UNITED STATES GOVERNMENT MEMORANDUM

July 1, 2024

To: Public Information (MS 5030)

From: Plan Coordinator, FO, Plans Section (MS 5231)

Subject: Public Information copy of plan

Control # - S-08131

Type - Supplemental Development Operations Coordinations Document

Lease(s) - OCS-G17561 Block - 813 Alaminos Canyon Area
OCS-G17565 Block - 857 Alaminos Canyon Area
OCS-G17570 Block - 900 Alaminos Canyon Area
OCS-G20870 Block - 856 Alaminos Canyon Area

Operator - Shell Offshore Inc.

Description - GD001,GD002,GD003,GD004,GD005, GD006,GD007,GD008,GD009,GD010,GD011,GD012, GD10ALTA,

Rig Type - Not Found

Attached is a copy of the subject plan.

It has been deemed submitted as of this date and is under review for approval.

Leslie Wilson
Plan Coordinator

Site Type/Name	Botm Lse/Area/Blk	Surface Location	Surf Lse/Area/Blk
WELL/GD001	G17565/AC/857	3581 FSL, 4404 FWL	G17565/AC/857
WELL/GD002	G17565/AC/857	5869 FSL, 6868 FEL	G17565/AC/857
WELL/GD003	G17565/AC/857	3515 FSL, 4553 FWL	G17565/AC/857
WELL/GD004	G17565/AC/857	2923 FSL, 6285 FWL	G17565/AC/857
WELL/GD005	G17565/AC/857	3138 FSL, 6358 FWL	G17565/AC/857
WELL/GD006	G17565/AC/857	4019 FSL, 5054 FWL	G17565/AC/857
WELL/GD007	G17565/AC/857	5792 FSL, 7010 FEL	G17565/AC/857
WELL/GD008	G17565/AC/857	4600 FSL, 1154 FWL	G17565/AC/857
WELL/GD010	G17565/AC/857	5680 FSL, 6800 FEL	G17565/AC/857
WELL/GD011	G20870/AC/856	3985 FSL, 1085 FWL	G17565/AC/857
WELL/GD012	G20870/AC/856	3835 FSL, 1092 FWL	G17565/AC/857
WELL/GD10ALTA	G17565/AC/857	5660 FSL, 6850 FEL	G17565/AC/857

Shell Offshore Inc.
P. O. Box 61933
New Orleans, LA 70161-1933
Tel +1 832 337 2168
Email: robin.voosen@shell.com

Public Information Copy

November 28, 2023

Mrs. Michelle Picou, Section Chief
Bureau of Ocean Energy Management
1201 Elmwood Park Boulevard
New Orleans, LA 70123-2394

Attn: Plans Group GM 235D

SUBJECT: Supplemental Development Operations Coordiation Document (SDOCD)
Alaminos Canyon Block 813, OCS-G 17561
Alaminos Canyon Block 856, OCS-G 20870
Alaminos Canyon Block 857, OCS-G 17565
Alaminos Canyon Block 900, OCS-G 17570
Alaminos Canyon Unit No. 754308001
Offshore, Texas

Dear Mrs. Picou:

In compliance with 30 CFR 550.241 and NTLs 2008-G04, 2009-G27 and 2015-N01, giving Development Plan guidelines, Shell Offshore Inc. (Shell) requests your approval of this Supplemental DOCD to commence production for the 6 subsea wells in SEP S-8117. This Plan also includes the seafloor equiptment needed to bring these wells online. An Alabama Coastal Zone Management has been added to the DOCD to allow for installation vessels to come from Theodore, Alabama.

This plan consists of a series of attachments describing our intended operations. The attachments we desire to be exempted from disclosure under the Freedom of Information Act are marked “Proprietary” and excluded from the Public Information Copies of this submittal. The cost recovery fee is provided in the Proprietary copy of the plan.

Should you require additional information, please contact me.

Sincerely,

Robin Voosen
Regulatory Specialist

SHELL OFFSHORE INC.

SUPPLEMENTAL DEVELOPMENT COORDINATION OPERATIONS DOCUMENT

For

Alaminos Canyon Block 813, OCS-G 17561
Alaminos Canyon Block 856, OCS-G 20870
Alaminos Canyon Block 857, OCS-G 17565
Alaminos Canyon Block 900, OCS-G 17570
Offshore Texas

Alaminos Canyon Unit No. 754308001

PUBLIC INFORMATION COPY

NOVEMBER 2023

PREPARED BY:

Robin Voosen
Regulatory Specialist

832.337.2168

robin.voosen@shell.com

REVISIONS TABLE:

Date of Request	Plan Section	What was Corrected	Date Resubmitted
12/18/2023	Section 1	Remove OCS Block AC-901	1/10/2024
6/27/2024	Section 1	Change EP to DOCD (pg. 6)	7/1/2024
6/27/2024	Section 9	Change Exploration Plan to DOCD (pg. 64)	7/1/2024
6/27/2024	Section 13	Added AL base and changed Exploration Plan to DOCD on icinity Map (pg. 100)	7/1/2024
6/27/2024	Section 15	Add Alabama to on-shore support facilities (pg. 101)	7/1/2024
6/27/2024	Section 17	Change Exploration Plan to DOCD on AL CZM and added Theodore, AL verbage (pg. 104)	7/1/2024

SUPPLEMENTAL DOCD
OFFSHORE TEXAS

TABLE OF CONTENTS

SECTION 1: PLAN CONTENTS

A. DESCRIPTION, OBJECTIVES & SCHEDULE

Shell Offshore Inc. (Shell) is submitting this Supplemental DOCD (SDOCD/Plan) to commence production of six (6) subsea wells at Perdido Great White Frio, Alaminos Canyon (AC) Block 813, OCS-G 17561. The wells being covered in this plan are as follows: LWP4, LWP4-Alt1, LWP4-Alt2, NWP5, NWP5-Alt1 and NWP5-Alt2 from SEP S-8117. We will also install seafloor equipment to support these wells (jumpers, flowline, umbilical & EFL) and cover all the wells at this drill center for future well work.

The proposed rig for this future well work is either a dynamically positioned (DP) semi-submersible or a Drill Ship. They are self-contained drilling vessels with accommodations for a crew which include quarters, galley and sanitation facilities. The drilling activities will be supported by the support vessels and aircraft as well as onshore support facilities as listed in Sections 14 and 15. Shell has employed or contracted with trained personnel to carry out its exploration activities. Shell is committed to local hire, local contracting and local purchasing to the maximum extent possible. Shell personnel and contractors are experienced at operating in the Gulf of Mexico and are well versed in all Federal and State laws regulating operations. Shell's employees and contractors share Shell's deep commitment to operating in a safe and environmentally responsible manner.

Shell, through its parent and affiliate corporations, has extensive experience safely exploring for oil and gas in the Gulf of Mexico. Shell will draw upon this experience in organizing and carrying out its drilling program. Shell believes that the best way to manage blowouts is to prevent them from happening. Significant effort goes into the design and execution of wells and into building and maintaining staff competence. In the unlikely event of a spill, Shell's Regional Oil Spill Response Plan (OSRP) is designed to contain and respond to a spill that meets or exceeds the worst-case discharge (WCD) as detailed in Section 9 of this DOCD. The WCD does not take into account potential flow mitigating factors such as well bridging, obstructions in wellbore, reservoir barriers, or early intervention. We continue to invest in research and development to improve safety and reliability of our well systems. All operations will be conducted in accordance with applicable federal and state laws, regulations and lease and permit requirements. Shell will have trained personnel and monitoring programs in place to ensure such compliance.

B. LOCATION

See BOEM forms (Attachments 1B through 1X).

C. RIG SAFETY AND POLLUTION FEATURES

The rig to be used for this work will comply with the regulations of the American Bureau of Shipping (ABS), International Maritime Organization (IMO) and the United States Coast Guard (USCG). All drilling operations will be conducted under the provisions of 30 CFR, Part 250, Subpart D and other applicable regulations and notices, including those regarding the avoidance of potential drilling hazards and safety and pollution prevention control. Such measures as inflow detection and well control, monitoring for loss of circulation and seepage loss and casing design will be our primary safety measures. Primary pollution prevention measures are contaminated and non-contaminated drain system, mud drain system and oily water processing.

The following drain items are typical for rigs in Shell's fleet.

DRAIN SYSTEM POLLUTION FEATURES

Drains are provided on the rig in all spaces and on all decks where water or oil can accumulate. The drains are divided into two categories, non-contaminated and contaminated. All deck drains are fitted with a removable strainer plate to prevent debris from entering the system.

Deck drainage from rainfall, rig washing, deck washing and runoff from curbs and gutters, including drip pans and work areas, are discharged depending on if it comes in contact with the contaminated or non-contaminated areas of the Rig.

1) Non-contaminated Drains

Non-contaminated drains are designated as drains that under normal circumstances do not contain hydrocarbons and are mostly located around the main deck and outboard in places where it is unlikely that hydrocarbons will be found. Non-Contaminated drains can be directed overboard or to Non-Hazardous storage tanks. Drains are normally directed to storage tanks and only sent overboard if static sheen test is completed.

All drains that have the ability to go overboard are plugged and labeled and are lined up to normally go into Hazardous and Non-Hazardous storage tanks. Any deviation from this requires a Request for Approval Drain Plug Removal Form to be filled out prior to any plug being pulled. The rig's drain plug program consists of a daily check of all deck drains leading to the sea to verify that their status is as designated.

In the event a leak or spill on deck, the event shall be contained as all drains are lined up to the holding tanks. Emergency spill kits are located around the vessel and kit deployment and notifications will be implemented as needed.

Rig personnel shall ensure that the perimeter kick-plates on weather decks are maintained and drain plugs are in place as needed to ensure a proper seal.

2) Contaminated Drains

Contaminated drains are designated as drains that may contain hydrocarbons, drains from likely zones (rig floor, active mud tanks, etc.) cannot be discharged overboard and are directed to hazardous storage tanks. Drains from zones less likely to be contaminated (BOP setback areas, well test deck, etc.) have the option to go overboard or to the hazardous storage tanks, drains are always directed to storage tank for this system. When oil-based mud is used for drilling it will be collected from decks via a mud vac system or pumped from storage tanks to portable tanks and sent to shore for processing.

3) Oily Water Processing

Oily water is collected in an oily water tank. It must be separated and cannot be pumped overboard until oil content is <15 ppm. The separated oil is pumped to a dirty oil tank and has to be sent ashore for disposal. On board the MODU an oil record log is kept according to instructions included in the log. All waste oil that is sent in to be disposed of is recorded in the MODU's oil log book.

All discharges will be in accordance with applicable NPDES permits. See Section 18, EIA.

4) Lower Hull Bilge System

- The main bilge system is designed to have drains directed to bilge pockets in lower machinery rooms or directly to the FWD and Aft bilge storage tanks. They are electrically driven, self-priming centrifugal pumps – forward and aft that automatically pump bilge pockets to storage tanks when high level is sensed.
- Bilge water is stored onboard and pumped overboard via the Oily Water Separator if below 15 PPM.

The Bilge pumps are manual/automatic type pumps. They are equipped with sensors that give a high and a high alarm. They are set to a point at which the water gets to a certain point they will automatically turn on to pump water out in order to keep flooding under control. The pumps are also capable of being put in manual mode in which they can be turned on by hand.

5) Emergency Bilge System

The Vessel has specific procedures for emergency bilge operations. It has emergency bilge pumps forward and aft for secondary response of de-watering vessel areas. For emergency purposes these overboard valves are kept open at all times. The pumps are manually controlled by the engine room operator in the Engine control room and all bilge pockets can be pumped and controlled from this area. In addition to this there is a third means of dewatering the vessel utilizing saltwater pumps and ballast pumps in various aft spaces. These valves must be manually operated in the affected machinery room.

6) Oily Water Drain/Separation System

Oily water/engine room bilge water is collected in an oily water tank. It must be separated and not pumped overboard until oil content is <15 ppm. The separated oil is pumped to a dirty oil tank and will to be sent ashore for disposal. On board all drilling Units, an oil record log is kept according to instructions included in the log.

The rig floor drains go to the hazardous or non-hazardous drain system. From there they are pumped through a 15ppm meter before going overboard or being diverted to a drain holding tank. Once the drain holding thank is full it is processed through a decanting and centrifugal separation system. The heavy solids that cannot pass are pumped to a tote and sent in for processing, the remaining fluid is either sent back to the holding tank or if under 15ppm it is diverted overboard.

7) Drain, Effluent and Waste Systems

- The rig's drainage system is designed in line with our environmental and single point discharge policies. Drains are either hazardous, i.e. from a hazardous area as depicted on the Area Classification drawings, or non-hazardous drains from nonhazardous areas.
- To prevent migration of hazardous materials and flammable gas from hazardous to non-hazardous areas, the drainage systems are segregated.
- The rig drainage systems tie into oily water separators that take out elements in the drainage that could harm the environment.

8) Rig Floor Drainage

The rig floor drains to the hazardous or non-hazardous drain system as described above. A dedicated mud vacuum system is also installed to remove any mud that may go down the drain.

9) Cement unit Drains

The drains in the containment for the mixing skid and chemical tanks are directed to a dedicated overboard line. This line is controlled by two gate valves for double isolation and is kept normally closed with locks.

10) Main Engine Rooms

The engine rooms have their own drainage and handling system. The engine rooms are outfitted with a dirty oil tank and the drainage in the tank is processed through the separator, the waste from the separator goes back to the dirty oil tank and the clean water (<15 ppm) goes overboard.

11) Helideck Drains

The helideck has a dedicated drainage system around its perimeter to drain heli-fuel from a helicopter incident. The fuel can be diverted to the designated heli fuel recovery tank which is located under the Helideck structure.

Operating configurations are as follows:

- The overboard piping valves and hydrocarbons take on valves are closed and locked. To unlock overboard or take on valves a permit or a Bulk Transfer Certificate must be filled out.
- The oily water separator continuously circulates the oily water collection tank. Waste oil is discharged into the waste oil tank and oily water is re-circulated back into the oily water collection tank. Clean water is pumped overboard, which is controlled/monitored by the oil content detector, set at 15 ppm.
- The solids control system is capable of being isolated for cuttings collection.

D. Storage Tanks – Transocean Proteus (or similar) Drillship

Type of Storage Tank	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (Specific)
Marine Oil	14788	1	14788	Marine oil (0.85 SG)
Marine Oil	14482	2	28964	Marine oil (0.85 SG)
Marine Oil settling tank	2338	2	4676	Marine oil (0.85 SG)
Marine Oil settling tank	1415	2	2830	Marine oil (0.85 SG)
Marine Oil settling tank	1145	2	2290	Marine oil (0.85 SG)
Lube oil	214	1	214	Lube Oil (.9 SG)
Lube oil	381	1	381	Lube Oil (.9 SG)
Lube oil	127	1	127	Lube Oil (.9 SG)
Lube Oil	169	1	169	Lube Oil (.9 SG)

Storage Tanks – Development Driller III (or similar) DP Semi-Submersible

Type of Storage Tank	Type of Facility	Tank Capacity (Bbls)	Number of Tanks	Total Capacity (Bbls)	Fluid Gravity (Specific)
Diesel Tank in stbd 1 80% fill in all hull tanks	Drilling Rig	3597	1	3597	Marine Diesel (0.91 SG)
Diesel Tank in stbd 2	Drilling Rig	2,713	1	2713	Marine Diesel (0.91 SG)
Diesel Tank in stbd 3	Drilling Rig	3,456	1	3456	Marine Diesel (0.91 SG)
Diesel Tank in stbd 4	Drilling Rig	653	1	653	Marine Diesel (0.91 SG)
Diesel Tank in port 1	Drilling Rig	2,090	1	2090	Marine Diesel (0.91 SG)
Diesel Tank in port 2	Drilling Rig	1,366	1	1366	Marine Diesel (0.91 SG)
Diesel Tank in port 3	Drilling Rig	4,787	1	4787	Marine Diesel (0.91 SG)
Diesel Tank in port 4	Drilling Rig	3,456	1	3456	Marine Diesel (0.91 SG)
Total storage hull tanks	Drilling Rig			22,118	Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	3	387	Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	139	1	139	Marine Diesel (0.91 SG)

E. Pollution Prevention Measures

Pursuant to NTL 2008-G04 the proposed operations covered by this Plan do not require Shell to specifically address the discharges of oil and grease from the rig during rainfall or routine operations. Nevertheless, Shell has provided this information as part of its response to 1(c) above.

F. Additional Measures

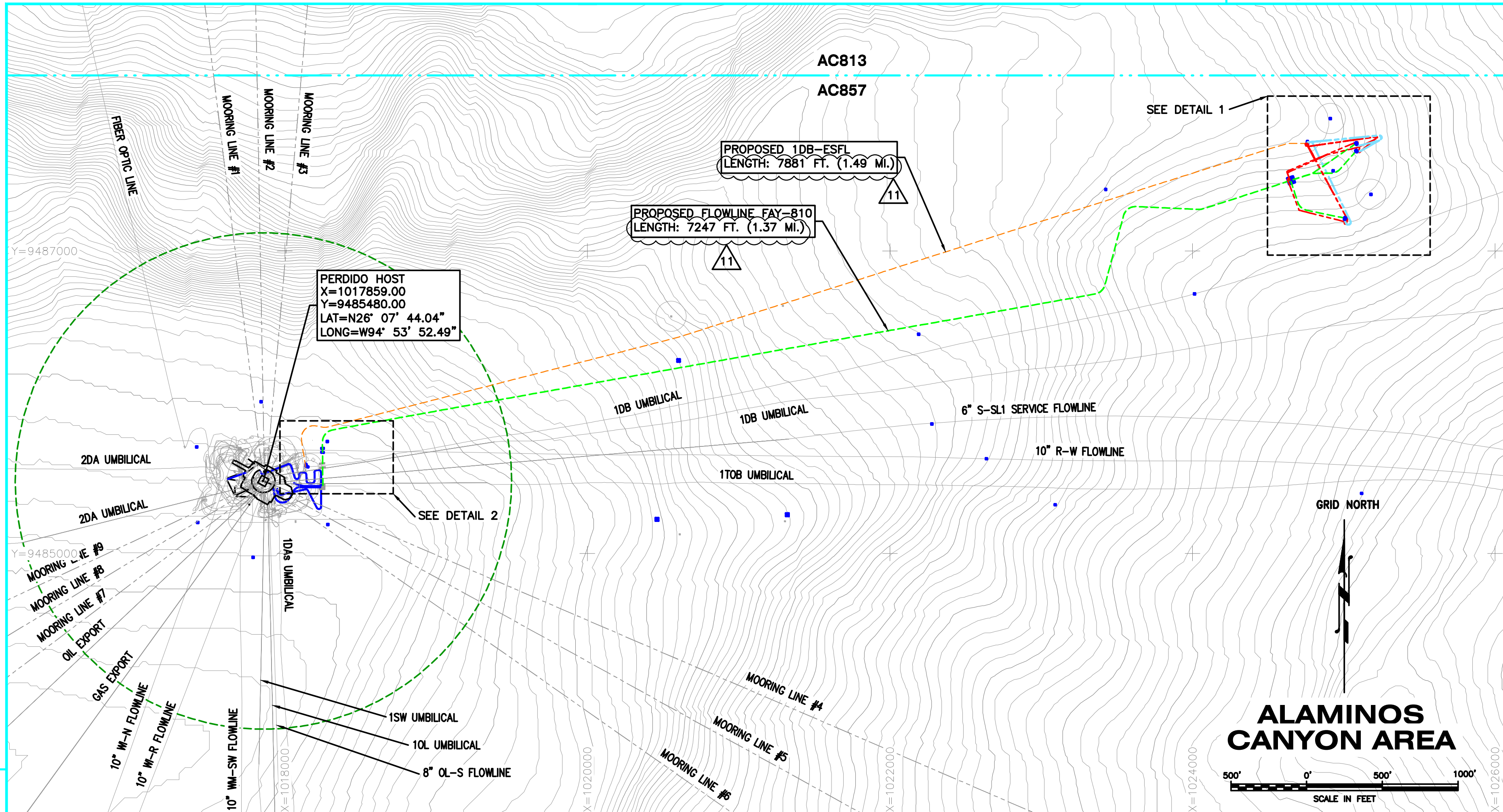
- HSE (health safety and environment) are the primary topics in pre-tour and pre-job safety meetings. The discussion around no harm to people or environment is a key mindset. All personnel are reminded daily to inspect work areas for safety issues as well as potential pollution issues.
- All tools that come to and from the rig have their pollution pans inspected, cleaned and confirmation of plugs installed prior to leaving dock and prior to loading on the boat.
- Preventive maintenance of rig equipment includes visual inspection of hydraulic lines and reservoirs on routine scheduled basis.
- All pollution pans on rig are inspected daily.
- Containment dikes are installed around all oil containment, drum storage areas, fuel vents and fuel storage tanks.
- All used oil and fuel is collected and sent in for recycling.
- Every drain on the rig is assigned a number. The number is logged when plug is removed and replaced.
- All trash containers are checked and emptied daily. The trash containers are kept covered. Trash is disposed of in a compactor and shipped in via boat.

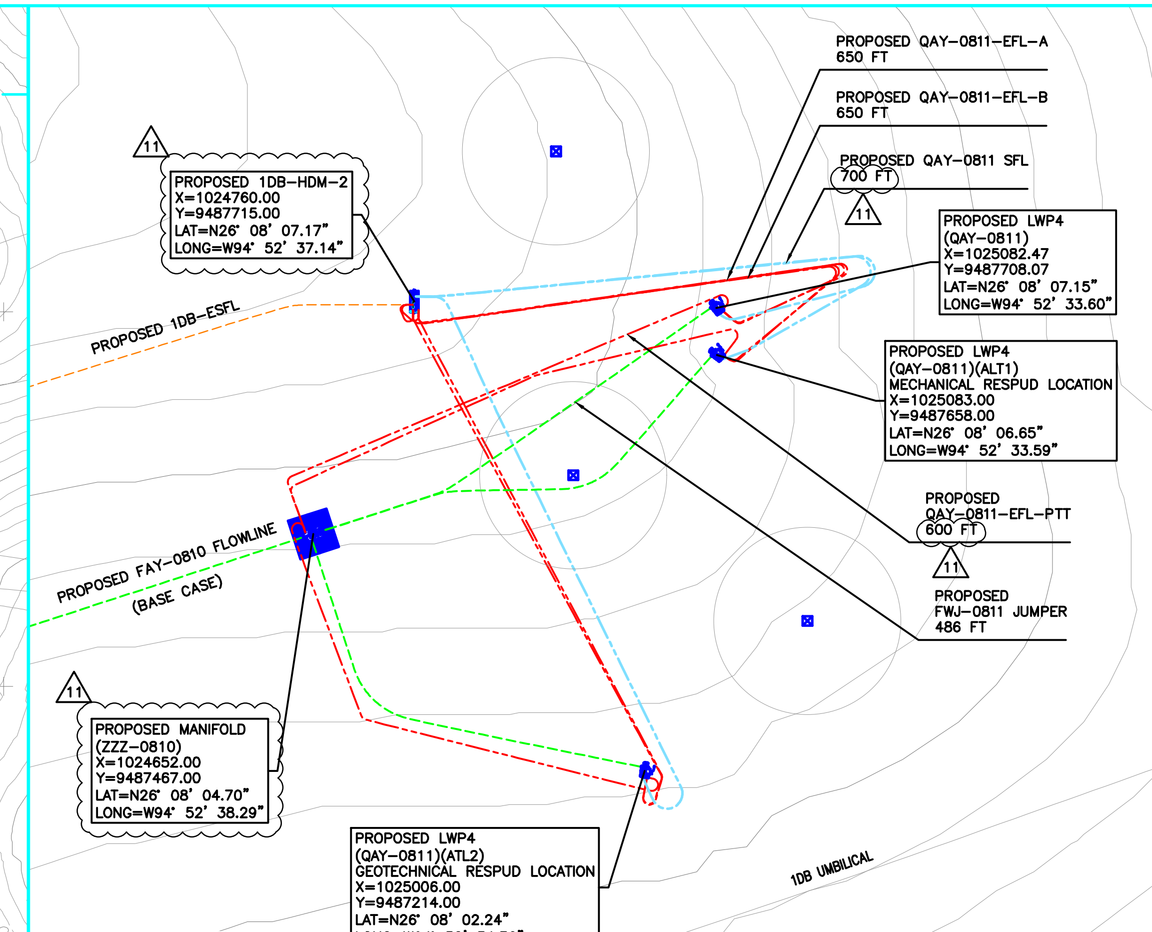
- Fuel hoses and SBM are changed on annual basis.
- TODO or (KLAW) spill prevention fittings are installed on all liquid take on hoses.
- Waste paint thinner is collected and sent ashore for disposal.
- Shell has obtained ISO14001 certification.
- Shell uses low sulfur fuel.

G. Description of Previously Approved Lease Activities

The leases are held by current production.

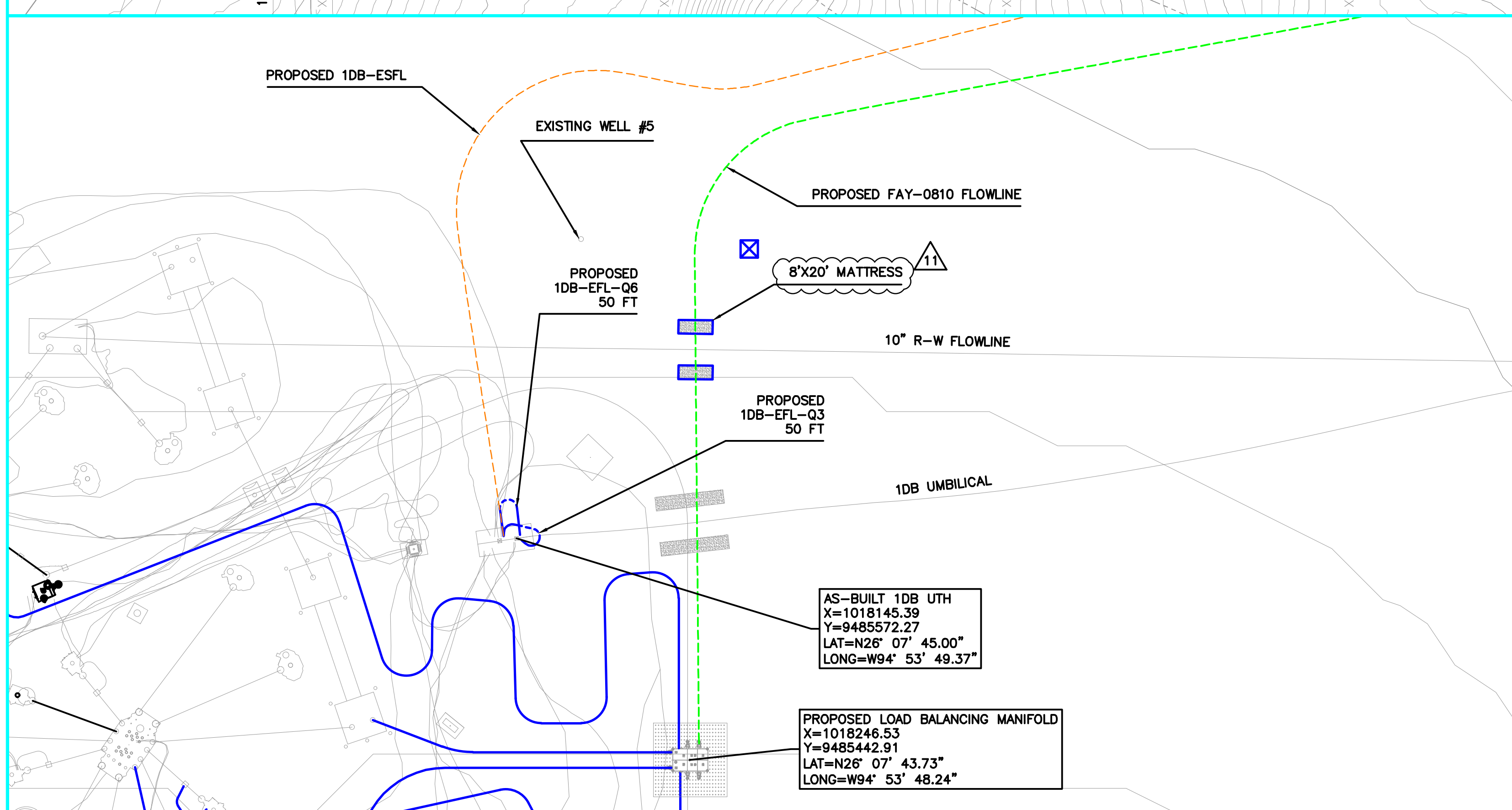
Attachment 1A.1 - Field Layout (Well LWP4)





DETAIL 1

SCALE: 1"=100'



DETAIL 2

SCALE: 1"=50'

LEGEND

- PROPOSED FLOWLINE & JUMPERS
- PROPOSED ESFL
- PROPOSED LEAD – SFL
- PROPOSED LEAD – EFL
- PROPOSED EQUIPMENT
- EXISTING EQUIPMENT

GEODETIC PARAMETERS

HORIZONTAL COORDINATE REFERENCE SYSTEM

CRS Name (EPSG):	NAD27/ BLM 15N (ftUS)
Alias:	NAD27/ UTM zone 15N (ftUS)
CRS Code (EPSG):	32065
TRANSFORMATION:	NAD27 to NAD83(1) [1241]
Map Units:	US survey feet

VERTICAL COORDINATE REFERENCE SYSTEM

Vertical Datum	Mean Sea Level
Elevation/Depth	Depth
Vertical Units:	Feet

REV	DATE	DESCRIPTION	DRAWN	CHK or TECH REP	DES ENG.	PROJ ENG.
011	2023-05-09	ISSUED FOR INFORMATION	MGS	JM	JM	AB
010	2023-05-09	APPROVED	MGS	JM	JM	AB
009	2023-03-27	ISSUED FOR APPROVAL	MGS	JM	JM	AB
008	2023-01-19	ISSUED FOR APPROVAL	MGS	JM	JM	AB
007	2022-06-16	ISSUED FOR REVIEW	MGS	JM	JM	AB

SHELL EXPLORATION & PRODUCTION COMPANY

SIEP SHELL INTERNATIONAL EXPLORATION AND PRODUCTION INC. - EPPROJECTS

PERDIDO PHASE 3 NORTH – PROPOSED SUBSEA LAYOUT

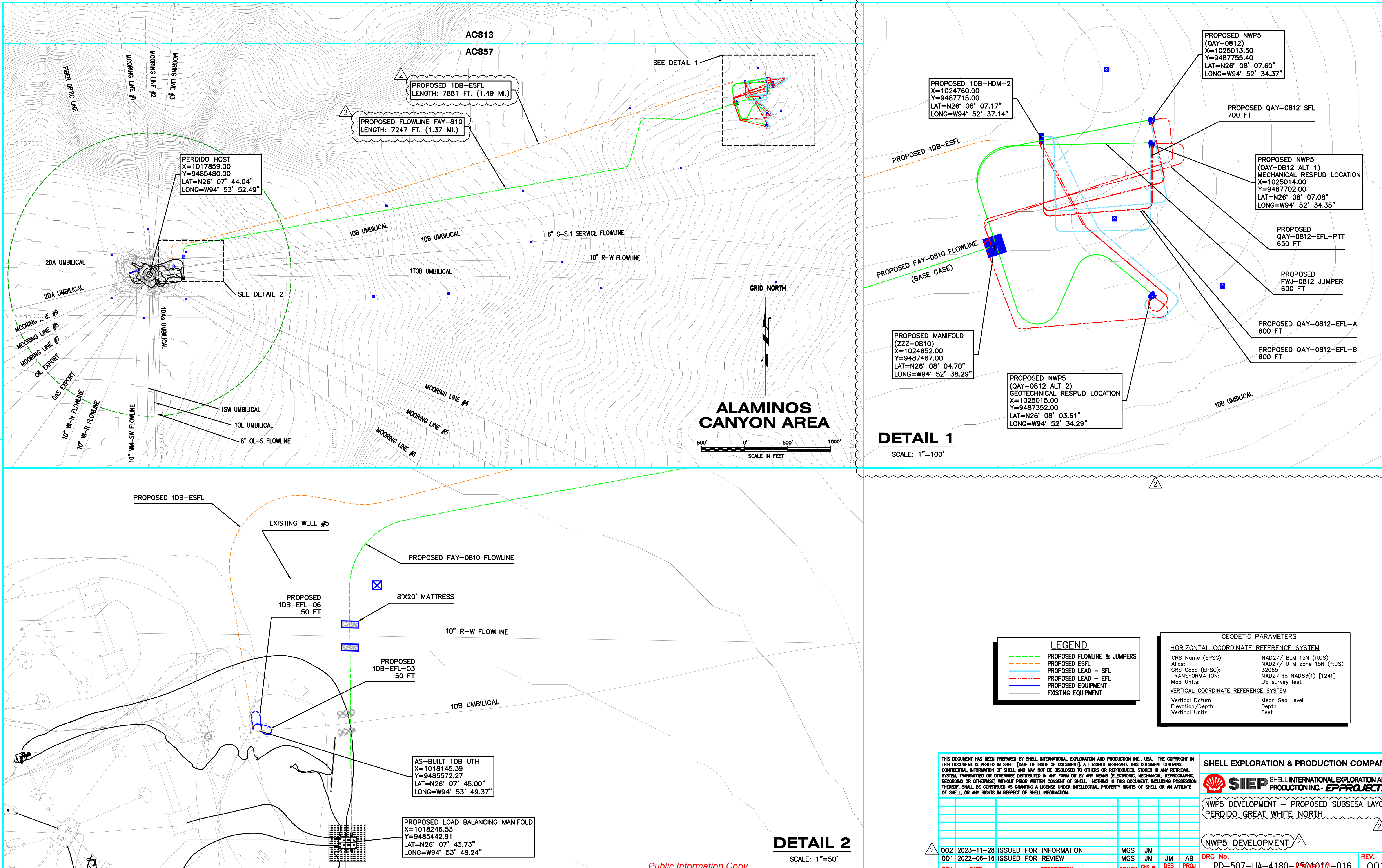
PERDIDO DEVELOPMENT

DRG No. PD-507-UA-4180-2501010-007 REV. 011

martin.soto 5/9/2023 3:08:16 PM C:\VaultWorkingFolder\Projects\247325 Shell Drafting Support\Perdido\Tie-backs\DVA Load Balancing\ACAD Deliverables\PD-507-UA-4180-2501010-007.dwg

THIS DOCUMENT HAS AN ECCN OF EAR99

Attachment 1A.2 - Field Layout (Well NWP5)



martin.soto 11/28/2023 9:27:44 AM C:\VaultWorkingFolder\Projects\247325 Shell Drafting Support\Perdido\Tie-backs\DVA Load Balancing\ACAD Deliverables\PD-507-UA-4180-2501010-016.dwg

THIS DOCUMENT HAS AN ECCN OF EAR99

OCS PLAN INFORMATION FORM

General Information				
Type of OCS Plan:		Exploration Plan (EP)	Development Operations Coordination Document (DOCD)	X

Company Name: Shell Offshore Inc.	BOEM Operator Number: 0689
Address: 701 Poydras St., Room 2418	Contact Person: Robin Voosen
New Orleans, LA 70131	Phone Number: 832.337.2168
	Email Address: robin.voosen@shell.com

If a service fee is required under 30 CFR 550.125(a) provide:	Amount Paid: $30,102.00	Receipt Nos. 279CUV0B & 279DNTS0

Project and Worst-Case Discharge (WCD) Information

Lease(s) OCS-G 17565	Area: AC	Block(s): 857	Project Name: Perdido

Objectives(s):	X	Oil		Gas		Sulphur		Salt	Onshore Support Base(s) Fourchon & Galveston

Platform/Well Name: GA014	Total Volume of WCD: 129,000 BOPD	API Gravity: 34°

Distance to Closest Land (Miles): 142	Volume from uncontrolled blowout: 53 MMBO

Have you previously provided information to verify the calculations and assumptions of your WCD?	X	Yes		No
If so, provide the Control Number of the EP or DOCD with which this information was provided	R-5144			
Do you propose to use new or unusual technology to conduct your activities?		Yes	X	No
Do you propose to use a vessel with anchors to install or modify a structure?		Yes	X	No
Do you propose any facility that will serve as a host facility for Deepwater subsea development?		Yes	X	No

Description of Proposed Activities and Tentative Schedule (Mark all that apply)

Proposed Activity	**Start Date**	**End Date**	**No. of Days**
Exploratory drilling			
Development drilling			
Well completion and well flow testing			
Well test flaring (for more than 48 hours)			
Installation or modification of structure			
Installation of production facilities			
Installation of subsea wellheads and/or dry hole tree			
Installation of lease term pipelines – jumper/flying lead/umbilical installation	2024	2029	280/yr
Commence production – 6 new subsea wells	2024	2029	280/yr
Other (Specify and attach description) Future well work	2024	2029	280/yr

Description of Drilling Rig				**Description of Structure**			
	Jackup	x	Drillship		Caisson		Tension Leg Platform
	Gorilla Jackup		Platform rig		Fixed Platform		Compliant Tower
	Semisubmersible		Submersible		Spar Other		Guyed tower
x	DP Submersible		Other (attached description)		Floating production system	X	Subsea manifold

Drilling Rig Name (If known): DW Proteus or similar drillship, Development Driller III or similar DP semi

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
AC857 (6 Jumpers/flying leads/umbilicals)	AC857	6”	~450-1200 feet
AC857 Production Flowline	AC857	6”	~450-1200 feet
AC857 Northeast Manifold / LBM	AC857		

Attachment 1C – Future Well Work

Proposed Well/Structure Location						
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD001		Previously reviewed under an approved EP or DOCD? R-5144	X	Yes		No

Is this an existing well or structure?		X Yes		No	If this is an existing well or structure, list the Complex ID or API Number:	608054007300

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	34°	
	Surface Location	**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**		
Lease Number	OCS-G 17565	OCS-G 17565		OCS OCS		
Area Name	Alaminos Canyon	Alaminos Canyon				
Block No.	857	857				
Blockline Departure (in feet)	N/S Departure: 3,581' FSL			N/S Departure: N/S Departure:		
	E/W Departure: 4,404' FWL			E/W Departure: E/W Departure:		
Lambert X-Y Coord.	X: 1,018,163			X:		
	Y: 9,475,900			Y:		
Lat/Long	Latitude: 26.1025 N			Latitude		
	Longitude: -94.8965 W			Longitude		
Water Depth (Feet): 7,995'				MD (Feet)	TVD (Feet)	
Anchor Radius (if applicable) in feet:						

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1D– Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD002	Previously reviewed under an approved EP or DOCD? R-6668	X	Yes		No

Is this an existing well or structure?	X	Yes		No	If this is an existing well or structure, list the Complex ID or API Number:	608054008300

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	Alaminos Canyon	Alaminos Canyon	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 5,869' FSL		N/S Departure: N/S Departure:
	E/W Departure: 6,868' FEL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,022,732		X:
	Y: 9,478,189		Y:
Lat/Long	Latitude: 26.1090		Latitude
	Longitude: -94.8827		Longitude

Water Depth (Feet): 8,432'			MD (Feet)	TVD (Feet)

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1E – Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD003	Previously reviewed under an approved EP or DOCD? R-6665	X	Yes		No

Is this an existing well or structure?	X	Yes		No	If this is an existing well or structure, list the Complex ID or API Number:	608054008200

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	Alaminos Canyon	Alaminos Canyon	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 3,515' FSL		N/S Departure: N/S Departure:
	E/W Departure: 4,553' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,018,313		X:
	Y: 9,475,835		Y:
Lat/Long	Latitude: 26.1023		Latitude
	Longitude: -94.8961		Longitude

Water Depth (Feet): 8,008'			MD (Feet)	TVD (Feet)
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1F - Future Well Work

Proposed Well/Structure Location						
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD004		Previously reviewed under an approved EP or DOCD? S7953 & S7994	X	Yes		No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	608054009000

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 2,923' FSL		N/S Departure: N/S Departure:
	E/W Departure 6,285' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,045		X:
	Y: 9,475,243		Y:
Lat/Long	Latitude: 26.100827		Latitude
	Longitude: -94.8908013		Longitude

Water Depth (Feet): 8,168'			MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1G- Future Well Work

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD005			Previously reviewed under an approved EP or DOCD? S7953 & S7994	X	Yes		No
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	608054009100	
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?				X	Yes		No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°			

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 17565	OCS OCS
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 3,138' FSL		N/S Departure: N/S Departure:
	E/W Departure 6,358' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 1,020,118		X:
	Y: 9,475,458		Y:
Lat/Long	Latitude: 26.101422		Latitude
	Longitude: -94.8905874		Longitude

Water Depth (Feet): 8,158'			MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1H - Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD006	Previously reviewed under an approved EP or DOCD? S7953 & S7994	X	Yes		No

Is this an existing well or structure?	X	Yes		No	If this is an existing well or structure, list the Complex ID or API Number:	608054008800

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**	
Lease Number	OCS-G 17565	OCS-G 17565		OCS OCS	
Area Name	AC	AC			
Block No.	857	857			
Blockline Departure (in feet)	N/S Departure: 4,019' FSL			N/S Departure: N/S Departure:	
	E/W Departure 5,054' FWL			E/W Departure: E/W Departure:	
Lambert X-Y Coord.	X: 1,018,814			X:	
	Y: 9,476,339			Y:	
Lat/Long	Latitude: 26.1037933			Latitude	
	Longitude: -94.8945992			Longitude	
Water Depth (Feet): 8,027'				MD (Feet)	TVD (Feet
Anchor Radius (if applicable) in feet:					

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1I - Future Well Work

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD007			Previously reviewed under an approved EP or DOCD? S7953 & S7994		X	Yes	No
Is this an existing well or structure?	X	Yes	No	If this is an existing well or structure, list the Complex ID or API Number:		608054008900	
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?					X	Yes	No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD		For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid		34°	
	Surface Location		**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**			
Lease Number	OCS-G 17565		OCS-G 17565	OCS OCS			
Area Name	AC		AC				
Block No.	857		857				
Blockline Departure (in feet)	N/S Departure: 5,792' FSL			N/S Departure: N/S Departure:			
	E/W Departure 7,010' FEL			E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 1,022,590			X:			
	Y: 9,478,112			Y:			
Lat/Long	Latitude: 26.1088214			Latitude			
	Longitude: -94.8831733			Longitude			
Water Depth (Feet): 8,399'				MD (Feet)		TVD (Feet	
Anchor Radius (if applicable) in feet:							

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1J – Future Well Work

<table>
<tr><th colspan="8">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD008</td><td colspan="2">Previously reviewed under an approved EP or DOCD? S-8064</td><td>X Yes</td><td>No</td></tr>
<tr><td colspan="2">Is this an existing well or structure? Yes X No</td><td colspan="4">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">608054010200</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X Yes</td><td>No</td></tr>
<tr><td>WCD Info</td><td>For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="3">For structures, volume of all storage and pipelines (bbls): NA</td><td>API Gravity of fluid</td><td colspan="2">34°</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="3">Bottom Hole Location (for Wells)</td><td colspan="3">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td>OCS-G 17565</td><td colspan="3">OCS-G 17565</td><td colspan="3">OCS
OCS</td></tr>
<tr><td>Area Name</td><td>AC</td><td colspan="3">AC</td><td colspan="3"></td></tr>
<tr><td>Block No.</td><td>857</td><td colspan="3">857</td><td colspan="3"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td>N/S Departure: 4,600’ FSL</td><td colspan="3"></td><td colspan="3">N/S Departure:
N/S Departure:</td></tr>
<tr><td>E/W Departure 1,154’ FWL</td><td colspan="3"></td><td colspan="3">E/W Departure:
E/W Departure:</td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td>X: 1,014,914</td><td colspan="3"></td><td colspan="3">X:</td></tr>
<tr><td>Y: 9,476,920</td><td colspan="3"></td><td colspan="3">Y:</td></tr>
<tr><td rowspan="2">Lat/Long</td><td>Latitude: 26.1052361</td><td colspan="3"></td><td colspan="3">Latitude</td></tr>
<tr><td>Longitude: -94.9065072</td><td colspan="3"></td><td colspan="3">Longitude</td></tr>
<tr><td colspan="2">Water Depth (Feet): 7,519’</td><td></td><td colspan="2"></td><td>MD (Feet)</td><td colspan="2">TVD (Feet</td></tr>
<tr><td colspan="8">Anchor Radius (if applicable) in feet:</td></tr>
<tr><td colspan="8">Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</td></tr>
</table>

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1K - Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD010	Previously reviewed under an approved EP or DOCD? S-8098	X	Yes		No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 17565	
Area Name	AC	AC	
Block No.	857	857	
Blockline Departure (in feet)	N/S Departure: 5,680' FSL		
	E/W Departure 6,800' FEL		
Lambert X-Y Coord.	X: 1,022,800		
	Y: 9,478,000		
Lat/Long	Latitude: 26.1085217		
	Longitude: -94.8825286		

Water Depth (Feet): 8,430'				

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1L - Future Well Work

<table>
<tr><th colspan="9">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD010 Alt-A</td><td colspan="2">Previously reviewed under an approved EP or DOCD? S-8098</td><td>X</td><td>Yes</td><td>No</td></tr>
<tr><td>Is this an existing well or structure?</td><td></td><td>Yes</td><td>X</td><td>No</td><td colspan="2">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">NA</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X</td><td>Yes</td><td>No</td></tr>
<tr><td>WCD Info</td><td colspan="3">For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td>For structures, volume of all storage and pipelines (bbls): NA</td><td>API Gravity of fluid</td><td colspan="3">34°</td></tr>
<tr><td></td><td colspan="3">Surface Location</td><td>Bottom Hole Location (for Wells)</td><td colspan="4">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td colspan="3">OCS-G 17565</td><td>OCS-G 17565</td><td colspan="4"></td></tr>
<tr><td>Area Name</td><td colspan="3">AC</td><td>AC</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td colspan="3">857</td><td>857</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td colspan="3">N/S Departure: 5,660’ FSL</td><td></td><td colspan="4"></td></tr>
<tr><td colspan="3">E/W Departure 6,850’ FEL</td><td></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td colspan="3">X: 1,022,750</td><td></td><td colspan="4"></td></tr>
<tr><td colspan="3">Y: 9,477,980</td><td></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lat/Long</td><td colspan="3">Latitude: 26.1085217</td><td></td><td colspan="4"></td></tr>
<tr><td colspan="3">Longitude: -94.8825286</td><td></td><td colspan="4"></td></tr>
<tr><td colspan="4">Water Depth (Feet): 8,430’</td><td></td><td></td><td colspan="2"></td><td></td></tr>
<tr><td colspan="9">Anchor Radius (if applicable) in feet:</td></tr>
<tr><td colspan="9">Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</td></tr>
</table>

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1M - Future Well Work

<table>
<tr><th colspan="8">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD010 Alt-B</td><td colspan="2">Previously reviewed under an approved EP or DOCD? S-8098</td><td>X</td><td>Yes</td><td></td><td>No</td></tr>
<tr><td>Is this an existing well or structure?</td><td></td><td>Yes</td><td>X</td><td>No</td><td colspan="2">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">NA</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X</td><td>Yes</td><td></td><td>No</td></tr>
<tr><td>WCD Info</td><td>For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="2">For structures, volume of all storage and pipelines (bbls): NA</td><td>API Gravity of fluid</td><td colspan="2">34°</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="2">Bottom Hole Location (for Wells)</td><td colspan="2">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td>OCS-G 17565</td><td colspan="2">OCS-G 17565</td><td colspan="2"></td></tr>
<tr><td>Area Name</td><td>AC</td><td colspan="2">AC</td><td colspan="2"></td></tr>
<tr><td>Block No.</td><td>857</td><td colspan="2">857</td><td colspan="2"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td>N/S Departure: 5,630’ FSL</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>E/W Departure 6,960’ FEL</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td>X: 1,022,640</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Y: 9,477,950</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td rowspan="2">Lat/Long</td><td>Latitude: 26.1083777</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td>Longitude: -94.8830139</td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="2">Water Depth (Feet): 8,430’</td><td></td><td></td><td></td><td></td></tr>
<tr><td colspan="6">Anchor Radius (if applicable) in feet:</td></tr>
<tr><th colspan="6">Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</th></tr>
</table>

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1N - Future Well Work

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD011			Previously reviewed under an approved EP or DOCD? S-8098	X	Yes		No
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA	
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?				X	Yes		No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°			

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 20870	
Area Name	AC	AC	
Block No.	857	856	
Blockline Departure (in feet)	N/S Departure: 3,985' FSL		
	E/W Departure 1,085' FWL		
Lambert X-Y Coord.	X: 1,014,845		
	Y: 9,476,305		
Lat/Long	Latitude: 26.103539		
	Longitude: -94.9066889		
Water Depth (Feet): 7,542'			
Anchor Radius (if applicable) in feet:			

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1O - Future Well Work

<table>
<tr><th colspan="8">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD011 Alt-A</td><td colspan="2">Previously reviewed under an approved EP or DOCD? S-8098</td><td>X Yes</td><td>No</td></tr>
<tr><td>Is this an existing well or structure?</td><td>Yes</td><td>X No</td><td colspan="3">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">NA</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X Yes</td><td>No</td></tr>
<tr><td>WCD Info</td><td>For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="2">For structures, volume of all storage and pipelines (bbls): NA</td><td>API Gravity of fluid</td><td colspan="3">34°</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="2">Bottom Hole Location (for Wells)</td><td colspan="4">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td>OCS-G 17565</td><td colspan="2">OCS-G 20870</td><td colspan="4"></td></tr>
<tr><td>Area Name</td><td>AC</td><td colspan="2">AC</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td>857</td><td colspan="2">856</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td>N/S Departure: 3,951' FSL</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>E/W Departure 1,124' FWL</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td>X: 1,014,884</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Y: 9,476,271</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lat/Long</td><td>Latitude: 26.1034484</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Longitude: -94.9065692</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td colspan="2">Water Depth (Feet): 7,542'</td><td></td><td></td><td></td><td colspan="3"></td></tr>
<tr><td colspan="8">Anchor Radius (if applicable) in feet:</td></tr>
<tr><td colspan="8">Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</td></tr>
</table>

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1P - Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD012	Previously reviewed under an approved EP or DOCD? S-8098		Yes	X	No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 20870	
Area Name	AC	AC	
Block No.	857	856	
Blockline Departure (in feet)	N/S Departure: 3,835' FSL		
	E/W Departure 1,092' FWL		
Lambert X-Y Coord.	X: 1,014,852		
	Y: 9,476,155		
Lat/Long	Latitude: 26.1031275		
	Longitude: -94.9066621		
Water Depth (Feet): 7,542'			
Anchor Radius (if applicable) in feet:			

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1Q - Future Well Work

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): GD012 Alt-A			Previously reviewed under an approved EP or DOCD? S-8098	X	Yes		No
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA	
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?				X	Yes		No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD		For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	34°	
	Surface Location		**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**		
Lease Number	OCS-G 17565		OCS-G 20870				
Area Name	AC		AC				
Block No.	857		856				
Blockline Departure (in feet)	N/S Departure: 3,801' FSL						
	E/W Departure 1,131' FWL						
Lambert X-Y Coord.	X: 1,014,891						
	Y: 9,476,121						
Lat/Long	Latitude: 26.1030361						
	Longitude: -94.9065412						
Water Depth (Feet): 7,542'							
Anchor Radius (if applicable) in feet:							

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1R - Future Well Work

<table>
<tr><th colspan="8">Proposed Well/Structure Location</th></tr>
<tr><td colspan="4">Well or Structure Name/Number (if renaming well or structure, reference previous name): GD012 Alt-B</td><td colspan="2">Previously reviewed under an approved EP or DOCD? S-8098</td><td>X Yes</td><td>No</td></tr>
<tr><td>Is this an existing well or structure?</td><td>Yes</td><td>X No</td><td colspan="3">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="2">NA</td></tr>
<tr><td colspan="6">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X Yes</td><td>No</td></tr>
<tr><td>WCD Info</td><td>For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="2">For structures, volume of all storage and pipelines (bbls): NA</td><td colspan="2">API Gravity of fluid</td><td colspan="2">34°</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="2">Bottom Hole Location (for Wells)</td><td colspan="4">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td>OCS-G 17565</td><td colspan="2">OCS-G 17570</td><td colspan="4"></td></tr>
<tr><td>Area Name</td><td>AC</td><td colspan="2">AC</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td>857</td><td colspan="2">900</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td>N/S Departure: 3,835' FSL</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>E/W Departure 1,092' FWL</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td>X: 1,014,852</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Y: 9,476,155</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lat/Long</td><td>Latitude: 26.1031275</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td>Longitude: -94.9066621</td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td colspan="2">Water Depth (Feet): 7,542'</td><td></td><td></td><td colspan="2"></td><td colspan="2"></td></tr>
<tr><td colspan="8">Anchor Radius (if applicable) in feet:</td></tr>
</table>

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1S - New Well and Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): LWP4	Previously reviewed under an approved EP or DOCD? S-8098	X	Yes		No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 17565	OCS-G 17561	
Area Name	AC	AC	
Block No.	857	813	
Blockline Departure (in feet)	N/S Departure: 452' FNL		
	E/W Departure 4,518' FEL		
Lambert X-Y Coord.	X: 1,025,082.47		
	Y: 9,487,708.07		
Lat/Long	Latitude: 26.135318		
	Longitude: -94.8760025		
Water Depth (Feet): 8,250'			

Anchor Radius (if applicable) in feet:

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1T - New Well and Future Well Work

<table>
<tr><th colspan="12">Proposed Well/Structure Location</th></tr>
<tr><td colspan="6">Well or Structure Name/Number (if renaming well or structure, reference previous name): LWP4-Alt1</td><td colspan="2">Previously reviewed under an approved EP or DOCD? S-8098</td><td>X</td><td>Yes</td><td></td><td>No</td></tr>
<tr><td>Is this an existing well or structure?</td><td></td><td>Yes</td><td>X</td><td>No</td><td colspan="3">If this is an existing well or structure, list the Complex ID or API Number:</td><td colspan="4">NA</td></tr>
<tr><td colspan="7">Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?</td><td>X</td><td>Yes</td><td></td><td colspan="2">No</td></tr>
<tr><td>WCD Info</td><td colspan="2">For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD</td><td colspan="3">For structures, volume of all storage and pipelines (bbls): NA</td><td colspan="2">API Gravity of fluid</td><td colspan="4">34°</td></tr>
<tr><td></td><td colspan="2">Surface Location</td><td colspan="3">Bottom Hole Location (for Wells)</td><td colspan="6">Completion (for multiple enter separate lines)</td></tr>
<tr><td>Lease Number</td><td colspan="2">OCS-G 17565</td><td colspan="3">OCS-G 17561</td><td colspan="6"></td></tr>
<tr><td>Area Name</td><td colspan="2">AC</td><td colspan="3">AC</td><td colspan="6"></td></tr>
<tr><td>Block No.</td><td colspan="2">857</td><td colspan="3">813</td><td colspan="6"></td></tr>
<tr><td rowspan="2">Blockline Departure (in feet)</td><td colspan="2">N/S Departure: 502’ FNL</td><td colspan="3"></td><td colspan="6"></td></tr>
<tr><td colspan="2">E/W Departure 4,517’ FEL</td><td colspan="3"></td><td colspan="6"></td></tr>
<tr><td rowspan="2">Lambert X-Y Coord.</td><td colspan="2">X: 1,025,083</td><td colspan="3"></td><td colspan="6"></td></tr>
<tr><td colspan="2">Y: 9,487,658</td><td colspan="3"></td><td colspan="6"></td></tr>
<tr><td rowspan="2">Lat/Long</td><td colspan="2">Latitude: 26.1351805</td><td colspan="3"></td><td colspan="6"></td></tr>
<tr><td colspan="2">Longitude: -94.8759972</td><td colspan="3"></td><td colspan="6"></td></tr>
<tr><td colspan="3">Water Depth (Feet): 8,250’</td><td></td><td colspan="2"></td><td colspan="2"></td><td colspan="4"></td></tr>
<tr><td colspan="12">Anchor Radius (if applicable) in feet:</td></tr>
<tr><th colspan="12">Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)</th></tr>
</table>

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1U - New Well and Future Well Work

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): LWP4-Alt2			Previously reviewed under an approved EP or DOCD? S-8098	X	Yes		No
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA	
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?					X	Yes	No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	34°		
	Surface Location	**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**			
Lease Number	OCS-G 17565	OCS-G 17561					
Area Name	AC	AC					
Block No.	857	813					
Blockline Departure (in feet)	N/S Departure: 946' FNL						
	E/W Departure 4,594' FEL						
Lambert X-Y Coord.	X: 1,025, 006						
	Y: 9,487,214						
Lat/Long	Latitude: 26.133956						
	Longitude: -94.8762123						
Water Depth (Feet): 8,250'							
Anchor Radius (if applicable) in feet:							

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1V - New Well and Future Well Work

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): NWP5				Previously reviewed under an approved EP or DOCD? S-8098	X	Yes	No
Is this an existing well or structure?		Yes	X No	If this is an existing well or structure, list the Complex ID or API Number:	NA		
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?					X	Yes	No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	34°		
	Surface Location	**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**			
Lease Number	OCS-G 17565	OCS-G 17561					
Area Name	AC	AC					
Block No.	857	813					
Blockline Departure (in feet)	N/S Departure: 405' FNL						
	E/W Departure 4,587' FEL						
Lambert X-Y Coord.	X: 1,025,013.50						
	Y: 9,487,755.40						
Lat/Long	Latitude: 26.1354457						
	Longitude: -94.8762133						
Water Depth (Feet): 8,500'							
Anchor Radius (if applicable) in feet:							

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1W - New Well and Future Well Work

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): NWP5-Alt1	Previously reviewed under an approved EP or DOCD? S-8098	X	Yes		No

Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA

Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?	X	Yes		No

WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°
	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**	
Lease Number	OCS-G 17565	OCS-G 17561		
Area Name	AC	AC		
Block No.	857	813		
Blockline Departure (in feet)	N/S Departure: 458' FNL			
	E/W Departure 4,586' FEL			
Lambert X-Y Coord.	X: 1,025,014			
	Y: 9,487,702			
Lat/Long	Latitude: 26.1352988			
	Longitude: -94.8762094			
Water Depth (Feet): 8,500'				
Anchor Radius (if applicable) in feet:				

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)					
Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

Attachment 1X - New Well and Future Well Work

Proposed Well/Structure Location								
Well or Structure Name/Number (if renaming well or structure, reference previous name): NWP5-Alt2				Previously reviewed under an approved EP or DOCD? S-8098		X	Yes		No
Is this an existing well or structure?		Yes	X	No	If this is an existing well or structure, list the Complex ID or API Number:	NA			
Do you plan to use a subsea BOP or a surface BOP on a floating facility to conduct your proposed activities?					X	Yes		No
WCD Info	For wells, volume of uncontrolled Blowouts (bbls/day): 129,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	34°				

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 17565	OCS-G 17561	
Area Name	AC	AC	
Block No.	857	813	
Blockline Departure (in feet)	N/S Departure: 808' FNL		
	E/W Departure 4,585' FEL		
Lambert X-Y Coord.	X: 1,025,015		
	Y: 9,487,352		
Lat/Long	Latitude: 26.134336		
	Longitude: -94.876191		
Water Depth (Feet): 8,500'			
Anchor Radius (if applicable) in feet:			

Anchor locations for drilling rig or construction barge (if anchor radius is supplied above, not necessary)

Anchor Name or No.	Area	Block	X Coordinate	Y Coordinate	Length of Anchor Chain on Seafloor
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	
			X=	Y=	

SECTION 2: GENERAL INFORMATION

A. Application and Permits

There are no individual or site-specific permits other than general NPDES permit and rig move notification that need to be obtained for future well work. Prior to beginning rig operations, the appropriate Bureau of Safety and Environmental Enforcement (BSEE) permits will be approved.

B. Drilling Fluids

See Section 7, Tables 7A and 7B for drilling fluids to be used and disposal of same.

C. Production

Type	Average Production Rate	Peak Production Rate	Life of Reservoir
Oil	**Proprietary Data**		
Gas			

D. Oil Characteristics

Provide the estimated chemical and physical characteristics of the oils that will be handled, stored, or transported on/by the facility.

Characteristic	Analytical Methodologies Should Be Compatible With:
1. Gravity (API) 36 (Flash Measurement)	**ASTM D4052**
2. Flash Point (°C)	**ASTM D93/IP 34**
3. Pour Point (°C) -20 deg C	**ASTM D97**
4. Viscosity (Centipoise at 25 ˚C) 0.36	**ASTM D445**
5. Wax Content (wt %)	**Precipitate with 2-butanon/dichloromethane (1 to 1 volume) at -10 ˚C**
6. Asphaltene Content (wt %)	**IP-Method 143/84**
7. Resin Content (wt %)	**Jokuty et al., 1996**
8. Boiling point distribution including, for each fraction, the percent volume or weight and the boiling point range in ˚C	**ASTM D2892 (TBP distillation) or ASTM D2887/5307**
9. Sulphur (wt %) 1.24	**ASTM D4294**

Note: If the distillation information in Item No. 8 in the above table is not available, the GOMR may accept the following information in lieu of Items Nos. 5, 6, 7, and 8: weight percent total of saturates, aromatics, waxes, asphaltenes, and resins; and total BTEX (ppm) using analytical methods compatible with the Hydrocarbon Groups methodology found in Jokuty et al., 1996.

All in wt% Topped Basis

SARA (Topped Basis) All in wt %				
Well #	Saturates	Aromatics	Resin	Asphaltenes
OCS-G-17565 AC857 #1	49.1	43.2	7.6	0.15
OCS-G-17565 AC857 #1 BP1	50.2	41.7	8.0	0.13

Oil from one well	Oil from more than one well sampled on a facility	Oil from a pipeline system
·Area/Block-**SeeTable Below** ·BSEE platform ·API Well No. ·Completion perforation interval ·Reservoir name ·Sample date ·Sample No.(if more than one is taken)	·Area/Block ·Platform ID ·Field/Unit ·Sample date ·Sample No. (if more than one is taken) ·Listing of API Well Nos. ·Storage tank ID No. (if sampled at a storage tank)	·Pipeline segment number ·For each pipeline that feeds into the system, the ID codes for the closest upstream LACT units and/or facility measurement points ·Storage tank ID No. (if sampled at a storage tank)

Sample Detail:

Area/Block	AC857	AC857	AC813	AC813	AC813	AC857
MMS platform	OCS-G-17565#1	OCS-G-17565#1BP#1	OCS-G-17561#1	OCS-G-17561#1	OCS-G-17561#1	OCS-G-17655 #3 & #3ST1
API Well No.	608054001800	608054001801	608054002200	608054002200	608054002200	608054002300
Completion perforation	13834.9 ft MD	13855 ft MD	14899 ft MD	14926.1 ft MD	14952.1 ft MD	14450 ft MD
MMS's reservoir name	WM12	WM12	WM12 (Upper)	WM12 (Middle)	WM12 (Lower)	WM12
Sample date	13-Apr-02	23-Apr-02	5-15-Dec-2002	5-15-Dec-2002	5-15-Dec-2002	1-Nov-03
Sample No.(if more than one is taken)	NG-O-3661A	NG-O-3672A	NG-O-4184	NG-O-4188	NG-O-4201	NG-O-4526A

E. New or Unusual Technology

Shell is not proposing to use new or unusual technology as defined in 30 CFR 250.200 to carry out the proposed activities in this Plan.

F. Bonding

The bond requirement for the activities proposed in this Plan are satisfied by an area-wide bond furnished and maintained according to 30 CFR Part 556.901, and Subpart I-Bonding; NTL No. 2015-N04, "General Financial Assurance."

G. Oil Spill Financial Responsibility (OSFR)

Shell Offshore Inc. (Shell), BOEM Operator Number 0689, has demonstrated oil spill financial responsibility for the activites proposed in this plan according to 30 CFR Parts 250 and 253, and NTL No. 2008-N05, "Guidelines for Oil Spill Financial Responsibility for Covered Facilities."

H. Deepwater well control statement

Shell Offshore Inc. (Shell), BOEM Operator Number 0689, has the financial capability to drill a relief well and conduct other emergency well control operations.

I. Suspension of Production

The operations proposed in this Plan are not under a Suspension of Production.

J. Blowout scenario

The blowout scenario for this area was provided by Shell and accepted by BOEM in plan R-5144 on September 1, 2011 for the Alaminos Canyon Block 857 Unit (Great White Field). The wells proposed in this Plan do not exceed this number.

Summary

This Section 2j was prepared by Shell Offshore Inc. (Shell) pursuant to the guidance provided in the Bureau of Ocean Energy Management Notice to Lessees (NTL) No. 2010-N06 with respect to blowout and worst case discharge scenario descriptions.

Shell focuses on an integrated, three-pronged approach to a blowout, including prevention, intervention /containment, and recovery. Shell believes that the best way to manage blowouts is to prevent them from happening. Maintaining well control at all times and thus preventing a blowout is the key focus of our operations. Significant effort goes into the design and execution of wells and into building and maintaining staff competence with the goal of safe and environmentally sound well construction. Shell continues to invest independently in Research and Development (R&D) to improve the safety and reliability of our well systems. Shell intends to comply with all applicable laws, regulations, rules, and Notice to Lessees.

Shell is a founding member of the Marine Well Containment Company (MWCC) and will have access to an integrated subsea well control and containment system that can be rapidly deployed through the MWCC. MWCC is a non-profit organization that owns, manages, and provides fully trained crews and operates the subsea containment system during a response. The near term containment response capability will include lessons learned and equipment used in the Macondo response. Shell is also investing in R&D to improve future containment systems. Shell is a member of Clean Caribbean America (CCA), Marine Spill Response Corporation (MSRC), Clean Gulf Associates (CGA), and OSRL/EARL to provide the resources necessary to respond to a spill as outlined in our Regional Oil Spill Response Plan.

The Worst Case Discharge (WCD) blowout scenario for the Alaminos Canyon Block 857 Unit (Great White Field) is calculated for the AC 814 GA014 proposed development well penetration of the target sand and based on the guidelines outlined in NTL No. 2010-N06 along with the subsequent Frequently Asked Questions (FAQ). Shell submitted AC 814 GA014 as the new worst-case scenario to the BOEM for inclusion in the previously approved Development Operations Coordination Document (DOCD) for Great White Field. In the unlikely event of a spill, Shell's Regional OSRP is designed to contain and respond to a spill that meets or exceeds this WCD. This WCD does not take into account potential flow mitigating factors such as well bridging, obstructions in the wellbore, reservoir barriers, or early intervention.

Uncontrolled blowout (volume first day)	129,000 bbl
Uncontrolled blowout rate (first 30-days average daily rate)	78,700 bopd
Duration of flow (days) based on relief well	100 days
Total volume of spill (bbls) for 100 days	5.4 MMBO

Table 1 Worst Case Discharge Summary

Great White Field Overview

The Alaminos Canyon Block 857 Unit (Great White Field) is located in the Gulf of Mexico approximately 200 miles south of Freeport, Texas in approximately 8,000 feet of water. The unit is comprised of Federal Outer Continental Shelf oil and gas leases OCS-G 24593 (AC 812), OCS-G 17561 (AC 813), the western half of OCS-G 20862 (AC 814), OCS-G 20870 (AC 856), OCS-G 17565 (AC 857), OCS-G 17570 (AC 900), and OCS-G 17571 (AC 901) formed in October 2007.

Purpose

Pursuant with 30 CFR 250.213(g), 250.219, 250.250, and NTL No. 2010-N06, this document provides a blowout scenario description, further information regarding any potential oil spill, the assumptions and calculations used to determine the worst case discharge (WCD) and the measures taken to: (1) enhance our ability to prevent a blowout and (2) respond and manage a blowout if it were to occur. These calculations are based on our best technical estimates of subsurface parameters that are derived from the Great White reservoir simulation model incorporating all Sand well control and the available high resolution 3D seismic data. The parameters are better than or consistent with the estimates used by Shell to justify the investment. Therefore, these assumed parameters were used to calculate the WCD. They do not reflect probabilistic estimates.

Background

This attachment has been developed to document the additional information requirements for Development Operations Coordination Documents (DOCD) as requested by NTL No. 2010-N06 in response to the explosion and sinking of the Mobile Offshore Drilling Unit (MODU) Deepwater Horizon and the resulting subsea well blowout and recovery operations of the exploration well at the MC-252 Macondo location.

Information Requirements

Blowout scenario

All development well locations in the approved Great White DOCD were assessed for WCD. The AC814 GA014 well represented the highest flow potential. The WCD blowout scenario was calculated for the GA014 penetration of the Sand and based on the guidelines outlined in NTL No. 2010-N06 and subsequent Frequently Asked Questions (FAQ) documents. The AC814 GA014 well will be drilled using the H&P 205 Perdido Spar platform rig with a high-pressure riser and surface BOP. The well will be deepened to the target sand as outlined in the Geological and Geophysical Information Section of the Supplemental DOCD, using a typical subsea wellhead system and casing program that will be described in detail later and is also shown in the attachments. A hydrocarbon influx and a well control event are modeled to occur from the reservoir. The simulated blowout modeled results in unrestricted flow from the well at the surface which represents the WCD scenario (no restrictions in the wellbore, failure/loss of the surface BOP, and a blowout to the surface).

Estimated flow rate of the potential blowout

Category	
Type of Activity	Drilling
Facility Location (area/block)	AC857
Facility Designation	Perdido Spar HP205 Platform Rig
Distance to Nearest Shoreline (miles)	142 miles
Uncontrolled blowout (volume first day)	129,000 bbl
Uncontrolled blowout rate (first 30-days average daily rate)	78,700 bopd

Table 2: Estimated Flow Rates of a Potential Blowout

Total volume and maximum duration of the potential blowout

Duration of flow (days)	100 days total duration to drill relief well (14 rig mob, 4 transit, 52 spud to top WM12, 30 ranging).
Total volume of spill (bbls)	5.4MMBO based on 100 days flowing. Note: From CMG IMEX dynamic reservoir models

Table 3: Estimated Duration and Volume of a Potential Blowout

There is a significant decline in the discharge rate as time proceeds, which is illustrated by the differences between the first 24-hour volume and 30-day average rate. At very short times, e.g. during the first 24 hours, the pressure profile in the reservoir changes from the moment the well first starts flowing to a pseudo-steady state pressure profile with time, and as a result the rate declines. At somewhat longer time scales, effects such as reservoir voidage and the impact of boundaries can cause the rate to drop continuously with production. Simulation and material balance models can include these effects and form the basis of the NTL No. 2010-N06 calculations for 24-hour and 30-day rates as well as maximum duration volumes.

