to 850 m, lies within the distinct upper slope zone described above.

3.2.2.3.2. Macrofauna

The benthic macrofaunal component of the NGMCS Study (Gallaway, 1988) included sampling in nearby grids (Grid 12, 13, and 14). A transect (the central transect) of 11 baseline stations from 305 m to nearly the 3,000-m contour was sampled in this study. All of these data are relevant to the proposed Matterhorn development because they were taken from the same geographic area and encompass the same depths and substrates.

The NGMCS Study examined 69,933 individual macrofauna from over 1,548 taxa; 1,107 species from 46 major groups were identified (Gallaway, 1988). Polychaetes (407 species), mostly deposit-feeding forms (196 taxa), dominated in terms of numbers. Carnivorous polychaetes were more diverse, but less numerous than deposit-feeders, omnivores, or scavengers (Pequegnat et al., 1990; Gallaway, 1988). Polychaetes were followed in abundance by nematodes, ostracods, harpacticoid copepods, bivalves, tanaidacids, bryozoans, isopods, amphipods, and others. Overall abundance of macrofauna ranged from 518 to 5,369 individuals/m^2 (Gallaway, 1988). The central transect (4,938 individuals/m^2) had higher macrofaunal abundance than either the eastern or Western Gulf transects (4,869 and 3,389 individuals/m^2, respectively) (Gallaway et al., 2002).

In the GOM, macrofaunal density and biomass declines with depth from approximately 5,000 individuals/m^2 on the lower shelf-upper slope to several hundred individuals/m^2 on the abyssal plain (USDOI, MMS, 2001b). This decline in benthos has been attributed to the relatively low productivity of the Gulf offshore open waters (USDOI, MMS, 2001b). However, Pequegnat et al. (1990) have reported mid-depth maxima of macrofauna in the upper slope at some locations of high organic particulate matter, and Gallaway et al. (2002) noted that the decline with depth is not clear cut and is somewhat obscured by sampling artifacts.

There is some suggestion that sizes of individual macrofauna decrease with depth (Gallaway, 1988) and that the size of individuals are generally small. Macrofaunal abundance appears to be higher in spring than in fall (Gallaway, 1988).

Macrofauna in the Gulf appears to have lower densities but higher diversities than the Atlantic, especially above 1,000 m, whereas at deep depths the fauna are less dissimilar in densities and very similar in diversities (Gallaway, 1988).

3.2.2.3.3. Meiofauna

Meiofauna (primarily composed of small nematode worms), as with megafauna and macrofauna, also decline in abundance with depth (Pequegnat et al., 1990; Gallaway, 1988; USDOI, MMS, 2001b). The overall density (mean of 707,000/m^2) of meiofauna is approximately two orders of magnitude greater than the macrofauna throughout the depth range of the slope (Gallaway, 1988). These authors reported 43 major groups of meiofauna with nematodes, harpacticoid copepods (adults and larvae), polychaetes, ostracods, and Kinorhyncha, accounting for 98 percent of the total numbers. Nematodes and harpacticoids were dominant in terms of numbers, but polychaetes and ostracods were dominant in terms of biomass, a feature that was remarkably consistent across all stations, regions, seasons, and years (Gallaway et al., 2002). Meiofaunal densities appeared to be somewhat higher in the spring than in the fall. Meiofaunal densities reported in the NGMCS Study are among the highest recorded worldwide (Gallaway et al., 2002). There is also evidence that the presence of chemosynthetic communities may enrich the density and diversity of meiofauna in the immediate surrounding area (Gallaway et al., 2002).

The above conclusions were partially based on the collections from the NGMCS Study stations in adjacent Grid 12 and 13 (the Central Gulf transect) (see also “Macrofauna” above). The Central Gulf transect appeared to contain a higher abundance of meiofauna than transects in the Eastern or Western

Gulf, and, in general, there was a trend of decreasing meiofauna numbers with depth (Gallaway et al., 2002).

3.2.2.3.4. Microbiota

Less is known about the microbiota than the other groups in the GOM, especially in deep water (USDOI, MMS, 2000). As reported by Rowe (CSA, 2000), the microbiota of the deep Gulf sediments is not well characterized. While direct counts have been coupled with some *in situ* and re-pressurized metabolic studies performed in other deep ocean sediments (Deming and Baross, 1993), none have been made in the deep GOM. Cruz-Kaegi (1998) made direct counts using a fluorescing nuclear stain at several depths down the slope, allowing bacterial biomass to be estimated from their densities and sizes. Mean biomass was estimated to be 2.37 g $C \cdot m^{-2}$ for the shelf and slope combined, and 0.37 g $C \cdot m^{-2}$ for the abyssal plain. In terms of biomass, data indicate that bacteria are the most important component of the functional infaunal biota. Cruz-Kaegi (1998) developed a carbon cycling budget based on estimates of biomass and metabolic rates in the literature. She discovered that, on the deep slope of the Gulf, the energy from organic carbon in the benthos is cycled through bacteria.

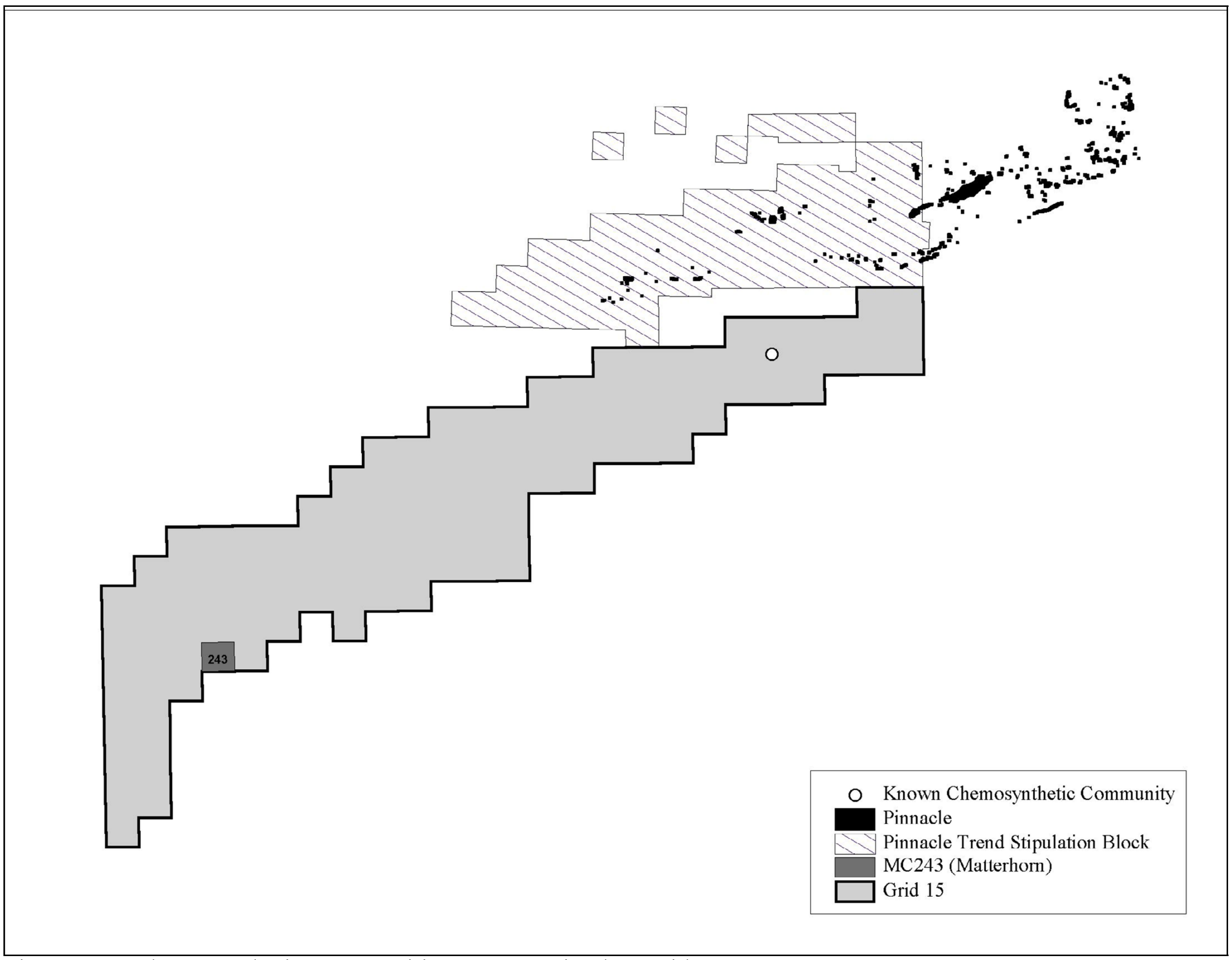

Figure 3-1. Chemosynthetic Communities In or Proximal to Grid 15.

3.2.3. Marine Mammals

Twenty-nine species of marine mammals are known to occur in the GOM (Davis et al., 2000). The Gulf's marine mammals are represented by members of the taxonomic order Cetacea, which is divided into the suborders Mysticeti (i.e., baleen whales) and Odontoceti (i.e., toothed whales, dolphins, and their allies), as well as the order Sirenia, which include the manatee and dugong. Within the GOM, there are 28 species of cetaceans (7 mysticete and 21 odontocete species) and 1 sirenian species, the manatee (Jefferson et al., 1992).

3.2.3.1. Nonthreatened and Nonendangered Species

Cetaceans – Mysticetes

Bryde's Whale (Balaenoptera edeni)

The Bryde's whale (*Balaenoptera edeni*) is the second smallest of the balaenopterid whales and it is generally confined to tropical and subtropical waters (i.e., between lat. 40º N. and lat. 40º S.) (Cummings, 1985). Unlike some baleen whales, it does not have a well-defined breeding season in most areas; thus, calving may occur throughout the year. The Bryde's whale feeds on small pelagic fishes and invertebrates (Leatherwood and Reeves, 1983; Cummings, 1985; Jefferson et al., 1993). There are more records of Bryde's whale than of any other baleen whale species in the northern GOM. It is likely that the Gulf represents at least a portion of the range of a dispersed, resident population of Bryde's whale (Jefferson and Schiro, 1997). Bryde's whale in the northern Gulf, with few exceptions, have been sighted along a narrow corridor near the 100-m (328-ft) isobath (Davis and Fargion, 1996; Davis et al., 2000). Most sightings have been made in the DeSoto Canyon region and off western Florida, though there have been some in the west-central portion of the northeastern Gulf. Group sizes range from one to seven animals.

Minke Whale (Balaenoptera acutorostrata)

The minke whale *(Balaenoptera acutorostrata*) is a small rorqual that is widely distributed in tropical, temperate, and polar waters. Minke whales may be found offshore but appear to prefer coastal waters. Their diet consists of invertebrates and fishes (Leatherwood and Reeves, 1983; Stewart and Leatherwood, 1985; Jefferson et al., 1993; Würsig et al., 2000).

The North Atlantic population migrates southward during winter months to the Florida Keys and the Caribbean Sea. There are 10 reliable records of minke whales in the GOM and all are the result of strandings (Jefferson and Schiro, 1997). Most records from the Gulf have come from the Florida Keys, although strandings in western and northern Florida, Louisiana, and Texas have been reported (Jefferson and Schiro, 1997). Sightings data suggest that minke whales either migrate into Gulf waters in small numbers during the winter or, more likely, that sighted individuals represent strays from low-latitude breeding grounds in the western North Atlantic (Jefferson and Schiro, 1997; Davis et al., 1998 and 2000).

Cetaceans — Odontocetes

Pygmy and Dwarf Sperm Whales (Family Kogiidae)

The pygmy sperm whale *(Kogia breviceps*) and its congener, the dwarf sperm whale *(K. sima*), are medium-sized toothed whales that feed on cephalopods and, less often, on deep-sea fishes and shrimps (Leatherwood and Reeves, 1983; Jefferson et al., 1993; Caldwell and Caldwell, 1989). Hence, they inhabit oceanic waters in tropical to warm temperate zones (Jefferson and Schiro, 1997). They appear to be most common in waters over the continental slope and along the shelf edge. Little is known of their natural history, although a recent study of *Kogia* in South Africa has determined that these two species attain sexual maturity much earlier and live fewer years than other similarly sized toothed whales (Plön and Bernard, 1999).

Kogia have been sighted throughout the Gulf in waters that vary broadly in depth and seafloor topographies (Mullin et al., 1991; Davis et al., 1998 and 2000). The GulfCet I study reported these animals in waters with a mean bottom depth of 929 m (Davis et al., 1998). *Kogia* have been sighted over the continental shelf, but there is insufficient evidence that they regularly inhabit continental shelf waters. *Kogia* sightings made during GulfCet aerial surveys (1992-97) in all waters between the 100-m and 2,000-m isobaths. Data also indicate that *Kogia* may associate with frontal regions along the shelf break and upper continental slope, areas with high epipelagic zooplankton biomass (Baumgartner, 1995). During the GulfCet II study, *Kogia* were widely distributed in the oceanic northern Gulf, including slope waters of the eastern Gulf. *Kogia* frequently strand on the coastline of the northern Gulf, more often in the eastern Gulf (Jefferson and Schiro, 1997). Between 1984 and 1990, 22 pygmy sperm whales and 10 dwarf sperm whales stranded in the GOM.

Beaked Whales (Family Ziphiidae)

Two genera and four species of beaked whales occur in the GOM. These encompass (1) three species of the genus *Mesoplodon* (Sowerby's beaked whale [*M. biden*s], Blainville's beaked whale [*M. densirostri*s], and Gervais' beaked whale [*M. europaeu*s]) and (2) one species of the genus *Ziphiu*s; Cuvier's beaked whale *(Ziphius cavirostri*s). Morphological similarities among species in the genus *Mesoplodon* make identification of free-ranging animals difficult. Generally, beaked whales appear to prefer oceanic waters, although little is known of their respective life histories. Stomach content analyses suggest that these whales feed primarily on deepwater cephalopods, although they also consume some mesopelagic fishes and deepwater benthic invertebrates (Leatherwood and Reeves, 1983; Heyning, 1989; Mead, 1989; Jefferson et al., 1993).

In the northern Gulf, beaked whales are broadly distributed in waters greater than 1,000 m over lower slope and abyssal landscapes (Davis et al., 1998 and 2000). Group sizes of beaked whales observed in the northern Gulf comprise 1-4 individuals per group (Mullin et al., 1991; Davis and Fargion, 1996; Davis et al., 2000). Sightings data indicate that Cuvier's beaked whale is probably the most common beaked whale in the Gulf (Jefferson and Schiro, 1997; Davis et al., 1998 and 2000). Wursig et al. (2000) indicate there are 18 documented strandings of Cuvier's beaked whales in the GOM. The Gervais' beaked whale is probably the most common mesoplodont in the northern Gulf, as suggested by stranding records (Jefferson and Schiro, 1997). Wursig et al. (2000) states there are four verified stranding records of Blainville's beaked whales from the GOM. Additionally, one beaked whale sighted during GulfCet II was determined to be a Blainville's beaked whale (Davis et al., 2000). Sowerby's beaked whale is represented in the Gulf by only a single record, a stranding in Florida; this record is considered extralimital since this species normally occurs much farther north in the North Atlantic (Jefferson and Schiro, 1997).

Dolphins (Family Delphinidae)

Atlantic Spotted Dolphin (Stenella frontalis)

The Atlantic spotted dolphin (*Stenella frontalis*) is endemic to the Atlantic Ocean within tropical to temperate zones. Surveys in the northern Gulf documented the Atlantic spotted dolphin primarily over the continental shelf and shelf edge in waters that were less than 250 m in depth, although some individuals were sighted along the slope in waters of up to approximately 600 m (1,969 ft) (Davis et al., 1998). Mills and Rademacher (1996) found the principal depth range of the Atlantic spotted dolphin to be much shallower at 15-100 m water depth. Griffin and Griffin (1999) found Atlantic spotted dolphins on the eastern Gulf continental shelf in waters greater than 20 m (30 km from the coast). A satellite-tagged Atlantic spotted dolphin was found to prefer shallow water habitat and make short dives (Davis et al., 1996). Atlantic spotted dolphins are sighted more frequently in areas east of the Mississippi River (Mills and Rademacher, 1996). Perrin et al. (1994a) relate accounts of brief aggregations of smaller groups of Atlantic spotted dolphins (forming a larger group) off the coast of northern Florida. While not well substantiated, these dolphins may demonstrate seasonal nearshore-offshore movements that appear to be influenced by prey availability and water temperature (Wursig et al., 2000). They are known to feed on a wide variety of fishes, cephalopods, and benthic invertebrates (Leatherwood and Reeves, 1983; Jefferson et al., 1993; Perrin et al., 1994a).

Bottlenose Dolphin (Tursiops truncatus)

The bottlenose dolphin *(Tursiops truncatu*s) is a common inhabitant of the continental shelf and upper slope waters of the northern Gulf. It is the most widespread and common cetacean observed in the northern GOM. Sightings of this species in the northern Gulf are rare beyond approximately the 1,200-m (3,937-ft) isobath (Mullin et al., 1994a; Jefferson and Schiro, 1997; Davis et al., 2000). There appears to be two ecotypes of bottlenose dolphins, a coastal form and an offshore form (Hersh and Duffield, 1990; Mead and Potter, 1990). The coastal or inshore stock(s) is genetically isolated from the offshore stock

(Curry and Smith, 1997). Genetic data also support the concept of relatively discrete bay, sound, and estuary stocks (Waring et al., 1999). In the northern Gulf of Mexico, bottlenose dolphins appear to have an almost bimodal distribution: a shallow water (16-67 m) and a shelf break (about 250 m) region. These regions may represent the individual depth preferences of the coastal and offshore forms (Baumgartner, 1995). Little is known of the behavior or ranging patterns of offshore bottlenose dolphins. Bottlenose dolphins are opportunistic feeders, taking a wide variety of fishes, cephalopods, and shrimp (Davis and Fargion, 1996; Jefferson and Schiro, 1997; Wells and Scott, 1999). Mating and calving occurs primarily from February through May.

Clymene Dolphin (Stenella clymene)

The Clymene dolphin *(Stenella clymene*) is endemic to the Atlantic Ocean and found only in tropical and subtropical waters (Perrin and Mead, 1994). Data suggest that Clymene dolphins are widespread within deeper Gulf waters (i.e., shelf edge and slope) (Davis et al., 2000; Würsig et al., 2000). The Clymene dolphin represents a significant component of the northern Gulf of Mexico cetacean assemblage (Mullin et al., 1994b). However, the few records of the Clymene dolphin in the northern Gulf in the past were probably a result of this species' recently clarified taxonomic status and the tendency for observers to confuse it with other species (Jefferson and Schiro, 1997). Sightings made during GulfCet surveys indicate the Clymene dolphin to be widely distributed in the western oceanic Gulf during spring and in the northeastern Gulf during summer and winter. Also, most sightings tended to occur in the central portion of the study area, west of the Mississippi Delta and east of Galveston Bay. Clymene dolphins have been sighted in water depths of 612-1,979 m (Davis et al., 1998). This species appears to feed on fishes and cephalopods (Leatherwood and Reeves, 1983; Jefferson et al., 1993; Mullin et al., 1994b).

False Killer Whale (Pseudorca crassidens)

The false killer whale (*Pseudorca crassidens*) occurs in oceanic waters of tropical and warm temperate zones (Odell and McClune, 1999). Most sightings have been made in waters exceeding 200 m, although there have been sightings from over the continental shelf (Davis and Fargion, 1996). Although sample sizes are small, most false killer whale sightings have been east of the Mississippi River (Mullin and Hansen, 1999). False killer whales primarily eat fish and cephalopods, but they have been known to attack other toothed whales (Leatherwood and Reeves, 1983; Jefferson et al., 1993).

Fraser's Dolphin (Lagenodelphis hosei)

The Fraser's dolphin (*Lagenodelphis hosei*) has a pantropical distribution (Perrin et al., 1994b) in oceanic waters and in areas where deep water approaches the coast. Fraser's dolphins feed on fishes, cephalopods, and crustaceans (Leatherwood and Reeves, 1983; Jefferson et al., 1993; Jefferson and Schiro, 1997). This species was previously known to occur in the northern Gulf based on a mass stranding in the Florida Keys in 1981 (Hersh and Odell, 1986). From 1992 to 1996, there were at least three strandings in Florida and Texas (Würsig et al., 2000). GulfCet ship-based surveys led to sightings of two large herds (greater than 100 individuals) and first-time recordings of sounds produced by these animals (Leatherwood et al., 1993). Fraser's dolphins have been sighted in the western and eastern Gulf at depths of around 1,000 m (3,281 ft) (Leatherwood et al., 1993; Davis and Fargion, 1996; Jefferson and Schiro, 1997; Davis et al., 2000).

Killer Whale (Orcinus orca)

The killer whale (*Orcinus orca*) is a cosmopolitan species that occurs in all oceans and seas (Dahlheim and Heyning, 1999). Generally, they appear to inhabit coastal, cold temperate and subpolar zones. Most killer whale sightings in the northern Gulf have been in waters greater than 200 m deep, although there are sightings made from over the continental shelf (Davis and Fargion, 1996). Killer whales are found almost exclusively in a broad area of the north-Central Gulf (Jefferson and Schiro, 1997; O'Sullivan and Mullin, 1997; Mullin and Hansen, 1999). There was a sighting in May 1998 of killer whales in DeSoto Canyon (Ortega, personal communication, 1998). Worldwide, killer whales feed on marine mammals, marine birds, sea turtles, cartilaginous and bony fishes, and cephalopods

(Leatherwood and Reeves, 1983; Jefferson et al., 1993). An attack by killer whales on a group of pantropical spotted dolphins was observed during one of the GulfCet surveys (O'Sullivan and Mullin, 1997).

Melon-headed Whale (Peponocephala electra)

The melon-headed whale *(Peponocephala electra*) is a deepwater, pantropical species (Perryman et al., 1994) that feeds on cephalopods and fishes (Leatherwood and Reeves, 1983; Jefferson et al., 1993; Mullin et al., 1994c; Jefferson and Schiro, 1997). Sightings of this species in the northern Gulf have been primarily in continental slope waters west of the Mississippi River (Jefferson and Schiro, 1997; Davis et al., 1998 and 2000; Mullin and Hansen, 1999). The first two records of this species occurrence in the Gulf are recent strandings—one in Texas in 1990 and the other in Louisiana in 1991 (Barron and Jefferson, 1993). GulfCet surveys resulted in many sightings of melon-headed whales, suggesting that this species is a regular inhabitant of the Gulf of Mexico (e.g., Mullin et al., 1994a).

Pantropical Spotted Dolphin (Stenella attenuata)

The pantropical spotted dolphin *(Stenella attenuat*a) is distributed in tropical and subtropical marine waters of the world (Perrin and Hohn, 1994). It is the most common cetacean in the oceanic northern Gulf (Mullin et al., 1994a; Davis and Fargion, 1996; Davis et al., 2000). Pantropical spotted dolphins are typically found in waters deeper than 1,200 m deep (Mullin et al., 1994a; Davis et al., 1998 and 2000) but have been sighted over the continental shelf (Mullin et al., 1994a). It feeds on epipelagic fishes and cephalopods (Leatherwood and Reeves, 1983; Jefferson et al., 1993).

Pygmy Killer Whale (Feresa attenuata)

The pygmy killer whale (*Feresa attenuata*) occurs in tropical and subtropical waters throughout the world (Ross and Leatherwood, 1994), although little is known of its biology or ecology. Its diet includes cephalopods and fishes, though reports of attacks on other dolphins have been reported (Leatherwood and Reeves, 1983; Jefferson et al., 1993). The pygmy killer whale does not appear to be common in the Gulf and most records are of strandings (Jefferson and Schiro, 1997). Fourteen strandings have been documented from southern Florida to south Texas. Four ship sightings occurred during the GulfCet surveys, once off the south Texas coast in November and three in the spring in the west-central portion of the GulfCet study area. Sightings of this species have been at depths of 500-1,000 m (1,641-3,281 ft) (Jefferson and Schiro, 1997; Davis et al., 1998 and 2000).

Risso's Dolphin (Grampus griseus)

The Risso's dolphin (*Grampus griseus*) is a pantropical species that inhabits deep oceanic and continental slope waters of tropical and warm temperate zones (Kruse et al., 1999). Risso's dolphins in the northern Gulf have been frequently sighted along the shelf edge, along the upper slope, and most commonly, over or near the 200-m water isobath just south of the Mississippi River in recent years (Würsig et al., 2000). A strong correlation between Risso's dolphin distribution and the steeper portions of the upper continental slope is most likely the result of cephalopod distribution along the continental slope (Baumgartner, 1997; Davis et al., 2000). Risso's dolphins have been sighted over the continental shelf at water depths less than 200 m (Mullin et al., 1994a; Davis et al., 1998). Strandings and GulfCet sightings have occurred in all seasons in the GOM and it is likely that Risso's dolphins occur year round in the GOM. Risso's dolphins feed primarily on squid and secondarily on fishes and crustaceans (Leatherwood and Reeves, 1983; Jefferson et al., 1993; Baumgartner, 1997; Würsig et al., 2000).

Rough-toothed Dolphin (Steno bredanensis)

The rough-toothed dolphin (*Steno bredanensis*) occurs in tropical to warm temperate marine waters globally (Miyazaki and Perrin, 1994). Sightings in the northern Gulf occur primarily over the deeper waters (950-1,100 m) off the continental shelf (Mullin et al., 1994a; Davis et al., 1998). Most sightings of the rough-toothed dolphin have been west of the Mississippi River (Mullin and Hansen, 1999); however, a mass stranding of 62 rough-toothed dolphins occurred near Cape San Blas, Florida, on December 14,

1997. Four of the stranded dolphins were rehabilitated and released; three carried satellite-linked transmitters (Wells et al., 1999). Water depth at tracking locations of these individuals averaged 195 m. Data from the tracked individuals, in addition to sightings at Santa Rosa Beach on December 28-29, 1998 (Rhinehart et al., 1999), suggest a regular occurrence of this species in the northern Gulf. This species feeds on cephalopods and fishes (Leatherwood and Reeves, 1983; Jefferson et al., 1993).

Short-finned Pilot Whale (Globicephala macrorhynchus)

The short-finned pilot whale (*Globicephala macrorhynchus*) is found in warm temperate to tropical marine waters of the world, generally in deep offshore areas (Bernard and Reilly, 1999). In the northern Gulf, it is most commonly sighted along the continental slope at depths of 250-2,000 m (Jefferson and Schiro, 1997; Davis et al., 1998 and 2000). Short-finned pilot whales have been sighted almost exclusively west of the Mississippi River (Mullin and Hansen, 1999). There was one sighting of short-finned pilot whales in the slope in the eastern Gulf during GulfCet II, in the extreme western part of the study area (Davis et al., 2000). Stranding records have declined dramatically over the past decade, which contributes to the evidence (though not conclusively) that this population may be declining in the GOM. Squid are the predominant prey, with fishes being consumed occasionally.

Spinner Dolphin (Stenella longirostris)

The spinner dolphin *(Stenella longirostri*s) occurs worldwide in tropical oceanic waters (Perrin and Gilpatrick, 1994; Jefferson and Schiro, 1997). In the northern Gulf, most sightings of spinner dolphins have been east of the Mississippi River at depths of 500-1,800 m (1,641-5,906 ft) (Jefferson and Schiro, 1997; Mullin and Hansen, 1999; Davis et al., 2000). Spinner dolphins have mass stranded on two occasions in the GOM, each time on the Florida coast. Spinner dolphins appear to feed on fishes and cephalopods (Würsig et al., 2000).

Striped Dolphin (Stenella coeruleoalba)

The striped dolphin *(Stenella coeruleoalba*) occurs in tropical and subtropical oceanic waters (Perrin et al., 1994c). Sightings in the northern Gulf occur primarily over the deeper waters beyond the continental shelf (Jefferson and Schiro, 1997; Davis et al., 2000; Würsig et al., 2000). Striped dolphins feed primarily on small mid-water squid and fishes (especially lanternfish).

3.2.3.2. Threatened and Endangered Species

Cetaceans — Mysticetes

Blue Whale (Balaenoptera musculus)

The blue whale (*Balaenoptera musculus*) is the largest animal known. It feeds almost exclusively on concentrations of zooplankton (Yochem and Leatherwood, 1985; Jefferson et al., 1993). The blue whale occurs in all major oceans of the world; some blue whales are resident, some are migratory (Jefferson et al., 1993; USDOC, NMFS, 1998). Those that migrate move to feeding grounds in polar waters during spring and summer, after wintering in subtropical and tropical waters (Yochem and Leatherwood, 1985). Records of the blue whale in the northern Gulf consist of two strandings on the Texas coast (Lowery, 1974). There appears to be little justification for considering the blue whale to be a regular inhabitant of the GOM (Jefferson and Schiro, 1997).

Fin Whale (Balaenoptera physalus)

The fin whale (*Balaenoptera physalus*) is an oceanic species that occurs worldwide in marine waters and is most commonly sighted where deep water approaches the coast (Jefferson et al., 1993). Fin whales feed on concentrations of zooplankton, fishes, and cephalopods (Leatherwood and Reeves, 1983; Jefferson et al., 1993). The fin whale makes seasonal migrations between temperate waters, where it mates and calves, and polar feeding grounds that are occupied during summer months. Their presence in the northern Gulf is considered rare (Würsig et al., 2000). Sightings in the northern Gulf have typically been made in oceanic waters, chiefly in the north-central region of the Gulf (Mullin et al., 1991). There are seven reliable reports of fin whales in the northern Gulf, indicating that fin whales are not abundant in the GOM (Jefferson and Schiro, 1997). Sparse sighting data on this species suggest that individuals in the northern Gulf may be extralimital strays from their western Atlantic population (Jefferson and Schiro, 1997; Würsig et al., 2000).

Humpback Whale (Megaptera novaeangliae)

The humpback whale (*Megaptera novaeangliae*) occurs in all oceans, feeding in higher latitudes during spring, summer, and autumn, and migrating to a winter range over shallow tropical banks, where they calve and presumably conceive (Jefferson et al., 1993). Humpback whales feed on concentrations of zooplankton and fishes using a variety of techniques that concentrate prey for easier feeding (Winn and Reichley, 1985; Jefferson et al., 1993). There have been occasional reports of humpback whales in the northern Gulf off Florida: a confirmed sighting of a humpback whale in 1980 in the coastal waters off Pensacola (Weller et al., 1996); two questionable records of humpback whale sightings from 1952 and 1957 off the coast of Alabama (Weller et al., 1996); a stranding east of Destin, Florida, in mid-April 1998 (Mullin, personal communication, 1998); and a confirmed sighting of six humpback whales in May 1998 in DeSoto Canyon (Ortega, personal communication, 1998). Most recently, a lone humpback whale was photographed at Main Pass 281 in December 2001. Humpback whales sighted in the GOM may be extralimital strays during their breeding season or during their migrations (Würsig et al., 2000). The time of the year (winter and spring) and the small size of the animals involved in many sightings suggest the likelihood that these records are of inexperienced juveniles on their first return migration northward (Weller et al., 1996).

Northern Right Whale (Eubalaena glacialis)

The northern right whale (*Eubalaena glacialis*) inhabits primarily temperate and subpolar waters. Northern right whales range from wintering and calving grounds in coastal waters of the southeastern United States to summer feeding, nursery, and mating grounds in New England waters and northward to the Bay of Fundy and the Scotian Shelf. During the winter, a portion of the population moves from the summer foraging grounds to the calving/breeding grounds off Florida, Georgia, and South Carolina. Right whales forage primarily on subsurface concentrations of zooplankton such as calanoid copepods by skim feeding with their mouths agape (Watkins and Schevill, 1976; Leatherwood and Reeves, 1983; Jefferson et al., 1993).

Confirmed historical records of northern right whales in the GOM consist of a single stranding in Texas (Schmidly et al., 1972) and a sighting off Sarasota County, Florida (Moore and Clark, 1963; Schmidly, 1981). The northern right whale is not considered a resident (year-round or seasonal) of the GOM; existing records probably represent extralimital strays from the wintering grounds of this species off the southeastern United States from Georgia to northeastern Florida (Jefferson and Schiro, 1997).

Sei Whale (Balaenoptera borealis)

The sei whale (*Balaenoptera borealis*) is an oceanic species that is not often seen close to shore (Jefferson et al., 1993). They occur in marine waters from the tropics to polar regions but are more common in mid-latitude temperate zones (Jefferson et al., 1993). Sei whales feed on concentrations of zooplankton, small fishes, and cephalopods (Gambell, 1985; Jefferson et al., 1993). The sei whale is represented in the northern Gulf by only four reliable records (Jefferson and Schiro, 1997). One stranding was reported for the Florida Panhandle and three strandings were in eastern Louisiana (Jefferson and Schiro, 1997). This species' occurrence in the northern Gulf is considered most likely to be accidental.

Cetaceans — Odontocetes

Sperm Whale (Physeter macrocephalus)

The sperm whale (*Physeter macrocephalus*) inhabits marine waters from the tropics to the pack-ice edges of both hemispheres, although generally only large males venture to the extreme northern and southern portions of their range (Jefferson et al., 1993). In general, sperm whales seem to prefer certain areas within each major ocean basin, which historically have been termed "grounds" (Rice, 1989). As deep divers, sperm whales generally inhabit oceanic waters, but they do come close to shore where submarine canyons or other geophysical features bring deep water near the coast (Jefferson et al., 1993). Sperm whales prey on cephalopods, demersal fishes, and benthic invertebrates (Rice, 1989; Jefferson et al., 1993).

The sperm whale is the only great whale that is considered to be common in the northern Gulf (Fritts et al., 1983a; Mullin et al., 1991; Davis and Fargion, 1996; Jefferson and Schiro, 1997). Sighting data suggest a northern Gulfwide distribution over slope waters. Congregations of sperm whales are commonly found in waters over the shelf edge in the vicinity of the Mississippi River delta in waters that are 500-2,000 m (1,641-6,562 ft) in depth (Mullin et al., 1994a; Davis and Fargion, 1996; Davis et al., 2000). Sperm whale sightings in the northern Gulf chiefly occur in waters with a mean seafloor depth of 1,105 m (Davis et al., 1998). Mesoscale biological and physical patterns in the environment are important in regulating sperm whale habitat use (Griffin, 1999). The GulfCet II study found that most sperm whales were concentrated along the slope in or near cyclones (Davis et al., 2000). Low-salinity, nutrient-rich water from the Mississippi River may contribute to enhanced primary and secondary productivity in the north-Central Gulf, and thus provide resources that support the year-round presence of sperm whales south of the delta.

Consistent sightings in the region indicate that there is a resident population of sperm whales in the northern Gulf consisting of adult females, calves, and immature individuals (Mullin et al., 1994a; Davis and Fargion, 1996; Sparks et al., 1996; Jefferson and Schiro, 1997; Davis et al., 2000). Also, recent sightings were made in 2000 and 2001 of solitary mature male sperm whales in the DeSoto Canyon area (Lang, personal communication, 2001). Sperm whales in the Gulf are currently considered a separate stock from those in the Atlantic and Caribbean (Waring et al., 1997).

Sirenians

West Indian Manatee (Trichechus manatus)

The West Indian manatee (*Trichechus manatus*) is the only sirenian known to occur in tropical and subtropical coastal waters of the southeastern U.S., GOM, Caribbean Sea, and the Atlantic coast of northern and northeastern South America (Reeves et al., 1992; Jefferson et al., 1993; O'Shea et al., 1995). During warmer months, manatees are common along the west coast of Florida from the Everglades National Park northward to the Suwannee River in northwestern Florida and less common farther westward. In winter, the population moves southward to warmer waters. Manatees are uncommon along the Florida Panhandle and are infrequently found (strandings and sightings) as far west as Louisiana and Texas (Powell and Rathbun, 1984; Rathbun et al., 1990; Schiro et al., 1998). One manatee that died in Louisiana waters was determined to be from Tampa Bay, Florida; this determination was based on a photoidentification rematch (Schiro et al., 1998). The manatees occasionally appearing in south Texas waters might be strays from Mexico rather than Florida (Powell and Rathbun, 1984).

Manatees are herbivores that feed opportunistically on submerged, floating, and emergent vegetation (USDOI, FWS, 2001). Distribution of the manatee is limited to low-energy, inshore habitats supporting the growth of seagrasses (Hartman, 1979). Manatees primarily use open coastal (shallow nearshore) areas and estuaries; and they are also found far up freshwater tributaries. Shallow grass beds with access to deep channels are preferred feeding areas in coastal and riverine habitats (USDOI, FWS, 2001). Notwithstanding their association with coastal areas, a manatee was documented offshore at several OCS work barges where it was grazing on algae growing on the vessel's sides and bottom. Multiple sightings of the animal were made in October 2001 and occurred in waters exceeding 1,500 m in depth south of Mobile Bay, Alabama.

3.2.4. Sea Turtles

Of the seven or eight extant species of sea turtles, five are known to inhabit the waters of the GOM (Pritchard, 1997): the green turtle, the loggerhead, the hawksbill, the Kemp's ridley, and the leatherback. As a group, sea turtles possess elongated, paddle-like forelimbs that are modified for swimming and shells that are depressed and streamlined (Márquez-M., 1990; Ernst et al., 1994; Pritchard, 1997). Sea turtles spend nearly all of their lives in the water and only depend on land (specifically sandy beaches) as nesting habitat. They mature slowly and are long-lived. Generally, their distributions are primarily circumtropical, although various species differ widely in their seasonal movements, geographical ranges, and behavior. There are also considerable differences in behavior among populations of the same species (Márquez-M., 1990). All sea turtle species inhabiting the GOM are listed as either endangered or threatened under the Endangered Species Act of 1973 (Pritchard, 1997).

Hard-shell Sea Turtles (Family Cheloniidae)

Green Sea Turtle (Chelonia mydas)

The green sea turtle (*Chelonia mydas*) is the largest hard-shelled sea turtle; adults commonly reach 100 cm in carapace length and 150 kg in weight (USDOC, NMFS and USDOI, FWS, 1991a). The green sea turtle is commonly found in tropical and subtropical marine waters with extralimital occurrences generally between latitude 40 ^{o}N. and latitude 40 ^{o}S. (USDOC, NMFS and USDOI, FWS, 1991a; Hirth, 1997). In U.S. Atlantic waters, green sea turtles are found around the U.S. Virgin Islands, Puerto Rico, and Atlantic and Gulf Coasts of the U.S. from Texas to Massachusetts.

Green sea turtles primarily occur in coastal waters, where they forage on seagrasses, algae, and associated organisms (Carr and Caldwell, 1956; Hendrickson, 1980). Small green sea turtles are omnivorous. Adult green sea turtles in the Caribbean and GOM are herbivorous, feeding primarily on seagrasses and, to a lesser extent, on algae and sponges. The adult feeding habitats are beds of seagrasses and algae in relatively shallow, protected waters; juveniles may forage in areas such as coral reefs, emergent rocky bottom, sargassum mats, and in lagoons and bays. Green sea turtles in the Western Gulf are primarily restricted to the Texas coast where seagrass meadows and algae-laden jetties provide them developmental habitat, especially during warmer months (Landry and Costa, 1999). Movements between principal foraging areas and nesting beaches can be extensive, with some populations regularly conducting transoceanic migrations (USDOC, NMFS and USDOI, FWS, 1991a; Ernst et al., 1994; Hirth, 1997).

Hawksbill Sea Turtle (Eretmochelys imbricata)

The hawksbill (*Eretmochelys imbricata*) is a small- to medium-sized sea turtle that occurs in tropical to subtropical waters of the Atlantic, Pacific, and Indian Oceans. The species is widely distributed in the Caribbean Sea and western Atlantic Ocean. In the continental U.S., the hawksbill has been recorded in coastal waters of each of the Gulf States and along the Atlantic coast from Florida to Massachusetts (USDOC, NMFS, 1993), although sightings north of Florida are rare (Hildebrand, 1982). They are considered to be the most tropical of all sea turtle species and the least commonly reported sea turtle species occurring in the Gulf (Márquez-M., 1990; Hildebrand, 1995).

Coral reefs are generally recognized as the resident foraging habitat for both juveniles and adults. Adult hawksbills feed primarily on sponges (Carr and Stancyk, 1975; Meylan, 1988) and demonstrate a high degree of selectivity, feeding on a relatively limited number of sponge species, primarily demosponges (Ernst et al., 1994). Texas and Florida are the only states in the U.S. where hawksbills are sighted with any regularity (USDOC, NMFS, 1993). Stranded hawksbills have been reported in Texas (Hildebrand, 1982; Amos, 1989) and in Louisiana (Koike, 1996); these tend to be either hatchlings or yearlings. A hawksbill was captured accidentally in a purse seine net just offshore Louisiana (Rester and Condrey, 1996).

Kemp's Ridley Sea Turtle (Lepidochelys kempi)

The Kemp's ridley (*Lepidochelys kempi*) is the smallest sea turtle species and occurs chiefly in the GOM. It may also be found along the northwestern Atlantic coast of North America as far north as Newfoundland. It is the most imperiled of the world's sea turtles.

In the northern Gulf, Kemp's ridleys are most abundant in coastal waters from Texas to west Florida (Ogren, 1989; Márquez-M., 1990 and 1994; Rudloe et al., 1991). Kemp's ridleys display strong seasonal fidelity to tidal passes and adjacent beachfront environs of the northern Gulf (Landry and Costa, 1999). There is little prolonged utilization of waters seaward of the 50-m isobath by this species (Renaud, 2001). Adult Kemp's ridley turtles usually occur only in the Gulf, but juvenile and immature individuals sometimes range between tropical and temperate coastal areas of the northwestern Atlantic and Gulf (Márquez-M., 1990). Within the Gulf, juvenile and immature Kemp's ridleys have been documented along the Texas and Louisiana coasts, at the mouth of the Mississippi River, and along the west coast of Florida, as quoted in stranding reports (Ogren, 1989; Márquez-M., 1990).

Loggerhead Sea Turtle *(Caretta caretta)*

The loggerhead (*Caretta caretta*) is a large sea turtle that inhabits temperate and tropical marine waters of the Atlantic, Pacific, and Indian Oceans. This species is wide-ranging throughout its range and is capable of living in varied habitat types for a relatively long time (Márquez-M., 1990; USDOC, NMFS and USDOI, FWS, 1991b; Ernst et al., 1994). Loggerheads feed primarily on benthic invertebrates but are capable of feeding on a wide range of food items (Ernst et al., 1994). Juvenile and subadult loggerheads are omnivorous, foraging on pelagic crabs, molluscs, jellyfish, and vegetation captured at or near the surface (Dodd, 1988; Plotkin et al., 1993). Adult loggerheads forage on benthic invertebrates (Dodd, 1988). The loggerhead is the most abundant species of sea turtle occurring in U.S. waters of the Atlantic, from Florida to Cape Cod, Massachusetts. The loggerhead is probably the most common sea turtle species in the northern Gulf (e.g., Fritts et al., 1983a; Fuller and Tappan, 1986; Rosman et al., 1987; Lohoefener et al., 1990) and is currently listed as a threatened species.

Aerial surveys indicate that loggerheads are largely abundant in water depths less than 100 m (Shoop et al., 1981; Fritts et al., 1983a). During the GulfCet aerial surveys, loggerheads were sighted throughout the northern Gulf continental shelf waters near the 100-m isobath (Davis et al., 2000). Loggerheads were also sighted over very deep waters (>1,000 m). Sightings indicate that loggerhead distribution is not as coastal-associated as that of Kemp's ridley and green sea turtles (Landry and Costa, 1999). Loggerheads have also been sighted seaward of the shelf break in the northeast U.S. (Shoop and Kenney, 1992b). Loggerhead abundance in continental slope waters of the eastern Gulf increased appreciably during winter (Davis et al., 2000).

Leatherback Sea Turtle (Family Dermochelyidae)

Leatherback Sea Turtle (Dermochelys coriacea)

The leatherback (*Dermochelys coriacea*) is the largest and most distinctive sea turtle. This species possesses a unique skeletal morphology, most evident in its flexible, ridged carapace, and in cold water maintains a core body temperature several degrees above ambient. They also have unique deep-diving abilities (Eckert et al., 1986). This species is the most wide-ranging sea turtle, undertaking extensive migrations from the tropics to boreal (cold-temperate regions of the northern latitudes) waters (Morreale et al., 1996; Hughes et al., 1998). Though considered oceanic, leatherbacks will occasionally enter bays and estuaries (Hoffman and Fritts, 1982; Knowlton and Weigle, 1989; Shoop and Kenney, 1992). Leatherbacks feed primarily on gelatinous zooplankton such as jellyfish, siphonophores, and salps (Brongersma, 1972), although they may ingest some algae and vertebrates (Ernst et al., 1994). Leatherbacks' stomach contents have been analyzed and data suggest that they may feed at the surface, at depth within deep scattering layers, or on the benthos. Florida is the only site in the continental U.S. where leatherbacks regularly nest (USDOC, NMFS and USDOI, FWS, 1992; Ernst et al., 1994; Meylan et al., 1995). The leatherback is currently listed as an endangered species.

Sightings of leatherbacks are common in oceanic waters of the northern GOM (Leary, 1957; Fritts et al., 1983b; Lohoefener et al., 1988 and 1990; Collard, 1990; Davis et al., 2000). Based on a summary of several studies, Davis and Fargion (1996) concluded that the primary habitat of the leatherback in the northWestern Gulf is oceanic waters (>200 m). It has been suggested that the region from Mississippi Canyon east to DeSoto Canyon appears to be an important habitat area for leatherbacks (Davis and Fargion, 1996). Most sightings of leatherbacks made during the GulfCet surveys occurred slightly north of DeSoto Canyon (Davis and Fargion, 1996; Davis et al., 2000). The nearly disjunct summer and winter distributions of leatherback sightings over the continental slope in the Eastern Gulf during GulfCet II indicate that specific areas may be important to this species either seasonally or for short periods of time. These specific locations are most probably correlated with oceanographic conditions and resulting concentrations of prey. Other clustered sightings of leatherbacks have been reported for the northern Gulf: 8 leatherbacks were sighted one day in DeSoto Canyon (Davis and Fargion, 1996), 11 during one day just south of the Mississippi River Delta (Lohoefener et al., 1990), and 14 during another day in DeSoto Canyon (Lohoefener et al., 1990).

3.2.5. Birds

Most species of marine birds listed as either threatened or endangered inhabit nearshore waters along the coast and the continental shelf of the GOM and rarely occur in deepwater areas (USDOI, MMS, 2001). Forty-three species of seabird representing four ecological categories have been documented from deepwater areas of the Gulf: summer migrants (e.g., shearwaters, storm-petrels, boobies), summer residents that breed in the Gulf (e.g., sooty, least, and sandwich terns), winter residents (e.g., gannets, gulls, and jaegers), and permanent resident species (e.g., laughing gull, royal, and bridled terns) (Hess and Ribic, 2000; USDOI, MMS, 2001b). The most abundant species typically found in deepwater areas include terns, storm-petrels, and gulls (Hess and Ribic 2000).

Seabirds' presence in the Gulf changes seasonally with species diversity and overall abundance being highest in the spring and summer and lowest in fall and winter. Seabirds also tend to associate with various oceanic conditions including specific sea-surface temperatures and salinities (e.g., laughing gull, black and sooty terns), areas of high plankton productivity (e.g., laughing gulls, pomarine jaeger, Audubon's shearwater, band-rumped storm-petrel, bridled tern), and particular currents (pomarine jaeger) (Hess and Ribic, 2000). Non-seabirds (especially passerines) that seasonally migrate over the Gulf may use offshore oil and gas platforms and merchant, cruise, and naval ships as artificial islands for rest and shelter during inclement weather.

Shorebirds

Shorebirds are those members of the order Charadriiformes generally restricted to coastline margins (beaches, mudflats, etc.). The GOM shorebirds comprise five taxonomic families--Jacanidae (jacanas), Haematopodidae (oystercatchers), Recurvirostridae (stilts and avocets), Charadriidae (plovers), and Scolopacidae (sandpipers, snipes, and allies) (Hayman et al., 1986). An important characteristic of almost all shorebird species is their strongly developed migratory behavior, with some shorebirds migrating from nesting places in the far north to the southern part of South America (Terres, 1991). Both spring and fall migrations take place in a series of "hops" to staging areas where birds spend time feeding heavily to store up fat for the sustained flight to the next staging area; many coastal habitats along the Gulf of Mexico are critical for such purposes. Along the Gulf Coast, 44 species of shorebirds have been recorded; only 6 species nest in the area. The remaining species are wintering residents and/or "staging" transients (Pashley, 1991). Although variations occur between species, most shorebirds begin breeding at 1-2 years of age and generally lay 3-4 eggs per year. They feed on a variety of marine and freshwater invertebrates and fish, and small amounts of plant life.

Marsh and Wading Birds

The following families of mostly wading birds have some representatives in the northern Gulf: Ardeidae (herons and egrets), Ciconiidae (storks), Threskiornithidae (ibises and spoonbills), and Gruidae (cranes). They have long legs that allow them to forage by wading into shallow water, while their long bills and usually long necks are used to probe under water or to make long swift strokes to seize fish, frogs, aquatic insects, crustaceans, and other prey (Terres, 1991). Seventeen species of wading birds in the Order Ciconiiformes are currently known to nest in the U.S., and all except the wood stork nest in the northern Gulf coastal region (Martin, 1991). Within the Gulf Coast region, Louisiana supports the majority of nesting wading birds. Great egrets are the most widespread nesting species in the Gulf region (Martin, 1991).

Along the GOM, most members of the family Rallidae have compact bodies; therefore, they are not labeled wading birds. They are also elusive and rarely seen within the low vegetation of fresh and saline marshes, swamps, and rice fields (Bent, 1926; National Geographic Society, 1983; Ripley and Beehler, 1985).

Waterfowl

Waterfowl belong to the taxonomic order Anseriformes and include swans, geese, and ducks. A total of 36 species are regularly reported along the north-central and Western Gulf Coast; they include 1 swan, 5 geese, 11 surface-feeding (dabbling) ducks and teal, 5 diving ducks (pochards), and 14 others (including the wood duck, whistling ducks, sea ducks, the ruddy duck, and mergansers) (Clapp et al., 1982; National Geographic Society, 1983; Madge and Burn, 1988). Many species usually migrate from wintering grounds along the Gulf Coast to summer nesting grounds in the north. Waterfowl migration pathways have traditionally been divided into four parallel north-south paths, or "flyways," across the North American continent. The Gulf Coast serves as the southern terminus of the Mississippi (Louisiana, Mississippi, and Alabama) flyway. Waterfowl are highly social and possess a diverse array of feeding adaptations related to their habitat (Johnsgard, 1975).

Threatened and Endangered Species

The following coastal and marine birds species that inhabit or frequent the northern GOM coastal areas are recognized by FWS as either endangered or threatened: piping plover, bald eagle, and brown pelican. The southeastern snowy plover is a species of concern to the State of Florida.

Piping Plover

The piping plover (*Charadrius melodus*) is a migratory shorebird that is endemic to North America. The piping plover breeds on the northern Great Plains, in the Great Lakes, and along the Atlantic Coast (Newfoundland to North Carolina); and winters on the Atlantic and Gulf of Mexico coasts from North Carolina to Mexico and in the Bahamas West Indies. Hypothetically, plovers may have a preferred prey base and/or the substrate coloration provides protection from aerial predators due to camouflage from chromatic matching in specific wintering habitat. Such areas include coastal sand flats and mud flats in proximity to large inlets or passes, which may attract the largest concentrations of piping plovers (Nicholls and Baldassarre, 1990). Similarly, nesting habitat in the north includes open flats along the Missouri River and the Great Lakes. This species remains in a precarious state given its low population numbers, sparse distribution, and continued threats to habitat throughout its range.

Southeastern Snowy Plover

The following account of the southeastern snowy plover (*Charadrius alexandrius tenuirostris*) is taken from Gore and Chase (1989). The species nests on coastal sand beaches and interior alkali flats. Observed nest sites in the Florida Panhandle ranged from the Florida-Alabama border eastward beyond Little St. George. At some locations more than 1.5 breeding pairs/km were counted. Most nests are near the front dune and close to vegetation. Vehicles and humans may cause nest failure. Human activity is absent near the beaches of Eglin West and Eglin East because Eglin Air Force Base has restricted areas. This may account for a high nest count in part of this area.

Bald Eagle

The bald eagle (*Haliaeetus leucocephalus*) is the only species of sea eagle that regularly occurs on the North American continent (USDOI, FWS, 1984). Its range extends from central Alaska and Canada to northern Mexico. The bulk of the bald eagle's diet is fish, though it will opportunistically take birds, reptiles, and mammals (USDOI, FWS, 1984). The general tendency is for winter breeding in the south with a progressive shift toward spring breeding in northern locations. In the southeast, nesting activities generally begin in early September; egg laying begins as early as late October and peaks in late December. The historical nesting range of the bald eagle within the southeast United States included the entire coastal plain and shores of major rivers and lakes. There are certain general elements that seem to be consistent among nest site selection. These include (1) the proximity of water (usually within ½ mi) and a clear flight path to a close point on the water, (2) the largest living tree in a span, and (3) an open view of the surrounding area. The proximity of good perching trees may also be a factor in site selection. An otherwise suitable site may not be used if there is excessive human activity in the area. The current range is limited, with most breeding pairs occurring in peninsular Florida and Louisiana, and some in

South Carolina, Alabama, and east Texas. Sporadic breeding takes place in the rest of the southeastern states and in the Florida Panhandle. One hundred twenty nests have been found in Louisiana; only 3 nests occurred within 5 mi of the coast (Patrick, written communication, 1997). The bald eagle was listed as endangered in 1967 in response to the declines due to DDT and other organochlorines that affected the species' reproduction (USDOI, FWS, 1984). In July 1995, the FWS reclassified the bald eagle from endangered to threatened in the lower 48 states (*Federal Register*, 1995).

Brown Pelican

The brown pelican (*Pelicanus occidentalis*) is one of two pelican species in North America. It feeds entirely upon fish captured by plunge diving in coastal waters. Organochlorine pesticide pollution apparently contributed to the endangerment of the brown pelican. In recent years, there has been a marked increase in brown pelican populations along its entire former range. The population of brown pelicans and their habitat in Alabama, Florida, Georgia, North and South Carolina, and points northward along the Atlantic Coast were removed from the endangered species list in 1985. Within the remainder of the range, which includes coastal areas of Mississippi, where populations are not secure, the brown pelican remains listed as endangered (*Federal Register*, 1985a). The brown pelican is not federally listed in Florida, but it is listed by the three other states (Louisiana, Mississippi, and Alabama).

3.2.6. Essential Fish Habitat and Fish Resources

3.2.6.1. Essential Fish Habitat

The Fishery Conservation and Management Act of 1976 (Magnuson Act) established national standards for the conservation and management of exploited fish and shellfish stocks in U.S. Federal waters. Coastal waters extending 200 nmi seaward, but outside areas under State jurisdiction, were delineated as fisheries conservation zones for the U.S. and it possessions. Eight Regional Fishery Management Councils were created to manage fish stocks within those conservation zones based upon the national standards. Councils were required to prepare Fishery Management Plans (FMP’s) that would provide the basis for local administration and management of regional fisheries. The FMP components generally address management objectives, alternatives, and rationale; habitat issues; the benefits and adverse impacts of each alternative; and plans for the monitoring, review, and possible amendments to any action.

The Fishery Conservation and Management Act was superceded by the Magnuson-Stevens Fishery Conservation and Management Act of 1996, which required that FMP’s further include the identification and description of essential fish habitat (EFH). Essential fish habitat includes those waters and substrate necessary for the successful spawning, breeding, feeding, or growth to maturity of targeted species. The Act also requires that management councils consult with Federal agencies regarding any activities that may adversely affect essential fish habitat designated in specific FMP’s. An adverse effect is any activity that reduces the quality of essential fish habitat whether it is direct (physical disruption) or indirect (loss of prey). Federal agencies are also required to assess actions that could conserve and enhance essential fish habitat.

In the Central and Western Gulf, EFH has been identified for 32 managed species of fish and shellfish (Gulf of Mexico Fisheries Management Council, 1998; USDOC, NMFS, 1999a and b). Of these, 21 species inhabit nearshore waters less than 200 m (656 ft) in depth. (See USDOI, MMS, 2001, for further information on the distribution and habitat of these species.) The remaining 11 "offshore" species include the silky shark, longfin mako shark, dolphin, swordfish, skipjack tuna, yellowfin tuna, bluefin tuna, greater amberjack, king mackerel, tilefish, and red snapper. Although these species spawn in deepwater areas of the GOM, little is known about the life history and fate of pelagic larvae and fry. Bluefin larvae have been found associated with the Loop Current boundary and the Mississippi River plume (Richards et al., 1989). Juvenile and adult red snapper aggregate around hard-bottom relief but seldom occur at depths >300 m (985 ft).

3.2.6.2. Description of Fish Resources

The GOM supports a great diversity of fish resources. The distribution and abundance of these resources are not random and are governed by a variety of ecological factors such as temperature, salinity, primary productivity, bottom types, and many other physical and biological factors. There are considerable inshore and offshore differences in fish resources. The majority of the GOM fisheries are dependent upon wetland, estuarine, and nearshore habitats (Darnell and Soniat, 1979; Darnell, 1988).

Fish can be classified as demersal (bottom-dwelling), oceanic pelagic, or mesopelagic (midwater). Demersal (or benthic) fish have been addressed above under the megafauna descriptions (Chapter 3.2.2.3.1). There are no commercial fisheries directed at demersal species in the vicinity of the Matterhorn Project. Oceanic pelagic and mesopelagic fishes are discussed briefly below. Additional life history information on important commercial invertebrate fish resources of the GOM is contained in USDOI, MMS (2000 and 2001a).

3.2.6.2.1. Oceanic Pelagics (Including Highly Migratory Species)

Common oceanic pelagic species include the large predatory tunas, marlins, sailfish, swordfish, dolphins, wahoo, and mako sharks. Other pelagics include halfbeaks, flyingfishes, and driftfishes (Stromateidae). Lesser known oceanic pelagics include opah, snake mackerels (Gempylidae), ribbonfishes (Trachipteridae), and escolar.

Oceanic pelagic species occur throughout the GOM, especially at or beyond the shelf edge. Oceanic pelagics are reportedly associated with mesoscale hydrographic features such as fronts, eddies, and discontinuities. Fishermen contend that yellowfin tuna aggregate near sea-surface temperature boundaries or frontal zones; however, Power and May (1991) found no correlation between longline catches of yellowfin tuna and sea-surface temperature (defined from satellite imagery) in the GOM. Many of the oceanic fishes associate with drifting *Sargassum* seaweed, which provides feeding and/or nursery habitat.

3.2.6.2.2. Mesopelagics (Midwater Fishes)

Mesopelagic fish assemblages in GOM collections are numerically dominated by myctophids (lanternfishes), with gonostomatids (bristlemouths) and sternoptychids (hatchet fishes) common but less abundant. These fishes make extensive vertical migrations during the night from mesopelagic depths (200-1,000 m; 656-3,280 ft) to feed in upper, more productive layers of the water column (Hopkins and Baird, 1985). Mesopelagic fishes are important ecologically because they transfer substantial amounts of energy between mesopelagic and epipelagic zones.

The GOM appears to be a distinct zoogeographic province based upon analysis of lanternfish distribution (Bakus et al., 1977). The GOM lanternfish assemblage was characterized by species with tropical and subtropical affinities. This was particularly true for the eastern GOM where Loop Current effects on species distributions were most pronounced. Gartner et al. (1987) collected 17 genera and 49 species of lanternfish in trawls fished at discrete depths from stations in the southern, Central, and Eastern Gulf. The most abundant species in decreasing order of importance were *Ceratoscopleus warmingii*, *Notolychus valdiviae*, *Lepidophanes guentheri*, *Lampanyctus alatus*, *Daiphus dumerili*, *Benthosema suborbitale*, and *Myctophum affine*. Ichthyoplankton collections from oceanic waters yielded high numbers of mesopelagic larvae as compared with larvae of other groups (Richards et al., 1989). Lanternfishes generally spawn year-round, with peak activity in spring and summer (Gartner, 1993).

3.2.7. Gulf Sturgeon

The Gulf sturgeon (*Acipenser oxyrhynchus desotoii*) is the only listed threatened fish species in the Gulf of Mexico. A subspecies of the Atlantic sturgeon, Gulf sturgeon are classified as anadromous, with immature and mature fish participating in freshwater migrations. Gill netting and biotelemetry have shown that subadults and adults spend 8-9 months each year in rivers and 3-4 of the coolest months in estuaries or Gulf waters. Sturgeon less than about two years old remain in riverine habitats and estuaries throughout the year (Clugston, 1991). According to Wooley and Crateau (1985), Gulf sturgeon occurred in most major riverine and estuarine systems from the Mississippi River to the Suwannee River, Florida, and marine waters of the Central and Eastern GOM south to Florida Bay. Important waters west-to-east and north-to-south are Biloxi Bay, Pascagoula Bay, Mobile Bay, Choctawhatchee Bay, the Apalachicola River, the Ochlockounee River, and the Suwannee River. It is not possible, at present, to estimate the size of Gulf sturgeon populations throughout the range of the species, but extant occurrences in 1996 include the Mississippi River and Lake Pontchartrain, Louisiana, to Charlotte Harbor, Florida (Patrick, personal communication, 1996). Eggs have now been discovered in six locations within the Choctawhatchee River system in Florida and Alabama (Fox and Hightower, 1998). During the riverine stage, adults cease feeding, undergo gonadal maturation, and migrate upstream to spawn. Spawning occurs over coarse substrate in deep holes. The decline of the Gulf sturgeon is believed to be due to overfishing, the damming of coastal rivers, and the degradation of water quality (Barkuloo, 1988).

3.2.8. Beach Mice

Hall (1981) recognizes 16 subspecies of field mouse (*Peromyscus polionotus*), eight of which are collectively known as beach mice. Of Gulf Coast subspecies, the Alabama, Perdido Key, Choctawhatchee, and St. Andrew beach mice occupy restricted habitats in the mature coastal dunes of Florida and Alabama and are listed as endangered (USDOI, FWS, 1987). Populations have fallen to levels approaching extinction. For example, in the late 1980's, estimates of total remaining beach mice were less than 900 for the Alabama beach mouse; about 80 for the Perdido Key beach mouse, and about 500 for the Choctawhatchee beach mouse. All four mice are listed as endangered: the Alabama subspecies in Alabama, the Perdido Key subspecies in both Alabama and Florida, and the St. Andrew and Choctawhatchee subspecies in Florida. The Alabama, Perdido Key, and Choctawhatchee beach mice were listed as endangered in the 1980's. The St. Andrew beach mouse was not listed as endangered until 1998 and is the only listed subspecies without designated critical habitat. Continued monitoring of populations of all subspecies along the Gulf Coast between 1985 and the present indicates that approximately 52 km (32.3 mi) of coastal dune habitat are now occupied by the four listed subspecies (1/3 of historic range). The Santa Rosa beach mouse occupies Santa Rosa Island of the Gulf Island National Seashore (GINS). It is not listed as threatened or endangered and is not analyzed in this EA.

The *Federal Register* (1985b) cites habitat loss as the primary cause for declines in populations of beach mice. The reduced distribution and numbers of the beach mouse subspecies have continued because of multiple habitat threats over their entire range (coastal real estate development and associated human activities, military activities, coastal erosion, severe storms, and catastrophic effects of hurricanes). Destruction of Gulf Coast sand dune ecosystems for commercial and residential development has destroyed about 60 percent of original beach mouse habitat.

The inland extent of the habitat may vary depending on the configuration of the sand dune system and the vegetation present. There are commonly several rows of dunes paralleling the shoreline, and within these rows there are generally three types of microhabitat. First, the frontal dunes are sparsely vegetated with widely scattered coarse grasses including sea oats (*Uniola paniculata*), bunch grass (*Andropogon maritimus*), and beach grass (*Panicum amarum* and *P. repens*), and with seaside rosemary (*Ceratiola ericoides*), beach morning glory (*Ipomoea stolonifera*), and railroad vine (*I. Pes-caprae*). Secondly, frontal dune grasses appear as a lesser component on the higher rear scrub dunes that support the growth of slash pine (*Pinus elliotti*), sand pine (*P. clausa*), and scrubby shrubs and oaks, including yaupon (*Ilex vomitoria*), marsh elder (*Iva sp.*), scrub oak (*Quercus myrtifolia*), and sand-live oak (*Q. virginiana* var. *maritima*). Thirdly, the interdunal areas contain sedges (*Cyperus sp.*), rushes (*Juncus scirpoides*), and salt grass (*Distichlis spicata).* Beach mice are restricted to the coastal barrier sand dunes along the Gulf.

Optimal overall beach mouse habitat is currently thought to be comprised of a heterogeneous mix of interconnected habitats including primary dunes, secondary dunes, scrub dunes, and interdunal areas. Beach mice dig burrows mainly in the primary, secondary, and interior scrub dunes where the vegetation provides suitable cover. Most beach mouse surveys conducted prior to the mid-1990's were in primary and secondary dunes, because investors assumed they are the preferred habitat of beach mice. A limited number of surveys in scrub dunes and other interior habitat resulted in less knowledge of the distribution and relative abundance there. In coastal environments, the terms "scrub" and "scrub dune" refer to habitat or vegetation communities adjacent to and landward of primary and secondary dune types where scrub oaks are visually dominant. Interior habitat can include vegetation types such as grass-like forbs (forbs are the herbs other than grasses). There is substantial variation in scrub oak density and cover within and among scrub dunes throughout ranges of beach mice. The variation, an ecological gradient, is represented by scrub oak woodland with a relatively closed canopy at one end of a continuum. At the other extreme of the gradient, scrub dunes are relatively open with patchy scrub ridges and intervening swales or interdunal flats dominated by herbaceous plants. For the three subspecies discussed above that have critical habitat areas (Alabama, Perdido Key, and Choctawhatchee beach mice), the major constituent elements that are known to require special management considerations or protection are dunes and interdunal areas and associated grasses and shrubs that provide food and cover (USDOI, FWS, 1985a and b).

For the most part, beach mice feed nocturnally in the dunes and remain in burrows during the day. Their diets vary seasonally but consist mainly of seeds, fruits, and insects (Ehrhart, 1978; Moyers, 1996). Changes in availability of foods result in changes in diets between seasons and account for variability of seasonal diets between years. Autumn diets of beach mice consist primarily of seeds and/or fruits of sea oats, evening primrose (*Oenothera humifusa*), bluestem (*Schizachyrium maritimum*), and dune spurge (*Chamaesyce ammannioides*). Sea oats and beach pea (Galactia sp.) dominate winter diets. Spring diets primarily consist of dune toadflax (*Linaria floridana*), yaupon holly (*Ilex vomitoria)*, seashore elder (*Iva imbricata*), and greenbrier (*Smilax sp.*). Summer diets are dominated by evening primrose, insects, dune toadflax, and ground cherry (*Physalis augustifolia*) (Moyers, 1996). Management practices designed to promote the recovery of dune habitat, increase food sources, and enhance habitat heterogeneity may aid in recovery of beach mouse populations.

In wild populations, beach mice have an average life span of about nine months. Males and females reach adulthood and are able to reproduce at approximately 35 days of age. Females can nurse one litter while pregnant with another litter. From captive colonies we know that litter size is 1-8 with an average of four. Young are weaned in 2-3 weeks and are generally on their own 1-2 weeks later.

Hurricanes are a natural environmental phenomenon affecting the Gulf Coast, and beach mice have evolved and persisted in coastal dune habitats since the Pleistocene. Hurricanes are part of a repeated cycle of destruction, alteration, and recovery of dune habitat. The extensive amount of predevelopment coastal dune habitat along the Gulf Coast allowed beach mice to survive even the most severe hurricane events to repopulate the habitat as it recovered. Beach mice are affected by the passage of hurricanes along the northwest Florida and Alabama Gulf Coast. Since records on hurricane intensity began in 1885, 32 hurricanes have struck northwest Florida within the historic ranges of the four Gulf Coast beach mouse subspecies (Williams and Duedall, 1997; Doehring et al., 1994; Neumann et al., 1993). In addition, since 1899 11 hurricanes have hit the coast of Alabama.

Hurricanes generally produce damaging winds, storm tides and surges, and rain that erode barrier island, peninsular, and mainland beaches and dunes. Following hurricanes, the dune system begins a slow natural repair process that may take 3-20 years depending on the magnitude of dune loss (Salmon et al., 1982). During this period, sea oats and pioneer dune vegetation become established, collecting sand and building dunes. As the dunes grow and become stable, other successional dune vegetation colonizes the area (Gibson and Looney, 1994), and beach mouse food sources and habitats are reestablished.

Tropical storms periodically devastate Gulf Coast sand dune communities, dramatically altering or destroying habitat, and either drowning beach mice or forcing them to concentrate on high scrub dunes where they are exposed to predators. The rate of recovery of food supplies for beach mice is variable with some areas adversely affected for an extended period of time by a hurricane and post-hurricane conditions. How a hurricane affects beach mice depends primarily on its characteristics (winds, storm surge, and rainfall), the time of year (midsummer is the worst), where the eye crosses land, population size, and impacts to habitat and food sources. The interior dunes and related access corridors may be essential habitats for beach mice following survival of a hurricane. For the three subspecies discussed above that have critical habitat areas (Alabama, Perdido Key, and Choctawhatchee beach mice), the major constituent elements that are known to require special management considerations or protection are dunes and interdunal areas and associated grasses and shrubs that provide food and cover (USDOI, FWS, 1985a and b).

Beach mice have existed in an environment subject to recurring hurricanes, but tropical storms and hurricanes are now considered to be a primary factor in the beach mouse's decline. It is only within the last 20-30 years that the combination of habitat loss to beachfront development, isolation of remaining habitat blocks and beach mouse populations, and destruction of remaining habitat by hurricanes have increased the threat of extinction of several subspecies of beach mice.

3.3. OTHER RELEVANT ACTIVITIES AND RESOURCES

3.3.1. Socioeconomic Conditions and Other Concerns

3.3.1.1. Economic and Demographic Conditions

3.3.1.1.1. Socioeconomic Impact Area

The MMS defines the GOM impact area for population, labor, and employment as that portion of the GOM coastal zone whose social and economic well-being (population, labor, and employment) is directly or indirectly affected by the OCS oil and gas industry. For this analysis, the coastal impact area consists of 80 counties and parishes along the U.S. portion of the GOM. This area includes 24 counties in Texas, 26 parishes in Louisiana, 4 counties in Mississippi, 2 counties in Alabama, and 24 counties in the Panhandle of Florida. Inland counties and parishes are included where offshore oil and gas activities are known to exist, where offshore-related petroleum industries are established, and where one or more counties or parishes within a Metropolitan Statistical Area (MSA) are on the coast; all counties and parishes within the MSA are included.

Most of the probable changes in population, labor, and employment resulting from the proposed activity would occur in the 24 counties in Texas and the 26 parishes in Louisiana because the oil and gas industry is best established in this region. Some of the likely changes in population, labor, and employment resulting from the proposed activity would occur to a lesser extent in the 6 Alabama and Mississippi counties due to having an established oil and gas industry and its proximity to the offshore location.

For analysis purposes, MMS has divided the impact area (defined geographically in the first paragraph of this section) into the subareas listed below. This impact area is based on the results of a recent MMS socioeconomic study, "Cost Profiles and Cost Functions for Gulf of Mexico Oil and Gas Development Phases for Input-Output Modeling." One of the objectives of this study was to allocate expenditures from the offshore oil and gas industry to the representative onshore subarea where the dollars were spent. Table E-1 (Appendix E) presents these findings in percentage terms. In the table, the IMPLAN number is the code given to the industry (sector) by the input-output software (IMPLAN) used to calculate impacts in Chapter 4. It is analogous to the standardized industry code (SIC). As shown in the table, very little has been spent in the Florida subareas. This is to be expected given the lack of offshore leasing in this area and Florida's attitude towards oil and gas development off their beaches. The table also makes clear the reason for including all of the GOM subareas in the economic impact area. Expenditures in Texas to several sectors are either exclusively found there or make up a very large percentage of the total. In addition, a significant percentage of total sector expenditures is allocated to each Louisiana subarea. The following subareas (which include the counties/parishes as listed below) are considered as the economic impact area for the proposed activity:

LA-1	LA-2	LA-3	MA-1
Acadia, LA	Ascension, LA	Jefferson, LA	Baldwin, AL
Calcasieu, LA	Assumption, LA	Orleans, LA	Hancock, MS
Cameron, LA	East Baton Rouge, LA	Plaquemines, LA	Harrison, MS
Iberia, LA	Iberville, LA	St. Bernard, LA	Jackson, MS
Lafayette, LA	Lafourche, LA	St. Charles, LA	Mobile, AL
St. Landry, LA	Livingston, LA	St. James, LA	Stone, MS
St. Martin, LA	St. Mary, LA	St. John the Baptist,	
Vermilion, LA	Tangipahoa, LA	St. Tammany, LA	
	Terrebonne, LA		
	West Baton Rouge, LA		

TX-1

Aransas, TX
Calhoun, TX
Cameron, TX
Jackson, TX
Kenedy, TX
Kleberg, TX
Nueces, TX
Refugio, TX
San Patricio, TX
Victoria, TX
Willacy, TX

TX-2

Brazoria, TX
Chambers, TX
Fort Bend, TX
Galveston, TX
Hardin, TX
Harris, TX
Jefferson, TX
Liberty, TX
Matagorda, TX
Montgomery, TX
Orange, TX
Waller, TX
Wharton, TX

FL-1

Bay, FL
Escambia, FL
Okaloosa, FL
Santa Rosa, FL
Walton, FL

FL-2

Dixie, FL
Franklin, FL
Gulf, FL
Jefferson, FL
Levy, FL
Taylor, FL
Wakulla, FL

FL-3

Charlotte, FL
Citrus, FL
Collier, FL
Hernando, FL
Hillsborough, FL
Lee, FL
Manatee, FL
Pasco, FL
Pinellas, FL
Sarasota, FL

FL-4

Miami-Dade, FL
Monroe, FL

3.3.1.1.2. Population and Education

Table E-2 (Appendix E) depicts baseline population projections for the potential impact area. Baseline projections are for the impact area in the absence of the proposed activity. According to Woods and Poole forecasts, most subareas in the region will experience an average annual growth in population of approximately 1-2 percent over next 25 years. On average, the percent of the population age 25 and over completing high school only in the impact area (53.82 %) is less than that for the United States (54.90%). The same holds true for college graduates (13.85 versus 20.34). While several individual parishes, counties and MSA's exhibit graduation percentages greater than the national average, most do not.

3.3.1.1.3. Infrastructure and Land Use

The GOM OCS Region has one of the highest concentrations of oil and gas activity in the world. The offshore oil and gas industry has experienced dramatic changes over recent years, particularly since 1981. Historically, most of the activity has been concentrated on the continental shelf off the coasts of Texas and Louisiana. Future activity is expected to extend into progressively deeper waters and into the Eastern Planning Area. To date, only exploration activities have taken place off the shores of the State of Florida. The high level of offshore oil and gas activity in the Gulf of Mexico is accompanied by an extensive development of onshore service and support facilities. The major types of onshore infrastructure include gas processing plants, navigation channels, oil refineries, pipelines and pipeline landfalls, pipecoating and storage yards, platform fabrication yards, separation facilities, service bases, terminals, and other industry-related installations such as landfills and disposal sites for drilling and production wastes.

Land use in the impact area varies from state to state. The coasts of Florida and Texas are a mixture of urban, industrial, recreational beaches, wetlands, forests, and agricultural areas. Alabama’s coastal impact area is predominantly recreational beaches, and small residential and fishing communities. Mississippi’s coast consists of barrier islands, some wetlands, recreational beaches, and urban areas. Louisiana’s coast impact area is mostly vast areas of wetlands; some small communities and industrial areas extend inward from the wetlands.