Likelihood for intervention to stop the blowout

Safety of our operations is Shell's top priority. Maintaining well control at all times and thus preventing a blowout is the key focus of our operations. Our safe drilling record is based on our robust standards, conservative well design, prudent operations practices, competency of personnel, and strong HSE focus. Collectively, these constitute a robust system that make blowouts extremely rare events.

Intervention Devices: Notwithstanding these facts, the main scenario for recovery from a blowout event is via intervention with the BOP attached to the well. There are built in redundancies in the BOP system to allow activation of selected components with the intent to seal off the well bore. As a minimum, the Shell contracted rig fleet in the GOM will have redundancies meeting NTL No. 2010-N05 (to the extent applicable) and the Drilling Safety Rule.

The potential for surface intervention on the Perdido Spar depends greatly on the nature of the breach, the flow volume, and to a lesser degree, whether the well flowed predominantly oil or gas. A relatively small leak could probably be managed in several different ways. Larger flows would certainly provide a greater challenge, but could be handled, particularly if the flow could be diverted away from the work area. In the event of uncontrolled flow from a Perdido Spar well, the facility would most likely be evacuated. If the structure is erect, the feasibility of reentering the facility would need to be assessed due to the volatile nature of the situation. In the event that surface intervention is possible, the Shell Well Control Contingency Plan (WCCP) document would be utilized to coordinate relief planning.

The unique design of the Perdido Spar where all the wellheads are subsea also makes it possible to contain a well with a subsea BOP stack deployed from a MODU. Any potential debris around the wellhead would have to be removed and the drilling riser must be disconnected in order for a subsea stack to be attached to the wellhead.

Containment: The experience of gaining control over the Macondo well has resulted in a better understanding of the necessary equipment and systems for well containment. As a result, industry and government are better equipped and prepared today to contain an oil well blowout in deepwater (See page 17 of the Decision Memorandum dated October 1, 2010). Shell is further analyzing these advances and incorporating them into its comprehensive approach to help prevent and, if needed, control another deepwater well control incident.

Should intervention at the wellhead not be possible, specialized equipment can be used to connect to a riser stub, damaged connector, casing stub, or to the sea floor and allow the well to be shut-in to contain the blowout. The subsea containment assembly and other specialized connection devices will be available from the Marine Well Containment Company (MWCC). If full shut-in, following capping is not possible because of well integrity issues, the well can be flowed with back-pressure maintained via the MWCC specialized well flow equipment. Shell is a founding member in the Marine Well Containment Company which is currently constructing the containment equipment and developing contracts for access to near term response capability. The near term response capability will incorporate lessons learned and technology advances as they apply to containment. Shell is currently in the process of concluding contracts that will secure the availability of some of the equipment and vessels used by BP during the Macondo spill response. The MWCC website can be accessed for a full description of the systems and components. It is expected that key components of the system will begin to be available by January 2011. The MWCC will own, maintain, and deploy both existing equipment and equipment being constructed for well intervention and containment. The newly constructed system will be designed to be flexible and adaptable, and be responsive to a wide range of potential scenarios, deepwater depths up to 10,000 feet, weather conditions, and flow rates. Once constructed, the system components will be fully tested to ensure functionality and will be maintained in a state of continuous operational readiness. In the event of a future incident, mobilization to the field will start within days and the system will be fully operational within weeks. Once built, the new containment system will further enhance Shell's Regional OSRP.

Shell is investing in Research and Development activities on its own to identify additional containment components and equipment that will potentially increase the range of applications and effectiveness for equipment similar to that of MWCC, and systems that can be deployed more effectively in the water column that resemble "tents or capture domes" and thus enhance well shut-in capability.

Availability of a rig to drill a relief well and rig package constraints

Blowout intervention can be conducted from the existing drilling rig or from another drilling rig. Shell has an active portfolio of well operations in the GOM which will be supported by a total of three to five MODU rigs capable of executing work at Great White water depths. The dynamically positioned rigs currently under contract will be the preferred rigs for blowout intervention work. It is unlikely that moored rigs can be used for Great White relief well activities due to the potential of mooring lines interfering with subsea infrastructure, in addition to the Perdido Spar mooring lines and production risers. Therefore, it is the preferred option to use a dynamically positioned (DP) MODU for any relief well or containment operations for the WCD Great White GA014 well. Additionally, in the event of a blowout, there is the distinct possibility that other non-contracted rigs in the GOM could be utilized because they are readily available or more suitable. All efforts will be made at the time to secure the appropriate rig. Shell's current contracted rigs capable of operating at Great White water depths and reservoir depths are shown in Table 4 below:

Rig Name	Rig Type
DW Proteus	Dynamically positioned drill ship
DW Poseidon	Dynamically positioned drill ship
Noble Globetrotter	Dynamically positioned drill ship

Table 4 Shell Contracted Rigs Capable at Great White

Time taken to contract a rig, move it onsite, and drill a relief well

Relief well operations will immediately take priority and displace any activity from Shell's contracted rig fleet. The list of rigs capable of operating at Great White is tabled above. It is expected to take an average of 14 days to safely secure the well that the rig is working on up to the point the rig departs location, and an additional 4 days transit to mobilize to the relief well site depending on distance to the site. The relief well will take approximately 52 days to drill down to the last casing string above the blowout zone, plus approximately 30 days for precision ranging activity to intersect the blowout well bore. Total time to drill a relief well would be ~100 days for the Great White wells.

As the Perdido Spar is in a remote location, it is not possible to drill relief wells from any other existing platforms. It is assumed that no relief well can be drilled from the Perdido Spar after a blowout.

Measures proposed to enhance ability to prevent blowout and to reduce likelihood of a blowout

Shell believes that the best way to manage blowouts is to prevent them from happening. Detailed below are the measures employed by Shell with the goal of no harm to people or the environment. The Macondo incident has highlighted the importance of these practices. The lessons learned from the investigation are, and will continue to be, incorporated into our operations.

Standards: Shell's well design and operations adhere to internal corporate standards, the Code of Federal Regulations, and industry standards. A robust management of change process is in place to handle un-defined or exception situations. Ingrained in the Shell standards for well control is the philosophy of multiple barriers in the well design and during operations on the well.

Risk Management: Shell believes that prevention of major incidents is best managed through the systematic identification and mitigation process (Safety Case). The safety case requirement is ingrained into Shell's Health, Security, Safety, Environment, and Social Performance Control Framework. All Shell contracted rigs in the GOM have been operating with a Safety Case and will continue to do so. A Safety Case requires both the owner and contractors to systematically identify the risks in drilling operations and align plans to mitigate those risks; an alignment which is critical before drilling begins.

Well Design Workflow: The Well Delivery Process (WDP) is a rigorous internal assurance process with defined decision gates. The WDP leverages functional experts (internal and external) to examine the well design at the conceptual and detailed design stages for robustness before making a recommendation to the management review board. Shell's involvement in global deepwater drilling, starting in the GOM in the mid-1980's, provides a significant depth and breadth of internal drilling and operational expertise. Third party vendors and rig contractors are involved in all stages of the planning and execution phases of the well, providing their specific expertise. Drill the Well On Paper (DWOP) exercises are routinely conducted with rig personnel and vendors involved in execution of our wells. This forum communicates the well plan and solicits input as to the safety of the plan and procedures proposed.

Well and rig equipment qualification, certification, and quality assurance: All rigs will meet all applicable rules, regulations, and Notice to Lessees. Shell works closely with rig contractors to ensure proper upkeep of all rig equipment, which meets or exceeds the strictest of Shell, industry, or regulatory requirements. Well tangibles are governed by our internal quality assurance/control standards and industry standards.

MWD/LWD/PWD Tools: Shell intends to use these tools at Great White. The MWD/LWD/PWD tools are run on the drill string so that data on subsurface zones can be collected as the well advances in real time instead of waiting until the drill string is pulled to run wireline logs. Data from the tools are monitored and interpreted real time against prognosis to provide early warning of abnormal pressures to allow measures to be taken to progress the well safely.

Mud Logger: Mud logging personnel continually monitor returning drilling fluids for indications of hydrocarbons, utilizing both a hot wire and a gas chromatograph. An abrupt increase in gas or oil carried in the returning fluid can be an indication of an impending kick. The mud logger also monitors drill cuttings returned to the surface in the drilling fluid for changes in lithology that can be an indicator that the well has penetrated or is about to penetrate a hydrocarbon-bearing interval. Mud logging instruments also monitor penetration rate to provide an early indication of drilling breaks that show the bit penetrating a zone that could contain hydrocarbons. The mud logging personnel are in close communication with both the drilling foreman and Shell representative to report any observed anomalies so appropriate action can be taken.

Remote Monitoring: The Real Time Operating Center has been used by Shell to complement and support traditional rig-site monitoring since 2003. Well site operations are monitored virtually by onshore teams consisting of geoscientists, petrophysicists, well engineers, and 24/7 monitoring specialists. The same real time well control indicators monitored by the rig personnel are watched by the monitoring specialist for an added layer of redundancy.

Competency and Behavior: A structured training program for Well Engineers and Foreman is practiced which includes internal professional examinations to verify competency. Other industry training in well control by the International Association of Drilling Contractors (IADC) and International Well Control Forum (IWCF) are also mandated. Progressions have elements of competency and Shell continues to have comprehensive internal training programs. The best systems and processes can be defeated by lack of knowledge and/or improper values. We believe that a combination of HSE tools (e.g. stop work, pre-job analysis, behavior based safety, DWOPs, audits) management HSE involvement and enforcement (e.g. compliance with Life Saving Rules) have created a strong safety culture in our operations.

Measures to conduct effective and early intervention in the event of a blowout

The response to a blowout is contained in our Well Control Contingency Plan (WCCP) which is a specific requirement of our internal well control standards. The WCCP in turn is part of the wider emergency response framework within Shell that addresses the overall organization response to an emergency situation. Resources are dedicated to these systems and drills are run frequently to test preparedness (security, medical, oil spill, and hurricane). This same framework is activated and tested during hurricane evacuations, thereby maintaining a fresh and responsive team.

The WCCP specifically addresses implementing actions at the emergency site that will ensure personnel safety, organizing personnel and their roles in the response, defining information requirements, establishing protocols to mobilize specialists and pre-selecting sources, and developing mobilization plans for personnel, material and services for well control procedures. The plan references individual activity checklists, a roster of equipment and services, initial information gathering forms, a generic description of relief well drilling, strategy and guidelines, intervention techniques and equipment, site safety management, exclusion zones, and re-boarding.

As set forth in Section 3 of this document, Shell is currently analyzing recent advances in containment technology and equipment and will incorporate them as they become available and is a founding member of MWCC.

Arrangements for drilling a relief well

The size of the Shell contracted rig fleet in the GOM ensures that there is adequate well equipment (e.g. casing and wellhead) available for relief wells. Rigs and personnel will also be readily available within Shell, diverted from their active roles elsewhere. Resources from other operators can also be leveraged should the need arise. Generally, relief well plans will mirror the blowout well, incorporating any learning on well design based on a root cause analysis of the blowout. A generic relief well description is outlined in the WCCP. It will be possible to drill a relief well as close as 1 mile away from the Perdido Spar location targeting the Great White GA014 WCD well. This will ensure that the relief well can be spudded without interfering with ongoing efforts at the Perdido Spar.

Assumptions and calculations used in approved or proposed OSRP

Shell has designed a response program based upon a regional capability of responding to a range of spill volumes, from small operational spills up to and including the WCD from an exploration well blowout. Shell's program is developed to fully satisfy federal oil spill planning regulations. The Regional OSRP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations.

SECTION 3: GEOLOGICAL AND GEOPHYSICAL INFORMATION

A. Geological description
See SEP S-8064, S-8098 and S-8117 for this information.

B. Structure Contour Map(s)
See SEP S-8064, S-8098 and S-8117 for this information.

C. Interpreted 2D and/or 3D Seismic line(s)
See SEP S-8064, S-8098 and S-8117 for this information.

D. Geological Structure Cross-section(s)
See SEP S-8064, S-8098 and S-8117 for this information.

E. Stratigraphic Column
See SEP S-8064, S-8098 and S-8117 for this information.

F. Shallow Hazards Report
See Section 6 for Shallow Hazards Report data.

G. Shallow Hazards Assessment
See Section 6 of SEP's S-8064, S-8098 and S-8117 for detailed site assessment, Power Spectrums, Top-hole Prognosis and ESR.

H. Geochemical Information
This information is not required for plans submitted in the GoM Region.

I. Future G&G Activities
This information is not required for plans submitted in the GoM Region.

SECTION 4: HYDROGEN SULFIDE (H_2S)

A. Concentration

0 ppm

B. Classification

Based on 30 CFR 250.490, Shell requests that the Regional Supervisor, Field Operations, classify the area in the proposed drilling operations as an area where the presence of H_2S is absent.

C. H_2S Contingency Plan

Shell will not be required to provide a H_2S Contingency Plan with the Application for Permit to Drill before conducting the proposed exploration activities.

D. Modeling Report

We do not anticipate encountering or handling H_2S at concentrations greater than 500 parts per million (ppm) and therefore have not included modeling for H_2S.

SECTION 5: MINERAL RESOURCE CONSERVATION INFORMATION

Proprietary Data

A. Technology and reservoir engineering practices and procedures

B. Technology and recovery practices and procedures

C. Reservoir Development

SECTION 6: BIOLOGICAL, PHYSICAL AND SOCIOECONOMIC INFORMATION

A. Wellsite Clearance

Shell Offshore Inc. (Shell) is submitting a Supplemental DOCD for Alaminos Canyon Block 857 (AC 857) for the addition of new seafloor equipment to continue its Perdido Field development. This S-DOCD will add two new wells LWP4 and NWP5 along with two backup locations each for a total of six well locations, a new Production Manifold, a Hydraulic/Electrical Distribution Module, along with associated jumpers, umbilicals, and flying leads to continue the field development previously approved in Revised and Supplemental-DOCD Plan Control Nos. R-6668, S-7994, S-8069, and S-8106. All six new wells LWP4, LWP4-Alt1, LWP4-Alt2, NWP5, NWP5-Alt1, and NWP5-Alt2 were approved in Supplemental EP Plan Control No. S-8117. This letter addresses specific seafloor conditions within the areas of installation.

The referenced S-EP cleared a 2000 ft vicinity around each of the previously approved wells. The assessment below addresses the seafloor conditions and clears a 500 ft installation area inclusive of all proposed seafloor installations, jumpers, umbilicals, and flying leads.

Seafloor conditions appear favorable within the vicinities of the proposed equipment installations. There are no features or areas that could or have been observed to support significant, high-density benthic communities within 2,000 ft of the proposed installation areas. There are no water bottom anomalies (positive possible oil) as defined by BOEM (BOEM, 2019) within 2,000 ft of the proposed installation areas.

There are two sonar contacts that have been identified within 500 ft of the proposed installation area. The identified sonar contacts are interpreted to be modern debris or natural in origin. There are no sonar contacts of archaeological significance within 2,000 ft of the proposed installation areas (see Illustration-1).

Geohazard and Archaeological Assessments.

The following geohazard discussions are based on the findings provided within the following geohazard reports:

- GEMS, "Geologic and Stratigraphic Assessment Blocks 756, 857, 900 and 901 Alaminos Canyon Gulf of Mexico", Project No. 0600-271, May 2001. Previously submitted.
- GEMS, "Seafloor and Near-Surface Geologic Assessment Blocks 812-814, 856-858, and 900-902 Alaminos Canyon Area Gulf of Mexico", Project No. 0204-780, July 2004. Previously submitted.
- C&C Technologies, "Hazards and Subsidence Monitoring Report, Block 857 and Vicinity, Alaminos Canyon Area, Gulf of Mexico," Project No. 120261, September 2012. Previously submitted.
- C&C Technologies, "Archaeological Assessment, Block 815 (OCS-G-19409) & Vicinity, Alaminos Canyon Area, Gulf of Mexico", Project No. 150440, May 2015. Previously submitted.
- Fugro Geoservices Inc., "Shallow Hazards Assessment, Multi-Temporal Subsidence Monitoring, & Archaeological Assessment Perdido Field Block 857 & Vicinity Alaminos Canyon Area Gulf of Mexico", Report No. 2414-5056, July 2015. Previously submitted.
- Fugro Geoservices, Inc., "Archaeological Assessment, Perdido Field, Blocks 768-771, 856-859, 899-903, and 944-946, Alaminos Canyon Area, Gulf of Mexico", Report No. 2414-5056, July 2015. Previously submitted.
- Oceaneering, "Hazards and Subsidence Monitoring Report Perdido AUV Survey Portions of Blocks 812-816, 856-80, and 900-902 Alaminos Canyon Area", Project No. 182843, June 2018. Previously submitted.
- Perdido ROV Interpretation Report 11-14-2017, Shell. Previously Submitted.

Available Data

This assessment is based on the analysis of: a) high-resolution geophysical datasets b) reprocessed exploration 3D seismic data volume and; c) offset well data including logs and drilling events.

Oil Field Infrastructure and Military Warning Areas

The proposed wellsites lie within Military Warning Area W-602. The nearest existing wells are the AC857-3 exploration well drilled in 2003 approximately 3,950 ft to the southeast and the number of wells drilled around the Perdido host structure approximately 7,500 ft to the west/southwest (pursuant to public information obtained from the 2019 BOEM database). There is a previously installed flexible umbilical cable more than 175 ft south of any of the proposed wellsite locations and two existing regional flowlines trending west-east more than 1,300 ft to the south of the proposed well locations.

Proposed Installation Location

The locations of the installation areas lie in the northeastern quadrant of block AC 857. Table A-1 shows the proposed and as-built location coordinates:

Table A-1. Location Coordinates of Proposed / As-Built Equipment

Equipment	Spheroid & Datum: Clarke 1866 NAD27 Projection: BLM Zone 15 North	
Well LWP4 (Proposed)	X: 1,025,082 ft.	Y: 9,487,708 ft.
Well LWP4-Alt1 (Proposed)	X: 1,025,083 ft.	Y: 9,487,658 ft.
Well LWP4-Alt2 (Proposed)	X: 1,025,006 ft.	Y: 9,487,214 ft.
Well NWP5 (Proposed)	X: 1,025,013.50 ft.	Y: 9,487,755.40 ft.
Well NWP5-Alt1 (Proposed)	X: 1,025,014 ft.	Y: 9,487,702 ft.
Well NWP5-Alt2 (Proposed)	X: 1,025,015 ft.	Y: 9,487,352 ft.
Northeast Manifold (Proposed)	X: 1,024,652 ft.	Y: 9,487,467 ft.
Electrical/Hydraulic Distribution Module (Proposed)	X: 1,024,760 ft.	Y: 9,487,715 ft.
Load Balancing Module (As-Built)	X: 1,018,246.85 ft.	Y: 9,485,442.89 ft.

Along with the installations listed in Table A-1, Shell proposes to install a 479 ft 6.0” ID flexible production jumper connecting the proposed LWP4 well to the proposed Northeast Manifold.

Shell also proposes to install a 594 ft 6.0” ID production flowline connecting the proposed NWP5 well to the proposed Northeast Manifold.

Shell also maintains the option to install, as needed, flexible production jumpers from proposed backup well locations LWP4-Alt1, LWP4-Alt2, NWP5-Alt1, and/or NWP5-Alt2 to the proposed Northeast Manifold.

Shell also proposes to install a production flowline connecting the proposed Northeast Manifold to the existing Load Balancing Module (LBM) near the Perdido Spar 7,000 ft to the west.

Shell also proposes to install the necessary electrical and steel flying leads for the control of the proposed wells and seafloor equipment.

This assessment addresses the seafloor conditions within a 500-ft radius around the proposed areas of impact (see Illustration-1).

Water Depth and Seafloor Conditions

The water depths at the proposed installation site range from approximately -8250 ft to -8500 ft and the seafloor slope ranges from 2°-10° primarily dipping to the southwest. Numerous drag scars and seafloor grooves have been identified to the north/northeast of the proposed installations and have been appropriately avoided. The installation site is located near the Perdido Escarpment south of the Perdido Canyon and is characterized by complex seafloor morphology from regional tectonics. Slopes are variable and can exceed 20° in areas along the seafloor escarpments and in the Perdido Canyon, but not in the vicinity of the proposed installations.

Man-Made Features

There are no previously drilled wells or existing infrastructure within 500 ft. of the proposed subsea installation area. There is a previously installed umbilical cable just south of the 500 ft vicinity and two existing regional flowlines trending west-east more than 1,500 ft to the south of the proposed installation site.

Deepwater Benthic Communities
Deepwater benthic communities are not expected in the vicinity of the proposed wellsite. The Amplitude-Enhanced Seafloor Rendering, the Side-Scan Sonar Mosaic, and the Multibeam Backscatter Mosaic data all show isolated areas of higher reflectivity. These areas of higher reflectivity are likely related to the steep slopes and consolidated slump deposits and lack of hemipelagic drape. The nearest area with presence of high-density deepwater communities is found almost 3,500 feet to the south of proposed location LWP4 and almost 3,000 ft south of proposed LWP4-Alt2. This area of chemosynthetic communities was visually confirmed while other possible locations were visually cleared by the Perdido 2017 ROV Survey referenced and previously submitted. There are no water bottom anomalies (positive possible oil) as defined by BOEM (BOEM, 2017) within 2,000 ft. of the proposed site.

Archaeological Assessment
The archaeological assessments of side-scan sonar and other AUV data covering AC 857 and the surrounding area resulted in two sonar contacts identified within 500 ft of the proposed installation site. There are no sonar contacts of archaeological significance identified within 2000 ft of the area. Contact #50 was identified in the 2012 Perdido Hazards and Subsidence Monitoring Report, Contact #13 was identified in the 2015 Fugro Archaeological Assessment; see reports for details.

Proposed Seafloor Equipment Installation: Concluding Remarks
The proposed installation area in Alaminos Canyon 857 (OCS-G-17565) appears suitable for the proposed development equipment. No seafloor obstructions or conditions exist that will be a constraint to the proposed equipment at the proposed location.

B. Topographic Features Map

The proposed activities are not within 1,000' of a no-activity zone or within the 3-mile radius zone of an identified topographic feature. Therefore, no map is required per NTL No. 2008-G04.

C. Topographic Features Statement (Shunting)

Shell does not plan to drill more than two wells from the same surface location within the Protective Zone of an identified topographic feature. Therefore, the topographic features statement required by NTL No. 2008-G04 is not applicable.

D. Live Bottoms (Pinnacle Trend) Map

The activities proposed in this plan are not within 200' of any pinnacle trend feature with vertical relief equal to or greater than 8'. Therefore, no map is required per NTL No. 2008-G04.

E. Live Bottoms (Low Relief) Map

The activities proposed in this plan are not within 100' of any live bottom low relief features. Therefore, no map is required per NTL No. 2008-G04.

F. Potentially Sensitive Biological Features

The activities proposed in this plan are not within 200' of any potentially sensitive biological features. Therefore, no map is required per NTL No. 2008-G04.

G. Remotely Operated Vehicle (ROV) Monitoring Plan

This information is no longer required by BOEM GoM.

H. Threatened and Endangered Species Information

Under Section 7 of the Endangered Species Act (ESA) all federal agencies must ensure that any actions they authorize, fund, or carry out are not likely to jeopardize the continued existence of a listed species, or destroy or adversely modify its designated critical habitat.

In accordance with 30 CFR 250, Subpart B, effective May 14, 2007, and further outlined in Notice to Lessees (NTL) 2008-G04, and the Biological Opinion on the National Marine Fisheries Service. 2020. Endangered Species Act, Section 7 Consultation – Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. St. Petersburg, FL. (NMFS 2020 Endangered Species Act, Section 7 Consultation – Biological Opinion),, lessees/operators are required to address site-specific information on the presence of federally listed threatened or endangered species and critical habitat designated under the ESA and marine mammals protected under the Marine Mammal Protection Act (MMPA) in the area of proposed activities under this plan.

Currently there are designated endangered species and their critical habitat in the Gulf of Mexico Outer Continental Shelf. There are listed species that include sea turtles, marine mammals, corals, sharks, manta ray and fish. Currently the only designated critical habitat is *Sargassum* habitat for the Loggerhead Sea turtle there are no designated critical habitats in the proposed project area; however, it is possible that this species and one or more of the other listed species could be seen in the area of our operations. The following tables reflects the Federally listed species and their designated habitat.

There are five (5) species of listed sea turtles in the area of our operations.

Common Name	Scientific Name	T/E Status
Hawksbill Turtle	*Eretmochelys imbricata*	E
Green Turtle	*Chelonia mydas*	T
Kemp's Ridley Turtle	*Lepidochelys kempii*	E
Leatherback Turtle	*Dermochelys coriacea*	E
Loggerhead Turtle*	*Caretta caretta*	T

Table 6.6 – Threatened and Endangered Sea Turtles

**NOTE: Critical Habitat Designated. Sargassum habitat designated for most of the Central and Western Planning Sections of the Gulf of Mexico.*

There are 28 species of cetaceans and 1 siren species that may be found in the Gulf of Mexico. Of the species listed as Endangered, only the Sperm whale is potentially present in the project area. The blue, fin, humpback and sei whales are rare or extralimital in the Gulf of Mexico and are unlikely to be present in the lease area. No critical habitat for these species has been designated in the Gulf of Mexico.

Common Name	**Scientific Name**	**T/E Status**
Atlantic Spotted Dolphin	*Stenella frontalis*	
Blainville's Beaked Whale	*Mesoplodon densirostris*	
Blue Whale	*Balaenoptera musculus*	E
Bottlenose Dolphin	*Tursiops truncatus*	
Rice's Whale	*Balaenoptera ricei*	E
Clymene Dolphin	*Stenella clymene*	
Cuvier's Beaked Whale	*Ziphius cavirostris*	
Dwarf Sperm Whale	*Kogia simus*	
False Killer Whale	*Pseudorca crassidens*	
Fin Whale	*Balaenoptera physalus*	E
Fraser's Dolphin	*Lagenodelphis hosei*	
Gervais' Beaked Whale	*Mesoplodon europaeus*	
Humpback Whale	*Megaptera novaeangliae*	E
Killer Whale	*Orcinus orca*	
Melon-headed Whale	*Peponocephala electra*	
Minke Whale	*Balaenoptera acutorostrata*	
Pantropical Spotted Dolphin	*Stenella attenuata*	
Pygmy Killer Whale	*Feresa attenuata*	
Pygmy Sperm Whale	*Kogia breviceps*	
Risso's Dolphin	*Grampus griseus*	
Rough-toothed Dolphin	*Steno bredanensis*	
Sei Whale	*Balaenoptera borealis*	E
Short-finned Pilot Whale	*Globicephala macrorhynchus*	
Sowerby's Beaked Whale	*Mesoplodon bidens*	
Sperm Whale	*Physeter macrocephalus*	E
Spinner Dolphin (Long-snouted)	*Stenella longirostris*	
Striped Dolphin	*Stenella coeruleoalba*	
West Indian manatee	*Trichechus manatus*	E

Table 6.7 – Threatened and Endangered Mammals

There are also listed species of birds, fishes, invertebrates and terrestrial mammals in the Gulf of Mexico waters and coastal environments. Of these, it is possible that Giant manta ray may be present in the lease area, but it is highly unlikely that any other birds, fish species or terrestrial mammals, given their coastal ranges, will be present in the lease area. The presence of invertebrates is identified through different lease operations, as biologically sensitive habitat features that must be avoided per BOEM NTL 2009-G40.

Birds		
Piping Plover	*Charadrius melodus*	T
Whooping Crane	*Grus americana*	E
Fishes		
Oceanic whitetip shark	*Carcharhinus longimanus*	T
Giant manta ray	*Mobula birostris*	T
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T
Nassau grouper	*Epinephelus striatus*	T
Smalltooth sawfish	*Pristis pectinata*	E
Invertebrates		
Elkhorn coral	*Acropora palmata*	T
Staghorn coral	*Acropora cervicornis*	T
Pillar coral	*Dendrogyra cylindrus*	T
Rough cactus coral	*Mycetophyllia ferox*	T
Lobed star coral	*Orbicella annularis*	T
Mountainous star coral	*Orbicella faveolata*	T
Boulder star coral	*Orbicella franksi*	T
Terrestrial Mammals		
Beach mice (Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E
Florida salt marsh vole	*Microtus pennsylvanicus dukecampbelli*	E

Table 6.8 – Threatened and Endangered

J. Archaeological Report

See previous Section 6A for this data.

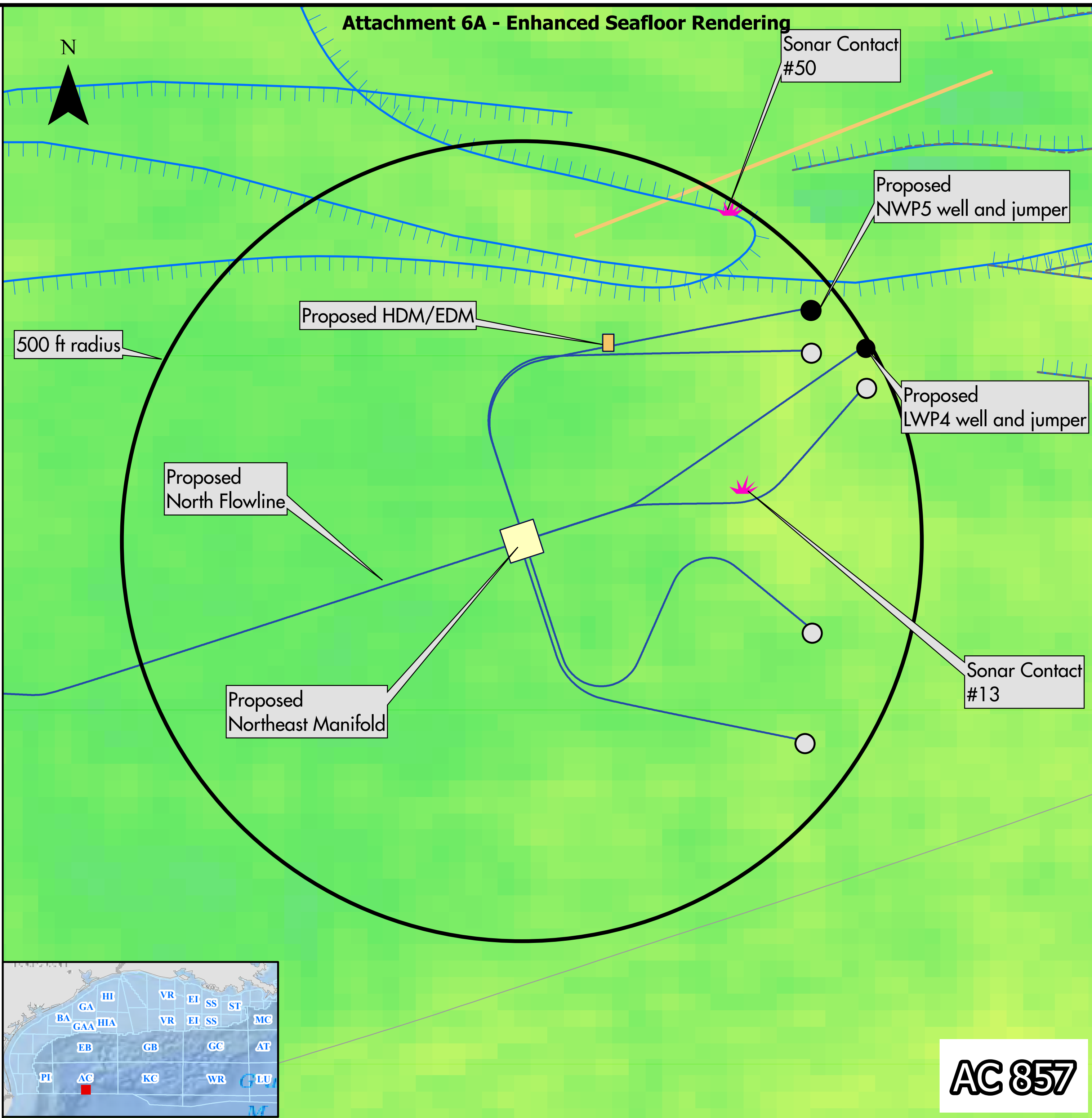
K. Air and Water Quality Information

Not required unless working in Florida waters.

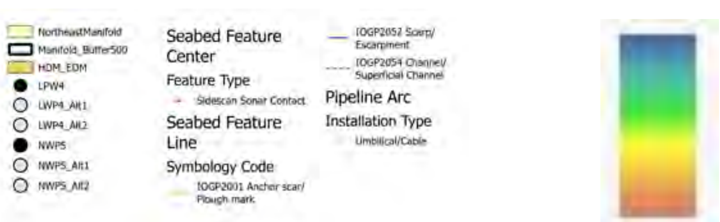
L. Socioeconomic Information

Not required unless working in Florida waters.

Attachment 6A - Enhanced Seafloor Rendering



MAP INFORMATION



APPLICATION BY: SHELL EXPLORATION & PRODUCTION COMPANY

MAP SCALE

SHELL EXPLORATION & PRODUCTION COMPANY

Amplitude Enhanced Seafloor Rendering
LWP4 & NWP5 Installation Area
Alaminos Canyon Block 857
Gulf of Mexico

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD1927 BLM Zone 15N
CRS name (Shell): NAD27 / BLM 15N (ftUS)
CRS code (EPSG): 32065
Geodetic datum: North American 1927
Projection name: Transverse Mercator
Horizontal units: Foot US

Author:	Date: 10 Aug 2023
Reviewed By:	EP Catalog No: N/A

Document Path: \\americas.shell.com\tcs\hou\ua.sepco\data\uax_shallow_hazards\Shallowhazard_Data\Greatwhite-AC857\LWP4,S-EP,2023\ArcGIS\PerdidoLWP4_ArcGIS.aprx

TABLE 7A: WASTES YOU WILL GENERATE, TREAT AND DOWNHOLE DISPOSE OR DISCHARGE TO THE GOM

Note: Please specify if the amount reported is a total or per well amount

Projected generated waste			Projected ocean discharges		Projected
Type of Waste and Composition	**Composition**	**Projected Amount**	**Discharge rate**	**Discharge Method**	**Answer yes or no**
Will drilling occur ? If yes, you should list muds and cuttings					
EXAMPLE: Cuttings wetted with synthetic based fluid	*Cuttings generated while using synthetic based drilling fluid.*	*X bbl/well*	*X bbl/day/well*	*discharge pipe*	*No*
Water-based drilling fluid	barite, additives, mud	85000 bbls/well	17000 bbls/day	Overboard discharge line below the water level and seafloor discharge prior to	No
Cuttings wetted with water-based fluid	Cuttings coated with water based drilling mud	11520 bbls/well	768 bbls/day	Seafloor prior to marine riser installation	No
Cuttings wetted with synthetic-based fluid	Cuttings generated while using synthetic based drilling fluid.	32720 bbls/well	409 bbls/day	Overboard discharge line below the water	No
Synthetic based drilling fluid adhering to washed drill cuttings	Synthetic based drilling fluid adhering to	560 bbls/well	7 bbls/day	Overboard discharge line below the water	No
Spent drilling fluids - synthetic	Synthetic-based drilling mud	0 bbls / well	0 bbls/day	Overboard discharge line below the water	No
Spent drilling fluids - water based	Water-based drilling mud	0 bbls / well	0 bbls/day	Overboard discharge line below the water	No
Chemical product waste	Chemical product waste	0 bbls / well	0 bbls/day	Treated to meet NPDES limits and discharged overboard	No
Brine	brine	N/A	N/A	N/A	No
Will humans be there? If yes, expect conventional waste					
EXAMPLE: Sanitary waste water		*X liter/person/day*	*NA*	*chlorinate and discharge*	*No*
Domestic waste (kitchen water, shower water)	grey water	30000 bbls/well	200 bbls/day/well	Ground to less than 25 mm mesh size and discharge overboard	No
Sanitary waste (toilet water)	treated sanitary waste	22500 bbls/well	150 bbls/day/well	Treated in the MSD** prior to discharge to meet NPDES limits	No
Is there a deck? If yes, there will be Deck Drainage					
Deck Drainage	Wash and rainwater	3000 bbls/well	20 bbls/day	Drained overboard through deck scuppers	No
Will you conduct well treatment, completion, or workover?					
well treatment fluids	Frac Fluids carrying ceramic proppant and	500 bbls/well	10 bbls/day	Overboard discharge line below the water	No
well completion fluids	and displacement spacers	750 bbls/well	15 bbls/day	Overboard discharge line below the water	No
workover fluids	Linear Frac Gel Flush Fluids, Crosslinked Frac Fluids carrying ceramic proppant, spacers, flushes, and acidic breaker fluid	750 bbls/well	15 bbls/day	NA	No
Miscellaneous discharges. If yes, only fill in those associated with your activity.					
Desalinization unit discharge	Rejected water from watermaker unit	60000 bbls/well	400 bbls/day/well	RO Desalinization Unit Discharge Line	No
Blowout preventer fluid	Water based	30 bbls/well	0 bbls/day		No
Ballast water	Uncontaminated seawater	491400 bbls/well	3276 bbls/day		No
Bilge water	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	231450 bbls/well	1543 bbls/day	MARPOL standards (< 15ppm oil in	No
Excess cement at seafloor	Cement slurry	20000 bbls/well (assume planned 100% excess is	200 bbls/day	Discharged at seafloor.	No
Fire water	Treated seawater	10000 bbls/well	2000 bbls/month	Discharged below waterline	No
Cooling water	Treated seawater	68451450 bbls/well	456343 bbls/day/well	Discharged below waterline	No
Untreated or treated seawater	Treated Seawater	2300 bbls / flowline	300 gpm	Discharged at seafloor.	No
Hydrate Inhibitor	Hydrate Inhibitor	flowline	300 gpm	Discharged at seafloor.	No
Sub sea Production Control Fluid	Water-based	72 bbls/year	72 bbls/year	Discharged at seafloor.	No
Will you produce hydrocarbons? If yes fill in for produced water.					
Produced water	NA	NA	NA	NA	
Will you be covered by an individual or general NPDES permit ?			**GENERAL PERMIT**	GMG290103	
NOTE: If you will not have a type of waste, enter NA in the row.					

TABLE 7B. WASTES YOU WILL TRANSPORT AND/OR DISPOSE OF ONSHORE

Note: Please specify whether the amount reported is a total or per well

Projected generated waste		Solid and Liquid Wastes transportation	Waste Disposal		
Type of Waste	**Composition**	**Transport Method**	**Name/Location of Facility**	**Amount**	**Disposal Method**
Will drilling occur ? If yes, fill in the muds and cuttings.					
EXAMPLE: Oil-based drilling fluid or mud	*NA*	*NA*	*NA*	*NA*	*NA*
Oil-based drilling fluid or mud	NA	NA	NA	NA	NA
Synthetic-based drilling fluid or mud	used SBF and additives	Drums/tanks on supply boat/barges	Halliburton Drilling Fluids, M-I Swaco - Fourchon, LA; R360 Environmental Solutions, EcoServ - Fourchon, LA; Schlumberger - Galveston, TX	6,500 bbls/well	Recycled/ Reconditioned; Deep Well Injection
Cuttings wetted with Water-based fluid	NA	NA	NA	NA	NA
Cuttings wetted with Synthetic-based fluid	Drill cuttings from synthetic based interval.	storage tank on supply boat.	R360 Environmental Solutions, EcoServ - Fourchon, LA	300 bbls / well	Deep Well Injection, or landfarm
Cuttings wetted with oil-based fluids	NA	NA	NA	NA	NA
Completion Fluids	Completion and treatment fluids	Storage tank on supply boat	Halliburton, Baker Hughes, Schlumberger or Tetra - Fourchon, LA; R360 Environmental Solutions, EcoServ - Fourchon, LA Schlumberger - Galveston, TX	4,000 bbls/well	Recycled/ Reconditioned; Deep Well Injection
Salvage Hydrocarbons	Well completion fluids, formation water, formation solids, and hydrocarbon	Barge or vessel tank	PSC Industrial Outsourcing - Jeanerette, LA	<8000 bbl./well	Recycled or Injection
Will you produce hydrocarbons? If yes fill in for produced sand.					
Produced sand and/or NORM (Naturally Occurring Radioactive Material)	Sand Produced from formation, sludges and scales	Drums/tanks on supply boat	Trinity Environmental, Liberty, TX; LOTUS, Andrews, TX; R360 Environmental Solutions, EcoServ - Fourchon, LA; EcoServ, Winnie, TX	200 bbls/year	Disposal or Deep Well Injection
Will you have additional wastes that are not permitted for discharge? If yes, fill in the appropriate rows.					
EXAMPLE: trash and debris	*cardboard, aluminum,*	*barged in a storage bin*	*shorebase*	*z tons total*	*recycle*
Trash and debris - recyclables	trash and debris	various storage containers on supply boat	Omega Waste Management, Patterson, LA Martin Energy - Galveston, TX	200 lbs/month	Recycle
Trash and debris - non-recyclables	trash and debris	various storage containers on supply boat	Riverbirch Landfill, Avondale, LA Coastal Plains Landfill, Alvin, TX	400 lbs/month	Landfill
E&P Wastes	Completion, treatment, and production wastes	various storage containers on supply boat	R360 Environmental Solutions, EcoServ, Clean Waste - Fourchon, LA	200 bbls / well	Deep Well Injection, or landfarm
Used oil and glycol	used oil, oily rags and pads, empty drums and cooking oil	various storage containers on supply boat	Omega Waste Management, Patterson, LA; Chemical Waste Management, Sulphur, LA	20 bbls/month	Recycle or RCRA Subtitle C landfill
Non-Hazardous Waste	paints, insulation, chemicals, completion and treatment fluids	various storage containers on supply boat	Waste Management Woodside Landfill Walker, LA; Coastal Plains Landfill, Alvin, TX	60 bbls/mo	RCRA Subtitle D landfill
Non-Hazardous Oilfield Waste	Chemicals, completion and treatment fluids	various storage containers on supply boat	Chemical Waste Management Sulphur, LA; EcoServ, Winnie, TX	60 bbls/mo	Deep Well Injected
Hazardous Waste	paints, solvents, chemicals, pyrotechnics, completion and treatment, commissioning fluids	various storage containers on supply boat	Chemical Waste Management Sulphur, LA; Clean Harbors, Colfax, LA; Veolia, Port Arthur, TX; SET Environmental, Houston, TX	60 bbls/mo	Recycle, treatment, incineration, or RCRA Subtitle C landfill
Universal Waste Items	Batteries, lamps, glass, and mercury-contaminated waste	various storage containers on supply boat	Chemical Waste Management Sulphur, LA	50 bbls/mo	Recycle, treatment, incineration, or landfill
NOTE: If you will not have a type of waste, enter NA in the row.					

SECTION 8: AIR EMISSIONS INFORMATION

A. Emissions Worksheet and Screening Questions

Screening Questions for DOCD's	Yes	No
Is any calculated Complex Total (CT) Emission amount (in tons) associated with your proposed development and production activities more than 90% of the amounts calculated using the following formulas: CT = $3400D^{2/3}$ for CO, and CT = 33.3D for the other air pollutants (where D = distance to shore in miles)?		X
Do your emission calculations include any emission reduction measures or modified emission factors?		X
Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?		X
Do you expect to encounter H_2S at concentrations greater than 20 parts per million (ppm)?		X
Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1160(a)(4) or (7)?		X
Do you propose to burn produced hydrocarbon liquids?		X
Are your proposed development and production activities located within 25 miles from shore?		X
Are your proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?		X

B. If you answer *no* to <u>all</u> of the above screening questions from the appropriate table, provide:

(1) Summary information regarding the peak year emissions for both Plan Emissions and Complex Total Emissions, if applicable. This information is compiled on the summary form of the two sets of worksheets. You can submit either these summary forms or use the format below. You do not need to include the entire set of worksheets.

Note: There are no collocated wells, activities or facilitates associated with this plan. The complex total is the same as Plan Emissions.

Air Pollutant		Plan Emission Amounts (tons)	Calculated Exemption Amounts (tons)		Calculated Complex Total Emission Amounts (tons)
PM					
SO_x					
NOx					
VOC					
CO					

(1) Contact: Carson Morey, (832) 337-2779, Carson.Morey@shell.com

C. Worksheets

See attached. The schedule in Form BOEM-0137 will not match the days presented in the AQR, as the AQR contains extra days for contingency delays.

Note: The air emissions in this plan were previously approved in Plan S-8117 on August 10, 2023, and increase by the operations proposed in this supplemental plan.

D. Emissions Reduction Measures

Emission Source	Reduction Control Method	Activity Year(s)	Amount of Reduction	Monitoring System	Annual Fuel Limit, gal
Not Applicable					

OMB Control No. 1010-0151
OMB Approval Expires: 08/31/2023

COMPANY	Shell Offshore Inc
AREA	Alaminos Canyon
BLOCK	857
LEASE	OCS-G-17565
FACILITY	Perdido Phase 3 North
WELL	Well work for LWP4, LWP4-Alt1, LWP4-Alt2, NWP5, NWP5-Alt1, and NWP5-Alt2
COMPANY CONTACT	Carson Morey
TELEPHONE NO.	832-337-2779
REMARKS	Perdido Ph3N sDOCD AQR WW INST MODU 20231002-BOEM.xlsx MODU (Drillship or DP Semi-sub) Subsea Installation, well work No non-default emission factors were used in this AQR. No emission reduction measures are included in this AQR. For vessels listed under "Pipeline Installation" section of Emissions tab see Footnote (1) on emissions tab for description of activities covered by General Service Vessels. "VESSELS - Well Stimulation" listed under "Production" section of Emissions tab will occur at the subsea drill center. Some activities associated with these sources, specifically Service Vessels, are not currently planned but are included as a contingency, per BOEM guidance, AIR EMISSIONS CALCULATIONS INSTRUCTIONS FOR DPPs/DOCDs and PRA Statement, https://www.boem.gov/sites/default/files/documents/newsroom/BOEM-0139-Instructions-July-2020.pdf. Therefore, the schedule in Form BOEM-0137 will not match the days presented in the AQR.

LEASE TERM PIPELINE CONSTRUCTION INFORMATION:

YEAR	NUMBER OF PIPELINES	TOTAL NUMBER OF CONSTRUCTION DAYS
2024	6	27
2025	5	10
2026		
2027		
2028		
2029		
2030		
2031		
2032		
2033		

Fuel Usage Conversion Factors	Natural Gas Turbines				Natural Gas Engines		Diesel Recip. Engine		Diesel Turbines			
	SCF/hp-hr	9.524			SCF/hp-hr	7.143	GAL/hp-hr	0.0514	GAL/hp-hr	0.0514		

Equipment/Emission Factors	units	TSP	PM10	PM2.5	SOx	NOx	VOC	Pb	CO	NH3	REF.	DATE	Reference Links
Natural Gas Turbine	g/hp-hr		0.0086	0.0086	0.0026	1.4515	0.0095	N/A	0.3719	N/A	AP42 3.1-1& 3.1-2a	4/00	https://www3.epa.gov/ttnchie1/ap42/ch03/final/c03s01.pdf
RECIP. 2 Cycle Lean Natural Gas	g/hp-hr		0.1293	0.1293	0.0020	6.5998	0.4082	N/A	1.2009	N/A	AP42 3.2-1	7/00	https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf
RECIP. 4 Cycle Lean Natural Gas	g/hp-hr		0.0002	0.0002	0.0020	2.8814	0.4014	N/A	1.8949	N/A	AP42 3.2-2	7/00	https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf
RECIP. 4 Cycle Rich Natural Gas	g/hp-hr		0.0323	0.0323	0.0020	7.7224	0.1021	N/A	11.9408	N/A	AP42 3.2-3	7/00	https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s02.pdf
Diesel Recip. < 600 hp	g/hp-hr	1	1	1	0.0279	14.1	1.04	N/A	3.03	N/A	AP42 3.3-1	10/96	https://www3.epa.gov/ttnchie1/ap42/ch03/final/c03s03.pdf
Diesel Recip. > 600 hp	g/hp-hr	0.32	0.182	0.178	0.0055	10.9	0.29	N/A	2.5	N/A	AP42 3.4-1 & 3.4-2	10/96	https://www3.epa.gov/ttn/chief/ap42/ch03/final/c03s04.pdf
Diesel Boiler	lbs/bbl	0.0840	0.0420	0.0105	0.0089	1.0080	0.0084	0.0001	0.2100	0.0336	AP42 1.3-6; Pb and NH3: WebFIRE (08/2018)	9/98 and 5/10	https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s03.pdf https://cfpub.epa.gov/webfire/
Diesel Turbine	g/hp-hr	0.0381	0.0137	0.0137	0.0048	2.7941	0.0013	0.0000	0.0105	N/A	AP42 3.1-1 & 3.1-2a	4/00	https://www3.epa.gov/ttnchie1/ap42/ch03/final/c03s01.pdf
Dual Fuel Turbine	g/hp-hr	0.0381	0.0137	0.0137	0.0048	2.7941	0.0095	0.0000	0.3719	0.0000	AP42 3.1-1& 3.1-2a; AP42 3.1-1 & 3.1-2a	4/00	https://cfpub.epa.gov/webfire/
Vessels – Propulsion	g/hp-hr	0.320	0.1931	0.1873	0.0047	7.6669	0.2204	0.0000	1.2025	0.0022	USEPA 2017 NEI;TSP refer to Diesel Recip. > 600 hp reference	3/19	
Vessels – Drilling Prime Engine, Auxiliary	g/hp-hr	0.320	0.1931	0.1873	0.0047	7.6669	0.2204	0.0000	1.2025	0.0022	USEPA 2017 NEI;TSP refer to Diesel Recip. > 600 hp reference	3/19	https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data
Vessels – Diesel Boiler	g/hp-hr	0.0466	0.1491	0.1417	0.4400	1.4914	0.0820	0.0000	0.1491	0.0003	USEPA 2017 NEI;TSP (units converted) refer to Diesel Boiler Reference	3/19	
Vessels – Well Stimulation	g/hp-hr	0.320	0.1931	0.1873	0.0047	7.6669	0.2204	0.0000	1.2025	0.0022	USEPA 2017 NEI;TSP refer to Diesel Recip. > 600 hp reference	3/19	
Natural Gas Heater/Boiler/Burner	lbs/MMscf	7.60	1.90	1.90	0.60	190.00	5.50	0.00	84.00	3.2	AP42 1.4-1 & 1.4-2; Pb and NH3: WebFIRE (08/2018)	7/98 and 8/18	https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s04.pdf https://cfpub.epa.gov/webfire/
Combustion Flare (no smoke)	lbs/MMscf	0.00	0.00	0.00	0.57	71.40	35.93	N/A	325.5	N/A	AP42 13.5-1, 13.5-2	2/18	
Combustion Flare (light smoke)	lbs/MMscf	2.10	2.10	2.10	0.57	71.40	35.93	N/A	325.5	N/A	AP42 13.5-1, 13.5-2	2/18	https://www3.epa.gov/ttn/chief/ap42/ch13/final/C13S05_02-05-18.pdf
Combustion Flare (medium smoke)	lbs/MMscf	10.50	10.50	10.50	0.57	71.40	35.93	N/A	325.5	N/A	AP42 13.5-1, 13.5-2	2/18	
Combustion Flare (heavy smoke)	lbs/MMscf	21.00	21.00	21.00	0.57	71.40	35.93	N/A	325.5	N/A	AP42 13.5-1, 13.5-2	2/18	
Liquid Flaring	lbs/bbl	0.42	0.0966	0.0651	5.964	0.84	0.01428	0.0001	0.21	0.0336	AP42 1.3-1 through 1.3-3 and 1.3-5	5/10	https://www3.epa.gov/ttnchie1/ap42/ch01/final/c01s03.pdf
Storage Tank	tons/yr/tank						4.300				2014 Gulfwide Inventory; Avg emiss (upper bound of 95% CI)	2017	https://www.boem.gov/environment/environmental-studies/2014-gulfwide-emission-inventory
Fugitives	lbs/hr/component						0.0005				API Study	12/93	https://www.apiwebstore.org/publications/item.cgi?9879d38a-8bc0-4abe-bb5c-9b623870125d
Glycol Dehydrator	tons/yr/dehydrator						19.240				2011 Gulfwide Inventory; Avg emiss (upper bound of 95% CI)	2014	https://www.boem.gov/environment/environmental-studies/2011-gulfwide-emission-inventory
Cold Vent	tons/yr/vent						44.747				2014 Gulfwide Inventory; Avg emiss (upper bound of 95% CI)	2017	https://www.boem.gov/environment/environmental-studies/2014-gulfwide-emission-inventory
Waste Incinerator	lb/ton		15.0	15.0	2.5	2.0	N/A	N/A	20.0	N/A	AP 42 2.1-12	10/96	https://www3.epa.gov/ttnchie1/ap42/ch02/final/c02s01.pdf
On-Ice – Loader	lbs/gal	0.043	0.043	0.043	0.040	0.604	0.049	N/A	0.130	0.003	USEPA NONROAD2008 model; TSP (units converted) refer to Diesel Recip. <600 reference	2009	
On-Ice – Other Construction Equipment	lbs/gal	0.043	0.043	0.043	0.040	0.604	0.049	N/A	0.130	0.003	USEPA NONROAD2008 model; TSP (units converted) refer to Diesel Recip. <600 reference	2009	
On-Ice – Other Survey Equipment	lbs/gal	0.043	0.043	0.043	0.040	0.604	0.049	N/A	0.130	0.003	USEPA NONROAD2008 model; TSP (units converted) refer to Diesel Recip. <600 reference	2009	
On-Ice – Tractor	lbs/gal	0.043	0.043	0.043	0.040	0.604	0.049	N/A	0.130	0.003	USEPA NONROAD2008 model; TSP (units converted) refer to Diesel Recip. <600 reference	2009	https://www.epa.gov/moves/nonroad2008a-installation-and-updates
On-Ice – Truck (for gravel island)	lbs/gal	0.043	0.043	0.043	0.040	0.604	0.049	N/A	0.130	0.003	USEPA NONROAD2008 model; TSP (units converted) refer to Diesel Recip. <600 reference	2009	
On-Ice – Truck (for surveys)	lbs/gal	0.043	0.043	0.043	0.040	0.604	0.049	N/A	0.130	0.003	USEPA NONROAD2008 model; TSP (units converted) refer to Diesel Recip. <600 reference	2009	
Man Camp - Operation (max people/day)	tons/person/day		0.0004	0.0004	0.0004	0.006	0.001	N/A	0.001	N/A	BOEM 2014-1001	2014	https://www.boem.gov/sites/default/files/uploadedFiles/BOEM/BOEM_Newsroom/Library/Publications/2014-1001.pdf
Vessels - Ice Management Diesel	g/hp-hr	0.320	0.1931	0.1873	0.0047	7.6669	0.2204	0.0000	1.2025	0.0022	USEPA 2017 NEI;TSP refer to Diesel Recip. > 600 hp reference	3/19	https://www.epa.gov/air-emissions-inventories/2017-national-emissions-inventory-nei-data
Vessels - Hovercraft Diesel	g/hp-hr	0.320	0.1931	0.1873	0.0047	7.6669	0.2204	0.0000	1.2025	0.0022	USEPA 2017 NEI;TSP refer to Diesel Recip. > 600 hp reference	3/19	

Sulfur Content Source	Value	Units
Fuel Gas	3.38	ppm
Diesel Fuel	0.0015	% weight
Produced Gas (Flare)	3.38	ppm
Produced Oil (Liquid Flaring)	1	% weight

Density and Heat Value of Diesel Fuel		
Density	7.05	lbs/gal
Heat Value	19,300	Btu/lb

Heat Value of Natural Gas		
Heat Value	1,050	MMBtu/MMscf

Natural Gas Flare Parameters	Value	Units
VOC Content of Flare Gas	0.6816	lb VOC/lb-mol gas
Natural Gas Flare Efficiency	98	%

Notes

1. Reserved.
2 Reserved.

COMPANY	AREA		BLOCK	LEASE	FACILITY	WELL						CONTACT		PHONE		REMARKS									
Shell Offshore Inc	Alaminos Canyon		857	OCS-G-17565	rdido Phase 3 N	Well work for LWP4, LWP4-Alt1, LWP4-Alt2, NWP5, NWP5-Alt1, and NWP5-Alt2						Carson Morey		832-337-2779		Perdido Ph3N sDOCD AQR WW INST MODU 20231002-BOEM.xlsxMODU (Drillship or DP Semi-sub)Subsea Installation, well workNo non-default emission factors were used in this A									
OPERATIONS	EQUIPMENT	EQUIPMENT ID	RATING	MAX. FUEL	ACT. FUEL	RUN TIME		MAXIMUM POUNDS PER HOUR									ESTIMATED TONS								
	Diesel Engines		HP	GAL/HR	GAL/D																				
	Nat. Gas Engines		HP	SCF/HR	SCF/D																				
	Burners		MMBTU/HR	SCF/HR	SCF/D	HR/D	D/YR	TSP	PM10	PM2.5	SOx	NOx	VOC	Pb	CO	NH3	TSP	PM10	PM2.5	SOx	NOx	VOC	Pb	CO	NH3
DRILLING, WELL WORK,	VESSELS- Drilling - Propulsion Engine - Diesel		10728	551.91	13245.90	24	280	7.57	4.57	4.43	0.11	181.33	5.21	0.00	28.44	0.05	25.43	15.34	14.88	0.37	609.28	17.52	0.00	95.56	0.18
INSTALLATION	VESSELS- Drilling - Propulsion Engine - Diesel		10728	551.91	13245.90	24	280	7.57	4.57	4.43	0.11	181.33	5.21	0.00	28.44	0.05	25.43	15.34	14.88	0.37	609.28	17.52	0.00	95.56	0.18
	VESSELS- Drilling - Propulsion Engine - Diesel		10728	551.91	13245.90	24	280	7.57	4.57	4.43	0.11	181.33	5.21	0.00	28.44	0.05	25.43	15.34	14.88	0.37	609.28	17.52	0.00	95.56	0.18
	VESSELS- Drilling - Propulsion Engine - Diesel		10728	551.91	13245.90	24	280	7.57	4.57	4.43	0.11	181.33	5.21	0.00	28.44	0.05	25.43	15.34	14.88	0.37	609.28	17.52	0.00	95.56	0.18
	VESSELS- Drilling - Propulsion Engine - Diesel		10728	551.91	13245.90	24	280	7.57	4.57	4.43	0.11	181.33	5.21	0.00	28.44	0.05	25.43	15.34	14.88	0.37	609.28	17.52	0.00	95.56	0.18
	VESSELS- Drilling - Propulsion Engine - Diesel		10728	551.91	13245.90	24	280	7.57	4.57	4.43	0.11	181.33	5.21	0.00	28.44	0.05	25.43	15.34	14.88	0.37	609.28	17.52	0.00	95.56	0.18
	RECIP.<600hp Diesel	Emergency Air Co	26	1.34	32.10	1	280	0.06	0.06	0.06	0.00	0.81	0.06	--	0.17	--	0.01	0.01	0.01	0.00	0.11	0.01	--	0.02	--
	RECIP.>600hp Diesel	Emergency Gener	2547	131.03	3144.79	1	280	1.80	1.02	1.00	0.03	61.21	1.63	--	14.04	--	0.25	0.14	0.14	0.00	8.57	0.23	--	1.97	--
PIPELINE	VESSELS - General Service (MPSV) - Diesel (1)		45000	2315.07	55561.68	24	30	31.75	19.15	18.58	0.46	760.62	21.87	0.00	119.30	0.22	11.43	6.90	6.69	0.17	273.82	7.87	0.00	42.95	0.08
INSTALLATION	VESSELS - General Service (MPSV) - Diesel (1)		42000	2160.73	51857.57	24	20	29.63	17.88	17.34	0.43	709.91	20.41	0.00	111.35	0.21	7.11	4.29	4.16	0.10	170.38	4.90	0.00	26.72	0.05
PRODUCTION	VESSELS - Well Stimulation		37500	1929.23	46301.40	24	10	26.46	15.96	15.48	0.39	633.85	18.22	0.00	99.42	0.18	3.17	1.92	1.86	0.05	76.06	2.19	0.00	11.93	0.02
2024-2029	**Annual Facility Total Emissions**							**135.10**	**81.47**	**79.03**	**1.97**	**3,254.39**	**93.48**	**0.01**	**514.93**	**0.93**	**174.55**	**105.31**	**102.15**	**2.54**	**4,184.60**	**120.30**	**0.01**	**656.97**	**1.22**
EXEMPTION CALCULATION	**DISTANCE FROM LAND IN MILES**																**4,695.30**			**4,695.30**	**4,695.30**	**4,695.30**		**92,106.79**	
	141																								
DRILLING	VESSELS- Fastl/Crew Diesel		8000	411.57	9877.63	24	140	5.64	3.41	3.30	0.08	135.22	3.89	0.00	21.21	0.04	9.48	5.72	5.55	0.14	227.17	6.53	0.00	35.63	0.07
	VESSELS - Supply Diesel		10100	519.60	12470.51	24	280	7.13	4.30	4.17	0.10	170.72	4.91	0.00	26.78	0.05	23.94	14.44	14.01	0.35	573.61	16.49	0.00	89.97	0.17
	VESSELS - Supply Diesel		10100	519.60	12470.51	24	56	7.13	4.30	4.17	0.10	170.72	4.91	0.00	26.78	0.05	4.79	2.89	2.80	0.07	114.72	3.30	0.00	17.99	0.03
	VESSELS - Supply Diesel		10100	519.60	12470.51	24	56	7.13	4.30	4.17	0.10	170.72	4.91	0.00	26.78	0.05	4.79	2.89	2.80	0.07	114.72	3.30	0.00	17.99	0.03
PIPELINE	VESSELS - General Support (MPSV) - Diesel (1)		21400	1100.94	26422.67	24	30	15.10	9.11	8.84	0.22	361.72	10.40	0.00	56.73	0.11	5.44	3.28	3.18	0.08	130.22	3.74	0.00	20.42	0.04
INSTALLATION	VESSELS - General Support (MPSV) - Diesel (1)		14751	758.88	18213.12	24	10	10.41	6.28	6.09	0.15	249.33	7.17	0.00	39.11	0.07	1.25	0.75	0.73	0.02	29.92	0.86	0.00	4.69	0.01
2024-2029	**Annual Non-Facility Total Emissions**							**52.52**	**31.69**	**30.74**	**0.76**	**1,258.42**	**36.18**	**0.00**	**197.38**	**0.37**	**49.68**	**29.97**	**29.08**	**0.72**	**1,190.36**	**34.23**	**0.00**	**186.71**	**0.35**

AIR EMISSIONS CALCULATIONS

COMPANY	AREA	BLOCK	LEASE	FACILITY	WELL
Shell Offshore Inc	Alaminos Canyon	857	OCS-G-17565	Perdido Phase 3 North	Well work for LWP4, LWP4-Alt1, LWP4-Alt2, NWP5, NWP5-Alt1, and NWP5-Alt2

Year	Facility Emitted Substance								
	TSP	PM10	PM2.5	SOx	NOx	VOC	Pb	CO	NH3
2024-2029	174.55	105.31	102.15	2.54	4184.60	120.30	0.01	656.97	1.22
Allowable	4695.30			4695.30	4695.30	4695.30		92106.79	

SECTION 9: OIL SPILL INFORMATION

A. Oil Spill Response Planning

All the proposed activities and facilities in this plan will be covered by the Regional OSRP filed by Shell Offshore Inc. (0689) in accordance with 30 CFR 254.47 and NTL 2013-N02. Shell's regional OSRP was approved by BSEE in June 2017. The biennial update was confirmed in compliance by BSEE in December 2021 orin the letter dated January 2022, the OSRP biennial update was confirmed in compliance by BSEE in December 12, 2021.

Primary Response Equipment Locations	Preplanned Staging Location(s)
Ingleside, TX; Galveston, TX; Venice, LA; Ft Jackson, LA; Harvey, LA; Stennis, MS; Pascagoula, MS; Theodore, AL; Tampa, FL	Galveston, TX; Port Fourchon; Venice, LA; Pascagoula, MS ; Mobile, AL; Tampa, FL

Table 9.1 – Response Equipment and Staging Areas

OSRO Information:

The names of the oil spill removal organizations (OSRO's) under contract include Clean Gulf Associates (CGA), Marine Spill Response Company (MSRC) and Oil Spill Response Limited (OSRL). These OSRO's provide equipment and will in some cases provide trained personnel to operate their response equipment (OSRVs, etc.) and Shell also has the option to pull from their trained personnel as needed for assistance/expertise in the Command Post and in the field.

Category	Regional OSRP	DOCD
Type of Activity	Production >10 miles to shore	Drilling
Facility Location (area/block)	MC 812	AC 857
Facility Designation	Subsea well B◊	Subsea well GA014◊◊
Distance to Nearest Shoreline (miles)	59	142
Volume Storage tanks (total) Flowlines (on facility) Pipelines Uncontrolled blowout (volume per day) Total Volume	 N/A Bbls N/A Bbls N/A Bbls 160,000* BOPD 147,000 Bbls	 4,000 100 8,300 129,000** BOPD 141,400 Bbls
Type of Oil(s) - (crude oil, condensate, diesel)	Crude oil	Crude oil
API Gravity(s)	31.4°	34°

Table 9.2 - Worst Case Scenario Determination

***24-hour rate (432,000 BOPD 30-day average)** ****24-hour rate (233,000 BOPD 30-day average)**

◊This well was accepted by BOEM in plan N-9840. ◊◊This well was accepted by BOEM in plan R-5144

Certification: *Since Shell Offshore Inc. has the capability to respond to the appropriate worst-case spill scenario included in its regional OSRP, approved by BSEE June 2017. The biennial review was found to be in compliance November 2019 and updates were found to be in compliance December 2022. Since the worst-case scenario determined for our Plan does not replace the appropriate worst-case scenario in our regional OSRP, I hereby certify that Shell Offshore Inc. has the capability to respond, to the maximum extent practicable, to a worst-case discharge, or a substantial threat of such a discharge, resulting from the activities proposed in our plan.*

Modeling: Based on the requirement per BSEE NTL 2008-G04 and the outcome of the OSRAM Model, Shell determined no additional modeling was needed for potential oil or hazardous substance spill for operations proposed in this DOCD, as the current, approved OSRP adequately meets the necessary response capabilities.

B. Oil Spill Response Discussion

1. Volume of the Worst Case Discharge

Please refer to Section 2j and 9(iv) of this Plan.

2. Trajectory Analysis

Trajectories of a spill and the probability of it impacting a land segment have been projected utilizing information in the BOEM Oil Spill Risk Analysis Model (OSRAM) for the Central and Western Gulf of Mexico available on the BOEM website using 30 day impact. Offshore areas along the trajectory between the source and land segment contact could be impacted. The land segment contact probabilities are shown in Table 9.C.1.

Area/Block	OCS-G	Launch Area	Land Segment Contact	%
AC 857	17565	11	Cameron, TX	5
			Willacy, TX	2
			Kenedy, TX	8
			Kleberg, TX	6
			Nueces, TX	4
			Aransas, TX	5
			Calhoun, TX	6
			Matagorda, TX	**10**
			Brazoria, TX	2
			Galveston, TX	3
			Jefferson, TX	1
			Cameron, LA	1

Table 9.C.1 Probability of Land Segment Impact

C. Resource Identification

The locations identified in Table 9.C.1 are the highest probable land segments to be impacted using the BOEM Oil Spill Risk Analysis Model (OSRAM). The environmental sensitivities are identified using the appropriate National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index (ESI) maps for the given land segment. ESI maps provide a concise summary of coastal resources that are at risk if an oil spill occurs nearby. Examples of at-risk resources include biological resources (such as birds and shellfish beds), sensitive shorelines (such as marshes and tidal flats), and human-use resources (such as public beaches and parks).

In the event an oil spill occurs, ESI maps can help responders meet one of the main response objectives: reducing the environmental consequences of the spill and the cleanup efforts. Additionally, ESI maps can be used by planners to identify vulnerable locations, establish protection priorities, and identify cleanup strategies.

The following is a list of resources of special economic or environmental importance that potentially could be impacted by the Alaminos Canyon 857 WCD scenario.

Onshore/Nearshore: Matagorda County is identified as the most probable impacted County within the Gulf of Mexico for the Exploratory Worst Case Discharge. The Matagorda County has a total area of 1,612 square miles of which, 1,114 square miles of it is land and 498 square miles is water. Matagorda County includes two National Wildlife Refuges and one Wildlife Management Area including the Big Boggy National Wildlife Refuge, part of San Bernard National Wildlife Refuge, and the Mad Island Wildlife Management Area (WMA). The Big Boggy National Wildlife Refuge and San Bernard National Wildlife Refuge form a vital complex of coastal wetlands harboring more than 300 bird species. The Mad Island WMA is 5,700 acres and wildlife consists of a variety of different species. Key ESI maps for Plaquemines Parish and the legend are shown in Figures 9.C.1, 9.C.2, 9.C.3, 9.C.4, and 9.C.5.

Offshore: An offshore spill may require an Essential Fishing Habitat (EFH) Assessment. This assessment would include a description of the spill, analysis of the potential adverse effects on EFH and the managed species; conclusions regarding the effects on the EFH; and proposed mitigation, if applicable.

Significant pre-planning of joint response efforts was undertaken in response to provisions of the National Contingency Plan (NCP). Area Contingency Plans (ACPs) were developed to provide a well-coordinated response to oil discharges and other hazardous releases. The One Gulf Plan is specific to the Gulf of Mexico to advance the unity of policy and effort in each of the Gulf Coast ACPs. Strategies used for the response to an oil spill regarding protection of identified resources are detailed in the One Gulf Plan and relevant Gulf Coast ACP.

D. Worst Case Discharge Response

Shell will make every effort to respond to the AC 857 Worst Case Discharge as effectively as possible. Below is a table outlining the applicable evaporation and surface dispersion quantity:

Alaminos Canyon Block 857		Calculations (BBLS)
i.	**TOTAL WCD (based on 30 day average/per day)**	**~78,700**
ii.	Loss of volume of oil to natural surface dispersion and evaporation base (approximate bbls per day)* (23% Natural surface evaporation and dispersion in 24 hrs.)	-18,100
	TOTAL REMAINING	**~60,600**

* As this scenario involves a surface blowout onboard the platform, an ADIOS 2 Model was ran to account for surface dispersion and evaporation.

Table 9.D.1 Oil Remaining After Subsurface and Surface Dispersion

Shell has contracted OSROs to provide equipment, personnel, materials and support vessels as well as temporary storage equipment to be considered in order to cope with a WCD spill. Under adverse weather conditions, major response vessels and Transrec skimmers are still effective and safe in sea states of 6-8 ft. If sea conditions prohibit safe mechanical recovery efforts, then natural dispersion and airborne chemical dispersant application (visibility & wind conditions permitting) may be the only safe and viable recovery option.