3.3.1.1.4. Navigation and Port Usage

A service base is a community of businesses that load, store, and supply equipment, supplies and personnel needed at offshore work sites. Although a service base may primarily serve the OCS planning area and subarea in which it is located, it may also provide significant services for the other OCS planning areas and subareas. As OCS operations have progressively moved into deeper waters, larger vessels with deeper drafts have been phased into service, mainly for their greater range of travel, greater speed of travel, and larger carrying capacity. Service bases with the greatest appeal for deepwater activity have several common characteristics: strong and reliable transportation system; adequate depth and width of navigation channels; adequate port facilities; existing petroleum industry support infrastructure; location central to OCS deepwater activities; adequate worker population within commuting distance; and insightful strong leadership. Typically, deeper draft service vessels require channels with depths of 6-8 m. The proposed activity is expected to impact Port Fourchon (primarily) and Venice, Louisiana, the designated service bases for the proposed action. A small amount of vessel and helicopter traffic may originate from bases other than those named above in order to address changes in weather, market, and operational conditions.

3.3.1.1.5. Employment

Table E-3 (Appendix E) depicts baseline employment projections for the potential impact area. Baseline projections are for the impact area in the absence of the proposed activity. Average annual employment growth projected over the life of the proposed actions range from a low of 1.19 percent for Subarea LA-3 (predominated by the Orleans MSA) to a high of 5.43 percent for Subarea FL-3 in the lower panhandle of Florida. Over the same time period, employment for the United States is expected to grow at about 2.25 percent per year, while the GOM analysis area is expected to grow at about 2.06 percent per year. As stated above, this represents growth in general employment for the subareas. Continuation of existing trends, both in OCS activity and other industries in the area, are included in the projections.

The industrial composition for the subareas in the WPA and that in the CPA are similar. With the exception of Subareas LA-2, LA-3, and FL-4, the top four ranking sectors in terms of employment in the analysis area are the service, manufacturing, retail trade, and State and local government sectors. In Subareas LA-2 and LA-3, construction replaces manufacturing as one of the top four industries on the basis of employment. In Subarea FL-4, transportation, communication, and public utilities replaces manufacturing as one of the top four industries on the basis of employment. The service industry employs more people in all subareas. The service industry is also the fastest growing industry.

3.3.1.1.6. Current Economic Baseline Data

Current crude oil and natural gas prices are substantially above the economically viable threshold for drilling in the GOM. As of January 17, 2002, South Louisiana Sweet Crude lists for $19.01 per barrel (a decrease of 37.2% or $11.28 from a year ago); and West Texas Intermediate Crude lists for $18.86 per barrel (a decrease of 37.7% or $11.43 from a year ago (*The Times-Picayune*, 2002). Natural Gas closed at $2.38 per million BTU (a decrease of 70.9% or $5.80 from a year ago) (*The Times-Picayune*, 2002). In addition to oil and gas prices, drilling rig use is employed by the industry as a barometer of economic activity. According to Offshore Data Services, the utilization rate for all marketed mobile rigs in the GOM was 70.9%. This breaks down as a 63.0 percent utilization rate for jackups (average day rates of $16,500-$59,000); 91.4 percent for semisubmersibles (average day rates of $30,000-$140,000); 100 percent for drillships (average day rates were unavailable); and 80 percent for submersibles (average day rates of $21,000-$22,000). Platform rigs in the Gulf recorded a 56.5 percent utilization rate, while inland barges had a 62.0 percent utilization rate (OneOffshore, 2001).

Offshore service vessel (OSV) day rates are another indicator of the industry's activity. The December 2001 average day rates for all three types of vessels used by the offshore oil and gas industry increased from the December 2000 averages with the exception of standard supply boats capable of drilling in water depths up to 200 ft. However, vessel day rates dropped from November 2001 rates across all categories except for high horsepower (hp), anchor-handling tug/supply (AHTS) vessels. Utilization also fell from November 2001 levels for all vessel types except standard supply boats. AHTS vessel average day rates ranged from $10,500 for under 6,000 hp to $13,500 for over 6,000 hp vessels; utilization rates were both 100 percent. Supply boat average day rates ranged from $5,980 for boats up to 200 ft and $9,990 for 200 ft and over; utilization was 93 percent and 96 percent, respectively. Crewboat average day rates ranged from $2,437 for boats under 125 ft to $3,312 for boats 125 ft and over; utilization was 74 percent and 91 percent, respectively (*WorkBoat*, 2002). Another indicator of the direction of the industry is the exploration and development (E&D) expenditures of the major oil and gas companies. After substantially cutting their E&D budgets during the 1998 and 1999 fiscal years, majors are once again increasing these areas on their balance sheets. According to Global Marine Chairman, President, and CEO, Bob Rose, "the outlook for 2001 is very bullish" (Rose, 2001). However, both Salomon Smith Barney and Lehman Brothers, that survey major and independent oil and gas companies, expect 2002 E&D spending to drop between 12 and 19 percent over 2001 levels. Because of the lower planned E&D spending, Salomon Smith Barney projects that Gulf of Mexico rig utilization will average 76 percent in 2002; however in the ultra-deepwater market many rigs in the Gulf of Mexico continue to work (*WorkBoat*, 2002).

Commencing with Central Gulf of Mexico Lease Sale 178 Part 1 in March 2001, new royalty relief provisions for both oil and gas production in the Gulf of Mexico's deep and shallow waters were enacted. These rules will govern the next three years of lease sales. Central Lease Sale 178 Part 1 resulted in 534 leases let (an increase of about 60% or 200 blocks from Central Lease Sale 175 in March 2000). Of these 534 leases, 348 were in shallow water (0-400 m). This increase of 67.30 percent from the last Central Lease Sale largely reflects the intensified interest in natural gas due to higher prices over the last year and the new royalty relief provisions. The 186 blocks receiving bids in deep water (greater than 400 m) reflects an increase of 47.62 percent or 60 blocks. Again, this dramatic increase in leasing could be a result of the recently issued royalty relief provisions. Western Gulf of Mexico Lease Sale 180 and Central Gulf of Mexico Lease Sale 178 Part 2, offering the newly available United States' blocks beyond the United States Exclusive Economic Zone, were held on August 22, 2001. No bids were received for blocks offered in Central Lease Sale 178 Part 2. Of the 4,114 blocks offered in Western Lease Sale 180, 320 received bids. Western Lease Sale 180 resulted in 313 leases let (an increase of about 43% from Western Lease Sale 177 in August 2000). Of these 313 leases, 138 were in shallow water (0-400 m) reflecting the new royalty relief provisions for natural gas. The 175 leases let in deep water (greater than 400 m) reflect an increase of almost 100 percent or 87 blocks from a year ago. Eastern Lease Sale 181 was held in December 2001; 95 of the 233 blocks offered received bids, and all bids were accepted. All blocks were in deep water.

3.3.1.1.7. How OCS Development Has Affected the Impact Area Over Time

1980 - 1989

In the oil and gas industry, drilling rig use is employed as a barometer of economic activity. Between the end of 1981 and mid-1983, drilling rig activity in the GOM took a sharp downturn. By 1986 the demand for mobile drilling rigs had suffered an even greater decline. Population and net migration paralleled these fluctuations in mobile drilling rig activity. Population growth rates for all coastal subareas were relatively high prior to 1983; families moved to the Gulf Coast looking for work in the booming oil and gas industry. Lower rates of population growth accompanied the decline in drilling activity as workers were laid off and left the area in search of work elsewhere. After 1983, all subareas experienced several years of significant net migration out of the region. The negative impact on population continued until 1986 when the demand for mobile rigs declined to its lowest level in over a decade and the price of oil collapsed.

1990 - 1997

In the early to mid-1990's, the impact area experienced a major resurgence in oil exploration and drilling due to advances in technology and the enactment of the Deep Water Royalty Relief Act in 1995. The renewed interest in oil and gas exploration and development in the Gulf of Mexico produced a modest to significant recovery from the high unemployment levels experienced after the 1986 downturn. Ironically, the Gulf Coast encountered a shortage of skilled labor in the oil and gas industry due to "the restructuring of the oil industry to centralize management, finance and business services, and the use of computer technology" (Baxter, 1990). Additionally, potential oil and gas industry employees experienced the "shadow effect". Workers who previously lost high-paying jobs in the oil industry (or oil service industry) during the 1980's downturn were reluctant to return. The shadow effect, coupled with the shortage of skilled labor where the core problems were lack of education and or training for requisite skills, created a situation where temporary communities of workers from out of the area (some from out of the country) were established. Furthermore, the higher skill levels required by deepwater development drilling could not be completely met by the existing impact area's labor force, causing in-migration. Unemployment in the impact area, though, declined due to increased economic diversification by the region.

1998 - Present

In early 1998 crude oil prices were hovering near 12-year lows. This restrained the resurgence of exploration and development activity in the GOM. While offshore development strategy varies by company, most major oil companies, diversified firms, and small independents cut back production and curtailed exploration projects. Several large integrated companies resorted to layoffs and mergers as ways to assail low prices; a redistribution of headquarter personnel from the New Orleans area to the Houston area occurred and unemployment in the impact area rose. Offshore drilling strategies focused on mega and large prospects, foregoing small prospects, and only considering medium prospects when prices rose (Rike, 1998). A few companies, though, took advantage of lower drilling rates during this period and increased their drilling. Concurrently, technological innovations (such as 3-D seismic, slim hole drilling, and hydraulic rigs) decreased the cost of extraction and thus stimulated the development of large or mega prospects that were still considered economic at low prices.

OPEC, who produces 40 percent of the world's oil, announced crude oil production cutbacks in March 1999. Full member compliance increased oil prices to 20-year highs encouraging moderate exploration and development spending during the 1999 fiscal year. Crude oil prices continued to increase during 2000 and now into 2002. It is generally believed that the increase in price is being driven by two major factors. The first factor is the continued OPEC compliance to maintain prices within their current output targets of a $22 minimum and a $28 maximum barrel price. This was recently fortified by the cartel's January 17, 2001, announcement to cut production by 1.5 million barrels per day beginning February 1, 2001, in order to increase the price. The second factor, according to the Federal Reserve Bank of Dallas, is the "world capacity to supply oil has not kept pace with the growth of oil demand spurred by a resurgent world economy. [Futhermore,] a short supply of oil tankers, rising shipping rates and low inventories of refined product and crude oil have added upward pressure to spot crude oil prices." (Brown, 2000) The low prices throughout much of the 1990's were too low to stimulate additions to capacity. In addition, many tankers were scrapped in the 1990's when weak demand, low shipping rates and increasing environmental regulation put a lot of pressure on the tanker industry (Brown, 2000; page 3).

High oil prices and Federal environmental clean air efforts have prompted fuel switching away from crude oil to natural gas. Like crude oil, the supply of natural gas did not keep up with demand, pushing prices higher. In December 2000, natural gas broke record highs, closing at $10.10. Matthew Simmons, industry analyst and President of Houston investment bank Simmons & Co. states, "in addition to heating about 53 percent of American homes, natural gas is also being used to generate about 16 percent of the country's electricity – a percentage that is still growing." (Simmons, 2001) Mr. Simmons believes, and many other analysts concur, that this is "a decade-long problem" (Simmons, 2001). However, in recent months, natural gas prices have decreased dramatically (75.25%) since its record high of $10.10. According to Kelley Doolan, a natural gas market specialist for Platts and chief editor of Inside FERC's Gas Market Report, several factors have kept a downward pressure on natural prices in recent months. These factors include moderate weather in most of the nation, keeping the demand for gas by electricity generators in check; relatively low oil prices; and the general economic slowdown that has reduced the demand for gas by the industrial sector. Even without this pronounced drop in price, demand growth for natural gas is expected to be strong during the next 20 years. The American Gas Association (2001) projects that natural gas demand would increase by 53 percent by the year 2020.

Since the September 11, 2001, terrorists' attacks, the economy has been in a downturn with some attempts of recovery. Indeed, the Labor Department's Consumer Price Index rose just 1.6 percent for all of 2001 (in 2001 that index rose 3.4% largely because of rocketing energy prices). Still, worldwide energy prices have been down about 13 percent from a year ago, reflecting a weak demand due to the worldwide economic slump. Many economists believe a recovery may be in sight for mid-year, but they are uncertain of the timing and strength of such a recovery (*The Times-Picayune*, 2002).

3.3.1.1.8. Environmental Justice

On February 11, 1994, President Clinton issued an executive order to address questions of equity in the environmental and health conditions of impoverished communities. The most effective way of assuring that environmental endangerment is not concentrated in minority or low-income neighborhoods is to locate and identify these neighborhoods from the outset of a proposed project. While low incomes tend to coincide with concentrations of minority populations: African-American, Hispanic, Native American, and/or Asian-people living on low incomes also include fishermen and timber harvesters. Minority populations within the impact region include African-American and Hispanic persons residing in all of the Gulf Coastal States, Native American tribal members scattered throughout coastal Louisiana, and Asian Americans in Louisiana, Mississippi, and Alabama.

The Native American Data Center lists tribes that are located in the impact area (www.indiandata.com/eastern.htm), including the Chitimacha, Tunica-Biloxi, Coushatta, Houma, and Jena Band of Choctaws. In the early 1970's, only the Coushatta tribe was federally recognized. Today, four of the five tribes have Federal status, with the United Houma Nation still awaiting a finding on its petition. And because members of the Houma Nation live principally in Lafourche Parish and close to Port Fourchon, they could be directly affected by increases in oil and gas activity from the proposed action.

3.3.2. Commercial Fisheries

More than 26 percent (40% excluding Alaska) of commercial fish landings in the continental U.S. occur in the GOM. In 1999, the GOM placed second in total landed weight (almost 1 million tons) and third in value ($776 million) considering all U.S. regions (USDOC, NMFS, 2001). The most important species, such as menhaden, shrimps, oyster, crabs, and drums, are all species that depend heavily on estuarine habitats and the fisheries are restricted to the continental shelf. Menhaden was the most valuable finfish landed in 1999, accounting for $78.5 million in total value. The GOM shrimp fishery, however, is the most valuable fishery in the U.S., and the Gulf fishery accounts for 71.5 percent of total domestic production.

Commercial fishing in deeper waters (i.e., >200 m [656 ft]) of the GOM is characterized by fewer species, and lower landed weights and values than the inshore fisheries. Historically, the deepwater offshore fishery contributes less than 1 percent to the regional total weight and value (USDOI, MMS, 2001a). Target species can be classified into three groups: (1) epipelagic fishes, (2) reef fishes, and (3) invertebrates. In general, the Matterhorn development is beyond the normal depth range of commercial reef fishes and invertebrates. While it is possible that new species of demersal fish or invertebrates may be pursued in the future if other fisheries fail, it appears unlikely at present because of the high cost and risk of fishing at extreme water depths. In addition, considerable time, effort, and finances would have to be expended to develop new markets for new species. Thus, if new fisheries develop in the deepwater Gulf, the most likely target species would be the epipelagic fishes, normally fished using surface longlines.

Epipelagic commercial fishes include dolphin, sharks (mako, silky, and thresher), snake mackerels (escolar and oilfish), swordfish, tunas (bigeye, blackfin, bluefin, and yellowfin), and wahoo (USDOI, MMS, 2001a). These species are widespread in the Gulf and probably occur in Grid 15. Nonetheless, it does not appear likely that significant fisheries for epipelagic fishes will develop in the far offshore waters of the Gulf, including the Matterhorn Project area, because of the generally low productivity and high costs and risks associated with these waters.

3.3.3. Recreational Resources and Beach Use

The northern GOM coastal zone has become increasingly domesticated over the past 20 years, with residential and recreational land use predominating. The satellite photograph below shows the distribution of the population throughout the U.S. Where there are lights, there are people. Nearly all of the Gulf Coast is a concentrated band of light. In addition to homes, condominiums, and some industry, that same coastline is also one of the major recreational regions of the U.S., particularly for marine fishing and beach activities. There is a diversity of natural and developed landscapes and seascapes, including coastal beaches, barrier islands, estuarine bays and sounds, river deltas, and tidal marshes. Other recreational resources are publicly owned and administered, such as national and state seashores, parks, beaches, and wildlife lands, as well as designated preservation areas, such as historic and natural sites and landmarks, wilderness areas, wildlife sanctuaries, research reserves, and scenic rivers. Gulf Coast residents and tourists from throughout the Nation, as well as from foreign countries, use these resources extensively and intensively for recreational activity. Commercial and private recreational facilities and establishments, such as resorts, marinas, amusement parks, and ornamental gardens, also serve as primary-interest areas. Locating, identifying, and observing coastal and marine birds is a recreational activity of growing interest and importance all along the Gulf Coast.

Figure 3-2. A Million Points of Lights: Population Distribution in the U.S. Year 2000.
Source: NASA, 2000.

More than 25 years ago Congress set aside outstanding examples of Gulf coastal beach and barrier island ecosystems to be managed by the National Park Service for the preservation, enjoyment, and understanding of their inherent value. State and county legislation added to this preservation program so that today there is a lengthy list of reserves, refuges, and public parks. That list, though much abbreviated, is as follows:

The U.S. coastline potentially affected runs from LaFourche Parish, Louisiana, to Gulf Shores, Alabama. It encompasses the confluence with the sea of the Mobile and Mississippi Rivers, which have two of the largest delta systems in the U.S. (Alabama State Docks Department, 2001). In this section, the coastline was divided into segments according to topography, discrete human and other biological populations, barrier island formations, and special preservation areas. This gives the reader the chance to put in geographical context the textual descriptions. Likewise, the reader will note that most of these counties include many ecological characteristics that humans use for recreation, research, and conservation.

Beaches

Louisiana

The three parishes of Cameron, Lafourche, and Jefferson comprise this segment. Spanning part of this coastline is the Barataria-Terrebone National Estuary Program, the Atchafalaya National Wildlife Refuge, and the Jean Lafitte National Historic Park and Reserve.

Gulf Islands, Mississippi and Alabama

Gulf Island National Seashore in this part of the Gulf stretches some 40 mi from Hancock, Harrison, and Jackson Counties in Mississippi to neighboring Mobile County and Dauphin Island in Alabama and over to Florida's Panhandle. It accommodates over 1 million recreational visits a year. In addition to beaches, the Seashore harbors historic forts, shipwrecks, wetlands, lagoons and estuaries, seagrass, fish and wildlife, and archaeological sites. In 1978, Congress designated approximately 1,800 ac on Horn and Petit Bois Islands, part of the Gulf Island National Seashore in Mississippi, as components of the National Wilderness System. There is also a national estuarine research reserve at Grand Bay (Weeks Bay Reserve Foundation, 1999).

Gulf Shores, Alabama

The southernmost part of Baldwin County is also known as Pleasure Island. It was not an island but a peninsula until the U.S. Army Corps of Engineers built the intracoastal waterways and cut the land ties to the mainland. Mobile Bay is part of the national estuary program. Weeks Bay, at the southeastern end of the bay, is also part of the national estuarine research reserve system (Weeks Bay Reserve Foundation, 1999).

Use of the shorefront directly associated with this proposal is diverse. It consists of national seashores, traditional beachfront cities such as Gulfport, state parks, marshland, casino-dotted beaches, the migratory bird habitats of Fort Morgan, and the sugar white sands of Gulf Shores, Alabama. Eco-tourism in national estuarine research reserves and beach recreation is interspersed with condominiums, hotels, planned communities, and private residences. Tourists and travelers are also attracted to the sites, sounds, shopping, and dining associated with developed marine areas. For example, spending for food, beverages, and lodging along Baldwin County beaches was estimated by Alabama's Gulf Coast Convention and Visitors Bureau at approximately $300 million in 1995 (*Mobile Register*, 1996). Although there is recreational use of the Central Gulf Coast year round, the primary season is the spring and summer. Kelley and Wade (1999) documented major increases in sales and lodging tax revenues in both Baldwin and Mobile Counties from 1979 to 1995, indicating the critical importance and effect of tourism on coastal Alabama. Other coastal trends charted by Foster and Associates (*Mobile Register*, 1996), such as population growth and the increase in pleasure boat registrations, also indicate a corresponding growth in resident recreational demand commensurate with the same resources-beaches and marine activities-attractive to the tourist. Both the Alabama and Mississippi coasts exhibit strong and growing economies closely tied to their abundant and attractive resources, especially Pleasure Island's beaches and Mississippi's casinos and associated tourism.

Marine recreational fishing in the Gulf Region from Louisiana to Alabama is also a major industry important to these states' economies. The marine recreational fishing industry in the Gulf accounts for nearly a billion dollars in sales of equipment, transportation, food, lodging, insurance, and services and accounts for thousands of jobs. The Gulf States from Louisiana to Florida account for about 1.6 million registered motorboats with almost 4 million anglers making more than 16 million saltwater fishing trips in 1998 (USDOC, NMFS, 1999c). Many of these trips are taken from Florida and Alabama, accounting for over 800 charter boats. The largest charter fleets closest to the proposed lease sale are located in Orange Beach, Alabama (Texas Gulf Coast Fishing, 2001). Just over one-third of the marine recreational fishing trips in the GOM extend into offshore water under Federal jurisdiction. Seatrout, drum, grunts, bluefish, and mackerel are some of the more popular inshore and nearshore fish harvested in coastal marine waters. Snapper, grouper, and dolphin are some of the more popular fish sought and caught more frequently in offshore waters. Billfish, tuna, and to some extent snapper, grouper, and dolphin are sought by recreational fishermen in the more-distant deep offshore waters. Recreational diving trips are also popular in nearshore and offshore waters near natural and artificial reefs.

3.3.4. Archaeological Resources

Archaeological resources are any material remains of human life or activities that are at least 50 years of age and that are of archaeological interest. The Archaeological Resources Regulation (30 CFR 250.194) provides specific authority to each MMS Regional Director to require archaeological resource surveys, analyses, and reports. Surveys are required prior to any exploration or development activities on leases within the high probability areas (NTL 2002-G01, effective in March 2002).

3.3.4.1. Prehistoric

Available geologic evidence suggests that sea level in the northern GOM was at least 90 m, and possibly as much as 130 m, lower than present sea level, and that the low sea-stand occurred during the period 20,000-17,000 years Before Present (B.P.) (Nelson and Bray, 1970). Sea level in the northern Gulf reached its present stand around 3,500 years B.P. (Coastal Environments, Inc., 1986).

During periods that the continental shelf was exposed above sea level, the area was open to habitation by prehistoric peoples. The advent of early man into the GOM region is currently accepted to be around 12,000 years B.P. (Aten, 1983). According to the sea-level curve for the northern GOM proposed by Coastal Environments, Inc. (CEI), sea level at 12,000 B.P. would have been approximately 45 m below the present still stand (CEI, 1977 and 1982). On this basis, the continental shelf shoreward of the 45-m to 60-m bathymetric contours has potential for prehistoric sites dating after 12,000 B.P. Because of inherent uncertainties in both the depth of sea level and the entry date of prehistoric man into North America, MMS adopted the 12,000 years B.P. and the 60-m water depth as the seaward extant of the prehistoric archaeological high probability area.

The water depth of Mississippi Canyon Area Block 243 at the proposed well site is 2,808 ft (856 m). Based on the current acceptable seaward extent of the prehistoric archaeological high probability area, the extreme depth precludes the existence of any prehistoric archaeological resources within the Grid 15 area.

3.3.4.2. Historic

With the exception of the Ship Shoal Lighthouse structure, historic archaeological resources on the OCS consist of historic shipwrecks. A historic shipwreck is defined as a submerged or buried vessel, at least 50 years old, that has foundered, stranded, or wrecked and is presently lying on or embedded in the seafloor. This includes vessels (except hulks) that exist intact or as scattered components on or in the seafloor. A 1977 MMS archaeological resources baseline study for the northern GOM concluded that two-thirds of the total number of shipwrecks in the northern Gulf lie within 1.5 km of shore and most of the remainder lie between 1.5 and 10 km of the coast (CEI, 1977). A subsequent MMS study published in 1989 found that changes in the late 19th and early 20th century sailing routes increased the frequency of shipwrecks in the open sea in the Eastern Gulf to nearly double that of the Western and Central Gulf (Garrison et al., 1989). The highest observed frequency of shipwrecks occurred within areas of intense marine traffic, such as the approaches and entrances to seaports and the mouths of navigable rivers and straits.

Review of the Garrison et al. (1989) shipwreck database lists four shipwrecks that fall within the Grid 15 area of Mississippi Canyon and Viosca Knoll. A fifth shipwreck was discovered in May 2001. This vessel is a copper-sheathed, wooden-hulled wreck that was discovered by Exxon/Mobil during a post-construction ROV survey. The copper-clad shipwreck dates between 1780 and 1810. The other four wrecks listed are known only through the historical record and, to date, have not been located on the ocean floor. All of these wrecks are listed in Table 3-2. The MMS shipwreck database should not be considered exhaustive lists of shipwrecks. Regular reporting of shipwrecks did not occur until late in the 19^{th} century, and losses of several classes of vessels, such as small coastal fishing boats, were largely unreported in official records.

Wrecks occurring in deeper water would have a moderate to high preservation potential, as can be seen by the copper-sheathed wreck in Mississippi Canyon Block 74. In the deep water, temperature at the seafloor is extremely cold, which slows the oxidation of ferrous metals and help to preserve wood features. The cold water would also eliminate wood-eating shipworm *Terredo navalis* (Anuskiewicz, 1989; page 90).

Aside from acts of war, hurricanes cause the greatest number of wrecks in the Gulf. The wreckage of the 19^{th} century steamer *New York,* which was destroyed in a hurricane in 1846, lies in 16 m of water and has been documented by MMS (Irion and Anuskiewicz, 1999) as scattered over the ocean floor in a swath over 1,500 ft long. Shipwrecks occurring in shallow water nearer to shore are more likely to have been reworked and scattered by subsequent storms than those wrecks occurring at greater depths on the OCS. Historic research indicates that shipwrecks occur less frequently in Federal waters. However, these wrecks are likely to be better preserved, less disturbed, and, therefore, more likely to be eligible for nomination to the National Register of Historic Places than are wrecks in shallower State waters.

Table 3-2

Shipwrecks In or Near Grid 15

Vessel Name	Year It Sank	Area and Block
Western Empire	1875	Mississippi Canyon 332
Copper-sheathed Wreck	1780-1810	Mississippi Canyon 74
Bradford C. French	1916	Viosca Knoll 957
Elmer E. Randall	1906	Viosca Knoll 826
Anona	1944	Viosca Knoll 830

3.3.5. Artificial Reef and Rigs-to-Reefs Development

Artificial reefs have been used along the coastline of the U.S. since the early 19th century. Stone (1974) documented that the use of obsolete materials to create artificial reefs has provided valuable habitat for numerous species of fish in areas devoid of natural bottom structure.

In 1984, the U.S. Congress, recognizing the social and economic value in developing artificial reefs, passed the National Fishing Enhancement Act (NFEA). The NFEA directed the Secretary of Commerce to develop and publish a long-term National Artificial Reef Plan (NARP) to promote and facilitate responsible and effective artificial reef use based on the best scientific information available. Mississippi's artificial reef efforts began in the 1960's and Louisiana's Artificial Reef Initiative (LARI) started in the 1980's.

Rigs-to-Reefs (RTR) is a catchy term for converting obsolete, nonproductive, offshore oil and gas platforms to designated artificial reefs (Reggio, 1987). Offshore oil and gas platforms began functioning as artificial reefs in 1947 when Kerr-McGee completed the world's first commercially successful oil well in 5.6 m of water, 70 km south of Morgan City, Louisiana. Today, approximately 4,000 offshore oil and gas platforms exist on the OCS; these platforms also form one of the world's most extensive defacto artificial reef systems.

The proposed Matterhorn Project in Mississippi Canyon Block 243 is located offshore Mississippi and Louisiana, approximately 30 mi south of the nearest Louisiana Artificial Reef Planning Area (i.e., Main Pass Planning Area). The proposed pipeline is also located south and far outside of the Main Pass Artificial Planning Area.

4. POTENTIAL ENVIRONMENTAL EFFECTS

4.1. PHYSICAL ELEMENTS OF THE ENVIRONMENT

4.1.1. Impacts on Water Quality

4.1.1.1. Coastal Water Quality

The proposed Matterhorn Project in Mississippi Canyon Block 243 is located approximately 25 mi (40 km) from the Louisiana coastline; the closest shoreline area being the Mississippi River's active delta area.

Offshore activities that have a potential to change water quality include operational discharges during drilling and production and accidental spills. Operational discharges from the drilling and completion of the eight wells and from routine production operations are not likely to impact nearby coastal water quality; given that this area is characterized by turbid, contaminated waters already being discharged from the Mississippi River into this area. An accidental oil spill ≥1,000 bbl occurring from drilling, completion, or production operations—a rare event based on historical statistics for the GOM—constitutes a possible exception. The degradation of coastal water quality from an offshore spill would depend on whether it was a subsurface or surface spill, the volume of the hydrocarbon release, environmental conditions at the time and place of the spill, and the type and volume of dispersant that might be used, if any. The likelihood of a large hydrocarbon spill occurring and reaching coastal waters and various parishes or counties is provided in Appendix A. The table in Appendix A shows that there is a negligible chance of impacts from spills from this project. Plaquemines Parish, Louisiana, and

Louisiana State offshore waters west of the Mississippi River have a the greatest percent chance (1%) of a spill 1,000 bbl or greater occurring from this project and contacting adjacent shoreline and resources.

Coastal waters could be degraded by support operations, including construction of new onshore support facilitates, routine point and non-point source discharges from onshore bases, discharges from associated support vessel traffic, spills from these coastal operations, canal dredging, and pipeline emplacement operations. TotalFinaElf proposes to use two existing onshore support bases during drilling, completion, and production operations associated with this project: (1) the C-Port Fourchon shore base located in Fourchon, Lafourche Parish, Louisiana; and (2) the Venice shore base located in Venice, Plaquemines Parish, Louisiana. No expansion of these physical facilities is expected to result from the proposed activities. No increase in maintenance dredging of access canals is expected. No sediment disturbance from pipeline emplacement would occur since TotalFinaElf proposes to use an existing pipeline system.

During the drilling/completion phase of the proposed activities, the operator estimates that there would be four trips per week by the crewboat and three trips per week by the supply boat. During the production phase, there would be one trip by the crewboat and supply boat, respectively. The primary method for transporting rig crews and service personnel would be helicopters from Venice, Louisiana. No dredging over and above normal channel maintenance would be required to support these vessels. The boats would discharge heated cooling water and non-oily bilge water. Most vessel trips would be from the Fourchon service base and most helicopter trips would originate from the Venice service base. Minor, transient changes in localized water quality would be intermittent, resulting from waste discharges from these service vessels.

Conclusion

The proposed action would use existing onshore support facilities. These facilities are not expected to expand their operations and no new coastal pipelines or channels are proposed. As a result, only vessel traffic associated with the proposed action would result in a negative impact to coastal waters. The level of this impact is expected to be very minor and transient, negligibly affecting water quality due to prop wash, accidental waste release, and other activities. Routine offshore activities associated with the project are not expected to adversely affect coastal water quality due to water depth and the location of the project off the mouth of the Mississippi River.

4.1.1.2. Offshore Water Quality

Discharges, sediment disturbance, and possible spills associated with the Matterhorn Project could affect offshore water quality to varying degrees. Factors associated with drilling activities that have the potential to affect water quality offshore include the discharge of drill mud and cuttings, well treatment, completion, and workover fluids, and domestic and sanitary wastes during the drilling of the eight wells. The installation of anchor systems, pipelines, and other subsea infrastructure during emplacement operations could result in sediment disturbances affecting water quality. Routine production activities that would affect water quality include the discharge of produced water, cooling water, and sanitary and domestic waste discharges. Decommissioning effects would presumably be similar in scope and magnitude with offshore construction and installation operations. All discharges would adhere to existing regulatory discharge criteria designed to mitigate significant environmental effects.

Sanitary and domestic waste discharges from personnel on-site during drilling and production are expected to increase nutrient input and biological oxygen demand (BOD) slightly, but this is not normally a concern in open oceanic waters.

The installation of anchor systems, pipelines, and other subsea infrastructure during emplacement operations of Platform A would result in localized increases in total suspended solids (TSS) or turbidity. Suspension of fine fractions from the drilling mud and cuttings in the water column would also result in increased localized turbidity. Unless the TSS from the drilling discharges are very high and chronic and unless they impinge on sensitive benthic communities, increased localized turbidity is not normally considered to have a significant effect on the marine water column. The drilling of the Matterhorn wells would entail the use of a synthetic-based fluid for drilling all sections in which cuttings would be discharged overboard, so cuttings would be the only source contributing to increased turbidity. The very fine fraction of the jetted or drilled material, including some of the very fine surface sediments, at the beginning of the drilling process may create near-bottom turbidity that would be transported away from the drill site by the bottom currents before dispersing and settling out. The resulting discharges should create little turbidity in the area except near the discharge point, as synthetic-based drilling fluids (SBF) tend to consolidate the cuttings, causing them to drop rather quickly to the seabed (USDOI, MMS, 2000; USEPA, 2001). Furthermore, because the drill cuttings would be discharged near the surface, much of the associated turbidity would be dispersed before reaching the deepwater seabed. Turbidity *per se* would create little impact on the water quality in the grid area because the inputs would be limited in amount and the discharges would be spread out over time. Light limitation (one of the effects of high turbidity) in deepwater areas is normally not an issue. Surface sediments in the deepwater GOM are relatively pristine so that any turbidity created by bottom disturbances would not decrease water quality other than for the expected TSS increase. In conclusion, any effects from elevated turbidity would be short term, localized, and reversible.

Major discharges estimated for the proposed project were included in supplemental information submitted along with the DOCD. Of the discharges listed in the plan, contaminants in the produced-water discharge stream is the most likely to affect offshore water quality to any degree because it may contain elevated levels of hydrocarbons and metals, and because it would be discharged more or less continuously in fairly large amounts from a surface outlet throughout the production phase (Neff, 1997). Any produced water that has been treated and discharged is expected to disperse rapidly into the open oceanic environment. Because of the water depth, no contamination of bottom sediments is expected. Produced-water discharges in Grid 15 would disperse in the water column before they reach the bottom and thus would not interact with the benthic environment.

Contaminants in the water-based drilling muds, if used, could impact bottom sediments. Most of the components of drilling fluid have low toxicity with the exception of some trace metals. Barium is the major element in the mud because of the high barite level, but trace amounts of chromium, copper, cadmium, mercury, lead, and zinc are also present. The USEPA guidelines limit the levels of cadmium and mercury in stock barite to 3.0 milligrams/kilogram (mg/kg) and 1.0 mg/kg (dry weight), respectively. The MMS-sponsored research efforts have found elevated levels of barium around drilling areas. Barium, and the contaminants that are bound to it, were physically mobile and could be spread out sporadically over a large area away from the discharge site. Often, levels of barite were not well correlated with distance from the discharge site due to transport processes and reworking of the sediments. Some localized effects were found, but no large-scale regional impacts were found (Kennicutt, 1995; Boothe and Presley, 1989).

The direct discharge of SBF is prohibited; however, some fluid adheres to the cuttings. A recent literature review (Neff et al., 2000) discusses the current knowledge about the fate and effects of SBF on the seabed. Like oil-based drilling fluids (OBF), the SBF do not disperse in the water column and therefore are not expected to adversely affect water quality. They do, however, settle very close to the discharge point, thus affecting the local sediments. Unlike OBF, SBF do not typically contain toxic aromatic compounds. The primary effects are smothering, alteration of grain size, and addition of organic matter, which can result in localized anoxia while the SBF degrade. Different formulations of SBF use different base fluids that degrade at different rates, thus affecting the impact. The SBF cuttings can pass the current discharge criterion for water-based drilling fluids (WBF) because of their low toxicity. Bioaccumulation tests also indicate that SBF and their degradation products should not significantly bioaccumulate. It is expected that discharged cuttings should degrade within 2-3 years after cessation of discharge. The MMS is currently jointly funding a study of the spatial and temporal effects of discharged cuttings to evaluate the effects.

A large oil spill or blowout, a very rare event that would be an exception, is examined in detail in Appendix A. An oil spill ≥1,000 bbl at the water surface could result from an accident on the TLP. Subsurface spills could occur from pipeline failure or at one of the eight wellheads from a blowout. Most of the oil from a subsurface spill would likely rise to the surface and would weather and behave similarly to a surface spill, dependent upon a number of factors, particularly the characteristics of the released oil and oceanographic conditions. However, some of the subsurface oil may also get dispersed within the water column, as in the case of the *Ixtoc I* seafloor blowout. Evidence from a recent experiment in the North Sea indicates that oil released during a deepwater blowout would quickly rise to the surface and form a slick (Johansen et al., 2001). Impacts from a deepwater oil spill would occur at the surface where the oil would be mixed into the water and dispersed by wind waves. Once the oil enters the ocean, a variety of physical, chemical, and biological processes act to disperse the oil slick, such as spreading, evaporation of the more volatile constituents, dissolution into the water column, emulsification of small droplets, agglomeration sinking, microbial modification, photochemical modification, and biological ingestion and excretion. The water quality of marine waters would be temporarily affected by the dissolved components and small oil droplets that do not rise to the surface are mixed down by surface turbulence. Dispersion by currents and microbial degradation remove the oil from the water column or dilute the constituents to background levels.

Conclusion

Near-bottom water quality would be affected during the period of development drilling and installation of subsea infrastructure, including the moorings and anchors. However, these activities are not expected to create a significant impact because they would be relatively short term, not geographically extensive, and the near-bottom TSS would likely be within the natural range encountered during episodic events of high current velocities. Routine discharges from development activities such as deck drainage, excess cement, other well fluids, sanitary and domestic wastes, and cooling water would affect water quality (e.g., TSS, nutrients, chlorine, and BOD) within tens of meters of the discharge.

Treated produced-water discharge would occur at varying volumes throughout the production phase and would affect local water quality, primarily by increases in metals and hydrocarbons levels, proximate to the TLP. The plume behavior and shape would be variable depending upon prevailing environmental conditions but, in total, would affect a relatively small area of oceanic water and would be rapidly diluted. Overall, there would be no significant effects to the water quality.

Effects to water quality during decommissioning operations would be similar or less than those that occur during development and thus are not considered significant.