MSRC OSRV	8 foot seas
VOSS System	4 foot seas
Expandi Boom	6 foot seas, 20 knot winds
Dispersants	Winds more than 25 knots, Visibility less than 3 nautical miles, or Ceiling less than 1,000 feet.

Table 9.D.2 Operational Limitations of Response Equipment

Upon notification of the spill, Shell would request a partial or full mobilization of contracted resources, including, but not limited to, skimming vessels, oil storage vessels, dispersant aircraft, subsea dispersant, shoreline protection, wildlife protection, and containment equipment. Following is a list of the contracted resources including de-rated recovery capacity, personnel, and estimated response times (procurement, load out, travel time to the site, and deployment). The Incident Commander or designee may contact other service companies if the Unified Command deems such services necessary to the response efforts.

Based on the anticipated worst case discharge scenario, Shell can be onsite with dedicated, contracted on water oil spill recovery equipment with adequate response capacity to contain and recover surface oil, and prevent land impact, within 28 hours (based on the equipment's Estimated Daily Response Capacity (EDRC)). Shell will continue to ramp up additional on-water mechanical recovery resources as well as apply dispersants and in-situ burning as needed and as approved under the supervision of the USCG Captain of the Port (COTP) and the Regional Response Team (RRT).

Subsea Control and Containment: Shell, as a founding member of the MWCC, will have access to the IRCS that can be rapidly deployed through the MWCC. The IRCS is designed to contain oil flow in the unlikely event of an underwater well blowout, and is designed, constructed, tested, and available for rapid response. Shell's specific containment response for AC 857 will be addressed in Shell's NTL10 submission at the time the APD is submitted.

Table 9.D.9 Control, Containment, and Subsea Dispersant Package Activation List

Mechanical Recovery (skimming): Response strategies include skimming utilizing available OSROs Oil Spill Response Vessels (OSRVs), Oil Spill Response Barges (OSRBs), ID Boats, and Quick Strike OSRVs. There is a combined de-rated recovery rate capability of approximately 525,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 377,000 barrels.

	De-rated Recovery Rate (bopd)	Storage (bbls)
Offshore Recovery and Storage	291,265	364,733
Nearshore Recovery and Storage	233,856	12,516
Total	525,121	377,249

Table 9.D.3 Mechanical Recovery Combined De-Rated Capability

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List
Table 9.D.5 Nearshore On-Water Recovery and Storage 5ctivation List

Oil Storage: The strategy for transferring, storing and disposing of oil collected in these recovery zones is to utilize two 150,000-160,000 ton (dead weight) tankers mobilized by Shell (or any other tanker immediately available). The recovered oil would be transferred to Motiva's Norco, LA storage and refining facility, or would be stored at Delta Commodities, Inc. Harvey, LA facility.

Aerial Surveillance: Aircraft can be mobilized to detect, monitor, and target response to oil spills. Aircraft and spotters can be mobilized within hours of an event.

Table 9.D.6 Aerial Surveillance Activation List

Aerial Dispersant: Depending on proximity to shore and water depth, dispersants may be a viable response option. If appropriate and approved, 4 to 5 sorties from three DC-3's can be made within the first 12 hour operating day of the response. These aerial systems could disperse approximately 7,704 to 9,630 barrels of oil per day. Additionally, 3 to 4 sorties from the BE90 King Air and 3 to 4 sorties from the Hercules C-130A within the first 12 hour operating day of the response could disperse 4,600 to 6,100 barrels of oil per day. For continuing dispersant operations, the CCA's Aerial Dispersant Delivery System (ADDS) would be mobilized. The ADDS has a dispersant spray capability of 5,000 gallons per sortie.

Table 9.D.7 Offshore Aerial Dispersant Activation List

Vessel Dispersant: Vessel dispersant application is another available response option. If appropriate, vessel spray systems can be installed on offshore vessels of opportunity using inductor nozzles (installed on fire-water monitors), skid mounted systems, or purpose-built boom arm spray systems. Vessels can apply dispersant within the first 12-24 hours of the response and continually as directed.

Table 9.D.8 Offshore Boat Spray Dispersant Activation List

Subsea Dispersant: Shell has contracted with MWCC and Wild Well Control for a subsea dispersant packages. Subsea dispersant application has been found to be highly effective at reducing the amount of oil reaching the surface. Additional data collection, laboratory tests and field tests will help in facilitating the optimal application rate and effectiveness numbers. For planning purposes, these system has the potential to disperse approximately 24,500 to 34,000 barrels of oil per day.

Table 9.D.9 Control, Containment, and Subsea Dispersant Package Activation List

In-Situ Burning: Open-water in-situ burning (ISB) also may be used as a response strategy, depending on the circumstances of the release. ISB services may be provided by the primary OSRO contractors. If appropriate conditions exist and approvals are granted, one or multiple ISB task forces could be deployed offshore. Task forces typically consist of two to four fire teams, each with two vessels capable of towing fire boom, guide boom or tow line with either a handheld or aerially-deployed oil ignition system. At least one support/safety boat would be present during active burning operations to provide logistics, safety and monitoring support. Depending upon a number of factors, up to 4 burns per 12-hour day could be completed per ISB fire team. Most fire boom systems can be used for approximately 8-12 burns before being replaced. Fire intensity and weather will be the main determining factors for actual burns per system. Although the actual amount of oil that will be removed per burn is dependent on many factors, recent data suggests that a typical burn might eliminate approximately 750 barrels. For planning purposes and based on the above assumptions, a single task force of four fire teams with the appropriate weather and safety conditions could complete four burns per day and remove up to ~12,000 bbls/day. In-situ burning nearshore and along shorelines may be a possible option based on several conditions and with appropriate approvals, as outlined in Section 19, In-situ Burn Plan (OSRP). In-situ burning along certain types of shorelines may be used to minimize physical damage where access is limited or if it is determined that mechanical/manual removal may cause a substantial negative impact on the environment. All safety considerations will be evaluated. In addition, Shell will assess the situation and can make notification within 48 hours of the initial spill to begin ramping up fire boom production through contracted OSRO(s). There are potential limitations that need to be assessed prior to ISB operations. Some limitations include atmospheric and sea conditions; oil weathering; air quality impacts; safety of response workers; and risk of secondary fires.

Table 9.D.10 In-Situ Burn Equipment Activation List

Shoreline Protection: If the spill went unabated, shoreline impact in Plaquemines Parish, LA would depend upon existing environmental conditions. Nearshore response may include the deployment of shoreline boom on beach areas, or protection and sorbent boom on vegetated areas. Strategies would be based upon surveillance and real time trajectories provided by The Response Group that depict areas of potential impact given actual sea and weather conditions. Strategies from the New Orleans, Louisiana Area Contingency Plan, Unified Command would be consulted to ensure that environmental and special economic resources would be correctly identified and prioritized to ensure optimal protection. Shell has access to shoreline response guides that depict the protection response modes applicable for oil spill clean-up operations. Each response mode is schematically represented to show optimum deployment and operation of the equipment in areas of environmental concern. Supervisory personnel have the option to modify the deployment and operation of equipment allowing a more effective response to site-specific circumstances.

Table 9.D.11 Shoreline Protection and Wildlife Support List

Wildlife Protection: If wildlife is threatened due to a spill, the contracted OSRO's have resources available to Shell, which can be utilized to protect and/or rehabilitate wildlife. The resources under contract for the protection and rehabilitation of affected wildlife are in Table 9.D.11.

New or unusual technology in regards to spill, prevention, control and clean-up:

Shell will use our normal well design and construction processes with multiple barrier approach as well as new stipulations mandated by NTL 05. Response techniques will utilize new learnings from Macondo response to include in-situ burning and subsea dispersant application. Mechanical recovery advancements are continuing to be made to incorporate utilization of Koseq arms outfitted on barges, conversion of Platform Support Vessels for Oil Spill Response, and inclusion of nighttime spill detection radar to improve tracking capabilities (X-Band radar, Infrared sensing, etc.). In addition, new response technologies/techniques are continuing to be considered by Shell and the appropriate government organizations for incorporation into our planned response. Any additional response technologies/techniques presented at the time of response will be used at the discretion of the Unified Command and USCG.

Figure 9.C.1 Environmental Sensitivity Index Map Legend

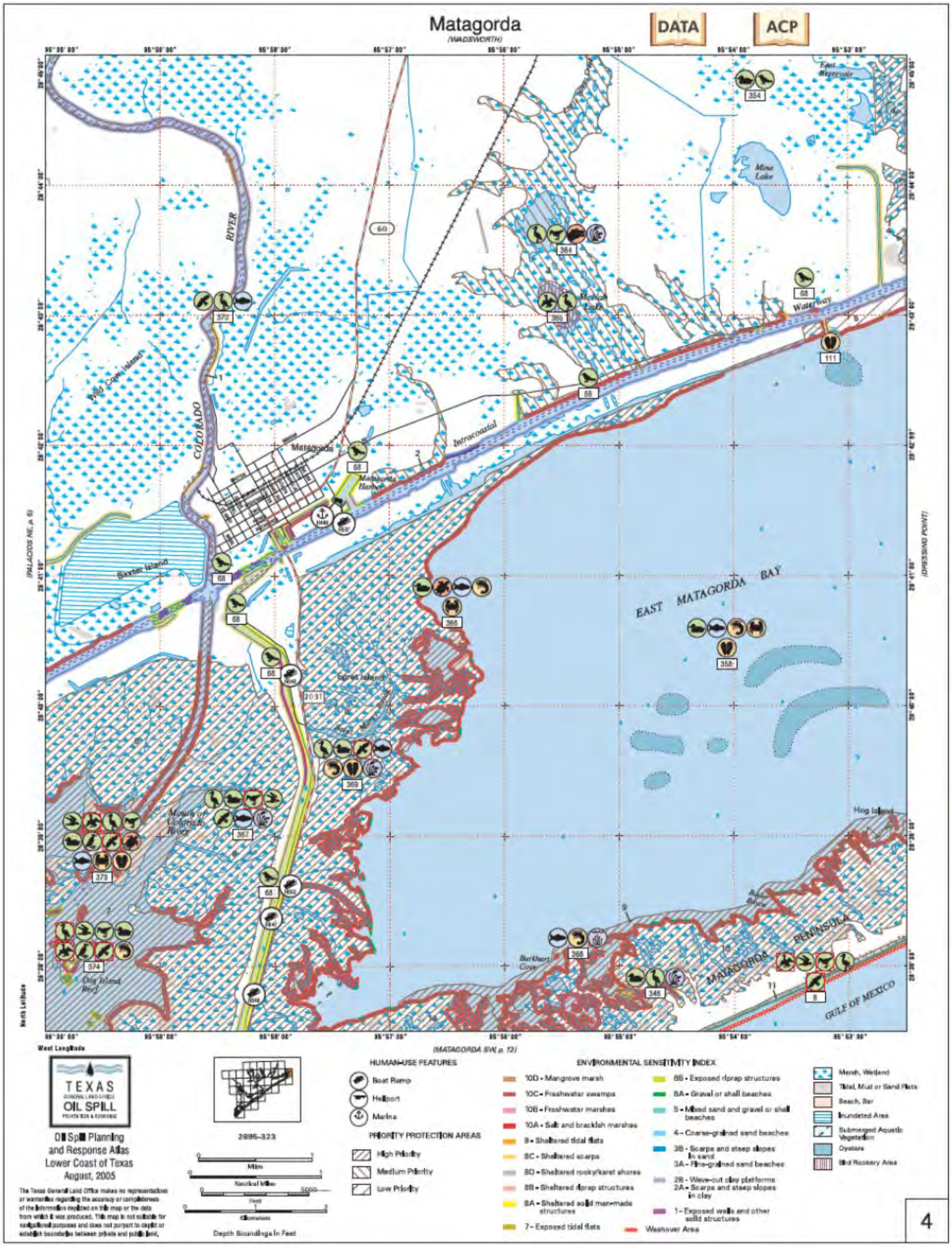


Figure 9.C.2 South Pass ESI Map

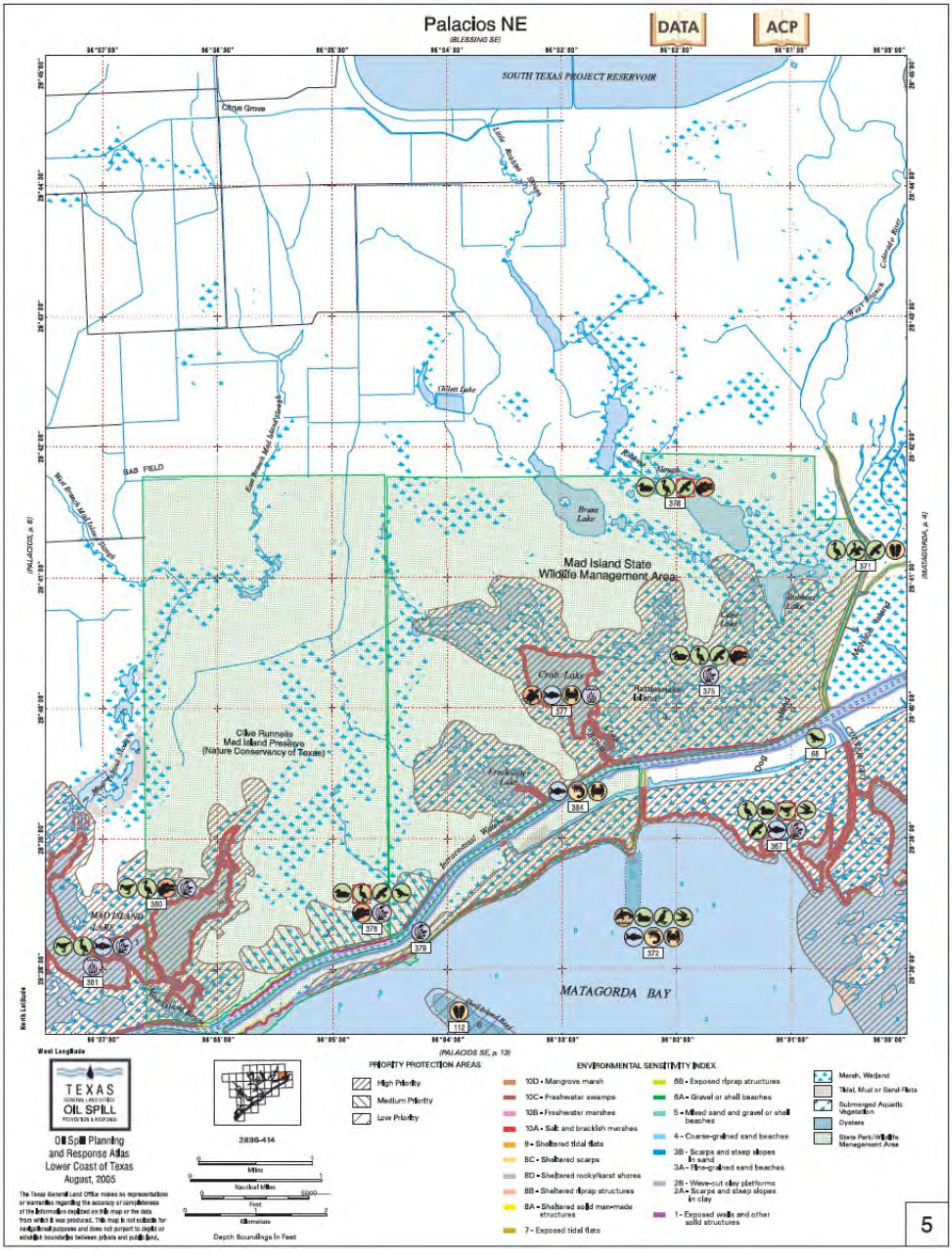


Figure 9.C.3 Garden Island Pass ESI Map

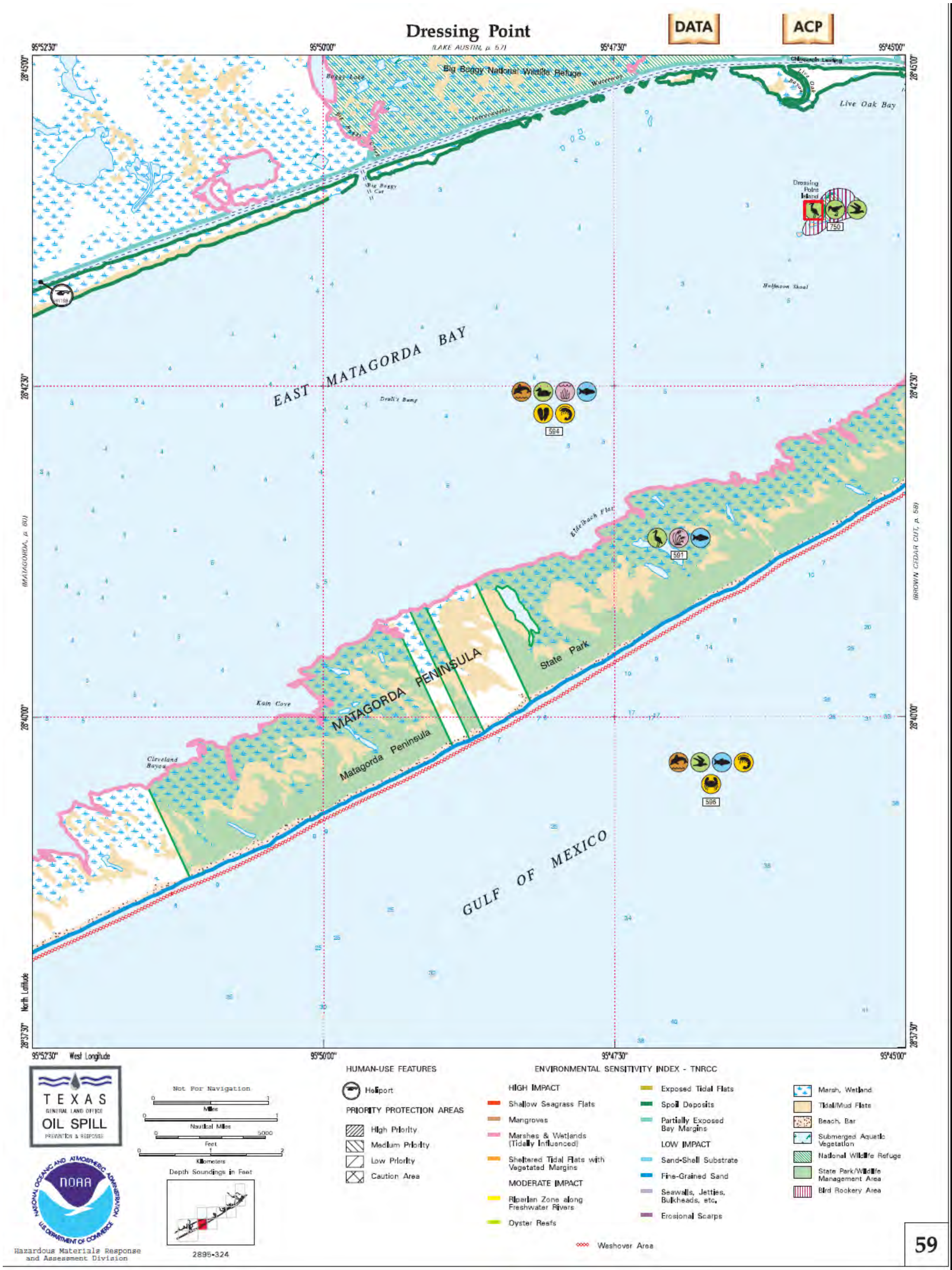


Figure 9.C.4 Pass a Loutre West ESI Map

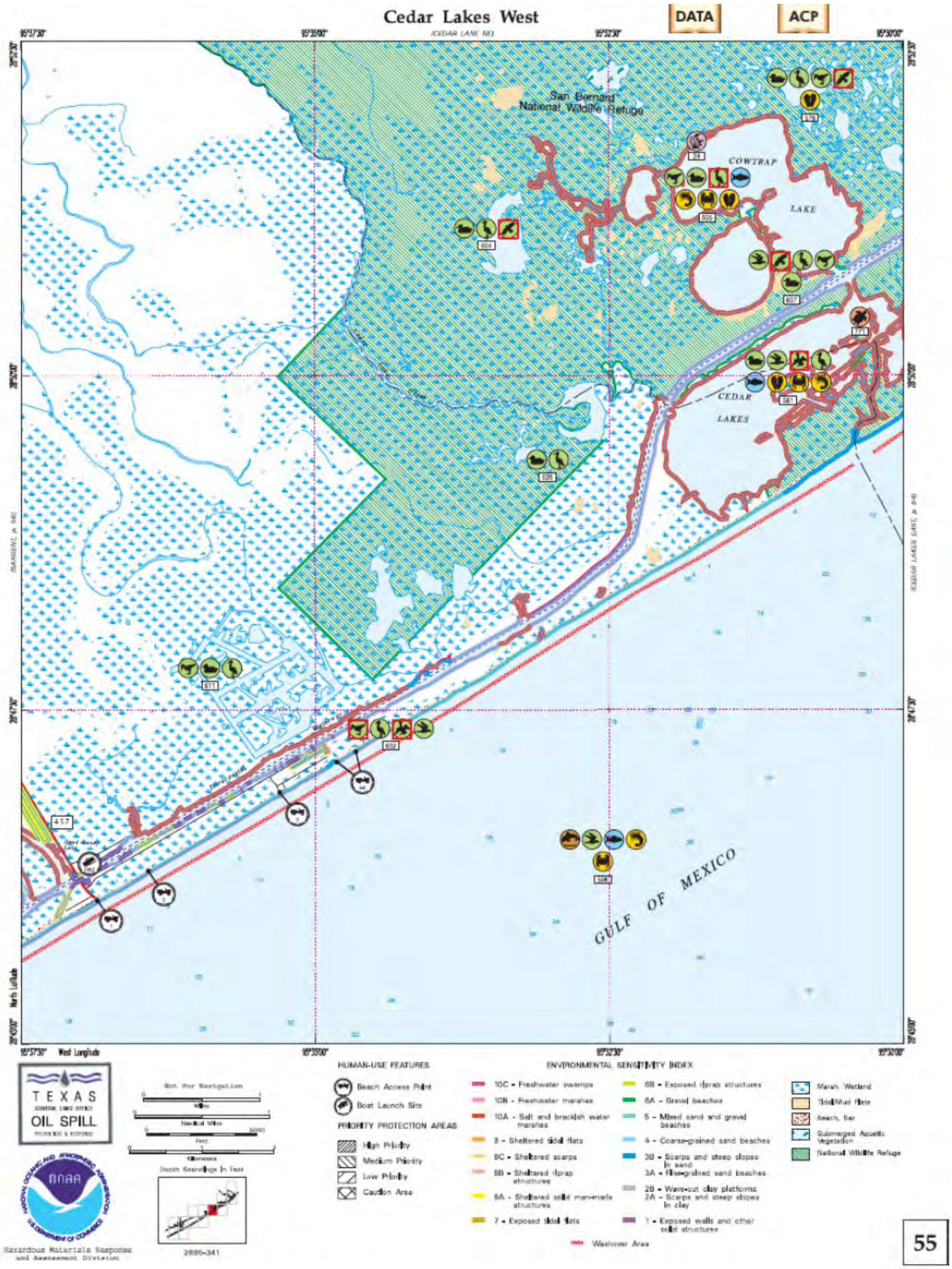


Figure 9.C.5 Main Pass ESI Map

AC 857 Drilling > 10 Miles
Sample Offshore On-Water Recovery & Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Site	Response Times (Hours): Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified. ** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment.													
FRV Galveston Island	CGA (888) 242-2007	Galveston, TX	Lamor Brush Skimmer	2	12,342	249	Galveston, TX	232	2	0	10.5	1	14
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	4									
Southern Responder Transrec-350	MSRC (800) OIL-SPIL	Ingleside, TX	Transrec Skimmer	1	10,567	4,000	Ingleside, TX	192	2	1	13.5	1	18
			Backup- Stress 1 Skimmer	1									
			Operational 67" Boom	2640'									
			Additional 67" Boom	4620'									
			210' Vessel	1									
			Personnel	10-12									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
FOILEX 250	MSRC (800) OIL-SPIL	Ingleside, TX	Offshore Skimmer	1	3,977	0	Aransas Pass, TX	185	4	1	13	1	19
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
Stress 1	MSRC (800) OIL-SPIL	Ingleside, TX	Offshore Skimmer	1	15,840	0	Aransas Pass, TX	185	4	1	13	1	19
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Aransas Pass, TX	Foilex 250 Skimmer	1	4,251	100	Aransas Pass, TX	185	4	1	13	1	19
			Personnel	4									
			* 100-165' Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
FRV H.I. Rich	CGA (888) 242-2007	Leeville, LA	Lamor Brush Skimmer	2	12,342	249	Leeville, LA	354	2	0	16	1	19
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	4									
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Galveston, TX	Foilex 250 Skimmer	1	4,251	100	Aransas Pass, TX	185	6	1	13	1	21
			Personnel	4									
			* 100-165' Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Texas Responder Transrec-350	MSRC (800) OIL-SPIL	Galveston, TX	Transrec Skimmer	1	10,567	4,000	Galveston, TX	232	2	1	16.5	1	21
			Backup- Stress 1 Skimmer	1									
			Operational 67" Boom	2640'									
			Additional 67" Boom	5280'									
			210' Vessel	1									
			Personnel	10-12									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
Walosep W-4	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Skimmer	1	3,017	0	Aransas Pass, TX	185	6	1	13	1	21
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
PT 150 Aquaguard Skimmer (1)	CGA (888) 242-2007	Galveston, TX	Brush skimmer	1	22,780	0	Aransas Pass, TX	185	6	1	13	1	21
			Personnel	4									
			* Offshore Utility Boat	1									
			* Add'l Storage	1		500							

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List

AC 857 Drilling > 10 Miles
Sample Offshore On-Water Recovery & Storage Activation List

* - These components are additional operational requirements that must be procured in addition to the system identified.
** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment.

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
PT 150 Aquaguard Skimmer (2)	CGA (888) 242-2007	Galveston, TX	Brush skimmer	1	22,780	0	Aransas Pass, TX	185	6	1	13	1	21
			Personnel	4									
			* Offshore Utility Boat	1									
			* Add'l Storage	1		500							
FRU 3.0 - Foilex 150 TDS	CGA (888) 242-2007	Galveston, TX	Weir Skimmer	1	1,131	0	Aransas Pass, TX	185	6	1	13	1	21
			Personnel	4									
			* Utility Boat (<100')	1									
			50 bbl Portable tank	1		50							
FOILEX 250	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Skimmer	1	3,977	0	Aransas Pass, TX	185	6	1	13	1	21
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
Stress 1	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Skimmer	1	15,840	0	Aransas Pass, TX	185	6	1	13	1	21
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
GT-185	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Skimmer	1	1,371	0	Aransas Pass, TX	185	6	1	13	1	21
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
FRV Breton Island	CGA (888) 242-2007	Venice, LA	Lamor Brush Skimmer	2	12,342	249	Venice, LA	416	2	0	19	1	22
			36" Boom	64									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	4									
GT-185	MSRC (800) OIL-SPIL	Port Arthur, TX	Offshore Skimmer	1	1,371	0	Aransas Pass, TX	185	6.75	1	13	1	22
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
FRU 3.0 - Foilex 150 TDS	CGA (888) 242-2007	Lake Charles, LA	Weir Skimmer	1	1,131	0	Aransas Pass, TX	185	7.5	1	13	1	23
			Personnel	4									
			* Utility Boat (<100')	1									
			50 bbl Portable tank	1		50							
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Lake Charles, LA	Foilex 250 Skimmer	1	4,251	100	Aransas Pass, TX	185	7.5	1	13	1	23
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
FOILEX 250	MSRC (800) OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	3,977	0	Aransas Pass, TX	185	7.5	1	13	1	23
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
DESMI OCEAN	MSRC (800) OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	3,017	0	Aransas Pass, TX	185	7.5	1	13	1	23
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew/Support Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Offshore On-Water Recovery & Storage Activation List

* - These components are additional operational requirements that must be procured in addition to the system identified.
** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment.

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Morgan City, LA	Foilex 250 Skimmer Personnel Utility Boat ** 67" Sea Sentry ** Crew Boat ** Add'l Storage	1 4 1 440' 1 1	4,251	100 100	Aransas Pass, TX	185	9.75	1	13	1	25
GT-185	MSRC (800) OIL-SPIL	Baton Rouge, LA	Offshore Skimmer 67" Offshore Boom Personnel * Crew/Support Boat *Utility Boat Temporary Storage	1 110' 4 1 1 1	1,371	0 500	Aransas Pass, TX	185	9.25	1	13	1	25
Gulf Coast Responder Transrec-350	MSRC (800) OIL-SPIL	Lake Charles, LA	Transrec Skimmer Backup- Stress 1 Skimmer Operational 67" Boom Additional 67" Boom 210' Vessel Personnel 32' Support Boat X Band Radar Infrared Camera	1 1 2640' 5280' 1 10-12 1 1 1	10,567	4,000	Lake Charles, LA	293	2	1	21	1	25
FRU 3.0 - Foilex 150 TDS	CGA (888) 242-2007	Harvey, LA	Weir Skimmer Personnel * Utility Boat (<100') 50 bbl Portable tank	1 4 1 1	1,131	0 50	Aransas Pass, TX	185	10.5	1	13	1	26
FOILEX 250	MSRC (800) OIL-SPIL	Belle Chasse, LA	Offshore Skimmer 67" Offshore Boom Personnel * Crew/Support Boat *Utility Boat Temporary Storage	1 110' 4 1 1 1	3,977	0 500	Aransas Pass, TX	185	10.75	1	13	1	26
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Harvey, LA	Foilex 250 Skimmer Personnel Utility Boat ** 67" Sea Sentry ** Crew Boat ** Add'l Storage	1 4 1 440' 1 1	4,251	100 100	Aransas Pass, TX	185	10.5	1	13	1	26
FOILEX 200	MSRC (800) OIL-SPIL	Belle Chasse, LA	Offshore Skimmer 67" Offshore Boom Personnel * Crew/Support Boat *Utility Boat Temporary Storage	1 110' 4 1 1 1	1,989	0 500	Aransas Pass, TX	185	10.75	1	13	1	26
GT-185	MSRC (800) OIL-SPIL	Belle Chasse, LA	Offshore Skimmer 67" Offshore Boom Personnel * Crew/Support Boat *Utility Boat Temporary Storage	1 110' 4 1 1 1	1,371	0 500	Aransas Pass, TX	185	10.75	1	13	1	26
Walosep W-4	MSRC (800) OIL-SPIL	Belle Chasse, LA	Offshore Skimmer 67" Offshore Boom Personnel * Crew Boat *Utility Boat Temporary Storage	1 110' 4 1 1 1	3,017	0 500	Aransas Pass, TX	185	10.75	1	13	1	26
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Leeville, LA	Foilex 250 Skimmer Personnel Utility Boat ** 67" Sea Sentry ** Crew Boat ** Add'l Storage	1 4 1 440' 1 1	4,251	100 100	Aransas Pass, TX	185	11.25	1	13	1	27

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Offshore On-Water Recovery & Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Site	Response Times (Hours): Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified. ** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment.													
M/V Responder MOSS Unit w/ GT-185	AMPOL (800) 482-6765	New Iberia, LA	GT-185 Skimmer	1	1,371	200	New Iberia, LA	317	2	1	22.5	1	27
			36" Expandi Boom	720'									
			Personnel	8									
			110' Utility Boat	1									
			Crew Boat - >65'	1									
Fast Response Unit "FRU" 1.0	CGA (888) 242-2007	Leeville, LA	Foilex 250 Skimmer	1	4,251	100	Aransas Pass, TX	185	11.25	1	13	1	27
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
WP-1	MSRC (800) OIL-SPIL	Pascagoula, MS	Offshore Skimmer	1	3,017	0	Aransas Pass, TX	185	11.45	1	13	1	27
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
MSRC-403 Offshore Barge	MSRC (800) OIL-SPIL	Ingleside, TX	Offshore Barge	1	11,122	40,300	Ingleside, TX	192	4	1	21.5	1	28
			67" Offshore Boom	1320'									
			Crucial Disc Skimmer	1									
			* Crew/Support Boat	1-2									
			Personnel	6-18									
			* Offshore Tug	2									
			X Band Radar	1									
			Infrared Camera	1									
M/V Recovery MOSS Unit w/ GT-185	AMPOL (800) 482-6765	Port Fourchon, LA	GT-185 Skimmer	1	1,371	200	Port Fourchon, LA	354	2	1	25.5	1	30
			36" Expandi Boom	720'									
			Personnel	8									
			110' Utility Boat	1									
			Crew Boat - >65'	1									
Deep Blue Responder LFF 100 Brush	MSRC (800) OIL-SPIL	Port Fourchon, LA	LFF 100 Brush Skimmer	1	18,086	4,000	Port Fourchon, LA	354	2	1	25.5	1	30
			Operational 67" Boom	2640'									
			Additional 67" Boom	4620'									
			210' Vessel	1									
			Personnel	10-12									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
MSRC-570 Offshore Barge	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Barge	1	22,244	56,900	Galveston, TX	232	4	1	25.5	1	32
			67" Offshore Boom	2640'									
			Crucial Disc Skimmer	2									
			* Crew/Support Boat	1-2									
			Personnel	6-18									
			* Offshore Tug	2									
			X Band Radar	1									
			Infrared Camera	1									

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Offshore On-Water Recovery & Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Site	Response Times (Hours): Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified. ** - These components are additional operational requirements for the packages to be used in an enhanced skimming deployment.													
Louisiana Responder Transec 350	MSRC (800) OIL-SPIL	Fort Jackson, LA	Transrec (Backup: Stress I)	1	10,567	4,000	Fort Jackson, LA	425	2	1	30.5	1	35
			Operational 67" Boom	2640'									
			Additional 67" Boom	5280'									
			210' Vessel	1									
			Personnel	10-12									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
GT-185	MSRC (800) OIL-SPIL	Tampa, FL	Offshore Skimmer	1	1,371	0	Aransas Pass, TX	185	19.75	1	13	1	35
			67" Offshore Boom	110'									
			Personnel	4									
			* Crew Boat	1									
			*Utility Boat	1									
			Temporary Storage	1		500							
Mississippi Responder Transrec-350	MSRC (800) OIL-SPIL	Pascagoula, MS	Transrec Skimmer	1	10,567	4,000	Pascagoula, MS	511	2	1	36.5	1	41
			Backup- Stress 1 Skimmer	1									
			Operational 67" Boom	2640'									
			Additional 67" Boom	5280'									
			210' Vessel	1									
			Personnel	10-12									
			32' Support Boat	1									
			X Band Radar	1									
			Infrared Camera	1									
CTCo-5001 Offshore Barge	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	47,000	Morgan City, LA	342	24-72	0	40.5	1	66 to 114
			Personnel	4									
			Offshore Tug	1									
CTCo-2606 Offshore Barge	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	20,000	Morgan City, LA	342	24-72	0	40.5	1	66 to 114
			Personnel	4									
			Offshore Tug	1									
CTCo-2608 Offshore Barge	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	23,000	Morgan City, LA	342	24-72	0	40.5	1	66 to 114
			Personnel	4									
			Offshore Tug	1									
CTCo-2609 Offshore Barge	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	23,000	Morgan City, LA	342	24-72	0	40.5	1	66 to 114
			Personnel	4									
			Offshore Tug	1									
Moran/ New Hampshire	CGA (888) 242-2007	Houma, LA	Offshore Barge	1	N/A	118,836	Houma, LA	370	24-72	0	43.5	1	69 to 117
			Personnel	4									
			Offshore Tug	1									
DERATED RECOVERY RATE (BBLS/DAY)													291,265
STORAGE CAPACITY INCLUDING SKIMMING VESSELS (BARRELS)													364,733

Table 9.D.4 Offshore On-Water Recovery and Storage Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Nearshore Environment	Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified.													
FRV CGA 58 Timbalier Bay	CGA (888) 242-2007	Aransas Pass, TX	Lori Brush Skimmer	2	5,000	65	Galveston, TX	232	2	0	10.5	1	14
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
SWS CGA-71 Trinity Shallow Water Skimmer	CGA (888) 242-2007	Galveston, TX	Marco Belt Skimmer	2	21,500	249	Galveston, TX	232	2	1	10.5	1	15
			36" Auto Boom	150'									
			Personnel	5									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
FRV M/V Bastian Bay	CGA (888) 242-2007	Lake Charles, LA	Lori Brush Skimmer	2	5,000	65	Lake Charles, LA	293	2	0	13.5	1	17
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Ingleside, TX	Marco I Skimmer	1	3,588	24	Aransas Pass, TX	185	4	1	13	1	19
			Personnel	4									
			30' Shallow Water Vessel	1									
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Ingleside, TX	Skimmer	1	1,371	400	Aransas Pass, TX	185	4	1	13	1	19
			18" Boom	50'									
			Personnel	4									
			Self-propelled barge	1									
WP-1	MSRC (800) OIL-SPIL	Ingleside, TX	Skimmer	1	3,017		Aransas Pass, TX	185	4	1	13	1	19
			67" Boom	110'									
			Personnel	4									
			* Crew/Utility Boat	1									
			* Utility Boat	1									
FRV M/V RW Armstrong	CGA (888) 242-2007	Morgan City, LA	Lori Brush Skimmer	2	5,000	65	Morgan City, LA	342	2	0	15.5	1	19
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
SWS CGA-72 Trinity Shallow Water Skimmer	CGA (888) 242-2007	Morgan City, LA	Marco Belt Skimmer	2	21,500	249	Morgan City, LA	342	2	1	15.5	1	20
			36" Auto Boom	150'									
			Personnel	5									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
SWS CGA-73 Trinity Shallow Water Skimmer	CGA (888) 242-2007	Leeville, LA	Marco Belt Skimmer	2	21,500	249	Leeville, LA	364	2	1	16.5	1	21
			36" Auto Boom	150'									
			Personnel	5									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Galveston, TX	Marco I Skimmer	1	3,588	24	Aransas Pass, TX	185	6	1	13	1	21
			Personnel	4									
			30' Shallow Water Vessel	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Galveston, TX	Skimmer	1	905	400	Aransas Pass, TX	185	6	1	13	1	21
			18" Boom	50'									
			Personnel	6									
			Push Boat	1									

Table 9.D.5 Nearshore On-Water Recovery Activation List

AC 857 Drilling > 10 Miles
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours): Staging ETA	Response Times (Hours): Loadout Time	Response Times (Hours): ETA to Nearshore Environment	Response Times (Hours): Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified.													
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Galveston, TX	Offshore Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 6 1 1	15,840	400	Aransas Pass, TX	185	6	1	13	1	21
FRV M/V Grand Bay	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer 36" Boom 46' Vessel Personnel	2 46' 1 4	5,000	65	Venice, LA	416	2	0	19	1	22
SWS CGA-74 Trinity Shallow Water Skimmer	CGA (888) 242-2007	Venice, LA	Marco Belt Skimmer 36" Auto Boom Personnel 56' SWS Vessel * 14'-16' Alum. Flatboat	2 150' 5 1 2	21,500	249	Venice, LA	416	2	1	19	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel * Push Boat	1 50' 4 1	905	400	Aransas Pass, TX	185	7.5	1	13	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel * Push Boat	1 50' 4 1	905	400	Aransas Pass, TX	185	7.5	1	13	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel * Push Boat	1 50' 4 1	905	400	Aransas Pass, TX	185	7.5	1	13	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Offshore Skimmer 18" Boom Personnel * Push Boat	1 50' 4 1	905	400	Aransas Pass, TX	185	7.5	1	13	1	23
MSRC "Quick Strike"	MSRC (800) OIL-SPIL	Lake Charles, LA	LORI Brush Skimmer Personnel 47' Fast Response Boat	2 4 1	5,000	50	Lake Charles, LA	293	2	1	21	1	25
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Belle Chasse, LA	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 4 1	3,588	24	Aransas Pass, TX	185	10.75	1	13	1	26
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Pascagoula, MS	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 4 1	3,588	24	Aransas Pass, TX	185	11.45	1	13	1	27
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer 18" Boom Personnel * Push Boat	1 50' 4 1	905	400	Aransas Pass, TX	185	11.45	1	13	1	27
SBS w/ AardVAC	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer 18" Boom Personnel Push Boat	1 50' 4 1	3,840	400	Aransas Pass, TX	185	11.45	1	13	1	27

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Nearshore Environment	Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified.													
GT-185	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer	1	1,371		Aransas Pass, TX	185	11	1	13	1	27
			67" Boom	110'									
			Personnel	4									
			* Crew/Utility Boat	1									
			* Utility Boat	1									
			Temporary Storage	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Walls, MS	Offshore Skimmer	1	905	400	Aransas Pass, TX	185	14	1	13	1	29
			18" Boom	50'									
			Personnel	4									
			* Push Boat	1									
CGA-54 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Galveston, TX	Egmopol Belt Skimmer	1	3,000	90	Aransas Pass, TX	185	6	1	20.5	1	29
			* 18" Boom (contractor)	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SWS CGA-51 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Lake Charles, LA	Marco Belt Skimmer	1	3,588	20	Aransas Pass, TX	185	8	1	20.5	1	30
			* 18" Boom (contractor)	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SWS CGA-55 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Morgan City, LA	Belt Skimmer	1	3,000	90	Aransas Pass, TX	185	10	1	20.5	1	33
			* 18" Boom (contractor)	100'									
			Personnel	3									
			38' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SWS CGA-53 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Leeville, LA	Marco Belt Skimmer	1	3,588	34	Aransas Pass, TX	185	11.25	1	20.5	1	34
			* 18" Boom (contractor)	100'									
			Personnel	3									
			38' Skimming Vessel	1									
SWS CGA-52 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Venice, LA	Marco Belt Skimmer	1	3,588	34	Aransas Pass, TX	185	12	1	20.5	1	35
			* 18" Boom (contractor)	100'									
			Personnel	3									
			36' Skimming Vessel	1									
			Shallow Water Barge	1		249							
WP-1	MSRC (800) OIL-SPIL	Tampa, FL	Offshore Skimmer	1	3,017		Aransas Pass, TX	185	20	1	13	1	35
			18" Boom	50'									
			Personnel	4									
			* Crew Boat	1									
			Towable Bladder	1									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Whiting, IN	Offshore Skimmer	1	905	400	Aransas Pass, TX	185	21.75	1	13	1	37
			18" Boom	50'									
			Personnel	4									
			* Push Boat	1									
WP-1	MSRC (800) OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,017		Aransas Pass, TX	185	22	1	13	1	38
			20" Boom	50'									
			Personnel	4									
			* Utility Boat	2									
			Towable Bladder	1		500							

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Effective Daily Recovery Capacity (EDRC in Bbls/Day)	Storage (Barrels)	Staging Area	Distance to Nearshore Environment (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Nearshore Environment	Deployment Time	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified.													
Barge Boat w/ AARDVAC	MSRC (800) OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,840		Aransas Pass, TX	185	22	1	13	1	38
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
Barge Boat w/ AARDVAC	MSRC (800) OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,840		Aransas Pass, TX	185	22	1	13	1	38
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Toledo, OH	Offshore Skimmer	1	905	400	Aransas Pass, TX	185	24	1	13	1	39
			18" Boom	50'									
			Personnel	4									
			* Push Boat	1									
SBS w/ AardVAC	MSRC (800) OIL-SPIL	Virginia Beach, VA	Offshore Skimmer	1	3,840	400	Aransas Pass, TX	185	26	1	13	1	41
			18" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
SBS w/ Stress 1	MSRC (800) OIL-SPIL	Chesapeake City, MD	Offshore Skimmer	1	15,840	400	Aransas Pass, TX	185	27	1	13	1	42
			18" Boom	50'									
			Personnel	4									
			* Push Boat	1									
SBS w/ Stress 1	MSRC (800) OIL-SPIL	Edison/Perth Amboy, NJ	Offshore Skimmer	1	15,840	400	Aransas Pass, TX	185	29	1	13	1	44
			18" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Boston, MA	Offshore Skimmer	1	905	400	Aransas Pass, TX	185	32	1	13	1	47
			18" Boom	50'									
			Personnel	4									
			* Push Boat	1									
SBS w/ WP-1	MSRC (800) OIL-SPIL	Portland, ME	Offshore Skimmer	1	3,017	400	Aransas Pass, TX	185	34	1	13	1	49
			18" Boom	50'									
			* Utility Boat	1									
			Personnel	4									
			Towable Bladder	1		500							
MSRC "Lightning"	MSRC (800) OIL-SPIL	Tampa, FL	LORI Brush Skimmer	2	5,000	50	Tampa, FL	781	2	1	56	1	60
			Personnel	4									
			47' Fast Response Boat	1									
DERATED RECOVERY RATE (BBLS/DAY)													233,856
SKIMMING VESSEL STORAGE CAPACITY (BARRELS)													12,516

Table 9.D.5 Nearshore On-Water Recovery Activation List (continued)

AC 857 Drilling > 10 Miles Sample Aerial Surveillance Activation List										
Aerial Surveillance System	Supplier & Phone	Airport/City, State	Aerial Surveillance Package	Quantity	Staging Location	Distance to Site from Staging (nautical miles)	Response Times (Hours)			
							Staging ETA	Loadout Time	ETA to Site	Total ETA
* - These components are additional operational requirements that must be procured in addition to the system identified.										
Twin Commander Air Speed - 260 Knots	Airborne Support (985) 851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	351	1	0.25	1.17	2.45
			Spotter Personnel	2						
			Crew - Pilots	1						
Aztec Piper Air Speed - 150 Knots	Airborne Support (985) 851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	351	1	0.25	2.04	3.30
			Spotter Personnel	2						
			Crew - Pilots	1						
Eurocopter EC-135 Helicopter Air Speed - 141 knots	PHI (985) 868-1705	Houma, LA	Surveillance Aircraft	1	Houma, LA	351	1	0.25	2.17	3.45
			Spotter Personnel	2						
			Crew - Pilots	1						
Sikorsky S-76 Helicopter Air Speed - 141 knots	PHI (985) 868-1705	Houma, LA	Surveillance Aircraft	1	Houma, LA	351	1	0.25	2.17	3.45
			Spotter Personnel	2						
			Crew - Pilots	1						
Helicopter Air Speed - Estimated 130 knots	Bristow (985) 288-1250	Galliano, LA	Surveillance Aircraft	1	Galliano, LA	364	1	0.25	2.44	3.70
			Spotter Personnel	2						
			Crew - Pilots	1						
Helicopter Air Speed - Estimated 130 knots	Bristow (985) 288-1250	Galliano, LA	Surveillance Aircraft	1	Galliano, LA	364	1	0.25	2.44	3.70
			Spotter Personnel	2						
			Crew - Pilots	1						

Table 9.D.6 Aerial Surveillance Activation List

AC 857 Drilling > 10 Miles
Sample Offshore Aerial Dispersant Activation List

Aerial Dispersant System	Supplier & Phone	Airport/ City, State	Aerial Dispersant Package	Quantity	Staging Location	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Twin Commander Air Speed - 300 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	Aero Commander	1	Houma, LA	351	2	0.4	1.17	0.2	3.80
			Spotter Personnel	2							
			Crew - Pilots	1							
BT-67 (DC-3 Turboprop) Aircraft Air Speed - 194 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA 1st Flight	351	2	0.5	1.81	0.3	4.65
			Dispersant - Gallons	2000							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	351	1.81	0.5	1.81	0.3	4.45
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC (800) OIL-SPIL	Kiln, MS	C130-A Disp Aircraft	1	Stennis INTL., MS 1st Flight	441	3	0.0	1.29	0.5	4.80
			Dispersant - Gallons	3250							
			*Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	441	0.50	0.3	1.29	0.5	2.65
			Crew - Pilots	2							
DC-3 Aircraft Air Speed - 150 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA 1st Flight	351	2	0.5	2.34	0.3	5.15
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	351	2.34	0.5	2.34	0.3	5.50
			Crew - Pilots	2							
DC-3 Aircraft Air Speed - 150 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	DC-3 Dispersant Aircraft	1	Houma, LA 1st Flight	351	2	0.5	2.34	0.3	5.15
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	351	2.34	0.5	2.34	0.3	5.50
			Crew - Pilots	2							
BE-90 King Air Aircraft Air Speed - 213 MPH	MSRC (800) OIL-SPIL	Kiln, MS	BE-90 Dispersant Aircraft	1	Stennis INTL., MS 1st Flight	441	3	0.00	2.07	0.20	5.30
			Dispersant - Gallons	250							
			* Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	441	2.07	0.20	2.07	0.20	4.55
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC (800) OIL-SPIL	Mesa, AZ	C130-A Disp. Aircraft	1	Stennis INTL., MS 1st Flight	441	7	0.3	1.29	0.5	9.15
			Dispersant - Gallons	3250							
			*Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	441	0.50	0.3	1.29	0.5	2.65
			Crew - Pilots	2							
BE-90 King Air Aircraft Air Speed - 213 MPH	MSRC (800) OIL-SPIL	Salisbury, MD	BE-90 Dispersant Aircraft	1	Stennis INTL., MS 1st Flight	441	9	0.30	2.07	0.20	11.60
			Dispersant - Gallons	250							
			* Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	441	2.07	0.20	2.07	0.20	4.55
			Crew - Pilots	2							

Table 9.D.7 Offshore Aerial Dispersant Activation List

AC 857 Drilling > 10 Miles Sample Offshore Boat Spray Dispersant Activation List											
							Response Times (Hours)				
Boat Spray Dispersant System	Supplier & Phone	Warehouse	Boat Spray Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Aransas Pass, TX	Dispersant Spray System Dispersant (Gallons) Personnel * Utility Boat	1 330 4 1	Aransas Pass, TX	185	4	0.5	13	1	18.5
Fire Monitor Induction Dispersant Spray System	AMPOL (800) 482-6765	Cameron, LA	Dispersant Spray System Dispersant (Gallons) Personnel * 110' Utility Boat * Crew Boat	1 500 4 1 1	Aransas Pass, TX	185	8	0.5	13	1	22.5
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Harvey, LA	Dispersant Spray System * Dispersant (Gallons) Personnel * Utility Boat	1 330 4 1	Aransas Pass, TX	185	10.5	0.5	13	1	25
Fire Monitor Induction Dispersant Spray System	AMPOL (800) 482-6765	Port Fourchon, LA	Dispersant Spray System Dispersant (Gallons) Personnel * 110' Utility Boat * Crew Boat	1 500 4 1 1	Aransas Pass, TX	185	11.5	0.5	13	1	26
USCG SMART Team	USCG	Mobile, AL	Personnel * Crew Boat	4 1	Aransas Pass, TX	185	12.25	1	13	0.5	26.75

Table 9.D.8 Offshore Boat Spray Dispersant Activation List

AC 857 Drilling > 10 Miles Sample Subsea Dispersant Package Activation List											
							Response Times (Days)				
Containment System	Supplier & Phone	Warehouse	Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
* - Response time may vary depending on Drill Ship's operations and location at the time of deployment.											
Site Assessment and Surveillance	RP	Port Fourchon, LA	Multi-Service Vessel ROV's	1 2	Port Fourchon, LA	354	0	1.5	25.5	0.5	27.5
Subsea Dispersant Application	RP / MWCC	Port Fourchon, LA Houston, TX	Multi-Service Vessel ROV's Coil Tubing Unit Dispersant Manifold Subsea Dispersant Injection System	1 2 1 200,000 gal 1 1	Port Fourchon, LA	354	1.5	1.5	25.5	2	30.5
Capping Stack	RP / MWCC	Port Fourchon, LA Houston, TX	Anchor Handling Tug Supply Vessel ROV's Hydraulic System Capping Stack	1 1 1 1	Port Fourchon, LA	354	2*	1.5	25.5	3	32*
"Top Hat" Unit	RP / MWCC	Port Fourchon, LA Houston, TX	Anchor Handling Tug Supply Vessel ROV's Multi-Purpose Supply Vessel Drill Ship (Processing Vessel) "Top Hat" Containment Chamber Shuttle Barge	1 2 1 1 1 1 1	Port Fourchon, LA	354	13*	1	25.5	3	43*

Table 9.D.9 Control, Containment, and Subsea Dispersant Package Activation List

AC 857 Drilling > 10 Miles
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
ISB Fire-Fighting Team	TBD	TBD	* Offshore Firefighting Vessels	2	Aransas Pass, TX	185	4	1	13	1	19
			* Cranes	2							
			* Roll-off Boxes	2							
			Personnel	8							
			* Air Monitoring Equipment	2							
SMART In-Situ Burn Monitoring Team	USCG	Mobile, AL	* Air Monitoring Equipment	1	Aransas Pass, TX	185	4	1	13	1	19
			* Offshore Vessel	1							
			Personnel	4							
Safety Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Aransas Pass, TX	185	4	1	13	1	19
			* Offshore Vessel	1							
			Personnel	4							
Wildlife Monitoring Team	TBD	TBD	* Air Monitoring Equipment	1	Aransas Pass, TX	185	4	1	13	1	19
			* Offshore Vessel	1							
			Personnel	4							
Aerial Spotting Team (per 2 ISB Task Forces)	TBD	TBD	Fixed Wing Aircraft	1	Aransas Pass, TX	185	4	1	13	1	19
			Trained ISB Spotter	2							
			ISB Documenter	1							
Fire Team (In-Situ Burn Fire System 1)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 2)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 3)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 4)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 5)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 6)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							

Table 9.D.10 In-Situ Burn Equipment Activation List

AC 857 Drilling > 10 Miles
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System 7)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 8)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 9)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 10)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 11)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 12)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 13)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 14)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 15)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25

Table 9.D.10 In-Situ Burn Equipment Activation List (continued)

AC 857 Drilling > 10 Miles
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System 16)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 17)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 18)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 19)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 20)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 21)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 22)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 23)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 24)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System 25)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Aransas Pass, TX	185	5.25	1	13	1	20.25
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							

Table 9.D.10 In-Situ Burn Equipment Activation List (continued)

AC 857 Drilling > 10 Miles
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System 26)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 27)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 28)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 29)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 30)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 31)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 32)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System 33)	MSRC (800) OIL-SPIL	Houston, TX	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	5.25	1	13	1	20.25
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Lake Charles, LA	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	7.5	1	13	1	22.5
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Lake Charles, LA	Fire Boom (ft) Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 600 2 6 10	Aransas Pass, TX	185	7.5	1	13	1	22.5

Table 9.D.10 In-Situ Burn Equipment Activation List (continued)

AC 857 Drilling > 10 Miles
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours) Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Lake Charles, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	7.5	1	13	1	22.5
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Lake Charles, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	7.5	1	13	1	22.5
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	10.5	1	13	1	25.5
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	10.5	1	13	1	25.5
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Port Fourchon, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	11.5	1	13	1	26.5
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Port Fourchon, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	11.5	1	13	1	26.5
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Port Fourchon, LA	Fire Boom (ft)	500	Aransas Pass, TX	185	11.5	1	13	1	26.5
			Tow Line (ft)	600							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
								TOTAL FIRE BOOM AVAILABLE (FEET)			21,000

Table 9.D.10 In-Situ Burn Equipment Activation List (continued)

AC 857 Drilling > 10 Miles
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours) Staging ETA	Loadout Time	Deployment Time	Total ETA
T&T Marine (409) 744-1222 (281) 488-5757	Houston/ Galveston, TX	Containment Boom - 18" to 24"	50,000'	Aransas Pass, TX	6	1	1	8
		Containment Boom - 6" to 10"	1,000'					
		Response Boats - 14' to 20'	12					
		Portable Skimmers	17					
Wildlife Ctr. of Texas (713) 861-9453	Houston, TX	Wildlife Specialist - Personnel	6 to 20	Aransas Pass, TX	5.25	1	1	8
USES Environmental (888) 534-2744	Houston, TX	Containment Boom - 18" to 24"	5,000'	Aransas Pass, TX	5.25	1	1	8
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	4					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	1					
OMI (800) 645-6671	Houston, TX	Containment Boom - 18" to 24"	4000'	Aransas Pass, TX	5.25	1	1	8
		Response Boats - 14' to 20'	4					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	1					
OMI (800) 645-6671	Port Arthur, TX	Containment Boom - 18" to 24"	4000'	Aransas Pass, TX	6.75	1	1	9
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	5					
		Shallow Water Skimmers	1					
		Response Personnel	8					
MSRC (800) OIL-SPIL	Lake Charles, LA	Wildlife Trailer	1	Aransas Pass, TX	7.5	1	1	10
		Contract Truck (Third Party)	1					
		Personnel (Responder/Mechanic)	1					
AMPOL (800) 482-6765	New Iberia, LA	Containment Boom - 6" to 10"	750'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 18" to 24"	4,3950'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	10					
		Portable Skimmers	27					
		Shallow Water Skimmers	2					
		Bird Scare Cannons	7					
		Response Personnel	70					
OMI (800) 645-6671	Port Allen, LA	Containment Boom - 18" to 24"	2500'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	3					
		Response Personnel	18					
OMI (800) 645-6671	New Iberia, LA	Containment Boom - 18" to 24"	3,500'	Aransas Pass, TX	9	1	1	11
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	6					
		Response Personnel	8					
USES Environmental (888) 534-2744	Geismar, LA	Containment Boom - 18" to 24"	1000'	Aransas Pass, TX	9.5	1	1	12
		Response Boats - 14' to 20'	3					
		Portable Skimmers	1					
		Response Personnel	9 to 18					
USES Environmental (888) 534-2744	Amelia, LA	Containment Boom - 18" to 24"	1000'	Aransas Pass, TX	9.75	1	1	12
Wildlife Ctr. of Texas (713) 861-9453	Baton Rouge, LA	Wildlife Specialist - Personnel	6 to 20	Aransas Pass, TX	9.25	1	1	12

Table 9.D.11 Shoreline Protection and Wildlife Support List

AC 857 Drilling > 10 Miles
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours) Staging ETA	Loadout Time	Deployment Time	Total ETA
OMI (800) 645-6671	Morgan City, LA	Containment Boom - 18" to 24"	1000'	Aransas Pass, TX	9.75	1	1	12
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	1					
		Portable Skimmers	1					
		Response Personnel	8					
ES&H Environmental (877) 437-2634	Morgan City, LA	Containment Boom - 18" to 24"	2,000'	Aransas Pass, TX	9.75	1	1	12
		Containment Boom - 6" to 10"	1,200'					
		Response Boats - 14' to 20'	7					
		Response Boats - 21' to 36'	8					
		Portable Skimmers	6					
		Response Personnel	6					
Lawson Environmental Service (985) 876-0420	Houma, LA	Containment Boom - 18" to 24"	50,000'	Aransas Pass, TX	10.25	1	1	13
		Containment Boom - 6" to 10"	9,500'					
		Response Boats - 14' to 20'	38					
		Response Boats - 21' to 36'	21					
		Portable Skimmers	6					
		Shallow Water Skimmers	2					
CGA (888) 242-2007	Harvey, LA	Wildlife Rehab Trailer	1	Aransas Pass, TX	10.5	1	1	13
		Wildlife Husbandry Trailer	1					
		Support Trailer	1					
		Contract Truck (Third Party)	3					
		Personnel (Responder/Mechanic)	4					
AMPOL (800) 482-6765	Harvey, LA	Containment Boom - 18" to 24"	28,600'	Aransas Pass, TX	10.5	1	1	13
		Containment Boom - 6" to 10"	2,400'					
		Response Boats - 14' to 20'	1					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	2					
		Shallow Water Skimmers	1					
		Response Personnel	18					
USES Environmental (888) 534-2744	Belle Chasse, LA	Containment Boom - 18" to 24"	600'	Aransas Pass, TX	10.75	1	1	13
USES Environmental (888) 534-2744	Meraux, LA	Containment Boom - 18" to 24"	6000'	Aransas Pass, TX	10.5	1	1	13
		Containment Boom - 6" to 10"	1000'					
		Response Boats - 14' to 20'	13					
		Response Boats - 21' to 36'	4					
		Portable Skimmers	3					
		Response Personnel	44					
USES Environmental (888) 534-2744	Harvey, LA	Containment Boom - 18" to 24"	300'	Aransas Pass, TX	10.5	1	1	13
USES Environmental (888) 534-2744	Marrero, LA	Containment Boom - 18" to 24"	600'	Aransas Pass, TX	10.5	1	1	13
USES Environmental (888) 534-2744	Hahnville, LA	Containment Boom - 18" to 24"	500'	Aransas Pass, TX	10.25	1	1	13
USES Environmental (888) 534-2744	Lafitte, LA	Containment Boom - 18" to 24"	1000'	Aransas Pass, TX	11	1	1	13
		Response Boats - 14' to 20'	2					

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

AC 857 Drilling > 10 Miles
Sample Shoreline Protection & Wildlife Support List

Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Response Times (Hours) Staging ETA	Loadout Time	Deployment Time	Total ETA
OMI (800) 645-6671	Belle Chasse, LA	Containment Boom - 18" to 24"	21,000'	Aransas Pass, TX	10.75	1	1	13
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	5					
		Portable Skimmers	23					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	20					
		Response Personnel	18					
ES&H Environmental (877) 437-2634	Houma, LA	Containment Boom - 18" to 24"	45,600'	Aransas Pass, TX	10.25	1	1	13
		Containment Boom - 6" to 10"	15,000'					
		Response Boats - 14' to 20'	38					
		Response Boats - 21' to 36'	13					
		Portable Skimmers	35					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	200					
		Response Personnel	11					
USES Environmental (888) 534-2744	Biloxi, MS	Containment Boom - 18" to 24"	2,000'	Aransas Pass, TX	11.25	1	1	14
		Response Boats - 14' to 20'	1					
		Portable Skimmers	2					
ES&H Environmental (877) 437-2634	Port Fourchon, LA	Containment Boom - 18" to 24"	1000'	Aransas Pass, TX	11.5	1	1	14
		Containment Boom - 6" to 10"	200'					
		Response Boats - 14' to 20'	3					
		Portable Skimmers	3					
		Response Personnel	2					
USES Environmental (888) 534-2744	Venice, LA	Containment Boom - 18" to 24"	10,000'	Aransas Pass, TX	12.25	1	1	15
		Response Boats - 14' to 20'	8					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	2					
		Shallow Water Skimmers	1					
USES Environmental (888) 534-2744	Mobile, AL	Containment Boom - 18" to 24"	5,000'	Aransas Pass, TX	12.25	1	1	15
		Containment Boom - 6" to 10"	800'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
TRI-STATE (302) 737-9543	Newark, DE	Wildlife Specialist - Personnel	6 to 12	Aransas Pass, TX	27	1	1	29

Table 9.D.11 Shoreline Protection and Wildlife Support List (continued)

SECTION 10: ENVIRONMENTAL MONITORING INFORMATION

A. Monitoring Systems

A rig based Acoustic Doppler Current Profiler (ADCP) is used to continuously monitor the current beneath the rig. Metocean conditions such as sea states, wind speed, ocean currents, etc. will also be continuously monitored. Shell will comply with NTL 2015-G04.

B. Incidental Takes

No incidental takes are anticipated. Although marine mammals may be seen in the area, Shell does not believe that its operations proposed under this plan will result Shell implements the mitigation measures and monitors for incidental takes of protected species according to the following notices to lessees and operators from the BOEM/BSEE:

NTL 2015-BSEE-G03	"Marine Trash and Debris Awareness and Elimination"
NTL 2016-BOEM-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2016-BOEM-G02	"Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

Additionally, based on the 2020 National Marine Fisheries Biological Opinion, the following applies to potential for endangered marine species entrapment or entanglement from proposed operations:

The area that may be referred to as a "moon pool" on a DP semi-submersible rig is an open area under the rig and is not enclosed and poses no risk to marine life.

There are three typical MODUs that may be used to conduct the operations stated in this Plan. The rigs will be selected from our common MODU fleet and the sizes of the moonpools range from approximately 82 x 41 ft to 111 x 36 ft.

Regardless of which moon pool will be used, all moon pools for these operations will be used for deploying casing and well heads, tools supporting drilling, blow-out preventers, and riser system components. The moon pool will not be used to deploy remote-operated vehicles (ROVs).

All moon pools listed do not have doors. There are wave breakers, but these will not be used during drilling operations. All MODUs have flexible lines, which are drape hoses, to support drilling operations, *see image on next page*. By definition, drape hoses have a U-shaped bend or 'drape' in the line that allows for relative movement between the inner barrel of the telescopic joint and the outer barrel of the telescopic joint as the MODU moves (ISO 13624-1:2009 *Petroleum and Natural Gas Industries*). The purpose of the flexible lines is to connect a choke, kill, or auxiliary line (e.g. hydraulic) terminal fitting on the telescopic joint to the appropriate piping on the drilling structure (*API Specification 16Q*). These drape hoses do not present a potential entanglement or entrapment threat to listed species.

Figure 1- Moon Pool on Transocean MODU

Specific to monitoring of the moon pool during operations, there is a minimum of one camera monitoring each moon pool 24/7. During operations there are generally two or more personnel monitoring the drilling unit and overseeing the moon pool.

At the time of this submission, the MODU contractor is not selected. Once this is determined, the following mitigations will be adhered to. Shell is committed to protecting marine life and will mitigate the potential for entrapment of endangered marine species in a moon pool area specific to these activities as follows:

1. The presence of Endangered Species Act listed marine species (listed species) in moon pools will be documented in MODU daily reports and logs. If a listed species is observed, rig/vessel personnel will follow actions listed in Bullet 3.

2. MODU personnel will take steps to avoid the presence or use of multiple flexible lines or ropes and/or nettings in the moon pool in a way that potentially may result in the entrapment or entanglement of a listed species. In the event critical operational and/or safety lines, ropes or nettings will be present, camera monitoring of the moon pool area as specified below will be in place. As stated above, drape hoses are not considered a type of flexible line that potentially may result in the entanglement or entrapment of listed species.

3. Cameras will monitor the moon pool area for the presence of listed species. Camera footage will be transmitted to the control room where personnel will monitor for presence of listed species. The occurrence of sea turtles or other listed species in a moon pool will be documented in operations daily report logs and personnel will alert our environmental lead on duty, who will immediately contact NMFS at nmfs.psoreview@noaa.gov and BSEE at 985-722-7902 and

protectedspecies@bsee.gov for additional guidance on any operation restrictions, continued monitoring requirements, recovery assistance needs (if required), and incidental report information.

a. If a listed species is observed in the moon pool prior to the start of operations, appropriate rig/vessel personnel will be notified by the control room before operations will be allowed to begin.

b. If operations have not commenced and conditions within the moonpool are such that visibility is limited to visually detect a listed species, rig/vessel personnel will monitor the moon pool for 30 minutes prior to start of activities in the moon pool. If operations are ongoing and conditions within the moonpool are such that visibility is limited, rig/vessel personnel will continue to monitor the moon pool and adjust operations (e.g., deploy or retrieve equipment) when it is safe to do so to minimize any potential interaction with an undetected listed species.

c. If any listed species is detected in the moon pool, personnel will assess whether ongoing operations have the potential to entangle or entrap the listed species:
    - If ongoing operations in the moon pool pose no potential threat of entrapment or entanglement to the listed species (e.g. drill pipe), operations will proceed and monitoring by rig/vessel operations personnel will continue.
    - If personnel determine that a potential threat exists, operations will pause until the threat is eliminated (e.g., the animal exits the moon pool on its own).
    - If pausing operations cannot eliminate the threat (e.g., the animal cannot or will not exit the moon pool within a reasonable time on its own volition) and/or the animal is dead, in distress, or injured, personnel will alert our environmental lead on duty, who will immediately contact NMFS at nmfs.psoreview@noaa.gov and BSEE at 985-722-7902 and protectedspecies@bsee.gov for additional guidance on any operation restrictions, continued monitoring requirements, recovery assistance needs (if required), and incidental report information.

Flower Garden Banks National Marine Sanctuary

The operations proposed in this Plan will not be conducted within the Protective Zones of the Flower Garden Banks and Stetson Bank.

SECTION 11: LEASE STIPULATIONS INFORMATION

AC 813 is not a part of any Biological Sensitive Area, Archeological, or Shipping Fairway. It is located in Military Warning Area W-602 and Shell will enter into an agreement with the Commander prior to commencing operations.

These leases are part of the Alaminos Canyon Unit Contract No. 754308001 approved, effective 11/15/2007. The unit consists of G17570, G17571, G17561, G17565, G20862, G20870, G24593.

SECTION 12: ENVIRONMENTAL MITIGATION MEASURE INFORMATION

A. Impacts to Marine and coastal environments

The proposed action will implement mitigation measures required by laws and regulations, including all applicable Federal & State requirements concerning air emissions, discharges to water and solid waste disposal, as well as any additional permit requirements and Shell policies. Project activities will be conducted in accordance with the Regional OSRP. Section 18 of this plan discusses impacts and mitigation measures, including Coastal Habitats and Protected Areas.

B. Incidental Takes

We do not anticipate any incidental takes related to the proposed operations. Shell implements the mitigation measures and monitors for incidental takes of protected species according to the following notices to lessees and operators from the BOEM/BSEE:

NTL 2015-BSEE-G03	"Marine Trash and Debris Awareness and Elimination"
NTL 2016-BOEM-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2016-BOEM-G02	"Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

National Marine Fisheries Service 2020 Endangered Species Act, Section 7 Consultation – Biological Opinion:

There will be no pile-driving or construction of pipelines making landfall proposed in this plan.

Appendix A: No seismic survey activities are proposed in this plan.

Appendix B: Shell will comply with GOM Marine and Trash Requirements in Appendix B 2020 NMFS BiOp and BOEM/BSEE Regulations.

Appendix C: Shell will comply with GOM Vessel Strike Avoidance and Protected Species Reporting Requirements in Appendix C and BOEM/BSEE Regulations.

Appendix J: There will be no explosive severance operations conducted in this Plan that may result in potential for entanglement or entrapment of endangered marine species. Shell intends to follow the monitoring and reporting procedures outlined in Section 12 and apply the measures in Appendix J, if appropriate, based on consultation with NMFS in the event an injured sea turtle is observed during operations.

SECTION 13: RELATED FACILITIES AND OPERATIONS INFORMATION

A. Related OCS Facilities and Operations

This Plan covers the seafloor hardware required to produce the additional GD wells back to the existing Perdido Regional Host Spar located in Alaminos Canyon Block 857 in the Western Gulf of Mexico. The facility is located approximately 200 miles sounth of Freeport, Texas in 7800 feet of water. The spar has complete processing capabilites, including oil and gas separation, oil conditioning, produced water treating and water injection. It is equiped with a platform drilling rig capable of drilling, completing and performing workover/maintenance activities on the 19 subsea wells (direct vertical access).