Offshore effects from an accidental discharge of oil would affect water quality immediately under the slick (top few meters of the water column). Operator-initiated activities to contain and clean up an oil spill would begin as soon as possible after an event. However, the remaining portion of the discharged oil would weather, disperse, and biodegrade within a short period of time, and no significant long-term effects on offshore water quality are expected to occur.

4.1.2. Impacts on Air Quality

There would be a limited degree of degradation of air quality in the vicinity of the proposed operations for the period of the projected production activities. The air emissions are expected to increase until 2003 (Table 3-1 in Chapter 3), then reduce to lower levels in 2004 through 2010.

Air quality would be affected in the event of a blowout or oil spill. The volatile organic compounds (VOC's) that would escape are precursors to photochemically produced ozone. A spike in VOC's could contribute to a corresponding spike in ozone, especially if the release was to occur on a hot sunny day in a NO_2-rich environment. The corresponding onshore area for the project is in attainment for ozone (USEPA, 2002). If a fire occurs, particulate and combustible emissions would be released in addition to the VOC's.

Conclusion

The proposed action is not expected to result in significant impacts to air quality. However, TotalFinaElf's proposed action(s) would occur within the Breton Wilderness Air Quality Class I Prevention of Significant Deterioration Zone and has the potential to exceed annual exemption levels. As a result, MMS has identified the following mitigations and recommendations to reduce the possible impact on the air quality:

Mitigation 2.2 (Advisory) - Potential to exceed exemption level, DOCD

> A deviation from your DOCD (such as additional drilling time, changes in the drilling schedule, and/or use of higher horsepower equipment, especially for the drilling rig and construction barges) could potentially cause the annual emissions exemption level NO_x to be exceeded. Therefore, if such a deviation occurs, please be advised that you will

immediately prepare a revised DOCD pursuant to 30 CFR 250.204(q)(2) to include the recalculated emission amounts and the air quality modeling required by 30 CFR 250.303(e). You will not proceed with the actions that could cause the potential exceedance until the revised DOCD has been submitted to and approved by this office.

Mitigation 2.5 (Advisory) - Fuel usage or run time documentation

The projected NO_x emissions amounts in your plan were calculated using historic (fuel consumption rates, run times). Therefore, please be advised that you will maintain records of the (total monthly fuel consumption, actual run times) for the ENSCO 7500 semi-submersible drilling unit and provide the information to this office (upon request, annually, upon project completion).

Recommendation

The use of low sulfur fuel and NO_x controls are recommended to reduce the impacts on the air quality in the Breton Sound National Wilderness Area.

4.2. BIOLOGICAL RESOURCES

4.2.1. Impacts on Sensitive Coastal Environments

4.2.1.1. Coastal Barrier Beaches and Associated Dunes

The following section describes potential impacts to coastal barrier beaches and associated dunes from oil spills that might occur as a result of proposed activities in Grid 15. The Oil Spill Risk Analysis (OSRA) model used describes the probabilities of spill movement around the GOM and projected contacts with the shore. Appendix A lists potential sources of hydrocarbon spills that might result from the proposed action. Appendix A also describes the probability of an oil spill and the estimated dispersal characteristics, should a spill occur. Spill response and effectiveness is also discussed in Appendix A.

Contact between an oil slick and a beach primarily depends upon environmental conditions, and the nature of the oil spilled indicates that if a spill were to occur in MMS's C4-3 cluster area and persist for 10 days, there is a very low probability of that spill contacting land.

Should a contact occur, the volume of oil involved could range from a few dispersed gallons of oil to a volume that approaches the projected volume of oil that might exist in the slick on the day of contact, as indicated by the OSRA model. The length of beach that might be contacted could range to about 20 km (12 mi). The possible range for dispersal patterns of contacting oil ranges from small, diffusely scattered specks to heavy concentrations spread over the beach.

Severe adverse impacts to dunes contacted by a spill are very unlikely. For storm tides to carry oil from a spill across and over the dunes, strong southerly or easterly winds must persist for an extended time, prior to or immediately after the spill. Strong winds required to raise water levels adequately to contact dunes would also accelerate oil slick dispersal, thereby reducing impact severity at a landfall site. In addition, a study in Texas showed that oil disposal on vegetated sand dunes had no deleterious effects on the existing vegetation or on the re-colonization of the oiled sand by plants (Webb, 1988).

Cleanup operations associated with large oil spills can affect the stability of barrier beaches more than the spill itself. If large quantities of sand were removed during spill cleanup operations, a new beach profile and sand configuration would be established in response to the reduced sand supply and volume. The net result of these changes would be accelerated rates of shoreline erosion at the contact site and down drift of that site. This situation would be accentuated in sand-starved or eroding barrier beaches, such as those found on Galveston Island and the Louisiana coast. State governments around the Gulf have recognized these problems and have established policies to limit sand removal by cleanup operations.

Conclusion

The proposed action is not expected to adversely alter barrier beach or dune configurations significantly as a result of an accidental oil spill, should one occur.

4.2.1.2. Wetlands

A description of a hypothetical oil spill associated with the proposed action is provided in Appendix A. The information below regarding potential impacts of oil spills on wetlands is based on information in the Final EIS for Central Gulf of Mexico Lease Sales 169, 172, 175, 178, and 182 (USDOI, MMS, 1997).

Data in Appendix A indicate that a very low probability exists for an oil spill to occur from the Matterhorn development. As discussed in USDOI, MMS (1997), distant offshore spills have even a further diminished probability of impacting inland wetland shorelines and seagrasses, largely due to the sheltered locations of these habitats.

An inland fuel-oil spill could occur at a shore base or as a result of a vessel collision. The probability of an inland, fuel-oil spill occurring in association with the proposed action is very small. However, should a spill occur inshore or in nearshore waters, it presents a much greater potential for adversely impacting wetlands and seagrasses than an offshore spill, due simply to their proximity to the spill. Oil could accumulate in sheens and thick layers in the marsh and in protected pools and embayments.

The works of several investigators (Webb et al., 1981 and 1985; Alexander and Webb, 1983, 1985, and 1987; Lytle, 1975; Delaune et al., 1979; Fischel et al., 1989; Irvine, 2000) were used to evaluate impacts of potential spills to area wetlands. For wetlands along the central Louisiana area, the critical oil concentration is assumed to be 1.0 liter/m^2 of marsh. Concentrations above this will result in longer-term impacts to wetland vegetation, including some plant mortality and loss of land. Concentrations less than this may cause diebacks for one growing season or less, depending upon the concentration and the season during which contact occurs.

Conclusion

Significant adverse impacts to wetlands resulting from an accidental spill associated with the proposed project are not expected. If a spill occurs at the offshore site, oceanographic and meteorological conditions are very unlikely to move oil far enough in a short enough time to cause oil contacts with wetlands. If an unlikely, project-related fuel-oil spill occurs inshore, some wetlands in the spill vicinity may be adversely impacted. Secondary impacts from cleanup activities present a greater impact potential.

4.2.1.3. Seagrasses

Seagrasses have generally experienced little or no damage from oil spills (Chan, 1977; Zieman et al., 1984). The relatively low susceptibility of seagrasses in the northern GOM to oil-spill impacts is partly the result of their location, which is subtidal, generally landward of barrier islands and in a region with a small tidal range. Furthermore, it should be noted that seagrasses are much less common in Louisiana, the most likely landfall for a spill, than elsewhere in the Gulf, particularly in Florida and Texas.

The lack of low-tide exposure protects seagrasses from direct contact with oil. The degree of impact depends on water depth, the nature of the oil, and the tidal and weather events in the affected area during the presence of the floating oil. Another reason for the low susceptibility of seagrass to oil spills is that a large percentage of their biomass is found in the buried root and rhizome, from which the leaves generate. An oil spill that moves over a seagrass area would not be expected to directly cause anything but slight damage to the vegetation. Some seagrass dieback for one growing season might occur, largely depending upon water currents and weather. No permanent loss of seagrass habitat is expected to result from such spills.

During extremely low water conditions such as wind-driven tidal events, seagrass beds might be exposed to the air and could potentially be impacted directly by an oil slick. Even then, their roots and rhizomes remain buried in the water bottom. Given the geography of the coastal area discussed, a strong wind that could lower the water that much would generally be a northerly or westerly wind, which would push water out of bays and estuaries and drive a slick away from the coast. In this situation, oil that was already in the bay or sound would be driven against the southern or eastern shores. Any seagrass beds that may be exposed there might be contacted.

The greatest oil-spill effect to seagrass communities has been to the diversity and populations of the epifaunal community found in the seagrass bed. Should water turbulence and turbidity increase sufficiently, some oil on the water surface may be emulsified. Suspended particles in the water column will adsorb oil from a sheen as well as from emulsified droplets, causing some particulates to clump together and decrease their suspendability. Typically, submerged vegetation reduces water velocity among the vegetation as well as for a short distance above it. Reduced flow velocity or turbulence further enhances sedimentation.

Minute oil droplets, whether emulsified or bound to suspended particulates, may adhere to vegetation or other marine life; they may be ingested by animals, particularly by filter and sedimentation feeders; or they may settle onto bottom sediments in or around a bed. In these situations, oil has a limited life because it will be degraded chemically and biologically (Zieman et al., 1984).

The potential danger to a seagrass community from an oil-spill event is a reduction for up to two years of the diversity or population of epifauna and benthic fauna found in seagrass beds. The degree of impact further depends on the time of year, water depth, currents, and weather in the affected area during the presence of a slick, as well as oil density, solubility, ability to emulsify, and toxicity.

A more damaging scenario would involve the secondary impacts of a slick that remains, for a period of time, over a submerged bed of vegetation in a protected embayment during typical fair-weather conditions. This would reduce light levels in the bed. If light reduction continues for several days, chlorophyll content in the leaves will be reduced (Wolfe et al., 1988), causing the grasses to yellow, reducing their productivity. By itself, shading from an oil slick should not last long enough to cause mortality, depending on the slick thickness, currents, weather, efforts to clean up the slick, and the nature of the embayment.

Also, a slick that remains over submerged vegetation in an embayment would reduce or eliminate oxygen exchange between the air and the water of the embayment. Currents may not flush adequately oxygenated water from the larger waterbody to the shallow embayment. Seagrasses and related epifauna might be stressed and possibly literally choked if the biochemical oxygen demand is high, as would be expected for a shallow waterbody that contains submerged vegetation, with its usual detritus load, and an additional burden of spilled oil (Wolfe et al., 1988).

The clean up of slicks that come to rest in shallow or protected waters [0 to 1.5 m (0 to 5 ft) deep] may be performed using "john" boats, booms, anchors, and skimmers mounted on boats or shore vehicles. Personnel assisting in oil-spill cleanup in water shallower than about 1m (3-4 ft) may readily wade through the water to complete their tasks. Foot traffic and equipment can easily damage seagrass beds and associated habitat. Oil can also be worked more deeply into their sediments by these activities.

As described for wetlands, oil that penetrates or is buried into the water bottom is less available for dissolution, oxidation, or microbial degradation. Depending upon circumstances, oil may be detectable in sediments for five years or more. Navigational vessels that vary their route from established navigation channels can directly scar shallow beds of submerged vegetation with their props, keels (or flat bottoms), and anchors (Durako et al., 1992).

Conclusion

Significant adverse impacts to seagrasses resulting from an accidental spill associated with the proposed project are not expected. If a spill does occur at the offshore site, oceanographic and meteorological conditions are very unlikely to move oil far enough in a short enough time to cause oil contacts with seagrasses. If an unlikely, project-related fuel-oil spill occurs inshore, some wetlands in the spill vicinity may be adversely impacted; however, seagrasses are unlikely to be impacted directly. A spill's secondary impacts, including shading, suffocation, and cleanup activities present a greater impact potential.

4.2.2. Impacts on Deepwater Benthic Communities/Organisms

4.2.2.1. Chemosynthetic Communities

A biological review for the potential occurrence of chemosynthetic communities in the area of the proposed action was performed. No areas having the potential to support chemosynthetic communities were identified in the area, including the 457-m (1,500-ft) avoidance distance from the discharging structure required by NTL 2000-G20. No other potential chemosynthetic community areas were identified within 152 m (500 ft) of all anchor locations.

Conclusion

The proposed project will not have an impact on known chemosynthetic communities, and no potential communities are located in the vicinity of the impacting activities, as indicated by geophysical characteristics.

4.2.2.2. Coral Reefs

Coral reefs in the GOM are normally associated with topographic features. There are no known topographic highs in Grid 15; thus, there are no known shallow-water coral reefs in this area. Deepwater coral reefs are rare in the GOM, and there are no documented hard substrate areas that might support deepwater corals in Grid 15.

Conclusion

The proposed action will have no impact on any known coral reefs.

4.2.2.3. Deepwater Benthos and Sediment Communities

The deepwater benthos in the immediate vicinity of the proposed project would be impacted by the discharge of drilling mud and cuttings, placement of mooring lines and anchors, and well site locations. The most common adverse impact would be physical smothering by sediments. Invertebrates, many with some degree of mobility, typically dominate the megafaunal benthic communities at the project depth range of 760-945 m. The macrofauna is dominated by deposit-feeding polychaete worms with varying degrees of mobility and tolerance to disturbance. The meiofauna, primarily composed of small nematode worms, is more abundant than macrofauna, and their numbers decline with depth. Little is known of the microbiota in deep water, but it probably includes hydrocarbon-degrading forms. None of the benthic communities found in Mississippi Canyon Block 243 are unique to the area and appear to be widespread throughout the Gulf, where similar depths, substrates, and other environmental factors occur.

The effects of drilling muds and cuttings on the deepwater benthos would be limited for the following reasons:

- *Low Toxicity*. The SBF’s are expensive and are recycled. Any unusable portion is sent to approved disposal/recycling sites onshore. The SBF cuttings would be treated to conform to regulatory guidelines. The SBF is essentially nontoxic, and the composite formulation of the discharged fluid adhering to the cuttings has a very low toxicity to aquatic organisms. Most of the SBF in current use can easily pass the USEPA's 96-hour, LC_{50} criteria of 30,000 ppm (McKelvie and Ayers, 1999). Test results with four types of SBF’s on algae, mysids, copepods, mussels, and amphipods range from 277 to 1,000,000 ppm (McKelvie and Ayers, 1999). Dose response studies on fish by Payne et al. (2001a and b) demonstrated that sediments contaminated with Hibernia (Grand Banks, Newfoundland) source cuttings containing an aliphatic hydrocarbon-based synthetic drilling fluid had a very low toxicity potential. Acute toxicity was not observed in juvenile flounder exposed for up to two months to sediment containing approximately 6,000 ppm of diesel-range (aliphatic) hydrocarbons.
- *Limited Biological Effects*. The only direct biological effect reported for SBF’s and associated cuttings in the field environment has been smothering of benthic animals by physical and/or anoxic conditions. Anoxia is caused by the rapid biodegradation of the SBF. Organic enrichment due to the introduction of carbon into a carbon-poor environment has also been noted (Pompano Study by Fechhelm et al. 2001).
- *Limited Affected Area*. Cuttings from wells drilled with SBF tend to clump together and are transported to the bottom relatively quickly. Thus, the affected area would be relatively small. The vast majority of historical literature ((based on the more toxic oil-based muds or water-based muds (WBM), which tend to disperse farther)

> indicates biological effects generally do not occur beyond 500 m (1,640 ft) from the source, although several papers have noted subtle effects beyond that range. Most relevant is the recent research in the North Sea (Jensen et al., 1999) that studied a number of platforms that used only SBF. That study found no benthic effects (i.e., benthic effects as measured by subtle community changes) beyond 250 m (820 ft) in most cases, 500 m (1,640 ft) in a few cases. However, one must note that the North Sea is a shallower environment than the deepwater GOM.

The anchor system and mooring lines should have minimal effects on the benthos. Installation of the anchors and activities at the proposed well sites would physically disturb the benthos in the immediate area. The benthos would also be affected in the unlikely event of a subsea blowout that caused disturbance and slumping of the surrounding seabed.

Conclusion

Structure emplacement (including anchor installations and moorings), well drilling, and completion operations would disturb benthic communities by smothering and displacing them from patches within limited distances of the well site locations and within a small area of the anchors and chains or cables that contact the bottom. Partial recovery of the community would occur within weeks or months of the disturbance probably followed by a more or less full recovery within 1-2 years. This would not result in significant impacts on the benthic communities because the duration and area extent of the proposed activities would be limited.

Routine production activities would not significantly impact the benthos. A subsea blowout would physically disturb the benthos within a small radius of the blowout, but most of the released fluids are expected to go to the surface and not interact with deepwater benthos.

Effects of decommissioning are not well characterized at this time because the detailed decommissioning scenario is not known due to uncertainties in future strategies and technologies. However, the overall effects are expected to be less than those caused by the initial installation activites and thus would not cause significant impacts to the benthos.

4.2.3. Impacts on Marine Mammals

The major impact-producing factors affecting marine mammals as a result of the proposed action include the degradation of water quality from operational discharges; noise generated by helicopters, vessels, operating platforms, and drillships; vessel traffic; explosive structure removals; and jetsam and flotsam from service vessels and OCS structures.

Some effluents are routinely discharged into offshore marine waters. It is expected that cetaceans may have some interaction with these discharges. Direct effects to cetaceans are expected to be sublethal. However, any pollution in the effluent could poison and kill or debilitate marine mammals and adversely affect the food chains and other key elements of the Gulf ecosystem (Tucker & Associates, Inc., 1990). Because OCS discharges are diluted and dispersed in the offshore environment, impacts to cetaceans are expected to be negligible relative to the contaminants introduced into the Gulf from national and international watersheds.

Helicopter activity projections are five trips per week during drilling and completion (approximately 21 months) and one trip per week during production. The FAA Advisory Circular 91-36C encourages pilots to maintain higher than minimum altitudes (noted below) over noise-sensitive areas. Corporate helicopter policy states that helicopters should maintain a minimum altitude of 700 ft while in transit offshore and 500 ft while working between platforms. In addition, guidelines and regulations promulgated by NMFS under the authority of the Marine Mammal Protection Act do include provisions specifying helicopter pilots to maintain an altitude of 1,000 ft within 100 yd (91 m) of marine mammals. It is unlikely that cetaceans would be affected by routine OCS helicopter traffic operating at these altitudes, provided pilots do not alter their flight patterns to more closely observe or photograph marine mammals. Routine overflights may elicit a startle response from, and interrupt cetaceans nearby (depending on the activity of the animals) (Richardson et al., 1995). Occasional overflights probably have no long-term consequences on cetaceans; however, frequent overflights could have long-term consequences if they repeatedly disrupt vital functions, such as feeding and breeding. Although helicopter activity will be relatively low for the Matterhorn Prospect project, as more blocks are developed within Grid 15, the helicopter activity is expected to increase. Many offshore fields are supported by resident helicopters; this results in increased but localized overflights. The area supported by a resident helicopter is dependent in part on the size of the field that it supports. Temporary disturbance to cetaceans may occur on occasion as a helicopter approaches or departs an OCS facility if animals are near the facility. Such disturbance is believed to be negligible relative to other sources of noise (e.g., vessel traffic).

TotalFinaElf estimates there would be seven support-vessel trips per week during drilling and completion of the Matterhorn Prospect project (lasting approximately 21 months). Subsequent support-vessel trips during production are two per week. Noise from support-vessel traffic may elicit a startle and/or avoidance reaction from cetaceans or mask their sound reception. There is the possibility of short-term disruption of movement patterns and behavior, but such disruptions are unlikely to affect survival or productivity. Long-term displacement of animals from an area is also a consideration. It is not known whether toothed whales exposed to recurring vessel disturbance would be stressed or otherwise affected in a negative but inconspicuous way. Increased vessel traffic increases the probability of collisions between ships and marine mammals, which could result in injury or death to some animals. Smaller delphinids may approach vessels that are in transit to bow-ride. Limited observations on an NMFS cruise off the mouth of the Mississippi River in the summer of 2000 indicated that sperm whales appeared to avoid passing service vessels. However, marine mammalogists conducting surveys in the Central Planning Area during the summer of 2001 documented an adult killer whale that bore conspicuous and aged scarring across its back that were indubitably the result of a collision with a motor vessel. A manatee was unintentionally hit and killed by a boat off Louisiana (Schiro et al., 1998). Another manatee was killed by vessel traffic (type of vessel unknown) in Corpus Christi Bay in October 2001 (Beaver, personal communication, 2001). It appears there is limited threat posed to smaller, coastal delphinids where the majority of OCS vessel traffic occurs. Support vessel activity in Grid 15 or adjacent waters would increase the risk of vessel strike to sperm whales and other deep-diving cetaceans (e.g., *Kogia* and beaked whales). Deep-diving whales are more vulnerable to vessel strikes because of the extended surface period required to recover from extended deep dives. Manatees are rare in the western and Central Gulf; consequently, there is little risk posed by OCS vessel traffic in Grid 15.

Drilling, completion, and production activities associated with the Matterhorn Prospect project could produce sounds at intensities and frequencies that could be heard by cetaceans. It is expected that noise from drilling and completion activities would be somewhat constant and last approximately 21 months. Odontocetes echolocate and communicate at higher frequencies than the dominant sounds generated by drilling platforms. Sound levels in this range are not expected to be generated by drilling operations (Gales, 1982). Bottlenose dolphins, one of the few species in which low-frequency sound detection has been studied, have been found to have poor sensitivity levels at the level where most industrial noise energy is concentrated. Potential effects on Gulf of Mexico marine mammals include disturbance (subtle changes in behavior, interruption of previous activities, or short- or long-term displacement), masking of calls from conspecifics, reverberations from own calls, and other natural sounds (e.g., surf, predators); stress (physiological); and hearing impairment (permanent or temporary) by explosions and strong nonexplosive sounds.

Potential impacts to marine mammals from the detonation of explosives used to remove OCS structures include lethal and injurious incidental take, as well as physical or acoustic harassment. Injury to the lungs and intestines and/or auditory system could occur. Harassment of marine mammals as a result of a noninjurious physiological response to the explosion-generated shock wave as well as to the acoustic signature of the detonation is also possible. Structure removals requiring explosives in Grid 15 would require a formal Section 7 consultation under the Endangered Species Act (ESA) with NMFS. Such consultations are expected to result in mitigation measures that would greatly reduce the deleterious effects of using explosives underwater in the vicinity of cetaceans occurring in the area.

Many types of materials, including plastics, are used during drilling and production operations. Some of this material is accidentally lost overboard where cetaceans can consume it. The result of ingesting some materials lost overboard could be lethal, and the probabilities of occurrence, ingestion, and lethal effect are unknown.

Conclusion

Small numbers of marine mammals could be killed or injured by chance collision with support vessels and by eating indigestible debris, particularly plastic items lost from support vessels, drilling rigs, and fixed and floating platforms. The likelihood of such "take" is greater within this grid than many other grids because surveys indicate there to be increased concentrations of sperm whales within Grid 15. Nonetheless, such cases of "take" are expected to be rare. Deaths due to structure removals are not expected due to mitigation measures to be set forth in Section 7 consultations (ESA). Contaminants in waste discharges and drilling muds might indirectly affect marine mammals through food-chain biomagnification.

The routine activities of the Matterhorn Project are not expected to have long-term adverse effects on the size and productivity of any marine mammal species or population stock endemic to the northern GOM.

4.2.4. Impacts on Sea Turtles

Some drilling fluids, drill cuttings, and produced waters would be discharged offshore as a result of the Matterhorn Project. These effluents are routinely discharged into offshore marine waters and are regulated by the USEPA's NPDES permits. Turtles may have some interaction with these discharges. Very little information exists on the impact of drilling muds on Gulf sea turtles (Tucker and Associates, Inc., 1990).

An estimated seven support-vessel trips per week would occur during drilling and completion activities associated with the Matterhorn facility, lasting approximately 21 months. Two support vessel trips per week are projected after the facility begins production activities. Transportation corridors would be through areas where Kemp's ridley, green, loggerhead, and leatherback sea turtles have been sighted. Helicopter trips during drilling and completion operations are estimated at five trips per week lasting approximately 21 months. Production operations would be supported by an estimated one trip per week. Noise from support vessel traffic and helicopter overflights may elicit a startle reaction from sea turtles and there is the possibility of short-term disruption of activity patterns. Sounds from approaching aircraft are detected in the air far longer than in water. There are no systematic studies published concerning the reactions of sea turtles to aircraft overflights, and anecdotal reports are scarce. It is assumed that aircraft noise could be heard by a sea turtle at or near the surface and cause it to alter its activity (Advanced Research Projects Agency, 1995). In the wild, most sea turtles spend at least 3-6 percent of their time at the surface. Despite the brevity of their respiratory phases, sea turtles sometime spend as much as 19-26 percent of their time at the surface engaged in surface basking, feeding, orientation, and mating (Lutcavage et al., 1997). Sea turtles located in shallower waters have shorter surface intervals, whereas turtles occurring in deeper waters have longer surface intervals. It is not known whether turtles exposed to recurring vessel disturbance will be stressed or otherwise affected in a negative but inconspicuous way.

Drilling and completion activities resulting from the Matterhorn Project could generate sounds at intensities and frequencies that could be heard by turtles. There is some evidence suggesting that turtles may be receptive to low-frequency sounds, which is at the level where most industrial noise energy is concentrated. Potential effects on turtles include disturbance (subtle changes in behavior and interruption of activity), masking of other sounds (e.g., surf, predators, and vessels), and stress (physiological). Such noise is expected to have sublethal effects on sea turtles.

Many types of materials, including plastics, are used during drilling and production operations. Some of this material is accidentally lost overboard where sea turtles can consume it. The result of ingesting some materials lost overboard could be lethal, and the probabilities of occurrence, ingestion, and lethal effect are unknown. However, leatherback turtles, a species known to inhabit Grid 15, do mistake plastics for jellyfish and may be more vulnerable to gastrointestinal blockage than other sea turtle species. Sea turtles can also become entangled in debris lost by vessels or platforms associated with the Matterhorn Project. As more blocks are developed in the Grid 15 area, the probability of OCS-related flotsam in the area increases. More flotsam increases the risks to sea turtles.

Conclusion

Routine activities resulting from the Matterhorn Project have the potential to harm individual sea turtles. These animals could be impacted by the degradation of water quality resulting from operational discharges; noise generated by helicopter and vessel traffic, platforms, and drillships; brightly-lit platforms; explosive removals of offshore structures; vessel collisions; and jetsam and flotsam generated by service vessels and OCS facilities. Lethal effects are most likely to be from chance collisions with OCS service vessels and ingestion of plastic materials. Most Matterhorn Project impacts are expected to have sublethal effects. Contaminants in waste discharges and drilling muds might indirectly affect sea turtles through food-chain biomagnification and there is uncertainty concerning the possible effects. Routine activities of the Matterhorn Project are unlikely to have significant adverse effects on the size and recovery of any sea turtle species or population in the GOM.

4.2.5. Impacts on Coastal and Marine Birds

Nonthreatened/Nonendangered Birds

This section discusses the possible effects of the proposed action on coastal and marine birds of the Gulf of Mexico and its contiguous waters and wetlands. Air emissions, water quality degradation resulting from discharges, helicopter and service vessel traffic and noise, light attraction, and discarded trash and debris from service vessels and the drilling rig may impact coastal and marine birds. Associated spill-response activities may also impact coastal and marine birds. Any effects would be especially critical for intensively managed populations such as endangered and threatened species that need to maintain a viable reproductive population size or that depend upon a few key habitats. Emissions of pollutants into the atmosphere from the activities associated with the proposed action are expected to have minimal effects on offshore air quality because of the prevailing atmospheric conditions, emission heights, and pollutant concentrations. Such emissions are expected to have negligible effects on onshore air quality because of the atmospheric regime, emission rates, and distance of these emissions from the coastline. These judgments are based on average steady state conditions; however, there will be days of low mixing heights and low wind speeds that could further decrease air quality. These conditions are characterized by fog formation, which in the Gulf occurs mostly during winter. Impacts from offshore sources are reduced in winter because the frequency of significant onshore winds decreases (25%) and the removal of pollutants by rain increases. The summer is more conducive to air quality effects as onshore winds occur more frequently, approximately 50 percent of the time. Helicopter and service-vessel traffic related to the proposed action could sporadically disturb feeding, resting, or nesting behavior of birds or cause abandonment of preferred habitat. These impact-producing factors could contribute to indirect population loss through reproductive failure resulting from nest abandonment. The FAA (Advisory Circular 91-36C) and corporate helicopter policy state that, when flying over land, the specified minimum altitude is 610 m (2,000 ft) over populated areas and biologically sensitive areas such as wildlife refuges and national parks. However, pilots traditionally have taken great pride in not disturbing birds. It is expected that approximately 10 percent of helicopter trips would occur at altitudes somewhat below the minimums listed above as a result of inclement weather. Although these incidents are only seconds in duration and sporadic in frequency, they can disrupt coastal bird behavior and, at worst, possibly result in habitat or nest abandonment.

Service vessels would use selected nearshore and coastal (inland) navigation waterways, or corridors, and adhere to protocol established by the USCG for reduced vessel speeds within these inland areas. Routine presence and low speeds of service vessels within these waterways would diminish the effects of disturbance from service vessels on nearshore and inland populations of coastal and marine birds. The effects of routine service-vessel traffic on birds offshore therefore would be negligible.

Seabirds (e.g., laughing gulls and petrels) may be attracted by lights and/or structures and may remain and feed in the vicinity of the TLP. Operational discharges or runoff in the offshore environment could affect these individuals. Impacts may be both direct and indirect.

Coastal and marine birds are commonly observed entangled and snared in discarded trash and debris. In addition, many species readily ingest small plastic debris, either intentionally or incidentally. Such interactions can lead to serious injury and death. The MMS prohibits the disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.300). Thus, it is expected that coastal and marine birds would seldom become entangled in or ingest OCS-related trash and debris. MARPOL (Annex V, Public Law 100-220; 101 Statute 1458; effective January 1989) prohibits the disposal of any plastics at sea or in coastal waters. Thus, due to the low potential for interaction between coastal and marine birds and project-related debris, any effects will be negligible.

A spill ≥1,000 bbl at the well site would have a spill risk for contacting the shoreline of 0.5% or greater only for Plaquemines Parish, Louisiana, where the risk is 1 percent and various birds along the coast could experience mortality and reproductive losses. Recovery would depend on subsequent influxes of birds from nearby feeding, roosting, and nesting habitats.

Oil-spill cleanup methods often require heavy traffic on beaches and wetland areas, application of oil dispersants and bioremediation chemicals, and the distribution and collection of oil containment booms and absorbent material. The presence of humans along with boats, aircraft, and equipment, would also disturb coastal birds after a spill. Investigations have shown that oil dispersant mixtures pose a threat to bird reproduction similar to that of oil (Albers 1979; Albers and Gay 1982). The external exposure of adult birds to oil/dispersant emulsions may reduce chick survival more than exposure to oil alone; however, successful dispersal of a spill will generally reduce the probability of exposure of coastal and marine birds to oil (Butler et al., 1988). It is possible that changes in the size of a breeding population may also be a result of disturbance from increased human activity related to cleanup, monitoring, and research efforts (Maccarone and Brzorad, 1994). A growing number of studies indicate that current rehabilitation techniques are not effective in returning healthy birds to the wild (Anderson et al., 1996; Boersma, 1995; Sharp, 1995 and 1996). Deterrent or preventative methods, such as scaring birds from the path of an approaching oil slick or the use of booms to protect sensitive colonies, have extremely limited applicability.

Threatened and Endangered Birds

Piping Plover

The impacts on shorebirds not listed as endangered or threatened discussed above also apply to the piping plover. A spill of ≥1,000 bbl at the well site would have a spill risk for contacting the shoreline of 0.5 percent or greater only for Plaquemines Parish, Louisiana, where the risk is 1 percent, and birds along the coast could experience mortality and reproductive losses. Recovery would depend on subsequent influxes of birds from nearby feeding and roosting habitats.

Bald Eagle

The bald eagle feeds on fish, waterfowl, shorebirds, and carrion near water. This bird may come in contact with an oil spill by eating contaminated dead and dying prey. Bald eagles have narrow preferences for nesting habitat. Any oiling of aquatic feeding habitat resulting in nest site abandonment could lead to relocation of a nest to less preferred habitat. This event in turn would reduce population growth for this already threatened species. However, the bald eagle has high mobility and, when an oil slick enters the feeding habitat, may relocate feeding to unpolluted parts of the waterbodies. When relocating feeding far from the nest, the eagle would successfully home to its nest after feeding because it prefers to build its nest in a highly visible place over the forest canopy with a clear short path from the water.

Brown Pelican

The brown pelican is a species of special concern in Louisiana and Mississippi although it is no longer listed as endangered or threatened in Florida or Alabama (USDOI, FWS, 1998). It is known to nest on Guillard Island, Alabama, a dredged material disposal island in Mobile Bay. There have been no reported nesting sites in Mississippi. Impacts to individual brown pelicans would be similar to those identified for the nonendangered and nonthreatened species discussed in preceding sections.

It is expected that the majority of effects from the major impact-producing factors on coastal and marine birds would be sublethal (behavioral effects and nonfatal intakes of discarded debris), causing temporary disturbance and displacement of localized groups, mostly inshore. However, chronic stress such as digestive upset, partial digestive occlusion, sublethal ingestion, and behavioral changes are often difficult to detect. Such stresses can weaken individuals and make them more susceptible to infection and disease as well as making migratory species less fit for migration. A spill ≥1,000 bbl at the well site would have a spill risk for contacting the shoreline of 0.5 percent or greater only for Plaquemines Parish, Louisiana, where the risk is 1 percent, and birds along the coast could experience mortality and reproductive losses. Recovery would depend on subsequent influxes of birds from nearby feeding, roosting and nesting habitats.

However, the amount of shoreline affected would be relatively small compared to the extensive shoreline habitat available in the northern Gulf of Mexico. Associated spill response can cause mortality to a number of bird species including ones of special concern. Although their rarity would make them less likely to be impacted, any reductions in numbers could threaten their existence as a population.

Conclusion

Coastal and marine birds may encounter periodic disturbance and temporary displacement of localized groups and individuals from the routine activities associated with the proposed action. A spill ≥1,000 bbl at the well site would have a spill risk for contacting the shoreline of 0.5 percent or greater only for Plaquemines Parish, Louisiana, where the risk is 1 percent and various birds along the coast could experience mortality and reproductive losses. Recovery would depend on subsequent influxes of birds from nearby feeding, roosting, and nesting habitats.

4.2.6. Impacts on Essential Fish Habitat and Fish Resources

Development activities that have potential to affect fish and fish habitat include discharge of mud and cuttings, and construction effects on water quality. Decommissioning effects would be similar to those from construction and installation of facilities. Production activities that may affect fish are those primarily associated with the "artificial reef effect" and the discharge of produced water.

Drill cuttings with mud adhering to them would be discharged to the water column at the well sites and may contain some contaminant metals. However, contaminant levels would reach background levels about 1,000 m (3,281 ft) from discharge and be undetectable beyond 3,000 m (9,843 ft) from the site (USDOI, MMS, 2000). The SBF's are virtually nontoxic, and cuttings with adherent SBF are expected to reach the seabed quickly in the form of clumps. Biological effects on the benthos are not expected beyond 500 m (1,640 ft) (Jensen et al., 1999). Neff et al. (1989) indicated that numerous studies have demonstrated that mercury impurities associated with drilling mud barite are virtually not capable of being taken up by marine organisms that might come in contact with discharged drilling fluid solids.

The well risers and platform itself can be expected to attract fish seeking cover and food. Produced-water discharges may affect fish in the immediate area of discharge, but the plume should reach non-impact levels within a few tens of meters. Likewise, concentrations sufficient to cause sublethal effects should cover a small area.

Accidental oil spills or blowouts also have the potential to affect fish resources. Adult fish will, for the most part, avoid the oil (Malins et al., 1982; NRC, 1985; Baker et al., 1991; USDOI, MMS, 2000). Farr et al. (1995) reported the behavioral avoidance of dissolved concentrations of a PAH as low as 14.7 μg/l by a species of minnow. Furthermore, adult fish must become exposed to crude oil for some time, probably on the order of several months for doses and types of oil to be encountered in the field, to suffer serious biological damage (Payne et al., 1988). Adult fish also possess some capability for metabolizing oil (Spies et al., 1982).

On the other hand, invertebrate and fish eggs and larvae are known to be very sensitive to oil in water (Linden et al., 1979; Longwell, 1977; Baker et al., 1991). However, most fish species produce very large numbers of eggs and larvae spread over wide areas. In order for an oil spill to affect fish resources at the population level, it would have to be very large and cover a very large area that corresponded to an area of highly concentrated eggs and larvae. In addition, the oil would have to disperse deep enough into the water column at levels high enough to cause toxic effects. None of these events seem likely, even in the low-risk, large-spill scenario. However, it should be noted that the use of dispersants, while potentially beneficial for surface-using birds, turtles and mammals, could increase the effects on water column organisms including ichthyoplankton. A worst case, in terms of location, would be a spill of fresh oil in a shallow, enclosed bay that contained eggs and larvae of important inshore species such as menhaden, shrimp, or blue crabs. Oil from the hypothetical offshore blowout would be well weathered before it hit shore, if in fact it did so. In addition, spawning areas of most species of marine fish are widespread enough to avoid catastrophic effects at the population level.

The spill risk (the probability of a spill ≥1,000 bbl occurring and contacting specific areas) is less than 0.5 percent for all Gulf Coast areas with one exception; Plaquemines Parish, Louisiana, has a spill risk of 1 percent (Table A-5 in Appendix A).

Conclusion

The structures would attract a variety of fish species. Produced water would influence water quality and hence, could potentially produce sublethal effects in fish over a limited area. Any effects would be localized and not significant.

Impacts on demersal fish from drilling activities would be negligible. There are no commercially-valuable demersal fish species in the area and effects on bottom fish habitat from cuttings and adherent SBF would likely be limited to within 500 m (1,640 ft) of the discharge.