No new pipelines to shore or pile-driving activities are associated with this Plan.

There is no moon pool located at the Perdido Regional Host.

This subsea tieback flows back to the Perdido Spar and was covered in the Initial DOCD (approved by the then MMS April 12, 2007, Control Number N-08809). This system remains as previously approved.

B. Transportation System

The identical Transportation System described in Section (13b) of the Initial DOCD (approved by the then MMS April 12, 2007, Control Number N-08809) pertains to this application. No additional measures are anticipated as a result of the drilling, installation or production of the equipment included in this Plan.

SECTION 14: SUPPORT VESSELS AND AIRCRAFT INFORMATION

A. General

Type	Maximum Fuel Tank Storage Capacity (Gals)	Maximum No. In Area at Any Time	Trip Frequency or Duration
Crew Boats	1040	2	2 per week
Offshore Support Vessels	9750	2	2 per week
Helicopter	22	1	Once per day
Subsea installation vessel	13,840	1	10 days

B. Diesel Oil Supply Vessels

Size of Fuel Supply Vessel	Capacity of Fuel Supply Vessel	Frequency of Fuel Transfers	Route Fuel Supply Vessel Will Take
280' length	135,000 gals.	1 week	Galveston due south to OCS AC857

Vessels associated with this proposed activity will not transit the designated Rice's whale area designated in the 2020 BiOp.

No support vessels associated with the proposed operations in this plan will have moon pools.

C. Drilling Fluids Transportation

According to NTL 2008-G04, this information in only required when activities are proposed in the State of Florida.

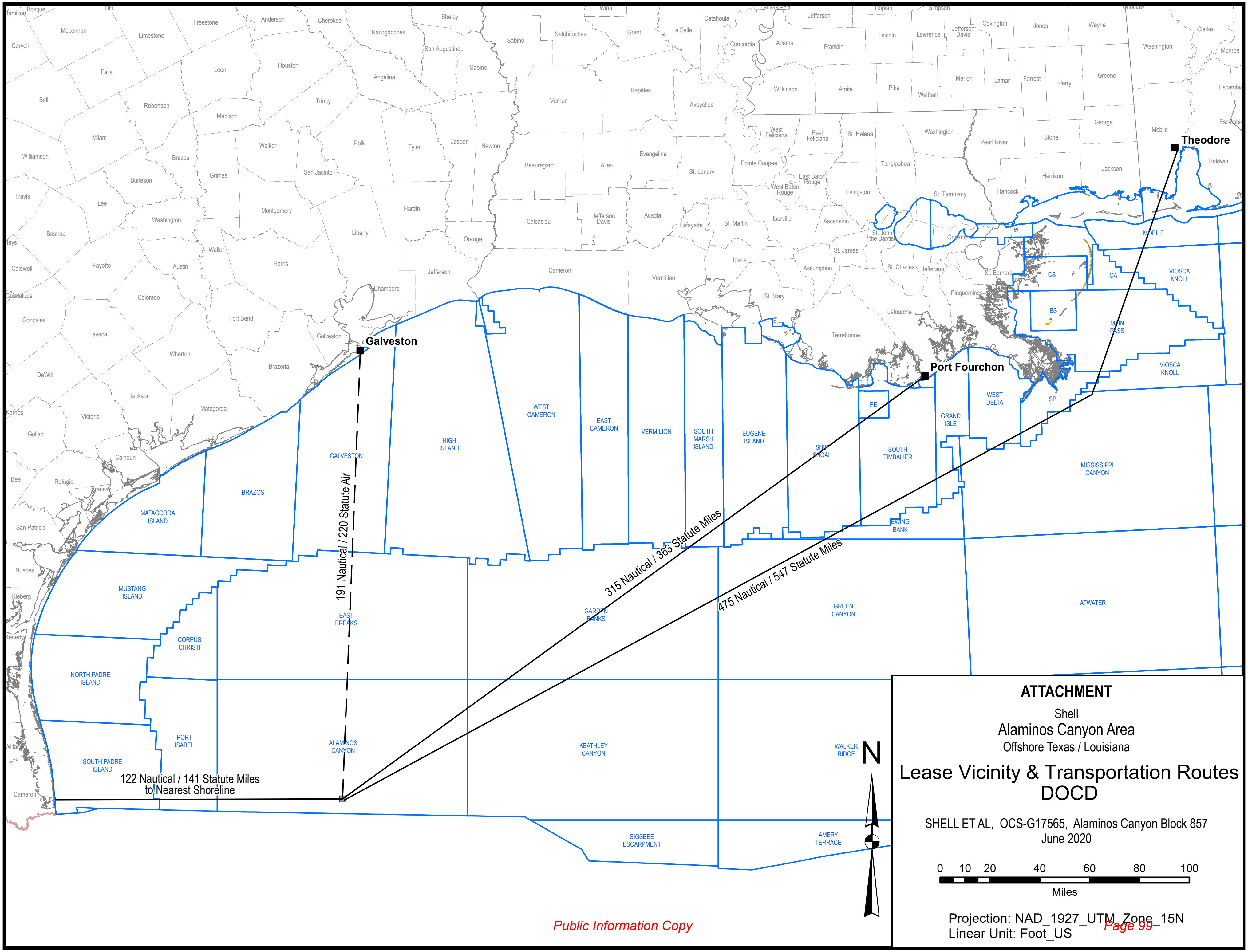
D. Solid and Liquid Wastes Transportation

See Section 7, Table 7B.

E. Vicinity Map

See Attachment 14A for Vicinity Map and transportation routes.

Attachment 14A - Vicinity Map



SECTION 15: ONSHORE SUPPORT FACILITIES INFORMATION

A. General

The existing onshore support base for air transportation will be PHI Heliport in Galveston, TX, located at 2215 Terminal Drive. Marine support for the drilling operation will be from Halliburton located at 1800 Seawolf Parkway in Galveston, TX or Martin Midstream at Pelican Island in Galveston, TX. The Fourchon boat facility may be utilized and is operated by Shell. It is located on Bayou Lafourche, south of Leeville, LA approximately 3 miles from the Gulf of Mexico.

Name	Location	Existing/New/Modified
Halliburton	Galveston, TX	Existing
Galveston PHI	Galveston, TX	Existing
Fourchon Terminal	Golden Meadow, LA	Existing
Core Industries	Theodore, ALA	Existing

B. Support Base Construction or Expansion

This does not apply to this Plan as Shell does not plan to construct a new onshore support base or expand an existing one to accommodate the activities proposed in this Plan.

C. Support Base Construction or Expansion Timetable

Since no onshore support base construction or expansion is planned for these activities, a timetable for land acquisition and construction or expansion is not applicable.

D. Waste Disposal

See Section 7, Tables 7A and 7B.

E. Air emissions

Not required by BOEM GoM.

F. Unusual solid and liquid wastes

Not required by BOEM GoM.

SECTION 16: SULPHUR OPERATIONS INFORMATION

Information regarding Sulphur Operations is not included in this Plan as we are not proposing to conduct sulphur operations.

SECTION 17: COASTAL ZONE MANAGEMENT ACT (CZMA) INFORMATION

Louisiana and Texas CZMA consistency are not required for supplemental plans.

See following pages for Alabama CZM.

ALABAMA
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

SUPPLEMENTAL DOCD
Type of Plan

ALAMINOS CANYON BLOCK 813
ALAMINOS CANYON BLOCK 856
ALAMINOS CANYON BLOCK 857
ALAMINOS CANYON BLOCK 900
Area and Blocks

OCS-G 17561
OCS-G 20870
OCS-G 17565
OCS-G 17570
Lease Number

ALAMINOS CANYON UNIT NO. 754308001

The proposed activity complies with the enforceable policies of Alabama's approved management program and will be conducted in a manner consistent with such program.

SHELL OFFSHORE INC.
Operator

Robin Voosen
Certifying Official

11/28/2023
Date

Coastal Zone Management Consistency Information
For the State of Alabama

In accordance with 30 CFR 550.226, Shell is hereby providing the following information in support of Section 18 (Environmental Impact Analysis) of our DOCD for this lease.

The regulations found in 15 CFR 930.58 identifies necessary data and information to be furnished to the State agency. The information is as follows:

A. CONSISTENCY CERTIFICATION

A Coastal Zone Consistency Certification for activities that affect the State of Alabama is provided in Section 17 of this EP.

B. OTHER INFORMATION

(1) Shell shall utilize a shore base in Fourchon, Louisiana for water support and PHI's Boothville terminal for air traffic for the proposed activities. However, Theodore, Alabama marine terminal may be used for installation vessel for the flowline.

(2) As per NTL 2008-G04, the following items have been identified as being required:

(3) A discussion of the method of disposal of wastes and discharges is provided in Section 7 of this EP.
(4) Oil Spill Information is provided in Section 9 of this EP.
(5) All operations are covered by Shell's Regional OSRP, which was approved by BSEE on April 11, 2013, and a modification approved November 17, 2014. Shell filed a new plan with BSEE on February 24, 2015, which was approved in April 2015 and modified in August 2015. The Plan is available upon request.

(3) Following is an evaluation that includes findings relating the coastal effects of the proposed activities and associated facilities to the relevant enforceable policies of the Alabama's Coastal Management Program:

All activities shall be consistent with Alabama's coastal management program and shall comply with all relevant rules and regulations. Pollution shall be prevented or reduced at the source; pollution that cannot be prevented shall be recycled in an environmentally safe manner; pollution that cannot be prevented or recycled shall be treated in an environmentally safe manner; and disposal or other release into the environment shall be employed only as a last resort and should be conducted in an environmentally safe manner. All activities comply with all applicable provisions of the administrative code. No activities are planned within special management areas. Activities will be carried out to avoid unnecessary conflicts with other uses of the vicinity.

COASTAL RESOURCE USE POLICIES

Coastal Development – All activities shall be conducted in a manner that minimizes significant impacts to coastal resources. No adverse effects to Alabama's coastal area are expected in association with the proposed activities.

Mineral Resource Exploration and Extraction – No conflicts with any other mineral resource exploration and extraction are expected.

Commercial Fishing **–** All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable adverse disruptions to fishery migratory patterns.

Hazard Management- Effective emergency plans are in place, practiced and updated as necessary. The best practical techniques shall be utilized to prevent the release of pollutants or toxic substances into the environment.

Shoreline Erosion **-** All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid, to the maximum extent practicable, adverse alteration of protective coastal features.

Recreation **–** We have considered the general factors utilized by permitting authorities and have determined that the proposed activities shall cause no adverse impacts on areas of public use or concern and all uses and activities shall be planned, sited, designed, constructed operated and maintained to avoid to the maximum extent practicable adverse alteration of these areas. The BOEM has regulations in place which explicitly prohibit the disposal of equipment, cables, chains, containers, or other materials which may pose an unreasonable risk to public health, property, aquatic life, wildlife, recreation, navigation, commercial fishing, or other uses of the ocean into offshore waters. Although marine debris gets lost from time to time, the impact on Gulf Coast recreational beaches is expected to be minimal. No impacts are expected to adversely affect Public access to tidal and submerged lands, navigable waters and beaches or other public recreational resources.

Transportation**-** Alabama's transportation resources are not expected to be impacted, as shore bases in Fourchon and Boothville, Louisiana will be utilized for the proposed operations. Also, boats will not travel through any sensitive coastal areas off of the coast of Alabama.

NATURAL RESOURCE PROTECTION POLICIES

Biological Productivity **-** All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable adverse alteration of biologically valuable areas. All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable reductions in long-term biological productivity of the coastal ecosystem. No impacts are expected to adversely affect the biological productivity of the area.

Water Quality **-** The proposed activities shall be carried out in conformance with applicable water quality laws, standards and regulations. All discharges shall be covered by an NPDES permit. There shall be no discharge of untreated produced water, drilling muds, or cuttings resulting from energy exploration and production activities to the coastal waters of Alabama. Produced waters that are discharged offshore are diluted and dispersed to very near background levels at a distance of 1,000 m and are undetectable at a distance of 3,000 m from the discharge point. The BOEM regulations, the USEPA's NPDES general permit and the USCG regulations implementing MARPOL 73/78 Annex V prohibit the disposal of any trash and debris into the marine environment.

Water Resources **-** All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable detrimental discharges into coastal waters.

Air Quality **-** The proposed activities shall be carried out in conformance with applicable air quality laws, standards and regulations. Emissions from the proposed activities are not expected to have significant impacts on onshore air quality because of the prevailing atmospheric conditions, emission heights, emission rates and the distance of these emissions from the coastline.

Wetlands and Submerged Grass beds - All uses and activities shall be planned, sited, designed, constructed operated and maintained to avoid to the maximum extent practicable reductions of natural circulation patterns within or into wetlands and submerged grass beds. Pipeline and navigation canals are considered the most significant impacting factors to wetlands and neither is proposed in the SUPPLEMENTAL EP. Proposed activities are not expected to have any adverse impact on sea grass communities.

Beach and Dune Protection - Effective environmental protection plans are in place, practiced and updated as necessary. No significant impacts to the physical shape and structure of barrier beaches and associated dunes are expected to occur. In the unlikely event of a spill contacting a barrier beach, sand removal during cleanup would be minimized.

Wildlife Habitat Protection - We have considered the general factors utilized by permitting authorities and have determined that the proposed activities shall cause no adverse impacts on wildlife habitat areas. All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable adverse alteration of wildlife habitats or coastal wildlife. Proposed activities are in OCS waters, so they are located away from critical wildlife and vegetation areas. Access routes from shore base operations shall pose no adverse impacts on these critical wildlife and vegetation areas.

Endangered Species

No impacts are expected to adversely affect wildlife and fishery habitat, especially the designated Critical Habitats of Endangered Species.

Beach mice – Potential impacts include oil spills, oil-spill response activities, consumption of beach trash and debris and coastal habitat degradation. No significant impacts to beach mice are expected to occur. Protective measures required under the Endangered Species Act should prevent any oil-spill response and cleanup activities from having significant impact to beach mice and their habitat.

Marine birds– Potential impact-producing factors for marine birds in the offshore environment include helicopter and service vessel traffic and noise, air emissions, degradation of water quality, habitat degradation and ingestion discarded trash and debris from service vessels and OCS structures. Adverse impacts to endangered coastal and marine birds are expected to be sublethal.

Sea turtles – Potential impact-producing factors from the proposed activities that may affect sea turtles include water quality degradation from operational discharges, noise from helicopter and vessel traffic and operating platforms, vessel collisions, brightly lit platforms and swallowing or getting tangled in OCS-related trash and debris. Routine activities are expected to be sublethal and unlikely to have significant adverse effects on the size and recovery of any sea turtle species or population in the Gulf of Mexico.

Sturgeon – Drilling mud discharges may contain chemicals toxic to sturgeon, at concentrations four or five orders of magnitude higher than concentrations found a few meters from the discharge point. These discharges dilute to background levels within 1000m of the discharge point. No impacts from the proposed activities are expected.

Cultural Resources Protection - All uses and activities shall be planned, sited, designed, constructed, operated and maintained to avoid to the maximum extent practicable adverse alteration of cultural resources. No impacts are expected to adversely affect historical, architectural, or archaeological sites. Should any historical, architectural, or archaeological resource be discovered in the course of conducting authorized activities, the Alabama Department of Environmental Management and the Alabama State Historical Officer shall be notified.

Environmental Impact Analysis

for a

Supplemental Development Operations Coordination Document

Alaminos Canyon Block 857 (OCS-G 17565)

Offshore Texas

November 2023

Prepared for:

Shell Offshore Inc.
P.O. Box 61933
New Orleans, Louisiana 70161
Telephone: (504) 425-6021

Prepared by:

CSA Ocean Sciences Inc.
8502 SW Kansas Avenue
Stuart, Florida 34997
Telephone: (772) 219-3000

Acronyms and Abbreviations

§	section
µPa	micropascal
ac	acre
AC	Alaminos Canyon
AQR	Air Quality Emissions Report
bbl	barrel
BOEM	Bureau of Ocean Energy Management
BOP	blowout preventer
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
dB	decibel
DOCD	development operations coordination document
DP	dynamic positioning
DPS	distinct population segment
EFH	Essential Fish Habitat
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAD	fish-aggregating device
FR	Federal Register
GMFMC	Gulf of Mexico Fishery Management Council
ha	hectare
HAPC	Habitat Area of Particular Concern
IPF	impact-producing factor
MARPOL	International Convention for the Prevention of Pollution from Ships
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MODU	mobile offshore drilling unit
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NPDES	National Pollutant Discharge Elimination System
NTL	Notice to Lessees and Operators
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
re	referenced to
ROV	remotely operated vehicle
SBM	synthetic-based muds
SEL_{24h}	sound exposure level over 24-hours
Shell	Shell Offshore Inc.
SPL	root-mean-square sound pressure level
USCG	U.S. Coast Guard
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
VOC	volatile organic compound
WCD	worst case discharge

Introduction

Project Summary

Shell Offshore Inc. (Shell) is submitting a Supplemental Development Operations Coordination Document (DOCD) for the drilling, completion, treatment, and workover of six development wells (LWP4, LWP4-Alt1, LWP4-Alt2, NWP5, NWP5-Alt1, and NWP5-Alt2) and subsea infrastructure installation. The six wells were previously approved in Exploration Plan No. S-8117. The Environmental Impact Analysis (EIA) provides information on potential impacts to environmental resources that could be affected by Shell's proposed activities in the project area under this DOCD.

The project area is in the Western Planning Area, 141 miles (227 km) from the nearest shoreline (Texas); 353 miles (568 km) from the onshore support base at Port Fourchon, Louisiana; and 220 miles (354 km) from the helicopter base in Galveston, Texas. A backup onshore support base in Galveston, Texas that could potentially be used is approximately 220 miles (354 km) from the project area. Additionally, a backup helicopter base in Houma, Louisiana that could potentially be used is approximately 347 miles (558 km) from the project area. All miles in the EIA are statute miles. The water depth at the project area ranges from approximately 8,250 to 8,500 ft (2,515 to 2,591 m).

The proposed activities will be completed with a dynamically positioned (DP) drillship or mobile offshore drilling unit (MODU) and/or installation vessel, as detailed in DOCD Section 14. Including contingency, drilling, completion, treatment, and workover of the proposed wells are estimated to take up to 280 days per year from 2024 to 2029. There are no anchors associated with the proposed work in the plan. The EIA addresses the environmental impacts from the proposed DOCD activities.

Purpose of the Environmental Impact Analysis

The EIA was prepared pursuant to the requirements of the Outer Continental Shelf Lands Act (OCSLA), 43 United States Code §§ 1331-1356 as well as regulations including 30 Code of Federal Regulations (CFR) § 550.242 and § 550.261. The EIA is a project-and site-specific analysis of Shell's planned activities under this DOCD.

The EIA presents data, analyses, and conclusions to support the Bureau of Ocean Energy Management (BOEM) reviews as required by the National Environmental Policy Act (NEPA) and other relevant federal laws, including the Endangered Species Act (ESA) and Marine Mammal Protection Act (MMPA). The EIA addresses impact-producing factors (IPFs), resources, and impacts associated with the proposed project activities. It identifies mitigation measures to be implemented in connection with the planned activities. Potential environmental impacts of a blowout scenario and worst-case discharge (WCD) are addressed in the EIA.

Potential impacts have been analyzed at a broad level in the 2017 to 2022 Programmatic Environmental Impact Statement (EIS) for the Outer Continental Shelf (OCS) Oil and Gas Leasing Program (BOEM, 2016a) and in multisale EISs for the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012a,b, 2013, 2014, 2015, 2016b, 2017a, 2023).

The most recent multisale EISs updated environmental baseline information in light of the Macondo (*Deepwater Horizon*) incident and addressed potential impacts of a catastrophic spill (BOEM, 2012a,b, 2013, 2014, 2015, 2016b, 2017a, 2023). Numerous technical studies have also been conducted to address the impacts of the incident. Findings of the post-*Deepwater Horizon* incident studies have been incorporated into this report and are supplemented by site-specific analyses, where applicable. The EIA relies on these documents, technical studies, and post-*Deepwater Horizon* incident studies, where applicable, to provide BOEM and other regulatory agencies with the necessary information to evaluate Shell's DOCD and ensure that oil and gas exploration activities are performed in a sound manner to minimize environmental impacts.

Outer Continental Shelf Regulatory Framework

The regulatory framework for OCS activities in the Gulf of Mexico is summarized by BOEM in its Final Programmatic EIS for the OCS Oil and Gas Leasing Program for 2017 to 2022 (BOEM, 2016a). Under the OCSLA, the U.S. Department of the Interior (USDOI) is responsible for the administration of mineral exploration and development of the OCS. Within the USDOI, BOEM and the Bureau of Safety and Environmental Enforcement (BSEE) are responsible for managing and regulating the development of OCS oil and gas resources in accordance with the provisions of the OCSLA. The BSEE offshore regulations are in 30 CFR Chapter II, Subchapter B. BOEM offshore regulations are in 30 CFR Chapter V, Subchapter B.

In implementing its responsibilities under the OCSLA and NEPA, BOEM consults numerous federal departments and agencies that have authority to comment on permitting documents under their jurisdiction and maintain ocean resources pursuant to other federal laws. Among these are the U.S. Coast Guard (USCG), U.S. Environmental Protection Agency (USEPA), U.S. Fish and Wildlife Service (USFWS), and the National Oceanic and Atmospheric Administration (NOAA) through the National Marine Fisheries Service (NMFS). Federal laws (e.g., ESA, MMPA, Coastal Zone Management Act of 1972, Magnuson-Stevens Fishery Conservation and Management Act) establish the consultation and coordination processes with federal, state, and local agencies. The NMFS Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico assesses impacts and mitigation measures to listed species (NMFS, 2020a).

In addition, Notices to Lessees and Operators (NTLs) are formal documents issued by BOEM and BSEE that provide clarification, description, or interpretation of pertinent regulations or standards. **Table 1** lists and summarizes the NTLs applicable to the EIA.

Table 1. Notices to Lessees and Operators (NTLs) that are applicable to this Environmental Impact Analysis (EIA), ordered from most recent to oldest.

NTL	Title	Summary
BOEM NTL No. 2020-G01	Air Quality Information Requirements for Exploration Plans, Development Operations Coordination Documents, and Development and Production Plans in the Gulf of Mexico Region	Cancels and supersedes the air emission information portion of NTL 2008-G04, Information Requirement for Exploration Plans and Development Operations Coordination Documents, effective date May 5, 2008.
BOEM-2016-G01	Vessel Strike Avoidance and Injured/Dead Protected Species Reporting	Recommends protected species identification training; recommends that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species; and requires operators to report sightings of any injured or dead protected species. Reissued in June 2020 to address instances where guidance in the 2020 NMFS Biological Opinion Appendix C (NMFS, 2020a) replaces compliance with this NTL.
BSEE-2015-G03	Marine Trash and Debris Awareness and Elimination	Instructs operators to exercise caution in the handling and disposal of small items and packaging materials; requires the posting of placards at prominent locations on offshore vessels and structures; and mandates a yearly marine trash and debris awareness training and certification process. Reissued in June 2020 to address instances where guidance in the 2020 NMFS Biological Opinion Appendix B (NMFS, 2020a) replaces compliance with this NTL.
BOEM-2015-N02	Elimination of Expiration Dates on Certain Notice to Lessees and Operators Pending Review and Reissuance	Eliminates the expiration dates on past or upcoming expiration dates from NTLs currently posted on the BOEM website.
BOEM-2015-N01	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the Outer Continental Shelf (OCS) for Worst Case Discharge (WCD) Blowout Scenarios	Provides guidance regarding information required in WCD descriptions and blowout scenarios.
BOEM-2014-G04	Military Warning and Water Test Areas	Provides contact links to individual command headquarters for the military warning and water test areas in the Gulf of Mexico.
BSEE-2014-N01	Elimination of Expiration Dates on Certain NTLs Pending Review and Reissuance	Eliminates expiration dates (past or upcoming) of all NTLs currently posted on the BSEE website.

NTL	Title	Summary
BSEE-2012-N06	Guidance to Owners and Operators of Offshore Facilities Seaward of the Coast Line Concerning Regional Oil Spill Response Plans	Provides clarification, guidance, and information for preparation of regional Oil Spill Response Plans. Recommends description of response strategy for WCD scenarios to ensure capability to respond to oil discharges is both efficient and effective.
2010-N10	Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources	Informs operators using subsea or surface blowout preventers on floating facilities that applications for well permits must include a statement signed by an authorized company official stating that the operator will conduct all activities in compliance with all applicable regulations, including the increased safety measures regulations (75 *Federal Register* 63346). Informs operators that BOEM will be evaluating whether each operator has submitted adequate information demonstrating that it has access to and can deploy containment resources to promptly respond to a blowout or other loss of well control.
2009-G40	Deepwater Benthic Communities	Provides guidance for avoiding and protecting high-density deepwater benthic communities (including chemosynthetic and deepwater coral communities) from damage caused by OCS oil and gas activities in water depths greater than 984 ft (300 m). Prescribes separation distances of 2,000 ft (610 m) from each mud and cuttings discharge location and 250 ft (76 m) from all other seafloor disturbances.
2009-G39	Biologically Sensitive Underwater Features and Areas	Provides guidance for avoiding and protecting biologically sensitive features and areas (i.e., topographic features, pinnacles, low-relief live bottom areas, and other potentially sensitive biological features) when conducting OCS operations in water depths less than 984 ft (300 m) in the Gulf of Mexico.
2009-N11	Air Quality Jurisdiction on the OCS	Clarifies jurisdiction for regulation of air quality in the Gulf of Mexico OCS.
2008-G04	Information Requirements for Exploration Plans and Development Operations Coordination Documents	Provides guidance on the information requirements for OCS plans, including EIA requirements and information regarding compliance with the provisions of the Endangered Species Act and the Marine Mammal Protection Act.
2005-G07	Archaeological Resource Surveys and Reports	Provides guidance on regulations regarding archaeological discoveries, specifies requirements for archaeological resource surveys and reports, and outlines options for protecting archaeological resources. Reissued in June 2020 to comply with Executive Order 13891 of October 9, 2019, and to rescind NTL 2011-JOINT-G01.

Oil Spill Prevention and Contingency Planning

Shell has an approved Gulf of Mexico Regional Oil Spill Response Plan (OSRP) as a fundamental component of the planned drilling program that certifies Shell's capability to respond to the maximum extent practicable to a WCD (30 CFR § 254.2) (see DOCD Section 9). The OSRP demonstrates Shell's capability to rapidly and effectively manage oil spills that may result from the project activities. Despite the extremely low likelihood of a large oil spill occurring during the project, Shell has designed its response program based on a regional capability of responding to a range of spill volumes that increase from small operational spills to a WCD from a well blowout. Shell's program is intended to meet the response planning requirements of the relevant coastal states and federal oil spill planning regulations. The OSRP includes information regarding Shell's regional oil spill organization, dedicated response assets, potential spill risks, and local environmental sensitivities. The OSRP presents specific information on the response program that includes a description of personnel and equipment mobilization, the incident management team organization, and the strategies and tactics used to implement effective and sustained spill containment and recovery operations.

Environmental Impact Analysis Organization

The EIA is organized into **Sections A** through **I** corresponding to the requirements of NTL 2008-G04 (as extended by NTL 2015-N02 and partially amended by BOEM NTL 2020-G01), which provides guidance regarding information required by 30 CFR Part 550 for EIAs. The main impact-related discussions are in **Section A** (Impact-Producing Factors) and **Section C** (Impact Analysis).

A. Impact-Producing Factors

Based on the description of Shell's proposed activities, a series of IPFs have been identified. **Table 2** identifies the potentially affected environmental resources and identifies IPFs associated with the proposed project. **Table 2** was adapted from Form BOEM-0142 and developed a priori to focus the impact analysis on those environmental resources that may be impacted as a result of one or more IPFs. The tabular matrix indicates which routine activities and accidental events could affect specific resources. An "X" indicates that an IPF could reasonably be expected to affect a certain resource, and a dash (--) indicates no impact or negligible impact on the resource (**Table 2**). Where there may be an effect from an IPF on an environmental resource, an analysis is provided in **Section C**. Potential IPFs for the proposed activities are listed below and briefly discussed in the following sections:

- Vessel presence (including noise and lights);
- Physical disturbance to the seafloor;
- Air pollutant emissions;
- Effluent discharges;
- Water intake;
- Onshore waste disposal;
- Marine debris;
- Support vessel and helicopter traffic; and
- Accidents.

Table 2. Matrix of impact-producing factors and affected environmental resources. X = potential impact on the resource; dash (--) = no impact or negligible impact on the resource.

Environmental Resources	Impact-Producing Factors									
	Vessel Presence (including noise & lights)	Physical Disturbance to Seafloor	Air Pollutant Emissions	Effluent Discharges	Water Intake	Onshore Waste Disposal	Marine Debris	Support Vessel/Helicopter Traffic	Accidents	
									Small Fuel Spill	Large Oil Spill
Physical/Chemical Environment										
Air quality	--	--	X(5)	--	--	--	--	--	X(6)	X(6)
Water quality	--	--	--	X	--	--	--	--	X(6)	X(6)
Seafloor Habitats and Biota										
Soft bottom benthic communities	--	X	--	X	--	--	--	--	--	X(6)
High-density deepwater benthic communities	--	--(4)	--	--(4)	--	--	--	--	--	X(6)
Designated topographic features	--	--(1)	--	--(1)	--	--	--	--	--	--
Pinnacle trend area live bottoms	--	--(2)	--	--(2)	--	--	--	--	--	--
Eastern Gulf live bottoms	--	--(3)	--	--(3)	--	--	--	--	--	--
Threatened, Endangered, and Protected Species and Critical Habitat										
Sperm whale (Endangered)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
Rice's whale (Endangered)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
West Indian manatee (Endangered)	--	--	--	--	--	--	--	X(8)	--	X(6,8)
Non-endangered marine mammals (protected)	X	--	--	--	--	--	--	X	X(6)	X(6)
Sea turtles (Endangered/Threatened)	X(8)	--	--	--	--	--	--	X(8)	X(6,8)	X(6,8)
Piping Plover (Threatened)	--	--	--	--	--	--	--	--	--	X(6)
Whooping Crane (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Oceanic whitetip shark (Threatened)	X	--	--	--	--	--	--	--	--	X(6)
Giant manta ray (Threatened)	X	--	--	--	--	--	--	--	--	X(6)
Gulf sturgeon (Threatened)	--	--	--	--	--	--	--	--	--	X(6)
Nassau grouper (Threatened)	--	--	--	--	--	--	--	--	--	X(6)
Smalltooth sawfish (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Beach mice (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Florida salt marsh vole (Endangered)	--	--	--	--	--	--	--	--	--	X(6)
Panama City crayfish (Threatened)	--	--	--	--	--	--	--	--	--	X(6)
Threatened coral species	--	--	--	--	--	--	--	--	--	X(6)
Coastal and Marine Birds										
Marine birds	X	--	--	--	--	--	--	X	X(6)	X(6)
Coastal birds	--	--	--	--	--	--	--	X	--	X(6)
Fisheries Resources										
Pelagic communities and ichthyoplankton	X	--	--	X	X	--	--	--	X(6)	X(6)
Essential Fish Habitat	X	--	--	X	X	--	--	--	X(6)	X(6)
Archaeological Resources										
Shipwreck sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Prehistoric archaeological sites	--	--(7)	--	--	--	--	--	--	--	X(6)
Coastal Habitats and Protected Areas										
Coastal Habitats and Protected Areas	--	--	--	--	--	--	--	X	--	X(6)
Socioeconomic and Other Resources										
Recreational and commercial fishing	X	--	--	--	--	--	--	--	X(6)	X(6)
Public health and safety	--	--	--	--	--	--	--	--	--	X(6)
Employment and infrastructure	--	--	--	--	--	--	--	--	--	X(6)
Recreation and tourism	--	--	--	--	--	--	--	--	--	X(6)
Land use	--	--	--	--	--	--	--	--	--	X(6)
Other marine uses	--	--	--	--	--	--	--	--	--	X(6)

Numbers in parentheses refer to table footnotes on the following page.

Table 2 Footnotes and Applicability:

(1) *Activities that may affect a marine sanctuary or topographic feature. Specifically, if the well, platform site, or any anchors will be on the seafloor within the following:*
   (a) *4-mile zone surrounding the Flower Garden Banks, or the 3-mile zone of Stetson Bank;*
   (b) *1,000-meter, 1-mile, or 3-mile zone of any topographic feature (submarine bank) protected by the Topographic Features Stipulation attached to an Outer Continental Shelf (OCS) lease;*
   (c) *Essential Fish Habitat (EFH) criteria of 500 ft from any no-activity zone; or*
   (d) *Proximity of any submarine bank (500-foot buffer zone) with relief greater than 2 m that is not protected by the Topographic Features Stipulation attached to an OCS lease.*
   - None of these conditions (a through d) are applicable. The project area is not within the given range (buffer zone) of any marine sanctuary, topographic feature, or no-activity zone. There are no submarine banks in the project area.

(2) *Activities with any bottom disturbance within an OCS lease block protected through the Live Bottom (Pinnacle Trend) Stipulation attached to an OCS lease.*
   - The Live Bottom (Pinnacle Trend) Stipulation is not applicable to the project area.

(3) *Activities within any Eastern Gulf OCS block and portions of Pensacola and Destin Dome area blocks in the Central Planning Area where seafloor habitats are protected by the Live Bottom (Low-Relief) Stipulation attached to an OCS lease.*
   - The Live Bottom (Low-Relief) Stipulation is not applicable to the project area.

(4) *Activities on blocks designated by the Bureau of Ocean Energy Management (BOEM) as being in water depths 300 m or greater.*
   - No impacts on high-density deepwater benthic communities are anticipated. The wellsite clearance assessments identified no features indicative of high-density chemosynthetic communities or coral communities within 2,000 ft (610 m) of the proposed wellsites nor 500 ft (152 m) of the proposed subsea infrastructure (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018).

(5) *Exploration or production activities where hydrogen sulfide (H_2S) concentrations greater than 500 parts per million might be encountered.*
   - Alaminos Canyon Block 857 is classified as H_2S absent.

(6) *All activities that could result in an accidental spill of produced liquid hydrocarbons or diesel fuel that you determine would impact these environmental resources. If the proposed action is located a sufficient distance from a resource that no impact would occur, the Environmental Impact Analysis (EIA) can note that in a sentence or two.*
   - Accidental hydrocarbon spills could affect the resources marked (X) in the matrix, and impacts are analyzed in **Section C**.

(7) *All activities that involve seafloor disturbances, including anchor emplacements, in any OCS block designated by the BOEM as having high probability for the occurrence of shipwrecks or prehistoric sites, including such blocks that will be affected that are adjacent to the lease block in which the planned activity will occur. If the proposed activities are located at a sufficient distance from a shipwreck or prehistoric site that no impact would occur, this will be noted in the EIA.*
   - No impacts on archaeological resources are expected from routine activities. The locations of the proposed activities are well beyond the 197-ft (60-m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. As discussed in **Section C.6**, the shallow hazard assessment did not identify any archaeologically significant sonar contacts within 2,000 ft (610 m) of the proposed wellsites nor 500 ft (152 m) of the proposed subsea infrastructure (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018).

(8) *All activities that might have an adverse effect on Endangered or Threatened marine mammals or sea turtles or their critical habitats.*
   - IPFs that may affect marine mammals or sea turtles include vessel presence and emissions, support vessel and helicopter traffic, and accidents. See **Section C**.

(9) *Production activities that involve transportation of produced fluids to shore using shuttle tankers or barges.*
   - Not applicable.

A.1 Vessel Presence (including noise and lights)

Drilling, completion, treatment, and workover of six development wells and subsea infrastructure installation activities will be accomplished with a DP MODU and/or installation vessel. DP vessels are self-propelled and maintains position using a global positioning system, specific computer software, and sensors in conjunction with a series of thrusters or azimuth propellers. Potential impacts to marine resources from the presence of the MODU and installation vessel include the physical presence of the MODU and/or installation vessel and support vessels in the ocean, increased light from working and safety lighting on the vessel, and audible noise above and below the water's surface.

The physical presence of the MODU and/or installation vessel in the ocean can attract pelagic fishes and other marine life. The vessels may concentrate small epipelagic fish species, resulting in the attraction of epipelagic predators. See **Section C.5.1** for further discussion.

The MODU and installation vessel will maintain exterior lighting for working at night and navigational and aviation safety in accordance with federal navigation and aviation safety regulations (International Regulations for Preventing Collisions at Sea, 1972 [72 COLREGS], Part C). Artificial lighting may attract and directly or indirectly impact natural resources, particularly birds, as discussed in **Section C.4**.

MODUs and installation vessels can be expected to produce noise from station keeping and maintenance operations. The noise levels produced by DP vessels largely depend on the level of thruster activity required to keep position and, therefore, vary based on environmental site conditions, vessel thruster specifications, and operational requirements. Representative source levels, expressed as root-mean-square sound pressure levels (SPL), for vessels in DP mode range from 184 to 190 decibels (dB) referenced to (re) 1 micropascal (µPa) m with a primary frequency below 600 Hz (Blackwell and Greene Jr., 2003; McKenna et al., 2012b; Kyhn et al., 2014). Zykov (2016) characterized a noisier MODU thruster with source levels from 190 to 195 dB re 1 Pa m. The source level for the thrusters used by Zykov (2016) were estimated for power output close to the nominal value (the maximum sustainable) for all thrusters; it is highly unlikely that all the thrusters of all vessels will be operated at such conditions for a prolonged period of time.

Positioning of the MODU and installation vessel requires the use of a vessel-mounted transducer and a series of transceivers placed on the seafloor. The transducer employs a high-frequency acoustic signal (i.e., main energy between 21 and 31 kHz) throughout the operation. While the acoustic signal emitted by the transducer is similar to that emitted by a commercial echosounder, its source level will vary depending upon water depth (i.e., higher source levels required in deeper water). Source levels for the vessel-mounted transceiver are estimated to be >200 dB re 1 Pa m, expressed as SPL, with energy focused toward the seafloor (Equinor, 2019). However, the directionality and frequency of the source results in minimal propagation outside the main beam of the pulse.

The response of marine mammals, sea turtles, and fishes to a perceived marine noise depends on a range of factors, including 1) the sound level, frequency, duration, and novelty of the noise; 2) the physical and behavioral state of the animal at the time of perception; and 3) the ambient acoustic features of the environment (Hildebrand, 2004).

A.2 Physical Disturbance to the Seafloor

Drilling, completion, treatment, and workover of six development wells and subsea infrastructure installation activities will be accomplished with a DP MODU and/or installation vessel; no vessel will use anchors. There will be minimal disturbance to the seafloor and soft bottom communities during positioning of the equipment. Physical disturbance of the seafloor will be limited to the proximal area where the wellbore penetrates the substrate and where mud and drill cuttings will be deposited. The total disturbed area is estimated to be 0.62 acres (ac) (0.25 hectares [ha]) per well (BOEM, 2012a) but may vary depending on the specific well configuration.

BOEM (2012a) estimated an area of seafloor disturbance between 1.2 and 2.5 ac (0.5 to 1.0 ha) per kilometer of pipeline or flowline installation. Due to the water depth in the project area, it is anticipated that the subsea equipment and flowlines will not be buried by trenching, but instead will be placed on the seafloor, decreasing the area of impact.

A.3 Air Pollutant Emissions

Estimates of air pollutant emissions are provided in DOCD Section 8. Offshore air pollutant emissions will result from operations of the MODU and installation vessel as well as service vessels and helicopters. These emissions occur mainly from combustion of diesel. Primary air pollutants typically associated with OCS activities are suspended particulate matter ($PM_{2.5}$ and PM_{10}), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), carbon monoxide (CO), (e ito lu et al., 2015), and ammonia (NH_3), and lead (Pb) per BOEM NTL 2020-G01.

The project area is located westward of 87.5° W longitude; thus, air quality is under BOEM jurisdiction, as explained in NTL 2009-N11. Anticipated emissions from the proposed project activities are calculated in the Air Quality Emissions Report (AQR) (see DOCD Section 8) prepared in accordance with BOEM requirements provided in 30 CFR Part 550 Subpart C. The AQR shows that the projected emissions associated with the proposed activities meet BOEM's exemption criteria.

A.4 Effluent Discharges

Effluent discharges from drilling and subsea installation operations are summarized in DOCD Section 7. Discharges from the MODU and installation vessel are required to comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for Oil and Gas Activities (General Permit No. GMG290000). Support vessel discharges are expected to be in accordance with USCG regulations.

Water-based drilling muds (WBM) and cuttings will be released at the seafloor during the initial well intervals before the marine riser is set. Excess cement slurry and blowout preventer (BOP) fluid will also be released at the seafloor.

A synthetic-based mud (SBM) system will be used for drilling activities after the marine riser is installed, which allows recirculation of the SBM fluids and cuttings and their subsequent processing aboard the surface vessel. Unused or residual SBM will be collected and transported to Port Fourchon, Louisiana, for recycling. Drill cuttings wetted with SBM will be discharged overboard via a downpipe below the water surface after treatment that complies with the NPDES permit limits for synthetic fluid retained on cuttings. The estimated volume of drill cuttings to be discharged is provided in DOCD Section 7.

Other effluent discharges from the MODU, installation vessel, and support vessels are expected to include treated sanitary and domestic wastes, deck drainage, non-contaminated well treatment, completion, and workover fluids, desalination unit discharge, ballast water, bilge water, fire water, hydrate inhibitor, BOP fluid, excess cement, subsea production control fluid, and non-contact cooling water. All discharges shall comply with the NPDES General Permit and/or USCG regulations, as applicable.

A.5 Water Intake

Seawater will be drawn from several meters below the ocean surface for various services, including firewater and once-through, non-contact cooling of machinery on the MODU and installation vessel (DOCD Table 7a).

Section 316(b) of the Clean Water Act requires NPDES permits to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impacts from impingement and entrainment of aquatic organisms. The NPDES General Permit No. GMG290000 specifies requirements for new facilities for which construction commenced after July 17, 2006, with cooling water intake structures having a design intake capacity of greater than 2 million gallons of water per day, of which at least 25% is used for cooling purposes.

The MODU and installation vessel that will be selected for this project will meet the described applicability for new facilities, and the vessel's water intakes are expected to be in compliance with the design, monitoring, and recordkeeping requirements of the General NPDES permit.

A.6 Onshore Waste Disposal

Wastes generated during exploration activities are tabulated in DOCD Section 7. Used SBMs and additives will be transported to shore for recycling, reconditioning, or deep well injection at Halliburton Drilling Fluids, M-I Swaco, R360 Environmental Solutions, or EcoServ in Port Fourchon, Louisiana; or Schlumberger in Galveston, Texas. Cuttings wetted with SBMs will be transported to shore for deep well injection or landfarm at R360 Environmental Solutions or EcoServ in Port Fourchon, Louisiana. Salvage hydrocarbons will be transported to shore for recycling or deep well injection at PSC Industrial Outsourcing, Inc. in Jeanerette, Louisiana. Completion fluids will be transported to shore for recycling, reconditioning, or deep well injection at Halliburton, Baker Hughes, Schlumberger, Tetra, R360 Environmental Solutions, or EcoServ in Port Fourchon, Louisiana; or to Schlumberger in Galveston, Texas. Produced sand and/or naturally occurring radioactive material will be transported to shore for disposal or deep well injection at Trinity Environmental in Liberty, Texas, LOTUS in Andrews, Texas; R360 Environmental Solutions and EcoServ in Port Fourchon, Louisiana; or EcoServ in Winnie, Texas.

Recyclable trash and debris will be generated during the proposed project and will be recycled at Omega Waste Management in Patterson, Louisiana; Martin Energy in Galveston, Texas; or at a similarly permitted facility. Non-recyclable trash and debris will be transported to the Riverbirch landfill in Avondale, Louisiana; Coastal Plains landfill in Alvin, Texas; or to a similarly permitted facility. Exploration and production wastes will be transported to R360 Environmental Solutions, EcoServ, or Clean Waste in Port Fourchon, Louisiana. Used oil and glycol will be transported to Omega Waste Management in Patterson, Louisiana; Chemical Waste Management in Sulphur, Louisiana; or to a similarly permitted facility. Non-hazardous waste will be transported to the Waste Management Woodside landfill in Walker, Louisiana; Coastal Plains landfill in Alvin, Texas; or to a similarly permitted facility. Non-hazardous oilfield waste will be transported to Chemical Waste Management in Sulphur, Louisiana or EcoServ in Winnie, Texas. Universal waste items such as batteries, lamps, glass, and mercury contaminated waste will be sent to Chemical Waste Management in Sulphur, Louisiana, for processing. Hazardous waste will be sent to Chemical Waste Management in Sulphur, Louisiana; Clean Harbors in Colfax, Louisiana; Veolia in

Port Arthur, Texas; SET Environmental in Houston, Texas; or to a similarly permitted facility. Wastes will be recycled or disposed according to applicable regulations at the respective onshore facilities.

A.7 Marine Debris

Trash and debris accidentally released into the marine environment can harm marine animals through entanglement and ingestion. Shell will adhere to the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) Annex V requirements, USEPA and USCG regulations, and BSEE regulations and NTLs regarding solid wastes. BSEE regulations at 30 CFR § 250.300(a) and (b)(6) prohibit operators from deliberately discharging containers and other materials (e.g., trash, debris) into the marine environment, and BSEE regulation 30 CFR § 250.300(c) requires durable identification markings on equipment, tools, and containers (especially drums), and other material. USCG and USEPA regulations require operators to become proactive in avoiding accidental loss of solid waste items by developing waste management plans, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. Additionally, the debris awareness training, instruction, and placards required by the Protected Species Lease Stipulation should minimize the amount of debris that is accidentally lost overboard by offshore personnel (NMFS [2020a] Appendix B). Shell will comply with NTL BSEE-2015-G03, which instructs operators to exercise caution in the handling and disposal of small items and packaging materials, requires the posting of informational placards at prominent locations on offshore vessels and structures, and mandates a yearly marine trash and debris awareness training and certification process. Compliance with these requirements is expected to result in either no or negligible impacts from this factor.

A.8 Support Vessel and Helicopter Traffic

Shell will use existing shore-based facilities in Port Fourchon, Louisiana and a backup base in Galveston, Texas for onshore support of vessels, and facilities in Galveston, Texas and a backup base in Houma, Louisiana for air transportation support. No terminal expansion or construction is planned at either location.

IPFs associated with support vessel and helicopter traffic include their physical presence and operational noise. Each factor is discussed in the following subsections.

A.8.1 Physical Presence

The primary supply base in Port Fourchon, Louisiana, is operated by Shell and located on Bayou Lafourche, approximately 3 miles (5 km) from the Gulf of Mexico. There will likely be at least one support vessel in the field at all times during drilling activities. NMFS (2020a) has found that support vessel traffic has the potential to disturb protected species (e.g., marine mammals, sea turtles, fishes) and creates a risk of vessel strikes. The probability of a vessel strike depends on the number, size, and speed of vessels as well as the distribution, abundance, and behavior of the species (Laist et al., 2001; Jensen and Silber, 2004; Hazel et al., 2007; Vanderlaan and Taggart, 2007; Conn and Silber, 2013; NMFS, 2020a). To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training, and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. Supply vessels will normally move to the project area via the most direct route from the shorebase.

Helicopters transporting personnel and small supplies will normally take the most direct route of travel between the helicopter base in Galveston, Texas and the project area when air traffic and weather conditions permit. Helicopters typically maintain a minimum altitude of 700 ft (213 m) while in transit offshore; 1,000 ft (305 m) over unpopulated areas or across coastlines; and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. Additional guidelines and regulations specify that helicopters maintain an altitude of 1,000 ft (305 m) within 328 ft (100 m) of marine mammals (NMFS, 2020a, 2021).

A.8.2 Noise

Vessel noise is one of the main contributors to overall noise in the sea (National Research Council, 2003b; Jasny et al., 2005). Offshore supply and service vessels associated with the proposed project will contribute to the overall acoustic environment by transmitting noise through both air and water. The support vessels will use conventional diesel-powered screw propulsion. Vessel noise is a combination of narrow-band (tonal) and broadband noise (Richardson et al., 1995; Hildebrand, 2009; McKenna et al., 2012). The vessel tonal noise typically dominates frequencies up to approximately 50 Hz, whereas broadband noise may extend to 100 kHz. The primary sources of vessel noise are propeller cavitation, propeller singing (high-pitched, clear harmonic tone), and propulsion; other sources include auxiliary engine noise, flow noise from water dragging along the hull, and bubbles breaking in the vessel's wake while moving through the water (Richardson et al., 1995). The intensity of noise from service vessels is approximately related to ship size, weight, and speed. Large ships tend to be noisier than small ones and ships underway with a full load (or towing or pushing a load) produce more noise than unladen vessels. For any given vessel, relative noise tends to increase with increased speed, and propeller cavitation is usually the dominant underwater noise source. Broadband source levels, expressed as SPL, for most small ships (a category that includes support vessels) are anticipated to be in the range of 150 to 180 dB re 1 Pa m (Richardson et al., 1995; Hildebrand, 2009; McKenna et al., 2012).

Helicopters used for offshore oil and gas operational support are potential sources of noise to the marine environment. Helicopter noise is generated from their jet turbine engines, airframe, and rotors. The dominant tones for helicopters are generally below 500 Hz (Richardson et al., 1995). Richardson et al. (1995) reported received underwater SPLs of 109 dB re 1 µPa from a Bell 212 helicopter flying at an altitude of 500 ft (152 m). Penetration of helicopter noise below the sea surface is greatest directly below the aircraft; at angles greater than 13 degrees from vertical, much of the noise is reflected from the sea surface and so does not penetrate into the water (Richardson et al., 1995). The duration of underwater noise from passing aircraft is much shorter in water than air. For example, a helicopter passing at an altitude of 500 ft (152 m) that is audible in air for 4 minutes may be detectable under water for only 38 seconds at 10 ft (3 m) depth and for 11 seconds at 59 ft (18 m) depth (Richardson et al., 1995). Additionally, the sound amplitude is greatest as the aircraft approaches or leaves a location.

A.9 Accidents

The analysis in the EIA focuses on two types of potential accidents:

- a small fuel spill (<1,000 barrels [bbl]), which is the most likely type of spill during OCS exploration and development activities; and
- an oil spill resulting from an uncontrolled blowout. A blowout resulting in a large oil spill (>1,000 bbl) is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in DOCD Section 2j.

The following subsections summarize assumptions about the sizes and fates of these spills as well as Shell's spill response plans. Impacts from these accidents are analyzed in **Section C**.

The lease sale EISs (BOEM, 2012a, 2015, 2016b, 2017a) discuss other types of accidents: loss of well control, pipeline failures, vessel collisions, chemical and drilling fluid spills, and H_2S release. These are briefly discussed in this section. No other site-specific issues have been identified for the EIA. The analysis in the lease sale EISs specific to these various accidental events is incorporated by reference.

Loss of Well Control. A loss of well control is the uncontrolled flow of a reservoir fluid that may result in the release of gas, condensate, oil, drilling fluids, sand, or water. Loss of well control is a broad term that includes very minor up to the most serious well control incidents, while blowouts are considered to be a subset of more serious incidents with greater risk of oil spill or human injury (BOEM, 2016a, 2017a). Loss of well control may result in the release of drilling fluid or loss of oil. Not all loss of well control events result in blowouts (BOEM, 2012a). In addition to the potential release of gas, condensate, oil, sand, or water, the loss of well control can also suspend and disperse bottom sediments (BOEM, 2012a, 2017a). BOEM (2016a) noted that most OCS blowouts have resulted in the release of gas; ABSG Consulting Inc. (2018) reported that most loss of well control event spills were <1,000 bbl.

Shell has a robust system in place to prevent loss of well control. Included in this DOCD is Shell's response to NTL 2015-N01, which includes descriptions of measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout. Shell will comply with NTL 2010-N10, as extended under NTL 2015-N02, which specify additional safety measures for OCS activities. See DOCD Sections 2j and 9b for further information.

Pipeline Failures. Pipeline failures can result from mass sediment movements and mudslides, impacts from anchor drops, and accidental excavation in the case that the exact location of a pipeline is uncertain (BOEM, 2012a, 2013, 2015). The project area has been evaluated through geologic and geohazard surveys and found to be geologically suitable for the proposed activities (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018).

Vessel Collisions. BSEE data show that there were 191 OCS-related collisions between 2007 and 2021 (BSEE, 2021). Most collision mishaps are the result of service vessels colliding with platforms or vessel collisions with pipeline risers. Approximately 10% of vessel collisions with platforms in the OCS resulted in diesel spills, and in several collision incidents, fires resulted from hydrocarbon releases. To date, the largest diesel spill associated with a collision occurred in 1979 when an anchor-handling boat collided with a drilling platform in the Main Pass project area, spilling 1,500 bbl. Diesel fuel is the product most frequently spilled, but oil, natural gas, corrosion inhibitor, hydraulic fluid, and lube oil have also been released as the result of vessel collisions. Human error accounted for approximately half of all reported vessel collisions from 2006 to 2009. As summarized by BOEM (2017c), vessel collisions occasionally occur during routine operations. Some of these collisions have caused spills of diesel fuel or chemicals. Shell intends to comply with all USCG- and BOEM-mandated safety requirements to minimize the potential for vessel collisions.

Chemical Spills. Chemicals are stored and used for pipeline hydrostatic testing, and during drilling and in well completion operations. The relative quantities of their use is reflected in the largest volumes spilled (BOEM, 2017c). Completion, workover, and treatment fluids are the largest quantity used and comprise the largest releases. Between 2007 and 2014, an average of two chemical spills <50 bbl in volume and three chemical spills >50 bbl in volume occurred each year (BOEM, 2017a).

H_2S Release. AC 857 is classified as H_2S absent. Based on the H_2S absent classification, no further discussion on H_2S impacts is warranted.

A.9.1 Small Fuel Spill

Spill Size. According to the analysis by BOEM (2017a), the most likely type of small spill (<1,000 bbl) resulting from OCS activities is a failure related to the storage of oil or diesel fuel. Historically, most diesel spills have been 1 bbl, and this is predicted to be the most common spill volume in ongoing and future OCS activities in the Western and Central Gulf of Mexico Planning Areas (Anderson et al., 2012). As the spill volume increases, the incident rate declines dramatically (BOEM, 2017a). The median size for spills 1 bbl is 0.024 bbl, and the median volume for spills of 1 to 10 bbl is 3 bbl (Anderson et al., 2012). For the EIA, a small diesel fuel spill of 3 bbl is used. Operational experience suggests that the most likely cause of such a spill would be a rupture of the fuel transfer hose resulting in a loss of contents (<3 bbl of fuel) (BOEM, 2012a).

Spill Fate. The fate of a small fuel spill in the project area would depend on meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response activities. However, given the open ocean location of the project area and the short duration of a small spill, it is expected that the opportunity for impacts to occur would be very brief.

The water-soluble fractions of diesel are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs), which are moderately volatile (National Research Council, 2003a). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel density is such that it will not sink to the seafloor unless it is dispersed in the water column and adheres to suspended sediments, but this generally occurs only in coastal areas with high-suspended solids loads (National Research Council, 2003a). Adherence to suspended sediments is not expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. Diesel fuel is readily and completely degraded by naturally occurring microbes (NOAA, 2019).

The fate of a small diesel fuel spill of 3 bbl was estimated using WebGNOME, a publicly available oil spill trajectory and fate model developed by NOAA's Office of Response and Restoration (NOAA, 2022a). This model uses the physical properties of oils in its database to predict the rate of evaporation and dispersion over time as well as changes in the density, viscosity, and water content of the product spilled. It is estimated that more than 90% of a small diesel spill would evaporate or naturally disperse within 24 hours (NOAA, 2022a). The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

The WebGNOME results, coupled with spill trajectory information discussed in the following section for a large spill, indicate that a small fuel spill would not impact coastal or shoreline resources. The project area is 141 miles (227 km) from the nearest shoreline (Texas). Slicks from fuel spills are expected to persist for relatively short periods of time ranging from minutes (<1 bbl) to hours (<10 bbl) to a few days (10 to 1,000 bbl) and rapidly spread out, evaporate, and disperse into the water column (BOEM, 2012a). Because of the distance from shore of these potential spills and their lack of persistence, it is unlikely that a small diesel spill would make landfall prior to dissipation (BOEM, 2012a).

Spill Response. In the unlikely event of a fuel spill, response equipment and trained personnel would be available to ensure that spill effects are localized and would result only in short-term, localized environmental consequences. DOCD Section 9b provides a detailed discussion of Shell's oil spill response plans.

A.9.2 Large Oil Spill

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in DOCD Section 2j. Blowouts are rare events, and most well control incidents do not result in oil spills (BOEM, 2016a). According to ABS Consulting Inc. (2016), the spill rate for spills >1,000 bbl is 0.22 spills per billion bbl. The baseline risk of loss of well control spill >10,000 bbl on the OCS is estimated to be once every 27.5 years (ABSG Consulting, 2018).

Spill Size. Shell has calculated the WCD for this DOCD using the requirements prescribed by NTL 2015-N01. The calculated initial release volume is 129,000 bbl of oil during the first day, and the calculated 30-day average WCD rate is 78,700 bbl of oil per day. The total potential spill volume along with a detailed analysis of this calculation can be found in DOCD Section 2j. The WCD scenario for this DOCD has a low probability of being realized. Some of the factors that are likely to reduce rates and volumes, which are not incorporated in the WCD calculation, include, but are not limited to, obstructions or equipment in the wellbore, well bridging, and early intervention such as containment.

Shell has a robust system in place to prevent blowouts. Shell's response to NTL 2015-N01, which includes descriptions of measures to prevent a blowout, reduce the likelihood of a blowout, and conduct effective and early intervention in the event of a blowout, can be found in DOCD Sections 2j and 9b. Shell will also comply with NTL 2010-N10 and applicable drilling regulations in 30 CFR Part 250, Subpart D, which specify additional safety measures for OCS activities.

Spill Trajectory. The fate of a large oil spill in the project area would depend on meteorological and oceanographic conditions at the time. The Oil Spill Risk Analysis (OSRA) model is a computer simulation of oil spill transport that uses realistic data for winds and currents to predict spill fate. The OSRA report by Ji et al. (2004) provides conditional contact probabilities for shoreline segments in the Gulf of Mexico.

The project area is in OSRA Launch Area W011 and the results are presented in **Table 3**. The 30-day OSRA model predicts a <0.5% probability of shoreline contact within 3 days following a spill. Within 10 days, there is a 1% probability of contact for six Texas counties. Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% probability of being contacted. Matagorda County, Texas has the highest probability of shoreline contact, with a 10% chance within 30 days of a spill. Other parishes and counties ranging from Cameron County, Texas, to Cameron Parish, Louisiana, have a 1% to 8% probability of shoreline contact within 30 days of a spill. Counties or parishes whose conditional probability for shoreline contact is <0.5% for 3, 10, and 30 days are not shown in **Table 3**.

Table 3. Conditional probabilities of a spill in the project area contacting shoreline segments based on a 30-day Oil Spill Risk Analysis (OSRA) (From: Ji et al., 2004). Values are conditional probabilities that a hypothetical spill in the project area (represented by OSRA Launch Area W011) could contact shoreline segments within 3, 10, or 30 days.

Shoreline Segment	County or Parish, State	Conditional Probability of Contact[1] (%)		
		3 Days	10 Days	30 Days
C01	Cameron, Texas	--	1	5
C02	Willacy, Texas	--	--	2
C03	Kenedy, Texas	--	1	8
C04	Kleberg, Texas	--	1	6
C05	Nueces, Texas	--	--	4
C06	Aransas, Texas	--	1	5
C07	Calhoun, Texas	--	1	6

Shoreline Segment	County or Parish, State	Conditional Probability of Contact[1] (%)		
		3 Days	10 Days	30 Days
C08	Matagorda, Texas	--	1	10
C09	Brazoria, Texas	--	--	2
C10	Galveston, Texas	--	--	3
C12	Jefferson, Texas	--	--	1
C13	Cameron, Louisiana	--	--	1

[1]Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred. -- indicates <0.5% probability of contact.

The OSRA model presented by Ji et al. (2004) does not evaluate the fate of a spill over time periods longer than 30 days, nor does it predict the fate of a release that continues over a period of weeks or months. Also as noted in Ji et al. (2004), the OSRA model does not take into account the chemical composition or biological weathering of oil spills, the spreading and splitting of oil spills, or spill response activities. The model does not assume a particular spill size; however, the model has generally been used by BOEM to evaluate contact probabilities for spills greater than 1,000 bbl. Thus, OSRA is a preliminary risk assessment model. In the event of an actual oil spill, trajectory modeling would be conducted using the location and estimated amount of spilled oil as well as current and wind data.

Weathering. Following an oil spill, several physical, chemical, and biological processes, collectively called weathering, interact to change the properties of the oil, and thereby influence its potential effects on marine organisms and ecosystems. The most important weathering processes include spreading, evaporation, dissolution, dispersion into the water column, formation of water-in-oil emulsions, photochemical oxidation, microbial degradation, adsorption to suspended PM, and stranding on shore or sedimentation to the seafloor (National Research Council, 2003a; International Tanker Owners Pollution Federation Limited, 2018).

Weathering decreases the concentration of oil and produces changes in its chemical composition, physical properties, and toxicity (BOEM, 2017a). The more toxic, light aromatic and aliphatic hydrocarbons in the oil are lost rapidly by evaporation and dissolution on the water surface. Evaporated hydrocarbons are degraded rapidly by sunlight. Biodegradation of oil on the water surface and in the water column by marine bacteria removes first the n-alkanes and then the light aromatics from the oil. Other petroleum components are biodegraded more slowly. Photo-oxidation attacks mainly the medium and high molecular weight PAHs in the oil on the water surface.

Spill Response. Shell is a founding member of the Marine Well Containment Company (MWCC) and has access to an integrated subsea well control and containment system that can be rapidly deployed through the MWCC. The MWCC is a non-profit organization that assists with the subsea containment system during a response. The near-term containment response capability will be specifically addressed in Shell's NTL 2010-N10 submission of an Application for Permit to Drill. The application will include equipment and services available to Shell through MWCC's near-term containment capabilities and other industry response sources. Shell is a member of Clean Caribbean & Americas, Marine Preservation Association (which funds Marine Spill Response Corporation), Clean Gulf Associates, and Oil Spill Response Limited: organizations that are committed to providing the resources necessary to respond to a spill as outlined in Shell's OSRP.

MWCC also offers its members access to equipment, instruments, and supplies for marine environmental sampling and monitoring in the event of an oil spill in the Gulf of Mexico. Members have access to a mobile laboratory container, operations container, and a launch and recovery system, which enables water sampling and monitoring to water depths of 3,000 m. The two 8-ft × 20-ft containers have been certified for offshore use by Det Norske Veritas and the American Bureau of Shipping. The launch and recovery system is a combined winch, A-frame, and 3,500-m long cable customized for instruments in the containers. The containers are designed to enable rapid mobilization of equipment to an incident site. The required equipment includes redundant systems to avoid downtime and supplies for sample handling and storage. Once deployed on a suitable vessel, the mobile containers then act as workspaces for scientists and operations personnel.

Mechanical recovery capabilities are addressed in the OSRP. The mechanical recovery response equipment that could be mobilized to the spill location in normal and adverse weather conditions is included in the Offshore On-Water Recovery Activation List in the OSRP.

Chemical dispersion capabilities are also readily available from resources identified in the OSRP. Available equipment for surface and subsea application of dispersants, response times, and support resources are identified in the OSRP.

Open-water in-situ burning may also be used as a response strategy, depending on the circumstances of the release. If appropriate conditions exist and approval from the Unified Command is received, one or multiple in situ burning task forces could be deployed offshore. See DOCD Section 9b for a detailed description of spill response measures.

B. Affected Environment

The project area is in the Western Planning Area, 141 miles (227 km) from the nearest shoreline (Texas); 353 miles (568 km) from the onshore support base at Port Fourchon, Louisiana; and 220 miles (354 km) from the helicopter base in Galveston, Texas. A backup onshore support base in Galveston, Texas that could potentially be used is approximately 220 miles (354 km) from the project area. Additionally, a backup helicopter base in Houma, Louisiana that could potentially be used is approximately 347 miles (558 km) from the project area. The water depth at the project area ranges from approximately 8,250 to 8,500 ft (2,515 to 2,591 m).

A detailed description of the regionally affected environment is provided by BOEM (2016b, 2017a), including meteorology, oceanography, geology, air and water quality, benthic communities, Threatened and Endangered species, biologically sensitive resources, archaeological resources, socioeconomic conditions, and other marine uses. These regional descriptions are based on extensive literature reviews and are incorporated by reference.

General background information is presented in the following sections, and brief descriptions of each potentially affected resource are presented in **Section C**, including site-specific or new information if available.

The local environment in the project area is not known to be unique with respect to the physical, chemical, biological, or socioeconomic conditions found in this region of the Gulf of Mexico. The baseline environmental conditions in the project area are expected to be consistent with the regional description of the locations evaluated by BOEM (2016b, 2017a).

C. Impact Analysis

This section analyzes the potential direct and indirect environmental impacts of routine activities and accidents; impacts from all planned activities are discussed in **Section C.9**.

Environmental impacts have been analyzed extensively in lease sale EISs for the Central and Western Gulf of Mexico Planning Areas (BOEM, 2012a, 2013, 2014, 2015, 2016b, 2017a, 2023). Site-specific issues are addressed in this section as appropriate and are organized by the environmental resources identified in **Table 2** that addresses each potential IPF.

C.1 Physical/Chemical Environment

C.1.1 Air Quality

Due to the distance from shore-based pollution sources, offshore air quality is expected to be good. The attainment status of federal OCS waters is unclassified because there is no provision in the Clean Air Act for classification of areas outside state waters (BOEM, 2012a).

In general, ambient air quality in coastal counties along the Gulf of Mexico is relatively good (BOEM, 2012a). As of September 2023, Mississippi, Alabama, and Florida Panhandle coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (USEPA, 2023). St. Bernard Parish in Louisiana is a nonattainment area for sulfur dioxide based on the 2010 standard. One coastal metropolitan area in Texas (Houston-Galveston-Brazoria) is a nonattainment area for 8-hour ozone (2015 Standard). One coastal metropolitan area in Florida (Tampa) was reclassified in 2018 from a nonattainment area to maintenance status for lead based on the 2008 Standard (USEPA, 2023).

Winds in the region are driven by the clockwise circulation around the Bermuda High (BOEM, 2017a). The Gulf of Mexico is located to the southwest of this center of circulation, resulting in a prevailing southeasterly to southerly flow, which is conducive to transporting emissions toward shore. However, circulation is also affected by tropical cyclones (hurricanes) during summer and fall and by extratropical cyclones (cold fronts) during winter.

IPFs that could potentially affect air quality are air pollutant emissions and both types of accidents: a small fuel spill and a large oil spill.

Impacts of Air Pollutant Emissions

Air pollutant emissions are the only routine IPF anticipated to affect air quality. Offshore air pollutant emissions will result from the operation of the MODU and installation vessel, and associated equipment as well as helicopters and service vessels as described in **Section A.3**. These emissions occur mainly from combustion or burning of diesel and Jet-A aircraft fuel. Primary air pollutants typically associated with OCS activities are suspended PM, SO_x, NO_x, VOCs, CO, NH_3, and Pb.

Due to the distance from shore, routine operations in the project area are not expected to impact air quality along the coast. As noted by BOEM (BOEM, 2012a, 2013, 2014, 2015, 2016b, 2017b, 2023), emissions of air pollutants from routine activities in the project area are projected to have minimal impacts on onshore air quality because of the prevailing atmospheric conditions, emission heights, emission rates, and the distance of these emissions from the coastline.

AC 857 is located west of 87.5° W longitude; thus, air quality is under BOEM jurisdiction as explained in NTL 2009-N11. The BOEM-implementing regulations are provided in 30 CFR Part 550 Subpart C. The AQR (see DOCD Section 8) prepared in accordance with BOEM requirements shows that the projected emissions from sources associated with the proposed activities meet BOEM's exemption criteria. Therefore, this DOCD is exempt from further air quality review pursuant to 30 CFR § 550.303(d).

The Breton Wilderness Area, which is part of the Breton National Wildlife Refuge (NWR), is designated under the Clean Air Act as a Prevention of Significant Deterioration Class I air quality area. BOEM coordinates with the USFWS if emissions from proposed projects may affect the Breton Class I area. The project area is approximately 414 miles (666 km) from the Breton Wilderness Area. Shell intends to comply with all BOEM requirements regarding air emissions. No further analysis or control measures are required.

There are three Class I air quality areas on the west coast of Florida: St. Marks National Wildlife Refuge in Wakulla County, Chassahowitzka National Wildlife Area in Hernando County, and Everglades National Park in Monroe, Miami-Dade, and Collier Counties. The project area is approximately 686 miles (1,104 km) from the closest Florida Class I air quality area (St. Marks National Wildlife Refuge Class I Air Quality Area). Shell will comply with emissions requirements as directed by BOEM. No further analysis or control measures are required.

Greenhouse gas emissions contribute to climate change, with impacts on temperature, rainfall, frequency of severe weather contributing to degradation/loss of ecosystems, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2014, 2022). Carbon dioxide (CO_2) and methane (CH_4) emissions from the project would constitute a very small incremental contribution to greenhouse gas emissions from all OCS activities. According to the Programmatic EIS (BOEM, 2016a) and OCS lease sale EISs (BOEM, 2017a), estimated CO_2 emissions from OCS oil and gas sources are 0.4% of the U.S. total. Greenhouse gas emissions from the proposed project represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter any of the climate change impacts evaluated in the Programmatic EIS (BOEM, 2016a).

Impacts of a Small Fuel Spill

Potential impacts of a small spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a). **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the extent and duration of air quality impacts at the project area from a small spill would not be significant.

A small fuel spill would likely affect air quality near the spill site by introducing VOCs into the atmosphere through evaporation. The WebGNOME model (see **Section A.9.1**) indicates that more than 90% of a small diesel spill would evaporate or disperse within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. Given the open ocean location of the project area, the extent and duration of air quality impacts at the project area from a small spill would not be significant.

A small fuel spill would not affect coastal air quality because the spill would be expected to dissipate prior to making landfall or reaching coastal waters (see **Section A.9.1**).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on air quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a, 2023).

A large oil spill would likely affect air quality by introducing VOCs into the atmosphere through evaporation from the oil on the water surface. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. Additional air quality impacts could occur if response measures approved by the Unified Command included in situ burning of the floating oil. In situ burning would generate a plume of black smoke offshore and result in emissions of NO_x, SO_x, CO, and PM as well as greenhouse gases.