Specific effects from oil spills would depend on several factors including timing, location, volume and type of oil, environmental conditions, and countermeasures used. The areas affected by the potential spill or blowout scenario would be avoided by adult fish. Fish eggs and larvae of some species of invertebrates and fish would be affected by a spill and some would suffer mortality in areas where their numbers are concentrated in the upper few meters of water and where oil concentrations under the slick are high enough. However, oil and fish concentrations, exposure times, and the area affected would not be great enough to cause significant impacts to northern GOM fish populations.

In summary, it is expected that marine environmental degradation from the proposed action and future known prospects in the grid would have little effect on fish resources or essential fish habitat. The level of marine environmental degradation from the Matterhorn development is expected to cause a small, undetectable decrease in fish populations and EFH.

4.2.7. Impacts on the Gulf Sturgeon

Existing occurrences of Gulf sturgeon in 1996 extended from the Mississippi River to Charlotte Harbor in western Florida (Patrick, personal communication, 1996). Spawning has been documented in most of the major river systems of the fish's range. A Gulfwide genetic assessment of Gulf sturgeon was completed in 1995. The results indicate there are four and possibly five geographically distinct units of Gulf sturgeon possessing different genetic material.

Oil spills are the OCS-related factor most likely to impact the Gulf sturgeon. Gulf sturgeon can take up oil by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products across gill mucus and gill epithelium. Upon any exposure to spilled oil, liver enzymes of adult fish oxidize soluble hydrocarbons into compounds that are easily excreted in the urine (Spies et al., 1982). Behavior studies of other fish species suggest that adult sturgeon are likely to actively avoid an oil spill, thereby limiting the effects and lessening the extent of damage (Baker et al., 1991; Malins et al., 1982). Linden et al. (1979) note that early life stages of fish are very sensitive to the toxic effects of hydrocarbons. Fish eggs and larvae, with their limited mobility, are killed when contacted by oil (Longwell, 1977). In adult Gulf sturgeon, contact with or ingestion/absorption of spilled oil could result in death or nonfatal physiological irritation, especially of gill epithelium and the liver.

The subsurface ecosystem with prey and feeding habitat for Gulf sturgeon would have little contact with a slick floating overhead, even in shallow water, but may contact emulsified, chemically dispersed oil.

Conclusion

The Gulf sturgeon could be impacted by oil spills resulting from the proposed action. The impact of the proposed action on the Gulf sturgeon could cause nonfatal irritation of gill epithelium or the liver in a few adults.

4.2.8. Impacts on Beach Mice

The Alabama, Perdido Key, Choctawhatchee, and St. Andrew beach mice are designated as protected species under the Endangered Species Act of 1973. The mice occupy restricted habitat behind coastal foredunes of Florida and Alabama (Ehrhart, 1978; USDOI, FWS, 1987). Portions of these areas have been designated as critical habitat.

The major impact-producing factors associated with the proposed action that may affect the mice include (1) beach trash and debris, (2) a spill at the proposed well site, and (3) spill-response activities. Beach mice may entangle themselves in trash and debris or may mistakenly consume it. The MMS prohibits both accidental and deliberate disposal of equipment, containers, and other materials into offshore waters by lessees (30 CFR 250.300). Thus, it is expected that beach mice would seldom entangle themselves in OCS-related trash and debris or ingest it. MARPOL (Annex V, Public Law 100-220; 101 Statute 1458; effective January 1989) prohibits the disposal of any plastics at sea or in coastal waters. Thus, due to the low potential for interaction between beach mice and project-related debris, any effects would be negligible.

Direct contact with spilled oil can cause skin and eye irritation. Other direct toxic effects come from asphyxiation from inhalation of fumes, oil ingestion, and food contamination. Indirect oil impacts include food reduction. Vehicular traffic and activity associated with oil-spill cleanup activities can degrade preferred habitat and cause displacement.

The proposed action is expected to contribute negligible marine debris or disruption to beach mice areas. The effects of oil that contacts a beach mouse are mentioned above. A slick cannot wash over the foredunes into beach mouse habitat unless carried by a heavy storm swell.

A spill ≥1,000 bbl at the well site would have a spill risk of <0.5 percent for contacting shoreline beach mouse habitat. In the unlikely event of crude oil contact, spill cleanup activities are not expected to disturb beach mice or their habitats. The home range of the beach mice is designated habitat that receives particular consideration during spill cleanup, as directed by the Oil Pollution Act of 1990. Because of the critical designation and general status of protected species habitats, spill contingency plans include requirements to minimize adverse effects from vehicular traffic during cleanup activities and to maximize protection efforts to prevent spilled petroleum with beach mouse habitat.

Conclusion

An impact from the proposed action on the Alabama, Choctawhatchee, St. Andrew, and Perdido Key beach mice is possible but unlikely as a result of beach trash and debris, oil spills, and spill-response activities because of the prohibition of trash and debris discard; the low probability of spill occurrence and contact; and the protected species and habitat requirements for cleanup included in the Oil Pollution Act. The proposed action is not expected to harm the Alabama, Choctawhatchee, St. Andrew, and Perdido Key beach mice or their habitats.

4.3. Other Relevant Activities and Resources

4.3.1. Socioeconomic Conditions and Other Concerns

4.3.1.1. Impacts on Economic and Demographic Conditions

In Chapter 3.3.1.1.1, the potential impact region was defined as that portion of the GOM coastal zone whose social and economic well-being (population, labor, and employment) is directly or indirectly affected by the OCS oil and gas industry. This section projects how and where future changes would occur and whether they correlate with the proposed action.

4.3.1.1.1. Population and Education

The impact region's population will continue to grow, but at a slower rate. Minimal effects on population are projected from activities associated with the proposed action. While some of the labor force is expected to be local to the Port Fourchon and Venice, Louisiana, areas, most of the additional employees associated with the proposed action are not expected to require local housing. Activities related to the proposed activity are not expected to significantly affect the region's educational level.

Conclusion

Activities related to the proposed activity are not expected to significantly affect the region's population and educational level.

4.3.1.1.2. Infrastructure and Land Use

While OCS-related servicing should increase in Port Fourchon and Venice, Louisiana, no expansion of these physical facilities is expected to result from the proposed activity. Changes in land use throughout the region as a result of the proposed activity are expected to be contained and minimal. While land use in the impact area will change over time, the majority of this change is estimated as general regional growth. Increased OCS deepwater activity is expected to impact Port Fourchon and other OCS ports with deepwater capability. The proposed activity with the DOCD is not expected to cause expansion to the ports (Port Fourchon and Venice) that TotalFinaElf plans to use.

Conclusion

The proposed action is not expected to significantly affect the region's infrastructure and land use.

4.3.1.1.3. Navigation and Port Usage

The proposed action would use the existing onshore support bases located in Port Fourchon and Venice, Louisiana, for completion, facility installation, commissioning, and production activities. The vessels to be used would be crew boats and supply boats. Support vessels and travel frequency during the proposed drilling and production activities are four and two drilling and completion trips per week and one production trip each per week for crew and supply boats, respectively. TotalFinaElf would use onshore facilities located in Fourchon as a port of debarkation for supplies and equipment. The primary method for transporting rig crews and service personnel would be by helicopter from Venice, Louisiana. Five helicopter trips are anticipated for drilling and completion activities and one helicopter trip is expected for production activity. Both the Port Fourchon and Venice shore bases are capable of providing the services necessary for the proposed activities; therefore, no onshore expansion or construction is anticipated with respect to the proposed action.

Conclusion

No impacts to navigation and port usage are expected as result of this proposed action.

4.3.1.1.4. Employment

The importance of the oil and gas industry to the coastal communities of the GOM is significant, particularly in Louisiana, eastern Texas, and coastal Alabama. Dramatic changes in the level of OCS oil and gas activity over recent years have resulted in similar fluctuations in population, labor, and employment in the GOM region. This economic analysis focuses on the potential direct, indirect, and induced impacts of the OCS oil and gas industry on the population and employment of the counties and parishes in the impact region.

To improve regional economic impact assessments and to make them more consistent with each other, MMS recently developed a methodology for estimating changes to employment and other economic factors. The methodology developed to quantify these impacts on population and employment takes into account changes in OCS-related employment, along with population impacts resulting from these employment changes within each individual coastal subarea.

The model for the GOM region has two steps. Because there are no publicly available models that estimate the expenditures resulting from offshore oil and gas activities, the first step in the model estimates the expenditures resulting from TotalFinaElf's Initial DOCD (for the fabrication/installation of a TLP structure and the drilling of eight development wells from the Ensco 7,500-HP semi-submersible rig, the completion of 8 development wells with a 750-HP platform type rig, the installation of a lease pipeline from the subsea water injector well to the platform, and the installation of export right-of-way pipelines to transport gas production to an existing pipeline network) and assigns these expenditures to industrial sectors in the 10 MMS coastal subareas defined in Chapter 3.3.1.1.1. The second step in the model uses multipliers from the commercial input-output model IMPLAN (using 1999 data, the latest available data) to translate these expenditures into direct, indirect, and induced employment and other economic factors. Direct employment results from the first round of industry spending. It is the employment that results from the initial dollars spent by TotalFinaElf on the platform, pipeline, and development wells from their fabrication/installation or completion through their productive lives. Indirect employment results as the initial spending reverberates through the economy. First, the suppliers of the goods and services for the platform and wells spend the initial direct dollars from the industry. Then, these dollars are re-spent by other suppliers until the initial dollars have trickled throughout the economy. Labor income produces induced spending by the households receiving that income.

Both the level (the amount spent) and the sectoral (the industry in which it is spent) allocation of expenditures can vary considerably. Because local economies vary, a separate set of IMPLAN multipliers is used for each MMS coastal subarea to which expenditures are assigned. Each set of multipliers is based on the actual historical patterns of economic transactions in the area. Model results for employment are presented in number of jobs per year, where one job is defined as a year of employment. This does not necessarily mean only one person occupies the position throughout the year. One job may be equal to two part-time positions occupied over the year or one person occupying a position for 6 months, while another person occupies it for the other 6 months.

Table E-6 (Appendix E) shows total employment projections for activities resulting from the proposed action for the peak year of 2003. The projections are expressed as absolute numbers and as a percentage of the employment levels expected if no development occurs. Note that Subareas LA-1, LA-2, LA-3, and MA-1 constitute the Central Planning Area; Subareas TX-1 and TX-2 represent the Western Planning Area; and Subareas FL-1, FL-2, FL-3, and FL-4 comprise the Eastern Planning Area. The baseline projections of employment used in this analysis are described in Chapter 3.3.1.1.5 and Table E-3 (Appendix E). Because these baseline projections assume the continuation of existing social, economic, and technological trends, they also include employment resulting from the continuation of current patterns in OCS Program activities. Based on model results, peak year (year 2003) direct employment associated with the proposed action is estimated at 740 jobs. Indirect employment for the peak year is projected at 245 jobs, while induced employment is calculated to be 307 jobs. Although the majority of employment is expected to occur in coastal Subarea TX-2, employment is not expected to exceed 1 percent of the total employment in any given subarea. Direct, indirect, and induced employment from 2004 through 2018 (that associated with operation and maintenance and workover activities) are expected at about 45-50 jobs throughout all subareas and be less than 1 percent of total employment in any subarea.

The resource costs of cleaning up an oil spill, both onshore and offshore, were not included in the above analysis for two reasons. First, oil-spill cleanup activities reflect the spill's opportunity cost. In other words, some of the resources involved in the cleanup of an oil spill, in the absence of that spill, would have produced other goods and services (e.g., tourism activities). Secondly, the occurrence of a spill is not a certainty. Spills are random accidental events. Given that the platform is fabricated and installed and the development wells are completed as described in the initial DOCD, the timing, numbers, sizes, offshore locations of occurrence, and onshore locations of contact of potential spills occurring over the drilling life of the plan are all unknown variables. Appendix A discusses oil spills in general, and the expected sizes, number, and probability of a spill from the proposed action. Additionally, the cost involved in any given cleanup effort is influenced by a variety of factors: whether or not the oil comes ashore; the type of coastal environment contacted by the spill; weather conditions at the time of the incident; the type and quantity of oil spilled; and the extent and duration of the oiling. Nevertheless, the same two-step model used above to project employment for the proposed action was applied to project the opportunity cost employment associated with cleaning up an oil spill. In this case, the first step considered estimates of the expenditures resulting from oil-spill cleanup activities should a worst-case blowout scenario spill occur. The second step incorporated the IMPLAN regional model multipliers to translate those expenditures into direct, indirect, and induced employment associated with oil-spill cleanup activities. The size of a spill scenario (on which model results are based) is assumed to be as much as 10,000 bbl a day for 30 days (Appendix A). Based on model results, should such a spill occur, it is projected to cost about 10,060 person-years of employment for cleanup and remediation depending on whether some of the oil contacts land. Table E-7 (Appendix E) below summarizes the direct, indirect, and induced opportunity cost employment (by subarea and planning area) for an oil-spill cleanup should such a spill occur. Employment impacts from the blowout scenario are expected to be minimal (less than 1% of total employment in any subarea even if combined with the employment projected with the proposed activities) should a spill of such magnitude occur. Employment associated with oil-spill cleanup is expected to be of short duration (less than 6 months) aside from employment associated with the legal aspects of a spill.

Conclusion

No impacts to employment that could result from a blowout and related spill cleanup scenario are expected as result of this proposed action.

4.3.1.1.5. Environmental Justice

Federal agencies are directed by Executive Order 12898 to assess whether their actions will have a disproportionate and negative effect on the environment and health of people of ethnic or racial minorities or those with low income. Since sufficient onshore facilities are available to support offshore activities in Grid 15, no effects to minorities or people with low incomes in the Gulf counties and parishes are expected.

Conclusion

No impacts to minorities or people with low incomes are expected as result of this proposed action.

4.3.2. Impacts on Commercial Fisheries

Little or no impact is expected on commercial fishers from routine project activities. Offshore operators do not normally require a large exclusion area, although the U.S. Coast Guard could enforce an area of 500 m (1,640 ft) or so from structures, if requested or required.

In the event of a spill, commercial fishermen would actively avoid the area of a spill and the area where there are ongoing activities to control a blowout. Even if fish resources successfully avoid spills, tainting (oily-tasting fish), public perception of tainting, or the potential of tainting commercial catches from oil or dispersants will prevent fishermen (either voluntarily or imposed by regulation) from initiating activities in the spill area. This in turn could decrease landings and/or value of catches for several months. However, GOM species can be found in many adjacent locations; Gulf commercial fishermen do not fish in one locale and have responded to past petroleum spills without discernible loss of catch or income by moving elsewhere for a few months.

There are few, if any, new potential fisheries that could occur in the Matterhorn area. The most likely target species would be epipelagic species that are highly mobile and have the ability to avoid disturbed areas. This fishery is traditionally pursued using a highly mobile longliner fleet. This type of fishery is less vulnerable to disturbance or loss of fishing space than others such as trap or bottom trawling fisheries.

Conclusion

There would be some unavoidable loss of fishing space due to the physical presence of the development that could otherwise have been used for pelagic fishing such as longlining. This impact is not considered to be significant because the overall footprint of the development is not large compared to the total space available in the Gulf. A large oil spill might have commercial implications, but for the most part, the Gulf fishing fleets are highly mobile and cover a wide area. In addition, there are no commercially important demersal species at the water depth of this proposed action.

4.3.3. Impacts on Recreational Resources and Beach Use

The focus here cannot be just OCS activities: it must involve people and places onshore as well. Millions of annual visitors attracted to the coast are responsible for thousands of local jobs and billions of dollars in regional economic activity. They also are responsible in large part for the trash and debris, which litter coastal lands, leaving behind nearly 75 tons of trash per week (Center for Marine Conservation, 2001). And that is only what is reported. Other sources of coastal trash are debris and small leaks from staffed structures in State and Federal waters where hydrocarbons are exploited, runoff from storm drains, antiquated storm and sewage systems in older cities, and commercial and recreational fisher folk who discard plastics.

Unfortunately, we do not know exactly *where* the debris is from: annual, so-called “beach sweeps,” with the resulting cleanup totals including all coastal beaches—rivers, lakes, and sea—and adjacent waters. And, given this lack of knowledge, we cannot predict that an additional production platform will have beneficial, detrimental, or neutral effects on human use of coastal lands. We do know, however, that intensification in human use of the natural environment always increases the signs of that use. Ecologically and economically, those signs usually become burdensome and/or potentially harmful to those natural resources.

Conclusion

The risk of a large oil spill occurring due to the proposed development operations in Grid 15 is very small. In the event such a spill did occur, according to trajectory analysis from the OSRA model, there is a negligible chance that the spill would contact land within 30 days of a spill. Project aircraft will normally be flying high enough to avoid disturbance to beachgoers.

TotalFinaElf has an established waste management plan for all of their offshore operations. While some accidental loss of solid wastes may occur from time to time, it is expected to have a negligible impact on recreational resources.

4.3.4. Impacts on Archaeological Resources

4.3.4.1. Prehistoric

The Matterhorn Grid 15, Mississippi Canyon Block 243, is not specifically located within either of the MMS's designated high-probability areas for the occurrence of prehistoric or historic archaeological resources. Lease blocks with a high probability for prehistoric archaeological resources may only be found landward of a line that roughly follows the 60-m (200-ft) bathymetric contour. As stated earlier in this document, MMS recognizes both the 12,000 B.P. date and 60-m (200-ft) water depth as the seaward extant of prehistoric archaeological potential on the OCS. The water depth of the Grid 15 lease area is 2,060-3,290 ft across the grid. Based on the extreme water depth of the Grid 15, there is simply no potential for prehistoric archaeological resources.

The proposed action includes the use of a derrick barge and its associated anchors, the emplacement of a TLP production facility and its associated anchors, and the impacts of these anchors on the seafloor. The proposed offshore development as described in this plan cannot result in an impact to an inundated prehistoric archaeological site. Therefore, any oil and gas development cannot possibly impact prehistoric archaeological resources.

Conclusion

Based on the extreme water depth of Grid 15 and Mississippi Canyon Block 243, the proposed oil or gas development would not impact any prehistoric archaeological resources.

4.3.4.2. Historic

There are areas of the northern GOM that are considered to have a high probability for historic period shipwrecks as defined by an MMS-funded study and shipwreck model (Garrison et al., 1989). The study expanded the shipwreck database in the GOM from 1,500 to more than 4,000 wrecks. Statistical analysis of shipwreck location data identified two specific types of high-probability areas—the first within 10 km (6 mi) of the shoreline and the second proximal to historic ports, barrier islands, and other loss traps. High-probability search polygons associated with individual shipwrecks were created to afford protection to wrecks located outside the two aforementioned high-probability areas.

An Archaeological Resources Stipulation was included in all GOM lease sales from 1974 through 1994. The stipulation was incorporated into MMS's Operational Regulations on November 21, 1994. The language of the stipulation was incorporated into the operational regulations under 30 CFR 250.26

with few changes, and all protective measures offered in the stipulation have been adopted by the regulation.

NTL 2002-G01, signed by the Regional Director on December 15, 2001, supersedes all other archaeological NTL's and LTL's. This new NTL makes minor technical amendments, updates cited regulatory authorities, and continues to mandate a 50-m (164-ft) remote-sensing survey linespacing density for historic shipwreck surveys in water depths of 60 m (200 ft) or less. The NTL also requires submission of an increased amount of magnetometer data to facilitate the MMS analyses. Survey and report requirements for prehistoric sites have not been changed.

Several OCS-related, impact-producing factors may cause adverse impacts to unknown historic archaeological resources. Offshore development could result in a drilling rig, platform, pipeline, or anchoring associated with tension leg platform installation and derrick barges impacting an historic shipwreck. Direct physical contact with a shipwreck site could destroy fragile ship remains, such as the hull and wooden or ceramic artifacts, and could disturb the site context. The result would be the loss of archaeological data on ship construction, cargo, and the social organization of the vessel's crew, and the concomitant loss of information on maritime culture for the time period from which the ship dates.

The emplacement of anchors associated with a derrick barge and with the anchors from The Ensco 7500-HP semi-submersible drilling unit and TLP production facility has the potential to cause physical impact to historic archaeological resources on the seafloor. Based on the plan submitted by the applicant, the manned TLP production facility will be permanently anchored to the foundation by tendons (3-in thick steel tube with 2- to 3-ft diameter). Placing of these permanent piles into the seafloor would directly disturb approximately an area of 2.1 ha per 3-pile pattern. The derrick barge with its anchoring system would directly disturb approximately 1.9 ha of the seafloor at each anchor point. Pile driving associated with the structure emplacement may also cause sediment liquefaction an unknown distance from the piling, disrupting stratigraphy in the area of liquefaction.

Pipeline installation also has the potential to cause a physical impact to historic archaeological resources. In a recent pipeline installation in March 2001, an 8-in pipeline was laid across a historic shipwreck in a water depth of approximately 808 m (2,650 ft).

Petroleum spills have the potential to affect historic archaeological resources. Impacts to historic resources would be limited to visual impacts and, possibly, to physical impacts associated with spill cleanup operations. The OCS operations may also generate tons of ferromagnetic structures and debris, which will tend to mask magnetic signatures of significant historic archaeological resources during magnetometer surveys. The task of locating historic resources via an archaeological survey is, therefore, made more difficult as a result of operational activities.

The specific locations of archaeological site areas cannot be identified without first conducting a remote-sensing survey of the seabed and near-surface sediments. The MMS, by virtue of its operational regulations under 30 CFR 250.196, requires that an archaeological survey be conducted prior to development of leases within the high-probability zones for historic and prehistoric archaeological resources. There are fourteen lease blocks within Grid 15 that fall within the MMS high-probability shipwreck zone. However, Mississippi Canyon, Block 243 is not located within this zone. In addition, a review of the geophysical report submitted by the applicant indicated that no seafloor features suggestive of historic shipwrecks were recorded during the lease block's side-scan sonar survey. Therefore, the aforementioned survey requirement reduces the potential for an impact to occur by an estimated 90 percent.

The proposed action includes installation of the subsea lease-term pipelines and umbilicals, installation of the TLP and associated mooring systems, installation of the TLP facilities, completion of hookup, pull in of risers/umbilicals for the subsea wells, and initiation of production from dry tree and subsea wells. Ferromagnetic debris associated with exploration and production activities has the potential to mask the magnetic signatures of historic shipwrecks. It is expected that most ferromagnetic debris associated with the proposed action would be removed from the seafloor during the required postlease site clearance and verification procedures. Site clearance, however, takes place after the useful life of the structure is complete. Therefore, there remains the potential for masking the signatures of historic shipwrecks as a result of ferromagnetic debris from OCS oil and natural gas activities.

Onshore historic properties include sites, structures, and objects such as historic buildings, forts, lighthouses, homesteads, cemeteries, and battlefields. Sites already listed on the National Register of Historic Places and those considered eligible for the National Register have already been evaluated as being able to make a unique or significant contribution to science. At present, unidentified historic sites may contain unique historic information and would have to be assessed after discovery to determine the importance of the data.

Onshore development in support of the proposed action, such as construction of new onshore facilities or pipelines, could result in the direct physical impact to previously unidentified historic sites. This direct physical contact with a historic site could cause physical damage to, or complete destruction of, information on the history of the region and the Nation. Each facility constructed must receive approval from the pertinent Federal, State, county/parish, and/or community involved. Protection of archaeological resources in these cases is expected to be achieved through the various approval processes involved. There is, therefore, no expected impact to onshore historic sites from any onshore development in support of the proposed action.

Should an oil spill contact a coastal historic site, such as a fort or a lighthouse, the major impact would be visual from petroleum contamination of the site and its environment. Impacts to coastal historic sites are expected to be temporary and reversible.

The greatest potential impact to a historic shipwreck as a result of the proposed action would result from the emplacement of a derrick barge and its associated anchors and this vessel's support to the installation of the truss spar facility. The remote-sensing survey and archaeological clearance of sites required prior to an operator beginning oil and gas activities on a lease are estimated to be 90 percent effective at identifying possible historic shipwreck sites. Since the survey and clearance provide a significant reduction in the potential for a damaging interaction between an impact-producing factor and a historic shipwreck, there is a very small possibility of the proposed OCS activities impacting a historic site.

According to Garrison et al. (1989), the shipwreck database lists four shipwrecks that fall within the Grid 15. One additional wreck was discovered when a pipeline was laid across it in March 2001. All five of the wrecks date prior to 1952. If the other four are found, they may be eligible for listing in the National Register of Historic Places. All of the blocks within the Grid 15 fall within the MMS GOM Region's low-probability area for the occurrence of historic shipwrecks.

Most other activities associated with the proposed action are not expected to impact historic archaeological resources. Ferromagnetic debris has the potential to mask the magnetic signatures of historic shipwrecks. It is expected that onshore archaeological resources would be protected through the review and approval processes of the various Federal, State, and local agencies involved in permitting onshore activities. There is a small chance of contact from an oil spill associated with the proposed action. Furthermore, the major impact from a spill contact on a historic coastal site, such as a fort or lighthouse, would be visual contamination. These impacts would be temporary and reversible.

Conclusion

Oil and gas activities associated with proposed project could impact a shipwreck because of incomplete knowledge on the location of shipwrecks in the Gulf. Although this occurrence is not probable, such an event would result in the disturbance or destruction of important historic archaeological information. Other factors associated with the proposed action are not expected to affect historic archaeological resources.

4.3.5. Impacts on Artificial Reef and Rigs-to-Reefs Development

Mississippi Canyon Block 243 and the Matterhorn Project area are located south and outside of State Artificial Reef Planning and Permit Areas (Figure 4-1). Therefore, potential environmental effects and conflict use between the proposed action and artificial reef and Rigs-to-Reefs development is not anticipated.

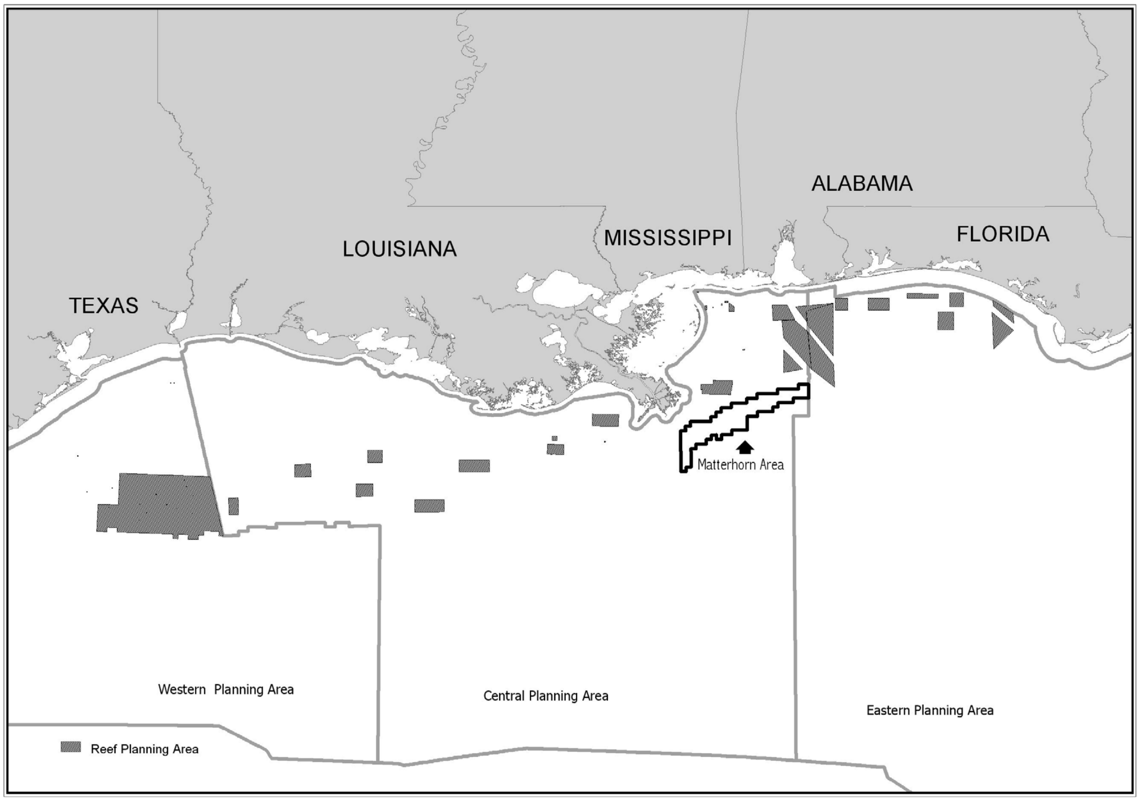

Figure 4-1. Location of State Artificial Reef Planning and Permit Areas.

4.4. CUMULATIVE EFFECTS

The MMS addressed the cumulative effects of OCS- and non-OCS-related activities for the Central Planning Area and the Gulf Coast region for the years 1996 through 2036 as part of the NEPA documentation completed for proposed multisale lease activities. The most recent final EIS applicable to Grid 15 was prepared for Central GOM Lease Sales 169, 172, 175, 178, and 182 (USDOI, MMS, 1997). Specific OCS-related effects from the proposed activities in Grid 15 and related to the Matterhorn Project are addressed in Chapters 4.1-4.3.

The following provides a summary of cumulative effects for potentially affected resources in the Central Planning Area of the GOM. For all of the resources discussed below, the incremental contribution of the Matterhorn project to cumulative impacts would be negligible.

4.4.1 Water Quality

4.4.1.1. Coastal Waters

Contaminant inputs to coastal waters bordering the GOM are largely coming from large volumes of water entering the Gulf from rivers draining over two-thirds of the contiguous U.S., from a large number of municipal and industrial point- and nonpoint-source discharges, and from numerous spill events.

Major sources expected to contribute to the contamination of Gulf coastal waters in the future include the petrochemical industry (oil and gas exploration and development on State offshore waters and OCS and processing of hydrocarbons), agriculture, urban expansion, municipal and camp sewerage treatment processes, marinas, commercial fishing, maritime shipping, and hydromodification activities. Lesser sources of contaminants are likely to be forestry, recreational boating, livestock farming, manufacturing industry activities, nuclear power plant operations, and pulp and paper mills. Runoff and wastewater discharge from these sources will cause water quality changes that will result in a significant percentage of coastal waters not attaining Federal water quality standards.

Vessel traffic will also degrade coastal water quality through routine releases of bilge and ballast waters, chronic fuel and tank spills, trash, and domestic and sanitary discharges. Increased turbidity from extensive dredging operations to support commercial activities and oil and gas development projected to continue within the Gulf coastal zone constitutes another considerable type of nonpoint-source pollution in the Gulf's coastal waters.

Degradation of water quality conditions due to these inputs is expected to continue. The Gulf Coast has been heavily used and is now showing some signs of environmental stress. Large areas experience nutrient overenrichment, low-dissolved oxygen, toxin and pesticide contamination, shellfish ground closures, and wetland loss.

4.4.1.2. Offshore Waters

Contaminant inputs to GOM marine waters include offshore, coastal, and land-based sources. Numerous studies have identified the Mississippi River, which drains two-thirds of the United States, as the major source of contamination for Gulf waters (e.g., Bedinger, 1981; Brooks and Giammona, 1988). Offshore sources of contaminants include the OCS oil and gas operations, marine transportation, commercial fishing, and natural hydrocarbon seeps.

Spills of oil and other hazardous substances could occur from vessels transporting crude oil and petroleum products, from vessels transporting other products through Gulf waters between U.S. ports, and from OCS oil and gas production operations. The amount of oil dispersed and dissolved from an oil slick is not likely to cause prolonged (more than a few months) adverse water quality conditions. Given this, the frequency of occurrence and the size of the spills are the major factors determining water quality degradation.

Bottom disturbance resulting from drilling wells, blowout, emplacement and removal of platforms and pipelines, and vessel anchoring can increase water-column turbidity in the overlying offshore waters. Besides resulting in turbidity, sediment disturbance can result in the resuspension of any accumulated pollutants. These events are expected to result in localized, short-term changes in water quality in the immediate vicinity that, but would not be of consequence to regional water quality.

Vessel traffic associated with the extensive maritime industry, the oil and gas support operations, and recreational and commercial fishing operations will also degrade marine water quality through routine releases of bilge and ballast waters, chronic fuel and tank spills, trash, and domestic and sanitary discharges into offshore waters. Natural hydrocarbon seeps have been documented in the deepwater area of the GOM (Brooks et al., 1986b; USDOI, MMS, 1996). MacDonald et al. (1996) identified 63 oil slicks from one or more remote-sensing images. These seeps contribute soluble hydrocarbon components into the water column.

The Mississippi River will continue to be the major source of contamination of the Gulf. Over time, continuing coastal water quality contamination will degrade offshore water quality. As the assimilative capacity of coastal waters is exceeded, there will be a subsequent, gradual movement of the area of degraded waters farther offshore over time.

4.4.2. Air Quality

Effects on air quality within the project area will come primarily from industrial, power generation, and urban emissions. The coastal areas nearest the project area are currently designed as "attainment" for all the National Ambient Air Quality Standards, regulated pollutants. The USEPA has designated several areas along the Gulf Coast as "nonattainment" for ground-level ozone-Houston-Galveston-Brazoria and Beaumont-Port Arthur areas in Texas and Lafourche Parish in Louisiana (USEPA, 2002).

4.4.3. Biological Resources

4.4.3.1. Sensitive Coastal Environments

4.4.3.1.1. Coastal Barrier Beaches and Associated Dunes

Coastal barrier beaches have experienced severe erosion and landward retreat because of human activities and natural processes. These adverse effects on barrier beaches and dunes have come from changes to the natural dynamics of water and sediment flow along the coast. Examples of these activities include pipeline canals, channel stabilization structures, beach stabilization structures, recreational use of vehicles on dunes and beaches, recreational and commercial development, and removal of coastal vegetation. Human activities cause direct impacts as well as accelerate natural process that deteriorate coastal barrier features. Natural processes that contribute to most effects include storms, subsidence, and sea-level rise acting upon shorelines with inadequate sand content and supply.

Deterioration of Gulf barrier beaches is expected to continue in the future. Federal, State, and parish governments have made efforts over the last 10 years to slow beach erosion.

4.4.3.1.2. Wetlands

In most areas that might be affected by the proposed action, the conversion of wetlands to agricultural, residential, and commercial uses has generally been the major cause of wetland loss. Commercial uses include dredging for both waterfront developments and coastal oil and gas activities. In the Chenier Plain of Louisiana, natural and man-induced erosion and subsidence are also important causes of wetland loss. Wetland loss is projected to continue around the Gulf.

4.4.3.1.3. Seagrasses

Seagrasses are adversely affected by several human activities. These activities include changes to water quality resulting from riverine input, stream channelization, urban runoff, and industrial discharges; physical removal of plants by various forms of dredging, anchoring, and grounding of vessels; and severe storms. These impacts and the general decline of seagrasses are expected to continue into the near future. Various local, State, and Federal programs are focused upon reversing this trend.

4.4.3.2. Deepwater Benthic Communities/Organisms

4.4.3.2.1. Chemosynthetic Communities

No cumulative impacts to chemosynthetic communities from non-OCS-related activities are expected. Normal fishing practices should not disturb these areas. Other bottom-disturbing activities such as trawling and anchoring are virtually nonexistent at water depths greater than 400 m.

4.4.3.2.2. Coral Reefs

All of the recognized topographic features in the CPA are protected by "no activity zones" and other operational zones to minimize effects on associated coral reefs. Uncontrolled anchoring remains a threat to these areas. Increasing pressure is being exerted on these features from both commercial and recreational sources.

4.4.3.2.3. Deepwater Benthos and Sediment Communities

The most serious impact-producing factor that may affect deepwater benthos and sediment communities is the physical disturbance of the sea bottom. Within anchoring depths, marine transportation vessels may affect localized areas. Hypoxic conditions at the seafloor may affect the deepwater benthos and associated communities.

4.4.3.3. Marine Mammals

Cumulative impacts to GOM marine mammals include the degradation of water quality resulting from operational discharges, vessel traffic, noise generated by platforms, drillships, helicopters and vessels, seismic surveys, explosive structure removals, oil spills, oil-spill response activities, loss of debris from service vessels and OCS structures, commercial fishing, capture and removal, and pathogens. The cumulative impact on marine mammals is expected to result in a number of chronic and sporadic sublethal effects (behavioral effects and nonfatal exposure to or intake of OCS-related contaminants or discarded debris) that may stress and/or weaken individuals of a local group or population and predispose them to infection from natural or anthropogenic sources. Few deaths are expected from oil spills, chance collisions with OCS service vessels, ingestion of plastic material, commercial fishing, and pathogens. Oil spills and slicks of any size are estimated to be erratic events that would periodically contact marine mammals. Deaths as a result of structure removals are not expected due to ESA Section 7 consultations. Disturbance (noise from vessel traffic and drilling operations, etc.) and/or exposure to sublethal levels of toxins and anthropogenic contaminants may stress animals, weaken their immune systems, and make them more vulnerable to parasites and diseases that normally would not be fatal. The net result of any disturbance would be dependent upon the size and percentage of the population likely to be affected; ecological importance of the disturbed area; environmental and biological parameters that influence an animal's sensitivity to disturbance and stress; or the accommodation time in response to prolonged disturbance (Geraci and St. Aubin, 1980). Collisions between cetaceans and ships, though expected to be rare events, could cause serious injury or mortality.

4.4.3.4. Sea Turtles

Cumulative impact factors that may harm sea turtles and their habitats include structure installation, dredging, water quality and habitat degradation, trash and flotsam, vessel traffic, seismic surveys, explosive structure removals, oil spills, oil-spill response activities, natural catastrophes, pollution, vessel collisions, commercial and recreational fishing, human consumption, beach lighting, and power plant entrainment. Sea turtles could be killed or injured by chance collision with OCS and non-OCS vessels or eating marine debris, particularly plastic items. It is expected that deaths due to structure removals would rarely occur due to mitigation measures established by ESA Section 7 consultations. The presence of and the noise produced by vessels and by the construction, operation, and removal of drilling rigs may cause physiological stress and make animals more susceptible to disease or predation, as well as disrupt normal activities. Contaminants from OCS waste discharges and drilling muds and non-OCS sources might indirectly affect sea turtles through food-chain biomagnfication; there is uncertainty concerning the possible effect. Oil spills and oil-spill response activities may cause turtle deaths. Contact with, and consumption of oil and oil-contaminated prey, may seriously impact turtles. Sea turtles have been seriously harmed by oil spills in the past. The majority of OCS activities are estimated to be sublethal (behavioral effects and nonfatal exposure to intake of OCS-related contaminants or debris). Chronic sublethal effects (e.g., stress) resulting in persistent physiological or behavioral changes and/or avoidance of impacted areas could cause declines in survival or productivity, resulting in either acute or gradual population declines. The incremental contribution of the Matterhorn Project to the cumulative impacts on sea turtles is negligible.