Due to the project area location, most air quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal air quality could also be affected. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, Matagorda County, Texas is the coastal area most likely to be affected (1% probability within 10 days and 10% probability within 30 days). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a large oil spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. Based on OSRA modeling, and the low likelihood of a large oil spill event, significant spill impacts on coastal air quality are not expected.

C.1.2 Water Quality

There are no site-specific baseline water quality data for the project area. Due to the lease location in deep, offshore waters, water quality is expected to be good, with low levels of contaminants. As noted by BOEM (2017a), deepwater areas in the northern Gulf of Mexico are relatively homogeneous with respect to temperature, salinity, and oxygen. Kennicutt (2000) noted that the deepwater region has little evidence of contaminants in the dissolved or particulate phases of the water column. IPFs that could potentially affect water quality are effluent discharges and two types of accidents (i.e., a small fuel spill and a large oil spill).

Impacts of Effluent Discharges

As described in **Section A.4**, NPDES General Permit No. GMG290000 establishes permit limits and monitoring requirements for effluent discharges from the MODU and support vessels.

WBM and cuttings, excess cement slurry, and BOP fluid will be released at the seafloor. The seafloor discharges of WBM and associated drill cuttings will produce turbidity near the seafloor. The turbidity plume will be carried away from the well by near-bottom currents and may be detectable within tens to hundreds of meters of the wellbore. As resuspended sediments settle to the seafloor, the water clarity will return to background conditions within minutes to a few hours after drilling of these well intervals ceases (Neff, 1987). Discharges of WBM and cuttings are likely to have little or no impact on water quality due to the low toxicity and rapid dispersion of these discharges (National Research Council, 1983; Neff, 1987; Hinwood et al., 1994).

Cuttings wetted with SBMs will be discharged overboard in accordance with the NPDES permit. After discharge, SBM retained on cuttings would be expected to adhere to the cuttings particles and, consequently, would not produce much turbidity as the cuttings sink through the water column (Neff et al., 2000). An EIS published by BOEM in 2017 concluded that the discharge of treated SBM cuttings will not cause persistent impacts on water quality (BOEM, 2017a). NPDES permit limits and requirements are expected to be met, and little or no impact on water quality is anticipated.

Treated sanitary and domestic wastes will be discharged by the MODU, installation vessel, and support vessels and may have a transient effect on water quality in the immediate vicinity of these discharges. NPDES permit limits and USCG requirements are expected to be met, as applicable, and little or no impact on water quality is anticipated.

Deck drainage includes effluents resulting from rain, deck washings, and runoff from curbs, gutters, and drains, including drip pans in work areas. Rainwater that falls on uncontaminated areas of the MODU and/or installation vessel will flow overboard without treatment. However, rainwater that falls on the MODU and/or installation vessel decks and other areas that may be contaminated with chemicals, such as chemical storage areas or places where equipment is exposed, will be collected and processed to separate oil and water to meet NPDES permit requirements. Negligible impact on water quality is anticipated.

Other effluent discharges from the MODU, installation vessel, and support vessels are expected to include desalination unit brine and non-contact cooling water, non-contaminated well treatment, completion, and workover fluids, BOP fluid, excess cement, hydrate inhibitor, treated seawater, fire water, bilge water, subsea production control fluid, and ballast water. The MODU, installation vessel, and support vessel discharges are expected to be in compliance with NPDES permit and USCG regulations, as applicable, and therefore are not expected to cause significant impacts on water quality.

Impacts of a Small Fuel Spill

Potential impacts of a small spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a, 2023). **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the extent and duration of water quality impacts from a small spill would not be significant.

The water-soluble fractions of diesel are dominated by two- and three-ringed PAHs, which are moderately volatile (National Research Council, 2003a). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel fuel is much lighter than water (specific gravity is between 0.83 and 0.88, compared to 1.03 for seawater). When spilled on water, diesel fuel spreads very quickly to a thin film of rainbow and silver sheens, except for marine diesel, which may form a thicker film of dull or dark colors. However, because diesel fuel has a very low viscosity, it is readily dispersed into the water column when winds reach 5 to 7 knots or with breaking waves (NOAA, 2019). It is possible for diesel fuel that is dispersed by wave action to form droplets that are small enough to be kept in suspension and moved by the currents.

Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high suspended solids loads (National Research Council, 2003a) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico.

The extent and persistence of water quality impacts from a small diesel fuel spill would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. It is estimated that more than 90% of a small diesel spill would evaporate or disperse within 24 hours (see **Section A.9.1**). The sea surface area covered with a very thin layer of diesel fuel would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. In addition to removal by evaporation, constituents of diesel fuel are readily and completely degraded by naturally occurring microbes (NOAA, 2019). Given the open ocean location of the project area, the extent and duration of water quality impacts from a small spill would not be significant.

A small fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters due to response efforts that would be undertaken as well as natural degradation and dilution (**Section A.9.1**).

The local environment in the project area is not known to be unique with respect to the physical, chemical, biological, or socioeconomic conditions found in this region of the Gulf of Mexico. The baseline environmental conditions in the project area are expected to be consistent with the regional description of the locations evaluated by BOEM (2016b, 2017a).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on water quality are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a, 2023). **Section A.9.2** discusses the size and fate of a potential large oil spill as a result of Shell's proposed activities. A large spill would likely affect water quality by producing a slick on the water surface and increasing the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of the spill response measures. Most of the spilled oil would be expected to form a slick at the surface, although observations following the *Deepwater Horizon* incident indicate that plumes of submerged oil droplets can be produced when subsea dispersants are applied at the wellhead (Camilli et al., 2010; Hazen et al., 2010; NOAA, 2011a,b,c). Recent analyses of the entire set of samples associated with the *Deepwater Horizon* incident have confirmed that the application of subsurface dispersants resulted in subsurface hydrocarbon plumes (Spier et al., 2013). A report by Kujawinski et al. (2011) indicates that chemical components of subsea dispersants used during the *Deepwater Horizon* incident persisted for up to 2 months and were detectable up to 186 miles (300 km) from the wellsite at water depths of 3,280 to 3,937 ft (1,000 to 1,200 m). Though, White et al. (2014) found that dispersants could remain associated with oil in the environment for up to 4 years. Dispersants were detectable in <9% of the samples (i.e., 353 of the 4,114 total water samples), and concentrations in the samples were significantly below the chronic screening level for dispersants (BOEM, 2012b).

Once oil enters the ocean, a variety of physical, chemical, and biological processes take place that degrade and disperse the oil. These processes include 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 (National Research Council, 2003a). Marine water quality would be temporarily affected by the dissolved components and small oil droplets that do not rise to the surface or are mixed down by surface turbulence. Liu et al. (2017) observed that after the *Deepwater Horizon* incident, hydrocarbon levels were reduced in the surface waters from May to August 2010 by either rapid weathering and/or physical dilution. A combination of dispersion by currents that dilutes the constituents and microbial degradation which removes the oil from the water column reduces concentrations to background levels. Most crude oil blends will emulsify quickly when spilled, creating a stable mousse that presents a more persistent cleanup and removal challenge.

A large oil spill could result in a release of gaseous hydrocarbons that could affect water quality. During the *Deepwater Horizon* incident, large volumes of CH_4 were released, causing localized oxygen depletion as methanotrophic bacteria rapidly metabolized the hydrocarbons (Joye et al., 2011; Kessler et al., 2011). However, a broader study of the deepwater Gulf of Mexico found that although some stations showed slight depression of dissolved oxygen concentrations relative to climatological background values, the findings were not indicative of hypoxia (<2.0 mg L^{-1}) (Operational Science Advisory Team, 2010). Stations revisited around the Macondo wellhead in October 2010, approximately 6 months after the beginning of the event showed no measurable oxygen depressions (Operational Science Advisory Team, 2010).

Due to the project area's location, most water quality impacts would occur in offshore waters. Depending on the spill trajectory and the effectiveness of spill response measures, coastal water quality could be affected. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, Matagorda County, Texas is the coastal area most likely to be affected (1% probability within 10 days and 10% probability within 30 days). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in DOCD Section 2j. In the event of a large spill, water quality would be temporarily affected, but no long-term detectable impacts are expected. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce any resultant impacts. DOCD Section 9b provides detail on spill response measures.

C.2 Seafloor Habitats and Biota

The water depth at the proposed project area ranges from approximately 8,250 to 8,500 ft (2,515 to 2,591 m). See DOCD Section 6a for further information.

According to BOEM (2016b, 2017a), existing information for the deepwater Gulf of Mexico indicates that the seafloor is composed primarily of soft sediments; exposed hard substrate habitats and associated biological communities are rare. No features or areas that could support significant, high-density benthic communities were found within 2,000 ft (610 m) of the proposed wellsites nor 500 ft (152 m) of the proposed subsea infrastructure (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018). As a result, proposed activities are not expected to have an impact on regionally present high-density deepwater benthic communities.

C.2.1 Soft Bottom Benthic Communities

There are no site-specific benthic community data from the project area. However, data from various gulf-wide studies have been conducted to regionally characterize the continental slope habitats and benthic ecology (Wei, 2006; Rowe and Kennicutt, 2009; Wei et al., 2010; Carvalho et al., 2013; Spies et al., 2016), which can be used to describe typical baseline benthic communities that could be present in vicinity of the proposed activities. **Table 4** summarizes data from two stations in the vicinity of the proposed activities. Sediments at these two stations were similar, predominantly clay (60.4% at Station AC1 and 61.3% at Station RW6) and silt (34.5% at Station AC1 and 61.3% at Station RW6) (Rowe and Kennicutt, 2009).

Table 4. Baseline benthic community data from stations near to the project area in water depths similar to those sampled during the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study (From: Wei, 2006; Rowe and Kennicutt, 2009).

Station	Distance from Lease Area	Water Depth (m)	Density		
			Meiofauna (>63 µm; individuals m^{-2})	Macroinfauna (>300 mm; individuals m^{-2})	Megafauna (>1 cm; individuals ha^{-1})
AC1	26 miles (42 km)	2,550	129,974	637	1,620
RW6	26 miles (42 km)	3,000	144,453	715	--

-- = No data available.

Density of meiofauna (animals that pass through a 0.5-millimeter sieve but are retained on a 0.062-millimeter sieve) in sediments collected at water depths representative of the project area ranged from approximately 130,000 to 144,000 individuals m^{-2} (Rowe and Kennicutt, 2009). Nematodes, nauplii, and harpacticoid copepods were the three dominant groups in the meiofauna, accounting for approximately 90% of total abundance.

The benthic macroinfauna is characterized by small mean individual sizes and low densities, both of which reflect the intrinsically low primary production in surface waters of the Gulf of Mexico continental slope (Wei, 2006). Densities decrease exponentially with water depth (Carvalho et al., 2013). Based on an equation presented by Wei (2006), the macroinfaunal density in the water depth of the project area is estimated to between 998 and 1,055 individuals m^{-2}; however, actual densities at the project area are unknown and often highly variable.

Polychaetes are typically the most abundant macroinfaunal group on the northern Gulf of Mexico continental slope, followed by amphipods, tanaids, bivalves, and isopods (Rowe and Kennicutt, 2009). Carvalho et al. (2013) found polychaete abundance to be higher in the central region of the northern Gulf of Mexico when compared to the eastern and western regions. Wei (2006) recognized four depth-dependent faunal zones (1 through 4), two of which (Zones 2 and 3) are divided horizontally. The project area is located outside of these delineated faunal zones, but is in close proximity to Zone 3W, which consists of stations on the mid Texas-Louisiana Slope ranging in depth from 1,875 to 3,008 m (6,152 to 9,869 ft). The most abundant species in this zone were the polychaetes *Levinsenia uncinata*, *Paraonides monilaris*, and *Tachytrypane* sp.; the bivalve *Heterodonta* sp.; and the isopod *Macrostylis* sp. (Wei, 2006, Wei et al., 2010).

Megafaunal density at a nearby station was approximately 1,620 individuals ha^{-1} (**Table 4**). Common megafauna included motile groups such as echinoderms, cnidarians (sessile sea anemones, pens, and whips), decapod crustaceans, and demersal fish (Rowe and Kennicutt, 2009).

Bacteria are the foundation of deep-sea chemosynthetic communities (Ross et al., 2012) and are an important component in terms of biomass and cycling of organic carbon (Cruz-Kaegi, 1998). Bacterial biomass at the depth range of the project area typically is approximately 1 to 2 g C m^{-2} in the top 6 inches (15 cm) of sediments (Rowe and Kennicutt, 2009). In deep-sea sediments, Main et al. (2015) observed that microbial oxygen consumption rates increased and bacterial biomass decreased with hydrocarbon contamination.

IPFs that could potentially affect benthic communities are physical disturbance to the seafloor, effluent discharges (drilling mud and cuttings), and a large oil spill resulting from a well blowout at the seafloor. A small fuel spill would not affect benthic communities because the diesel fuel would float and dissipate on the sea surface.

Impacts of Physical Disturbance to the Seafloor

Drilling, completion, treatment, and workover of six development wells and subsea infrastructure installation activities will be accomplished with a DP MODU and/or installation vessel; no vessel will use anchors. There will be minimal disturbance to the seafloor and soft bottom communities during positioning of the equipment. Physical disturbance of the seafloor will be limited to the proximal area where the wellbore penetrates the substrate and where mud and drill cuttings will be deposited. The total disturbed area is estimated to be 0.62 ac (0.25 ha) per well (BOEM, 2012a) but may vary depending on the specific well configuration.

BOEM (2012a) estimated an area of seafloor disturbance between 1.2 ac (0.5 ha) and 2.5 ac (1.0 ha) per kilometer of pipeline or flowline installation. Due to the water depth in the project area, it is anticipated that the subsea equipment and flowlines will not be buried by trenching, but instead will be placed on the seafloor, decreasing the area of impact. Physical disturbance to the seafloor during this project will have no significant impact on soft bottom benthic communities on a regional basis.

Impacts of Effluent Discharges

Drilling muds and cuttings are the only effluents likely to affect these soft bottom benthic communities that could be present in vicinity of the wellsites. During drilling activities, cuttings and seawater-based “spud mud” may be released at the seafloor. Excess cement slurry will also be released at the seafloor by casing installation during the riserless portion of the drilling operations. Cement slurry components typically include cement mix and some of the same chemicals used in WBM (Boehm et al., 2001; Fink, 2015). The main impacts will be burial and smothering of benthic organisms within several meters to tens of meters around the wellbore. Small amounts of water-based BOP fluid will be released at the seafloor and are expected to be rapidly diluted and dispersed.

Benthic community effects of drilling discharges have been reviewed extensively by the National Research Council (1983), Neff (1987), Neff et al. (2005), and Hinwood et al. (1994). Due to the low toxicity of WBM and associated drill cuttings, the main mechanism of impact to benthic communities is increased sedimentation, possibly resulting in burial or smothering within several meters to tens of meters around the wellbore. Monitoring programs have shown that benthic impacts of drilling are minor and localized within a few hundred meters of the wellsite (National Research Council, 1983; Neff, 1987; Neff et al., 2005; Continental Shelf Associates, 2006). Soft bottom sediments disturbed by cuttings, drilling mud, cement slurry, and BOP fluid will eventually be recolonized through larval settlement and migration from adjacent areas. Because some deep-sea biota grow and reproduce slowly, recovery may require several years.

Discharges of treated SBM associated cuttings from the MODU may affect benthic communities, primarily within several hundred meters of the wellsites. The fate and effects of SBM cuttings have been reviewed by Neff et al. (2000), and monitoring studies have been conducted in the Gulf of Mexico by Continental Shelf Associates (2004, 2006). In general, cuttings with adhering SBM tend to clump together and form thick cuttings piles close to the drill sites. Areas of SBM cuttings deposition may develop elevated organic carbon concentrations and anoxic conditions (Continental Shelf Associates, 2006). Where SBM cuttings accumulate and concentrations exceed approximately 1,000 mg kg^{-1}, benthic infaunal communities may be adversely affected due to both the toxicity of the base fluid and organic enrichment (with resulting anoxia) (Neff et al., 2000). Infaunal density may increase and diversity may decrease as opportunistic species that tolerate low oxygen and high H_2S predominate (Continental Shelf Associates, 2006). As the base SBM is biodegraded by microbes, the area will gradually recover to pre-drilling conditions. Disturbed sediments will be recolonized through larval settlement and migration from adjacent areas.

The areal extent of impacts from drilling discharges will be small; the typical effect radius is approximately 1,640 ft (500 m) around each wellsite. Soft bottom benthic communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway, 1988; Gallaway et al., 2003; Rowe and Kennicutt, 2009); thus, impacts from drilling discharges during this project will not have a significant impact on soft bottom benthic communities on a regional basis.

Impacts of a Large Oil Spill

Potential impacts of a large oil spill on the benthic community are expected to be consistent with those analyzed and discussed by BOEM (2012a, 2015, 2016b, 2017a, 2023). Impacts from a subsea blowout could include smothering and exposure to toxic hydrocarbons from oiled sediment settling to the seafloor. The most likely effects of a subsea blowout on benthic communities would be within a few hundred meters of the wellsites. BOEM (2012a) estimated that a severe subsurface blowout could suspend and disperse sediments within a 984-ft (300-m) radius. Although coarse sediments (sands) would probably settle at a rapid rate within 1,312 ft (400 m) from the blowout site, fine sediments (silts and clays) could be suspended for more than 30 days and dispersed over a much wider area. A previous study characterized surface sediments at the sampling stations in the vicinity of the proposed activities' location. Sediments at two nearby stations were similar, composed predominantly of clay (60.4% at Station AC1 and 61.3% at Station RW6) and silt (34.5% at Station AC1 and 61.3% at Station RW6) (Rowe and Kennicutt, 2009).

Previous analyses by BOEM (2016b, 2017a) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. During the *Deepwater Horizon* incident, the use of subsea dispersants at the wellhead caused the formation of subsurface plumes (NOAA, 2011b). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could contact the seafloor and affect benthic communities beyond the 984-ft (300-m) radius (BOEM, 2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). This contact could result in smothering and/or toxicity to benthic organisms. The subsurface plumes observed following the *Deepwater Horizon* incident were reported in water depths of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011b; Spier et al., 2013). Montagna et al. (2013) estimated that the most severe impacts to soft bottom benthic communities (e.g., reduction of faunal abundance and diversity) from the *Deepwater Horizon* incident extended 2 miles (3 km) from the wellhead in all directions, covering an area of approximately 9 miles^2 (24 km^2). Moderate impacts were observed up to 11 miles (17 km) to the southwest and 5 miles (8.5 km) to the northeast of the wellhead, covering an area of 57 miles^2 (148 km^2). NOAA (2016a) documented a footprint of over 772 miles^2 (2,000 km^2) of impacts to benthic habitats surrounding the *Deepwater Horizon* incident site. The analysis also identified a larger area of approximately 3,552 miles^2 (9,200 km^2) of potential exposure and uncertain impacts to benthic communities (NOAA, 2016a). Stout and Payne (2018) also noted that SBM released as a result of the blowout covered a seafloor area of 2.5 miles^2 (6.5 km^2).

While the behavior and impacts of subsurface oil plumes are not well known, the Macondo findings indicate that benthic impacts likely extend beyond the immediate vicinity of the wellsite, depending on the extent, trajectory, and persistence of the plume. Baguley et al. (2015) noted that while nematode abundance increased with proximity to the Macondo wellhead, copepod abundance, relative species abundance, and diversity decreased in response to the *Deepwater Horizon* incident. Washburn et al. (2017) noted that richness, diversity, and evenness were affected within a radius of 0.62 miles (1 km) of the wellhead. Reuscher et al. (2017) found that meiofauna and macrofauna community diversity was significantly lower in areas that were impacted by Macondo oil. Demopoulos et al. (2016) reported abnormally high variability in meiofaunal and macrofaunal density in areas near the Macondo wellhead, which supports the Valentine et al. (2014) supposition that hydrocarbon deposition and impacts in the vicinity of the Macondo wellhead were patchy. Noirungsee et al. (2020) observed that pressure has a significant influence on deep-sea sediment microbial communities with the addition of dispersant and oil with dispersants being shown to have an inhibitory effect on hydrocarbon degraders. Thus, the dispersant persistence due to hydrostatic pressure could further limit microbial oil biodegradation (Noirungsee et al., 2020). While there are some indications of partial recovery of benthic fauna, as of 2015, full recovery had not occurred (Montagna et al., 2016; Reuscher et al., 2017; Washburn et al., 2017).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will minimize potential impacts. DOCD Section 9b provides detail on spill response measures. A large oil spill could have impacts on soft bottom communities but significant impacts on a regional basis are not expected.

C.2.2 High-Density Deepwater Benthic Communities

As defined in NTL 2009-G40, high-density deepwater benthic communities are features or areas that could support high-density chemosynthetic communities, high-density deepwater corals, or other associated high-density hard bottom communities. Chemosynthetic communities were discovered in the central Gulf of Mexico in 1984 and have been studied extensively (MacDonald, 2002). Deepwater coral communities are also known from numerous locations in the Gulf of Mexico (Cordes et al., 2008; Brooks et al., 2012; Demopoulos et al., 2017; Hourigan et al., 2017). These communities occur almost exclusively on exposed authigenic carbonate rock created by a biogeochemical (microbial) process, and on shipwrecks.

In water depths such as those encountered in the project area, the DP MODU or installation vessel will disturb the seafloor only in the immediate vicinity of the drill sites or subsea infrastructure (**Section A.2**). The nearest known high-density deepwater benthic community is located approximately 28 miles (45 km) from the project area. A high-resolution geophysical survey, including an autonomous underwater vehicle, multi-beam echosounder and three-dimensional seismic data, has been conducted in the project area as part of the assessment of archaeological resources and shallow hazards (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018). The survey found no evidence of high-density deepwater benthic communities.

The only IPF identified for this project that could potentially affect high-density deepwater benthic communities is a large oil spill from a well blowout at the seafloor. Physical disturbances and effluent discharges are not likely to affect high-density deepwater benthic communities since these are generally limited to localized impacts. A small fuel spill would not affect benthic communities because the diesel fuel would float and dissipate from the sea surface.

Impacts of a Large Oil Spill

BOEM (2012a, 2015, 2016c, 2017a) concluded that oil spills would be unlikely to affect benthic communities beyond the immediate vicinity of the wellhead (i.e., due to physical impacts of a blowout) because the oil would rise quickly to the sea surface directly over the spill location. However, subsea oil plumes resulting from a seafloor blowout could affect sensitive deepwater communities (BOEM, 2016b). During the *Deepwater Horizon* incident, subsurface plumes were reported at a water depth of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of subsea dispersants at the wellhead (NOAA, 2011c). Chemical components of subsea dispersants used during the *Deepwater Horizon* incident persisted for up to 2 months and were detectable up to 186 miles (300 km) from the wellsite at water depths of 3,280 to 3,937 ft (1,000 to 1,200 m) (Kujawinski et al., 2011). However, estimated dispersant concentrations in the subsea plume were below levels known to be toxic to marine life. While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could have the potential to contact high-density deepwater benthic communities beyond the 984-ft (300-m) radius estimated by BOEM (2016a) depending on its extent, trajectory, and persistence (Spier et al., 2013). Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants.

Potential impacts of oil on high-density deepwater benthic communities are discussed by BOEM (2012a, 2015, 2016c, 2017a, 2023). Oil plumes that directly contact localized patches of sensitive benthic communities before degrading could potentially impact the resource. However, the potential impacts would be localized due to the directional movement of oil plumes by the water currents and because the sensitive habitats have a scattered, patchy distribution. The more likely result would be exposure to widely dispersed, biodegraded particles that “rain” down from a passing oil plume. While patches of habitat may be affected, the Gulf-wide ecosystem of live bottom communities would be expected to suffer no significant effects (BOEM, 2016b).

Although chemosynthetic communities live among hydrocarbon seeps, natural seepage occurs at a relatively constant low rate compared with the potential rates of oil release from a blowout. In addition, seep organisms require unrestricted access to oxygenated water at the same time as exposure to hydrocarbon energy sources (MacDonald, 2002). Oil droplets or oiled sediment particles could come into contact with chemosynthetic organisms. As discussed by BOEM (2017a), impacts could include loss of habitat and biodiversity; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats.

Sublethal effects are possible for deepwater coral communities that receive a lower level of oil impact. Effects to deepwater coral communities could be temporary (e.g., lack of feeding, loss of tissue mass) or long lasting and could affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2012a, 2015, 2016b, 2017a, 2023). The potential for a spill to affect deepwater corals was observed during an October 2010 survey of deepwater coral habitats in water depths of 4,600 ft (1,400 m) approximately 7 miles (11 km) southwest of the Macondo wellhead. Much of the soft coral observed in a location measuring approximately 50 ft × 130 ft (15 m × 40 m) was covered by a brown flocculent material (Bureau of Ocean Energy Management, Regulation, and Enforcement, 2010) with signs of stress, including varying degrees of tissue loss and excess mucous production (White et al., 2012). Hopanoid petroleum biomarker analysis of the flocculent material indicated that it contained oil from the *Deepwater Horizon* incident. The injured and dead corals were in an area in which a subsea plume of oil had been documented during the spill in June 2010. The deepwater coral at this location showed signs of tissue damage that was not observed elsewhere during these surveys or in previous deepwater coral studies in the Gulf of Mexico. The team of researchers concluded that the observed coral injuries likely resulted from exposure to the subsurface oil plume (White et al., 2012). Apparent recovery of some affected areas by March 2012 correlated negatively with the proportion of the coral covered with floc in late 2010 (Hsing et al., 2013). Fisher et al. (2014a) reported two additional coral areas affected by the *Deepwater Horizon* incident; one 4 miles (6 km) south of the Macondo wellsite, and the other 14 miles (22 km) to the southeast. Prouty et al. (2016) found evidence that corals located northeast of the *Deepwater Horizon* incident were also affected. In addition to direct impacts on corals and other sessile epifauna, the spill also affected macroinfauna associated with these hard bottom communities (Fisher et al., 2014b).

Although no known deepwater coral communities are likely to be impacted by a subsurface plume, previously unidentified communities may be encountered if a large subsurface oil spill occurs. However, because of the scarcity of deepwater hard bottom communities, their comparatively low surface area, and the requirements set by BOEM in NTL 2009-G40, it is unlikely that a sensitive habitat would be located adjacent to a seafloor blowout or that concentrated oil would contact the site (BOEM, 2012a).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j.

In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on Shell's spill response measures. Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants.

C.2.3 Designated Topographic Features

The project location is not within or near a designated topographic feature or a no-activity zone as identified in NTL 2009-G39. The nearest designated topographic feature stipulation block is North Padre Island East Block PNA83, located approximately 116 miles (187 km) from the project area. There are no IPFs associated with either routine operations or accidents that could cause impacts to designated topographic features due to their distance from the project area.

C.2.4 Pinnacle Trend Area Live Bottoms

The project area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined in NTL 2009-G39, the nearest pinnacle trend block is Main Pass Block 290, approximately 444 miles (715 km) from the project area. There are no IPFs associated with either routine operations or accidents that could cause impacts to pinnacle trend area live bottoms due to the distance from the project area.

C.2.5 Eastern Gulf Live Bottoms

The project area is not covered by the Live Bottom (Low-Relief) Stipulation, which pertains to seagrass communities and low-relief hard bottom reef within the Gulf of Mexico Eastern Planning Area blocks in water depths of 328 ft (100 m) or less and portions of Pensacola and Destin Dome Area Blocks in the Central Planning Area. The nearest block covered by the Live Bottom Stipulation, as defined in NTL 2009-G39, is Destin Dome Block 573, located approximately 487 miles (784 km) from the project area. There are no IPFs associated with either routine operations or accidents that could cause impacts to eastern Gulf of Mexico live bottom areas due to the distance from the project area.

C.3 Threatened, Endangered, and Protected Species and Critical Habitat

This section discusses species listed as Endangered or Threatened under the ESA. In addition, it includes marine mammal species in the region that are protected under the MMPA. To provide reference for potential impacts to Threatened, Endangered, and protected species, the following sections include discussions of individual- (i.e., effect on single individual), population- (i.e., effect on localized population of individuals) and species-level (i.e., effect on entire species as a whole) impacts for select species. It is understood that contact with potential IPFs, particularly large oil spills, does not necessarily result in mortality. However, the size of the population, along with its status as Threatened, Endangered, or protected were considered when determining if potential individual mortality may result in impacts at the individual, population, or species level.

Endangered, Threatened, or species of concern that may occur in the project area and/or along the northern Gulf Coast are listed in **Table 5**. The table also indicates the location of designated critical habitat in the Gulf of Mexico. Critical habitat is defined as (1) specific areas within the geographical area occupied by the species at the time of listing, if they contain physical or biological features essential to conservation, and those features may require special management considerations or protection; and (2) specific areas outside the geographical area occupied by the species if the agency determines that the area itself is essential for conservation. NMFS has jurisdiction over ESA-listed marine mammals (cetaceans) and fishes in the Gulf of Mexico, and USFWS has jurisdiction over ESA-listed birds and the West Indian manatee (*Trichechus manatus*). These two agencies share federal jurisdiction over sea turtles, with NMFS having lead responsibility at sea and USFWS on nesting beaches.

Table 5. Federally listed Endangered and Threatened species potentially present in the project area and along the northern Gulf Coast. Adapted from U.S. Fish and Wildlife Service (2020a) and National Oceanic and Atmospheric Administration Fisheries (2020).

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Project Area	Coastal	
Marine Mammals					
Rice's whale	*Balaenoptera ricei*	E	X	--	None
Sperm whale	*Physeter macrocephalus*	E	X	--	None
West Indian manatee	*Trichechus manatus*[1]	T	--	X	Florida (Peninsular)
Sea Turtles					
Loggerhead turtle	*Caretta caretta*	T,E[2]	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida; *Sargassum* habitat including most of the central & western Gulf of Mexico.
Green turtle	*Chelonia mydas*	T	X	X	None
Leatherback turtle	*Dermochelys coriacea*	E	X	X	None
Hawksbill turtle	*Eretmochelys imbricata*	E	X	X	None
Kemp's ridley turtle	*Lepidochelys kempii*	E	X	X	None
Birds					
Piping Plover	*Charadrius melodus*	T	--	X	Coastal Texas, Louisiana, Mississippi, Alabama, and Florida
Whooping Crane	*Grus americana*	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Fishes					
Oceanic whitetip shark	*Carcharhinus longimanus*	T	X	--	None
Giant manta ray	*Mobula birostris*	T	X	X	None
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida
Nassau grouper	*Epinephelus striatus*	T	--	X	None
Smalltooth sawfish	*Pristis pectinata*	E	--	X	Southwest Florida
Invertebrates					
Elkhorn coral	*Acropora palmata*	T	--	X	Florida Keys and the Dry Tortugas
Staghorn coral	*Acropora cervicornis*	T	--	X	Florida Keys and the Dry Tortugas
Pillar coral	*Dendrogyra cylindrus*	T	--	X	Southeast Florida and Florida Keys, Puerto Rico, St Thomas, St. John, St. Croix, and Navassa Island

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Project Area	Coastal	
Rough cactus coral	*Mycetophyllia ferox*	T	--	X	Southeast Florida and Florida Keys, Puerto Rico, St. Thomas, St. John, St. Croix, and Navassa Island
Lobed star coral	*Orbicella annularis*	T	--	X	Southeast Florida and Florida Keys, Puerto Rico, St. Thomas, St. John, St. Croix, Navassa Island, East and West Flower Garden Banks, Rankin Bright Bank, Geyer Bank, and McGrail Bank
Mountainous star coral	*Orbicella faveolata*	T	--	X	Southeast Florida and Florida Keys, Puerto Rico, St. Thomas, St. John, St. Croix, Navassa Island, East and West Flower Garden Banks, Rankin Bright Bank, Geyer Bank, and McGrail Bank
Boulder star coral	*Orbicella franksi*	T	--	X	Southeast Florida and Florida Keys, Puerto Rico, St. Thomas, St. John, St. Croix, Navassa Island, East and West Flower Garden Banks, Rankin Bright Bank, Geyer Bank, and McGrail Bank
Panama City crayfish	*Procambarus econfinae*	T	--	X	South-central Bay County, Florida
Terrestrial Mammals					
Beach mice (Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches
Florida salt marsh vole	*Microtus pennsylvanicus dukecampbelli*	E	--	X	None

-- = not present; E = Endangered; T = Threatened; X = potentially present.

[1] There are two subspecies of West Indian manatee: the Florida manatee (*T. m. latirostris*), which ranges from the northern Gulf of Mexico to Virginia, and the Antillean manatee (*T. m. manatus*), which ranges from northern Mexico to eastern Brazil. Only the Florida manatee subspecies is likely to be found in the northern Gulf of Mexico.

[2] The Northwest Atlantic Ocean Distinct Population Segment (DPS) of loggerhead turtles is designated as Threatened (76 *Federal Register* [*FR*] 58868). The National Marine Fisheries Service and the U.S. Fish and Wildlife Service designated critical habitat for this DPS, including beaches and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as *Sargassum* spp. habitat throughout most of the central and western Gulf of Mexico (79 *FR* 39756 and 79 *FR* 39856).

Coastal Endangered or Threatened species that may occur along the U.S. Gulf Coast include the West Indian manatee, Piping Plover (*Charadrius melodus*), Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*), Panama City crayfish (*Procambarus econfinae*), Whooping Crane (*Grus americana*), Gulf sturgeon (*Acipenser oxyrinchus desotoi*), smalltooth sawfish (*Pristis pectinata*), and four subspecies of beach mouse. Critical habitat has been designated for all of these species (except the Florida salt marsh vole) as indicated in **Table 5** and is discussed in individual sections. Two other coastal bird species (Bald Eagle [*Haliaeetus leucocephalus*] and Brown Pelican [*Pelecanus occidentalis*]) are no longer federally listed as Endangered or Threatened; these are discussed in **Section C.4.2**.

Five sea turtle species, the Rice's whale (*Balaenoptera ricei*), sperm whale (*Physeter macrocephalus*), oceanic whitetip shark (*Carcharhinus longimanus*), and giant manta ray (*Mobula birostris*) are the only Endangered or Threatened species that could potentially occur within the project area. The listed sea turtles include the leatherback turtle (*Dermochelys coriacea*), Kemp's ridley turtle (*Lepidochelys kempii*), hawksbill turtle (*Eretmochelys imbricata*), loggerhead turtle (*Caretta caretta*), and green turtle (*Chelonia mydas*) (Pritchard, 1997). Effective August 11, 2014, NMFS has designated certain marine areas as critical habitat for the northwest Atlantic distinct population segment (DPS) of the loggerhead sea turtle (**Section C.3.5**). No critical habitat has been designated in the Gulf of Mexico for the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, or the green turtle.

Listed marine mammal species include one odontocete (sperm whale) which is known to occur in the Gulf of Mexico (Würsig, 2017); no critical habitat has been designated for the sperm whale. The Rice's whale exists in the Gulf of Mexico as a small, resident population. This species was formerly known as a subspecies to the Bryde's whale (*Balaenoptera edeni brydei*) until a 2021 DNA study identified it as a separate species (Rosel et al., 2021). It is the only baleen whale known to be resident of the Gulf of Mexico. The species is thought to be severely restricted in range, usually being found in the northeastern Gulf in the waters of the DeSoto Canyon (Waring et al., 2016; Rosel et al., 2021). However, recent work by Soldevilla et al. (2022) suggests the range may be broader than previously thought (see **Section C.3.2**). The giant manta ray could occur in the project area but is most commonly observed in the Gulf of Mexico at the Flower Garden Banks. The Nassau grouper (*Epinephelus striatus*) has been observed in the Gulf of Mexico at the Flower Garden Banks but is most commonly observed in shallow tropical reefs of the Caribbean and is not expected to occur in the project area. The smalltooth sawfish is a coastal species limited to shallow areas off the west coast of Florida and is not expected to occur in the project area.

Four Endangered mysticete whales (blue whale [*Balaenoptera musculus*], fin whale [*Balaenoptera physalus*], North Atlantic right whale [*Eubalaena glacialis*], and sei whale [*Balaenoptera borealis*]) have been reported in the Gulf of Mexico but are considered rare or extralimital (Würsig et al., 2000). These species are not included in the most recent final NMFS stock assessment report (Hayes et al., 2022) nor in the most recent BOEM multisale EIS (BOEM, 2023) as present in the Gulf of Mexico; therefore, they are not considered further in the EIA.

Seven Threatened coral species are known to be present in the Gulf of Mexico: elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), boulder star coral (*Orbicella franksi*), pillar coral (*Dendrogyra cylindrus*), and rough cactus coral (*Mycetophyllia ferox*). None of these species are expected to be present in the project area (see **Section C.3.16**). Critical habitat for lobed star coral, mountainous star coral, boulder star coral, rough cactus coral, and pillar coral was designated by NMFS in August 2023 (Table 6; 88 FR 54026).

There are no other Threatened or Endangered species in the Gulf of Mexico that are likely to be affected by either routine or accidental events associated with project activities.

C.3.1 Sperm Whale (Endangered)

Resident populations of sperm whales occur within the Gulf of Mexico. Gulf of Mexico sperm whales are classified as an Endangered species and a "strategic stock" by NMFS (Waring et al., 2016). A "strategic stock" is defined by the MMPA as a marine mammal stock that meets the following criteria:

- The level of direct human-caused mortality exceeds the potential biological removal level;
- Based on the best available scientific information, is in decline and is likely to be listed as a Threatened species under the ESA within the foreseeable future; or
- Is listed as a Threatened or Endangered species under the ESA or is designated as depleted under the MMPA.

Current threats to sperm whale populations worldwide are discussed in a final recovery plan for the sperm whale published by NMFS (2010). Threats are defined as "any factor that could represent an impediment to recovery," and include fisheries interactions, anthropogenic noise, vessel interactions, contaminants and pollutants, disease, injury from marine debris, research, predation and natural mortality, direct harvest, competition for resources, loss of prey base due to climate change and ecosystem change, and cable laying. In the Gulf of Mexico, the impacts from many of these threats are identified as either low or unknown (BOEM, 2012a).

The distribution of sperm whales in the Gulf of Mexico is correlated with mesoscale physical features such as eddies associated with the Loop Current (Jochens et al., 2008). Sperm whale populations in the north-central Gulf of Mexico are present there throughout the year (Davis et al., 2000). Results of a multi-year tracking study show female sperm whales typically concentrated along the upper continental slope between the 656- and 3,280-ft (200- and 1,000-m) depth contours (Jochens et al., 2008). Male sperm whales were more variable in their movements and were documented in water depths greater than 9,843 ft (3,000 m). Generally, groups of sperm whales sighted in the Gulf of Mexico during the Minerals Management Service-funded Sperm Whale Seismic Study consisted of mixed-sex groups comprising adult females and juveniles, and groups of bachelor males. Typical group size for mixed groups was 10 individuals (Jochens et al., 2008). A review of sighting reports from seismic mitigation surveys in the Gulf of Mexico conducted over a 6-year period found a mean group size for sperm whales of 2.5 individuals (Barkaszi et al., 2012).

In these mitigation surveys, sperm whales were the most common cetacean encountered. Results of the Sperm Whale Seismic Study showed that sperm whales' transit through the vicinity of the project area. Movements of satellite-tracked individuals suggest that this area of the Gulf continental slope is within the home range of the Gulf of Mexico population (within the 95% utilization distribution) (Jochens et al., 2008).

IPFs that could potentially affect sperm whales include vessel presence, noise, and lights; support vessel and helicopter traffic; and both types of spill accidents: a small fuel spill and a large oil spill. Effluent discharges are likely to have negligible impacts on sperm whales due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these marine mammals.

Though NMFS (2020a) identified marine debris as an IPF for sperm whales, compliance with BSEE NTL 2015-G03 and NMFS (2020a) Appendix B will minimize the potential for marine debris-related impacts on sperm whales. NMFS (2020a) estimates that no more than three sperm whales will be nonlethally taken, with one sperm whale lethally taken through the ingestion of marine debris over 50 years of proposed action. Therefore, marine debris is likely to have negligible impacts on sperm whales and is not further discussed (See **Table 2**).

Impacts of Vessel Presence (including noise and lights)

Some noises produced by the MODU and/or installation vessel may be emitted at levels that could potentially disturb individual whales or mask the sounds animals would normally produce or hear. Noise associated with drilling activities are relatively weak in intensity, and an individual animal's sound exposure would be transient. As discussed in **Section A.1**, an actively drilling MODU can produce a maximum broadband (10 Hz to 10 kHz) source level of approximately 190 dB re 1 µPa m, expressed as SPL (Hildebrand, 2005).

NMFS (2018a) lists sperm whales in the same functional hearing group (i.e., mid-frequency cetaceans) as most dolphins and other toothed whales, with an estimated hearing sensitivity from 150 Hz to 160 kHz. Therefore, vessel-related noise is likely to be heard by sperm whales. Frequencies <150 Hz produced by the drilling operations are not likely to be perceived with any significance by mid-frequency cetaceans. The sperm whale may possess better low-frequency hearing than some of the other odontocetes, although not as low as many baleen whale species that primarily produce sounds between 12 Hz and 28 kHz (Wartzok and Ketten, 1999). Generally, most of the acoustic energy produced by sperm whales is present at frequencies below 10 kHz, although diffuse energy up to and past 20 kHz is common, with source levels up to 236 dB re 1 Pa m, expressed as SPL (Møhl et al., 2003).

It is expected that, due to the relatively stationary nature of the MODU and/or installation vessel, sperm whales would move away from the proposed operations area, and noise levels that could cause auditory injury would be avoided. Noise associated with proposed vessel operations may cause behavioral (disturbance) effects to sperm whales. Observations of sperm whales near offshore oil and gas operations suggest an inconsistent response to anthropogenic marine noise (Jochens et al., 2008). Most observations of behavioral responses of marine mammals to anthropogenic noises, in general, have been limited to short-term behavioral responses, which included the cessation of feeding, resting, or social interactions (NMFS, 2015b). Animals can determine the direction from which a noise arrives based on cues, such as differences in arrival times, noise levels, and phases at the two ears. Thus, an animal's directional hearing capabilities have a bearing on its ability to avoid sound sources (National Research Council, 2003b).

NMFS (2018a) presents criteria that are used to determine physiological (i.e., auditory injury) thresholds for marine mammals. For mid-frequency cetaceans exposed to a non-impulsive source (such as MODU operations), permanent threshold shifts are estimated to occur when the mammal has received a sound exposure level over 24-hours (SEL_{24h}) of 198 dB re 1 μPa^2 s (NMFS, 2018a). Similarly, temporary threshold shifts are estimated to occur when the mammal has received an SEL_{24h} of 178 dB re 1 μPa^2 s. Due to the short propagation distance of above-threshold SEL_{24h}, the transient nature of sperm whales, and the stationary nature of the proposed activites, it is not expected that any sperm whales will receive exposure levels necessary for the onset of auditory threshold shifts.

Behavioral disturbance thresholds have not been updated in the most recent acoustic guidance (NMFS, 2018a) and therefore, revert to thresholds established and published by NMFS in 70 *Federal Register* (*FR*) 1871. Behavioral disturbance thresholds for marine mammals are applied equally across all functional hearing groups. Received SPL of 120 dB re 1 µPa from a non-impulsive, continuous source is considered high enough to elicit a behavioral reaction in some marine mammal species. The 120-dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. However, in the case of behavioral responses, received levels alone do not indicate a behavioral response and, more importantly, do not equate to biologically important responses (Ellison et al., 2012; Southall et al., 2016, 2021).

The MODU and installation vessel will be located within a deepwater, open ocean environment. Sounds generated by drilling operations will be generally non-impulsive and continuous, with some variability in noise level. This analysis assumes that the non-impulsive, continuous nature of noise produced by the MODU will provide individual whales with cues relative to the direction and relative distance (sound intensity) of the noise source, and the fixed position of the MODU will allow for active avoidance of potential physical impacts. Drilling-related noise will contribute to increases in the ambient noise environment of the Gulf of Mexico, but it is not expected to be in amplitudes sufficient enough to cause hearing effects to sperm whales. Vessel lighting and presence are not identified as an IPF for sperm whales (NMFS, 2007, 2015a, 2020b; BOEM, 2016c, 2017a, 2023).

Impacts of Support Vessel and Helicopter Traffic

NMFS has found that support vessel traffic has the potential to disturb sperm whales and creates a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (NMFS, 2010). To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. This NTL was reissued in June 2020 to address instances where guidance in the 2020 NMFS Biological Opinion was updated (NMFS, 2020a). In addition, when sperm whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 328 ft (100 m) or greater whenever possible (NTL BOEM 2016-G01 and NMFS, 2020a). Vessel operators are required to reduce vessel speed to 10 knots or less, as safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel (NTL BOEM-2016-G01). When sperm whales are sighted while a vessel is underway, the vessel should take action (e.g., attempt to remain parallel to the whale's course, avoid excessive speed or abrupt changes in direction until the whale has left the area) as necessary to avoid violating the relevant separation distance. However, if the sperm whale is sighted within this distance, the vessel should reduce speed and shift the engine to neutral and not re-engage until the whale is outside of the separation area. This does not apply to any vessel towing gear (NMFS [2020a] Appendix C). Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sperm whales.

NMFS (2020a) analyzed the potential for vessel strikes and harassment of sperm whales in its Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico. NMFS concluded that the observed avoidance of passing vessels by sperm whales is an advantageous response to avoid a potential threat and is not expected to result in any significant effect on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the level of the population. With the implementation of the NMFS vessel strike protocols listed in Appendix C of NMFS (2020a) in addition to the NTL BOEM-2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced during daylight hours. During nighttime and during periods of poor visibility, it is assumed that vessel noise and sperm whale avoidance of moving vessels would reduce the chance of vessel strikes with this species. It is, however, likely that a collision between a sperm whale and a moving support vessel would result in severe injury or mortality of the stricken animal. The current Potential Biological Removal (PBR) level for the Gulf of Mexico stock of sperm whales is 2.0 (Hayes et al., 2022). The PBR level is defined by the MMPA as the maximum number of animals, not including natural mortalities, that may be removed from a marine mammal stock while allowing that stock to reach or maintain its optimum sustainable population. Based on its Endangered status, mortality of a single sperm whale would constitute a significant impact to the local (Gulf of Mexico) population of sperm whales but would not likely be significant at the species level.

Helicopter traffic also has the potential to disturb sperm whales. Smultea et al. (2008) documented responses of sperm whales offshore Hawaii to fixed wing aircraft flying at an altitude of 804 ft (245 m). A reaction to the initial pass of the aircraft was observed during 3 of

24 sightings (12%). All three reactions consisted of a hasty dive and occurred at less than 1,180 ft (360 m) lateral distance from the aircraft. Additional reactions were seen when aircraft circled certain whales to make further observations. Based on other studies of cetacean responses to noise, the authors concluded that the observed reactions to brief overflights by the aircraft were short term and limited to behavioral disturbances (Smultea et al., 2008).

Helicopters maintain altitudes above 700 ft (213 m) during transit to and from the offshore working area. If a whale is seen during transit, the helicopter will not approach or circle the animal(s). In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 328 ft (100 m) of marine mammals (BOEM, 2016a, 2017a; NMFS, 2020a, 2021). Although whales may respond to helicopters (Smultea et al., 2008), NMFS (2020a, 2021) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals including sperm whales are discussed by NMFS (2020a) and BOEM (2012a, 2015, 2016b, 2017a, 2023). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the Marine Mammal Commission (MMC) (2011). For the EIA, there are no unique site-specific issues with respect to spill impacts on sperm whales that were not analyzed in the previous documents.

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on sperm whales. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill as well as the mobility of sperm whales, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals including sperm whales are discussed by BOEM (2012a, 2015, 2016b, 2017a, 2023) and NMFS (2020a). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011). For the EIA, there are no unique site-specific issues with respect to spill impacts on sperm whales.

Impacts of oil spills on sperm whales can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, dispersants) (MMC, 2011). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes;

ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. The level of impact of oil exposure depends on the amount, frequency, and duration of exposure; route of exposure; and type or condition of petroleum compounds or chemical dispersants (Waring et al., 2016). Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, changing prey availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011). Ackleh et al. (2012) hypothesized that sperm whales may have temporarily relocated away from the vicinity of the *Deepwater Horizon* incident in 2010. However, based on aerial surveys conducted in the aftermath of the spill, visibly oiled cetaceans (including several sperm whales) were identified within the footprint of the oil slick (Dias et al., 2017).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb sperm whales and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (see **Table 1**) to reduce the potential for striking or disturbing these animals.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting sperm whales, it is expected that impacts resulting in the injury or death of individual sperm whales would be adverse. Based on the current PBR level for the Gulf of Mexico stock of sperm whales (2.0), mortality of a single sperm whale would constitute a significant impact to the local (Gulf of Mexico) population of sperm whales but would not be significant at species level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.2 Rice's Whale (Endangered)

A recent study by Rosel et al. (2021), identified the genetically distinct Northern Gulf of Mexico Bryde's whale stock as a new species of baleen whale named the Rice's whale through DNA analysis. The reclassification was approved by NMFS under 86 *FR* 47022 and became effective October 22, 2021. The designated Rice's whale distribution area as presented by NMFS is presented in **Figure 1** for reference and is approximately 306 miles (492 km) from the project area. Under 88 FR 47453, has proposed critical habitats be established for this species.

The Rice's whale is the only year-round resident baleen whale in the northern Gulf of Mexico with the population estimated to be fewer than 100 individuals (NOAA Fisheries, 2022a). NOAA, in partnership with Scripps Institution of Oceanography and Florida International University, created the Gulf of Mexico Rice's Whale Trophic Ecology Project to develop a comprehensive ecological understanding of the newly identified species (NOAA Fisheries, 2022a). The group is working on building a photo-identification catalog, conducting animal telemetry, biological sampling, and understanding their prey/distribution. Through animal telemetry, they have identified that Rice's whales make foraging dives during the day near the seafloor.

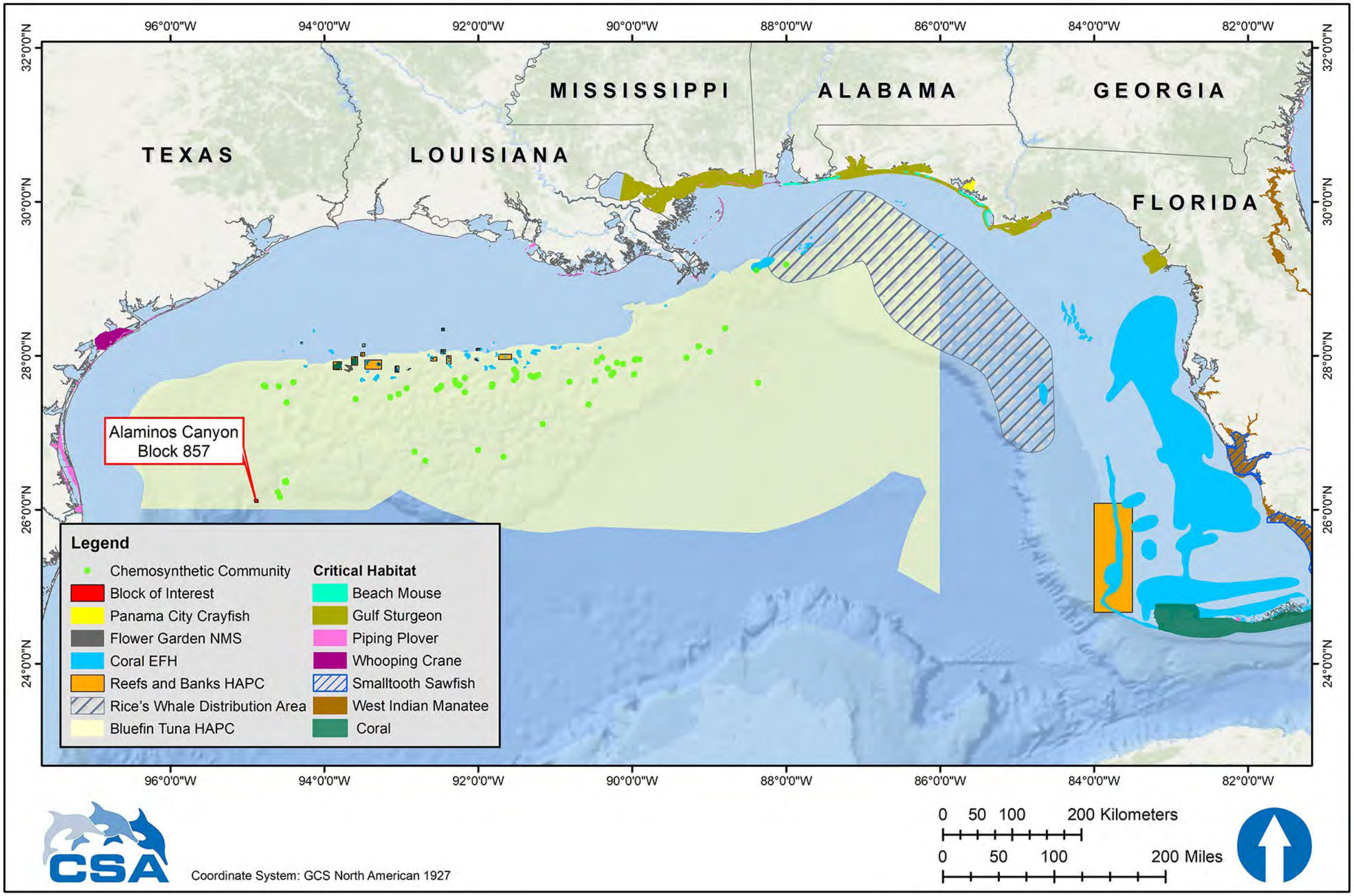


Figure 1. Location of selected environmental features in relation to the project area. EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern; NMS = National Marine Sanctuary.

The Rice's whale is sighted most frequently in the waters over DeSoto Canyon between the 328- and 3,280-ft (100- and 1,000-m) isobaths (Rosel et al., 2016; Hayes et al., 2021). Most sightings have been made in the DeSoto Canyon region and off western Florida, although there have been some in the west-central portion of the northeastern Gulf of Mexico. Soldevilla et al. (2022) identified new variants of long-moan calls along the northwestern Gulf of Mexico shelf break that were determined to share distinctive features with typical eastern Gulf of Mexico long-moan calls. A genetically confirmed sighting of a Rice's whale individual offshore Corpus Christi, Texas in 2017, along with the newly identified long-moan calls in the northwestern Gulf of Mexico indicate that Rice's whales may occur in a broader range in the Gulf of Mexico than previously known. Additionally, Kiska et al. (2023) studied the drivers of resource selection by Rice's whales in relation to prey availability and energy density. The study indicated that Rice's whales are selective predators consuming schooling prey with the highest energy content (i.e., silver rag [*Ariomma bondi*]). The silver rag is found at a depth range of 82 to 2,100 ft (25 to 640 m) primarily over muddy bottoms on the OCS though juveniles can be within the surficial waters (Smithsonian Tropical Research Institute, 2015). Support vessels transiting through the 82 to 2,100 ft (25 to 640 m) water depths are unlikely to encounter a Rice's whale, given the rate of sightings of the whales.

In 2014, a petition was submitted to designate the northern Gulf of Mexico population of the Bryde's whale as a DPS and list it as Endangered under the ESA (Natural Resources Defense Council, 2014). This petition received a 90-day positive finding by NMFS in 2015 and a proposed rule to list was published in 2016 (Hayes et al., 2019). On April 15, 2019, NMFS issued a final rule to list the Gulf of Mexico DPS of Bryde's whale as Endangered under the ESA. The NMFS final rule on the reclassification (86 *FR* 47022) does not affect the ESA standing; thus, the Rice's whale is listed as an Endangered species.

IPFs that could affect the Rice's whales include vessel presence, noise, and lights; support vessel and helicopter traffic; and both types of spill accidents: a small fuel spill and a large oil spill. Effluent discharges are likely to have negligible impacts on Rice's whales due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility and low abundance of Rice's whales in the Gulf of Mexico.

Though NMFS (2020a) stated marine debris as an IPF, compliance with BSEE NTL 2015-G03 and NMFS (2020a) Appendix B will minimize the potential for marine debris-related impacts on Rice's whales. NMFS (2020a) estimated one sublethal take and no lethal takes of Rice's whale (Bryde's whales at the time of publication) from marine debris over 50 years of proposed action. Therefore, marine debris is likely to have negligible impacts on Rice's whales and is not further discussed (See **Table 2**).

Impacts of Vessel Presence (including noise and lights)

Some noise produced by the MODU and/or installation vessel may be emitted at levels that could potentially disturb individual whales or mask the sounds animals would normally produce or hear. Noise associated with drilling is relatively weak in intensity, and an individual animal's sound exposure would be transient. As discussed in **Section A.1**, an actively drilling MODU can produce noise with a maximum broadband (10 Hz to 10 kHz) source level of approximately 177 to 190 dB re 1 µPa m expressed as SPL (Hildebrand, 2005).

NMFS (2018a) lists Rice's whales (Bryde's whales at the time of publication) in the functional hearing group of low-frequency cetaceans (baleen whales), with an estimated hearing sensitivity from 7 Hz to 35 kHz. Therefore, vessel-related noise is likely to be heard by Rice's whales.

It is expected that, due to the relatively stationary nature of the MODU and installation vessel operations, Rice's whales would move away from the proposed operations area, and sound levels that could cause auditory injury would be avoided. Noise associated with proposed vessel operations may cause behavioral (disturbance) effects to individual Rice's whales. NMFS (2018a) presents criteria that are used to determine physiological (i.e., auditory injury) thresholds for marine mammals. For low-frequency cetaceans, specifically the Rice's whale, permanent and temporary threshold shift onset from non-impulsive sources is estimated to occur at SEL_{24h} of 199 dB re 1 μPa^2 s and 179 re 1 μPa^2 s, respectively. MODU operations and DP thrusters are not expected to reach permanent or temporary theshold shift values, and due to the short propagation distance of above-threshold SEL_{24h} and the stationary nature of the proposed activites, it is not expected that any Rice's whales will receive exposure levels necessary for the onset of auditory threshold shifts.

Behavioral disturbance thresholds have not been updated in the most recent acoustic guidance (NMFS, 2018a) and therefore, revert to thresholds established and published by NMFS in 70 *FR* 1871. Received SPL of 120 dB re 1 μPa from a non-impulsive, continuous source is considered high enough to elicit a behavioral reaction in some marine mammal species. The 120-dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. However, exposure to a SPL of 120 dB re 1 μPa alone does not equate to a behavioral response or a biological consequence; rather it represents the level at which onset of a behavioral response may occur (Ellison et al., 2012; Southall et al., 2016, 2021).

The MODU and installation vessel will be located within a deepwater, open ocean environment. This analysis assumes that the non-impulsive, continuous nature of noise produced by the MODU will provide individual whales with cues relative to the direction and relative distance (sound intensity) of the noise source, and the fixed position of the MODU and installation vessel will allow for active avoidance of potential physical impacts. Drilling-related noise will contribute to increases in the ambient noise environment of the Gulf of Mexico, but it is not expected to be in amplitudes sufficient enough to cause hearing effects to Rice's whales and due to the low density of Rice's whales in the Gulf of Mexico, no significant impacts are expected.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb Rice's whales and creates a potential for vessel strikes. To reduce the potential for vessel strikes, BOEM has issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. When whales are sighted, vessel operators and crews are required to attempt to maintain a distance of 1,640 ft (500 m) or greater whenever possible (NTL BOEM-2016-G01; NMFS, 2020a). Vessel operators are required to reduce vessel speed to 10 knots or less, as safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel (NTL BOEM-2016-G01). When a Rice's whale is sighted while a vessel is underway, the vessel should take action (e.g., attempt to remain parallel to the whale's course, avoid excessive speed or abrupt changes in direction until the whale has left the area) as necessary to avoid violating the relevant separation distance. However, if the whale is sighted within this distance, the vessel should reduce speed and shift the engine to neutral and not re-engage until the whale is outside of the separation area. This does not apply to any vessel towing gear (NMFS [2020a] Appendix C).

Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing Rice's whales. The current PBR level for the Gulf of Mexico stock of Rice's whale is 0.1 (Hayes et al., 2021). Mortality of a single Rice's whale would constitute a significant impact to the local (Gulf of Mexico) stock of Rice's whales. However, it is very unlikely that Rice's whales occur within the project area, including the transit corridor for support vessels; consequently, the probability of a vessel collision with this species is extremely low. Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing Rice's whales.

Helicopter traffic also has the potential to disturb Rice's whales. Based on studies of cetacean responses to noise, the observed reactions to brief overflights by aircraft were short term and limited to behavioral disturbances (Smultea et al., 2008). Helicopters maintain altitudes above 700 ft (213 m) during transit to and from the offshore working area. In the event that a whale is seen during transit, the helicopter will not approach or circle the animal(s). In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 328 ft (100 m) of marine mammals (BOEM, 2016a, 2017a; NMFS, 2020a, 2021). Due to the brief potential for disturbance the low density of Rice's whales thought to reside in the Gulf of Mexico, no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals are discussed by NMFS (2020a) and BOEM (2012a, 2015, 2016b, 2017a). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011). The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on Rice's whales. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time of the spill as well as the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill as well as the mobility of Rice's whales and the unlikelihood of Rice's whales in the project area, no significant impacts are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals are discussed by BOEM (2012a, 2015, 2016b, 2017a, 2023), and NMFS (2020a). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990) and by the MMC (2011).

Potential impacts of a large oil spill on Rice's whales could include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, dispersants) (MMC, 2011). Direct physical and physiological effects could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. The level of impact of oil exposure depends on the amount, frequency, and duration of exposure; route of exposure; and type or condition of petroleum compounds or chemical dispersants (Hayes et al., 2019). Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, changing prey availability and foraging distribution and/or patterns, changing reproductive behavior/ productivity, and changing movement patterns or migration (MMC, 2011).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb Rice's whales and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (see **Table 1**) to reduce the potential for striking or disturbing these animals.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting Rice's whales, it is expected that impacts resulting in the injury or death of individual Rice's whales would be significant based on the current PBR level for the Gulf of Mexico subspecies and stock (0.1) (Hayes et al., 2022). Mortality of a single Rice's whale would constitute a significant population- and species-level impact. The core distribution area for Rice's whales is within the eastern Gulf of Mexico OCS Planning Area; therefore, it is unlikely that Rice's whales occur within the project area and surrounding waters. Consequently, the probability of spilled oil from a project-related well blowout reaching Rice's whales is extremely low.

C.3.3 West Indian Manatee (Threatened)

Most of the Gulf of Mexico West Indian manatee population is located in peninsular Florida (USFWS, 2001a). Critical habitat has been designated in southwest Florida in Manatee, Sarasota, Charlotte, Lee, Collier, and Monroe counties. Manatees regularly migrate farther west of Florida in the warmer months into Alabama and Louisiana coastal habitats (Wilson, 2003), with some individuals traveling as far west as Texas (Fertl et al., 2005). There have been three verified reports of Florida manatee sightings on the OCS during seismic surveys in mean water depths of over 1,969 ft (600 m) (Barkaszi and Kelly, 2019). One of these sightings resulted in a shutdown of airgun operations. A species description is presented in the recovery plan for this species (USFWS, 2001a).

IPFs that could potentially affect manatees include support vessel and helicopter traffic and a large oil spill. A small fuel spill in the project area would be unlikely to affect manatees because the project area is approximately 141 miles (227 km) from the nearest shoreline (Texas). As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to dissipating. Compliance with NTL BSEE 2015-G013 (see **Table 1**) will minimize the potential for marine debris-related impacts on manatees. In certain cases, guidance in Appendix A of NMFS (2020a) replaces guidance in the NTL per the June 2020 reissued BSEE-NTL-2015-G03. Consistent with the analysis by BOEM (2016a), impacts of routine project-related activities on the manatee would be negligible.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic associated with routine operations has the potential to disturb manatees, and there is also a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (USFWS, 2001a). Manatees are expected to be limited to inner shelf and coastal waters, and impacts are expected to be limited to transits of these vessels and helicopters through these waters. To reduce the potential for vessel strikes, BOEM has issued NTL BOEM-2016-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. Vessel strike avoidance measures described in NMFS (2021) stating for marine mammals and other aquatic protected species includes manatees. Specifically, all vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m (164 ft) from all "other aquatic protected species" including sea turtles, with an exception made for those animals that approach the vessel.

Compliance with NTL BOEM-2016-G01 will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected. The current PBR level for the Florida subspecies of Antillean manatee is 14 (USFWS, 2014). In the event of a vessel strike during support vessel transits, the mortality of a single manatee would constitute an adverse but insignificant impact to the subspecies.

Depending on flight altitude, helicopter traffic also has the potential to disturb manatees. Rathbun (1988) reported that manatees were disturbed more by helicopters than by fixed-wing aircraft; however, the helicopter was flown at relatively low altitudes of 66 to 525 ft (20 to 160 m). Helicopters used in support operations maintain a minimum altitude of 700 ft (213 m) while in transit offshore, 1,000 ft (305 m) over unpopulated areas or across coastlines, and 2,000 ft (610 m) over populated areas and sensitive habitats such as wildlife refuges and park properties. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 328 ft (100 m) of marine mammals (BOEM, 2012a,b; NMFS, 2020a). This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

Impacts of a Large Oil Spill

Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, Matagorda County, Texas is the coastal area most likely to be affected (1% probability within 10 days and 10% probability within 30 days). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted. There is no manatee critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population in peninsular Florida.

In the event that manatees were exposed to oil, effects could include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, dispersants) (MMC, 2011). Direct physical and physiological effects can include asphyxiation, acute poisoning, lowering of tolerance to other stress, nutritional stress, and inflammation infection (BOEM, 2017a). Indirect impacts include stress from the activities and noise of response vessels and aircraft (BOEM, 2017a). Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, changing prey availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011).

In the event that a large spill reached coastal waters where manatees were present, the level of vessel and aircraft activity associated with spill response could disturb manatees and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 (see **Table 1**) to reduce the potential for striking or disturbing these animals.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill enters areas inhabited by manatees, it is expected that impacts resulting in the injury or death of individual manatees could be significant at the population level. The current PBR level for the Florida subspecies of Antillean manatee is 14 (USFWS, 2014). It is not anticipated that groups of manatees would occur in coastal waters of the north central Gulf of Mexico; therefore, in the event of mortality of individual manatees from a large oil spill would constitute an adverse but insignificant impact at the population level to the subspecies. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.4 Non-Endangered Marine Mammals (Protected)

All marine mammal species are protected under the MMPA. In addition to the three Endangered species of marine mammals that were cited in **Sections C.3.1** to **C.3.3**, 20 additional species of marine mammals may be found in the Gulf of Mexico. These include the dwarf and pygmy sperm whales (*Kogia sima* and *K. breviceps*, respectively), four species of beaked whales, and 14 species of delphinid whales and dolphins (see DOCD Section 6h). The minke whale (*Balaenoptera acutorostrata*) is considered rare in the Gulf of Mexico, and is therefore not considered further in the EIA (BOEM, 2012a). The most common non-endangered cetaceans in the deepwater environment are odontocetes (toothed whales and dolphins) such as the pantropical spotted dolphin (*Stenella attenuata*), spinner dolphin (*Stenella longirostris*), and Clymene dolphin (*Stenella clymene*). A brief summary is presented in this section, and additional information on these groups is presented by BOEM (2017a).

<u>Dwarf and pygmy sperm whales</u>. At sea, it is difficult to differentiate dwarf sperm whales from pygmy sperm whales, and sightings are often grouped together as *Kogia* spp. Both species have a worldwide distribution in temperate to tropical waters. In the Gulf of Mexico, both species occur primarily along the continental shelf edge and in deeper waters off the continental shelf (Mullin et al., 1991; Mullin, 2007; Hayes et al., 2019, 2021, 2022). Either species could occur in the project area.

<u>Beaked whales</u>. Four species of beaked whales are known from the Gulf of Mexico. They are Blainville's beaked whale (*Mesoplodon densirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), Gervais' beaked whale (*Mesoplodon europaeus*), and Cuvier's beaked whale (*Ziphius cavirostris*). Stranding records (Würsig et al., 2000) as well as passive acoustic monitoring in the Gulf of Mexico (Hildebrand et al., 2015), suggest that Gervais' beaked whale and Cuvier's beaked whale are the most common species in the region. The Sowerby's beaked whale is considered extralimital, with one documented stranding reported in the Gulf of Mexico by Bonde and O'Shea (1989). There are a number of extralimital strandings and sightings reported beyond the recognized range of Sowerby's beaked whale (e.g., Canary Islands, Mediterranean Sea), including from the eastern Gulf of Mexico (Pitman and Brownell, 2020). Blainville's beaked whales are rare, with only four documented strandings in the northern Gulf of Mexico (Würsig et al., 2000) and three sightings in the Gulf of Mexico (Hayes et al., 2021).

Due to the difficulties of at-sea identification, beaked whales in the Gulf of Mexico are identified either as Cuvier's beaked whales (*Ziphius* spp.) or grouped into an undifferentiated species complex (*Mesoplodon* spp.). In the northern Gulf of Mexico, they are broadly distributed in waters greater than 3,281 ft (1,000 m) over lower slope and abyssal landscapes (Davis et al., 2000). Any of these species could occur in the project area (Hayes et al., 2022).

<u>Delphinids</u>. Fourteen species of delphinids are known to occur in the Gulf of Mexico: Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (*Tursiops truncatus*), Clymene dolphin, killer whale (*Orcinus orca*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), melon-headed whale (*Peponocephala electra*), pantropical spotted dolphin, pygmy killer whale (*Feresa attenuata*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), spinner dolphin, and striped dolphin (*Stenella coeruleoalba*). The most common non-endangered cetaceans in the deepwater environment of the northern Gulf of Mexico are the pantropical spotted dolphin, spinner dolphin, and rough-toothed dolphin. Any of these delphinid species could occur in the project area (Waring et al., 2016; Hayes et al., 2022).

The bottlenose dolphin is a common inhabitant of the northern Gulf of Mexico, particularly within continental shelf waters. There are two ecotypes of bottlenose dolphins, a coastal form and an offshore form, which are genetically isolated from each other (Waring et al., 2016). The offshore form of the bottlenose dolphin inhabits waters seaward from the 200-m isobath and may occur within the project area. Inshore populations of coastal bottlenose dolphins in the northern Gulf of Mexico are separated by the NMFS into 31 geographically distinct population units, or stocks, for management purposes (Hayes et al., 2022).

Bottlenose dolphins in the northern Gulf of Mexico are categorized into three stocks by NMFS (2016): Bay, Sound, and Estuary; Continental Shelf; and Coastal and Oceanic. The Bay, Sound, and Estuary Stock is considered to be a strategic stock. The strategic stock designation in this case was based primarily on the occurrence of an "unusual mortality event" of unprecedented size and duration (from April 2010 through July 2014) (NOAA, 2016b) that affected these stocks. Carmichael et al. (2012) hypothesized that the unusual number of bottlenose dolphin strandings in the northern Gulf of Mexico during this time may have been associated with environmental perturbations, including sustained cold weather and the *Deepwater Horizon* incident in 2010 as well as large volumes of cold freshwater discharge in the early months of 2011. Carmichael et al. (2012) and Schwacke et al. (2014a) reported that one year after the *Deepwater Horizon* incident, many dolphins in Barataria Bay, Louisiana, showed evidence of disease conditions associated with petroleum exposure and toxicity. Venn-Watson et al. (2015) performed histological studies to examine contributing factors and causes of deaths for stranded common bottlenose dolphins from Louisiana, Mississippi, and Alabama and found that the dead dolphins from the "unusual mortality event" were more likely than those from other areas to have primary bacterial pneumonia and thin adrenal cortices. The adrenal gland and lung diseases were consistent with exposure to petroleum compounds, and the exposure to petroleum compounds during and after the *Deepwater Horizon* incident are proposed as a cause.

IPFs that could potentially affect non-endangered marine mammals include vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on marine mammals due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of marine mammals. Compliance with NTL BSEE 2015-G013 (see **Table 1**) will minimize the potential for marine debris-related impacts on marine mammals.

Impacts of Vessel Presence (including noise and lights)

Noise from routine drilling activities has the potential to disturb marine mammals. Most odontocetes use higher frequency sounds than those produced by OCS drilling activities (Richardson et al., 1995). Three functional hearing groups are represented in the 20 non-endangered cetaceans found in the Gulf of Mexico (NMFS, 2018a). Eighteen of the 19 odontocete species are considered to be in the mid-frequency functional hearing group and two species (dwarf and pygmy sperm whales) are in the high-frequency functional hearing group (NMFS, 2018a). Thruster noise will affect each group differently depending on the frequency bandwiths produced by operations.

For mid-frequency cetaceans exposed to a non-impulsive source (like drilling operations), permanent threshold shifts are estimated to occur when the mammal has received an SEL_{24h} of 198 dB re 1 μPa^2 s. Simlarly, temporary threshold shifts are estimated to occur when the mammal has received an SEL_{24h} of 178 dB re 1 μPa^2 s. Due to the short propagation distance of above-threshold SEL_{24h}, the transient nature of marine mammals and the stationary nature of the proposed activites, it is not expected that any marine mammals will receive exposure levels necessary for the onset of auditory threshold shifts. NMFS (2018a) presents criteria that are used to determine physiological (i.e., auditory injury) thresholds for marine mammals. Behavioral disturbance thresholds have not been updated in the most recent acoustic guidance (NMFS, 2018a) and therefore, revert to thresholds established and published by NMFS in 70 *FR* 1871. Received SPL of 120 dB re 1 µPa from a non-impulsive, continuous source is considered high enough to elicit a behavioral reaction in some marine mammal species. The 120-dB isopleth may extend tens to hundreds of kilometers from the source depending on the propagation environment. However, in the case of behavioral responses, received levels alone do not indicate a behavioral response and, more importantly, do not equate to biologically important responses (Ellison et al., 2012; Southall et al., 2016, 2021).

BOEM (2012a) stated the source level from oil and gas production platforms are low with a frequency range of 50 to 500 Hz. The operation of the MODU and installation vessel would represent an incremental contribution of noise to the ambient levels. It is expected that marine mammals within or near the project area would be able to detect the presence of the MODU and installation vessel to avoid exposure to higher energy noise, particularly within an open ocean environment.

Some odontocetes have shown increased feeding activity around lighted platforms at night (Todd et al., 2009). Even the temporary presence of the vessels present an attraction to pelagic food sources that may attract cetaceans (and sea turtles). Therefore, prey congregation could pose an attraction to protected species that would expose them to higher levels or longer durations of noise that might otherwise be avoided.

There are other OCS facilities and activities near the project area, and the region as a whole has a large number of similar sources. Due to the limited scope, timing, and geographic extent of drilling activities, this project would represent a small temporary contribution to the overall noise regime, and any short-term impacts are not expected to be biologically significant to marine mammal populations.

Vessel lighting and presence are not identified as an IPF for marine mammals by BOEM (2016b, 2017a). Therefore, no significant impacts are expected from this IPF.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb marine mammals, and there is also a risk of vessel strikes. Data concerning the frequency of vessel strikes are presented by BOEM (2017a). To reduce the potential for vessel strikes, BOEM has issued NTL BOEM-2016-G01 (see **Table 1**), which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. Vessel operators and crews are required to attempt to maintain a distance of 300 ft (91 m) or greater from whales and 148 ft (45 m) or greater from small cetaceans and sea turtles (NTL BOEM-2016-G01). When cetaceans are sighted while a vessel is underway, vessels must attempt to remain parallel to the animal's course and avoid excessive speed or abrupt changes in direction until the cetacean has left the area. Vessel operators are required to reduce vessel speed to 10 knots or less when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel, when safety permits. Although vessel strike avoidance measures described in NMFS (2020a) are only applicable to ESA-listed species, an amendment was issued April 2021 (NMFS, 2021) stating measures for marine mammals and other aquatic protected species. Specifically, all vessels must, to the maximum extent practicable, attempt to maintain a minimum separation distance of 50 m (164 ft) from all "other aquatic protected species" including sea turtles, with an exception made for those animals that approach the vessel. Use of these measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing marine mammals, and therefore no significant impacts are expected.

The current PBR levels for several non-endangered cetacean species in the Gulf of Mexico are less than three individuals (e.g., rough-toothed dolphin = undetermined, Clymene dolphin = 2.5, Fraser's dolphin = 1.0, killer whale = 1.5, pygmy and false killer whale = 2.8, dwarf and pygmy sperm whales = 2.5) (Hayes et al., 2022). Mortality of individuals equal to or in excess of their PBR level would constitute a significant impact at a population level to the local (Gulf of Mexico) stocks of these species.

Helicopter traffic also has the potential to disturb marine mammals (Würsig et al., 1998). However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. In addition, guidelines and regulations issued by NMFS under the authority of the MMPA specify that helicopters maintain an altitude of 1,000 ft (305 m) within 328 ft (100 m) of marine mammals (BOEM, 2017a; NMFS, 2020a, 2021). Maintaining this altitude will minimize the potential for disturbing marine mammals, and no significant impacts are expected.

Impacts of a Small Fuel Spill

Potential spill impacts on marine mammals are discussed by BOEM (2016b, 2017a, 2023), and oil impacts on marine mammals in general are discussed by Geraci and St. Aubin (1990). For the EIA, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a fuel spill will be minimized by Shell's preventative measures, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on marine mammals. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the duration of a small spill, the opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small fuel spill and indicates that over 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). However, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, as well as the mobility of marine mammals, no significant impacts would be expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine mammals are discussed by BOEM (2016b, 2017a, 2023). For the EIA, there are no unique site-specific issues.

Impacts of oil spills on marine mammals can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, dispersants) (MMC, 2011). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil (and dispersants) directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems (DeGuise et al., 2017), physiological stress, declining physical condition, and death. Kellar et al. (2017) estimated reproductive success rates for two northern Gulf of Mexico stocks affected by oil were less than a third (19.4%) of those previously reported in other areas (64.7%) not impacted. Behavioral responses can include displacement of animals from prime habitat (McDonald et al., 2017a); disruption of social structure; changing prey availability and foraging distribution and/or patterns; changing reproductive behavior/productivity; and changing movement patterns or migration (MMC, 2011).

Data from the *Deepwater Horizon* incident, as analyzed and summarized by NOAA (2016a) indicate the scope of potential impacts from a large spill. Tens of thousands of marine mammals were exposed to oil, where they likely inhaled, aspirated, ingested, physically contacted, and absorbed oil components (NOAA, 2016a; Takeshita et al., 2017). Nearly all marine mammal stocks in the northern Gulf of Mexico were affected. The oil's physical, chemical, and toxic effects damaged tissues and organs, leading to a constellation of adverse health effects, including reproductive failure, adrenal disease, lung disease, and poor body condition (NOAA, 2016a). According to the National Wildlife Federation (2016a), nearly all of the 20 species of non-endangered dolphins and whales that live in the northern Gulf of Mexico had demonstrable, quantifiable injuries. Because of known low detection rates of carcasses (Williams et al., 2011), it is possible that the number of marine mammal deaths was underestimated. Also, necropsies to confirm the cause of death could not be conducted for many of these marine mammals, therefore some cause of deaths reported as unknown were likely attributable to oil interaction. Schwacke et al. (2014b) reported that 1 year after the spill, many dolphins in Barataria Bay, Louisiana, showed evidence of disease conditions associated with petroleum exposure and toxicity. Lane et al. (2015) noted a decline in pregnancy success rate among dolphins in the same region. BOEM (2012a) concluded that potential effects from a large spill could potentially contribute to more significant and longer-lasting impacts including mortality and longer-lasting chronic or sublethal effects than a small, but severe accidental spill.

In the event of a large spill, response activities that may impact marine mammals include increased vessel traffic, use of dispersants, and remediation activities (e.g., controlled burns, skimmers, boom) (BOEM, 2017a). The increased level of vessel and aircraft activity associated with spill response could disturb marine mammals, potentially resulting in behavioral changes. The large number of response vessels could result in vessel strikes, entanglement or other injury, or stress. Response vessels would operate in accordance with NTL BOEM-2016-G01 to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill, it is expected that impacts resulting in the injury or death of individual marine mammals could be significant at the population level depending on the level of oiling and the species affected. Based on the current PBR level for several non-endangered cetacean species in the Gulf of Mexico that are less than 3 individuals (e.g., rough-toothed dolphin = undetermined, Clymene dolphin = 2.5, Fraser's dolphin = 1.0, killer whale = 1.5, pygmy and false killer whale = 2.8, dwarf and pygmy sperm whales = 2.5) (Hayes et al., 2022), mortality of individuals equal to or in excess of their PBR level would constitute a significant impact at the population level to the local (Gulf of Mexico) stocks of these species. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.5 Sea Turtles (Endangered/Threatened)

As listed in DOCD Section 6h, five species of Endangered or Threatened sea turtles may be found near the project area. Endangered species are the leatherback, Kemp's ridley, and hawksbill turtles. As of May 6, 2016, the entire North Atlantic DPS of the green turtle is listed as Threatened (81 *FR* 20057). The DPS of loggerhead turtle that occurs in the Gulf of Mexico is listed as Threatened, although other DPSs are Endangered. Of the sea turtle species that may be found in the project area, only the Kemp's ridley relies on the Gulf of Mexico as its sole breeding ground. Species descriptions are presented by BOEM (2017a).

Critical habitat has been designated for the loggerhead turtle in the Gulf of Mexico as shown in **Figure 2**. Critical habitat in the northern Gulf of Mexico includes nesting beaches in Mississippi, Alabama, and the Florida Panhandle; nearshore reproductive habitat seaward from these beaches; and a large area of *Sargassum* habitat. The nearest designated nearshore reproductive critical habitat for loggerhead sea turtles is approximately 465 miles (748 km) from the project area.

Loggerhead turtles in the Gulf of Mexico are part of the Northwest Atlantic Ocean DPS (NMFS, 2014a). In July 2014, NMFS and the USFWS designated critical habitat for this DPS. The USFWS designation (79 *FR* 39756) includes nesting beaches in Jackson County, Mississippi; Baldwin County, Alabama; and Bay, Gulf, and Franklin Counties in the Florida Panhandle as well as several counties in southwest Florida and the Florida Keys (and other areas along the Atlantic coast). The NMFS designation (79 *FR* 39856) includes nearshore reproductive habitat within 1 mile (1.6 km) seaward of the mean high-water line along these same nesting beaches. NMFS also designated a large area of shelf and oceanic waters, termed *Sargassum* habitat, in the Gulf of Mexico (and Atlantic Ocean) as critical habitat. *Sargassum* is a genus of brown alga (Class Phaeophyceae) that has a epipelagic existence. Rafts of *Sargassum* spp. serve as important foraging and developmental habitat for numerous fishes, and young sea turtles, including loggerhead, green, hawksbill, and Kemp ridley's turtles. NMFS also designated three other categories of critical habitat: of these, two (migratory habitat and overwintering habitat) are along the Atlantic coast, and the third (breeding habitat) is found in the Florida Keys and along the Florida east coast (NMFS, 2014a).

Leatherbacks and loggerheads are the species most likely to be present near the project area as adults. Green, hawksbill, and Kemp's ridley turtles are typically inner-shelf and nearshore species, unlikely to occur near the project area as adults. Female Kemp's ridley turtles may be found in the project area as they transit to and from nesting beaches. Hatchlings or juveniles of any of the sea turtle species may be present in deepwater areas, including the project area, where they may be associated with *Sargassum* spp. and other flotsam.

All five sea turtle species in the Gulf of Mexico are migratory and use different marine habitats according to their life stage. These habitats include high-energy beaches for nesting females and emerging hatchlings and pelagic convergence zones for hatchling and juvenile turtles. As adults, green, hawksbill, Kemp's ridley, and loggerhead turtles forage primarily in shallow benthic habitats. Leatherbacks are the most pelagic of the sea turtles, feeding primarily on jellyfish.

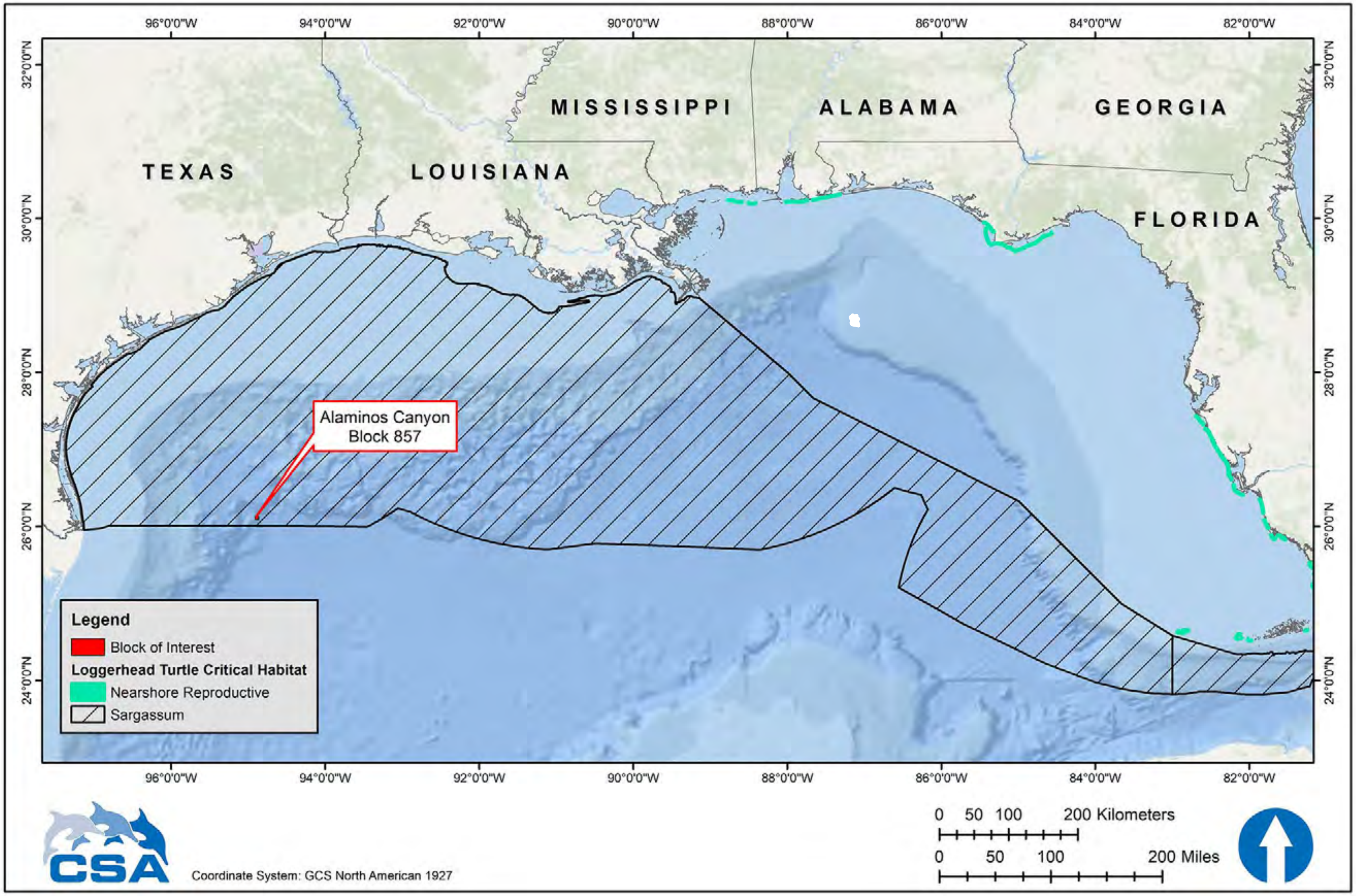


Figure 2. Location of loggerhead turtle critical habitat in the northern Gulf of Mexico in relation to the project area. The critical habitat includes terrestrial habitat (nesting beaches) and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as *Sargassum* habitat.

Sea turtle nesting in the northern Gulf of Mexico can be summarized by species as follows:

- Loggerhead turtles—loggerhead turtles nest in significant numbers along the Florida Panhandle (Florida Fish and Wildlife Conservation Commission, nd-a) and, to a lesser extent, from Texas through Alabama (NMFS and USFWS, 2008);
- Green and leatherback turtles—green and leatherback turtles infrequently nest on Florida Panhandle beaches (Florida Fish and Wildlife Conservation Commission, nd-b,-c);
- Kemp's ridley turtles—the main nesting site is Rancho Nuevo beach in Tamaulipas, Mexico (NMFS et al., 2011). A total of 256 Kemp's ridley turtle nests have been counted on Texas beaches in 2023. A total of 284 Kemp's ridley turtle nests were counted during the 2022 nesting season and a total of 195 Kemp's ridley turtle nests were counted on Texas beaches during the 2021 nesting season (Turtle Island Restoration Network, 2023). Padre Island National Seashore, along the coast of Willacy, Kenedy, and Kleberg Counties in southern Texas, is the most important nesting location for this species in the U.S.; and
- Hawksbill turtles—hawksbill turtles typically do not nest anywhere near the project area, with most nesting in the region located in the Caribbean Sea and on beaches of the Yucatán Peninsula (USFWS, 2016).

IPFs that could potentially affect sea turtles include vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill). Effluent discharges are likely to have negligible impacts on sea turtles due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges.

Though NMFS (2020a) stated marine debris as an IPF, compliance with NTL BSEE 2015-G03 (See **Table 1**) and NMFS (2020a) Appendix B will minimize the potential for marine debris-related impacts on sea turtles. NMFS (2020a) estimated a small proportion of individual sea turtles would be adversely affected from exposure to marine debris. Therefore, marine debris is likely to have negligible impacts on sea turtles and is not further discussed (See **Table 2**).

Impacts of Vessel Presence (including noise and lights)

Offshore activities produce broadband noise at frequencies and intensities that may be detected by sea turtles (Samuel et al., 2005; Popper et al., 2014). Potential impacts could include behavioral disruption and displacement from the area near the noise source. There is scarce information regarding hearing and acoustic thresholds for marine turtles. Sea turtles can hear low- to mid-frequency noise and they appear to hear best between 200 and 750 Hz and do not respond well to noise above 1,000 Hz (Ketten and Bartol, 2005). The currently accepted hearing and response estimates are derived from fish hearing data rather than from marine mammal hearing data in combination with the limited experimental data available (Popper et al., 2014). The NMFS 2020 Biological Opinion (NMFS, 2020a) lists the sea turtle underwater acoustic SEL_{24h} permanent threshold shift and temporary threshold shift thresholds as 204 and 189 dB re 1 μPa^2 s, respectively, and the SPL behavioral threshold as 175 dB re 1 µPa. However, these thresholds were developed for impulsive noise sources based on work by Finneran et al. (2017). Based on the assessment conducted in the NMFS Biological Opinion (NMFS, 2020a), there is a minimal likelihood of acoustic injury such as PTS in sea turtles, and behavioral responses to noise produced by activities such as vessel operations are not expected beyond 33 ft (10 m) from the source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990; Gitschlag et al., 1997; Colman et al., 2020) and thus, may be more susceptible to impacts from noise produced during routine drilling activities. Helicopters and support vessels may also affect sea turtles because of machinery noise or visual disturbances. Any impacts would likely be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Because of the limited scope, these short-term impacts are not expected to be biologically significant to sea turtle populations.

BOEM (2012a) stated the source level from oil and gas production platforms are low with a frequency range of 50 to 500 Hz. The operation of the MODU and installation vessel would represent an incremental contribution of noise to the ambient levels. This noise will be of variable duration and intensity, depending on the type of machinery used.

Artificial lighting can disrupt the nocturnal orientation of sea turtle hatchlings (Tuxbury and Salmon, 2005; Berry et al., 2013; Simões et al., 2017). However, hatchlings may rely less on light cues when they are offshore than when they are emerging on the beach (Salmon and Wyneken, 1990). NMFS (2007) concluded that the effects of lighting from offshore structures on sea turtles are insignificant. Therefore, no significant impacts are expected.

NMFS (2020a) stated sea turtles have the potential to be entangled or entrapped in moon pools, and though many sea turtles could exit the moon pool under their own volition, sublethal effects could occur. Based on the moon pool entrapment cases of sea turtles reported and successful rescues and releases that have occurred, NMFS (2020a) estimated approximately one sea turtle will be sub-lethally entrapped in moon pools every year. Therefore, no significant impacts are expected.

Impacts of Support Vessel and Helicopter Traffic

Support vessel traffic has the potential to disturb sea turtles, and there is also a risk of vessel strikes. Data show that vessel traffic is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al., 1997; NMFS, 2020a, 2021). While adult sea turtles are visible at the surface during the day and in clear weather, they can be difficult to spot from a moving vessel when resting below the water surface, during nighttime, or during periods of inclement weather. To reduce the potential for vessel strikes, BOEM issued NTL BOEM-2016-G01, which recommends protected species identification training, and that vessel operators and crews maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking protected species and requires operators to report sightings of any injured or dead protected species. When sea turtles are sighted, vessel operators and crews are required to attempt to maintain a distance of 164 ft (50 m) or greater whenever possible (NMFS [2020a] Appendix C). Compliance with these mitigation measures will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sea turtles. Therefore, no significant impacts are expected.

Helicopter traffic also has the potential to disturb sea turtles. However, while flying offshore, helicopters maintain altitudes above 700 ft (213 m) during transit to and from the working area. This altitude will minimize the potential for disturbing sea turtles, and no significant impacts are expected (NMFS, 2020a, 2021; BOEM, 2012a).

Impacts of a Small Fuel Spill

Potential spill impacts on sea turtles are discussed by NMFS (2020a) and BOEM (2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts on sea turtles. **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (NMFS, 2020b). As discussed in **Section A.9.1**, more than 90% of a small diesel spill in offshore waters would evaporate or disperse naturally within 24 hours. Therefore, due to the limited areal extent and short duration of water quality impacts from a small fuel spill, no significant impacts to sea turtles from direct or indirect exposure would be expected.

Loggerhead Critical Habitat – Nesting Beaches. A small fuel spill in the project area would be unlikely to affect sea turtle nesting beaches because the project area is 141 miles (227 km) from the nearest shoreline (Texas). Loggerhead turtle nesting beaches and nearshore reproductive habitat designated as critical habitat are located in Mississippi, Alabama, and the Florida Panhandle, at least 465 miles (748 km) from the project area. As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to dissipating.

Loggerhead Critical Habitat – *Sargassum* Habitat. The project area is within the *Sargassum* portion of the loggerhead turtle critical habitat (**Figure 2**) and a small spill could contact the *Sargassum* habitat. If a slick from a small spill did reach the *Sargassum* habitat, juvenile sea turtles could ingest diesel fuel, resulting in death, injury, or other sublethal effects.

Impacts of a Large Oil Spill

Impacts of oil spills on sea turtles can include direct impacts from oil exposure as well as indirect impacts due to response activities and materials (e.g., vessel traffic, noise, dispersants). Direct physical and physiological effects can include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes and smoke (e.g., from in situ burning of oil); ingestion of oil (and dispersants) directly or via contaminated food; and stress from the activities and noise of response vessels and aircraft. Complications of the above may lead to dysfunction of immune and reproductive systems, physiological stress, declining physical condition, and death. Behavioral responses can include displacement of animals from prime habitat, disruption of social structure, change in food availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011, NMFS, 2014a). In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for these types of impacts on sea turtles. DOCD Section 9b provides detail on spill response measures.

Studies of oil effects on loggerheads in a controlled setting (Lutcavage et al., 1995; NOAA, 2021a) suggest that sea turtles show no avoidance behavior when they encounter an oil slick, and any sea turtle in an affected area would be expected to be exposed. Sea turtles' diving behaviors also put them at risk. Sea turtles rapidly inhale a large volume of air before diving and continually resurface over time, which may result in repeated exposure to volatile vapors and oiling (NMFS, 2020a).

Results of *Deepwater Horizon* incident studies provide an indication of potential effects of a large oil spill on sea turtles. NOAA (2016a) estimated that between 4,900 and 7,600 large juvenile and adult sea turtles (Kemp's ridleys, loggerheads, and hardshelled sea turtles not identified to species) and between 56,000 and 166,000 small juvenile sea turtles (Kemp's ridleys, green turtles, loggerheads, hawksbills, and hardshelled sea turtles not identified to species) were killed by the *Deepwater Horizon* incident. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities (NOAA, 2016a). Evidence from McDonald et al. (2017b) suggests 402,000 turtles were exposed to oil in the aftermath of the *Deepwater Horizon* incident, including 54,800 which were likely to have been heavily oiled.

Spill response activities could also kill sea turtles and interfere with nesting. NOAA (2016a) concluded that after the *Deepwater Horizon* incident, hundreds of sea turtles were likely killed by response activities such as increased boat traffic, dredging for berm construction, increased lighting at night near nesting beaches, and oil cleanup operations on nesting beaches. In addition, it is estimated that oil cleanup operations on Florida Panhandle beaches following the spill deterred adult female loggerheads from coming ashore and laying their eggs, resulting in a decrease of approximately 250 loggerhead nests, or a reduction of 43.7%, in 2010 (NOAA, 2016a; Lauritsen et al., 2017). Impacts from a large oil spill resulting in the death of individual listed sea turtles would be significant to local populations.

Loggerhead Critical Habitat – Nesting Beaches. Spilled oil reaching sea turtle nesting beaches could affect nesting sea turtles and egg development (NMFS, 2020a). An oiled beach could affect nest site selection or result in no nesting at all (e.g., false crawls). Upon hatching and successfully reaching the water, hatchlings would be subject to the same types of oil spill exposure hazards as adults. Hatchlings that contact oil residues while crossing a beach could exhibit a range of effects, from acute toxicity to impaired movement and normal bodily functions (NMFS, 2007).

Based on the 30-day OSRA modeling (**Table 3**), Texas shorelines between Cameron and Matagorda Counties have a 1% conditional probability of shoreline contact within 10 days of a spill. Texas and Louisiana shorelines that support sea turtle nesting could be contacted within 30 days of spill (1% to 10% conditional probability). The nearest nearshore reproductive critical habitat for loggerhead turtles is 465 miles (748 km) from the project area.

Loggerhead Critical Habitat – *Sargassum* Habitat. The project area is within the *Sargassum* habitat portion of the loggerhead turtle critical habitat (**Figure 2**). Due to the large area covered by the designated *Sargassum* habitat for loggerhead turtles, a large spill could result in oiling of a substantial part of the *Sargassum* habitat in the northern Gulf of Mexico. The *Deepwater Horizon* incident affected approximately one-third of the *Sargassum* habitat in the northern Gulf of Mexico (BOEM, 2016b). It is extremely unlikely that the entire *Sargassum* habitat would be affected by a large spill. Because *Sargassum* spp. are floating, pelagic species, it would only be affected by oil that is present near the surface.

The effects of oiling on *Sargassum* spp. vary with severity, but moderate to heavy oiling that could occur during a large spill could cause complete mortality to *Sargassum* spp. and its associated communities (BOEM, 2017a). *Sargassum* spp. also has the potential to sink during a large spill; thus temporarily removing the habitat and possibly being an additional pathway of exposure to the benthic environment (Powers et al., 2013). Lower levels of oiling may cause sublethal effects, including reduced growth, productivity, and recruitment of organisms associated with *Sargassum* spp. The *Sargassum* spp. algae itself could be less impacted by light to moderate oiling than associated organisms because of a waxy outer layer that might help protect it from oiling (BOEM, 2016b). *Sargassum* spp. have a yearly seasonal cycle of growth and a yearly cycle of dispersal from the Gulf of Mexico to the western Atlantic. A large spill could affect a large portion of the annual crop of the algae; however, because of its ubiquitous distribution and seasonal cycle, recovery of the *Sargassum* spp. community would be expected to take one to two years (BOEM, 2017a).

Impacts to sea turtles from a large oil spill and associated cleanup activities would depend on spill extent, duration, and season (relative to turtle nesting season); the amount of oil reaching the shore; the importance of specific beaches to sea turtle nesting; and the level of cleanup vessel and beach crew activity required. A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill, it is expected that impacts resulting in the injury or death of individual sea turtles would be adverse but not likely significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP would mitigate and reduce direct and indirect impacts to turtles from oil exposure and response activities and materials. DOCD Section 9b provides detail on spill response measures.

C.3.6 Piping Plover (Threatened)

The Piping Plover is a migratory shorebird that overwinters along the southeastern U.S. and Gulf of Mexico coasts. This Threatened species experienced declines in population as a result of hunting, habitat loss and modification, predation, and disease (USFWS, 2003). However, as a result of intensive conservation and management, populations of Piping Plover appear to have been increasing since 1991 throughout its range (BirdLife International, 2020). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 1**). Piping Plovers inhabit coastal sandy beaches and mudflats, feeding by probing for invertebrates at or just below the surface. They use beaches adjacent to foraging areas for roosting and preening. A species description is presented by BOEM (2017a).

A large oil spill is the only IPF that could potentially affect Piping Plovers. There are no IPFs associated with routine project activities that could affect these birds. A small fuel spill in the project area would be unlikely to affect Piping Plovers because a small fuel spill would not be expected to make landfall or reach coastal waters prior to dissipating (see explanation in **Section A.9.1**).

Impacts of a Large Oil Spill

The project area is 139 miles (224 km) from the nearest shoreline designated as Piping Plover critical habitat. The 30-day OSRA modeling (**Table 3**) predicts that Piping Plover critical habitat would have up to a 1% conditional probability of being contacted within 10 days of a spill.

Piping Plovers could become externally oiled while foraging on oiled shores or become exposed internally through ingestion of oiled intertidal sediments and prey (BOEM, 2017a). They congregate and feed along tidally exposed banks and shorelines, following the tide out and foraging at the water's edge. It is possible that some deaths of Piping Plovers could occur, especially if spills occur during winter months when the birds are most common along the coastal Gulf or if spills contacted critical habitat. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP.

However, a large spill that contacts shorelines would not necessarily impact Piping Plovers. In the aftermath of the *Deepwater Horizon* incident, Gibson et al. (2017) completed thorough surveys of coastal Piping Plover habitat in coastal Louisiana, Mississippi, and Alabama and found that only 0.89% of all observed Piping Plovers were visibly oiled, leaving the authors to conclude that the *Deepwater Horizon* incident did not substantially affect Piping Plover populations.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting beaches inhabited by Piping Plovers, it is expected that impacts resulting in the injury or death of individual Piping Plovers could be significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.7 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is a large omnivorous wading bird and a federally listed Endangered species. Four wild populations live in North America (National Wildlife Federation, 2016b; USFWS, 2020b). One population winters along the Texas coast at Aransas NWR and summers at Wood Buffalo National Park in Canada. This population represents the majority of the world's population of free-ranging Whooping Cranes, reaching an estimated population of 536 individuals at Aransas NWR during the 2022 to 2023 winter (USFWS, 2023), a slight decrease from an estimated 543 individuals counted in the 2021 to 2022 winter survey. Another reintroduced population summers in Wisconsin and migrates to Florida for the winter (USFWS, 2020c). Whooping Cranes breed, migrate, winter, and forage in a variety of habitats, including coastal marshes and estuaries, inland marshes, lakes, ponds, wet meadows and rivers, and agricultural fields (USFWS, 2007). About 22,240 ac (9,000 ha) of salt flats in Aransas NWR and adjacent islands comprise the principal wintering grounds of the Whooping Crane. Aransas NWR is designated as critical habitat for the species (**Figure 1**). A species description is presented by BOEM (2012a).

A large oil spill is the only IPF that could potentially affect Whooping Cranes due to the distance of the project area from Aransas NWR.

Impacts of a Large Oil Spill

The 30-day OSRA modeling (**Table 3**) predicts that there is a 1% and 6% probability (within 10 and 30 days, respectively) that an oil spill in the project area would reach a shoreline designated as critical habitat for the Whooping Crane, approximately 179 miles (288 km) from the project area.

In the event of oil exposure, Whooping Cranes could physically oil themselves while foraging in oiled areas or secondarily contaminate themselves through ingestion of contaminated shellfish, frogs, and fishes. It is possible that some deaths of Whooping Cranes could occur if the spill contacts their critical habitat in Aransas NWR, especially if spills occur during winter months when Whooping Cranes are most common along the Texas coast. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP. Impacts leading to the death of individual Whooping Cranes would be significant at population and species levels.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.8 Oceanic Whitetip Shark (Threatened)

The oceanic whitetip shark was listed as Threatened under the ESA in 2018 by NMFS (83 *FR* 4153). Oceanic whitetip sharks are found worldwide in offshore waters between approximately 30° N and 35° S latitude, and historically were one of the most widespread and abundant species of shark (Rigby et al., 2019). However, based on reported oceanic whitetip shark catches in several major long-line fisheries, the global population appears to have suffered substantial declines (Camhi et al., 2008) and the species is now only occasionally reported in the Gulf of Mexico (Rigby et al., 2019).

Oceanic whitetip shark management is complicated due to it being globally distributed, highly migratory, and overlapping in areas of high fishing pressure; thus, leaving assessment of population trends on fishery dependent catch-and-effort data rather than scientific surveys (Young and Carlson, 2020). A comparison of historical shark catch rates in the Gulf of Mexico by Baum and Myers (2004) noted that most recent papers dismissed the oceanic whitetip shark as rare or absent in the Gulf of Mexico. NMFS (2018b) noted that there has been an 88% decline in abundance of the species in the Gulf of Mexico since the mid-1990s due to commercial fishing pressure.

IPFs that could affect the oceanic whitetip shark include vessel presence, noise, and lights, and a large oil spill. Though NMFS (2020a) lists a small diesel fuel spill as an IPF, in the project area, a small diesel fuel spill would be unlikely to affect oceanic whitetip sharks due to rapid natural dispersion of diesel fuel and the low density of oceanic whitetip sharks potentially present in the project area. Therefore, no significant impacts are expected from a small diesel fuel spill and they are not further discussed (**Table 2**).

Impacts of Vessel Presence (including noise and lights)

Offshore drilling activities produce a broad array of noise at frequencies and intensities that may be detected by elasmobranchs including the Threatened oceanic whitetip shark. The general frequency range for elasmobranch hearing is approximately between 20 Hz and 1 kHz (Ladich and Fay, 2013), which includes frequencies exhibited by individual species such as the nurse shark (*Ginglymostoma cirratum*; 300 and 600 Hz) and the lemon shark (*Negaprion brevirostris*; 20 Hz to 1 kHz) (Casper and Mann, 2006). These frequencies overlap with noise associated with production activities (source levels of 195 dB re 1 Pa m, expressed as SPL, with peak frequencies at 40 to 100 Hz) (Hildebrand, 2005). Impacts from offshore activities (i.e., non-impulsive noise from MODU activities) could include masking or behavioral change (Popper et al., 2014). However, because the propagation distances of SPL sufficient to elicit behavioral disturbances from the MODU would be limited in geographic scope, no population level impacts on oceanic whitetip sharks are expected.

Impacts of a Large Oil Spill

Information regarding the direct effects of oil on elasmobranchs, including the oceanic whitetip shark are largely unknown. A study by Cave and Kajiura (2018) reported that when exposed to crude oil, the Atlantic stingray (*Hypanus sabinus*) experienced impaired olfactory function which could lead to decreased fitness. In the event of a large oil spill, oceanic whitetip sharks could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Because oceanic whitetip sharks may be found in surface waters, they could be more likely to be impacted by floating oil than other species which only reside at depth.

It is possible that a large oil spill could affect individual oceanic whitetip sharks and result in injuries or deaths. Due to the low density of oceanic whitetip sharks thought to exist in the Gulf of Mexico, it is unlikely that a large spill would come in contact with oceanic whitetip sharks. However, if contact resulted in individual mortality, regional population-level effects on the species could be observed.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.9 Giant Manta Ray (Threatened)

The giant manta ray was listed as Threatened under the ESA in 2018 by NMFS (83 *FR* 2916). The species is slow-growing, migratory, and planktivorous, inhabiting tropical, subtropical, and temperate bodies of water worldwide (NOAA, 2022b).

Commercial fishing is the primary threat to giant manta rays (NOAA, 2022b). The species is targeted and caught as bycatch in several global fisheries throughout its range. Although protected in U.S. waters, protection of populations is difficult as they are highly migratory with sparsely distributed and fragmented populations throughout the world. Some estimated regional population sizes are small (less than 1,000 individuals) (NOAA, 2022b; Marshall et al., 2020). Stewart et al. (2018) reported evidence that the Flower Garden Banks serves as nursery habitat for aggregations of juvenile manta rays. Approximately 100 unique individuals have been positively identified at the Flower Garden Banks based on unique underbelly coloration (Belter et al., 2020). Genetic and photographic evidence in the Flower Garden Banks over 25 years of monitoring showed that 95% of identified giant manta ray male individuals were smaller than mature size (Stewart et al., 2018).

IPFs that may affect giant manta rays include vessel presence, noise, and lights, and a large oil spill. Though NMFS (2020a) lists a small diesel fuel spill as an IPF, in the project area a small diesel fuel spill would be unlikely to affect giant manta rays due to rapid natural dispersion of diesel fuel and the low density of giant manta rays potentially present in the project area. Therefore, no significant impacts are expected from a small diesel fuel spill and they are not discussed further (See **Table 2**).

Impacts of Vessel Presence (including noise and lights)

Offshore drilling activities produce a broad array of noise at frequencies and intensities that may be detected by elasmobranchs including the giant manta ray. The general frequency range for elasmobranch hearing is approximately between 20 Hz and 1 kHz (Ladich and Fay, 2013). Studies indicate that the most sensitive hearing ranges for individual species were 300 and 600 Hz (yellow stingray [*Urobatis jamaicensis*]) and 100 to 300 Hz (little skate [*Leucoraja erinacea*])

(Casper et al., 2003; Casper and Mann, 2006). These frequencies overlap with noise associated with production activities (source levels of 195 dB re 1 Pa m, expressed as SPL, with peak frequencies at 40 to 100 Hz) (Hildebrand, 2005). Impacts from offshore activities (i.e., non-impulsive noise from MODU activities) could include masking or behavioral change (Popper et al., 2014). However, because the propagation distances of SPL sufficient to elicit behavioral disturbances from the MODU would be limited in geographic scope, no population level impacts on giant manta rays are expected.

Impacts of a Large Oil Spill

A large oil spill in the project area could reach coral reefs at the Flower Garden Banks which is the only known location of giant manta ray aggregations in the Gulf of Mexico; although, individuals may occur anywhere in the Gulf. Information regarding the direct effects of oil on elasmobranchs, including the giant manta ray, is largely unknown. In the unlikely event of a large oil spill impacting areas with giant manta rays, individual rays could be affected by direct ingestion of oil which could cover their gill filaments or gill rakers, or by ingestion of oiled plankton. A study by Cave and Kajiura (2018) reported that when exposed to crude oil, the Atlantic stingray experienced impaired olfactory function which could lead to decreased fitness. Giant manta rays typically feed in shallow waters of less than 33 ft (10 m) depth (NOAA, 2022b). Because of this shallow water feeding behavior, giant manta rays may be more likely to be impacted by floating oil than other species which only reside at depth.

In the event of a large oil spill, due to the distance between the project area and the Flower Garden Banks (approximately 130 miles [209 km]), it is unlikely that oil would impact the giant manta ray nursery habitat. It is possible that a large oil spill could impact individual giant manta rays, and due to the low density of individuals thought to occur in the Gulf of Mexico, there would likely be regional population-level effects on the species if mortality is observed.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.10 Gulf Sturgeon (Threatened)

The Gulf sturgeon is a Threatened fish species that inhabits major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida (Barkuloo, 1988; Wakeford, 2001). The Gulf sturgeon is anadromous, migrating from the sea upstream into coastal rivers to spawn in freshwater. The historic range of the species extended from the Texas/Louisiana border to Tampa Bay, Florida (Pine and Martell, 2009). This range has contracted to encompass major rivers and inner shelf waters from the Lake Pontchartrain and the Pearl River system in Louisiana and Mississippi to the Suwannee River, Florida (NOAA, 2022c). Populations have been depleted or even extirpated throughout the species' historical range by fishing, shoreline development, dam construction, water quality changes, and other factors (Barkuloo, 1988; Wakeford, 2001). These declines prompted the listing of the Gulf sturgeon as a Threatened species in 1991. The best-known populations occur in the Apalachicola and Suwannee Rivers in Florida (Carr, 1996; Sulak and Clugston, 1998), the Choctawhatchee River in Alabama (Fox et al., 2000), and the Pearl River in Mississippi/Louisiana (Morrow et al., 1998). Rudd et al. (2014) reconfirmed the spatial distribution and movement patterns of Gulf sturgeon by surgically implanting acoustic telemetry tags. Critical habitat in the Gulf extends from Lake Borgne, Louisiana (St. Bernard Parish), to Suwannee Sound, Florida (Levy County) (NMFS, 2014b) (**Figure 1**). Species descriptions are presented by BOEM (2012a) and in the recovery plan for this species (USFWS et al., 1995).

A large oil spill is the only IPF that could potentially affect Gulf sturgeon. There are no IPFs associated with routine project activities that could affect this species. A small fuel spill in the project area would be unlikely to affect Gulf sturgeon because a small fuel spill would not be expected to make landfall or reach coastal waters prior to dissipating (see explanation in **Section A.9.1**). Vessel strikes to Gulf sturgeon would be unlikely based on the location of the support vessel base and that NMFS (2020a, 2021) estimated one non-lethal Gulf sturgeon strike in the 50 years of proposed action. Due to the distance of the project area from the nearest Gulf sturgeon critical habitat (448 miles [721 km]) and the support vessel base being in Port Fourchon, Louisiana, it is anticipated impacts from vessel strikes due to project activities will be negligible. The large oil spill IPF with potential impacts listed in **Table 2** is discussed below.

Impacts of a Large Oil Spill

Potential spill impacts on Gulf sturgeon are discussed by BOEM (2016b, 2017a) and NMFS (2007). For this DOCD, there are no unique site-specific issues with respect to this species.

The project area is approximately 448 miles (721 km) from the nearest Gulf sturgeon critical habitat. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the project area has a <5% conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 30 days of a spill.

In the event of oil reaching Gulf sturgeon habitat, the fish could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills. Based on the life history of this species, sub-adult and adult Gulf sturgeon would be most vulnerable to an estuarine or marine oil spill, and would be vulnerable primarily from October through April when this species is foraging in estuarine and marine habitats (NMFS, 2020a).

NOAA (2016a) estimated that 1,100 to 3,600 Gulf sturgeon were exposed to oil from the *Deepwater Horizon* incident. Overall, 63% of the Gulf sturgeon from six river populations were potentially exposed to the spill. Although the number of dead or injured Gulf sturgeon was not estimated, laboratory and field tests indicated that Gulf sturgeon exposed to oil displayed both genotoxicity and immunosuppression, which can lead to malignancies, cell death, susceptibility to disease, infections, and a decreased ability to heal (NOAA, 2016a).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting waterways inhabited by Gulf sturgeon, it is expected that impacts resulting in the injury or death of individual sturgeon would be adverse but not likely significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. Shell has extensive resources available to protect coastal and estuarine wildlife and habitats in the event of a spill reaching the shoreline, as detailed in the OSRP. DOCD Section 9b provides detail on spill response measures.

C.3.11 Nassau Grouper (Threatened)

The Nassau grouper is a Threatened, long-lived reef fish typically associated with hard bottom structures such as natural and artificial reefs, rocks, and underwater ledges (NOAA, nd). Once one of the most common reef fish species in the coastal waters of the United States and Caribbean (Sadovy, 1997), the Nassau grouper has been subject to overfishing and is considered extinct in much of its historical range. Observations of current spawning aggregations compared with historical landings data suggest that the Nassau grouper population is substantially smaller than its historical size (NOAA, nd). The Nassau grouper was listed as Threatened under the ESA in 2016 (81 *FR* 42268).

Nassau groupers are found mainly in the shallow tropical and subtropical waters of eastern Florida (rare), the Florida Keys, Bermuda, the Yucatán Peninsula, and the Caribbean, including the U.S. Virgin Islands and Puerto Rico within water depths up to 426 ft (130 m) (NOAA, nd). There has been one confirmed sighting of Nassau grouper from the Flower Garden Banks in the Gulf of Mexico at a water depth of 118 ft (36 m) (Foley et al., 2007). Three additional unconfirmed reports (i.e., lacking photographic evidence) of Nassau grouper have also been documented from mooring buoys and the coral cap region of the West Flower Garden flats (Foley et al., 2007).

There are no IPFs associated with routine project activities that could affect Nassau grouper. A small fuel spill would not affect Nassau grouper because the fuel would float and dissipate on the sea surface and would not be expected to reach the Flower Garden Banks or the Florida Keys. A large oil spill is the only relevant IPF.

Impacts of a Large Oil Spill

Based on the 30-day OSRA modeling results, a large oil spill would be unlikely (<0.5% probability) to reach Nassau grouper habitat in the Florida Keys (Monroe County, Florida). A spill would be unlikely to contact the Flower Garden Banks based on the distance between the project area and the Flower Garden Banks (approximately 130 miles [209 km]), and the difference in water depth between the project area (approximately 8,250 to 8,500 ft [2,515 to 2,591 m]) and the Banks (approximately 56 to 476 ft [17 to 145 m]). While on the surface, oil would not be expected to contact subsurface fish. Natural or chemical dispersion of oil could cause a subsurface plume which would have the possibility of contacting Nassau groupers.

If a subsurface plume were to occur, impacts to Nassau groupers on the Flower Garden Banks would be unlikely due to the low density of Nassau grouper present on the Banks, the distance between the project area and the Flower Garden Banks (approximately 130 miles [209 km]), and the shallow location of the coral cap of the Banks. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. Valentine et al. (2014) observed the spatial distribution of excess hopane, a crude oil tracer from the *Deepwater Horizon* incident sediment core samples, to be in the deeper waters and not transported up the shelf, thus confirming that near-bottom currents flow along the isobaths.

In the unlikely event that an oil slick should reach Nassau grouper habitat, oil droplets or oiled sediment particles could come into contact with Nassau grouper present on the reefs. Potential impacts include the direct ingestion of oil which could cover their gill filaments or gill rakers, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills.

In the event of a large oil spill, due to the distance between the project area and the Flower Garden Banks, it is unlikely that oil would impact Nassau grouper habitats. Due to the low density of individuals thought to occur in the Gulf of Mexico, there is a very low probability for Nassau groupers to be exposed to oil from the spill. Impacts to Nassau grouper from a large oil spill would be considered at an individual level and very unlikely at a population level.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.12 Smalltooth Sawfish (Endangered)

The smalltooth sawfish, named after their flat, saw-like rostrum, is an elasmobranch ray which lives in shallow coastal tropical seas and estuaries where they feed on fish and invertebrates such as shrimp and crabs (NOAA Fisheries, 2022b). Once found along most of the northern Gulf of Mexico coast from Texas to Florida, their current range in the Gulf of Mexico is restricted to areas primarily in southwest Florida (Brame et al., 2019) where several areas of critical habitat have been designated (**Figure 1**). A species description is presented in the recovery plan for this species (NMFS, 2009a).

Listed as Endangered under the ESA in 2003, population numbers have drastically declined over the past century primarily due to accidental bycatch (Seitz and Poulakis, 2006). Although there are no reliable estimates for smalltooth sawfish population numbers throughout its range (NMFS, 2018c), data from 1989 to 2004 indicated a slight increasing trend in population numbers in Everglades National Park during that time period (Carlson et al., 2007). More recent data resulted in a similar conclusion, with indications that populations were stable or slightly increasing in southwest Florida (Carlson and Osborne, 2012).

There are no IPFs associated with routine project activities that could affect smalltooth sawfish. A small fuel spill would not affect smalltooth sawfish because the fuel would float and dissipate on the sea surface and would not be expected to reach smalltooth sawfish habitat in coastal areas (see **Section A.9.1**). A large oil spill is the only relevant IPF.

Impacts of a Large Oil Spill

The project area is approximately 778 miles (1,252 km) from the nearest smalltooth sawfish critical habitat in Charlotte County, Florida. Based on the 30-day OSRA modeling (**Table 3**), coastal areas containing smalltooth sawfish critical habitat are unlikely to be affected within 30 days of a spill (<0.5% conditional probability).

Information regarding the direct effects of oil on elasmobranchs, including the smalltooth sawfish are largely unknown. A study by Cave and Kajiura (2018) reported that when exposed the crude oil, the Atlantic stingray experienced impaired olfactory function which could lead to decreased fitness. In the event of oil reaching smalltooth sawfish habitats, the smalltooth sawfish could be affected by direct ingestion, ingestion of oiled prey, or the absorption of dissolved petroleum products through the gills as well as impaired olfactory function. Based on the shallow, coastal habitats preferred by smalltooth sawfish, individuals in areas subject to coastal oiling could be more likely to be impacted than other species that reside at depth. Due to its Endangered status, a large oil spill with death to individuals could have impacts to smalltooth sawfish at population and species levels.

C.3.13 Beach Mouse (Endangered)

Four subspecies of Endangered beach mouse occur on the barrier islands of Alabama and the Florida Panhandle: the Alabama (*Peromyscus polionotus ammobates*), Choctawhatchee (*P. p. allophrys*), Perdido Key (*P. p. trissyllepsis*), and St. Andrew beach mouse (*P. p. peninsularis*). Critical habitat has been designated for all four subspecies and is shown combined in **Figure 1**. One additional species of beach mouse inhabiting dunes on the western Florida Panhandle, the Santa Rosa beach mouse (*P. p. leucocephalus*), is not listed under the ESA. Species descriptions are presented by BOEM (2017a).

A large oil spill is the only IPF that could potentially affect subspecies of the beach mouse. There are no IPFs associated with routine project activities that could affect these animals due to the distance from shore and the lack of onshore support activities near their habitat.

Impacts of a Large Oil Spill

Potential spill impacts on Endangered beach mouse subspecies are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to these species.

The project area is approximately 502 miles (808 km) from the nearest beach mouse critical habitat. The 30-day OSRA modeling predicts that a spill in the project area has a <0.5% conditional probability of contacting any coastal areas containing beach mouse critical habitat within 30 days of a spill.

In the event of oil contacting these beaches, beach mice could experience several types of direct and indirect impacts. Contact with spilled oil could cause skin and eye irritation and subsequent infection; matting of fur; irritation of sweat glands, ear tissues, and throat tissues; disruption of sight and hearing; asphyxiation from inhalation of fumes; and toxicity from ingestion of oil and oiled food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup (BOEM, 2017a).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting beach mice habitat, it is expected that impacts resulting in the death of individual beach mice would be adverse and due to its Endangered status potentially significant at the population and species levels. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.3.14 Florida Salt Marsh Vole (Endangered)

The Florida salt marsh vole is a small, dark brown or black rodent found only in saltgrass (*Distichlis spicata*) meadows in the Big Bend region of Florida that was listed as Endangered under the ESA in 1991. Only two populations of Florida salt marsh vole are known to exist: one near Cedar Key in Levy County, Florida and one in the Lower Suwanee National Wildlife Refuge in Dixie County, Florida (Florida Fish and Wildlife Conservation Commission, nd-d). No critical habitat has been established for the Florida salt marsh vole in part due to concerns over illegal trapping or trespassing if the location of the populations were publicly disclosed (USFWS, 2001b).

A large oil spill is the only IPF that may potentially affect the Florida salt marsh vole. There are no IPFs associated with routine project activities that could affect these animals due to the distance from the project area to their habitat and the lack of any onshore support activities near their habitat. A small fuel spill in the project area would not affect the Florida salt marsh vole because a small fuel spill would not be expected to reach their habitat prior to dissipating (see **Section A.9.1**).

Impacts of a Large Oil Spill

Florida salt marsh vole habitat in Levy and Dixie counties, Florida is approximately 733 miles (1,180 km) from the project area. The 30-day OSRA modeling predicts that a spill in the project area has a <0.5% conditional probability of contacting any coastal areas containing Florida salt marsh voles within 30 days of a spill.

In the event of oil contacting beaches containing these animals, Florida salt marsh voles could experience several types of direct and indirect impacts. Contact with spilled oil could cause skin and eye irritation and subsequent infection; matting of fur; irritation of sweat glands, ear tissues, and throat tissues; disruption of sight and hearing; asphyxiation from inhalation of fumes; and toxicity from ingestion of oil and contaminated food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup. Impacts associated with an extensive oiling of coastal habitat containing Florida salt marsh voles from a large oil spill are expected to be significant. Due to the extremely low population numbers, extensive oiling of Florida salt marsh vole habitat could result in the extinction of the species. However, any such impacts are unlikely due to the distance from the project area to Florida salt marsh vole habitat and response actions that would occur in the event of a spill.

C.3.15 Panama City crayfish (Threatened)

The USFWS issued a Final Rule designating the Panama City crayfish as Threatened under the ESA on January 5, 2022 (effective February 4, 2022). The Panama City crayfish is a semi-terrestrial crayfish that grows up to 2 inches (51 mm) in size and is found in south-central Bay County, Florida.

Medium to dark brown in color, the crayfish prefers areas dominated by herbaceous vegetation and shallow or fluctuating water levels (Keppner and Keppner, 2004). Historically prevalent in shallow freshwater bodies in pine and prairie communities, development has largely replaced these habitats with commercial or residential buildings. The Panama City crayfish is now generally found in wet or semi-wet swales, ditches, slash pine plantations, undeveloped utility rights-of-way, and remnant wetlands (Florida Fish and Wildlife Conservation Commission, 2016).

A large oil spill is the only IPF that may potentially affect the Panama City crayfish. There are no IPFs associated with routine project activities that could affect these animals due to the distance from the project area to their habitat and the lack of any onshore support activities near their habitat. A small fuel spill in the project area would not affect the Panama City crayfish because a small fuel spill would not be expected to reach their habitat prior to dissipating (**Section A.9.1**).

Impacts of a Large Oil Spill

Panama City crayfish critical habitat in Bay County, Florida is approximately 626 miles (1,007 km) from the project area. The 30-day OSRA modeling (**Table 3**) predicts that a spill in the project area has a <0.5% conditional probability of contacting any coastal areas containing Panama City crayfish critical habitat within 30 days.

Effects of oiling on the Panama City crayfish are largely unknown. In general, crayfishes use chemoreception to orient themselves in their environment and find food, and avoid predators (Bergman and Moore, 2005). Exposure to hydrocarbons has been shown to damage receptor cells that crayfish use for chemoreception, thus decreasing their fitness (Tierney et al., 2010).

Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of burrows. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup. Impacts associated with an extensive oiling of coastal habitat containing Panama City crayfish from a large oil spill are expected to be significant. Due to the low population numbers and restricted range, extensive oiling of Panama City crayfish habitat could be significant at the species level. However, any such impacts are unlikely due to the distance from the project area to Panama City crayfish habitat and response actions that would occur in the event of a spill.

C.3.16 Threatened Coral Species

Seven Threatened coral species are known from the Gulf of Mexico: elkhorn coral, staghorn coral, lobed star coral, mountainous star coral, boulder star coral, pillar coral, and rough cactus coral. Elkhorn coral, lobed star coral, mountainous star coral, and boulder star coral have been reported from the coral cap region of the Flower Garden Banks (NOAA, 2021b), but are unlikely to be present as regular residents in the northern Gulf of Mexico (proximity to project area) because they typically inhabit coral reefs in shallow, clear tropical, or subtropical waters. Staghorn coral, pillar coral, and rough cactus coral are not known to inhabit reefs of the Flower Garden Banks, but are present on reefs in the Florida Keys and Dry Tortugas (Florida Fish and Wildlife Conservation Commission, nd-e). Other Caribbean coral species evaluated by NMFS in 2014 (79 *FR* 53852) either do not meet the criteria for ESA listing or are not known from the Flower Garden Banks, Florida Keys, or Dry Tortugas. Critical habitat has been designated for elkhorn coral and staghorn coral in the Florida Keys (Monroe County, Florida) and Dry Tortugas.

NMFS has designated critical habitat for the boulder star coral, lobed star coral, mountainous star coral, pillar coral, and rough cactus coral in the Atlantic Ocean, Gulf of Mexico, and Caribbean Sea per 88 *FR* 54026. The critical habitat designation became effective in September 2023. For the areas in the Gulf of Mexico this includes the Flower Garden Banks and the waters near Miami-Dade and Monroe counties, Florida, and the Dry Tortugas (**Figure 1**).

There are no IPFs associated with routine project activities that could affect Threatened corals in the northern Gulf of Mexico. A small fuel spill would not affect Threatened coral species because the oil would float and dissipate on the sea surface. A large oil spill is the only relevant IPF (potential impacts listed in **Table 2**) and is discussed below.

Impacts of a Large Oil Spill

A large oil spill would be unlikely to reach coral reefs at the Flower Garden Banks or elkhorn coral critical habitat in the Florida Keys (Monroe County, Florida) or Dry Tortugas. The 30-day OSRA modeling (**Table 3**) predicts the conditional probability of oil contacting the Florida Keys is <0.5% within 30 days of a spill. A surface slick would not contact corals on the seafloor. If a subsurface plume were to occur, impacts on the Flower Garden Banks would be unlikely due to the distance and the difference in water depth.

Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. Valentine et al. (2014) observed the spatial distribution of excess hopane, a crude oil tracer from *Deepwater Horizon* incident sediment core samples, to be in the deeper waters and not transported up the shelf, thus confirming near-bottom currents flow along the isobaths.

In the unlikely event that an oil slick reached reefs at the Flower Garden Banks or other Gulf of Mexico reefs, oil droplets or oiled sediment particles could come into contact with reef organisms or corals. As discussed by BOEM (2017a) impacts could include loss of habitat, biodiversity, and live coral coverage; destruction of hard substrate; change in sediment characteristics; and reduction or loss of one or more commercial and recreational fishery habitats. Sublethal effects could be long-lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature, diseases) (BOEM, 2017a).

Due to the distance between the project area and coral habitats, there is a low chance of oil contacting Threatened coral habitat in the event of a spill and no significant impacts on Threatened coral species are expected.

C.4 Coastal and Marine Birds

C.4.1 Marine Birds

Marine birds include seabirds and other species that may occur in the pelagic environment of the project area (Clapp et al., 1982a,b; Clapp et al., 1983; Peake, 1996; Hess and Ribic, 2000). Seabirds spend much of their lives offshore over the open ocean, except during breeding season when they nest on islands and along the coast. Other waterbirds, such as waterfowl, marsh birds, and shorebirds may occasionally be present over open ocean areas. No Endangered or Threatened bird species are likely to occur at the project area. For a discussion of coastal birds, see **Section C.4.2**.

Marine birds of the northern Gulf of Mexico were surveyed from ships during the GulfCet II program (Davis et al., 2000). Davis et al. (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater area. From these surveys, four ecological categories of seabirds were documented in the deepwater areas of the Gulf: summer migrants (shearwaters, storm-petrels, boobies); summer residents that breed along the Gulf coast (Sooty Tern [*Onychoprion fuscatus*], Least Tern [*Sternula antillarum*], Sandwich Tern [*Thalasseus sandvicensis*], Magnificent Frigatebird [*Fregata magnificens*]); winter residents (gannets, gulls, jaegers); and permanent resident species (Laughing Gulls [*Leucophaeus atricilla*], Royal Terns [*Thalasseus maximus*], Bridled Terns [*Onychoprion anaethetus*]) (Davis et al., 2000). The GulfCet II study did not estimate bird densities; however, seabird densities over the open ocean have been estimated to be 1.6 birds km^{-2} (Haney et al., 2014).

The distributions and relative densities of seabirds within the deepwater areas of the Gulf of Mexico, including the project area, vary temporally (i.e., seasonally) and spatially. In GulfCet II studies (Davis et al., 2000), species diversity and density varied by hydrographic environment and by the presence and relative location of mesoscale features such as Loop Current eddies that may enhance nutrient levels and productivity of surface waters where these seabird species forage (Davis et al., 2000).

Trans-Gulf migrant birds including shorebirds, wading birds, and terrestrial birds may also be present in the project area. Migrant birds may use offshore structures, including platforms and semisubmersibles for resting, feeding, or as temporary shelter from inclement weather (Ronconi et al., 2015). Some birds may be attracted to offshore structures because of the lights and the fish populations that aggregate around these structures.

IPFs that could potentially affect marine birds include vessel presence, noise, and lights; support vessel and helicopter traffic; and two types of accidents (a small fuel spill and a large oil spill).

Effluent discharges permitted under the NPDES general permit are likely to have negligible impacts on the birds due to rapid dispersion, the small area of ocean affected, the intermittent nature of the discharges, and the mobility of these animals. Compliance with BSEE NTL 2015-G013 (See **Table 1**) will minimize the potential for marine debris-related impacts on birds.

Impacts of Vessel Presence (including noise and lights)

Marine birds migrating over water have been known to strike offshore structures, resulting in death or injury (Wiese et al., 2001; Russell, 2005). Mortality of migrant birds at tall towers and other land-based structures has been reviewed extensively, and the mechanisms involved in platform collisions appear to be similar. In some cases, migrants simply do not see a part of the platform until it is too late to avoid it. In other cases, navigation may be disrupted by noise or lighting (Russell, 2005; Ronconi et al., 2015). However, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migrant species, particularly in the spring (Russell, 2005; Ronconi et al., 2015).

Overall, potential negative impacts to marine birds from vessel lighting, potential collisions, or other adverse effects are highly localized and may be expected to affect only small numbers of birds during migration periods. Therefore, these potential impacts are not expected to affect birds at the population level and are not significant (BOEM, 2012a). Any impacts on populations of marine and pelagic birds are not expected to be significant.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters are unlikely to substantially disturb marine birds in open, offshore waters. Schwemmer et al. (2011) showed that several sea birds showed behavioral responses and altered distribution patterns in response to ship traffic, which could potentially cause loss of foraging time and resting habitat. However, it is likely that individual birds would experience, at most, only short-term behavioral disruption resulting from support vessel and helicopter traffic, and the impact would not be significant.

Impacts of a Small Fuel Spill

Potential spill impacts on marine birds are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts on marine birds.

The probability of a fuel spill will be minimized by Shell's preventative measures implemented during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on marine birds. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area and the short duration of a small spill, the potential exposure for pelagic marine birds would be brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

Birds exposed to fuel on the sea surface could experience direct physical and physiological effects including skin irritation; chemical burns of skin, eyes, and mucous membranes; and inhalation of VOCs.

Because of the limited areal extent and short duration of water quality impacts from a small fuel spill, secondary impacts due to ingestion of oil via contaminated prey or reductions in prey abundance are unlikely. Due to the low densities of birds in open ocean areas, the small area affected, and the brief duration of the surface slick, no significant impacts on marine birds are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine birds are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts on marine birds.

Pelagic seabirds could be exposed to oil from a spill at the project area. Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater Gulf of Mexico (>656 ft [200 m]). Haney et al. (2014) estimated that seabird densities over the open ocean are approximately 1.6 birds km^{-2}. The number of marine birds that could be affected in open, offshore waters would depend on the extent and persistence of the oil slick.

Data following the *Deepwater Horizon* incident provide relevant information about the species of marine birds that may be affected in the event of a large oil spill. Birds that have been treated for oiling include several pelagic species such as the Northern Gannet (*Morus bassanus*), Magnificent Frigatebird, and Masked Booby (*Sula dactylatra*). The Northern Gannet was among the species with the largest numbers of individuals affected by the spill. NOAA reported that at least 93 resident and migratory bird species across all five Gulf Coast states were exposed to oil from the *Deepwater Horizon* incident in multiple habitats, including offshore/open waters, island waterbird colonies, barrier islands, beaches, bays, and marshes (NOAA, 2016a). Exposure of marine birds to oil can result in adverse health, with severity depending on the level of oiling. Effects can range from plumage damage and loss of buoyancy for external oiling to more severe effects such as organ damage, immune suppression, endocrine imbalance, reduced aerobic capacity and death as a result of oil inhalation or ingestion (NOAA, 2016a).

However, a blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. It is expected that impacts to marine birds from a large oil spill resulting in the death of individual birds would be adverse but likely not significant at population levels. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.4.2 Coastal Birds

Threatened and Endangered bird species present in the Gulf of Mexico (Piping Plover and Whooping Crane) are discussed in **Section C.3**. Various species of non-endangered coastal birds are also found along the northern Gulf Coast, including diving birds, shorebirds, marsh birds, wading birds, and waterfowl. Gulf Coast marshes and beaches also provide important feeding grounds and nesting habitats. Species that nest on beaches, flats, dunes, bars, barrier islands, and similar coastal and nearshore habitats include the Sandwich Tern, Wilson's Plover (*Charadrius wilsonia*), Black Skimmer (*Rynchops niger*), Forster's Tern (*Sterna forsteri*), Gull-Billed Tern (*Gelochelidon nilotica*), Laughing Gull, Least Tern, and Royal Tern. Additional information is presented by BOEM (2012a, 2017a).

The Brown Pelican was delisted from federal Endangered status in 2009 (USFWS, 2009) and was delisted from state species of special concern status by the State of Florida in 2017 (Florida Fish and Wildlife Conservation Commission, 2021) and Louisiana (Louisiana Wildlife & Fisheries, 2020). However, this species remains listed as Endangered by Mississippi (Mississippi Natural Heritage Program, 2018). Brown Pelicans inhabit coastal habitats and forage within both coastal waters and waters of the inner continental shelf. Aerial and shipboard surveys, including GulfCet and GulfCet II (Davis et al., 2000) indicate that Brown Pelicans do not occur over deep offshore waters (Fritts and Reynolds, 1981; Peake, 1996).

The Bald Eagle was delisted from its federal Threatened status under the ESA in 2007. The Bald Eagle still receives protection under the Migratory Bird Treaty Act of 1918 and the Bald and Golden Eagle Protection Act of 1940 (USFWS, 2015). The Bald Eagle is a terrestrial raptor widely distributed across the southern U.S., including coastal habitats along the Gulf of Mexico. The Gulf Coast is inhabited by both wintering migrant and resident Bald Eagles (Buehler, 2000).

IPFs that could potentially affect coastal birds include support vessel and helicopter traffic and a large oil spill. As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to dissipating. Compliance with NTL BSEE 2015-G013 will minimize the potential for marine debris-related impacts on shorebirds.

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters will transit coastal areas where coastal birds may be found. These activities could periodically disturb individuals or groups of birds within sensitive coastal habitats (e.g., wetlands that may support feeding, resting, or breeding birds).

Vessel traffic may disturb some foraging and resting birds. Flushing distances vary among species and individuals (Rodgers and Schwikert, 2002; Schwemmer et al., 2011; Mendel et al., 2019). The disturbances will be limited to flushing birds away from vessel pathways; known distances are from 65 to 160 ft (20 to 49 m) for personal watercraft and 75 to 190 ft (23 to 58 m) for outboard-powered boats (Rodgers and Schwikert, 2002). Flushing distances may be similar or less for the support vessels to be used for this project, and some species such as gulls are attracted to boats. Support vessels will not approach nesting or breeding areas on the shoreline, so nesting birds, eggs, and chicks will not be disturbed. Vessel operators will use designated navigation channels and comply with posted speed and wake restrictions while transiting sensitive inland waterways. Due to the limited scope, duration, and geographic extent of the project activities, any short-term impacts are not expected to be significant to coastal bird populations.

Helicopter traffic can cause some disturbance to birds on shore and offshore. Responses highly depend on the type of aircraft, bird species, activities that animals were previously engaged in, and previous exposures to overflights (Efroymson et al., 2001). Helicopters seem to cause the most intense responses over other human disturbances for some species (Bélanger and Bédard, 1989; Rojek et al., 2007; Fuller et al., 2018). However, Federal Aviation Administration Advisory Circular

No. 91-36D recommends that pilots maintain a minimum altitude of 2,000 ft (610 m) when flying over noise-sensitive areas such as wildlife refuges, parks, and areas with wilderness characteristics. This is greater than the distance (slant range) at which aircraft overflights have been reported to cause behavioral effects on most species of birds studied in Efroymson et al. (2001). With these guidelines in effect, it is likely that individual birds would experience, at most, only short-term behavioral disruption. The potential impacts are not expected to be significant to bird populations in the project area.

Impacts of Large Oil Spill

Coastal birds can be exposed to oil as they float on the water surface, dive during foraging, or wade in oiled coastal waters. The Brown Pelican and Bald Eagle could be impacted by the ingestion of contaminated fish or birds (BOEM, 2012a, 2016b). In the event of a large oil spill reaching coastal habitats, cleanup personnel and equipment could create short-term disturbances to coastal birds. Indirect effects could occur from restoration efforts, resulting in habitat loss, alteration, or fragmentation (BOEM, 2017a). Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 10 days of a spill. However, coastal areas between Cameron County, Texas, and Vermilion Parish, Louisiana may be affected within 30 days of a spill (1% to 7% conditional probability).