4.4.3.5. Coastal and Marine Birds

Cumulative activities could detrimentally affect coastal and marine birds. It is expected that the majority of effects from the major impact-producing factors on coastal and marine birds are sublethal (behavioral effects and nonfatal exposure to or intake of contaminants or discarded debris) and will usually cause temporary disturbances and displacement of localized groups inshore. Chronic sublethal stress, however, is often undetectable in birds. It can serve to weaken individuals (which is especially serious for migratory species) and expose them to infection and disease. A worst-case oil spill from any source in deep water is assumed to be 10,000 bbl/day for 30 days (a total of 300,000 bbl). Such a spill would cause significant bird mortality, which would be ameliorated by an increase in spill cleanup with experience and acquisition of more and more cleanup resources like skimmers. A 300,000-bbl spill would be so improbable that no real impact on either threatened/endangered or nonendangered/nonthreatened birds would be expected. Lethal effects, resulting primarily from uncontained coastal oil spills and associated spill-response activities in wetlands and other biologically sensitive coastal habitats, are expected to remove a number of individuals from any or all groups through primary effects from physical oiling and the ingestion of oil, and secondary effects resulting from the ingestion of oiled prey. Recruitment of birds through successful reproduction is expected to take up to many years, depending upon the species and existing conditions. The net effect of habitat loss from oil spills, new construction, and maintenance and use of pipeline corridors and navigation waterways will alter species composition and reduce the overall carrying capacity of disturbed area(s) in general.

The incremental contribution of the proposed action (Chapter 4.2.5) to the cumulative impact is negligible because the effects of the most probable impacts, such as OCS-related operational discharges and helicopters and service-vessel noise and traffic, are expected to be sublethal, although some displacement of local individuals or groups may occur. It is expected that there will be little interaction between OCS-related oil spills and coastal and marine birds.

The cumulative effect on coastal and marine birds is expected to result in a discernible decline in the numbers of birds that form localized groups or populations, with associated change in species composition and distribution. Some of these changes are expected to be permanent, as exemplified in historic census data, and to stem from a net decrease in preferred and/or critical habitat.

4.4.3.6. Essential Fish Habitat and Fish Resources

Degradation of water quality, loss of essential habitat (including wetland loss), pathogens, trash and debris, riverine influences, and overfishing could affect fish resources. Eggs and larvae are more susceptible than adults to environmental contaminants. Portions of the Gulf experience hypoxia during portions of the year (LATEX B; Murray, 1998). However, areas of hypoxia typically occur only on the continental shelf.

4.4.3.7. Gulf Sturgeon

The Gulf sturgeon can be impacted by cumulative activities such as oil spills, alteration and destruction of habitat, and commercial fishing. The effects from contact with spilled oil are expected to be nonfatal and last for less than one month. Substantial damage to Gulf sturgeon habitats is expected from inshore alteration activities and natural catastrophes. As a result, it is expected that the Gulf sturgeon will experience a decline in population sizes and a displacement from their current distribution that will last more than one generation. Deaths of adult sturgeon are expected to occur from commercial fishing. The incremental contribution of the proposed action (as analyzed in Chapter 4.2.7) to the cumulative impact is negligible because the effect of contact between sale-specific oil spills and Gulf sturgeon is expected to be nonfatal and last less than one month.

4.4.3.8. Beach Mice

Cumulative activities have a potential to harm or reduce the numbers of Alabama, Choctawhatchee, St. Andrew, and Perdido Key beach mice. Those activities include oil spills, oil-spill response activities, alteration and reduction of habitat, predation and competition, and beach trash and debris. The majority of OCS-related activities and events, as well as oil spills stemming from import tankering and prior and future lease sales, are not expected to contact beach mice or their habitats. The expected incremental contribution of the proposed action (as analyzed in Chapter 3.2.8) to the cumulative impact level is negligible. Non-OCS activities or natural catastrophes could potentially deplete some beach mice populations to unsustainable levels, especially if reintroduction could not occur.

4.4.4. Other Relevant Activities

4.4.4.1. Socioeconomic Conditions and Other Concerns

4.4.4.1.1. Economic and Demographic Conditions

The economic and demographic conditions evaluated in this PEA are limited to that portion of the GOM's coastal zone whose social and economic well being (population, labor, and employment) is directly or indirectly affected by the OCS oil and gas activities. Chapter 4.3.1 (the Chapter that describes the impact area) gives an overview of those areas. The energy industry has become increasingly more global. While the OCS Program, in general, has played a significant role in the GOM region’s economy and demography, the activities anticipated in Grid 15 are expected to have minimal economic and demographic consequences to the region as a whole. Areas that focus on OCS development, such as Port Fourchon, may have more noteworthy impacts from activities in Grid 15.

4.4.4.1.2. Population and Education

The impact area’s population is expected to grow at an average annual rate of 1.0-1.5 percent over the next 40 years, with that growth slowing over time. This population growth is based on continuation of existing conditions, including OCS energy development. Activities in Grid 15 are not expected to affect the population's growth rate. Some new residents are expected with respect to activities in Grid 15. While these new residents are not of the magnitude to alter the population growth rate associated with the region, they are expected to cause some localized stresses to communities that focus on OCS development. Education levels are expected to remain largely unchanged by activities within the grid.

4.4.4.1.3. Infrastructure and Land Use

Sufficient infrastructure is in place to support activities within Grid 15. Sufficient land is designated in commercial and industrial parks and adjacent to the existing ports to minimize potential disruption to current residential and business use patterns. While land use in the area will change over time, the majority of this change is expected to be general regional growth. While Port Fourchon, Louisiana, does plan to use wetland areas for future expansions at the port, primarily due to OCS oil and gas activities of which Grid 15 is a part, the Corps of Engineers has approved their permit. The port will create wetlands in kind at the port as a mitigation action.

4.4.4.1.4. Navigation and Port Usage

There are approximately 50 shore bases that are traditionally used by the oil and gas industry to support activities on the Federal OCS. Certain shore bases cater to OCS development almost to the exclusion of other port uses. Those shore bases are expanding in response to OCS oil and gas activities in general. Minimal new expansion or construction is expected at these existing shore bases to support offshore activities within Grid 15.

4.4.4.1.5. Employment

The oil and gas and service industries are very important to many of the communities of the GOM, especially in coastal Louisiana and northeast Texas. Changes in OCS oil and gas activities have significant employment implications to these communities, particularly in industries directly and indirectly related to oil and gas development. However, the energy industry has global markets (both for the supply of goods and services needed to produce energy and the demand for energy products). While mergers, relocations, and consolidation of oil and gas companies' assets have affected employment in the GOM region in recent years, employment changes to the coastal communities as a result of activities in Grid 15 are expected to be negligible. Some new resident employment is expected with respect to activities in Grid 15. While this new resident employment is not of the magnitude to alter the employment growth rate associated with the region, it is expected to cause some localized stresses to the labor force of communities that focus on OCS development.

4.4.4.1.6. Environmental Justice

This proposed project, in combination with existing extraction activities on the OCS, should prove beneficial to minority peoples and those with low incomes. Benefits would be derived from direct employment in the oil/gas industry, in a supporting service or in another part of the economy positively affected by financial multipliers. This is contingent, of course, on the persons' willingness to seek employment in a highly volatile industry. It is also contingent on these individuals having the job skills and experience needed to meet the labor requirements of the various companies.

4.4.4.2. Commercial Fisheries

Federal and State fishery management agencies will control the "take" of commercial fishes. The agencies' primary responsibility is to manage effectively the fishery stock to perpetuate commercially important species. Various management plans aimed at selected species have been and will continue to be prepared. The GOM will remain one of the Nation's most important commercial fisheries area.

4.4.4.3. Recreational Activities and Beach Use

The risk of a large oil spill occurring due to the proposed development operations in Mississippi Canyon Block 243 is very small. In the event such a spill did occur, according to OSRA model, there is little chance that significant amounts of oil would contact specific segments of Louisiana, particularly after natural weathering and countermeasures. Because of the low probability, the limited coverage by oil, and recovery and remediation capabilities for accessible sandy beaches, significant impacts of beach resources are not expected. Project aircraft will normally be flying high enough (610 m or more) to avoid disturbing beach-goers.

The MMS requires that companies operating on the OCS have an established waste management plan for all of their offshore activities. While some accidental loss of solid wastes may occur from time to time, it is expected to have a negligible impact on recreational resources.

Present use of the Matterhorn area by recreational fishers is minimal but could increase given the presence of a structure attractive to fish and fishermen alike.

The amount of trash and debris due to OCS and other activities will likely increase. The degree to which they affect coastal waters and recreational areas depends on the unknowns of human behavior, currents, winds, and weather.

4.4.4.4. Archaeological Resources

4.4.4.4.1. Prehistoric

The MMS's analysis indicates there is simply no potential for the occurrence of prehistoric archaeological sites in water depths greater than 60 m. The aforementioned statement is based on the current acceptable seaward extant of the prehistoric archaeological, high-probability area in the GOM. The effects of the various impact-producing factors related to OCS and non-OCS activities (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) may have resulted in the loss of significant or unique prehistoric archaeological information. In the case of factors related to OCS Program activities in the cumulative activity area, it is reasonable to assume that most impacts would have occurred prior to 1973 (the date of initial archaeological survey and clearance requirements). Impacts associated with the proposed drilling of eight wells from a single platform located in Mississippi Canyon Block 243 are expected to be negligible due to the efficacy of the required terrestrial and marine remote-sensing surveys and concomitant archaeological report and clearance.

4.4.4.4.2. Historic

The Matterhorn Project in Mississippi Canyon Block 243 is located in 856 m of water. Deepwater archaeological surveys are assumed to reduce the potential for an interaction between an impact-producing activities (pipeline and platform installations, drilling rig emplacement and operation, dredging, and anchoring activities) and a historic resource by approximately 95 percent in those areas that have a thin Holocene sediment veneer because any historic resource is likely to be detected by side-scan sonar. It is at this water depth that the majority of lease blocks with a high probability for historic shipwrecks occur. The potential of an interaction between rig or platform emplacement and a historic shipwreck is greatly diminished by requisite site surveys, but it still exists. Such an interaction could result in the loss of or damage to significant or unique historic information.

The effects of the various impact-producing factors discussed in this analysis have likely resulted in the loss of significant or unique historic archaeological information. In the case of factors related to OCS Program activities in the cumulative activity area, it is reasonable to assume that most impacts would have occurred prior to 1973 (the date of initial archaeological survey and clearance requirements). Impacts associated with the proposed drilling of eight wells from a single platform location in Mississippi Canyon Block 243 is expected to be negligible due to the efficacy of the required remote-sensing survey and archaeological review of these data. However, there is a possibility of an interaction between bottom-disturbing activity (rig emplacement, pipeline trenching, and anchoring) and a historic shipwreck.

4.4.4.5. Artificial Reefs

Because the proposed project is located outside of State Artificial Reef and Permit Areas, no potential cumulative environmental effects or use conflicts are expected. Non-OCS activities, including anchoring and trawling, have the potential to impact artificial reef areas.

5. CONSULTATION AND COORDINATION

A Notice of Intent to Prepare an Environmental Assessment on the Matterhorn Project was published in the *The Times-Picayune* on December 3, 2001. The Notice provided the public with a 30-day comment period to provide issues that should be addressed in the PEA. No comments were received.

The States of Louisiana and Mississippi have an approved Coastal Zone Management (CZM) Program. Therefore, Certificates of Coastal Zone Consistency from the States of Louisiana and Mississippi are required for the proposed activities. The MMS mailed the plan and other required and necessary information to both of the State's appropriate CZM agencies on September 12, 2001. In a letter dated October 5, 2001, the Louisiana Department of Natural Resources indicated that the plan is consistent with the Louisiana Coastal Resources Program as required by Section 307(c)(3)(B) of the Coastal Zone Management Act of 1972, as amended. The Mississippi Department of Marine Resources provided a similar consistency determination about the proposed activities on September 14, 2001.

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8. APPENDICES

Appendix A — Accidental Hydrocarbon Discharge Analysis
Appendix B — Meteorological Conditions
Appendix C — Geology
Appendix D — Physical Oceanography
Appendix E — Socioeconomic Conditions
Appendix F — Other Information on Grid 15

Appendix A

Accidental Hydrocarbon Discharge Analysis

APPENDIX A

ANALYSIS OF THE POTENTIAL FOR AN ACCIDENTAL OIL SPILL AND POTENTIAL FOR IMPACTS FROM PRODUCTION IN MISSISSIPPI CANYON BLOCK 243 (N-7249), MATTERHORN PROJECT

Introduction

The National Environmental Policy Act (NEPA) requires Federal agencies to consider potential environmental impacts (direct, indirect, and cumulative) of proposed actions as part of agency planning and decisionmaking. The NEPA analyses address many issues relating to potential impacts, including issues that may have a very low probability of occurrence, but which the public considers important or for which the environmental consequences could be significant.

The past several decades of spill data show that accidental oil spills (> 1 bbl) associated with oil and gas exploration and development are low probability events in Federal Outer Continental Shelf (OCS) waters of the Gulf of Mexico (GOM), yet the issue of oil spills is important to the public. This document summarizes key information about the low probability of accidental spills from offshore oil and gas activities in the GOM.

Spill Prevention

The MMS has comprehensive pollution prevention requirements that include numerous redundant levels of safety devices, as well as inspection and testing requirements to confirm that these devices work. Many of these requirements have been in place since about 1980. Spill trends analysis for the GOM OCS show that spills from facilities have decreased over time, indicating that MMS engineering and safety requirements have minimized the potential for spill occurrence and associated impacts. Details regarding MMS engineering and safety requirements can be found at 30 CFR 250.800 Subpart H.

OCS Spills in the Past

This summary of past OCS spills presents data for the period 1985-1999. The 1985-1999 time period was chosen to reflect more modern engineering and regulatory requirements and because OCS spill rates are available for this period. For the period 1985-1999, there were no spills ≥1,000 bbl from OCS platforms, eight spills ≥1,000 bbl from OCS pipelines, and no spills ≥1,000 bbl from OCS blowouts (Tables A-1 through A-3). It is considered a conservative assumption that a spill would need to be at least ≥1,000 bbl in order for the spill to stay together as a slick long enough to significantly impact shoreline and associated resources. It should be noted that past OCS spills (Tables A-1 through A-3), some of which are considerably larger than 1,000 bbl, have not resulted in any documented significant impacts to shorelines or other resources. The most recent Final Environmental Impact Statements for Lease Sales 169, 172, 175, 178, and 182 in the Central Planning Area and Lease Sale 181 in the Eastern Planning Area provide additional information on past OCS spills.

Estimating Future Potential Spills

The MMS estimates the risk of future potential spills by multiplying variables to result in a numerical expression of risk. These variables include the potential of a spill occurring based on historical OCS spill rates and a variable for the potential for a spill to be transported to environmental resources based on trajectory modeling. The following subsections describe the spill occurrence and transport variables used to estimate risk and the risk calculation for the proposed action.

Spill Occurrence Variable (SOV) Representing the Potential for a Spill

The SOV is derived based on past OCS spill frequency; that is, data from past OCS spills are used to estimate future potential OCS spills. The MMS has estimated spill rates for spills from the following sources: facilities, pipelines, and blowouts.

Spill rates for facilities and pipelines have been developed for several time periods and an analysis of trends for spills is presented in *Update of Comparative Occurrence Rates for Offshore Oil Spills* (Spill Science & Technology Bulletin, 2000). Spill rates for the most recent period analyzed, 1985-1999, are presented here. Data for this recent period should reflect more modern spill prevention requirements.

Spill rates for facilities and pipelines are based on the number of spills per volume of oil handled. Spill rates for blowouts are based on the number of blowouts with a release of oil per number of wells drilled. Spill rates for the period 1985-1999 are shown in Table A-4. It should be noted that there were no platform or blowout spills ≥1,000 bbl for the period 1985-1999. Use of "zero" spills would result in a zero spill rate. To allow for conservative future predictions of spill occurrence, a spill number of one was "assigned" to provide a non-zero spill rate for blowouts. The spill period was expanded to 1980 to include a spill for facilities. While there were no facility or blowout spills during the 1985-1999 period for which data are available, spills could occur in the future. In fact, a pipeline spill ≥1,000 bbl was reported subsequent to this period; therefore, it is reasonable to include a spill to provide a non-zero spill rate.

Spill rates are combined with site-specific data on production or pipeline volumes or number of wells being drilled to result in a site-specific SOV.

Transport Variable (TV) Representing the Potential for a Spill to be Transported to Important Environmental Resources

The TV is derived using an oil-spill trajectory model. This model predicts the direction that winds and currents would transport spills. The model uses an extensive database of observed and theoretically computed ocean currents and fields that represent a statistical estimate of winds and currents that would occur over the life of an oil and gas project, which may span several decades. This model produces the TV that can be combined with other variables, such as the SOV, to estimate the risk of future potential spills and impacts.

Risk Calculation for the Proposed Action

The proposed action includes the drilling, completion, and production of Well Locations AA-HH, installation of a TLP structure to be designated as Platform A, and installation of an associated lease pipeline in approximately 2,816 ft of water approximately 25 mi from the nearest shoreline. Two of the proposed wells will be water injector wells. The OCS-G 19931 Well No. 1 will be completed under a previously approved Initial Plan of Exploration; however, in the event that the operator is unable to re-enter the subject well, the new Well Location AA will replace this well. Table A-5 presents an estimate of spill risk to resources. The risk estimate was calculated using the spill rate of 0.13 per billion barrels of oil produced, the estimated production for the proposed action, and oil-spill trajectory calculations.

The coastline and associated environmental resources are presented in Table A-5. The final column in Table A-5 presents the result of combining the SOV and the TV. The risk of a spill from the proposed facility could be considered to be so low as to be near zero.

Given the low risk of a spill, spill-prevention requirements, and spill-response requirements, significant impacts to environmental resources are unlikely. The most recent Final Environmental Impact Statements for Lease Sales 169, 172, 175, 178, and 182 in the Central Planning Area and Lease Sale 181 in the Eastern Planning Area provide additional information on spills and potential impacts. The following section provides additional information regarding the spill-response preparedness requirements of MMS.

Spill Response

The MMS has extensive requirements both for the prevention of spills and preparedness to respond to a spill in the event of an accidental spill. The MMS spill-prevention requirements and the low incidence of past OCS spills were addressed earlier in this document. This Chapter presents information on MMS requirements for spill-response preparedness.

MMS Oil-Spill Response Program

The MMS Oil-Spill Response Program oversees the review of oil-spill response plans, coordinates inspection of oil-spill response equipment, and conducts unannounced oil-spill drills. This program also supports continuing research to foster improvements in spill prevention and response. Studies funded by MMS address issues such as spill prevention and response, *in-situ* burning, and dispersant use.

In addition, MMS works with the U.S. Coast Guard and other members of the multiagency National Response System and their National Strike Force to further improve spill-response capability in the GOM. The Gulf Strike Force includes 38 members and associated response expertise and equipment. The combined resources of these groups and the resources of commercially contracted oil-spill response organizations result in extensive equipment and trained personnel for spill response in the GOM.

Spill Response for this Project

The subject operator has an oil-spill response plan on file with MMS and has current contracts with offshore oil-spill response organizations.

Potential spill sources for this project include a spill during the life of the facility, an accidental blowout during drilling or a spill of diesel fuel stored on the facility. The operator has addressed these spill sources in their oil-spill response plan.

The MMS will continue to verify the operator's capability to respond to oil spills via the MMS Oil Spill Program. The operator is required to keep their oil-spill response plan up to date in accordance with MMS regulations. The operator must also conduct an annual drill to demonstrate the adequacy of their spill preparedness. The MMS also conducts unannounced drills to further verify the adequacy of an operator's spill-response preparedness; such a drill could be conducted for this proposed action.

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Table A-1

Historical Record of OCS Spills ≥1,000 Barrels from OCS Facilities, 1985-1999

Spill Date	Area and Block (water depth and distance from shore)	Volume Spilled (bbl)	Cause of Spill

No OCS Facility Spills ≥1,000 bbl during the period 1985-1999.

Table A-2

Historical Record of OCS Spills ≥1,000 Barrels from OCS Pipelines, 1985-1999

Spill Date	Area and Block (water depth and distance from shore)	Volume Spilled (bbl)	Cause of Spill
February 7, 1988	South Pass 60 (75 ft, 3.4 mi)	15,576	Service vessel's anchor damaged pipeline
January 24, 1990	Ship Shoal 281 (197 ft, 60 mi)	14,423*	Anchor drag, flange and valve broke off
May 6, 1990	Eugene Island 314 (230 ft, 78 mi)	4,569	Trawl drag pulled off valve
August 31, 1992	South Pelto 8 (30 ft, 6 mi)	2,000	Hurricane Andrew, loose drilling rig's anchor drag damaged pipeline
November 22, 1994	Ship Shoal 281 (197 ft, 60 mi)	4,533*	Trawl drag
January 26, 1998	East Cameron 334 (264 ft, 105 mi)	1,211*	Service vessel's anchor drag damaged pipeline during rescue operation
September 29, 1998	South Pass 38 (110 ft, 6 mi)	8,212	Hurricane Georges, mudslide parted pipeline
July 23, 1999	Ship Shoal 241 (133 ft, 50 mi)	3,189	Jack-up barge sat on pipeline

*condensate

Table A-3

Historical Record of OCS Spills ≥1,000 Barrels from OCS Blowouts, 1985-1999

Spill Date	Area and Block (water depth and distance from shore)	Volume Spilled (bbl)	Cause of Spill

No OCS Blowout Spills ≥1,000 barrels during the period 1985–1999.

Table A-4

Spill Rates Used to Estimate the Future Potential for Spills

Spill Source	Volume of Oil Handled in Billions of Barrels	Number of Wells Drilled	No. of Spills ≥1,000 Barrels	Risk of Spill from Facilities or Pipelines per Billion Barrels	Risk of Spill from Drilling Blowout per Well
Facilities	7.41 [a]	Not Applicable	1[a]	>0 to <0.13[c]	Not Applicable
Pipelines	5.81	Not Applicable	8	1.38	Not Applicable
Drilling	Not Applicable	14,067	1[b]	Not Applicable	>0 to < 0.00007 [c]

[a] There were actually zero spills ≥1,000 bbl from facilities during the period 1985-1999. The data shown represent 1980-1999. The spill period for facility spills was expanded to 1980 to include a spill for facilities to result in a nonzero risk.

[b] There have been no spills ≥1,000 bbl from blowouts during the period 1985-1999. One spill was "assigned" to provide a nonzero spill rate.

[c] There were no facility or blowout spills ≥1,000 bbl for the period 1985-1999; however, a nonzero spill rate was calculated by expanding the facility period to 1980 and by "assigning" a blowout spill. Therefore, the spill rates for these categories are presented as greater than zero but below the rates calculated by expanding the data period and assigning a spill.

Table A-5

Spill Risk Estimate

Environmental Resource	Spill Occurrence Variable [1] (%)	Transport Variable [2] [3] within 30 Days (%)	Spill Risk [4] within 30 Days (%)
Counties/Parishes			
Cameron, Tex.	2	<0.5[5]	<0.5
Willacy, Tex.	2	<0.5	<0.5
Kenedy, Tex..	2	<0.5	<0.5
Kleberg, Tex.	2	<0.5	<0.5
Nueces, Tex.	2	<0.5	<0.5
Aransas, Tex.	2	<0.5	<0.5
Calhoun, Tex.	2	<0.5	<0.5
Matagorda, Tex.	2	<0.5	<0.5
Brazoria, Tex.	2	<0.5	<0.5
Galveston, Tex.	2	<0.5	<0.5
Chambers, Tex.	2	<0.5	<0.5
Jefferson, Tex.	2	<0.5	<0.5
Cameron, La.	2	1	<0.5
Vermilion, La.	2	1	<0.5
Iberia, La.	2	<0.5	<0.5
St. Mary, La.	2	<0.5	<0.5
Terrebonne, La.	2	2	<0.5
Lafourche, La.	2	2	<0.5
Jefferson, La.	2	1	<0.5
Plaquemines, La.	2	26	1
St. Bernard, La.	2	5	<0.5
Harrison, Miss.	2	1	<0.5
Jackson, Miss.	2	2	<0.5
Baldwin, Ala.	2	2	<0.5
Mobile, Ala.	2	<0.5	<0.5
Escambia, Fla.	2	1	<0.5
Santa Rosa, Fla.	2	<0.5	<0.5
Okaloosa, Fla.	2	1	<0.5
Walton, Fla.	2	1	<0.5
Bay, Fla.	2	1	<0.5
Gulf, Fla.	2	1	<0.5
Franklin, Fla.	2	<0.5	<0.5
Wakulla, Fla.	2	<0.5	<0.5
Jefferson, Fla.	2	<0.5	<0.5
Taylor, Fla.	2	<0.5	<0.5
Dixie, Fla.	2	<0.5	<0.5
Levy, Fla.	2	<0.5	<0.5
Citrus, Fla.	2	<0.5	<0.5
Hernando, Fla.	2	<0.5	<0.5
Pasco, Fla.	2	<0.5	<0.5
Pinellas, Fla.	2	<0.5	<0.5
Hillsborough, Fla.	2	<0.5	<0.5
Manatee, Fla.	2	<0.5	<0.5
Sarasota, Fla.	2	<0.5	<0.5
Charlotte, Fla.	2	<0.5	<0.5
Lee, Fla.	2	<0.5	<0.5
Collier, Fla.	2	<0.5	<0.5
Monroe, Fla.	2	<0.5	<0.5
Dade, Fla.	2	<0.5	<0.5

Table A-5. Spill Risk Estimate (continued).

Environmental Resource	Spill Occurrence Variable [1] (%)	Transport Variable [2] [3] within 30 Days (%)	Spill Risk [4] within 30 Days (%)
State Offshore Waters			
Texas State Offshore Waters	2	1	<0.5
Louisiana (Western) State Offshore Waters	2	29	1
Louisiana (Eastern) State Offshore Waters	2	21	<0.5
Mississippi State Offshore Waters	2	3	<0.5
Alabama State Offshore Waters	2	4	<0.5
Florida Panhandle State Offshore Waters	2	7	<0.5
Florida Peninsula State Offshore Waters	2	<0.5	<0.5
Major Recreational Beach Areas			
Texas Coastal Bend area beaches	2	<0.5	<0.5
Texas Matagorda area beaches	2	<0.5	<0.5
Texas Galveston area beaches	2	<0.5	<0.5
Texas Sea Rim State Park	2	<0.5	<0.5
Louisiana beaches	2	2	<0.5
Alabama/Mississippi Gulf Islands	2	3	<0.5
Alabama Gulf Shores	2	1	<0.5
Florida Panhandle beaches	2	5	<0.5
Florida Big Bend beaches	2	<0.5	<0.5
Florida Southwest beaches	2	<0.5	<0.5
Florida Ten Thousand Islands	2	<0.5	<0.5

(1) The percent chance of a spill ≥1,000 bbl occurring.

(2) The percent chance that winds and currents will move a point starting at Mississippi Canyon Block 243 and ending at specified coastal features. The results are calculated using a numerical model that simulates the trajectory of a drifting point projected onto the surface of the GOM waters using temporally and spatially varying winds and ocean current fields. These probabilities do not factor in the risk of spill occurrence or consideration of the spill size, any spill response or cleanup actions, or any dispersion and weathering. The effect these factors have on slick persistence is accounted for by the length of time of the modeled simulation. In this case, the point is allowed to drift on the water surface for 30 days.

(3) Model results used are for the MMS's C4-3 cluster area. These cluster areas represent areas that exhibit a similar trajectory pattern for all points originating within the cluster area contacting 10-mi land segments (unpublished results).

(4) The probability of a spill >1,000 bbl occurring and contacting identified environmental features represents weighted spill risk that accounts for both the risk that a spill of this magnitude will occur and the risk that it will contact locations where the resources occur, given the assumptions already described in (1) and (2).

(5) <0.5 = less than 0.5%.

Sources: USDOI, MMS, 1997 and 2001b.

Appendix B

Meteorological Conditions

APPENDIX B

METEOROLOGICAL CONDITIONS

General Description

The Gulf of Mexico is influenced by a maritime subtropical climate controlled mainly by the clockwise circulation around the semipermanent area of high barometric pressure commonly known as the Bermuda High. The Bermuda High is a high-pressure cell. The center of the high is usually located at the Atlantic Ocean or sometimes near the Azores Islands off the coast of Spain (Henry et al., 1994). The Gulf of Mexico is located to the southwest of this center of circulation. This proximity to the high-pressure system results in a predominantly east to southeasterly flow in the Gulf of Mexico region. Two important classes of cyclonic storms are occasionally superimposed on this circulation pattern. During the winter months of December through March, cold fronts associated with cold continental air masses influence mainly the northern coastal areas of the Gulf of Mexico. Behind the fronts, strong north winds bring drier air into the region. During the summer and fall months of June through October, tropical cyclones may develop or migrate into the Gulf of Mexico. These storms may affect any area of the Gulf of Mexico and substantially alter the local wind circulation around them. In coastal areas, the sea breeze effect may become the primary circulation feature during the summer months of May through October. In general, however, the subtropical maritime climate is the dominant feature in driving all aspects of the weather in this region; as a result, the climate shows relatively small diurnal variation in summer.

The climatology of the Gulf of Mexico region is primarily governed by two types of air masses. One type of air mass is the warm and moist, maritime tropical air; the other type is very cold and dry, continental polar air. During summer months, the mid-latitude polar jet retreats northward, allowing maritime air to dominate through the Gulf of Mexico. In the southeastern region of the Gulf of Mexico, the climate is dominated by the warm and moist, maritime tropical air year-round.

Pressure, Temperature, and Relative Humidity

The western extension of the Bermuda High into the Gulf of Mexico dominates the circulation throughout the year; the high-pressure center is weakening in winter and strengthening in summer. The average monthly pressure shows a west to east gradient during summer. In the winter, the monthly pressure is more uniform. The minimum average monthly pressure occurs during the summer. The maximum pressure occurs during the winter as a result of the pressure and influence of transitional continental cold air.

Average air temperature at coastal locations vary with latitude and exposure. Winter temperatures depend on the frequency and intensity of penetration by polar air masses from the north. Air temperature over the open Gulf exhibit much smaller variation on a daily and seasonal basis due to the moderating effect of the large body of water.

The relative humidity over the Gulf of Mexico region is high throughout the year. Minimum humidities occur during the late fall and winter when cold, continental air masses bring dry air into the northern Gulf. Maximum humidities occur during the spring and summer. Due to the presence of the warm, moist, maritime tropical air mass in the southern Gulf of Mexico, the relative humidity in this region is high for the whole year.

Surface Winds

Winds are more variable near the coast than over open waters because coastal winds are more directly influenced by the moving cyclonic storms that are characteristic of the continent and because of the land and sea breeze regime. During the relatively constant summer conditions, the southerly positions of the Bermuda High generates predominantly southeasterly winds in the northern Gulf and easterly winds in the southern parts of the Gulf. Winter winds usually blow from northeasterly directions and become more easterly in the southern parts of the Gulf.

Precipitation and Visibility

Precipitation is frequent and abundant throughout the year but does show distinct seasonal variation. The highest precipitation rates occur during the warmer months of the year. The warmer months usually have convective cloud systems that produce showers and thunderstorms; however, these thunderstorms rarely cause any damage or have attendant hail (USDOC, 1967; Brower et al., 1972). Hail can occur when water droplets freeze in the strong updraft of a convective cloud system. Winter rains are associated with the frequent passage of frontal systems through the area. Rainfalls are generally slow, steady, and relatively continuous, often lasting several days. In the northern parts of the Gulf, snowfalls are rare, and when frozen precipitation does occur, it usually melts upon contact with the ground. Incidence of frozen precipitation decreases with distance offshore and rapidly reaches zero. The annual average precipitation in Lake Charles, Louisiana, is 1.35 m. In the southern portions of the Gulf of Mexico, because of warm climate, the frozen precipitation is unlikely to occur.

Warm, moist Gulf air blowing slowly over chilled land or water surfaces brings about the formation of fog. Fog occurrence decreases seaward, but visibility has been less than 800 m (less than ½ mile) due to offshore fog in the coastal area. Coastal fogs generally last 3 or 4 hours, although particularly dense sea fogs may persist for several days. The poorest visibility conditions occur during winter and early spring. The period from November through April has the most days with low visibility. Industrial pollution and agricultural burning also impact visibility.

Atmospheric Stability and Mixing Height

Mixing height is very important because it determines the volume of air available for dispersing pollutants. Mixing height is directly related to vertical mixing in the atmosphere. A mixed layer is expected to occur under neutral and unstable atmospheric conditions. Vertical mixing is most vigorous during unstable conditions. Vertical motion is suppressed during stable conditions. The mixing height tends to be lower in winter and daily variations are smaller than in summer.

Not all of the Pasquill-Gifford stability classes are found offshore in the Gulf of Mexico. Specifically, the F stability class seldom occurs and the G stability class is markedly absent; the G stability class is the extremely stable condition that only develops at night over land with rapid radiative cooling. This large body of water is simply incapable of losing enough heat overnight to set up a strong radiative inversion. Likewise, A stability class is rarely present but could be encountered during cold air outbreaks in the wintertime, particularly over warmer waters. Category A is the extremely unstable condition that requires a very rapid warming of the lower layer of the atmosphere, along with cold air aloft. This is normally brought about when cold air is advected aloft, and in strong insolation rapidly warms the earth's surface, which, in turn, warms the lowest layer of the atmosphere. Once again, the ocean surface is incapable of warming rapidly; therefore, you would not expect to find stability class A over the ocean. For the most part, the stability is neutral to slightly unstable.

In this area, the over-water stability is predominantly unstable, with neutral conditions making up the bulk of the remainder of the time (Hsu, 1996; Marks, written communication, 1996 and 1997; Nowlin et al., 1998). Stable conditions do occur, although infrequently.

The mixing heights offshore are quite shallow, 900 m or less (Hsu, 1996; Nowlin et al., 1998). The exception to this is close to shore, where the influence of the land penetrates out over the water for a short distance. Transient cold fronts also have an impact on the mixing heights; some of the lowest heights can be expected to occur with frontal passages and on the cold-air side of the fronts. This effect is caused by the frontal inversion.

Severe Storms

The Gulf of Mexico is part of the Atlantic tropical cyclone basin. Tropical cyclones generally occur in summer and fall seasons; however, the Gulf also experiences winter storms or extratropical storms. These winter storms generally originate in middle and high latitudes and have winds that can attain speeds of 15-26 m/sec (11.2-58.2 mph). The Gulf is an area of cyclone development during cooler months due to the contrast of the warm air over the Gulf and the cold continental air over North America. Cyclogenesis, or the formation of extratropical cyclones, in the Gulf of Mexico is associated with frontal overrunning (Hsu, 1992). The most severe extratropical storms in the Gulf originate when a cold front encounters the subtropical jetstream over the warm waters of the Gulf. Statistics of 100-year data of extratropical cyclones reveal that most activity occurs above 25°N. in the Western Gulf of Mexico. The mean number of these storms ranges from 0.9 storms per year near the southern tip of Florida to 4.2 over central Louisiana (USDOI, MMS, 1988).

The frequency of cold fronts in the Gulf exhibits similar synoptic weather patterns during the four-month period of December through March. During this time the area of frontal influence reaches south to 10°N. Frontal frequency is about nine fronts per month in February (1 front every 3 days on the average) and about seven fronts per month in March (1 front every 4-5 days on the average). By May, the frequency decreases to about four fronts per month (1 front every 7-8 days), and the region of frontal influence retreats to about 15°N. During June-August frontal activity decreases to almost zero and fronts seldom reach below 25°N. (USDOI, MMS, 1988).

Tropical cyclones affecting the Gulf originate over the equatorial portions of the Atlantic Ocean, the Caribbean Sea, and the Gulf of Mexico. Tropical cyclones occur most frequently between June and November. Based on 42 years of data, there are about 9.9 storms per year with about 5.5 of those storms becoming major hurricanes in the Atlantic Ocean (Gray, written communication, 1992). Data from 1886 to 1986 show that 44.5 percent of these storms, or 3.7 storms per year, will affect the Gulf of Mexico (USDOI, MMS, 1988). The Yucatan Channel is the main entrance of Atlantic storms into the Gulf of Mexico, and a reduced translation speed over Gulf waters leads to longer residence times in this basin. The probability of occurrence for a tropical storm in Louisiana and Mississippi is on average about 15 percent.

There is a high probability that tropical storms will cause damage to physical, economic, biological, and social systems in the Gulf. Tropical storms also affect OCS operations and activities; platform design needs to consider the storm surge, waves, and currents generated by tropical storms. Most of the damage is caused by storm surge, waves, and high winds. Storm surge depends on local factors, such as bottom topography and coastline configuration, and storm intensity. Water depth and storm intensity control wave height during hurricane conditions. Sustained winds for major hurricanes (Saffir-Simpson Category 3 and above) are higher than 49 m/sec (109.6 mph).

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Appendix C

Geology

APPENDIX C

GEOLOGY

General Description

The present day Gulf of Mexico is a small ocean basin of more than 1.5 million km^2 with its greatest water depth reaching approximately 3,700 m. It is almost completely surrounded by land, opening to the Atlantic Ocean through the Straits of Florida and to the Caribbean Sea through the Yucatan Channel. Underlying the present Gulf of Mexico and the adjacent coast is the larger geologic basin that began forming in Triassic time. Over the last 20 million years, clastic sediments (sands and silts) have poured into the Gulf of Mexico Basin from the north and west. The centers of sediment deposition shifted progressively eastward and southward in response to changes in the source of sediment supply. Sediments more than 15 km in thickness have been deposited. Each sediment layer is different, reflecting the source of the material and the geologic processes occurring during deposition. In places where the Gulf was shallow and intermittently dry, evaporitic deposits such as salt were formed. Where there was gradual subsidence and shallow seas persisted overtime, marine plants and animals created reefs. Where marine life was abundant, the deposition of limestone was dominant.

The physiographic provinces in the Gulf of Mexico—shelf, slope, rise, and abyssal plain—reflect the underlying geology. In the Gulf, the continental shelf extends seaward from the shoreline to about the 200-m water depth and is characterized by a gentle slope of less than one degree. The shelf is wide off Texas, but it is narrower or absent where the Mississippi River delta has extended across the entire shelf. The continental slope extends from the shelf edge to the continental rise, usually at about the 2,000-m water depth. The topography of the slope in the Gulf is uneven and is broken by canyons, troughs, and escarpments. The gradient on the slope is characteristically 3-6 degrees, but may exceed 20 degrees in some places, particularly along escarpments. The continental rise is the apron of sediment accumulated at the base of the slope. It is a gentle incline, with slopes of less than one degree, to the abyssal plain. The abyssal plain is the flat region of the basin floor at the base of the continental rise.

The Western Gulf, which includes both the Western and Central Planning Areas, is a clastic province. Many wells have been drilled in the Western Gulf, and the geology has been studied in detail for the identification and development of natural gas and oil resources.

Sedimentary features, such as deltas, fans, canyons, and sediment flow forms, are formed by the erosion of land and deposition of sediments. Structural features, such as faults, folds, and ridges, are produced by displacement and deformation of rocks. The regional dip of sediments in the Gulf of Mexico is interrupted by salt diapirs, shale diapirs, and growth faults. Deformation has been primarily in response to heavy sediment loading.

The most significant factor controlling the hydrocarbon potential in the northern Gulf of Mexico is the environment of deposition. Sediments deposited on the outer shelf and upper slope have the greatest potential for hydrocarbon accumulation because it is the optimum zone for encountering the three factors necessary for the successful formation and accumulation of oil and gas: source material, reservoir space, and geologic traps. The massive shale beds with high organic content are excellent source beds. The thick sands and sandstones with good porosity (pore space between the sand grains where oil and gas can exist) and permeability (connections between the pore spaces through which oil and gas can flow) provide reservoir space. Impermeable shales, salt dome caprocks, and faults serve as seals, trapping oil and gas in the pore spaces of the reservoir rocks.

The geologic horizons with the greatest potential for hydrocarbon accumulation on the continental shelf of the northern Gulf are Miocene, Pliocene, and Pleistocene in age. Producing horizons become progressively younger in a seaward direction. Recent developments in high-energy, 3D seismic technology has allowed industry to "see" below the regional salt layers and identify potential "subsalt plays" or hydrocarbon traps. Exploration and development in the Gulf of Mexico have resulted in the identification of more than 1,000 fields.

The presence of hydrogen sulfide (H_2S) within formation fluids occurs sporadically throughout the Gulf of Mexico OCS. H_2S-rich oil and gas is called "sour." Approximately 65 operations have encountered H_2S-bearing zones on the Gulf of Mexico OCS to date. Occurrences of H_2S offshore Texas are in Miocene Age rocks and occur principally within a geographically narrow band. There is some debate as to the origin of H_2S in these wells offshore Texas as they were reported mostly from deep, high-temperature drilling wells using a ligno-sulfonate mud component, which is widely believed to break down under high wellbore temperature to generate H_2S. The occurrences of H_2S offshore Louisiana are mostly on or near piercement domes with caprock and are associated with salt and gypsum deposits. The H_2S from a caprock environment is generally thought to be a reaction product of sulfates and hydrocarbons in the presence of sulfate-reducing microbes. In some areas offshore Louisiana, H_2S-rich hydrocarbons are produced from lower Cretaceous Age limestone deposits not associated with piercement domes. Generally speaking, formations of Lower Cretaceous Age or older (which are deeply buried in the Gulf) are prone to contain H_2S in association with hydrocarbons (cf. Bryan and Lingamallu, 1990). There has also been some evidence that petroleum from deepwater plays contain significant amounts of sulfur (cf. Smith, written communication, 1996; Thorpe, 1996).

The concentrations of H_2S found in conjunction with hydrocarbons vary extensively. Examination of in-house data suggest that H_2S concentrations vary from as low as fractional ppm to as high as 650,000 ppm in one isolated case (the next highest concentrations of H_2S reported are about 55,000 and 19,000 ppm). The concentrations of H_2S found to date are generally greatest in the eastern portion of the CPA.

Geologic Hazards

The major geologic hazards that may affect oil and gas activities within the Gulf of Mexico north of 26°N. latitude can be generally grouped into the following categories: (a) slope instability and mass transport of sediments; (b) gas hydrates; (c) sediment types and characteristics; and (d) tectonics.

Geologic conditions that promote seafloor instability are variable sediment types, steep slopes, high-sedimentation rates, gas hydrates at or near the seafloor, interstitial gas, faulting, areas of lithified and mounded carbonates, salt and shale mobilization, and mudflows. Some features that may indicate a possible unstable condition include step faulting, deformed bedding, detached blocks, detached masses, displaced lithologies, acoustically transparent layers, anomalously thick accumulations of sediment, and shallow faulting and fissures. These features can be identified on seismic survey profiles or through coring samples.

Mass movement of sediments includes landslides, slumps, and creeps. Sediment types, accumulation rates, sediment accumulation over features with seafloor relief, and internal composition and structure of the sedimentary layers are all factors that affect seafloor stability. Rapidly accumulated sediments that have not had the opportunity to dewater properly are underconsolidated. These underconsolidated sediments can be interbedded with normal or overconsolidated sediments and may act as slide zones causing mass movement or collapse. A slope of less than one degree can be sufficient to cause sliding or slumping when high sedimentation rates have resulted in underconsolidation or high pore-pressure conditions in the sediments.

In the deepwater areas of the Gulf, slope stability and soil properties are of great concern in the design of oil and gas operations. Slopes steep enough to create conditions conducive to mass transport are found regionally on the continental slope. Steeper slopes are found locally along the walls of canyons and channels, adjacent to salt structures, and at fault scarps.

Gas hydrates occur in the upper sediments and are of biogenic in origin rather than petrogenic. Methane is the major and often the only component. Gas hydrates are more prevalent in deeper waters than on the shelf because of the lower temperature and high pressures at greater depths. The effect of gas pressure, distribution of gas in pores, solution-dissolution potential, and upward dispersal characteristics are factors considered in the engineering design of production facilities.

Overpressured salt, shale, and mud have a tendency to become plasticized and mobile. Movements of overpressured salts and shales could form mounds and diapirs. Large diapirs formed by the upward movement of shale or salt originates from a greater depth and do not form an environmental geologic hazard by itself. These features have associated faulting and sometimes collapse structures. Their upward movement causes slope steepening and consequently slumping. Movement of overpressured mud could form mud volcanoes. Soft mud diapirs resulting from delta front muds are excellent indicators of an unstable sediment at shallow depths.

Evidence of geologic hazards includes hydrocarbon seeps, deformed bedding, detached blocks or masses, anomalously thick accumulations of sediments, shallow faulting and fissures, diapirs, sediment dikes or mud lumps, displaced lithologies, internal chaotic masses, hummocky topography, en echelon faulting, and horst and graben blocks. Evidence of geologic hazards can be obtained or seen by using core sampling techniques, high-resolution seismic surveying, and side-scan sonar. Geologic hazards pose engineering, structural design, and operational constraints that can usually be effectively mitigated through existing or new technologies and designs.

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Appendix D

Physical Oceanography

APPENDIX D

PHYSICAL OCEANOGRAPHY

The Gulf of Mexico is a semi-enclosed, subtropical sea with a surface area about 1.6 million km^2 (USDOI, MMS, 2000). The main physiographic regions of the Gulf Basin are the continental shelf (including the Campeche, Mexican, and U.S. shelves), continental slopes and associated canyons, abyssal plains, the Yucatan Channel, and Florida Straits.

The Gulf of Mexico is unique oceanographically with a basin depth of 3,000 m and two shallow entrances of Yucatan Channel (1,600-m depth) and the Straits of Florida (1,000-m) (USDOI, MMS, 2000). These "shallow" sills prevent the input of cold (2°C) Atlantic bottom water and thus bottom water in the Gulf basin remains relatively warm (about 4°C). The offshore oceanography is dominated by the Loop Current, the main origin of the Gulf Stream, and the inshore oceanography is heavily influenced by major freshwater input from precipitation and numerous river systems, including some extremely large ones such as the Mississippi and Atchafalaya rivers.

There are at least five major identifiable watermasses in the Central/Western Gulf of Mexico (USDOI, MMS, 2000):

Gulf of Mexico water—(0-250 m; 0-820 ft),
Tropical Atlantic Central Water—(250-400 m; 820-1,312 ft),
Antarctic Intermediate Water (phosphate maximum)—(500-700 m; 1,641-2,297 ft),
Antarctic Intermediate Water (salinity maximum)—(600-860 m; 1,969-2,822 ft), and
Mixed Upper North Atlantic Deep and Caribbean mid water—(1,000-1,100 m; 3,281-3,609 ft).

These watermasses can be identified by their different temperatures and chemical signatures based on salinity, dissolved oxygen, nitrate, phosphate, and silicate concentrations. Below about 1,650 m, temperature, salinity, and oxygen remain fairly constant to the bottom at about 4ºC, 35-36 ppt, 5.0 ml/l, respectively (Gulf Basin Water) (Gallaway et al., 2001).

In addition to the above watermasses, there is an upper mixed isothermal layer that varies in thickness but averages about 75 m in thickness (Pequegnat, 1983). Sea surface (i.e., 0-m depth) temperatures within the relevant area are fairly constant throughout the Gulf in August, about 30°C. In January, surface waters cool considerably in northern coastal areas (14-15°C) and slightly in the center of the Loop Current to 25°C. At 1,000-m depths, the water temperatures are more or less constant at a cool 4.9°C (USDOI, MMS, 2000).

Oceanographic fronts are important features of marine systems because they tend to be productive areas and also concentrate drifting material such as plankton, which attracts fish, birds, turtles, and mammals for feeding purposes. Unfortunately, fronts also may collect debris such as floating plastics or contaminants such as oil slicks or tar balls.

Fronts form along sharp discontinuities in temperature and or salinity; they can be horizontal or vertical and surface or subsurface. In the Gulf semi-permanent fronts form along the interface between the low salinity coastal or riverine water and offshore water and along edges of major currents (e.g., the Loop Current) and eddies.

The Loop Current, a dominant feature of the Gulf, enters through the Yucatan Strait and exits through the Straits of Florida where it becomes the Gulf Stream. The Current flows clockwise around the fairly static water in the center of the Gulf. Its influence can be seen in hydrographic data to depths as deep as 800-1,000 m. It is a highly variable current in geographic extent (may go as far north as Mississippi-Alabama Shelf), width (25- to 50-km), and velocity (normally 100-200 cm/sec but up to 300 cm/sec) (USDOI, MMS, 2000).

On average about once a year and on no regular pattern, the Loop Current will form into a "warm core eddy" with a diameter of 300-400 km, a depth to 1,000 m, and velocities of 50-200 cm/sec. These warm core eddies normally move to the Western Gulf at speeds between 2 and 5 km per day, out of the study area and have a life span of about one year. Smaller eddies (both clockwise and counterclockwise) are also created by the Loop Current and by other less known sources. Other currents are also present in the Gulf as ephemeral; semi-permanent and permanent features, primarily wind-driven by prevailing winds and by extreme events such as hurricanes. The mechanisms of some currents are poorly known and are still subject to study (USDOI, MMS, 2001). Short-lived, intense current jets have been reported at mid-depths (to about 200 m; see Figure 3-17 *in* USDOI, MMS, 2001) along the Louisiana-Texas slope but little is known about them (USDOI, MMS, 2000). Loop Current eddies may be found to about 1,500 m and topographic Rossby Wave activity may be encountered below 500 m, with possible intensification below 2,500-m depth (see Figure 3-17 *in* USDOI, MMS, 2001). Warm core Loop Current eddies interacting with the continental slope to the north can result in strong eastward flow and negative offshore temperature gradients to at least 500 m water depth, and cold core Loop Current frontal eddies interacting with the slope can result in westward flow following the slope bathymetry. The most characteristic flow pattern in the DeSoto Canyon continental slope region is a two-layer jet with eastward flow at the surface and a return flow at depth. The transition between the upper and lower flows varies with the offshore forcing but is typically between 200 and 300 m (Hamilton et al., 2000).

Coastal currents, based on historical current meter data, for the northern Gulf of Mexico are described in Dinnel et al. (1997); their predominant directions are alongshore, east or west depending upon location.

High frequency currents in continental slope regions near the DeSoto Canyon are dominated by inertial oscillations, with periods of ~1 day, that are present in deep water throughout the year. At the shelf break, inertial oscillations are present in the summer but not in the winter because of lack of stratification in winter. Hurricanes passing over the slope produce a strong inertial response, which can persist for many days (Hamilton et al., 2000).

Average wave heights for the northern Gulf have been reported at 1 m with 94 percent being 2 m or less, with a maximum height to 9.5 m (Quayle and Fulbright, 1977 *in* USDOI, MMS, 2001). Because the Gulf of Mexico is an enclosed sea, and thus fetch is somewhat limited, long period, large amplitude waves are rare except during extreme events such as hurricanes (McGrail and Carnes, 1983; NDBC, 1990; and others *in* USDOI, MMS, 2001). The maximum 100-yr wave height has been estimated by Ward et al. (1979) as 21 m for water depths of 100 m and greater (USDOI, MMS, 2000).

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Appendix E

Socioeconomic Conditions

Table E-1

Onshore Expenditure Allocation by Subarea

Sector	Sector Definition	TX-1	TX-2	LA-1	LA-2	LA-3	MA-1	FL-1	FL-2	FL-3	FL-4	GULF-OTHER	US-OTHER
38	Oil & Gas Operations	0.00	0.34	0.09	0.06	0.15	0.00	0.00	0.00	0.00	0.00	0.23	0.12
50	New Gas Utility Facilities	0.07	0.38	0.05	0.10	0.10	0.10	0.00	0.00	0.00	0.00	0.11	0.07
53	Misc Natural Resource Facility Construction	0.03	0.21	0.23	0.15	0.30	0.02	0.00	0.00	0.00	0.00	0.01	0.03
56	Maintenance and Repair, Other Facilities	0.06	0.31	0.04	0.08	0.09	0.08	0.00	0.00	0.00	0.00	0.21	0.11
57	Other Oil & Gas Field Services	0.00	0.30	0.26	0.12	0.16	0.00	0.00	0.00	0.00	0.00	0.07	0.05
160	Office Furniture and Equipment	0.15	0.54	0.00	0.00	0.08	0.23	0.00	0.00	0.00	0.00	0.00	0.00
178	Maps and Charts (Misc Publishing)	0.12	0.59	0.02	0.06	0.11	0.10	0.00	0.00	0.00	0.00	0.01	0.00
206	Explosives	0.50	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
209	Chemicals, NEC	0.03	0.64	0.04	0.10	0.04	0.04	0.00	0.00	0.00	0.00	0.04	0.04
210	Petroleum Fuels	0.11	0.50	0.09	0.16	0.09	0.05	0.00	0.00	0.00	0.00	0.00	0.00
232	Hydraulic Cement	0.00	0.10	0.00	0.00	0.00	0.10	0.00	0.00	0.00	0.00	0.50	0.30
258	Steel Pipe and Tubes	0.00	0.50	0.31	0.05	0.07	0.00	0.00	0.00	0.00	0.00	0.08	0.04
284	Fabricated Plate Work	0.04	0.63	0.06	0.09	0.05	0.14	0.00	0.00	0.00	0.00	0.00	0.00
290	Iron and Steel Forgings	0.00	0.81	0.00	0.00	0.05	0.00	0.00	0.00	0.00	0.00	0.14	0.00
307	Turbines	0.05	0.65	0.00	0.10	0.20	0.00	0.00	0.00	0.00	0.00	0.00	0.00
311	Construction Machinery & Equipment	0.06	0.42	0.00	0.06	0.19	0.11	0.00	0.00	0.00	0.00	0.11	0.06
313	O&G Field Machinery & Equipment	0.03	0.18	0.27	0.18	0.22	0.00	0.00	0.00	0.00	0.00	0.05	0.04
331	Special Industrial Machinery	0.00	0.00	0.00	0.38	0.54	0.00	0.00	0.00	0.00	0.00	0.00	0.03
332	Pumps & Compressors	0.04	0.30	0.17	0.22	0.09	0.00	0.00	0.00	0.00	0.00	0.12	0.06
354	Industrial Machines, NEC	0.05	0.66	0.06	0.10	0.06	0.06	0.00	0.00	0.00	0.00	0.00	0.00
356	Switchgear	0.00	0.63	0.00	0.07	0.11	0.07	0.00	0.00	0.00	0.00	0.11	0.00
374	Communication Equipment, NEC	0.13	0.50	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.13	0.00
392	Shipbuilding and Ship Repair	0.09	0.24	0.05	0.24	0.18	0.19	0.00	0.00	0.00	0.00	0.00	0.00
399	Transportation Equipment, NEC	0.00	0.78	0.06	0.11	0.00	0.06	0.00	0.00	0.00	0.00	0.00	0.00
401	Lab Equipment	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
403	Instrumentation	0.01	0.13	0.39	0.27	0.08	0.00	0.00	0.00	0.00	0.00	0.08	0.04
435	Demurrage/Warehousing/Motor Freight	0.11	0.37	0.21	0.09	0.09	0.01	0.00	0.00	0.00	0.00	0.07	0.00
436	Water Transport	0.02	0.27	0.10	0.25	0.22	0.04	0.01	0.00	0.01	0.00	0.06	0.00
437	Air Transport	0.03	0.42	0.11	0.11	0.08	0.02	0.00	0.00	0.00	0.01	0.21	0.00
441	Communications	0.09	0.51	0.07	0.11	0.11	0.11	0.00	0.00	0.00	0.00	0.00	0.00
443	Electric Services	0.13	0.36	0.06	0.15	0.12	0.18	0.00	0.00	0.00	0.00	0.00	0.00
444	Gas Production/Distribution	0.10	0.54	0.08	0.07	0.05	0.03	0.00	0.00	0.00	0.00	0.05	0.04
445	Water Supply	0.08	0.43	0.08	0.12	0.05	0.11	0.00	0.00	0.00	0.00	0.01	0.01
446	Waste Treatment/Disposal	0.00	1.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Table E-1. Onshore Expenditure Allocation by Subarea (continued).

Sector	Sector Definition	TX-1	TX-2	LA-1	LA-2	LA-3	MA-1	FL-1	FL-2	FL-3	FL-4	GULF-OTHER	US-OTHER
454	Eating/Drinking	0.00	0.24	0.28	0.08	0.40	0.00	0.00	0.00	0.00	0.00	0.00	0.00
455	Misc Retail	0.09	0.48	0.06	0.10	0.15	0.11	0.00	0.00	0.00	0.00	0.00	0.00
459	Insurance	0.04	0.47	0.07	0.12	0.09	0.00	0.00	0.00	0.00	0.00	0.17	0.03
462	Real Estate	0.09	0.47	0.04	0.08	0.11	0.08	0.00	0.00	0.00	0.00	0.11	0.01
469	Advertisement	0.06	0.45	0.06	0.08	0.15	0.08	0.00	0.00	0.00	0.00	0.12	0.01
470	Other Business Services	0.00	0.60	0.11	0.09	0.06	0.00	0.00	0.00	0.00	0.00	0.09	0.05
473	Misc. Equipment Rental and Leasing	0.09	0.26	0.22	0.10	0.10	0.01	0.00	0.00	0.00	0.00	0.18	0.03
490	Doctors & Veterinarian Services	0.09	0.53	0.06	0.09	0.14	0.08	0.00	0.00	0.00	0.00	0.00	0.00
494	Legal Services	0.07	0.48	0.07	0.11	0.19	0.08	0.00	0.00	0.00	0.00	0.00	0.00
506	Environmental/Engineering Services	0.06	0.38	0.11	0.08	0.08	0.03	0.01	0.00	0.02	0.00	0.20	0.01
507	Acct/Misc Business Services	0.06	0.46	0.05	0.09	0.13	0.07	0.00	0.00	0.00	0.00	0.11	0.01
508	Management/Consulting Services	0.04	0.54	0.04	0.09	0.11	0.05	0.00	0.00	0.00	0.00	0.11	0.01
509	Testing/Research Facilities	0.00	0.38	0.14	0.14	0.05	0.00	0.00	0.00	0.00	0.00	0.21	0.11

Table E-2

Population Forecast from 2000 to 2041
by Year and by Subarea
(in thousands)

Year	Coastal Subarea													
	LA-1	LA-2	LA-3	MA-1	TX-1	TX-2	FL-1	FL-2	FL-3	FL-4	CGOM	WGOM	EGOM	GOM
2000	667.12	1,009.54	1,337.60	920.12	920.58	5,158.08	774.39	128.07	3,954.32	2,340.67	3,934.36	6,078.66	7,197.46	17,210.48
2001	672.18	1,020.72	1,343.62	930.79	930.98	5,238.54	787.39	129.53	4,022.21	2,362.41	3,967.32	6,169.52	7,301.53	17,438.37
2002	677.35	1,032.14	1,350.07	941.63	941.65	5,320.26	800.68	131.07	4,091.10	2,384.86	4,001.19	6,261.91	7,407.70	17,670.81
2003	682.66	1,043.66	1,356.53	952.61	952.50	5,402.58	813.98	132.59	4,160.29	2,408.00	4,035.47	6,355.07	7,514.87	17,905.41
2004	688.01	1,055.31	1,363.03	963.72	963.47	5,486.16	827.51	134.14	4,230.65	2,431.38	4,070.07	6,449.64	7,623.67	18,143.38
2005	693.29	1,066.73	1,369.47	974.61	974.23	5,567.43	840.64	135.65	4,298.86	2,454.36	4,104.10	6,541.66	7,729.51	18,375.26
2006	698.70	1,078.41	1,376.22	985.73	985.30	5,650.56	854.05	137.23	4,368.60	2,478.49	4,139.06	6,635.87	7,838.37	18,613.29
2007	704.16	1,090.21	1,382.99	996.98	996.51	5,734.94	867.67	138.82	4,439.48	2,502.86	4,174.34	6,731.45	7,948.83	18,854.62
2008	709.66	1,102.14	1,389.80	1,008.35	1,007.84	5,820.57	881.51	140.44	4,511.50	2,527.47	4,209.96	6,828.41	8,060.92	19,099.29
2009	715.20	1,114.20	1,396.65	1,019.86	1,019.30	5,907.49	895.57	142.07	4,584.70	2,552.32	4,245.91	6,926.78	8,174.66	19,347.36
2010	720.38	1,125.14	1,403.21	1,030.25	1,029.64	5,983.33	907.72	143.54	4,647.77	2,575.09	4,278.97	7,012.97	8,274.12	19,566.06
2011	726.20	1,137.43	1,410.76	1,041.94	1,041.44	6,069.85	921.64	145.17	4,720.05	2,601.26	4,316.33	7,111.28	8,388.12	19,815.73
2012	732.08	1,149.85	1,418.35	1,053.77	1,053.36	6,157.62	935.78	146.82	4,793.45	2,627.70	4,354.04	7,210.98	8,503.74	20,068.76
2013	738.00	1,162.40	1,425.99	1,065.73	1,065.43	6,246.66	950.13	148.48	4,868.00	2,654.41	4,392.11	7,312.09	8,621.01	20,325.21
2014	743.97	1,175.09	1,433.66	1,077.82	1,077.63	6,336.99	964.70	150.17	4,943.70	2,681.38	4,430.54	7,414.62	8,739.95	20,585.11
2015	749.53	1,186.60	1,440.99	1,088.74	1,088.63	6,416.17	977.37	151.69	5,009.36	2,706.02	4,465.86	7,504.81	8,844.44	20,815.11
2016	755.65	1,199.33	1,449.10	1,100.87	1,100.92	6,505.30	991.66	153.38	5,083.64	2,733.69	4,504.94	7,606.21	8,962.38	21,073.53
2017	761.83	1,212.18	1,457.25	1,113.13	1,113.34	6,595.66	1,006.17	155.09	5,159.02	2,761.65	4,544.39	7,708.99	9,081.93	21,335.31
2018	768.05	1,225.18	1,465.45	1,125.53	1,125.90	6,687.28	1,020.90	156.81	5,235.52	2,789.89	4,584.21	7,813.17	9,203.11	21,600.50
2019	774.33	1,238.32	1,473.70	1,138.06	1,138.60	6,780.17	1,035.83	158.56	5,313.15	2,818.42	4,624.40	7,918.77	9,325.96	21,869.12
2020	780.19	1,250.28	1,481.58	1,149.44	1,150.11	6,862.28	1,048.94	160.14	5,381.16	2,844.53	4,661.48	8,012.39	9,434.78	22,108.65
2021	786.67	1,263.57	1,490.31	1,162.08	1,162.96	6,954.70	1,063.76	161.94	5,460.95	2,873.84	4,702.62	8,117.67	9,560.49	22,380.77
2022	793.20	1,276.99	1,499.09	1,174.87	1,175.96	7,048.36	1,078.79	163.76	5,538.93	2,903.44	4,744.15	8,224.32	9,684.92	22,653.39
2023	799.79	1,290.56	1,507.92	1,187.80	1,189.10	7,143.29	1,094.04	165.60	5,618.02	2,933.35	4,786.07	8,332.39	9,811.00	22,929.46
2024	806.43	1,304.27	1,516.81	1,200.87	1,202.39	7,239.49	1,109.49	167.46	5,698.24	2,963.56	4,828.38	8,441.88	9,938.75	23,209.01
2025	812.61	1,316.73	1,525.25	1,212.71	1,214.41	7,324.63	1,123.09	169.14	5,765.56	2,991.12	4,867.31	8,539.04	10,048.91	23,455.25
2026	819.36	1,330.72	1,534.24	1,226.06	1,227.98	7,423.27	1,138.95	171.03	5,847.89	3,021.93	4,910.38	8,651.25	10,179.81	23,741.44
2027	826.17	1,344.86	1,543.28	1,239.55	1,241.70	7,523.25	1,155.05	172.95	5,931.39	3,053.06	4,953.86	8,764.95	10,312.46	24,031.26
2028	833.03	1,359.15	1,552.38	1,253.19	1,255.58	7,624.57	1,171.37	174.90	6,016.09	3,084.51	4,997.74	8,880.15	10,446.86	24,324.75
2029	839.95	1,373.59	1,561.52	1,266.98	1,269.61	7,727.25	1,187.92	176.86	6,101.99	3,116.29	5,042.04	8,996.86	10,583.05	24,621.95
2030	846.93	1,388.18	1,570.73	1,280.92	1,283.80	7,831.32	1,204.70	178.84	6,189.12	3,148.39	5,086.75	9,115.12	10,721.06	24,922.93
2031	853.96	1,402.93	1,579.98	1,295.01	1,298.15	7,936.79	1,221.72	180.85	6,277.50	3,180.82	5,131.89	9,234.93	10,860.89	25,227.71
2032	861.06	1,417.83	1,589.29	1,309.26	1,312.65	8,043.68	1,238.98	182.88	6,367.14	3,213.58	5,177.45	9,356.33	11,002.59	25,536.36

Table E-2. Population Forecast from 2000 to 2041 by Year and by Subarea (in thousands) (continued).

Year:	Coastal Subarea													
	LA-1	LA-2	LA-3	MA-1	TX-1	TX-2	FL-1	FL-2	FL-3	FL-4	CGOM	WGOM	EGOM	GOM
2033	868.21	1,432.90	1,598.66	1,323.67	1,327.32	8,152.01	1,256.49	184.93	6,458.06	3,246.69	5,223.43	9,479.33	11,146.17	25,848.93
2034	875.42	1,448.12	1,608.08	1,338.23	1,342.16	8,261.79	1,274.24	187.01	6,550.27	3,280.13	5,269.86	9,603.95	11,291.65	26,165.46
2035	882.70	1,463.50	1,617.56	1,352.96	1,357.16	8,373.06	1,292.25	189.11	6,643.80	3,313.92	5,316.72	9,730.22	11,439.08	26,486.01
2036	890.03	1,479.05	1,627.09	1,367.85	1,372.32	8,485.82	1,310.50	191.23	6,738.67	3,348.06	5,364.02	9,858.15	11,588.46	26,810.63
2037	897.42	1,494.77	1,636.68	1,382.90	1,387.66	8,600.11	1,329.02	193.38	6,834.90	3,382.54	5,411.76	9,987.77	11,739.84	27,139.37
2038	904.88	1,510.65	1,646.32	1,398.12	1,403.17	8,715.93	1,347.80	195.55	6,932.49	3,417.39	5,459.96	10,119.10	11,893.23	27,472.28
2039	912.39	1,526.69	1,656.02	1,413.50	1,418.85	8,833.31	1,366.84	197.75	7,031.48	3,452.59	5,508.61	10,252.16	12,048.66	27,809.43
2040	919.97	1,542.91	1,665.78	1,429.05	1,434.70	8,952.28	1,386.15	199.96	7,131.89	3,488.16	5,557.72	10,386.98	12,206.16	28,150.86
2041	927.62	1,559.31	1,675.60	1,444.78	1,450.74	9,072.84	1,405.74	202.21	7,233.72	3,524.09	5,607.30	10,523.58	12,365.76	28,496.63

Table E-3

Employment Impacts Projected
from Murphy's Initial Development Operations Coordinations Document
(peak employment is projected for the year 2002 as shown)

Onshore Subarea	Direct Employment	Indirect Employment	Induced Employment	Total Employment	Baseline Employment	Murphy's Plan as a % of Baseline
FL-1	1.0	0.7	0.5	2.3	442,848	0.00%
FL-2	0.1	0.1	0.0	0.3	46,099	0.00%
FL-3	1.6	1.3	0.9	3.8	2,347,939	0.00%
FL-4	0.5	0.3	0.2	1.0	1,341,807	0.00%
EGOM	1.1	0.9	0.6	2.6	4,178,693	0.00%
LA-1	170.2	37.5	64.2	271.9	386,145	0.07%
LA-2	131.0	47.0	53.7	231.7	590,659	0.04%
LA-3	209.0	63.8	83.5	356.3	793,664	0.04%
MA-1	13.8	5.2	5.4	24.5	529,892	0.00%
CGOM	524.0	153.6	206.8	884.4	2,300,360	0.04%
TX-1	20.5	5.8	7.5	33.9	466,673	0.01%
TX-2	332.9	173.9	190.6	697.5	3,143,659	0.02%
WGOM	353.4	179.8	198.2	731.4	3,610,332	0.02%
Total GOM	878.6	334.2	405.5	1,618.0	10,089,385	0.02%

Table E-4

Employment Forecast from 2000 to 2041 by Year and by Subarea
(in thousands)

Year	Coastal Subareas													
	LA-1	LA-2	LA-3	MA-1	TX-1	TX-2	FL-1	FL-2	FL-3	FL-4	CGOM	WGOM	EGOM	GOM
2000	377.47	571.95	781.67	515.20	454.25	3,046.85	427.04	44.99	2,248.28	1,306.73	2,246.29	3,501.10	4,027.03	9,774.42
2001	381.65	580.15	787.95	522.71	460.67	3,095.53	435.03	45.55	2,298.83	1,324.75	2,272.46	3,556.20	4,104.15	9,932.81
2002	386.15	590.66	793.66	529.89	466.67	3,143.66	442.85	46.10	2,347.94	1,341.81	2,300.36	3,610.33	4,178.69	10,089.39
2003	391.13	597.79	799.20	537.22	472.64	3,192.77	450.71	46.63	2,396.65	1,358.41	2,325.34	3,665.41	4,252.40	10,243.15
2004	396.19	605.00	804.77	544.65	478.68	3,242.66	458.72	47.17	2,446.37	1,375.22	2,350.61	3,721.33	4,327.47	10,399.42
2005	401.12	612.06	810.28	551.90	484.58	3,291.14	466.47	47.69	2,494.20	1,391.66	2,375.37	3,775.72	4,400.02	10,551.11
2006	406.59	620.40	816.60	559.63	490.78	3,342.60	474.56	48.24	2,543.53	1,408.55	2,403.22	3,833.38	4,474.86	10,711.47
2007	412.12	628.86	822.98	567.47	497.06	3,394.87	482.78	48.79	2,593.82	1,425.64	2,431.43	3,891.93	4,551.03	10,874.39
2008	417.74	637.43	829.40	575.41	503.42	3,447.96	491.15	49.34	2,645.12	1,442.94	2,459.98	3,951.38	4,628.55	11,039.90
2009	423.43	646.11	835.87	583.47	509.87	3,501.87	499.66	49.92	2,697.43	1,460.44	2,488.88	4,011.74	4,707.45	11,208.07
2010	428.46	653.79	841.92	590.56	515.60	3,548.60	506.92	50.41	2,740.96	1,476.14	2,514.73	4,064.20	4,774.43	11,353.35
2011	434.19	662.57	849.67	598.72	522.23	3,603.53	515.28	50.97	2,791.75	1,494.05	2,545.16	4,125.76	4,852.05	11,522.97
2012	440.01	671.47	857.50	606.99	528.94	3,659.31	523.78	51.53	2,843.48	1,512.18	2,575.96	4,188.25	4,930.98	11,695.20
2013	445.90	680.48	865.39	615.38	535.74	3,715.96	532.42	52.10	2,896.18	1,530.54	2,607.16	4,251.70	5,011.24	11,870.09
2014	451.88	689.62	873.36	623.88	542.62	3,773.49	541.20	52.68	2,949.85	1,549.11	2,638.74	4,316.11	5,092.84	12,047.68
2015	457.17	697.71	880.71	631.38	548.75	3,823.42	548.75	53.20	2,995.06	1,565.76	2,666.96	4,372.16	5,162.78	12,201.90
2016	463.11	706.94	889.98	639.94	555.91	3,882.59	557.39	53.77	3,047.79	1,585.13	2,699.96	4,438.50	5,244.08	12,382.54
2017	469.12	716.29	899.34	648.63	563.16	3,942.68	566.16	54.35	3,101.45	1,604.74	2,733.38	4,505.84	5,326.69	12,565.92
2018	475.22	725.76	908.80	657.43	570.51	4,003.70	575.07	54.93	3,156.06	1,624.59	2,767.22	4,574.21	5,410.64	12,752.07
2019	481.39	735.36	918.37	666.36	577.96	4,065.66	584.12	55.52	3,211.62	1,644.68	2,801.48	4,643.62	5,495.94	12,941.04
2020	486.90	743.91	927.09	674.27	584.60	4,119.61	591.98	56.06	3,259.01	1,662.71	2,832.17	4,704.20	5,569.74	13,106.11
2021	493.05	753.66	937.98	683.29	592.41	4,183.83	600.92	56.64	3,314.18	1,683.95	2,867.98	4,776.24	5,655.69	13,299.91
2022	499.28	763.55	948.98	692.43	600.34	4,249.05	610.00	57.23	3,370.29	1,705.46	2,904.24	4,849.39	5,742.98	13,496.61
2023	505.58	773.56	960.12	701.70	608.37	4,315.29	619.21	57.83	3,427.35	1,727.25	2,940.97	4,923.66	5,831.64	13,696.26
2024	511.97	783.70	971.39	711.09	616.50	4,382.57	628.56	58.43	3,485.38	1,749.31	2,978.16	4,999.07	5,921.69	13,898.91
2025	517.67	792.71	981.53	719.41	623.71	4,440.89	636.71	58.98	3,535.04	1,768.97	3,011.32	5,064.60	5,999.70	14,075.62

Table E-4. Employment Forecast from 2000 to 2041 by Year and by Subarea (in thousands) (continued).