Studies concerning the *Deepwater Horizon* incident provide additional information regarding impacts on coastal birds that may be affected in the event a large oil spill reaches coastal habitats. According to NOAA (2016a), an estimated 51,600 to 84,500 birds were killed by the spill, and the reproductive output lost as a result of breeding adult bird mortality was estimated to range from 4,600 to 17,900 fledglings that would have been produced in the absence of premature deaths of adult birds (NOAA, 2016a). Species with the largest numbers of estimated mortalities were American White Pelican (*Pelecanus erythrorhynchos*), Black Skimmer, Black Tern (*Chilidonias niger*), Brown Pelican, Laughing Gull, Least Tern, Northern Gannet, and Royal Tern (NOAA, 2016a).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. However, if oil from a large spill reaches coastal bird habitats, significant injuries or mortalities to coastal birds are possible and could be significant at the population level. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.5 Fisheries Resources

C.5.1 Pelagic Communities and Ichthyoplankton

Biggs and Ressler (2000) reviewed the biology of pelagic communities in the deepwater environment of the northern Gulf of Mexico. The biological oceanography of the region is dominated by the influence of the Loop Current, whose surface waters are among the most oligotrophic in the world's oceans. Superimposed on this low-productivity condition are productive "hot spots" associated with entrainment of nutrient-rich Mississippi River water and mesoscale oceanographic features. Anticyclonic and cyclonic hydrographic features play an important role in determining biogeographic patterns and controlling primary productivity in the northern Gulf of Mexico (Biggs and Ressler, 2000).

Most fishes inhabiting shelf or oceanic waters of the Gulf of Mexico have planktonic eggs and larvae (Ditty, 1986; Ditty et al., 1988; Richards et al., 1989; Richards et al., 1993). A study by Ross et al. (2012) on midwater fauna to characterize vertical distribution of mesopelagic fishes in selected deepwater areas in the Gulf of Mexico substantiated high species richness, but the community was dominated by relatively few families and species.

IPFs that could potentially affect pelagic communities and ichthyoplankton include vessel presence, noise, and lights; effluent discharges; water intakes; and two types of accidents (a small fuel spill and a large oil spill).

Impacts of Vessel Presence (including noise and lights)

The MODU and installation vessel, as floating structures in the deepwater environment, will act as fish-aggregating devices (FAD). In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Holland, 1990; Higashi, 1994; Relini et al., 1994). Positive fish associations with offshore rigs and platforms in the Gulf of Mexico are well documented (Gallaway and Lewbel, 1982; Wilson et al., 2003; Wilson et al., 2006; Edwards and Sulak, 2006). The FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. MODU and installation vessel noise could potentially cause acoustic masking in fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014). The only defined acoustic threshold levels for non-impulsive noise are given by Popper et al. (2014) and apply only to species of fish with swim bladders that provide some hearing (pressure detection) function. Popper et al. (2014) estimated threshold SPL of 170 dB re 1 µPa accumulated over a 48-hour period for onset of recoverable injury and 158 dB re 1 µPa accumulated over a 12-hour period for onset temporary auditory threshold shifts. However, no consistent behavioral thresholds for fish have been established (Popper et al., 2014). Noise may also influence fish behaviors, such as predator-avoidance, foraging, reproduction, and intraspecific interactions (Picciulin et al., 2010; Bruintjes and Radford, 2013; McLaughlin and Kunc, 2015). Because the MODU and installation vessel are temporary structures, impacts on fish populations, whether beneficial or adverse, are not expected to be significant since it would be short term.

Limited data exist regarding the impacts of noise on pelagic larvae and eggs. Generally, it is believed that larval fish will have similar hearing sensitivities as adults, but may be more susceptible to barotrauma injuries associated with impulsive noise (Popper et al., 2014). Larval fish were experimentally exposed to simulated impulsive noise by Bolle et al. (2012).

The controlled playbacks produced SEL_{24h} of 206 dB re 1 μPa^2 s but resulted in no increased mortality between the exposure and control groups. Non-impulsive noise sources (such as MODU operations) are expected to be far less injurious than noise sounds. Because of the limited propagation distances of above-threshold SEL_{24h} and the periodic and transient nature of ichthyoplankton, no impacts to these life stages are expected.

Impacts of Effluent Discharges

Discharges of treated WBM- and SBM-associated cuttings will produce temporary, localized increases in suspended solids in the water column around the MODU. In general, turbid water can be expected to extend between a few hundred meters and several kilometers down current from the discharge point (National Research Council, 1983; Neff, 1987). NPDES permit limits and requirements will be met.

WBM and cuttings will be released at the seafloor. Excess cement slurry and BOP fluid will also be released at the seafloor. These discharges could smother or cover benthic communities in the vicinity of the discharge location. Impacts will be limited to the immediate area of the discharge, with little or no impact to fisheries resources.

Treated sanitary and domestic wastes may have little or no effect on the pelagic environment in the immediate vicinity of these discharges. These wastes may have elevated levels of nutrients, organic matter, and chlorine, but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. As a result of quick dilution, minimal impacts on water quality, plankton, and nekton are anticipated.

Deck drainage will have little or no impact on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from oily areas will be passed through an oil-and-water separator prior to release, and discharges will be monitored for visible sheen. The discharges may have slightly elevated levels of hydrocarbons but should dilute rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Other effluent discharges from the MODU, installation vessel, and support vessels are expected to include desalination unit brine and non-contact cooling water, non-contaminated well treatment, completion, and workover fluids, BOP fluid, excess cement, hydrate inhibitor, treated seawater, fire water, bilge water, subsea production control fluid, and ballast water. The MODU, installation vessel, and support vessel discharges are expected to be in compliance with NPDES permit and USCG regulations, as applicable, and are not expected to cause significant impacts on water quality (BOEM, 2012a).

Impacts of Water Intakes

Seawater will be drawn from several meters below the ocean surface for various services, including firewater and once-through non-contact cooling of machinery on the MODU and installation vessel (DOCD Table 7a). Section 316(b) of the Clean Water Act requires NPDES permits to ensure that the location, design, construction, and capacity of cooling water intake structures reflect the best technology available to minimize adverse environmental impact from impingement and entrainment of aquatic organisms. The current general NPDES Permit No. GMG290000 specifies requirements for new facilities for which construction commenced after July 17, 2006, with a cooling water intake structure having a design intake capacity of greater than two million gallons of water per day, of which at least 25% is used for cooling purposes.

The MODU and installation vessel selected for this project meets the described applicability for new facilities, and the vessel's water intakes are expected to be in compliance with the design, monitoring, and recordkeeping requirements of the NPDES permit.

The intake of seawater for cooling water will entrain plankton. The low intake velocity should allow most strong-swimming juvenile fishes and smaller adults to escape entrainment or impingement. However, drifting plankton would not be able to escape entrainment except for a few fast-swimming larvae of certain taxonomic groups. Those organisms entrained may be stressed or killed, primarily through changes in water temperature during the route from cooling intake structure to discharge structure and mechanical damage (turbulence in pumps and condensers). Because of the limited scope and short duration of drilling activities, any short-term impacts of entrainment are not expected to be significant to plankton or ichthyoplankton populations (BOEM, 2017a).

Impacts of a Small Fuel Spill

Potential spill impacts on fisheries resources are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on pelagic communities, including ichthyoplankton. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

A small fuel spill could have localized impacts on phytoplankton, zooplankton, ichthyoplankton, and nekton. Due to the limited areal extent and short duration of water quality impacts, a small fuel spill would be unlikely to produce detectable impacts on pelagic communities.

Impacts of a Large Oil Spill

Potential spill impacts on pelagic communities and ichthyoplankton are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues.

A large oil spill could directly affect water column biota including phytoplankton, zooplankton, ichthyoplankton, and nekton. A large spill that persisted for weeks or months would be more likely to affect these communities. While adult and juvenile fishes may actively avoid a large spill, planktonic eggs and larvae would be unable to avoid contact. Eggs and larvae of fishes in the upper layers of the water column are especially vulnerable to oiling; certain toxic fractions of spilled oil may be lethal to these life stages. Impacts would be potentially greater if local scale currents retained planktonic larval assemblages (and the floating oil slick) within the same water mass. Impacts to ichthyoplankton from a large spill would be greatest during spring and summer when concentrations of ichthyoplankton on the continental shelf peak (BOEM, 2014, 2015, 2016b).

Oil spill impacts to phytoplankton include changes in community structure and increases in biomass, which have been attributed to the effects of oil contamination and of decreased predation due to zooplankton mortality (Abbriano et al., 2011; Ozhan et al., 2014). Ozhan et al. (2014) reported that the formation of oil films on the water surface can limit gas exchange through the air-sea interface and can reduce light penetration into the water column which will limit phytoplankton photosynthesis. Determining the impact of a diesel spill on phytoplankton is a complex issue as some phytoplankton species are more tolerant of oil exposure than others while some species are more tolerant under low concentrations and some under high concentrations (Ozhan et al., 2014). Phytoplankton populations can change quickly on small temporal and spatial scales making it difficult to predict how a phytoplankton community as a whole will respond to an oil spill.

Mortality of zooplankton has been shown to be positively correlated with oil concentrations (Lennuk et al., 2015). Spills that are not immediately lethal can have short- or long-term impacts on biomass and community composition, behavior, reproduction, feeding, growth and development, immune response, and respiration (Harvell et al., 1999; Wootton et al., 2003; Auffret et al., 2004; Hannam et al., 2010; Bellas et al., 2013; Blackburn et al., 2014). Zooplankton are especially vulnerable to acute oil pollution, showing increased mortality and sublethal changes in physiological activities (e.g., egg production) (Moore and Dwyer, 1974; Linden, 1976; Lee et al., 1978; Suchanek, 1993). Zooplankton may also accumulate PAHs through diffusion from surrounding waters, direct ingestion of micro-droplets (Berrojalbiz et al., 2009; Lee et al., 2012; Lee, 2013), and by ingestion of droplets that are attached to phytoplankton (Almeda et al., 2013). Bioaccumulation of hydrocarbons can lead to additional impacts among those higher trophic level consumers that rely on zooplankton as a food source (Almeda et al., 2013; Blackburn et al., 2014).

Planktonic communities have a high capacity for recovery from the effects of oil spill pollution due to their short life cycle and high reproductive capacity (Abbriano et al., 2011). Planktonic communities drift with water currents and recolonize from adjacent areas. Because of these attributes, plankton usually recover relatively rapidly to normal population levels following hydrocarbon spill events. Research in the aftermath of the *Deepwater Horizon* incident found that phytoplankton population recovered within weeks to months and zooplankton populations may have only been minimally affected (Abbriano et al., 2011).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. It is expected that impacts to pelagic communities and ichthyoplankton from a large oil spill would be adverse but not significant at population levels. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.5.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, or growth to maturity. Under the Magnuson-Stevens Fishery Conservation and Management Act, as amended, federal agencies are required to consult on activities that may adversely affect EFH designated in Fishery Management Plans developed by the regional Fishery Management Councils.

The Gulf of Mexico Fishery Management Council (GMFMC) has prepared Fishery Management Plans for corals and coral reefs, shrimps, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum (*Sciaenops ocellatus*). In 2005, the EFH for these managed species was redefined in Generic Amendment No. 3 to the various Fishery Management Plans (GMFMC, 2005). The EFH for most of these GMFMC-managed species is on the continental shelf in waters shallower than 600 ft (183 m). The shelf edge is the outer boundary for coastal migratory pelagic fishes, reef fishes, and shrimps. EFH for corals and coral reefs includes some shelf-edge topographic features located approximately 117 miles (188 km) from the project area.

EFH has been identified in the deepwater Gulf of Mexico for highly migratory pelagic fishes, which occur as transients in the project area. Species in this group, including tunas, swordfishes, billfishes, and sharks, are managed by NMFS. Highly migratory species with EFH within or near the project area include the following (NMFS, 2009b):

- Blue marlin (*Makaira nigricans*) (juveniles, adults);
- Bluefin tuna (*Thunnus thynnus*) (spawning, eggs, larvae);
- Oceanic whitetip shark (*Carcharhinus longimanus*) (all);
- Sailfish (*Istiophorus albicans*) (juveniles, adults);
- Skipjack tuna (*Katsuwonus pelamis*) (spawning);
- Swordfish (*Xiphias gladius*) (larvae, juveniles, adults);
- White marlin (*Kajikia albida*) (juveniles); and
- Yellowfin tuna (*Thunnus albacares*) (spawning, juveniles, adults).

Research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna (Theo and Block, 2010), and NMFS (2009b) has designated a Habitat Area of Particular Concern (HAPC) for this species. The HAPC covers much of the deepwater Gulf of Mexico, including the project area (**Figure 1**). The areal extent of the HAPC is approximately 115,830 miles^2 (300,000 km^2). Atlantic bluefin tuna follow an annual cycle of foraging in June through March off the eastern U.S. and Canadian coasts, followed by migration to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b). The Atlantic bluefin tuna has also been designated as a species of concern (NMFS, 2011).

NTLs 2009-G39 and 2009-G40 provide guidance and clarification of regulations for biologically sensitive underwater features and areas and benthic communities that are considered EFH. As part of an agreement between BOEM and NMFS to complete a new programmatic EFH consultation for each new Five-Year Program, an EFH consultation was initiated between BOEM's Gulf of Mexico Region and NOAA's Southeastern Region during the preparation, distribution, and review of BOEM's 2017-2022 Gulf of Mexico Multisale EIS (BOEM, 2017a). The EFH assessment was completed and there is ongoing coordination among NMFS, BOEM, and BSEE, including discussions of mitigation (BOEM, 2016c).

Other HAPCs to protect corals and coral reefs have been designated in the GMFMC (2005, 2010). These include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, and several other reefs and banks of the northwestern Gulf of Mexico (**Figure 1**). The nearest HAPC is the West Flower Garden Bank, which is located approximately 130 miles (209 km) from the project area.

Routine IPFs that could potentially affect EFH and fisheries resources include vessel presence, noise, and lights; effluent discharges; and water intakes. In addition, two types of accidents (a small fuel spill and a large oil spill) may potentially affect EFH and fisheries resources.

Impacts of Vessel Presence (including noise and lights)

The MODU and installation vessel, as floating structures in the deepwater environment, will act as a FAD. In oceanic waters, the FAD effect would be most pronounced for epipelagic fishes such as tunas, dolphin, billfishes, and jacks, which are commonly attracted to fixed and drifting surface structures (Holland, 1990; Higashi, 1994; Relini et al., 1994; Gates et al., 2017). The FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species.

MODU and installation vessel noise could potentially cause acoustic masking for fishes, thereby reducing their ability to hear biologically relevant sounds (Radford et al., 2014). Noise may also influence fish behaviors such as predator avoidance, foraging, reproduction, and intraspecific interactions (Picciulin et al., 2010; Bruintjes and Radford, 2013; McLaughlin and Kunc, 2015; Nedelec et al., 2017). Further discussion on impact to fish from noise and injury criteria are discussed in **Section C.5.1**. Any impacts on EFH for highly migratory pelagic fishes are not expected to be significant.

Impacts of Effluent Discharges

Effluent discharges affecting EFH by diminishing ambient water quality include treated sanitary and domestic wastes, deck drainage, and miscellaneous discharges such as desalination unit brine and non-contact cooling water, BOP fluid, excess cement, hydrate inhibitor, treated seawater, non-contaminated well treatment, completion, and workover fluids, subsea production control fluid, fire water, bilge water, and ballast water. Impacts on EFH from effluent discharges are anticipated to be similar to those described in **Section C.5.1** for pelagic communities. No significant impacts on EFH for highly migratory pelagic fishes or coral are expected from these discharges.

Impacts of Water Intakes

As noted previously, cooling water intake will cause entrainment and impingement of plankton, including fish eggs and larvae (ichthyoplankton). Due to the limited scope, timing, and geographic extent of drilling activities, any short-term impacts on EFH for highly migratory pelagic fishes are not expected to be significant.

Impacts of a Small Fuel Spill

Potential spill impacts on EFH are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on EFH. DOCD Section 9b provides detail on spill response measures. Given the open ocean location of the project area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill in offshore waters would produce a thin slick on the water surface and introduce concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.1** discusses the likely fate of a small fuel spill and indicates that more than 90% would evaporate or disperse naturally within 24 hours. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

A small fuel spill could have localized impacts on EFH for highly migratory pelagic fishes, including tunas, swordfishes, billfishes, and sharks. These species occur as transients in the project area.

A spill would also produce short-term impacts on surface and near-surface water quality in the HAPC for spawning Atlantic bluefin tuna, which covers much of the deepwater Gulf of Mexico. The affected area would represent a negligible portion of the HAPC, which covers approximately 115,830 $miles^2$ (300,000 km^2) of the Gulf of Mexico. Therefore, no significant spill impacts on EFH for highly migratory pelagic fishes are expected.

A small fuel spill would not affect EFH for corals or coral reefs; the nearest of which is located approximately 117 miles (188 km) from the project area. A small fuel spill would float and dissipate on the sea surface and would not contact these seafloor features. Therefore, no significant spill impacts on EFH for corals and coral reefs are expected.

Impacts of a Large Oil Spill

Potential spill impacts on EFH are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to EFH.

An oil spill in offshore waters would temporarily increase hydrocarbon concentrations on the water surface and potentially the subsurface as well. Given the extent of EFH designations in the Gulf of Mexico (GMFMC, 2005; NMFS, 2009b), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species, including shrimps, spiny lobster, reef fishes, coastal migratory pelagic fishes, and red drum. It would result in adverse impacts on water quality and water column biota including phytoplankton, zooplankton, ichthyoplankton, and nekton. In coastal waters, sediments could be oiled and result in persistent degradation of the seafloor habitat for managed demersal fish and shellfish species.

The project area is within the HAPC for spawning bluefin tuna (NMFS, 2009b). A large spill could temporarily degrade the HAPC due to increased hydrocarbon concentrations in the water column, with the potential for lethal or sublethal impacts on spawning tuna. Potential impacts would depend in part on the timing of a spill, as this species migrates to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009b).

The nearest feature designated as EFH for corals is located 117 miles (188 km) from the project area. An accidental spill could reach or affect this feature, although near-bottom currents in the region are expected to flow along the isobaths (Nowlin et al., 2001; Valentine et al., 2014) and typically would not carry a plume up onto the continental shelf edge.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of oil from a large spill contacting EFH for managed species, it is expected that impacts could be significant, but the duration of these impacts would likely be short term. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.6 Archaeological Resources

C.6.1 Shipwreck Sites

In BOEM (2012a), information was presented that altered the impact conclusion for archaeological resources which came to light as a result of BOEM-sponsored studies and industry surveys. Evidence of damage to significant cultural resources (i.e., historic shipwrecks) has been shown to have occurred because of an incomplete knowledge of seafloor conditions in project areas >656 ft (200 m) water depth that have been exempted from high-resolution surveys. Since significant historic shipwrecks have recently been discovered outside the previously designated high-probability areas (some of which show evidence of impacts from permitted activities prior to their discovery), a survey is now required for exploration and development projects.

The shallow hazard assessment identified two sonar contacts within 500 ft (152 m) of the proposed subsea infrastructure (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018) though they are not archeologically significant. No archaeological impacts are expected from routine activities in the project area.

Because no historic shipwreck sites are known to be present in the project area (see DOCD Section 6), there are no routine IPFs that are likely to affect these resources. A small fuel spill would not affect shipwrecks in adjoining blocks because the oil would float and dissipate on the sea surface. The only IPF considered would be the impact from a large oil spill that could contact shipwrecks in other blocks.

Impacts of a Large Oil Spill

BOEM (2012a) estimated that a severe subsurface blowout could resuspend and disperse sediments within a 984-ft (300-m) radius. Because there are no known historic shipwrecks in the project area, this impact would not be relevant.

Beyond the seafloor blowout radius, there is the potential for impacts from oil, dispersants, and depleted oxygen levels (BOEM, 2017a). These impacts could include chemical contamination, alteration of the rates of microbial activity (BOEM, 2017a), and reduced biodiversity as shipwreck-associated sediment microbiomes (Hamdan et al., 2018). During the *Deepwater Horizon* incident, subsurface plumes were reported at a water depth of approximately 3,600 ft (1,100 m), extending at least 22 miles (35 km) from the wellsite and persisting for more than a month (Camilli et al., 2010). The subsurface plumes apparently resulted from the use of dispersants at the wellhead (NOAA, 2011b). While the behavior and impacts of subsurface plumes are not well known, a subsurface plume could contact shipwreck sites beyond the 984-ft (300-m) radius estimated by BOEM (2012a), depending on its extent, trajectory, and persistence (Spier et al., 2013). If oil from a subsea spill should contact wooden shipwrecks on the seafloor, it could adversely affect their condition and in situ preservation.

A spill entering shallow coastal waters could conceivably contaminate undiscovered or known historic shipwreck sites. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, coastal areas of Texas between Cameron and Matagorda Counties could be affected within 10 days (1% conditional probability). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted. If an oil spill contacted a coastal historic site, such as a fort or a lighthouse, the impacts may be temporary and reversible (BOEM, 2017a). Undiscovered shipwreck sites on or nearshore could also be impacted by foot or vehicle traffic during response and clean-up efforts in the aftermath of a spill.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.6.2 Prehistoric Archaeological Sites

With water depth approximately 8,250 to 8,500 ft (2,515 to 2,591 m), the project area is well beyond the 197-ft (60-m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Because prehistoric archaeological sites are not found in the project area, the only relevant IPF is a large oil spill that would reach coastal waters within the 197-ft (60-m) depth contour.

Impacts of a Large Oil Spill

Because of the water depth and the lack of prehistoric archaeological sites found in the project area, it is highly unlikely that any such resources would be affected by the physical effects of a subsea blowout. BOEM (2012a) estimates that a severe subsurface blowout could resuspend and disperse sediments within a 984-ft (300-m) radius.

Along the northern Gulf Coast, prehistoric sites occur frequently along the barrier islands and mainland coast and along the margins of bays and bayous (BOEM, 2012a). Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, coastal areas of Texas between Cameron and Matagorda Counties could be affected within 10 days (1% conditional probability). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted. A spill reaching a prehistoric site along these shorelines could coat fragile artifacts or site features and compromise the potential for radiocarbon dating organic materials in a site (although other dating methods are available, and it is possible to decontaminate an oiled sample for radiocarbon dating). Coastal prehistoric sites could also be damaged by spill cleanup operations (e.g., destroying fragile artifacts; disturbing the provenance of artifacts or site features). BOEM (2017a) notes that some unavoidable direct and indirect impacts on coastal historic resources could occur.

A blowout resulting in a large oil spill Is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.7 Coastal Habitats and Protected Areas

Coastal habitats in the northern Gulf of Mexico that may be affected by oil and gas activities are described in previous EISs (BOEM, 2012a, 2013, 2014, 2015, 2016b, 2017a, 2023) and are tabulated in the OSRP. Coastal habitats inshore of the project area include coastal and barrier island beaches and dunes, wetlands, oyster reefs, and submerged seagrass beds. Most of the northern Gulf of Mexico is fringed by coastal and barrier island beaches, with wetlands, oyster reefs, and submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Because of the distance from shore, the only IPF associated with routine activities in the project area that could affect beaches and dunes, wetlands, oyster reefs, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area is support vessel traffic. The support bases at Port Fourchon, Louisiana and Galveston, Texas are not located in wildlife refuges or wilderness areas. Potential impacts of support vessel traffic are briefly addressed below.

A large oil spill is the only accidental IPF that could affect coastal habitats and protected areas. A small fuel spill in the project area would be unlikely to affect coastal habitats because the project area is 141 miles (227 km) from the nearest shoreline (Texas). As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to natural dispersion.

Impacts of Support Vessel Traffic

Support operations, including the crew boats and supply boats as detailed in DOCD Section 14, may have a minor incremental impact on coastal and barrier island beaches, wetlands, oyster reefs, and protected habitats. Over time, with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors, resulting in localized land loss. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

Support operations, including crew boats and supply boats, are not anticipated to have a significant impact on submerged seagrass beds. While submerged seagrass beds have the potential to be uprooted, scarred, or lost due to direct contact from vessels, use of navigation channels and adherence to local requirements and implemented programs will decrease the likelihood of impacts to submerged seagrass beds (BOEM, 2017a,c).

Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed by BOEM (2016b, 2017a). Coastal habitats inshore of the project area include coastal and barrier island beaches, wetlands, oyster reefs, and submerged seagrass beds. For this DOCD, there are no unique site-specific issues with respect to coastal habitats.

NWRs and other protected areas such as Wildlife Management Areas along the coast are discussed in the lease sale EIS (BOEM, 2017a) and Shell's OSRP. Based on the 30-day OSRA, coastal and near-coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts within 30 days are listed in **Table 6**. The level of impacts from oil spills on coastal habitats depends on many factors, including the oil characteristics, the geographic location of the landfall, and the weather and oceanographic conditions at the time of the spill (BOEM, 2017a). Oil that makes it to beaches may be liquid, weathered oil, an oil-and-water mousse, or tarballs. Oil is generally deposited on beaches in lines defined by wave action at the time of landfall. Oil that remains on the beach will thicken as its volatile components are lost. Thickened oil may form tarballs or aggregations that incorporate sand, shell, and other materials into its mass. Tar may be buried to varying depths under the sand. On warm days, both exposed and buried tarballs may liquefy and ooze. Oozing may also serve to expand the size of a mass as it incorporates beach materials. Oil on beaches may be cleaned up manually, mechanically, or both. Some oil can remain on the beach at varying depths and may persist for several years as it slowly biodegrades and volatilizes (BOEM, 2017a). Impacts associated with an extensive oiling of coastal and barrier island beaches from a large oil spill are expected to be significant (**Table 6**).

Table 6. Wildlife refuges, wilderness areas, and state and national parks and preserves within the geographic range of 1% or greater conditional probability of shoreline contact within 30 days of a hypothetical spill from Launch Area W011 based on the 30-day Oil Spill Risk Analysis (OSRA) model.

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Cameron, Texas	Boca Chica State Park
	Brazos Island State Park
	Laguna Atascosa National Wildlife Refuge
	Laguna Madre Gulf Ecological Management Site
	Las Palomas Wildlife Management Area
	Lower Rio Grande Valley National Wildlife Refuge
Willacy, Texas	Laguna Atascosa National Wildlife Refuge

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Kenedy, Texas	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Kleberg, Texas	Laguna Madre Gulf Ecological Management Site
	Padre Island National Seashore
Nueces, Texas	I.B. Magee Beach Park
	Laguna Madre Gulf Ecological Management Site
	Mission-Aransas National Estuarine Research Reserve
	Mustang Island State Park
	Port Aransas Nature Preserve
	Roberts Point Park
Aransas, Texas	Aransas National Wildlife Refuge
	Goose Island State Park
	Lydia Ann Island Audubon Sanctuary
	Rattlesnake Island, Ayres Island, and Roddy Island Audubon Sanctuary
	Redfish Bay State Scientific Area
	Mission-Aransas National Estuarine Research Reserve
Calhoun, Texas	Aransas National Wildlife Refuge
	Chester Island Bird Sanctuary
	Guadalupe Delta Wildlife Management Area
	Matagorda Island Wildlife Management Area
	Welder Flats Wildlife Management Area
Matagorda, Texas	Big Boggy National Wildlife Refuge
	Matagorda Bay Nature Park
	San Bernard National Wildlife Refuge
	West Moring Dock Park
Brazoria, Texas	Brazoria National Wildlife Refuge
	Christmas Bay Coastal Preserve
	Justin Hurst Wildlife Management Area
	San Bernard National Wildlife Refuge
Galveston, Texas	Anahuac National Wildlife Refuge
	Bolivar Flats Shorebird Sanctuary
	Fort Travis Seashore Park
	Galveston Island State Park
	Horseshoe Marsh Bird Sanctuary
	Mundy Marsh Bird Sanctuary
	R.A. Apffel Park
	Seawolf Park
Jefferson, Texas	McFaddin National Wildlife Refuge
	Sea Rim State Park
	Texas Point National Wildlife Refuge
Cameron, Louisiana	Sabine National Wildlife Refuge
	Rockefeller State Wildlife Refuge and Game Preserve
	Peveto Woods Sanctuary

Coastal wetlands are highly sensitive to oiling and can be significantly impacted because of the inherent toxicity of hydrocarbon and non-hydrocarbon components of the spilled substances (Mendelssohn et al., 2012; Lin et al., 2016). Numerous variables such as oil concentration and chemical composition, vegetation type and density, season or weather, preexisting stress levels, soil types, and water levels may influence the impacts of oil exposure on wetlands. Light oiling could cause plant die-back, followed by recovery in a fairly short time. Vegetation exposed to oil that persists in wetlands could take years to recover (BOEM, 2017a). However, in a study in Barataria Bay, Louisiana, after the *Deepwater Horizon* spill, Silliman et al. (2012) reported that previously healthy marshes largely recovered to a pre-oiling state within 18 months. At 103 salt marsh locations that spanned 267 miles (430 km) of shoreline in Louisiana, Mississippi, and Alabama, Silliman et al. (2016) determined a threshold for oil impacts on marsh edge erosion with higher erosion rates occurring for approximately 1 to 2 years after the *Deepwater Horizon* spill at sites with the highest amounts of plant stem oiling (90% to 100%); thus, displaying a large-scale ecosystem loss.

In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates (BOEM, 2017a). A review of the literature and new studies indicated that oil spill impacts to seagrass beds are often limited and may be limited to when oil is in direct contact with these plants (Fonseca et al., 2017). However, if oiling were to occur, oil within the estuarine sediments may pose the risk of periodic re-releases of oil in the area, causing potential secondary impacts to the localized area (BOEM, 2023). Impacts associated with an extensive oiling of coastal wetland habitat are expected to be significant.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.8 Socioeconomic and Other Resources

C.8.1 Recreational and Commercial Fishing

Potential impacts to recreational and commercial fishing are analyzed by BOEM (2017a). The major species sought by commercial fishermen in federal waters of the Gulf of Mexico include shrimp, menhaden, red snapper (*Lutjanus campechanus*), tunas, and groupers (BOEM, 2017a). However, most of the fishing effort for these species is on the continental shelf in shallow waters. The main commercial fishing activity in deep waters of the northern Gulf of Mexico is pelagic longlining for tunas, swordfishes, and other billfishes (Continental Shelf Associates, 2002; Beerkircher et al., 2009). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

It is unlikely that any commercial fishing activity other than longlining will occur at or near the project area due to the water depth. Benthic species targeted by commercial fishers occur on the upper continental slope, well inshore of the project area. Royal red shrimp (*Pleoticus robustus*) are caught by trawlers in water depths of approximately 820 to 1,804 ft (250 to 550 m) (Stiles et al., 2007). Tilefishes (primarily *Lopholatilus chamaeleonticeps*) are caught by bottom longlining in water depths from approximately 540 to 1,476 ft (165 to 450 m) (Continental Shelf Associates, 2002).

Most recreational fishing activity in the region occurs in water depths less than 656 ft (200 m) (Continental Shelf Associates, 1997, 2002; Keithly and Roberts, 2017). In deeper water, the main attraction to recreational fishers is petroleum rigs offshore Texas and Louisiana. Due to the project site's distance from shore, it is unlikely that recreational fishing activity is occurring in the project area.

The only routine IPF that could potentially affect fisheries (commercial and recreational) is vessel presence (including noise and lights). Two types of potential accidents are also addressed in this section: a small fuel spill and a large oil spill.

Impacts of Vessel Presence (including noise and lights)

There is a slight possibility of pelagic longlines becoming entangled in the MODU and/or installation vessel. For example, in January 1999, a portion of a pelagic longline snagged on the acoustic Doppler current profiler of a drillship working in the Gulf of Mexico (Continental Shelf Associates, 2002). The line was removed without incident. Generally, longline fishers use radar and are aware of offshore structures and ships when placing their sets. Therefore, little or no impact on pelagic longlining is expected.

No other adverse impacts on fishing activities are anticipated. The presence of the MODU and/or installation vessel would result in a limited area being unavailable for fishing activity, but this effect is considered negligible. Other factors such as effluent discharges are likely to have negligible impacts on commercial or recreational fisheries due to rapid dispersion, the small area of ocean affected, and the intermittent nature of the discharges.

Impacts of a Small Fuel Spill

The probability of a fuel spill will be minimized by Shell's preventative measures during routine operations, including fuel transfer. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. DOCD Section 9b provides details on Shell's spill response measures. Given the open ocean location of the project area and the short duration of a small spill, the opportunity for impacts to occur would be very brief.

Pelagic longlining activities in the project area, if any, could be interrupted in the event of a small fuel spill. The area of diesel fuel on the sea surface would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. Fishing activities could be interrupted due to the activities of response vessels operating in the project area. A small fuel spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to dissipating (**Section A.9.1**).

Impacts of a Large Oil Spill

Potential spill impacts on fishing activities are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to this activity.

Pelagic longlining activities in the project area and other fishing activities in the northern Gulf of Mexico could be interrupted in the event of a large oil spill. A spill may or may not result in fishery closures, depending on the duration of the spill, the oceanographic and meteorological conditions at the time, and the effectiveness of spill response measures. Data from the *Deepwater Horizon* incident provide information about the maximum potential extent of fishery closures in the event of a large oil spill in the Gulf of Mexico. At its peak on 12 July 2010, closures encompassed 84,101 $miles^2$ (217,821 km^2), or 34.8% of the U.S. Gulf of Mexico Exclusive Economic Zone. BOEM (2012a) notes that fisheries closures from a large spill event could have a negative effect on short-term fisheries catch and marketability.

According to BOEM (2012a, 2017a), the potential impacts on commercial and recreational fishing activities from an accidental oil spill are anticipated to be minimal because the potential for oil spills is very low; the most typical events are small and of short duration; and the effects are so localized that fishes are typically able to avoid the affected area. Fish populations may be affected by an oil spill event should it occur, but they would be primarily affected if the oil reaches the productive shelf and estuarine areas where many fishes spend a portion of their life cycle. However, most species of commercially valuable fish in the Gulf of Mexico have planktonic eggs or larvae which may be affected by a large oil spill in deep water (BOEM, 2017a). The probability of an offshore spill affecting these nearshore environments is also low.

Should a large oil spill occur, economic impacts on commercial and recreational fishing activities would likely occur, but are difficult to predict because impacts would differ by fishery and season (BOEM, 2017a,c). Loss of consumer confidence and public health concerns can lead to the potential for economic loss since it is likely to result in seafood being withdrawn from the market. A loss of consumer confidence may also lead to price reductions or outright rejection of seafood products by commercial buyers and consumers. Quantifying financial loss due to loss in market confidence can be difficult, because it depends on reliable data being available to demonstrate both that sales have been lost and that prices have fallen as a direct consequence of the spill (International Tanker Owners Pollution Federation Limited, 2014). An analysis of the effects of the *Deepwater Horizon* incident on the seafood industry in the Gulf of Mexico estimated that the spill reduced total seafood sales by $51.7 to $952.9 million, with an estimated loss of 740 to 9,315 seafood-related jobs (Carroll et al., 2016).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of a large spill, impacts to recreational and commercial fishing are expected to be significantly adverse for up to several years. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.8.2 Public Health and Safety

There are no IPFs associated with routine operations that are expected to affect public health and safety. A small fuel spill that is dissipated within a few days would have little or no impact on public health and safety, as the spill response would be completed entirely offshore, 141 miles (227 km) from the nearest shoreline (Texas). A large oil spill is the only IPF that has the potential to affect public health and safety.

Impacts of a Large Oil Spill

In the event of a large spill from a blowout, the main safety and health concerns are those of the offshore personnel involved in the incident and those responding to the spill. The proposed activities will be covered by the OSRP and, in addition, the MODU and installation vessel maintains a Shipboard Oil Pollution Emergency Plan as required under MARPOL 73/78.

Depending on the spill rate and duration, the physical and chemical characteristics of the oil, the meteorological and oceanographic conditions at the time, and the effectiveness of spill response measures, the public could be exposed to oil on the water and along the shoreline, through skin contact or inhalation of VOCs. Crude oil is a highly flammable material, and any smoke or vapors from a crude oil fire can cause irritation. Exposure to large quantities of crude oil may pose a health hazard.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. No significant spill impacts on public health and safety are expected.

C.8.3 Employment and Infrastructure

There are no IPFs associated with routine operations that are expected to affect employment and infrastructure. The project involves drilling with support from existing shore-based facilities in Louisiana and Texas. No new or expanded facilities will be constructed, and no new employees are expected to move permanently into the area. The project will have a negligible impact on socioeconomic conditions such as local employment and existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water). A small fuel spill that is dissipated within a few days would have little or no economic impact, as the spill response would use existing facilities, resources, and personnel. A large oil spill is the only IPF that has the potential to affect employment and infrastructure.

Impacts of a Large Oil Spill

Potential socioeconomic impacts of an oil spill are discussed by BOEM (2016b, 2017a). For this DOCD, there are no unique site-specific issues with respect to employment and coastal infrastructure. A large spill could cause several types of economic impacts: extensive fishery closures could put fishermen out of work; temporary employment could increase as part of the response effort; adverse publicity could reduce employment in coastal recreation and tourism industries; and OCS drilling activities, including service and support operations that are an important part of local economies, could be suspended.

Nonmarket effects such as traffic congestion, strains on public services, shortages of commodities or services, and disruptions to the normal patterns of activities or expectations could also occur in the short term. These negative, short-term social and economic consequences of a spill are expected to be modest in terms of projected cleanup expenditures and the number of people employed in cleanup and remediation activities (BOEM, 2017a). Net employment impacts from a spill would not be expected to exceed 1% of baseline employment in any given year (BOEM, 2017a).

The project area is 141 miles (227 km) from the nearest shoreline (Texas) and, based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, coastal areas of Texas between Cameron and Matagorda Counties could be affected within 10 days (1% conditional probability). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted. A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. No significant spill impacts on employment and infrastructure are expected.

C.8.4 Recreation and Tourism

For this DOCD, there are no unique site-specific issues with respect to recreation and tourism. There are no known recreational or tourism uses in the project area. Recreational resources and tourism in coastal areas would not be affected by routine activities due to the distance from shore. Compliance with NTL BSEE-2015-G013 (See **Table 1**) will minimize the chance of trash or debris being lost overboard from the MODU and/or installation vessel and subsequently washing up on beaches. As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to dissipating. Therefore, a small fuel spill in the project area would be unlikely to affect recreation and tourism. A large oil spill is the only IPF that has the potential to affect recreation and tourism.

Impacts of a Large Oil Spill

Potential impacts of an oil spill on recreation and tourism are discussed by BOEM (2017a). For this DOCD, there are no unique site-specific issues with respect to these impacts.

Impacts on recreation and tourism would vary depending on the duration of the spill and its fate, including the effectiveness of response measures. A large spill that reached coastal waters and shorelines could adversely affect recreation and tourism by contaminating beaches and wetlands, resulting in negative publicity that encourages people to stay away. Loss of tourist confidence and public health concerns can then lead to the potential for economic loss. Media coverage of oil contamination, or word-of-mouth, can have implications on public perception of the incident. However, quantifying financial loss due to loss in confidence can be difficult because it depends on implementation of an effective response plan as well as a strategy to restore any loss of appeal to tourists that the area may have suffered.

According to BOEM (2017a), should an oil spill occur and contact a beach area or other recreational resource, it would cause some disruption during the impact and cleanup phases of the spill. However, these effects are also likely to be small in scale and of short duration, in part because the probability of an offshore spill contacting most beaches is small. Based on the 30-day OSRA modeling (**Table 3**), coastal areas would not likely be affected within 3 days; however, coastal areas of Texas between Cameron and Matagorda Counties could be affected within 10 days (1% conditional probability). Within 30 days, shoreline segments of 11 Texas counties and 1 Louisiana parish have a 1% to 10% conditional probability of being contacted. In the unlikely event that a spill occurs that is sufficiently large to affect areas of the coast and, through public perception, have effects that reach beyond the damaged area, effects to recreation and tourism could be significant (BOEM, 2017a).

Impacts of the *Deepwater Horizon* incident on recreation and tourism provide some insight into the potential effects of a large spill. NOAA (2016a) estimated that the public lost 16,857,116 user-days of fishing, boating, and beach-going experiences as a result of the spill. The U.S. Travel Association has estimated the economic impact of the *Deepwater Horizon* incident on tourism across the Gulf Coast over a 3-year period at $22.7 billion (Oxford Economics, 2010). Hotels and restaurants were the most affected tourism businesses, but charter fishing, marinas, and boat dealers and sellers were among the others affected (Eastern Research Group, 2014).

However, a blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the event of a large spill, impacts to recreation and tourism are expected to be adverse, but likely temporary. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures.

C.8.5 Land Use

Land use along the northern Gulf Coast is discussed by BOEM (2016b, 2017a). There are no routine IPFs potentially affecting land use. The project will use existing onshore support facilities in Louisiana and Texas. The land use at the existing shorebase sites is industrial. The project will not involve new construction or changes to existing land use and, therefore, will not have any impacts. Levels of boat and helicopter traffic as well as demand for goods and services, including scarce coastal resources, will represent a small fraction of the level of activity occurring at the shorebases.

A large oil spill is the only relevant accidental IPF. A small fuel spill would not have impacts on land use, as the response would be staged out of existing shorebases and facilities.

Impacts of a Large Oil Spill

The initial response for a large oil spill would be staged out of existing facilities, with no effect on land use. A large spill could have limited temporary impacts on land use along the coast if additional staging areas were needed. For example, during the *Deepwater Horizon* incident, 25 temporary staging areas were established in Louisiana, Mississippi, Alabama, and Florida for spill response and cleanup efforts (BOEM, 2012a). In the event of a large spill in the project area, similar temporary staging areas could be needed. These areas would eventually return to their original use as the response is demobilized.

An oil spill is not likely to significantly affect land use and coastal infrastructure in the region, in part because an offshore spill would have a small probability of contacting onshore resources. BOEM (2016b) states that landfill capacity would probably not be an issue at any phase of an oil spill event or the long-term recovery. In the case of the *Deepwater Horizon* incident and response, USEPA reported that existing landfills receiving oil spill waste had sufficient capacity to handle waste volumes; the wastes that were disposed of in landfills represented less than 7% of the total daily waste normally accepted at these landfills (USEPA, 2016).

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. No significant spill impacts on land use are expected.

C.8.6 Other Marine Uses

The project area is not located within any USCG-designated fairway or shipping lane. The project area is located within Military Warning Area W-602. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircrafts. A large oil spill is the only relevant IPF that could affect other marine uses. A small fuel spill would not have impacts on other marine uses because the spill and response activities would be mainly within the project area, and the duration would be brief.

Impacts of a Large Oil Spill

An accidental spill would be unlikely to significantly affect shipping or other marine uses. In the event of a large spill requiring numerous response vessels, coordination would be required to manage the vessel traffic for safe operations.

A blowout resulting in a large oil spill is a rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in DOCD Section 2j. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. DOCD Section 9b provides detail on spill response measures. No significant spill impacts on other marine uses are expected.

C.9 Cumulative Impacts[1]

Prior Studies. Prior to the lease sales, BOEM and its predecessors prepared multisale EISs to analyze the environmental impact of activities that might occur in the multisale area. BOEM and its predecessors also analyzed the impacts from all planned activities of OCS exploration activities similar to those planned in this DOCD in several documents. The level and types of activities planned in Shell's DOCD are within the range of activities described and evaluated by BOEM (2012a,b, 2013, 2014, 2015, 2016a,b, 2017a, 2023). Past, present, and reasonably foreseeable activities were identified in these documents, which are incorporated by reference. The proposed action will not result in any additional impacts beyond those evaluated in the multisale and Final EISs.

Description of Planned Actions to Occur in the Vicinity of Project Area. Shell does not anticipate other projects in the vicinity of the project area beyond the types of projects analyzed in the lease sale and Supplemental EISs (BOEM, 2012a, 2013, 2014, 2015, 2016b, 2017a, 2023).

Impacts of Other Planned Activities in the Development Operations Coordination Document. The BOEM (2017a) Final EIS included a lengthy discussion of impacts of planned activities, which analyzed the environmental and socioeconomic impacts from the incremental impact of the

[1] On May 20, 2022, NEPA original requirements came into effect and were reinstated by the Council on Environmental Quality (CEQ), which is responsible for Federal agency implementation of NEPA.

10 proposed lease sales, in addition to all activities (including non-OCS activities) projected to occur from past, proposed, and future lease sales. The EISs considered exploration, delineation, and development wells; platform installation; service vessel trips; and oil spills. The EISs examined the potential effects of the planned actions on each specific resource for the entire Gulf of Mexico.

The EIA incorporates and builds on these analyses by examining the potential impacts on physical, biological, and socioeconomic resources from the work planned in this DOCD, in conjunction with the other reasonably foreseeable activities expected to occur in the Gulf of Mexico. Thus, for all impacts, the incremental contribution of Shell's proposed actions to the impacts from all planned activities in these prior analyses is not considered significant.

C.9.1 Impacts to Physical/Chemical Resources

The work planned in this DOCD is limited in geographic scope and the impacts on the physical/chemical environment will be correspondingly limited.

Air Quality. Emissions from pollutants into the atmosphere from activities are not projected to have significant effects on onshore air quality because of the distance from shore, the prevailing atmospheric conditions, emission rates and heights, and resulting pollutant concentrations. As BOEM found in the multisale EISs, the incremental contribution of activities similar to Shell's proposed activities is not significant and will not cause or contribute to a violation of NAAQS (BOEM, 2012a, 2013, 2014, 2015, 2016b, 2017a, 2023). In addition, the planned actions contribution to visibility impairment is also very small. As mentioned in previous sections, projected emissions meet BOEM's exemption criteria and would not contribute to the impacts from all planned activities on air quality.

Climate Change. CO_2 and CH_4 emissions from the project would constitute a negligible contribution to greenhouse gas emissions from all OCS activities. According to BOEM (2013), greenhouse gas emissions from all OCS oil and gas activities make up a very small portion of national CO_2 emissions, and BOEM does not believe that emissions directly attributable to OCS activities are a significant contributor to global greenhouse gas levels. Greenhouse gas emissions identified in this DOCD represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter any of the climate change impacts evaluated in the previous EISs.

Water Quality. Shell's project may result in some minor water quality impacts due to the NPDES-permitted discharge of drilling muds and cuttings, treated sanitary and domestic wastes, non-contact cooling water, deck drainage, desalination unit brine, non-contaminated well treatment, completion, and workover fluids, BOP fluid, subsea production control fluid, excess cement, hydrate inhibitor, uncontaminated fire water, bilge water and ballast water. These effects are expected to be minor (localized to the area within a few hundred meters of the MODU and/or installation vessel) and temporary (lasting only hours longer than the disturbance or discharge). Any impacts from all planned activities to water quality are unquantifiable and expected to be negligible.

Archaeological Resources. No known shipwrecks or other archaeological artifacts were identified in the project area (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018). The project area is well beyond the 197-ft (60-m) depth contour used by BOEM as the seaward extent for prehistoric archaeological site potential in the Gulf of Mexico. Therefore, Shell's operations will have no impacts from all planned activities on historic shipwrecks or prehistoric archaeological resources.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2017a, 2023) has been incorporated into the EIA, where applicable.

C.9.2 Impacts to Biological Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on biological resources will be correspondingly limited.

Seafloor Habitats and Biota. Effects on seafloor habitats and biota from discharges of drilling mud and cuttings are expected to be minor and limited to a small area. The shallow hazards assessment did not identify any features that could support significant high-density deepwater benthic communities within 2,000 ft (610 m) of the proposed wellsites nor 500 ft (152 m) of the proposed subsea infrastructure (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018).

Areas that may support high-density deepwater benthic communities will be avoided as required by NTL 2009-G40. Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope, and the extent of benthic impacts during this project is insignificant regionally. As noted in the multisale EISs, the incremental contributions of activities similar to Shell's proposed activities to the impacts from all planned activities is not significant (BOEM, 2012a,b, 2013, 2014, 2015, 2016b, 2017a, 2023).

Threatened, Endangered, and Protected Species. Threatened, Endangered, and protected species that could occur in the project area include the sperm whale, Rice's whale, oceanic whitetip shark, giant manta ray, and five species of sea turtles. Potential impact sources include the MODU and installation vessel traffic. Potential effects for these species would be limited and temporary and would be reduced by Shell's compliance with BOEM-required mitigation measures, including NTLs BSEE-2015-G013 and BOEM-2016-G01 and NMFS (2020a, 2021) Appendix B and C. No significant impacts from all planned activities are expected.

Coastal and Marine Birds. Birds may be exposed to contaminants, including air pollutants and routine discharges, but significant impacts are unlikely due to rapid dispersion. Shell's compliance with NTL BSEE-2015-G013 will minimize the likelihood of debris-related impacts on birds. Support vessel and helicopter traffic may disturb some foraging and resting birds; however, it is likely that individual birds would experience, at most, only short-term behavioral disruption.

Due to the limited scope, timing, and geographic extent of the proposed activities, collisions or other adverse effects are unlikely, and no significant impacts from all planned activities are expected.

Fisheries Resources. Exploration and production structures occur in the vicinity of the project area. The additional effect of the proposed activities would be negligible.

Coastal Habitats. Due to the distance of the project area from shore, routine activities are not expected to have any impacts on beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases are not in wildlife refuges or wilderness areas. Support operations, including the crew boat and supply boats, may have a minor incremental impact on coastal habitats. Over time with a large number of vessel trips, vessel wakes can erode shorelines along inlets, channels, and harbors. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2012a,b, 2013, 2014, 2015, 2016a,b, 2017a, 2023) has been incorporated into the EIA, where applicable.

C.9.3 Impacts to Socioeconomic Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on socioeconomic resources will be correspondingly limited.

The multisale and Supplemental and Final EISs analyzed the impacts from all planned activities of oil and gas exploration and development in the project area, in combination with other impact-producing activities, on commercial fishing, recreational fishing, recreational resources, historical and archaeological resources, land use and coastal infrastructure, demographics, and environmental justice (BOEM, 2012a, 2013, 2014, 2015, 2016b, 2017a, 2023). BOEM also analyzed the economic impact of oil and gas activities on the Gulf States, finding only minor impacts in most of Texas, Mississippi, Alabama, and Florida, more significant impacts in parts of Texas, and substantial impacts on Louisiana.

Shell's proposed activities will have negligible impacts from all planned activities on socioeconomic resources. There are no IPFs associated with routine operations that are expected to affect public health and safety, employment and infrastructure, recreation and tourism, land use, or other marine uses. Due to the distance from shore, it is unlikely that any recreational fishing activity is occurring in the project area, and it is unlikely that any commercial fishing activity other than longlining occurs at or near the project area. The project will have negligible impacts on fishing activities.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2017a) has been incorporated into the EIA, where applicable.

D. Environmental Hazards

D.1 Geologic Hazards

Based on the results of high-resolution geophysical surveys the proposed wellsites appear suitable for the planned activities (Geoscience Earth and Marine Services, 2001, 2004; C&C Technologies, 2012, 2015; Fugro Geoservices Inc., 2015a,b; Shell, 2017; Oceaneering Inc., 2018). See DOCD Section 6a for supporting geological and geophysical information.

D.2 Severe Weather

Under most circumstances, weather is not expected to have any effect on the proposed activities. Extreme weather, including high winds, strong currents, and large waves, was considered in the design criteria for the MODU and installation vessel. High winds and limited visibility during a severe storm could disrupt communication and support activities (vessel and helicopter traffic) and make it necessary to suspend some activities on the MODU and installation vessel for safety reasons until the storm or weather event passes.

From 1992 to 2022, 48 tropical storms and/or hurricanes have shut down oil and gas activities in the Gulf of Mexico (BSEE, 2023). Damage was minimal from the storms in 2017 to 2022 and only Hurricane Ida in 2021 caused an accidental release from a ruptured pipeline and well head off the Louisiana coastline (BOEM, 2023). In the event of a hurricane, procedures in Shell's Hurricane Evacuation Plan would be followed.

D.3 Currents and Waves

A rig-based acoustic Doppler current profiler will be used to continuously monitor the current beneath the MODU. Metocean conditions, such as sea state, wind speed, ocean currents, etc., will also be continuously monitored. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the MODU and installation vessel. High waves during a severe storm could disrupt support activities (i.e., vessel and helicopter traffic) and make it necessary to suspend some activities on the MODU and installation vessel for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in this DOCD. However, various technical and operational options, including the location of the proposed wellsites and the selection of a DP MODU and installation vessel, were considered by Shell in developing the proposed action. There are no other reasonable alternatives to accomplish the goals of this project.

F. Mitigation Measures

The proposed action includes numerous mitigation measures required by laws, regulations, and BOEM lease stipulations and NTLs. The project will comply with applicable federal, state, and local requirements concerning air pollutant emissions, discharges to water, and solid waste disposal. Project activities will be conducted under Shell's OSRP and will include the measures described in DOCD Section 2j.

G. Consultation

No persons beyond those cited as Preparers (**Section H.**, **Preparers**) or agencies were consulted regarding potential impacts associated with the proposed activities during the preparation of the EIA.

H. Preparers

The EIA was prepared for Shell Offshore Inc. by its contractor, CSA Ocean Sciences Inc. Contributors included the following:

- Kathleen Gifford (Project Scientist, CSA Ocean Sciences Inc.);
- Deborah Murray (Document Production Services Manager, CSA Ocean Sciences Inc.);
- Ciarra Martin (GIS Specialist, CSA Ocean Sciences Inc.);
- JP Matsuura (Project Engineer, Shell International Exploration & Production);
- Justin Landry (Project Engineer, Shell International Exploration & Production);
- Tracy Albert (Senior Regulatory Specialist, Shell Exploration & Production Co.);
- Andrew Koller (Regulatory Specialist, Shell International Exploration & Production);
- Robin Voosen (Regulatory Specialist, Shell Exploration & Production Co.);
- Joshua O'Brien (Senior Environmental Engineer, Shell Exploration & Production Co.);
- Carson Morey (Environmental Engineer, Shell Exploration & Production Co.); and
- Tim Langford (Emergency Management Advisor, Shell Exploration & Production Co.).

I. References

Abbriano, R.M., M.M. Carranza, S.L. Hogle, R.A. Levin, A.N. Netburn, K.L. Seto, S.M. Snyder, and P.J.S. Franks. 2011. *Deepwater Horizon* oil spill: A review of the planktonic response. Oceanography 24(3): 294-301.

ABS Consulting Inc. 2016. 2016 Update of Occurrence Rates for Offshore Oil Spills. Prepared for the Bureau of Ocean Energy Management and the Bureau of Safety and Environmental Enforcement. Contract # E15PX00045, Deliverable 7. https://www.bsee.gov/sites/bsee.gov/files/osrr-oil-spill-response-research//1086aa.pdf.

ABSG Consulting Inc. 2018. US Outer Continental Shelf Oil Spill Statistics. Arlington (VA): Prepared for US Department of the Interior, Bureau of Ocean Energy Management. OCS Study BOEM 2018-006. 38 pp.

Ackleh, A.S., G.E. Ioup, J.W. Ioup, B. Ma, J.J. Newcomb, N. Pal, N.A. Sidorovskaia, and C. Tiemann. 2012. Assessing the *Deepwater Horizon* oil spill impact on marine mammal population through acoustics: endangered sperm whales. Journal of the Acoustical Society of America 131(3): 2306-2314.

Almeda, R., Z. Wambaugh, Z. Wang, C. Hyatt, Z. Liu, and E.J. Buskey. 2013. Interactions between zooplankton and crude oil: toxic effects and bioaccumulation of polycyclic aromatic hydrocarbons. PLoS ONE 8(6): e67212.

Anderson, C.M., M. Mayes, and R. LaBelle. 2012. Update of Occurrence Rates for Offshore Oil Spills. U.S. Department of the Interior, Bureau of Ocean Energy Management and Bureau of Safety and Environmental Enforcement. OCS Report BOEM 2012-069, BSEE 2012-069. 76 pp.

Auffret, M., M. Duchemin, S. Rousseau, I. Boutet, A. Tanguy, D. Moraga, and A. Marhic. 2004. Monitoring of immunotoxic responses in oysters reared in areas contaminated by the Erika oil spill. Aquatic Living Resources 17(3): 297-302.

Baguley, J.G., P.A. Montagna, C. Cooksey, J.L. Hyland, H.W. Bang, C.L. Morrison, A. Kamikawa, P. Bennetts, G. Saiyo, E. Parsons, M. Herdener, and M. Ricci. 2015. Community response of deep-sea soft-sediment metazoan meiofauna to the *Deepwater Horizon* blowout and oil spill. Marine Ecology Progress Series 528: 127-140.

Barkaszi, M.J. and C.J. Kelly. 2018. Seismic Survey Mitigation Measures and Protected Species Observer Reports: Synthesis Report. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. Contract No.: M17PD00004. OCS Study BOEM 2019-012. 141 pp. + apps.

Barkaszi, M.J., M. Butler, R. Compton, A. Unietis, and B. Bennett. 2012. Seismic Survey Mitigation Measures and Marine Mammal Observer Reports. New Orleans, LA. OCS Study BOEM 2012-015. 28 pp. + apps.

Barkuloo, J.M. 1988. Report on the Conservation Status of the Gulf of Mexico sturgeon, *Acipenser oxyrinchus desotoi*. U.S. Department of the Interior, U.S. Fish and Wildlife Service. Panama City, FL.

Baum, J.K. and R.A. Myers. 2004. Shifting baselines and the decline of pelagic sharks in the Gulf of Mexico. Ecology Letters 7(2): 135-145.

Beerkircher, L., C.A. Brown, and V. Restrepo. 2009. Pelagic Observer Program Data Summary, Gulf of Mexico Bluefin Tuna (*Thunnus thynnus*) Spawning Season 2007 and 2008; and Analysis of Observer Coverage Levels. NOAA Technical Memorandum NMFS-SEFSC-588. 33 pp.

Bélanger, L. and J. Bédard. 1989. Responses of staging greater snow geese to human disturbance. Journal of Wildlife Management 53(3): 713-719.

Bellas, J., L. Saco-Álvarez, Ó. Nieto, J.M. Bayona, J. Albaigés, and R. Beiras. 2013. Evaluation of artificially-weathered standard fuel oil toxicity by marine invertebrate embryo-genesis bioassays. Chemosphere 90: 1103-1108.

Belter, M., J. Blondeau, C. Donovan, K. Edwards, I. Enochs, N. Formel, E. Geiger, S. Gittings, J. Grove, S. Groves, E. Hickerson, M. Johnston, H. Kelsey, K. Lohr, N. Miller, M. Nuttall, G.P. Schmahl, E. Towle, and S. Viehman. 2020. Coral Reef Condition: A Status Report for the Flower Garden Banks. NOAA Coral Reef Conservation Program. 7 pp.

Bergman, D.A. and P.A. Moore. 2005. The role of chemical signals in the social behavior of crayfish. Chemical Senses 30: i305-i306.

Berrojalbiz, N., S. Lacorte, A. Calbet, E. Saiz, C. Barata, and J. Dachs. 2009. Accumulation and cycling of polycyclic aromatic hydrocarbons in zooplankton. Environmental Science & Technology 43: 2295-2301.

Berry, M., D.T. Booth, and C.J. Limpus. 2013. Artificial lighting and disrupted sea-finding behaviour in hatchling loggerhead turtles (*Caretta caretta*) on the Woongarra coast, south-east Queensland, Australia. Australian Journal of Zoology 61(2): 137-145.

Biggs, D.C. and P.H. Ressler. 2000. Water column biology, pp. 141-188. In: Deepwater Gulf of Mexico Environmental and Socioeconomic Data Search and Literature Synthesis. Volume I: Narrative Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2000-049. 340 pp.

BirdLife International. 2020. Piping Plover *Charadrius melodus*. The IUCN Red List of Threatened Species 2020. https://www.iucnredlist.org/species/22693811/182083944.

Blackburn, M., C.A.S. Mazzacano, C. Fallon, and S.H. Black. 2014. Oil in Our Oceans. A Review of the Impacts of Oil Spills on Marine Invertebrates. The Xerces Society for Invertebrate Conservation, Portland, OR. 160 pp.

Blackwell, S.B. and C.R. Greene Jr. 2003. Acoustic Measurements in Cook Inlet, Alaska, during August 2001. Greeneridge Sciences, Inc., for NMFS, Anchorage, AK. 43 pp.

Boehm, P., D. Turton, A. Raval, D. Caudle, D. French, N. Rabalais, R. Spies, and J. Johnson. 2001. Deepwater Program: Literature Review, Environmental Risks of Chemical Products used in Gulf of Mexico Deepwater Oil and Gas Operations. Volume I: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2001-011. 326 pp.

Bolle, L.J., C.A.F. de Jong, S.M. Bierman, P.J.G. Van Beek, O.A. van Keeken, P.W. Wessels, C.J.G. van Damme, H.V. Winter, D. de Haan, and R.P.A. Dekeling. 2012. Common sole larvae survive high levels of pile-driving sound in controlled exposure experiments. PLoS One 7(3): e33052.

Bonde, R.K. and T.J. O'Shea. 1989. Sowerby's beaked whale (*Mesoplodon bidens)* in the Gulf of Mexico. Journal of Mammalogy 70: 447-449.

Brame, A.B., T.R. Wiley, J.K. Carlson, S.V. Fordham, R.D. Grubbs, J. Osborne, R.M. Scharer, D.M. Bethea, and G.R. Poulakis. 2019. Biology, ecology, and status of the smalltooth sawfish *Pristis pectinata* in the USA. Endangered Species Research 39: 9-23.

Brooks, J.M., C. Fisher, H. Roberts, E. Cordes, I. Baums, B. Bernard, R. Church, P. Etnoyer, C. German, E. Goehring, I. McDonald, H. Roberts, T. Shank, D. Warren, S. Welsh, and G. Wolff. 2012. Exploration and Research of Northern Gulf of Mexico Deepwater Natural and Artificial Hard-bottom Habitats with Emphasis on Coral Communities: Reefs, Rigs, and Wrecks — "Lophelia II" Interim Report. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study BOEM 2012-106. 126 pp.

Bruintjes, R. and A.N. Radford. 2013. Context-dependent impacts of anthropogenic noise on individual and social behaviour in a cooperatively breeding fish. Animal Behaviour 85(6): 1343-1349.

Buehler, D.A. 2000. Bald Eagle (*Haliaeetus leucocephalus*), version 2.0. In: A.F. Poole and F.B. Gill (Eds.), The Birds of North America, Cornell Lab of Ornithology, Ithaca, NY, USA. https://birdsna.org/Species-Account/bna/species/baleag/introduction.

Bureau of Ocean Energy Management, Regulation, and Enforcement. 2010. Federal & Academic Scientists Return from Deep-sea Research Cruise in Gulf of Mexico: Scientists Observe Damage to Deep-sea Corals. U.S. Department of the Interior, Bureau of Ocean Energy Management, Regulation, and Enforcement. https://www.boem.gov/BOEM-Newsroom/Press-Releases/2010/press1104a.aspx.

Bureau of Ocean Energy Management. 2012a. Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017. Western Planning Area Lease Sales 229, 233, 238, 246, and 248. Central Planning Area Lease Sales 227, 231, 235, 241, and 247. Final Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 92012-019. 3 volumes.

Bureau of Ocean Energy Management. 2012b. Gulf of Mexico OCS Oil and Gas Lease Sale: 2012. Central Planning Area Lease Sale 216/222. Final Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 2012-058. 2 volumes.

Bureau of Ocean Energy Management. 2013. Gulf of Mexico OCS Oil and Gas Lease Sales: 2013-2014. Western Planning Are Lease Sale 233. Central Planning Area 231. Final Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 2013-0118. 526 pp.

Bureau of Ocean Energy Management. 2014. Gulf of Mexico OCS Oil and Gas Lease Sales: 2015-2017. Central Planning Area Lease Sales 235, 241, and 247. Final Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 2014-655. 838 pp.

Bureau of Ocean Energy Management. 2015. Gulf of Mexico OCS Oil and Gas Lease Sales: 2016 and 2017. Central Planning Area Lease Sales 241 and 247; Eastern Planning Area Lease Sale 226. Final Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 2015-033. 748 pp.

Bureau of Ocean Energy Management. 2016a. Outer Continental Shelf Oil and Gas Leasing Program: 2017-2022. Final Programmatic Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. OCS EIS/EIA BOEM 2016-060.

Bureau of Ocean Energy Management. 2016b. Gulf of Mexico OCS Oil and Gas Lease Sale: 2016. Western Planning Area Lease Sale 248. Final Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 2016-005.

Bureau of Ocean Energy Management. 2016c. Essential Fish Habitat Assessment for the Gulf of Mexico. USDOI. New Orleans, LA. OCS Report BOEM 2016-016.

Bureau of Ocean Energy Management. 2017a. Gulf of Mexico OCS Oil and Gas Lease Sales: 2017-2022. Gulf of Mexico Lease Sales 249, 250, 251, 252, 253, 254, 256, 257, 259, and 261. Final Multisale Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA.

Bureau of Ocean Energy Management. 2017b. Gulf of Mexico OCS Oil and Gas Lease Sale. Final Supplemental Environmental Impact Statement 2018. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS EIS/EA BOEM 2017-074.

Bureau of Ocean Energy Management. 2017c. Catastrophic Spill Event Analysis: High-Volume, Extended Duration Oil Spill Resulting from Loss of Well Control on the Gulf of Mexico Outer Continental Shelf. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study BOEM 2017-007. 339 pp.

Bureau of Ocean Energy Management. 2023. Gulf of Mexico OCS Oil and Gas Lease Sale: Lease Sales 259 and 261. Final Supplemental Environmental Impact Statement. U.S. Department of the Interior, Bureau of Ocean Energy Management, New Orleans Office. OCS EIS/EA BOEM 2023-001.

Bureau of Safety and Environmental Enforcement. 2021. Offshore Incident Statistics. U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement. https://www.bsee.gov/stats-facts/offshore-incident-statistics.

Bureau of Safety and Environmental Enforcement. 2023. Hurricane Activity Updates. https://www.bsee.gov/resources-tools/planning-preparedness/hurricane/hurricane-history.

C&C Technologies. 2012. Hazards and Subsidence Monitoring Report, Block 857 and Vicinity, Alaminos Canyon Area, Gulf of Mexico. Project No. 120261.

C&C Technologies. 2015. Archaeological Assessment, Block 815 (OCS-G-19409) & Vicinity, Alaminos Canyon Area, Gulf of Mexico. Project No. 150440.

Camhi, M.D., E.K. Pikitch, and E.A. Babcock. 2008. Sharks of the Open Ocean: Biology, Fisheries, and Conservation. Oxford, UK., Blackwell Publishing Ltd. 502 pp.

Camilli, R., C.M. Reddy, D.R. Yoerger, B.A. Van Mooy, M.V. Jakuba, J.C. Kinsey, C.P. McIntyre, S.P. Sylva, and J.V. Maloney. 2010. Tracking hydrocarbon plume transport and biodegradation at *Deepwater Horizon*. Science 330(6001): 201-204.

Carlson, J.K. and J. Osborne. 2012. Relative abundance of smalltooth sawfish (*Pristis pectinata*) based on Everglades National Park Creel Survey. NOAA Technical Memorandum NMFS-SEFSC-626. 15 pp. https://repository.library.noaa.gov/view/noaa/4326.

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

Carmichael, R.H., W.M. Graham, A. Aven, G. Worthy, and S. Howden. 2012. Were multiple stressors a 'perfect storm' for northern Gulf of Mexico bottlenose dolphins (*Tursiops truncatus*) in 2011? PLoS One 7(7): e41155.

Carr, A. 1996. Suwanee River sturgeon, pp 73-83. In: M.H. Carr, A Naturalist in Florida. Yale University Press, New Haven, CT.

Carroll, M., B. Gentner, S. Larkin, K. Quigley, N. Perlot, L. Degner, and A. Kroetz. 2016. An Analysis of the Impacts of the *Deepwater Horizon* Oil Spill on the Gulf of Mexico Seafood Industry. U.S. Department of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study BOEM 2016-020.

Carvalho, R., C.-L. Wei, G.T. Rowe, and A. Schulze. 2013. Complex depth-related patterns in taxonomic and functional diversity of polychaetes in the Gulf of Mexico. Deep Sea Research I: Oceanographic Research Papers 80: 66-77.

Casper, B.M. and D.A. Mann. 2006. Evoked potential audiograms of the nurse shark (*Ginglymostoma cirratum*) and the yellow stingray (*Urobatis jamaicensis*). Environmental Biology of Fishes 76: 101-108.

Casper, B.M., P.S. Lobel, and H.Y. Yan. 2003. The hearing sensitivity of the little skate, *Raja erinacea*: a comparison of two methods. Environmental Biology of Fishes 68: 371–379.

Cave, E.J. and S.M. Kajiura. 2018. Effect of *Deepwater Horizon* crude oil water accommodated fraction on olfactory function in the Atlantic stingray, *Hypanus sabinus*. Scientific Reports 8: 15786.

Clapp, R.B., R.C. Banks, D. Morgan-Jacobs, and W.A. Hoffman. 1982a. Marine Birds of the Southeastern United States and Gulf of Mexico. Part I. Gaviiformes through Pelicaniformes. U.S. Fish and Wildlife Service, Office of Biological Services. Washington, DC. FWS/OBS-82/01.

Clapp, R.B., D. Morgan-Jacobs, and R.C. Banks. 1982b. Marine Birds of the Southeastern United States and Gulf of Mexico. Part II. Anseriformes. U.S. Fish and Wildlife Service, Office of Biological Services. Washington DC. FWS/OBS 82/20.

Clapp, R.B., D. Morgan-Jacobs, and R.C. Banks. 1983. Marine Birds of the Southeastern United States and Gulf of Mexico. Part III. Charadriiformes. U.S. Fish and Wildlife Service, Office of Biological Services. Washington, DC. FWS/OBS-83/30.

Colman, L.P., P.H. Lara, J. Bennie, A.C. Broderick, J.R. de Freitas, A. Marcondes, M.J. Witt, and B.J. Godley. 2020. Assessing coastal artificial light and potential exposure of wildlife at a national scale: the case of marine turtles in Brazil. Biodiversity and Conservation 29: 1135-1152.

Conn, P.B. and G.K. Silber. 2013. Vessel speed restrictions reduce risk of collision-related mortality for North Atlantic right whales. Ecosphere 4(4): 1-16.

Continental Shelf Associates, Inc. 1997. Characterization and Trends of Recreational and Commercial Fishing from the Florida Panhandle. U.S. Department of Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. USGS/BRD/CR-1997-0001 and OCS Study MMS 97-0020. 336 pp.

Continental Shelf Associates, Inc. 2002. Deepwater Program: Bluewater Fishing and OCS Activity, Interactions Between the Fishing and Petroleum Industries in Deepwaters of the Gulf of Mexico. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2002-078. 193 pp. + apps.

Continental Shelf Associates, Inc. 2004. Final Report: Gulf of Mexico Comprehensive Synthetic Based Muds Monitoring Program. Prepared for SBM Research Group. Submitted to Shell Global Solutions. Houston TX. 3 volumes.