Year	Coastal Subareas													
	LA-1	LA-2	LA-3	MA-1	TX-1	TX-2	FL-1	FL-2	FL-3	FL-4	CGOM	WGOM	EGOM	GOM
2026	524.21	803.11	993.05	729.03	632.05	4,510.12	646.33	59.60	3,594.89	1,791.57	3,049.40	5,142.18	6,092.38	14,283.96
2027	530.83	813.64	1,004.71	738.79	640.50	4,580.44	656.09	60.22	3,655.75	1,814.46	3,087.97	5,220.94	6,186.52	14,495.42
2028	537.54	824.31	1,016.50	748.67	649.07	4,651.84	666.01	60.85	3,717.65	1,837.64	3,127.02	5,300.91	6,282.13	14,710.06
2029	544.33	835.12	1,028.43	758.69	657.75	4,724.36	676.07	61.48	3,780.59	1,861.11	3,166.57	5,382.11	6,379.25	14,927.93
2030	551.20	846.08	1,040.50	768.84	666.55	4,798.01	686.28	62.12	3,844.59	1,884.89	3,206.62	5,464.56	6,477.88	15,149.06
2031	558.17	857.17	1,052.71	779.13	675.46	4,872.81	696.65	62.77	3,909.68	1,908.97	3,247.18	5,548.27	6,578.07	15,373.52
2032	565.22	868.41	1,065.07	789.55	684.50	4,948.77	707.17	63.43	3,975.88	1,933.35	3,288.25	5,633.27	6,679.83	15,601.35
2033	572.36	879.80	1,077.57	800.12	693.65	5,025.92	717.85	64.09	4,043.19	1,958.05	3,329.85	5,719.57	6,783.18	15,832.60
2034	579.59	891.34	1,090.22	810.83	702.93	5,104.27	728.70	64.76	4,111.64	1,983.06	3,371.97	5,807.20	6,888.16	16,067.33
2035	586.91	903.03	1,103.01	821.68	712.33	5,183.85	739.70	65.43	4,181.25	2,008.40	3,414.63	5,896.17	6,994.79	16,305.59
2036	594.32	914.88	1,115.96	832.67	721.86	5,264.66	750.88	66.11	4,252.05	2,034.06	3,457.83	5,986.51	7,103.09	16,547.44
2037	601.83	926.87	1,129.06	843.81	731.51	5,346.73	762.22	66.80	4,324.03	2,060.04	3,501.57	6,078.24	7,213.10	16,792.92
2038	609.43	939.03	1,142.31	855.10	741.29	5,430.08	773.74	67.50	4,397.24	2,086.36	3,545.87	6,171.38	7,324.84	17,042.09
2039	617.13	951.34	1,155.72	866.54	751.21	5,514.74	785.42	68.21	4,471.69	2,113.01	3,590.74	6,265.94	7,438.33	17,295.01
2040	624.93	963.82	1,169.28	878.14	761.25	5,600.71	797.29	68.92	4,547.40	2,140.00	3,636.17	6,361.96	7,553.61	17,551.74
2041	632.82	976.46	1,183.01	889.89	771.44	5,688.02	809.33	69.64	4,624.39	2,167.34	3,682.18	6,459.45	7,670.70	17,812.33

(Woods & Poole, 2002)

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Table E-5

Employment Impacts Projected from the Blowout Scenario
in Murphy's Initial Development Operations Coordination Document
(peak employment is projected for the year 2002 as shown)

Onshore Subarea	Direct Employment	Indirect Employment	Induced Employment	Total Employment	Baseline Employment	Murphy's Blowout Scenarios a % of Baseline
FL-1	11.6	7.1	5.4	24.0	442,848	0.01%
FL-2	0.0	0.0	0.0	0.0	46,099	0.00%
FL-3	20.1	13.8	10.2	44.0	2,347,939	0.00%
FL-4	3.5	2.1	1.5	7.1	1,341,807	0.00%
EGOM	11.6	7.1	5.4	24.0	4,178,693	0.00%
LA-1	656.5	146.4	326.8	1,129.6	386,145	0.29%
LA-2	823.0	159.6	386.3	1,368.9	590,659	0.23%
LA-3	1,250.6	261.3	712.9	2,224.8	793,664	0.28%
MA-1	536.4	104.7	286.0	927.1	529,892	0.17%
CGOM	3,266.4	672.0	1,712.0	5,650.3	2,300,360	0.25%
TX-1	589.7	136.8	300.1	1,026.6	466,673	0.22%
TX-2	2,725.4	872.4	1,769.3	5,367.1	3,143,659	0.17%
WGOM	3,315.1	1,009.2	2,069.4	6,393.7	3,610,332	0.18%
Total GOM	6,593.1	1,688.3	3,786.8	12,068.1	10,089,385	0.12%

Appendix F

Other Information on Grid 15

Table F-1

Grid 15 — Exploration and Development Drilling Activities

Area	Well	Operator	Spud Date	Total Depth Date	Water Depth (ft)	Remarks
MC-26	001	BP	05/18/94	05/29/94	1,272	P&A
MC-27	001	BP	11/17/88	11/18/88	1,400	ST
MC-27	001	BP	12/01/88	12/09/88	1,400	P&A
MC-27	001	BP	12/14/88	12/25/88	1,403	ST
MC-28	001	ARCO	01/16/81	05/06/81	1,775	P&A
MC-28	002	ARCO	11/10/81	03/10/82	1,790	P&A
MC-28	002	BP	06/09/89	07/14/89	1,830	TA
MC-28	003	BP	10/04/89	11/27/89	1,494	ST
MC-28	003	BP	11/29/98	12/16/98	1,494	P&A
MC-28	TB001	BP	12/11/95	01/25/96	1,853	COM
MC-28	TB002	BP	11/26/95	11/27/95	1,853	COM
MC-28	TB003	BP	11/09/95	11/12/95	1,853	ST
MC-28	TB003	BP	03/14/01	03/15/01	1,853	ST
MC-28	TB003	BP	03/16/01	03/16/01	1,853	ST
MC-28	TB003	BP	03/18/01	3/19/01	1,853	ST
MC-28	TB003	BP	03/22/01	04/07/01	1,853	COM
MC-28	TB004	BP	11/29/95	11/30/95	1,853	COM
MC-28	TB005	BP	11/17/95	05/12/96	1,853	COM
MC-28	TB006	BP	11/24/96	11/26/96	1,853	COM
MC-28	TB007	BP	08/19/96	09/10/96	1,853	COM
MC-28	TB008	BP	11/03/95	11/05/95	1,853	COM
MC-28	TB009	BP	11/14/95	08/27/01	1,853	ST
MC-28	TB009	BP	09/08/01	09/16/01	1,853	ST
MC-28	TB009	BP	09/18/01	10/02/01	1,853	DRL
MC-28	TB010	BP	11/20/95	03/05/97	1,853	COM
MC-29	001	BP	01/30/98	01/31/98	2,266	P&A
MC-29	002	BP	02/19/98	03/04/98	2,266	TA
MC-68	001	ATOFINA	11/21/75	12/09/75	1,121	P&A
MC-68	001	Walter O&G	05/30/00	05/21/00	1,337	COM
MC-68	002	ATOFINA	12/21/76	01/05/76	1,121	P&A
MC-68	003	ATOFINA	01/14/76	01/23/76	1,276	P&A
MC-68	004	ATOFINA	01/26/76	03/04/76	1,276	P&A
MC-68	005	ATOFINA	03/13/76	04/05/76	1,150	P&A
MC-72	001	BP	02/17/90	03/17/90	1,978	P&A
MC-109	001	BP	05/12/84	07/20/84	1,104	P&A
MC-109	002	BP	01/25/87	03/30/87	1,205	P&A
MC-109	003	BP	05/25/88	06/01/88	1,055	ST
MC-109	003	BP	06/22/88	06/30/88	1,055	P&A
MC-109	004	BP	02/01/89	02/11/89	980	ST
MC-109	004	BP	02/16/89	02/23/89	980	P&A
MC-109	005	BP	07/29/89	08/11/89	1,021	P&A
MC-109	A001	BP	09/24/91	10/11/91	1,030	COM
MC-109	A002	BP	10/26/91	11/04/91	1,030	COM
MC-109	A003	BP	11/19/91	11/28/91	1,030	COM
MC-109	A004	BP	12/29/91	01/09/92	1,030	COM
MC-109	A005	BP	07/28/92	08/07/92	1,030	COM
MC-109	A006	BP	02/5/92	02/12/92	1,030	COM
MC-109	A007	BP	02/24/92	03/01/92	1,030	COM
MC-109	A008	BP	03/24/92	04/05/92	1,030	COM
MC-109	A009	BP	04/17/92	04/23/92	1,030	ST
MC-109	A009	BP	10/12/00	10/23/00	1,030	COM
MC-109	A010	BP	05/04/92	05/12/92	1,030	COM

Table F-1. Grid 15—Exploration and Development Drilling Activities (continued).

Area	Well	Operator	Spud Date	Total Depth Date	Water Depth (ft)	Remarks
MC-109	A011	BP	06/22/92	06/30/92	1,030	ST
MC-109	A011	BP	08/07/01	08/19/01	1,030	COM
MC-109	A012	BP	08/14/92	08/19/92	1,030	COM
MC-109	A013	BP	09/21/92	09/26/92	1,030	COM
MC-109	A014	BP	10/09/92	10/16/92	1,030	COM
MC-109	A015	BP	10/26/92	11/02/92	1,030	COM
MC-109	A016	BP	11/19/92	11/27/92	1,030	ST
MC-109	A016	BP	11/15/99	12/16/99	1,030	ST
MC-109	A016	BP	01/09/00	01/14/00	1,030	COM
MC-109	A017	BP	12/03/92	12/11/92	1,030	COM
MC-109	A018	BP	12/23/92	01/02/93	1,030	COM
MC-109	A019	BP	01/12/93	01/22/93	1,030	COM
MC-109	A020	BP	03/03/93	03/10/93	1,030	COM
MC-109	A021	BP	03/23/93	04/02/93	1,030	COM
MC-109	A022	BP	04/25/93	05/04/93	1,030	COM
MC-109	A023	BP	05/14/93	05/25/93	1,030	COM
MC-109	A024	BP	05/20/93	06/27/93	1,030	ST
MC-109	A024	BP	09/12/01	10/01/01	1,030	ST
MC-109	A024	BP	10/08/01	10/15/01	1,030	COM
MC-109	A025	BP	07/12/93	08/2/93	1,030	ST
MC-109	A025	BP	05/05/01	05/30/01	1,030	ST
MC-109	A025	BP	06/10/01	06/16/01	1,030	COM
MC-109	A026	BP	08/14/93	08/21/93	1,030	COM
MC-109	A027	BP	09/01/93	10/28/93	1,030	COM
MC-109	A028	BP	11/22/93	12/05/93	1,030	COM
MC-109	A029	BP	12/13/93	12/24/93	1,030	ST
MC-109	A029	BP	11/09/01		1,030	DRL
MC-109	A030	BP	01/12/94	01/24/94	1,030	COM
MC-109	A031	BP	03/23/00	04/08/00	1,030	COM
MC-109	A032	BP	05/07/00	07/05/00	1,030	ST
MC-109	A032	BP	07/17/00	07/31/00	1,030	ST
MC-109	A032	BP	12/26/00	12/30/00	1,030	ST
MC-109	A032	BP	01/21/01	03/01/01	1,030	COM
MC-110	001	BP	10/29/83	11/13/83	1,450	P&A
MC-110	001	BP	03/12/98	03/30/98	1,212	TA
MC-110	002	BP	12/21/83	03/02/84	1,456	P&A
MC-110	003	BP	09/04/84	11/21/84	1,240	P&A
MC-118	001	ARCO	11/18/89	12/06/89	2,782	ST
MC-118	001	ARCO	12/10/89	01/04/90	2,782	P&A
MC-119	001	Shell	05/12/99	05/29/99	2,875	P&A
MC-154	001	Devon	10/26/97	11/28/97	1,700	P&A
MC-198	001	Phillips	01/01/80	01/02/80	2,211	P&A
MC-199	001	TotalFinaElf	11/16/00	11/26/00	2,528	ST
MC-199	001	TotalFinaElf	11/29/00	12/01/00	2,528	ST
MC-199	001	TotalFinaElf	12/03/00	12/03/00	2,528	ST
MC-199	001	TotalFinaElf	12/06/00	12/22/00	2,528	TA
MC-201	001	Texaco	12/14/87	01/17/88	2,780	P&A
MC-240	001	Marathon	05/27/88	06/19/88	2,107	P&A
MC-241	001	Marathon	06/29/88	08/01/88	2,415	P&A
MC-243	001	Conoco	06/27/90	09/04/90	2,900	P&A
MC-243	001	TotalFinaElf	02/20/99	03/20/99	2,805	ST
MC-243	001	TotalFinaElf	03/25/99	03/26/99	2,805	ST
MC-243	001	TotalFinaElf	03/28/99	04/12/99	2,805	TA
MC-243	002	Conoco	09/17/94	10/19/94	3,270	P&A
MC-243	002	TotalFinaElf	06/26/99	07/27/99	2,835	TA
MC-243	003	TotalFinaElf	08/18/99	09/21/99	3,085	TA
MC-285	001	Texaco	07/03/87	09/16/87	3,161	P&A
MC-285	002	Texaco	01/30/88	04/22/88	2,974	P&A
MC-329	001	Texaco	05/18/88	08/27/88	3,220	P&A

Table F-1. Grid 15—Exploration and Development Drilling Activities (continued).

Area	Well	Operator	Spud Date	Total Depth Date	Water Depth (ft)	Remarks
MC-460	001	Amoco	07/07/88	12/10/88	2,693	P&A
VK-741	001	Amerada Hess	02/08/96	02/28/96	689	ST
VK-741	001	Amerada Hess	03/03/96	03/08/96	689	P&A
VK-742	001	Texaco	07/13/97	08/08/97	1,004	ST
VK-742	001	Texaco	08/23/97	09/01/97	1,004	ST
VK-742	001	Texaco	09/05/97	09/06/97	1,004	TA
VK-783	001	Shell	11/02/84	12/07/84	1,450	ST
VK-783	001	Shell	12/08/84	01/12/85	1,387	P&A
VK-783	002	Shell	08/03/85	10/02/85	1,151	ST
VK-783	002	Shell	10/11/85	01/20/86	1,151	P&A
VK-783	003	Shell	03/12/86	04/18/86	1,505	P&A
VK-783	004	Shell	11/22/88	12/11/88	1,494	ST
VK-783	004	Shell	12/18/88	01/01/89	1,494	COM
VK-783	005	Shell	10/09/95	10/30/95	1,142	ST
VK-783	005	Shell	11/03/95	05/08/96	1,142	COM
VK-783	A001	Shell	10/29/95	02/02/96	1,451	ST
VK-783	A001	Shell	02/10/96	08/14/96	1,450	COM
VK-783	A002	Shell	10/22/95	06/06/96	1,451	COM
VK-783	A003	Shell	10/23/95	03/18/96	1,451	ST
VK-783	A003	Shell	03/24/96	11/07/96	1,451	COM
VK-786	A001	Texaco	06/28/95	07/14/95	1,754	COM
VK-786	A002	Texaco	11/28/95	12/18/95	1,754	ST
VK-786	A002	Texaco	12/30/95	01/20/96	1,754	COM
VK-786	A003	Texaco	11/25/95	02/28/96	1,754	COM
VK-786	A004	Texaco	09/30/97	10/27/97	1,754	COM
VK-786	A005	Texaco	09/26/97	02/01/98	1,754	COM
VK-786	A006	Texaco	09/22/97	01/15/98	1,751	COM
VK-786	A007	Texaco	09/30/97	12/16/00	1,754	COM
VK-786	A008	Texaco	10/07/97	10/07/97	1,754	DSI
VK-786	A009	Texaco	10/06/97	10/07/97	1,751	DSI
VK-786	A010	Texaco	09/18/97	05/05/01	1,751	COM
VK-786	A011	Texaco	10/04/97	10/04/97	1,751	DSI
VK-786	A012	Texaco	09/29/97	02/21/01	1,754	ST
VK-786	A012	Texaco	03/07/01	03/27/01	1,754	COM
VK-786	A013	Texaco	10/03/97	10/15/00	1,754	COM
VK-786	A014	Texaco	09/27/97	09/27/97	1,751	DSI
VK-786	A015	Texaco	09/18/97	05/30/01	1,751	COM
VK-786	A016	Texaco	10/08/97	10/09/97	1,751	DSI
VK-786	A017	Texaco	09/26/97		1,751	DSI
VK-786	A018	Texaco	09/23/97	08/14/01	1,751	COM
VK-786	A019	Texaco	09/18/97	10/21/01	1,751	DSI
VK-786	A020	Texaco	10/04/97	10/05/97	1,751	DSI
VK-786	A021	Texaco	09/17/97	09/20/97	1,751	DSI
VK-823	001	TotalFinaElf	11/05/92	01/01/93	1,209	P&A
VK-823	A001	TotalFinaElf	03/26/97	05/02/97	1,132	COM
VK-823	A002	TotalFinaElf	07/17/97	09/28/97	1,132	COM
VK-823	A003	TotalFinaElf	11/06/99	12/10/99	1,132	COM
VK-823	A004	TotalFinaElf	02/10/00	03/25/00	1,120	COM
VK-823	A005	TotalFinaElf	06/15/00	07/13/00	1,132	COM
VK-823	A006	TotalFinaElf	08/07/00	09/28/00	1,130	ST
VK-823	A006	TotalFinaElf	10/01/00	12/05/00	1,130	COM
VK-823	A007	TotalFinaElf	01/18/01	02/22/01	1,132	COM
VK-823	A008	TotalFinaElf	04/02/01	04/29/01	1,130	COM
VK-823	A009	TotalFinaElf	06/29/01	07/01/01	1,130	TA
VK-823	A010	TotalFinaElf	07/09/01	07/31/01	1,130	COM
VK-823	A011	TotalFinaElf	09/18/01	10/15/01	1,130	DRL
VK-823	001	Kerr-McGee	08/08/87	11/10/87	1,710	P&A
VK-823	002	Kerr-McGee	07/18/90	09/01/90	1,575	P&A
VK-823	003	Kerr-McGee	02/27/91	03/23/91	1,712	P&A

Table F-1. Grid 15—Exploration and Development Drilling Activities (continued).

Area	Well	Operator	Spud Date	Total Depth Date	Water Depth (ft)	Remarks
VK-823	004	Kerr-McGee	07/27/98	08/12/98	1,722	ST
VK-823	004	Kerr-McGee	08/12/98	08/17/98	1,722	COM
VK-823	005	Kerr-McGee	07/06/99	07/29/99	1,711	COM
VK-826	001	Kerr-McGee	04/11/89	05/26/89	1,537	TA
VK-826	002	Kerr-McGee	01/12/90	01/27/90	1,726	ST
VK-826	002	Kerr-McGee	02/03/90	02/26/90	1,726	P&A
VK-826	003	Kerr-McGee	11/14/90	12/22/90	2,028	ST
VK-826	003	Kerr-McGee	12/26/90	01/08/91	2,028	ST
VK-826	003	Kerr-McGee	01/21/91	02/09/91	2,028	P&A
VK-826	004	Kerr-McGee	04/09/91	06/26/91	1,645	P&A
VK-826	005	Kerr-McGee	01/16/94	03/13/94	1,932	ST
VK-826	012	Kerr-McGee	03/03/00	04/26/00	1,543	COM
VK-826	A001	Kerr-McGee	02/07/96	02/17/96	1,932	COM
VK-826	A002	Kerr-McGee	11/22/95	12/21/95	1,935	COM
VK-826	A003	Kerr-McGee	11/25/95	01/12/96	1,925	COM
VK-826	A004	Kerr-McGee	07/26/94	08/15/94	1,920	COM
VK-826	A005	Kerr-McGee	01/26/96	01/28/96	1,935	COM
VK-826	A006	Kerr-McGee	11/18/95	02/03/96	1,932	COM
VK-826	A007	Kerr-McGee	02/23/96	03/06/96	1,925	COM
VK-826	A008	Kerr-McGee	04/05/98	07/16/98	1,932	COM
VK-826	A009	Kerr-McGee	04/15/98	04/23/98	1,932	ST
VK-826	A009	Kerr-McGee	04/28/98	05/26/98	1,932	COM
VK-826	A010	Kerr-McGee	04/10/98	04/14/98	1,932	ST
VK-826	A010	Kerr-McGee	06/23/98	07/01/98	1,932	COM
VK-826	A011	Kerr-McGee	04/07/98	04/08/98	1,932	TA
VK-826	A012	Kerr-McGee	02/05/01	03/09/01	1,928	ST
VK-826	A012	Kerr-McGee	03/19/01	03/23/01	1,933	COM
VK-826	A013	Kerr-McGee	02/08/01	04/11/01	1,928	TA
VK-826	A014	Kerr-McGee	02/04/01	05/09/01	1,928	ST
VK-826	A014	Kerr-McGee	05/11/01	05/16/01	1,933	COM
VK-828	001	Shell	02/10/96	03/05/96	1,750	COM
VK-829	001	Amerada Hess	06/17/94	08/15/94	2,649	P&A
VK-863	001	ARCO	07/12/80	11/21/80	1,068	P&A
VK-863	001	Walter Oil & Gas	05/09/01	05/19/01	1,027	P&A
VK-863	002	ARCO	12/05/80	12/20/80	1,068	P&A
VK-864	001	Conoco	08/09/81	10/06/81	1,508	P&A
VK-864	001	McMoRan	04/04/97	05/13/97	1,457	TA
VK-864	002	Conoco	08/22/82	10/04/82	1,455	P&A
VK-869	001	Exxon-Mobil	05/26/88	06/06/88	1,918	ST
VK-869	001	Exxon-Mobil	06/16/88	06/30/88	1,918	P&A
VK-869	002	Exxon-Mobil	04/06/89	04/18/89	2,050	ST
VK-869	002	Exxon-Mobil	05/23/89	06/14/89	2,050	P&A
VK-870	001	Texaco	02/23/89	02/28/89	2,463	P&A
VK-871	001	Amoco	05/26/94	07/16/94	2,920	P&A
VK-906	001	Exxon-Mobil	11/25/76	01/8/77	1,140	P&A
VK-906	001	Dominion	07/30/99	08/16/99	1,190	P&A
VK-906	002	Exxon-Mobil	07/20/78	08/27/78	1,363	P&A
VK-912	001	Shell	03/01/85	05/14/85	2,441	TA
VK-912	003	Shell	06/23/86	08/15/86	2,952	P&A
VK-989	001	BP	99/19/85	11/16/85	1,255	P&A
VK-989	002	BP	94/17/87	06/03/87	1,250	P&A
VK-989	003	BP	96/30/87	08/10/87	1,230	P&A
VK-989	004	BP	91/21/89	02/06/89	1,190	ST
VK-989	004	BP	92/11/89	03/05/89	1,190	P&A
VK-989	A001	BP	11/21/92	12/18/92	1,290	COM
VK-989	A002	BP	11/30/92	01/07/93	1,290	COM
VK-989	A003	BP	11/29/92	03/19/93	1,290	COM
VK-989	A004	BP	11/27/92	04/02/93	1,294	ST
VK-989	A004	BP	04/24/93	05/12/93	1,294	COM

Table F-1. Grid 15—Exploration and Development Drilling Activities (continued).

Area	Well	Operator	Spud Date	Total Depth Date	Water Depth (ft)	Remarks
VK-989	A005	BP	11/25/92	11/12/94	1,290	COM
VK-989	A006	BP	11/22/92	02/06/93	1,290	COM
VK-989	A007	BP	06/09/93	06/21/93	1,294	ST
VK-989	A007	BP	06/27/93	07/08/93	1,294	COM
VK-989	A008	BP	11/12/93	02/21/95	1,290	COM
VK-989	A009	BP	06/04/93	12/05/93	1,290	COM
VK-989	A009	BP	12/20/95	12/23/95	1,290	COM
VK-989	A010	BP	05/31/93	12/20/93	1,290	COM
VK-989	A011	BP	02/28/96	05/16/96	1,290	COM
VK-989	A012	BP	04/22/93	05/05/95	1,290	COM
VK-989	A013	BP	08/19/95	10/23/95	1,295	COM
VK-989	A014	BP	06/19/96	06/29/96	1,295	COM
VK-989	A015	BP	07/14/96	09/04/96	1,295	COM
VK-989	A016	BP	09/26/96	10/17/96	1,295	COM
VK-989	A017	BP	11/01/96	11/10/96	1,295	COM
VK-989	A018	BP	12/20/96	03/11/97	1,295	COM
VK-989	A019	BP	04/16/97	05/12/97	1,295	COM
VK-989	A020	BP	06/03/97	06/21/97	1,295	COM
VK-989	A021	BP	07/11/97	07/30/97	1,295	COM
VK-989	A022	BP	08/09/97	08/16/97	1,295	TA
VK-989	A023	BP	10/17/97	11/07/97	1,295	COM
VK-989	A024	BP	09/05/97	10/01/97	1,295	ST
VK-989	A024	BP	09/09/97	10/01/97	1,295	COM
VK-989	A025	BP	01/16/98	01/30/98	1,295	COM
VK-989	A026	BP	02/13/00	03/05/00	1,290	COM
VK-989	A027	BP	04/10/00	05/01/00	1,290	ST
VK-989	A027	BP	05/16/00	05/17/00	1,290	P&A
VK-989	A028	BP	06/05/00	07/13/00	1,290	ST
VK-989	A028	BP	07/15/00	07/21/00	1,290	COM
VK-989	A029	BP	11/15/00	06/25/01	1,290	COM
VK-989	A030	BP	09/09/00	10/07/00	1,290	COM
VK-989	A031	BP	09/20/01	10/12/01	1,290	ST
VK-989	A031	BP	10/26/01	10/30/01	1,290	DRL
VK-989	001	BP	03/29/85	04/27/85	1,325	P&A

Remarks: COM = Completions
P&A = Plugged and Abandoned
TA = Temporarily Abandoned
ST = Sidetracks
DRL = Drilling
DSI = Drilling Shut In

Note: MC = Mississippi Canyon
VK = Viosca Knoll

Table F-2
Grid 15 — Approved Plan Activities

Area	Operator	Approval Date	Water Depth (ft)	Type Plan
MC-27	BP	04-Nov-88	0	EP
MC-27	BP	04-Nov-88	0	EP
MC-27	BP	06-Apr-88	0	EP
MC-27	BP	25-Aug-89	1,305	EP
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,854	DOCD
MC-28	BP	12-Apr-95	1,854	DOCD
MC-28	BP	12-Apr-95	1,854	DOCD
MC-28	BP	12-Apr-95	1,854	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	12-Apr-95	1,863	DOCD
MC-28	BP	27-Apr-01	1,853	DOCD
MC-28	BP	27-Sep-01	1,863	DOCD
MC-28	BP	01-Jun-89	2,000	EP
MC-28	BP	01-Jun-89	2,000	EP
MC-29	ORYX ENERGY	07-Jan-98	2,282	EP
MC-29	ORYX ENERGY	07-Jan-98	2,288	EP
MC-29	ORYX ENERGY	07-Jan-98	2,288	EP
MC-29	Chieftain	28-Nov-00	2,078	EP
MC-29	Chieftain	28-Nov-00	2,035	EP
MC-29	Chieftain	19-Nov-98	1,975	EP
MC-29	Chieftain	19-Nov-98	2,035	EP
MC-29	Chieftain	19-Nov-98	2,115	EP
MC-29	Chieftain	19-Nov-98	1,868	EP
MC-68	Walter Oil & Gas	01-May-00	1,380	EP
MC-68	Walter Oil & Gas	01-May-00	1,300	EP
MC-68	Walter Oil & Gas	22-Jan-01	1,337	DOCD
MC-68	Walter Oil & Gas	22-Jan-01	1,337	DOCD
MC-109	BP	24-Oct-83	1,090	EP
MC-109	BP	06-Aug-90	1,090	DOCD
MC-109	BP	20-Oct-93	915	DOCD
MC-109	BP	20-Oct-93	915	DOCD
MC-109	Shell	14-Jan-00	1,030	DOCD
MC-109	Shell	14-Jan-00	1,030	DOCD
MC-109	Shell	14-Jan-00	1,030	DOCD
MC-109	Shell	14-Jan-00	1,030	DOCD
MC-109	BP	20-Jul-89	1,040	EP
MC-109	BP	18-Oct-84	1,090	EP
MC-109	BP	18-Oct-84	1,090	EP
MC-109	BP	18-Oct-84	1,090	EP
MC-109	BP	18-Oct-84	1,090	EP
MC-109	BP	20-Aug-86	1,090	EP
MC-109	BP	20-Aug-86	1,090	EP
MC-109	BP	20-Aug-86	1,090	EP
MC-109	BP	20-Aug-86	1,090	EP

Table E-2. Grid 15 — Approved Plan Activities (continued).

Area	Operator	Approval Date	Water Depth (ft)	Type Plan
MC-109	BP	21-Nov-86	1,090	EP
MC-109	BP	28-Apr-88	1,090	EP
MC-109	BP	28-Apr-88	1,090	EP
MC-109	BP	28-Apr-88	1,090	EP
MC-109	BP	01-Sep-99	1,030	DOCD
MC-109	BP	01-Sep-99	1,030	DOCD
MC-110	Shell	09-Jan-98	1,300	EP
MC-110	Shell	09-Jan-98	1,300	EP
MC-110	Shell	09-Jan-98	1,250	EP
MC-110	Shell	09-Jan-98	1,400	EP
MC-116	Walter Oil & Gas	30-Aug-00	2,810	EP
MC-153	Devon	22-Oct-97	1,500	EP
MC-154	Devon	22-Oct-97	1,700	EP
MC-154	Devon	22-Oct-97	1,600	EP
MC-159	Samedan	20-Dec-01	2,826	EP
MC-159	Samedan	20-Dec-01	2,731	EP
MC-159	Samedan	20-Dec-01	2,819	EP
MC-161	Walter Oil & Gas	30-Aug-00	3,030	EP
MC-161	Walter Oil & Gas	30-Aug-00	2,930	EP
MC-199	TotalFinaElf	15-Feb-00	2,495	EP
MC-199	TotalFinaElf	25-Jan-01	2,465	EP
MC-243	TotalFinaElf	13-Nov-98	2,805	EP
MC-243	TotalFinaElf	03-Jun-99	2,835	EP
MC-243	TotalFinaElf	25-Jun-99	2,835	EP
MC-243	TotalFinaElf	11-Aug-99	2,940	EP
MC-243	TotalFinaElf	11-Aug-99	3,075	EP
MC-243	TotalFinaElf	23-Dec-99	2,839	EP
MC-243	TotalFinaElf	25-Jan-01	2,775	EP
MC-243	TotalFinaElf	25-Jan-01	2,710	EP
MC-243	TotalFinaElf	06-Nov-01	2,838	EP
MC-243	TotalFinaElf	29-Jan-02	2,816	EP
MC-243	TotalFinaElf	29-Jan-02	2,816	EP
MC-243	TotalFinaElf	29-Jan-02	2,816	EP
MC-243	TotalFinaElf	29-Jan-02	2,816	EP
MC-373	Amerada Hess	06-Apr-00	2,700	EP
MC-373	Amerada Hess	06-Apr-00	2,940	EP
MC-373	Amerada Hess	06-Apr-00	2,860	EP
VK-741	Amerada Hess	25-Jan-96	920	EP
VK-741	Amerada Hess	25-Jan-96	1,125	EP
VK-741	Amerada Hess	25-Jan-96	695	EP
VK-742	Amerada Hess	13-Dec-96	1,080	EP
VK-742	Amerada Hess	13-Dec-96	1,085	EP
VK-742	Amerada Hess	13-Dec-96	1,350	EP
VK-742	Amerada Hess	13-Dec-96	910	EP
VK-742	Amerada Hess	13-Dec-96	982	EP
VK-742	Texaco	08-Jul-97	1,002	EP
VK-783	Shell	13-Aug-93	1,494	DOCD
VK-783	Shell	22-Mar-96	1,450	DOCD
VK-783	Shell	22-Mar-96	1,450	DOCD
VK-783	Shell	22-Mar-96	1,450	DOCD
VK-783	Shell	22-Mar-96	1,450	DOCD
VK-783	Shell	22-Mar-96	1,144	DOCD
VK-783	Shell	15-Nov-88	0	EP
VK-783	Shell	16-Sep-93	1,500	DOCD
VK-783	Shell	29-Sep-95	1,500	EP
VK-783	Shell	29-Sep-95	1,500	EP
VK-783	Shell	29-Sep-95	1,500	EP
VK-783	Shell	29-Sep-95	1,500	EP
VK-783	Shell	05-Apr-01	1,451	DOCD

Table E-2. Grid 15 — Approved Plan Activities (continued).

Area	Operator	Approval Date	Water Depth (ft)	Type Plan
VK-783	Shell	12-Dec-01	1,500	DOCD
VK-783	Shell	21-Jul-95	1,450	EP
VK-783	Shell	21-Jul-95	1,144	EP
VK-783	Shell	21-Jul-95	1,450	EP
VK-783	Shell	21-Jul-95	1,450	EP
VK-783	Shell	21-Jul-95	1,450	EP
VK-784	Shell	14-Jul-97	0	EP
VK-784	Shell	16-Mar-01	1,550	EP
VK-786	Texaco	06-Feb-95	1,700	EP
VK-786	Texaco	06-Feb-95	1,700	EP
VK-786	Texaco	06-Feb-95	1,700	EP
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	05-Jun-97	1,754	DOCD
VK-786	Texaco	03-Jan-02	1,754	DOCD
VK-786	Texaco	03-Jan-02	1,754	DOCD
VK-786	Texaco	18-Oct-01	1,754	EP
VK-786	Texaco	02-Oct-97	1,754	DOCD
VK-786	Texaco	02-Oct-97	1,754	DOCD
VK-786	Texaco	02-Oct-97	1,754	DOCD
VK-786	Texaco	02-Oct-97	1,754	DOCD
VK-823	BP	19-Aug-92	1,078	EP
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	TotalFinaElf	02-Nov-99	1,126	DOCD
VK-823	BP	29-Oct-92	1,204	EP
VK-823	TotalFinaElf	10-Feb-97	1,120	EP
VK-825	ORYX ENERGY	20-Apr-84	0	EP
VK-825	ORYX ENERGY	20-Apr-84	0	EP
VK-825	ORYX ENERGY	20-Apr-84	0	EP
VK-825	ORYX ENERGY	29-May-87	0	EP
VK-825	Exxon-Mobil	15-Jun-90	1,700	EP

Table E-2. Grid 15 — Approved Plan Activities (continued).

Area	Operator	Approval Date	Water Depth (ft)	Type Plan
VK-825	Exxon-Mobil	15-Jun-90	1,575	EP
VK-825	ORYX ENERGY	04-Feb-91	1,705	EP
VK-825	ORYX ENERGY	13-Feb-91	1,550	EP
VK-825	ORYX ENERGY	13-Feb-91	1,650	EP
VK-825	ORYX ENERGY	13-Feb-91	1,660	EP
VK-825	ORYX ENERGY	23-Jul-98	1,718	DOCD
VK-825	ORYX ENERGY	23-Jul-98	1,718	DOCD
VK-825	ORYX ENERGY	23-Jul-98	1,718	DOCD
VK-826	ORYX ENERGY	10-Mar-89	0	EP
VK-826	ORYX ENERGY	10-Mar-89	0	EP
VK-826	ORYX ENERGY	05-Apr-89	0	EP
VK-826	ORYX ENERGY	09-Jan-90	1,710	EP
VK-826	ORYX ENERGY	15-Mar-91	1,480	EP
VK-826	ORYX ENERGY	15-Mar-91	1,628	EP
VK-826	ORYX ENERGY	30-Dec-93	1,930	EP
VK-826	ORYX ENERGY	16-Aug-90	1,990	EP
VK-826	ORYX ENERGY	16-Aug-90	1,455	EP
VK-826	ORYX ENERGY	16-Aug-90	1,630	EP
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	ORYX ENERGY	28-Jul-95	1,930	DOCD
VK-826	Kerr-McGee	29-Feb-00	1,534	DOCD
VK-863	McMoRan	11-Jan-01	1,275	EP
VK-863	McMoRan	11-Jan-01	1,050	EP
VK-863	McMoRan	11-Jan-01	1,255	EP
VK-863	McMoRan	11-Jan-01	1,035	EP
VK-864	Texaco	28-Jun-96	1,460	EP
VK-864	Texaco	28-Jun-96	1,445	EP
VK-864	Texaco	28-Jun-96	1,415	EP
VK-871	Amoco	11-May-94	2,980	EP
VK-871	Amoco	11-May-94	2,920	EP
VK-871	Amoco	11-May-94	2,820	EP
VK-871	Amoco	11-May-94	3,080	EP
VK-871	Amoco	11-May-94	3,170	EP
VK-906	Dominion	03-May-99	1,195	EP
VK-906	Dominion	03-May-99	1,195	EP
VK-906	Dominion	03-May-99	1,195	EP
VK-989	BP	20-Dec-84	0	EP
VK-989	BP	20-Dec-84	0	EP
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD

Table E-2. Grid 15 — Approved Plan Activities (continued).

Area	Operator	Approval Date	Water Depth (ft)	Type Plan
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	21-May-92	1,290	DOCD
VK-989	BP	03-Apr-87	0	EP
VK-989	BP	03-Apr-87	0	EP
VK-989	BP	05-Jul-00	1,290	DOCD
VK-989	BP	13-Jun-86	0	EP
VK-989	BP	13-Jun-86	0	EP
VK-989	BP	13-Jun-86	0	EP
VK-989	BP	06-Apr-88	0	EP
VK-989	BP	06-Apr-88	0	EP
VK-989	BP	06-Apr-88	0	EP
VK-990	BP	20-Dec-84	0	EP
VK-990	BP	29-Apr-88	0	EP
VK-990	BP	13-Jun-86	0	EP
VK-990	BP	13-Jun-86	0	EP
VK-990	BP	27-Sep-89	1,610	EP
VK-990	BP	27-Sep-89	1,490	EP

Note: EP = Exploration Plan
DOCD = Development Operations Coordination Document
MC = Mississippi Canyon
VK = Viosca Knoll

Table F-3

Grid 15 — Surface Structures (proposed and existing)

Project	Area	Structure	Year Installed	Wells	Remarks
	MC 28	Subsea Template	1998		
Amberjack	MC 109	Fixed	1991		
Matterhorn	MC 243	Tension-leg Platform	To be installed in 2003	8	Drilling eight wells and reentering one existing appraisal well
Petronius	VK 786	CT	2000		
Virgo	VK 823	Fixed	1999		
Neptune	VK 826	WP	1996		
Pompano	VK 989	Fixed	1994		

Note: MC = Mississippi Canyon
VK = Viosca Knoll

The Department of the Interior Mission

As the Nation's principal conservation agency, the Department of the Interior has responsibility for most of our nationally owned public lands and natural resources. This includes fostering sound use of our land and water resources; protecting our fish, wildlife, and biological diversity; preserving the environmental and cultural values of our national parks and historical places; and providing for the enjoyment of life through outdoor recreation. The Department assesses our energy and mineral resources and works to ensure that their development is in the best interests of all our people by encouraging stewardship and citizen participation in their care. The Department also has a major responsibility for American Indian reservation communities and for people who live in island territories under U.S. administration.

The Minerals Management Service Mission

As a bureau of the Department of the Interior, the Minerals Management Service's (MMS) primary responsibilities are to manage the mineral resources located on the Nation's Outer Continental Shelf (OCS), collect revenue from the Federal OCS and onshore Federal and Indian lands, and distribute those revenues.

Moreover, in working to meet its responsibilities, the **Offshore Minerals Management Program** administers the OCS competitive leasing program and oversees the safe and environmentally sound exploration and production of our Nation's offshore natural gas, oil and other mineral resources. The MMS **Minerals Revenue Management** meets its responsibilities by ensuring the efficient, timely and accurate collection and disbursement of revenue from mineral leasing and production due to Indian tribes and allottees, States and the U.S. Treasury.

The MMS strives to fulfill its responsibilities through the general guiding principles of: (1) being responsive to the public's concerns and interests by maintaining a dialogue with all potentially affected parties and (2) carrying out its programs with an emphasis on working to enhance the quality of life for all Americans by lending MMS assistance and expertise to economic development and environmental protection.