Continental Shelf Associates, Inc. 2006. Effects of Oil and Gas Exploration and Development at Selected Continental Slope Sites in the Gulf of Mexico. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2006-045. 595 pp.

Cordes, E., M.P. McGinley, E.L. Podowski, E.L. Becker, S. Lessard-Pilon, S.T. Viada, and C.R. Fisher. 2008. Coral communities of the deep Gulf of Mexico. Deep Sea Research I: Oceanographic Research Papers 55(6): 777-787.

Cruz-Kaegi, M.E. 1998. Latitudinal Variations in Biomass and Metabolism of Benthic Infaunal Communities. Ph.D. Dissertation, Texas A&M University, College Station, TX.

Davis, R.W., W.E. Evans, and B. Würsig. 2000. Cetaceans, Sea Turtles, and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical Report. U.S. Geological Survey, Biological Resources Division, USGS/BRD/CR-1999-0006 and U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2000-003. 346 pp.

DeGuise, S., M. Levin, E. Gebhard, L. Jasperse, L.B. Hart, C.R. Smith, S. Venn-Watson, F.I. Townsend, R.S. Wells, B.C. Balmer, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Changes in immune functions in bottlenose dolphins in the northern Gulf of Mexico associated with the *Deepwater Horizon* oil spill. Endangered Species Research 33: 291-303.

Demopoulos, A.W.J., J.R. Bourque, E. Cordes, and K.M. Stamler. 2016. Impacts of the *Deepwater Horizon* oil spill on deep-sea coral-associated sediment communities. Marine Ecology Progress Series 561: 51-68.

Demopoulos, A.W.J., S.W. Ross, C.A. Kellogg, C.L. Morrison, M.S. Nizinski, N.G. Prouty, J.R. Borque, J.P. Galkiewicz, M.A. Gray, M.J. Springmann, D.K. Coykendall, A. Miller, M. Rhode, A.M. Quattrini, C.L. Ames, S. Brooke, J. McClain-Counts, E.B. Roark, N.A. Buster, R.M. Phillips, and J. Frometa. 2017. Deepwater Program: Lophelia II: Continuing Ecological Research on Deep-Sea Corals and Deep-reef Habitats in the Gulf of Mexico. U.S. Geological Survey Open-File Report 2017-1139. 269 pp.

Dias, L.A., J. Litz, L. Garrison, A. Martinez, K. Barry, and T. Speakman. 2017. Exposure of cetaceans to petroleum products following the *Deepwater Horizon* oil spill in the Gulf of Mexico. Endangered Species Research 33: 119-125.

Ditty, J.G. 1986. Ichthyoplankton in neritic waters of the northern Gulf of Mexico off Louisiana: Composition, relative abundance, and seasonality. Fishery Bulletin 84(4): 935-946.

Ditty, J.G., G.G. Zieske, and R.F. Shaw. 1988. Seasonality and depth distribution of larval fishes in the northern Gulf of Mexico above 26°00'N. Fishery Bulletin 86(4): 811-823.

Eastern Research Group, Inc. 2014. Assessing the Impacts of the *Deepwater Horizon* Oil Spill on Tourism in the Gulf of Mexico Region. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study BOEM 2014-661. 188 pp.

Edwards, R.E. and K.J. Sulak. 2006. New paradigms for yellowfin tuna movements and distributions – implications for the Gulf and Caribbean region. Proceedings of the Gulf and Caribbean Fisheries Institute 57: 283-296.

Efroymson, R.A., W.H. Rose, S. Nemeth, and G.W. Sutter II. 2001. Ecological Risk Assessment Framework for Low Altitude Overflights by Fixed-wing and Rotary-wing Military Aircraft. Oak Ridge National Lab, Oak Ridge, TN. ORNL/TM-2000/289. 116 pp.

Ellison, .T., Southall, B.L., Clark, C. . and rankel, A.S., 2012. A new context based approach to assess marine mammal behavioral responses to anthropogenic sounds. Conservation Biology 26(1): 21-28.

Equinor Australia B.V. (Equinor). 2019. Environment plan, Appendix 6-1, Underwater Sound Modelling Report. Stromlo-1 Exploration Drilling Program. Rev 1. April 2019. 49 pp.

Fertl, D., A.J. Schiro, G.T. Regan, C.A. Beck, and N. Adimey. 2005. Manatee occurrence in the northern Gulf of Mexico, west of Florida. Gulf and Caribbean Research 17(1): 69-94.

Fink, J. (Ed.). 2015. Chapter 10 – Cement Additives, pp. 317-367. In: Petroleum Engineer's Guide to Oil Field Chemicals and Fluids. 2nd Edition. Elsevier Science, San Diego, CA.

Finneran, J.J., E.E. Henderson, D.S. Houser, K. Jenkins, S. Kotecki, and J. Mulsow. 2017. Criteria and Thresholds for U.S. Navy Acoustic and Explosive Effects Analysis (Phase III). Technical report by Space and Naval Warfare Systems Center Pacific (SSC Pacific). 183 pp.

Fisher, C.R., A.W.J. Demopoulos, E.E. Cordes, I.B. Baums, H.K. White, and J.R. Borque. 2014a. Coral communities as indicators of ecosystem-level impacts of the *Deepwater Horizon* spill. BioScience 64: 796-807.

Fisher, C.R., P.Y. Hsing, C.L. Kaiser, D.R. Yoerger, H.H. Roberts, W.W. Shedd, E.E. Cordes, T.M. Shank, S.P. Berlet, M.G. Saunders, E.A. Larcom, and J.M. Brooks. 2014b. Footprint of *Deepwater Horizon* blowout impact to deep-water coral communities. Proceedings of the National Academy of Sciences USA 111(32): 11744-11749.

Florida Fish and Wildlife Conservation Commission. 2016. Draft Panama City Crayfish Management Plan. *Procambarus econfinae*.

Florida Fish and Wildlife Conservation Commission. 2021. Florida's Endangered and Threatened Species. https://myfwc.com/media/1945/threatened-endangered-species.pdf.

Florida Fish and Wildlife Conservation Commission. nd-a. Loggerhead Nesting in Florida. https://myfwc.com/research/wildlife/sea-turtles/nesting/loggerhead/.

Florida Fish and Wildlife Conservation Commission. nd-b. Green Turtle Nesting in Florida. https://myfwc.com/research/wildlife/sea-turtles/nesting/green-turtle/.

Florida Fish and Wildlife Conservation Commission. nd-c. Leatherback Nesting in Florida. https://myfwc.com/research/wildlife/sea-turtles/nesting/leatherback/.

Florida Fish and Wildlife Conservation Commission. nd-d. Florida Salt Marsh Vole, *Microtus pennsylvanicus dekecampbelli*. https://myfwc.com/wildlifehabitats/profiles/mammals/land/florida-salt-marsh-vole/.

Florida Fish and Wildlife Conservation Commission. nd-e. Listed Invertebrates. https://myfwc.com/wildlifehabitats/profiles/.

Foley, K.A., C. Caldow, and E.L. Hickerson. 2007. First confirmed record of Nassau Grouper *Epinephelus striatus* (Pisces: Serranidae) in the Flower Garden Banks National Marine Sanctuary. Gulf of Mexico Science 25(2): 162-165.

Fonseca, M., G.A. Piniak, and N. Cosentino-Manning. 2017. Susceptibility of seagrass to oil spills: A case study with eelgrass, *Zostera marina*, in San Francisco Bay, USA. Marine Pollution Bulletin 115(1-2): 29-38.

Fox, D.A., J.E. Hightower, and F.M. Parauka. 2000. Gulf sturgeon spawning migration and habitat in the Choctawhatchee River System, Alabama–Florida. Transactions of the American Fisheries Society 129(3): 811-826.

Fritts, T.H. and R.P. Reynolds. 1981. Pilot Study of the Marine Mammals, Birds, and Turtles in OCS Areas of the Gulf of Mexico. U.S. Department of the Interior, Fish and Wildlife Service, Biological Services Program. FWS/OBS 81/36. 139 pp.

Fugro Geoservices Inc. 2015a. Shallow Hazards Assessment, Multi-Temporal Subsidence Monitoring, & Archaeological Assessment Perdido Field Block 857 & Vicinity Alaminos Canyon Area Gulf of Mexico. Report No. 2414-5056

Fugro Geoservices, Inc. 2015b. Archaeological Assessment, Perdido Field, Blocks 768-771, 856-859, 899-903, and 944-946, Alaminos Canyon Area, Gulf of Mexico. Report No. 2414-5056.

Fuller, A.R., G.J. McChesney, and R.T. Golightly. 2018. Aircraft disturbance to Common Murres (*Uria aalge*) at a breeding colony in central California, USA. Waterbirds 41(3): 257-267.

Gallaway, B.J., (Ed.). 1988. Northern Gulf of Mexico Continental Slope Study, Final report: Year 4. Volume II: Synthesis report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 88-0053. 701 pp.

Gallaway, B.J. and G.S. Lewbel. 1982. The Ecology of Petroleum Platforms in the Northwestern Gulf of Mexico: A Community Profile. U.S. Fish and Wildlife Service, Biological Services Program and U.S. Department of the Interior, Bureau of Land Management. Washington, DC. FWS/OBS-82/27 and Open File Report 82-03. 91 pp.

Gallaway, B.J., J.G. Cole, and R.G. Fechhelm. 2003. Selected Aspects of the Ecology of the Continental Slope Fauna of the Gulf of Mexico: A Synopsis of the Northern Gulf of Mexico Continental Slope Study, 1983-1988. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2003-072. 44 pp.

Gates, A.R., M.C. Benfield, D.J. Booth, A.M. Fowler, D. Skropeta, and D.O.B. Jones. 2017. Deep-sea observations at hydrocarbon drilling locations: Contributions from the SERPENT Project after 120 field visits. Deep-Sea Research Part II: Topical Studies in Oceanography 137: 463-479.

Geoscience Earth and Marine Services. 2001. Geologic and Stratigraphic Assessment Blocks 756, 857, 900 and 901 Alaminos Canyon Gulf of Mexico. Project No. 0600-271.

Geoscience Earth and Marine Services. 2004. Seafloor and Near-Surface Geologic Assessment Blocks 812-814, 856-858, and 900-902 Alaminos Canyon Area Gulf of Mexico. Project No. 0204-780.

Geraci, J.R. and D.J. St. Aubin. 1990. Sea Mammals and Oil: Confronting the Risks. Academic Press, San Diego, CA. 282 pp.

Gibson, D., D.H. Catlin, K.L. Hunt, J.D. Fraser, S.M. Karpanty, M.J. Friedrich, M.K. Bimbi, J.B. Cohen, and S.B. Maddock. 2017. Evaluating the impact of man-made disasters on imperiled species: Piping plovers and the *Deepwater Horizon* oil spill. Biological Conservation 2012: 48-62.

Gitschlag, G., B. Herczeg, and T. Barcack. 1997. Observations of sea turtles and other marine life at the explosive removal of offshore oil and gas structures in the Gulf of Mexico. Gulf Research Reports 9(4): 247-262.

Gulf of Mexico Fishery Management Council. 2005. Generic Amendment Number 3 for Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing in the Following Fishery Management Plans of the Gulf of Mexico: Shrimp fishery of the Gulf of Mexico, United States Waters Red drum Fishery of the Gulf of Mexico, Reef Fish Fishery of the Gulf of Mexico Coastal Migratory Pelagic Resources (Mackerels) in the Gulf of Mexico and South Atlantic, Stone Crab Fishery of the Gulf of Mexico, Spiny Lobster in the Gulf of Mexico and South Atlantic, Coral and Coral Reefs of the Gulf of Mexico. Tampa, FL. 104 pp. https://gulfcouncil.org/wp-content/uploads/FISHERY%20MANAGEMENT/GENERIC/FINAL3_EFH_Amendment.pdf.

Gulf of Mexico Fishery Management Council. 2010. 5-Year Review of the Final Generic Amendment Number 3 Addressing Essential Fish Habitat Requirements, Habitat Areas of Particular Concern, and Adverse Effects of Fishing in the Fishery Management Plans of the Gulf of Mexico. https://gulfcouncil.org/wp-content/uploads/EFH-5-Year-Review-Final-10-10.pdf.

Hamdan, L.J., J.L. Salerno, A. Reed, S.B. Joye, and M. Damour. 2018. The impact of the *Deepwater Horizon* blowout on historic shipwreck-associated sediment microbiomes in the northern Gulf of Mexico. Scientific Reports 8: 9057.

Haney, C.J., H.J. Geiger, and J.W. Short. 2014. Bird mortality from the *Deepwater Horizon* oil spill. Exposure probability in the Gulf of Mexico. Marine Ecology Progress Series 513: 225-237.

Hannam, M.L., S.D. Bamber, A.J. Moody, T.S. Galloway, and M.B. Jones. 2010. Immunotoxicity and oxidative stress in the Arctic scallop *Chlamys islandica*: Effects of acute oil exposure. Ecotoxicology and Environmental Safety 73: 1440-1448.

Harvell, C.D., K. Kim, J.M. Burkholder, R.R. Colwell, P.R. Epstein, D.J. Grimes, E.E. Hoffmann, E.K. Lipp, A.D.M.E. Osterhaus, R.M. Overstreet, J.W. Porter, G.W. Smith, and G.R. Vasta. 1999. Emerging marine diseases: climate links and anthropogenic factors. Science 285(5433): 1505-1510.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, B. Byrd, S. Chavez-Rosales, L.P. Garrison, J. Hatch, A. Henry, S.C. Horstman, J. Litz, M.C. Lyssikatos, K.D. Mullin, C. Orphanides, R.M. Pace, D.L. Palka, J. Powell, and F.W. Wenzel. 2019. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2018. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NE-258. 298 pp.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, J. Turek, B. Byrd, S. Chavez-Rosales, T.V.N. Cole, L.P. Garrison, J. Hatch, A. Henry, S.C. Horstman, J. Litz, M.C. Lyssikatos, K.D. Mullin, C. Orphanides, J. Ortega-Ortiz, R.M. Pace, D.L. Palka, J. Powell, G. Rappucci, and F.W. Wenzel. 2021. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2020. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NE-271. 394 pp.

Hayes, S.A., E. Josephson, K. Maze-Foley, P.E. Rosel, J.W. Wallace, A. Brossard, S. Chavez-Rosales, T.V.N. Cole, L.P. Garrison, J. Hatch, A. Henry, S.C. Horstman, J. Litz, M.C. Lyssikatos, K.D. Mullin, K. Murray, C. Orphanides, J. Ortega-Ortiz, R.M. Pace, D.L. Palka, J. Powerll, G. Rappicci, M. Soldevilla, and F.W. Wenzel. 2022. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments - 2021. U.S. Department of Commerce. NOAA Technical Memorandum NMFS-NE-288. 387 pp.

Hazel, J., I. R. Lawler, H. Marsh, and S. Robson. 2007. Vessel speed increases collision risk for the green turtle *Chelonia mydas*. Endangered Species Research 3: 105-113.

Hazen, T.C., E.A. Dubinsky, T.Z. DeSantis, G.L. Andersen, Y.M. Piceno, N. Singh, J.K. Jansson, A. Probst, S.E. Borglin, J.L. Fortney, W.T. Stringfellow, M. Bill, M.E. Conrad, L.M. Tom, K.L. Chavarria, T.R. Alusi, R. Lamendella, D.C. Joyner, C. Spier, J. Baelum, M. Auer, M.L. Zemla, R. Chakraborty, E.L. Sonnenthal, P. D'Haeseleer, H.Y. Holman, S. Osman, Z. Lu, J.D. Van Nostrand, Y. Deng, J. Zhou, and O.U. Mason. 2010. Deep-sea oil plume enriches indigenous oil-degrading bacteria. Science 330(6001): 204-208.

Hess, N.A. and C.A. Ribic. 2000. Seabird ecology, pp 275-315. In: R.W. Davis, W.E. Evans and B. Würsig, Cetaceans, Sea Turtles, and Seabirds in the Northern Gulf of Mexico: Distribution, Abundance and Habitat Associations. Volume II: Technical report. U.S. Geological Survey, Biological Resources Division, USGS/BRD/CR 1999 0006 and U.S. Department of the Interior, Minerals Management Service, New Orleans, LA.

Higashi, G.R. 1994. Ten years of fish aggregating device (FAD) design development in Hawaii. Bulletin of Marine Science 55(2-3): 651-666.

Hildebrand, J.A. 2004. Impacts of anthropogenic sound on cetaceans. Unpublished paper submitted to the International Whaling Commission Scientific Committee SC/56 E 13.

Hildebrand, J.A. 2005. Impacts of anthropogenic sound, pp. 101-124. In: J.E. Reynolds III, W.F. Perrin, R.R. Reeves, S. Montgomery and T.J. Ragen, (Eds.). Marine Mammal Research: Conservation Beyond Crisis. Johns Hopkins University Press, Baltimore, MD.

Hildebrand, J.A. 2009. Anthropogenic and natural sources of ambient noise in the ocean. Marine Ecology Progress Series 395: 5-20.

Hildebrand, J.A., S. Baumann-Pickering, K.E. Frasier, J.S. Trickey, K.P. Merkens, S.M. Wiggins, M.A. McDonald, L.P. Garrison, D. Harris, T.A. Marques, and L. Thomas. 2015. Passive acoustic monitoring of beaked whale densities in the Gulf of Mexico. Scientific Reports 5: 16343.

Hinwood, J.B., A.E. Potts, L.R. Dennis, J.M. Carey, H. Houridis, R.J. Bell, J.R. Thomson, P. Boudreau, and A.M. Ayling. 1994. Part 3: Drilling activities. pp. 124-206. In: Swan, J.M., Neff, J.M., Young, P.C. (Eds.), Environmental Implications of Offshore Oil and Gas Development in Australia; the Findings of an Independent Scientific Review. Australian Petroleum Exploration Association and Energy Research and Development Corporation. Sydney, Australia.

Holland, K.N. 1990. Horizontal and vertical movements of yellowfin and bigeye tuna associated with fish aggregating devices. Fishery Bulletin 88: 493-507.

Hourigan, T.F., P. Etnoyer, and S.D. Cairns. 2017. The State of Deep-sea Coral and Sponge Ecosystems of the United States. U.S. Department of Commerce, National Oceanographic and Atmospheric Administration. NOAA Technical Memorandum NMFS OHC 4. 467 pp.

Hsing, P.-Y., B. Fu, E.A. Larcom, S.P. Berlet, T.M. Shank, A.F. Govindarajan, A.J. Lukasiewicz, P.M. Dixon, and C.R. Fisher. 2013. Evidence of lasting impact of the *Deepwater Horizon* oil spill on a deep Gulf of Mexico coral community. Elementa: Science of the Anthropocene 1(1): 000012.

Intergovernmental Panel on Climate Change. 2014. Climate Change 2014: Impacts, Adaptation and Vulnerability. https://www.ipcc.ch/report/ar5/wg2/.

Intergovernmental Panel on Climate Change. 2022. Climate Change 2022: Impacts, Adaptation and Vulnerability. https://www.ipcc.ch/report/ar6/wg2/.

International Tanker Owners Pollution Federation Limited. 2014. Effects of Oil Pollution on Fisheries and Mariculture. International Tanker Owners Pollution Federation Limited. London, UK. 12 pp.

International Tanker Owners Pollution Federation Limited. 2018. Weathering. https://www.itopf.org/knowledge-resources/documents-guides/fate-of-oil-spills/weathering/.

Jasny, M., J. Reynolds, C. Horowitz, and A. Wetzler. 2005. Sounding the Depths II: The Rising Toll of Sonar, Shipping and Industrial Ocean Noise on Marine Life. Natural Resources Defense Council, New York, NY. vii + 76 pp.

Jensen, A.S. and G. K. Silber. 2004. Large Whale Ship Strike Database. Office of Protected Resources, National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce, NOAA Technical Memorandum NMFSOPR-25, Silver Spring, Maryland. 37 pp.

Ji, Z.-G., W.R. Johnson, C.F. Marshall, and E.M. Lear. 2004. Oil-Spill Risk Analysis: Contingency Planning Statistics for Gulf of Mexico OCS Activities. Minerals Management Service. U.S. Department of the Interior, Gulf of Mexico OCS Region. New Orleans, LA. OCS Report MMS 2004-026. 53 pp.

Jochens, A., D.C. Biggs, D. Benoit-Bird, D. Engelhaupt, J. Gordon, C. Hu, N. Jaquet, M. Johnson, R.R. Leben, B. Mate, P. Miller, J.G. Ortega-Ortiz, A. Thode, P. Tyack, and B. Würsig. 2008. Sperm Whale Seismic Study in the Gulf of Mexico: Synthesis Report. Minerals Management Service. U.S. Department of the Interior, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2008-006. 323 pp.

Joye, S.B., I.R. MacDonald, I. Leifer, and V. Asper. 2011. Magnitude and oxidation potential of hydrocarbon gases released from the BP oil well blowout. Nature Geoscience 4: 160-164.

Keithly, W.R., and K.J. Roberts. 2017. Commercial and recreational fisheries of the Gulf of Mexico, pp. 1039-1188. In: C.H. Ward (Ed.), Habitats and Biota of the Gulf of Mexico: Before the *Deepwater Horizon* Oil Spill. Volume 2: Fish Resources, Fisheries, Sea Turtles, Avian Resources, Marine Mammals, Diseases and Mortalities. Springer, New York.

Kellar, N.M., T.R. Speakman, C.R. Smith, S.M. Lane, B.C. Balmer, M.L. Trego, K.N. Catelani, M.N. Robbins, C.D. Allen, R.S. Wells, E.S. Zolman, T.K. Rowles, and L.H. Schwacke. 2017. Low reproductive success rates of common bottlenose dolphins *Tursiops truncatus* in the northern Gulf of Mexico following the *Deepwater Horizon* disaster (2010-2015). Endangered Species Research 33: 143-158.

Kennicutt, M.C. 2000. Chemical Oceanography, pp. 123-139. In: Continental Shelf Associates, Inc. Deepwater Program: Gulf of Mexico Deepwater Information Resources Data Search and Literature Synthesis. Volume I: Narrative report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2000-049. 340 pp.

Keppner, E.J. and L.A. Keppner. 2004. A Summary of the Panama City Crayfish, *Procambarus econfinae* Hobbs, 1942. Prepared for The Candidate Conservation Agreement with Assurances.

Kessler, J.D., D.L. Valentine, M.C. Redmond, M. Du, E.W. Chan, S.D. Mendes, E.W. Quiroz, C.J. Villanueva, S.S. Shusta, L.M. Werra, S.A. Yvon-Lewis, and T.C. Weber. 2011. A persistent oxygen anomaly reveals the fate of spilled methane in the deep Gulf of Mexico. Science 331: 312-315.

Ketten, D.R. and S.M. Bartol. 2005. Functional Measures of Sea Turtle Hearing. Woods Hole Oceanographic Institution: ONR Award No: N00014-02-0510.

Kiszka, J., M. Caputo, J. Vollenweider, M.R. Heithaus, L.A. Dias, and L.P. Garrison. 2023. Critically endangered Rice's whales (*Balaenoptera ricei*) selectively feed on high-quality prey in the Gulf of Mexico. Scientific Reports 13: 6710. https://www.nature.com/articles/s41598-023-33905-6#Abs1 .

Kujawinski, E.B., M.C. Kido Soule, D.L. Valentine, A.K. Boysen, K. Longnecker, and M.C. Redmond. 2011. Fate of dispersants associated with the *Deepwater Horizon* oil spill. Environmental Science & Technology 45(4): 1298-1306.

Kyhn, L.A., S. Sveegaard, and J. Tougaard. 2014. Underwater noise emissions from a drillship in the Arctic. Marine Pollution Bulletin 86: 424-433.

Ladich, F. and R.R. Fay. 2013. Auditory evoked potential audiometry in fish. Reviews in Fish Biology and Fisheries 23(3): 317-364.

Laist, D.W., A. R. Knowlton, J. G. Mead, A. S. Collet, and M. Podesta. 2001. Collisions between ships and whales. Marine Mammal Science 17(1): 35-75.

Lane, S.M., C.R. Smith, J. Mitchell, B.C. Balmer, K.P. Barry, T. McDonald, C.S. Mori, P.E. Rosel, T.K. Rowles, T.R. Speakman, F.I. Townsend, M.C. Tumlin, R.S. Wells, E.S. Zolman, and L.H. Schwacke. 2015. Reproductive outcome and survival of common bottlenose dolphins sampled in Barataria Bay, Louisiana, USA, following the *Deepwater Horizon* oil spill. Proceedings of the Royal Society B: Biological Sciences 282: 20151944.

Lauritsen, A.M., P.M. Dixon, D. Cacela, B. Brost, R. Hardy, S.L. MacPherson, A. Meylan, B.P. Wallace, and B. Witherington. 2017. Impact of the *Deepwater Horizon* oil spill on loggerhead turtle *Caretta caretta* nest densities in northwest Florida. Endangered Species Research 33: 83-93.

Lee, R.F. 2013. Ingestion and Effects of Dispersed Oil on Marine Zooplankton. Anchorage, Alaska., Prepared for: Prince William Sound Regional Citizens' Advisory Council (PWSRCAC). 21 pp.

Lee, R.F., M. Koster, and G.A. Paffenhofer. 2012. Ingestion and defecation of dispersed oil droplets by pelagic tunicates. Journal of Plankton Research 34: 1058-1063.

Lee, W.Y., K. Winters, and J.A.C. Nicol. 1978. The biological effects of the water-soluble fractions of a No. 2 fuel oil on the planktonic shrimp, *Lucifer faxoni*. Environmental Pollution 15: 167-183.

Lennuk, L., J. Kotta, K. Taits, and K. Teeveer. 2015. The short-term effects of crude oil on the survival of different size-classes of cladoceran *Daphnia magna* (Straus, 1820). Oceanologia 57(1): 71-77.

Lin, Q., I.A. Mendelssohn, S.A. Graham, A. Hou, J.W. Fleeger, and D.R. Deis. 2016. Response of salt marshes to oiling from the *Deepwater Horizon* spill: Implications for plant growth, soil-surface erosion, and shoreline stability. Science of the Total Environment 557-558: 369-377.

Linden, O. 1976. Effects of oil on the reproduction of the amphipod *Gammarus oceanicus*. Ambio 5: 36-37.

Liu, J., H.P. Bacosa, and Z. Liu. 2017. Potential environmental factors affecting oil-degrading bacterial populations in deep and surface waters of the northern Gulf of Mexico. Frontiers in Microbiology 7: 2131.

Lohoefener, R., W. Hoggard, K.D. Mullin, C. Roden, and C. Rogers. 1990. Association of Sea Turtles with Petroleum Platforms in the North Central Gulf of Mexico. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 90-0025. 90 pp.

Louisiana Wildlife & Fisheries. 2020. Rare Species and Natural Communities by Parish. https://www.wlf.louisiana.gov/page/rare-species-and-natural-communities-by-parish.

Lutcavage, M.E., P.L. Lutz, G.D. Bossart, and D.M. Hudson. 1995. Physiologic and clinicopathologic effects of crude oil on loggerhead sea turtles. Archives of Environmental Contamination and Toxicology 28(4): 417-422.

Lutcavage, M.E., P. Plotkin, B. Witherington, and P.L. Lutz. 1997. Human impacts on sea turtle survival, pp. 387-409. In: P.L. Lutz and J.A. Musick (Eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, FL.

MacDonald, I.R. 2002. Stability and Change in Gulf of Mexico Chemosynthetic Communities. Volume II: Technical Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2002-036. 455 pp.

Main, C.E., H.A. Ruhl, D.O.B. Jones, A. Yool, B. Thornton, and D.J. Mayor. 2015. Hydrocarbon contamination affects deep-sea benthic oxygen uptake and microbial community composition. Deep Sea Research Part I: Oceanographic Research Papers 100: 79-87.

Marine Mammal Commission. 2011. Assessing the Long-term Effects of the BP *Deepwater Horizon* Oil Spill on Marine Mammals in the Gulf of Mexico: A statement of research needs. 38 pp. http://www.mmc.gov/wp-content/uploads/longterm_effects_bp_oilspil.pdf.

Marshall, A., R. Barreto, J. Carlson, D. Fernando, S. Fordham, M.P. Francis, D. Derrick, K. Herman, R.W. Jabado, K.M. Liu, C.L. Rigby, and E. Romanov. 2020. *Mobula birostris.* The IUCN Red List of Threatened Species. 2018: e.T198921A68632946. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T198921A68632946.en.

McDonald, T.L., F.E. Hornsby, T.R. Speakman, E.S. Zolman, K.D. Mullin, C. Sinclair, P.E. Rosel, L. Thomas, and L.H. Schwacke. 2017a. Survival, density, and abundance of common bottlenose dolphins in Barataria Bay (USA) following the *Deepwater Horizon* oil spill. Endangered Species Research 33: 193-209.

McDonald, T.L., B.A. Schroeder, B.A. Stacy, B.P. Wallace, L.A. Starcevich, J. Gorham, M.C. Tumlin, D. Cacela, M. Rissing, D.B. McLamb, E. Ruder, and B.E. Witherington. 2017b. Density and exposure of surface-pelagic juvenile sea turtles to *Deepwater Horizon* oil. Endangered Species Research 33: 69-82.

McKenna, M.F., D. Ross, S.M. Wiggins, and J.A. Hildebrand. 2012. Underwater radiated noise from modern commercial ships. Journal of the Acoustical Society of America 131: 92-103.

McLaughlin, K.E. and H.P. Kunc. 2015. Changes in the acoustic environment alter the foraging and sheltering behaviour of the cichlid *Amititlania nigrofasciata*. Behavioural Processes 116: 75-79.

Mendel, B., P. Schwemmer, V. Peschko, S. Muller, H. Schwemmer, M. Mercker, and S. Garthe. 2019. Operational offshore wind farms and associated ship traffic cause profound changes in distribution patterns of Loons (*Gavia* spp.). Journal of Environmental Management 231: 429-438.

Mendelssohn, I.A., G.L. Andersen, D.M. Baltx, R.H. Caffey, K.R. Carman, J.W. Fleeger, S.B. Joyce, Q. Lin, E. Maltby, E.B. Overton, and L.P. Rozas. 2012. Oil impacts on coastal wetlands: Implications for the Mississippi River delta ecosystem after the *Deepwater Horizon* oil spill. BioScience 62(6): 562-574.

Mississippi Natural Heritage Program. 2018. Natural Heritage Program. Listed Species of Mississippi. https://www.mdwfp.com/media/255911/ms-listed-species-2018.pdf.

Møhl, B., M. Wahlberg, and P.T. Madsen. 2003. The monopulsed nature of sperm whale clicks. Journal of the Acoustical Society of America 114(2): 1143-1154.

Montagna, P.A., J.G. Baguley, C. Cooksey, I. Hartwell, L.J. Hyde, J.L. Hyland, R.D. Kalke, L.M. Kracker, M. Reuscher, and A.C. Rhodes. 2013. Deep-sea benthic footprint of the *Deepwater Horizon* blowout. PLoS One 8(8): e70540.

Montagna, P.A., J.G. Baguley, C. Cooksey, and J.L. Hyland. 2016. Persistent impacts to the deep soft bottom benthos one year after the *Deepwater Horizon* event. Integrated Environmental Assessment and Management 13(2): 342-351.

Moore, S.F. and R.L. Dwyer. 1974. Effects of oil on marine organisms: a critical assessment of published data. Water Research 8: 819-827.

Morrow, J.V.J., J.P. Kirk, K.J. Killgore, H. Rugillio, and C. Knight. 1998. Status and recovery of Gulf sturgeon in the Pearl River system, Louisiana-Mississippi. North American Journal of Fisheries Management 18: 798-808.

Mullin, K.D. 2007. Abundance of Cetaceans in the Oceanic Gulf of Mexico based on 2003-2004 ship surveys. National Marine Fisheries Service, Southeast Fisheries Science Center. Pascagoula, MS. 26 pp. https://aquadocs.org/handle/1834/30916.

Mullin, K.D., W. Hoggard, C. Roden, R. Lohoefener, C. Rogers, and B. Taggart. 1991. Cetaceans on the Upper Continental Slope in the North-central Gulf of Mexico. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 91-0027. 108 pp.

National Marine Fisheries Service. 2007. Endangered Species Act, Section 7 Consultation – Biological Opinion. Gulf of Mexico Oil and Gas Activities: Five Year Leasing Plan for Western and Central Planning Areas 2007-2012. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. St. Petersburg, FL.

National Marine Fisheries Service. 2009a. Smalltooth Sawfish Recovery Plan (*Pristis pectinata*). Prepared by the Smalltooth Sawfish Recovery Team for the National Marine Fisheries Service, Silver Spring, MD. 102 pp. https://repository.library.noaa.gov/view/noaa/15983.

National Marine Fisheries Service. 2009b. Final Amendment 1 to the Consolidated Atlantic Highly Migratory Species Fishery Management Plan Essential Fish Habitat. Highly Migratory Species Management Division, Office of Sustainable Fisheries. Silver Spring, MD. http://pbadupws.nrc.gov/docs/ML1219/ML12195A241.pdf.

National Marine Fisheries Service. 2010. Final Recovery Plan for the Sperm Whale (*Physeter macrocephalus*). Silver Spring, MD. https://www.fisheries.noaa.gov/resource/document/recovery-plan-sperm-whale-physeter-macrocephalus.

National Marine Fisheries Service. 2011. Species of Concern: Western Atlantic bluefin tuna, *Thunnus thynnus*. https://www.fisheries.noaa.gov/resource/document/endangered-species-act-status-review-atlantic-bluefin-tuna-thunnus-thynnus.

National Marine Fisheries Service. 2014a. Loggerhead Sea Turtle Critical Habitat in the Northwest Atlantic Ocean. https://www.fisheries.noaa.gov/resource/map/loggerhead-turtle-northwest-atlantic-ocean-dps-critical-habitat-map.

National Marine Fisheries Service. 2014b. Gulf sturgeon (*Acipenser oxyrinchus desotoi*). https://www.fisheries.noaa.gov/species/gulf-sturgeon#conservation-management.

National Marine Fisheries Service. 2015a. Sperm Whale (*Physeter macrocephalus*) 5-Year Review: Summary and Evaluation. National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Sustainable Fisheries, Highly Migratory Species Management Division. Silver Spring, MD. https://repository.library.noaa.gov/view/noaa/17032.

National Marine Fisheries Service. 2015b. Endangered Species Act Section 7 Consultation Biological Opinion for the Virginia Offshore Wind Technology Advancement Project. NER-2015-12128

National Marine Fisheries Service. 2016. Marine Mammal Stock Assessment Reports (SARs) by Species/Stock. https://www.fisheries.noaa.gov/national/marine-mammal-protection/marine-mammal-stock-assessment-reports-region.

National Marine Fisheries Service. 2018a. Revisions to: Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing (Version 2.0): Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. NOAA Technical Memorandum NMFS-OPR-59. 167 pp. https://www.fisheries.noaa.gov/resource/document/technical-guidance-assessing-effects-anthropogenic-sound-marine-mammal-hearing.

National Marine Fisheries Service. 2018b. Oceanic Whitetip Shark, *Carcharhinus longimanus*. https://www.fisheries.noaa.gov/species/oceanic-whitetip-shark.

National Marine Fisheries Service. 2018c. Smalltooth Sawfish (*Pristis pectinata*) 5-Year Review: Summary and Evaluation of United States Distinct Population Segment of Smalltooth Sawfish. Southeast Regional Office, St. Petersburg, Florida. 63 pp. https://repository.library.noaa.gov/view/noaa/19253/Print.

National Marine Fisheries Service. 2020a. Endangered Species Act, Section 7 Consultation – Biological Opinion on the Federally Regulated Oil and Gas Program Activities in the Gulf of Mexico. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. St. Petersburg, FL. https://www.fisheries.noaa.gov/resource/document/biological-opinion-federally-regulated-oil-and-gas-program-activities-gulf-mexico.

National Marine Fisheries Service. 2020b. Sea Turtles, Dolphins, and Whales-10 years after the *Deepwater Horizon* Oil Spill. https://www.fisheries.noaa.gov/national/marine-life-distress/sea-turtles-dolphins-and-whales-10-years-after-deepwater-horizon-oil.

National Marine Fisheries Service. 2021. Amended Incidental Take Statement (ITS) on BOEM Gulf of Mexico Oil and Gas Program. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Office of Protected Resources. Tracking No. FPR-2017-92341, Amended 26 April 2021. 245 pp. https://repository.library.noaa.gov/view/noaa/29355.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 2008. Recovery Plan for the Northwest Atlantic Population of the Loggerhead Sea Turtle (*Caretta caretta*), Second Revision. https://www.fisheries.noaa.gov/resource/document/recovery-plan-northwest-atlantic-population-loggerhead-sea-turtle-caretta-caretta.

National Marine Fisheries Service, U.S. Fish and Wildlife Service and Secretaría de Medio Ambiente y Recursos Naturales. 2011. Bi-National Recovery Plan for the Kemp's Ridley Sea Turtle (*Lepidochelys kempii*), Second Revision. 177 pp. https://www.fisheries.noaa.gov/resource/document/bi-national-recovery-plan-kemps-ridley-sea-turtle-2nd-revision.

National Oceanic and Atmospheric Administration. 2011a. Joint Analysis Group. *Deepwater Horizon* oil spill: Review of Preliminary Data to Examine Subsurface Oil in the Vicinity of MC252#1, May 19 to June 19, 2010. U.S. Department of Commerce, National Ocean Service. Silver Spring, MD. NOAA Technical Report NOS OR&R 25. https://repository.library.noaa.gov/view/noaa/130.

National Oceanic and Atmospheric Administration. 2011b. Joint Analysis Group, *Deepwater Horizon* Oil Spill: Review of R/V *Brooks McCall* Data to Examine Subsurface Oil. U.S. Department of Commerce, National Ocean Service. Silver Spring, MD. NOAA Technical Report NOS OR&R 24. https://repository.library.noaa.gov/view/noaa/131.

National Oceanic and Atmospheric Administration. 2011c. Joint Analysis Group, *Deepwater Horizon* Oil Spill: Review of Preliminary Data to Examine Oxygen Levels in the Vicinity of MC252#1 May 8 to August 9, 2010. U.S. Department of Commerce, National Ocean Service. Silver Spring, MD. NOAA Technical Report NOS OR&R 26. https://repository.library.noaa.gov/view/noaa/133.

National Oceanic and Atmospheric Administration. 2016a. *Deepwater Horizon* Oil Spill: Final Programmatic Damage Assessment and Restoration Plan and Final Programmatic Environmental Impact Statement. http://www.gulfspillrestoration.noaa.gov/restoration-planning/gulf-plan/.

National Oceanic and Atmospheric Administration. 2016b. Cetacean Unusual Mortality Event in Northern Gulf of Mexico (2010-2014). https://www.fisheries.noaa.gov/national/marine-life-distress/2010-2014-cetacean-unusual-mortality-event-northern-gulf-mexico.

National Oceanic and Atmospheric Administration. 2019. Small Diesel Spills (500 - 5,000 gallons). Office of Response and Restoration. https://response.restoration.noaa.gov/sites/default/files/Small-Diesel-Spills.pdf.

National Oceanic and Atmospheric Administration. 2020. Oil Types. Office of Response and Restoration. http://response.restoration.noaa.gov/oil-and-chemical-spills/oil-spills/oil-types.html.

National Oceanic and Atmospheric Administration. 2021a. Oil and Sea Turtles. Biology, Planning, and Response. 150 pp. https://response.restoration.noaa.gov/sites/default/files/Oil_Sea_Turtles_2021.pdf.

National Oceanic and Atmospheric Administration. 2021b. Flower Garden Banks National Marine Sanctuary. Cnidarian Species. http://flowergarden.noaa.gov/about/cnidarianlist.html.

National Oceanic and Atmospheric Administration. 2022a. WebGNOME. https://gnome.orr.noaa.gov/#

National Oceanic and Atmospheric Administration. 2022b. Giant Manta Ray - *Manta birostris*. https://www.fisheries.noaa.gov/species/giant-manta-ray.

National Oceanic and Atmospheric Administration. 2022c. Gulf Sturgeon: About the species. https://www.fisheries.noaa.gov/species/gulf-sturgeon#overview.

National Oceanic and Atmospheric Administration. nd. Nassau Grouper, *Epinephelus striatus*. https://www.fisheries.noaa.gov/species/nassau-grouper.

National Oceanic and Atmospheric Administration Fisheries. 2020. Species Directory – ESA Threatened and Endangered. www.fisheries.noaa.gov/species-directory/threatened-endangered.

National Oceanic and Atmospheric Administration Fisheries. 2022a. Trophic Interactions and Habitat Requirements of Gulf of Mexico Rice's Whales. https://www.fisheries.noaa.gov/southeast/endangered-species-conservation/trophic-interactions-and-habitat-requirements-gulf-mexico#animal-telemetry.

National Oceanic and Atmospheric Administration Fisheries. 2022b. Smalltooth Sawfish, *Pristis pectinata*. https://www.fisheries.noaa.gov/species/smalltooth-sawfish.

National Research Council. 1983. Drilling Discharges in the Marine Environment. National Academy Press, Washington, DC. 180 pp.

National Research Council. 2003a. Oil in the Sea III: Inputs, Fates, and Effects. National Academy Press, Washington, DC. 182 pp. + app.

National Research Council. 2003b. Ocean Noise and Marine Mammals. National Academy Press, Washington, DC. 204 pp.

National Wildlife Federation. 2016a. *Deepwater Horizon*'s impact on wildlife. http://nwf.org/oilspill/.

National Wildlife Federation. 2016b. Wildlife Library: Whooping Crane.https://www.nwf.org/Educational-Resources/Wildlife-Guide/Birds/Whooping-Crane.

Natural Resources Defense Council. 2014. A Petition to List the Gulf of Mexico Bryde's Whale (*Balaenoptera edeni*) as Endangered Under the Endangered Species Act. https://www.nrdc.org/sites/default/files/wil_14091701a.pdf.

Nedelec, S.L., A.N. Radford, L. Pearl, B. Nedelec, M.I. McCormick, M.G. Meekan, and S.D. Simpson. 2017. Motorboat noise impacts parental behaviour and offspring survival in a reef fish. Proceedings of the Royal Society B: Biological Sciences 284(1856): p20170143.

Neff, J.M. 1987. Biological effects of drilling fluids, drill cuttings and produced waters, pp 469-538. In: D.F. Boesch and N.N. Rabalais (Eds.), Long Term Effects of Offshore Oil and Gas Development. Elsevier Applied Science Publishers, London, UK.

Neff, J.M., A.D. Hart, J.P. Ray, J.M. Limia, and T.W. Purcell. 2005. An Assessment of Seabed Impacts of Synthetic Based Drilling-Mud Cuttings in the Gulf of Mexico. 2005 SPE/EPA/DOE Exploration and Production Environmental Conference, 7-9 March 2005, Galveston, TX. SPE 94086.

Neff, J.M., S. McKelvie, and R.C. Ayers. 2000. Environmental Impacts of Synthetic Based Drilling Fluids. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2000-064. 121 pp.

Noirungsee, N., S. Hackbush, J. Viamonte, P. Bubenheim, A. Liese, and R. Muller. 2020. Influence of oil, dispersant, and pressure on microbial communities from the Gulf of Mexico. Scientific Reports 10: 7079.

Nowlin, W.D.J., A.E. Jochens, S.F. DiMarco, R.O. Reid, and M.K. Howard. 2001. Deepwater Physical Oceanography Reanalysis and Synthesis of Historical Data: Synthesis Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2001-064. 514 pp.

Oceaneering. 2018. Hazards and Subsidence Monitoring Report Perdido AUV Survey Portions of Blocks 812-816, 856-860, and 900-902 Alaminos Canyon Area. Project No. 182843.

Operational Science Advisory Team. 2010. Summary Report for Sub-sea and Sub-surface Oil and Dispersant Detection: Sampling and Monitoring. Prepared for Paul F. Zukunft, U.S. Coast Guard Federal on Scene Coordinator, *Deepwater Horizon* MC252. 131 pp. http://www.restorethegulf.gov/sites/default/files/documents/pdf/OSAT_Report_FINAL_17DEC.pdf.

Ozhan, K., M.L. Parsons, and S. Bargu. 2014. How were phytoplankton affected by the *Deepwater Horizon* oil spill? Bioscience 64: 829-836.

Peake, D.E. 1996. Bird surveys, pp. 271-304. In: R.W. Davis and G.S. Fargion (Eds.), Distribution and Abundance of Cetaceans in the North Central and Western Gulf of Mexico, Final report. Volume II: Technical report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region New Orleans, LA. OCS Study MMS 96-0027. 356 pp.

Picciulin, M., L. Sebastianutto, A. Codarin, A. Farina, and E.A. Ferrero. 2010. In situ behavioural responses to boat noise exposure of *Gobius cruentatus* (Gmelin, 1789; fam. Gobiidae) and *Chromis chromis* (Linnaeus, 1758; fam. Pomacentridae) living in a Marine Protected Area. Journal of Experimental Marine Biology and Ecology 386(1): 125-132.

Pine III, W.E, and S. Martell. 2009. Status of Gulf Sturgeon *Acipenser oxyrinchus desotoi* in the Gulf of Mexico. Unpublished report by University of Florida prepared for 2009 Gulf sturgeon annual working group meeting, Cedar Key, FL. 17-19 November 2009. 51 pp.

Pitman, R.L. and R.L. Brownell Jr. 2020. *Mesoplodon bidens*. The IUCN Red List of Threatened Species 2020: eT13241A50363686. https://dx.doi.org/10.2305/IUCN.UK.2020-3.RLTS.T13241A50363686.en.

Popper, A.N., A.D. Hawkins, R.R. Fay, D. Mann, S. Bartol, T.J. Carlson, S. Coombs, W.T. Ellison, R.L. Gentry, M.B. Halvorsen, S. Lokkeborg, P. Rogers, B.L. Southall, D. Zeddies, and W.N. Tavolga. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report. ASA S3/SC1.4 TR-2014 prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. Springer, Cham, Switzerland. 73 pp.

Powers, S.P., F.J. Hernandez, R.H. Condon, J.M. Drymon, and C.M. Free. 2013. Novel pathways for injury from offshore oil spills: Direct, sublethal and indirect effects of the *Deepwater Horizon* oil spill on pelagic Sargassum communities. PLoS One 8(9): e74802.

Pritchard, P.C.H. 1997. Evolution, phylogeny, and current status, pp. 1-28. In: P.L. Lutz and J.A. Musick (Eds.), The Biology of Sea Turtles. CRC Press, Boca Raton, FL.

Prouty, N.G., C.R. Fisher, A.W.J. Demopoulos, and E.R.M. Druffel. 2016. Growth rates and ages of deep-sea corals impacted by the *Deepwater Horizon* oil spill. Deep-Sea Research Part II: Topical Studies in Oceanography 129: 196-212.

Radford, A.N., E. Kerridge, and S.D. Simpson. 2014. Acoustic communication in a noisy world: Can fish compete with anthropogenic noise? Behavioral Ecology 25: 1,022-1,030.

Rathbun, G.B. 1988. Fixed-wing airplane versus helicopter surveys of manatees. Marine Mammal Science 4(1): 71-75.

Relini, M., L.R. Orsi, and G. Relini. 1994. An offshore buoy as a FAD in the Mediterranean. Bulletin of Marine Science 55(2-3): 1099-1105.

e ito lu, .A., . Altini ik, and A. eskin. 2015. The pollutant emissions from diesel-engine vehicles and exhaust after treatment systems. Clean Technologies and Environmental Policy 17(1): 15-27.

Reuscher, M.G., J.G. Baguley, N. Conrad-Forrest, C. Cooksey, J.L. Hyland, C. Lewis, P.A. Montagna, R.W. Ricker, M. Rohal, and T. Washburn. 2017. Temporal patterns of *Deepwater Horizon* impacts on the benthic infauna of the northern Gulf of Mexico continental slope. PLoS One 12(6): e0179923.

Richards, W.J., T. Leming, M.F. McGowan, J.T. Lamkin, and S. Kelley-Farga. 1989. Distribution of fish larvae in relation to hydrographic features of the Loop Current boundary in the Gulf of Mexico. ICES Marine Science Symposia 191: 169-176.

Richards, W.J., M.F. McGowan, T. Leming, J.T. Lamkin, and S. Kelley-Farga. 1993. Larval fish assemblages at the Loop Current boundary in the Gulf of Mexico. Bulletin of Marine Science 53(2): 475-537.

Richardson, W.J., C.R. Greene Jr., C.I. Malme, and D.H. Thomson. 1995. Marine Mammals and Noise. Academic Press, San Diego, CA. 592 pp.

Rigby, C.L., R. Barreto, J. Carlson, D. Fernando, S. Fordham, M.P. Francis, K. Herman R.W. Jabado, K.M. Liu, A. Marshall, N. Pacoureau, E. Romanov, R.B. Sherley and H. Winker. 2019. Oceanic Whitetip Shark, *Carcharhinus longimanus*. The IUCN Red List of Threatened Species 2019: e.T39374A2911619. https://www.iucnredlist.org/species/39374/2911619.

Rodgers, J.A. and S.T. Schwikert. 2002. Buffer-zone distances to protect foraging and loafing waterbirds from disturbance by personal watercraft and outboard-powered boats. Conservation Biology 16(1): 216-224.

Rojek, N.A., M.W. Parker, H.R. Carter, and G.J. McChesney. 2007. Aircraft and vessel disturbances to Common Murres *Uria aalge* at breeding colonies in central California, 1997-1999. Marine Ornithology 35: 61-69.

Ronconi, R.A., K.A. Allard, and P.D. Taylor. 2015. Bird interactions with offshore oil and gas platforms: Review of impacts and monitoring techniques. Journal of Environmental Management 147: 34-45.

Rosel, P.E., P. Corkeron, L. Engleby, D. Epperson, K.D. Mullin, M.S. Soldevilla, and B.L. Taylor. 2016. Status Review of Bryde's Whales (*Balaenoptera edeni*) in the Gulf of Mexico under the Endangered Species Act. National Oceanic and Atmospheric Administration. NOAA Technical Memorandum NMFS-SEFSC-692.

Rosel, P.E., L.A. Wilcox, T.K. Yamada, and K.D. Mullin. 2021. A new species of baleen whale (Balnaenoptera) from the Gulf of Mexico, with a review of its geographic distribution. Marine Mammal Science 37(2): 577-610

Ross, S.W., A.W.J. Demopoulos, C.A. Kellogg, C.L. Morrison, M.S. Nizinski, C.L. Ames, T.L. Casazza, D. Gualtieri, K. Kovacs, J.P. McClain, A.M. Quattrini, A.Y. Roa-Varón, and A.D. Thaler. 2012. Deepwater Program: Studies of Gulf of Mexico Lower Continental Slope Communities Related to Chemosynthetic and Hard Substrate Habitats. U.S. Department of the Interior, U.S. Geological Survey. U.S. Geological Survey Open-File Report 2012-1032.

Rowe, G.T. and M.C. Kennicutt. 2009. Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology Study. Final Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2009-039. 419 pp.

Rudd, M.B., R.N.M. Ahrens, W.E. Pine III, and S.K. Bolden. 2014. Empirical spatially explicit natural mortality and movement rate estimates for the threatened Gulf Sturgeon (*Acipenser oxyrinchus desotoi*). Canadian Journal of Fisheries and Aquatic Sciences 71: 1407-1417.

Russell, R.W. 2005. Interactions Between Migrating Birds and Offshore Oil and Gas Platforms in the Northern Gulf of Mexico: Final Report. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2005-009. 325 pp.

Sadovy, Y. 1997. The case of the disappearing grouper; *Epinephelus striatus*, the Nassau grouper in the Caribbean and western Atlantic. Proceedings of the Gulf and Caribbean Fisheries Institute 45: 5-22.

Salmon, M., and J. Wyneken. 1990. Do swimming loggerhead sea turtles (*Caretta caretta* L.) use light cues for offshore orientation? Marine and Freshwater Behaviour and Physiology 17(4): 233-246.

Samuel, Y., S.J. Morreale, C.W. Clark, C.H. Greene, and M.E. Richmond. 2005. Underwater, low-frequency noise in a coastal sea turtle habitat. Journal of the Acoustical Society of America 117(3): 1465-1472.

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, J.L.J. Guillette, and S.V. Lamb. 2014a. Health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana, following the *Deepwater Horizon* oil spill. Environmental Science & Technology 48(1): 93-103.

Schwacke, L.H., C.R. Smith, F.I. Townsend, R.S. Wells, L.B. Hart, B.C. Balmer, T.K. Collier, S. De Guise, M.M. Fry, L.J. Guillette, Jr., S.V. Lamb, S.M. Lane, W.E. McFee, N.J. Place, M.C. Tumlin, G.M. Ylitalo, E.S. Zolman, and T.K. Rowles. 2014b. Response to comment on health of common bottlenose dolphins (*Tursiops truncatus*) in Barataria Bay, Louisiana following the *Deepwater Horizon* oil spill. Environmental Science & Technology 48(7): 4,209-4,211.

Schwemmer, P., B. Mendel, N. Sonntag, V. Dierschke, and S. Garthe. 2011. Effects of ship traffic on seabirds in offshore waters: implications for marine conservation and spatial planning. Ecological Applications 21(5): 1851-1860.

Seitz, J.C. and G.R. Poulakis. 2006. Anthropogenic effects on the smalltooth sawfish (*Pristis pectinata*) in the United States. Marine Pollution Bulletin 52(11): 1533-1540.

Shell. 2017. Perdido ROV Interpretation Report 11-14-2017.

Silliman, B.R., J. van de Koppel, M.W. McCoy, J. Diller, G.N. Kasozi, K. Earl, P.N. Adams, and A.R. Zimmerman. 2012. Degradation and resilience in Louisiana salt marshes after the BP *Deepwater Horizon* oil spill. Proceedings of the National Academy of Sciences USA 109(28): 11234-11239.

Silliman, B.R., P.M. Dixon, C. Wobus, Q. He, P. Daleo, B.B. Hughes, M. Rissing, J.M. Willis, and M.W. Hester. 2016. Thresholds in marsh resilience to the *Deepwater Horizon* oil spill. Scientific Reports 6: 32520.

Simões, T.N., A. Candido de Silva, and C. Carneiro de Melo Moura. 2017. Influence of artificial lights on the orientation of hatchlings of *Eretmochelys imbricata* in Pernambuco, Brazil. Zoologia 34: e13727.

Smithsonian Tropical Research Institute. 2015. Speices: Ariomma bondi, Silver Rag Driftfish, Silver Rage, Silver-rag driftfish. https://biogeodb.stri.si.edu/caribbean/en/thefishes/species/4273.

Smultea, M.A., J.R. Mobley Jr., D. Fertl, and G.L. Fulling. 2008. An unusual reaction and other observations of sperm whales near fixed wing aircraft. Gulf and Caribbean Research 20: 75-80.

Soldevilla, M.S., A.J. Debich, L.P. Garrison, J.A. Hildebrand, and S.M. Wiggins. 2022. Rice's whales in the northwestern Gulf of Mexico: call variation and occurrence beyond the known core habitat. Endangered Species Research 48: 155-174.

Southall, B.L., D.P. Nowacek, P.J. Miller, and P.L. Tyack. 2016. Experimental field studies to measure behavioral responses of cetaceans to sonar. Endangered Species Research 31: 293-315.

Southall B.L., D.P. Nowacek, A.E. Bowles, V. Senigaglia, L. Bejder, and P.L. Tyack. 2021. Marine Mammal Noise Exposure Criteria: Assessing the Severity of Marine Mammal Behavioral Responses to Human Noise. Aquatic Mammals 47(5): 421-464.

Spier, C., W.T. Stringfellow, T.C. Hazen, and M. Conrad. 2013. Distribution of hydrocarbons released during the 2010 MC252 oil spill in deep offshore waters. Environmental Pollution 173: 224-230.

Spies, R.B., S. Senner and C.S. Robbins. 2016. An Overview of the Northern Gulf of Mexico Ecosystem. Gulf of Mexico Science 33(1): 98-121.

Stewart, J.D., M. Nuttall, E.L. Hickerson, and M.A. Johnston. 2018. Important juvenile manta ray habitat at Flower Garden Banks National Marine Sanctuary in the northwestern Gulf of Mexico. Marine Biology 165: 111.

Stiles, M.L., E. Harrould-Kolieb, R. Faure, H. Ylitalo-Ward, and M.F. Hirshfield. 2007. Deep Sea Trawl Fisheries of the Southeast U.S. and Gulf of Mexico: Rock Shrimp, Royal Red Shrimp, Calico Scallops. Oceana, Washington, DC. 18 pp.

Stout, S.A. and J.R. Payne. 2018. Footprint, weathering, and persistence of synthetic-base drilling mud olefins in deep-sea sediments following the *Deepwater Horizon* disaster. Marine Pollution Bulletin 118: 328-340.

Suchanek, T.H. 1993. Oil impacts on marine invertebrate populations and communities. American Zoologist 33: 510-523.

Sulak, K.J. and J.P. Clugston. 1998. Early life history stages of Gulf sturgeon in the Suwanee River, Florida. Transactions of the American Fisheries Society 127: 758-771.

Takeshita, R., L. Sullivan, C.R. Smith, T.K. Collier, A. Hall, T. Brosnan, T.K. Rowles, and L.H. Schwacke. 2017. The *Deepwater Horizon* oil spill marine mammal injury assessment. Endangered Species Research 33: 95-106.

Theo, S.L.H. and B.A. Block. 2010. Comparative influence of ocean conditions on Yellowfin and Atlantic Bluefin Tuna catch from longlines in the Gulf of Mexico. PLoS One 5(5): e10756.

Tierney, K.B., Baldwin, D.H., Hara, T.J., Ross, P.S., Scholz, N.L., and C.J. Kennedy. 2010. Olfactory toxicity in fishes. Aquatic Toxicology 96: 2-26.

Todd, V.L.G., W.D. Pearse, N.C. Tegenza, P.A. Lepper, and I.B. Todd. 2009. Diel echolocation activity of harbour porpoises (*Phocoena phocoena*) around North Sea offshore gas installations. ICES Journal of Marine Science 66: 734-745.

Turtle Island Restoration Network. 2023. Kemp's Ridley Sea Turtle Count on the Texas Coast. https://seaturtles.org/turtle-count-texas-coast/.

Tuxbury, S.M. and M. Salmon. 2005. Competitive interactions between artificial lighting and natural cues during seafinding by hatchling marine turtles. Biological Conservation 121: 311-316.

U.S. Environmental Protection Agency. 2016. Questions and Answers about the BP Oil Spill in the Gulf Coast. https://archive.epa.gov/emergency/bpspill/web/html/qanda.html.

U.S. Environmental Protection Agency. 2023. Nonattainment Areas for Criteria Pollutants (Green Book). https://www.epa.gov/green-book.

U.S. Fish and Wildlife Service, Gulf States Marine Fisheries Commission and National Marine Fisheries Service. 1995. Gulf Sturgeon Recovery/Management Plan. U.S. Department of Interior, U.S. Fish and Wildlife Service, Southeast Region. Atlanta, GA. https://www.fisheries.noaa.gov/resource/document/recovery-management-plan-gulf-sturgeon-acipenser-oxyrinchus-desotoi.

U.S. Fish and Wildlife Service. 2001a. Florida manatee recovery plan (*Trichechus manatus latirostris*), Third Revision. U.S. Department of the Interior, Southeast Region. Atlanta, GA. https://sjrda.stuchalk.domains.unf.edu/files/content/sjrda_535.pdf.

U.S. Fish and Wildlife Service. 2001b. Endangered and threatened wildlife and plants; Endangered status for the Florida salt marsh vole. Federal Register 56(9): 1457-1459.

U.S. Fish and Wildlife Service. 2003. Recovery plan for the Great Lakes Piping Plover (*Charadrius melodus*). U.S. Department of the Interior. Fort Snelling, MN. https://ecos.fws.gov/docs/recovery_plan/030916a.pdf.

U.S. Fish and Wildlife Service. 2007. International Recovery Plan: Whooping Crane (*Grus americana*), Third Revision. U.S. Department of the Interior. Albuquerque, NM. https://www.nrc.gov/docs/ML1118/ML111880004.pdf.

U.S. Fish and Wildlife Service. 2009. Brown Pelican *Pelecanus occidentalis* Fact Sheet. https://www.fws.gov/sites/default/files/documents/brown_pelicanfactsheet09.pdf.

U.S. Fish and Wildlife Service. 2014. West Indian Manatee (*Trichechus manatus*) Florida Stock (Florida subspecies, *Trichechus manatus latirostris*). Jacksonville, Florida. https://esadocs.defenders-cci.org/ESAdocs/misc/FR00001606_Final_SAR_WIM_FL_Stock.pdf.

U.S. Fish and Wildlife Service. 2015. Bald and Golden Eagle Information. http://www.fws.gov/birds/management/managed-species/bald-and-golden-eagle-information.php.

U.S. Fish and Wildlife Service. 2016. Hawksbill Sea Turtle (*Eretmochelys imbricata*). https://www.fws.gov/species/hawksbill-sea-turtle-eretmochelys-imbricata.

U.S. Fish and Wildlife Service. 2020a. FWS-Listed U.S. Species by Taxonomic Group. Accessed at: https://ecos.fws.gov/ecp/report/species-listings-by-tax-group-totals.

U.S. Fish and Wildlife Service. 2020b. Whooping Crane Survey Results: Winter 2019-2020. https://ecos.fws.gov/ServCat/DownloadFile/171652.

U.S. Fish and Wildlife Service. 2020c. Whooping Crane *Grus americana.* https://www.fws.gov/species/whooping-crane-grus-americana.

U.S. Fish and Wildlife Service. 2023. Whooping Crane Survey Results: Winter 2022-2023. https://www.fws.gov/sites/default/files/documents/WHCR%20Update%20Winter%202022-2023.pdf.

Valentine, D.L., G.B. Fisher, S.C. Bagby, R.K. Nelson, C.M. Reddy, S.P. Sylva, and M.A. Woo. 2014. Fallout plume of submerged oil from *Deepwater Horizon*. Proceedings of the National Academy of Sciences USA 111(45): 906-915.

Vanderlaan, A. S. and C. T. Taggart. 2007. Vessel collisions with whales: The probability of lethal injury based on vessel speed. Marine Mammal Science 23(1): 144-156.

Venn-Watson, S., K.M. Colegrove, J. Litz, M. Kinsel, K. Terio, J. Saliki, S. Fire, R.H. Carmichael, C. Chevis, W. Hatchett, J. Pitchford, M.C. Tumlin, C. Field, S. Smith, R. Ewing, D. Fauquier, G. Lovewell, H. Whitehead, D. Rotstein, W.E. McFee, and E. Fougeres. 2015. Adrenal gland and lung lesions in Gulf of Mexico common bottlenose dolphins (*Tursiops truncatus*) found dead following the *Deepwater Horizon* Oil Spill. PLoS One 10(5): e0126538.

Wakeford, A. 2001. State of Florida Conservation Plan for Gulf sturgeon (*Acipencer oxyrinchus desotoi*). St. Petersburg, FL, Florida Marine Research Institute. FMRI Technical Report TR-8. 100 pp. https://aquadocs.org/bitstream/handle/1834/18092/TR8.pdf?sequence=1&isAllowed=y.

Waring, G.T., E. Josephson, K. Maze-Foley, and P.E. Rosel. 2016. U.S. Atlantic and Gulf of Mexico Marine Mammal Stock Assessments – 2015. U.S. Department of Commerce, National Oceanic and Atmospheric Administration. NOAA Technical Memorandum NMFS NE 238. 501 pp.

Wartzok, D. and D.R. Ketten. 1999. Marine mammal sensory systems, pp 117-175. In: J.E. Reynolds III and S. Rommel (Eds.), Biology of Marine Mammals. Smithsonian Institution Press, Washington, DC.

Washburn, T.W., M.G. Reuscher, P.A. Montagna, and C. Cooksey. 2017. Macrobenthic community structure in the deep Gulf of Mexico one year after the *Deepwater Horizon* blowout. Deep-Sea Research Part I: Oceanographic Research Papers 127: 21-30.

Wei, C.-L. 2006. The Bathymetric Zonation and Community Structure of Deep-sea Macrobenthos in the Northern Gulf of Mexico. M.S. Thesis, Texas A&M University. Galveston, TX. 91 pp. https://www.ices.dk/sites/pub/CM%20Doccuments/2006/D/D0506.pdf .

Wei, C.-L., G.T. Rowe, G.F. Hubbard, A.H. Scheltema, G.D.F. Wilson, I. Petrescu, J.M. Foster, M.K. Wickstein, M. Chen, R. Davenport, Y. Soliman, and Y. Wang. 2010. Bathymetric zonation of deep-sea macrofauna in relation to export of surface phytoplankton production. Marine Ecology Progress Series 39: 1-14.

White, H.K., P.Y. Hsing, W. Cho, T.M. Shank, E.E. Cordes, A.M. Quattrini, R.K. Nelson, R. Camilli, A.W.J. Demopoulos, C. German, J.M. Brooks, H. Roberts, W.W. Shedd, C.M. Reddy, and C. Fisher. 2012. Impact of the *Deepwater Horizon* oil spill on a deep-water coral community in the Gulf of Mexico. Proceedings of the National Academy of Sciences USA 109(50): 20303-20308.

White, H.K., L.L. Shelby, S.J. Harrison, D.M. Findley, Y. Liu, and E.B. Kujawinski. 2014. Long-term Persistence of Dispersants following the Deepwater Horizon Oil Spill. Environmental Science & Technology Letters 1(7): 295-299.

Wiese, F.K., W.A. Montevecchi, G.K. Davoren, F. Huettmann, A.W. Diamond, and J. Linke. 2001. Seabirds at risk around offshore oil platforms in the north-west Atlantic. Marine Pollution Bulletin 42(12): 1285-1290.

Williams, R., E. Ashe, and P.D. O'Hara. 2011. Marine mammals and debris in coastal waters of British Columbia, Canada. Marine Pollution Bulletin 62(6): 1303-1316.

Wilson, C.A., M.W. Miller, Y.C. Allen, K.M. Boswell, and D.L. Nieland. 2006. Effects of Depth, Location, and Habitat Type on Relative Abundance and Species Composition of Fishes Associated with Petroleum Platforms and Sonnier Bank in the Northern Gulf of Mexico. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2006-037. 85 pp.

Wilson, C.A., A. Pierce, and M.W. Miller. 2003. Rigs and Reefs: A Comparison of the Fish Communities at Two Artificial Reefs, a Production Platform, and a Natural Reef in the Northern Gulf of Mexico. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region. New Orleans, LA. OCS Study MMS 2003-009. 95 pp.

Wilson, J. 2003. Manatees in Louisiana. Louisiana Conservationist July/August 2003. 7 pp.

Wootton, E.C., E.A. Dyrynda, R.K. Pipe, and N.A. Ratcliffe. 2003. Comparisons of PAH-induced immunomodulation in three bivalve molluscs. Aquatic Toxicology 65(1): 13-25.

Würsig, B. 2017. Marine mammals of the Gulf of Mexico, pp. 1489-1587. In: C. Ward (Ed.), Habitats and Biota of the Gulf of Mexico: Before the *Deepwater Horizon* Oil Spill. Springer, New York, NY.

Würsig, B., T.A. Jefferson, and D.J. Schmidly. 2000. The Marine Mammals of the Gulf of Mexico. Texas A&M University Press, College Station, TX. 232 pp.

Würsig, B., S.K. Lynn, T.A. Jefferson, and K.D. Mullin. 1998. Behaviour of cetaceans in the northern Gulf of Mexico relative to survey ships and aircraft. Aquatic Mammals 24(1): 41-50.

Young, C.N. and J.K. Carlson. 2020. The biology and conservation status of the oceanic whitetip shark (*Carcharhinus longimanus*) and future directions for recovery. Reviews in Fish Biology and Fisheries 30: 293-321.

Zykov, M.M. 2016. Modelling Underwater Sound Associated with Scotian Basin Exploration Drilling Project: Acoustic Modelling Report. JASCO Document 01112, Version 2.0. Technical report by JASCO Applied Sciences for Stantec Consulting Ltd. 90 pp.

SECTION 19: ADMINISTRATIVE INFORMATION

A. Exempted Information Description (Public Information Copies Only)

The following attachments were excluded from the public information copies of this plan:

Section 1B OCS Plan Information form – Bottom hole locations & proposed total depths
Section 2J Blowout Scenario – confidential information for NTL 2015-N01 WCD calculation
Section 3A Geologic Description
Section 3B Structure Contour Maps
Section 3C Interpreted 2D or 3D seismic line(s)
Section 3D Cross Section(s)
Section 3E Stratigraphic Column
Section 4 Proprietery analog and stratigraphy encountered data
Section 5 – Mineral Resource Conservation Data (DOCD's only)

B. Bibliography

CSA Environmental Impact Analysis

Shell's Regional OSRP

Shell SEP's S-8064, S-8098 & S-8117

GEMS, "Geologic and Stratigraphic Assessment Blocks 756, 857, 900 and 901 Alaminos Canyon Gulf of Mexico", Project No. 0600-271, May 2001. Previously submitted.

GEMS, "Seafloor and Near-Surface Geologic Assessment Blocks 812-814, 856-858, and 900-902 Alaminos Canyon Area Gulf of Mexico", Project No. 0204-780, July 2004. Previously submitted.

C&C Technologies, "Hazards and Subsidence Monitoring Report, Block 857 and Vicinity, Alaminos Canyon Area, Gulf of Mexico," Project No. 120261, September 2012. Previously submitted.

C&C Technologies, "Archaeological Assessment, Block 815 (OCS-G-19409) & Vicinity, Alaminos Canyon Area, Gulf of Mexico", Project No. 150440, May 2015. Previously submitted.

Fugro Geoservices Inc., "Shallow Hazards Assessment, Multi-Temporal Subsidence Monitoring, & Archaeological Assessment Perdido Field Block 857 & Vicinity Alaminos Canyon Area Gulf of Mexico", Report No. 2414-5056, July 2015. Previously submitted.

Fugro Geoservices, Inc., "Archaeological Assessment, Perdido Field, Blocks 768-771, 856-859, 899-903, and 944-946, Alaminos Canyon Area, Gulf of Mexico", Report No. 2414-5056, July 2015. Previously submitted.

Oceaneering, "Hazards and Subsidence Monitoring Report Perdido AUV Survey Portions of Blocks 812-816, 856-80, and 900-902 Alaminos Canyon Area", Project No. 182843, June 2018. Previously submitted.

Perdido ROV Interpretation Report 11-14-2017, Shell. Previously Submitted.