UNITED STATES GOVERNMENT May 23, 2018
MEMORANDUM

To: Public Information (MS 5030)
From: Plan Coordinator, FO, Plans Section (MS 5231)

Subject: Public Information copy of plan

Control # - N-10015

Type - Initial Exploration Plan

Lease(s) - OCS-G36087 Block - 594 Walker Ridge Area
OCS-G36088 Block - 595 Walker Ridge Area

Operator - Shell Offshore Inc.

Description - Subsea Wells A,B,C,D,E,F,G,H and H-ALT

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/A	G36088/WR/595	7027 FSL, 1947 FWL	G36088/WR/595
WELL/B	G36088/WR/595	7621 FNL, 1676 FWL	G36088/WR/595
WELL/C	G36088/WR/595	5402 FSL, 3417 FWL	G36088/WR/595
WELL/D	G36088/WR/595	4615 FSL, 4392 FWL	G36088/WR/595
WELL/E	G36087/WR/594	6722 FSL, 2006 FEL	G36087/WR/594
WELL/F	G36088/WR/595	4162 FNL, 2632 FWL	G36088/WR/595
WELL/G	G36088/WR/595	6238 FSL, 2788 FWL	G36088/WR/595
WELL/H	G36088/WR/595	7426 FNL, 2360 FWL	G36088/WR/595
WELL/H-ALT	G36087/WR/594	7426 FNL, 2360 FWL	G36088/WR/595

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Public Information Copy

April 9, 2018

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: Initial Exploration Plan
Walker Ridge 594 & 595
OCS-G 36087 & OCS-G 36088
Offshore Louisiana

Dear Mrs. Picou:

In compliance with 30 CFR 550.211 and NTLs 2008-G04, 2009-G27 and 2015-N01, giving Exploration Plan guidelines, Shell Offshore Inc. (Shell) requests your approval of this Initial Exploration Plan for drilling of nine (9) subsea wells, wells A through H and H-Alt.

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 attached to the Proprietary copy of the plan.

We are providing the following report with this filing: *Gardline Surveys Inc, "3D Geohazards Assessment, Shell Exploration and Production Company, Blocks WR594 & 595, Offshore Gulf of Mexico" (Gardline Project No. 11165).*

Should you require additional information, please contact Tracy Albert at 504.425.4652 or tracy.albert@shell.com or myself at 504.425.7215.

Sincerely,

Sylvia A. Bellone

SHELL OFFSHORE INC.

INITIAL EXPLORATION PLAN

For

Walker Ridge Block 594, OCS-G 36087
Walker Ridge Block 595, OCS-G 36088

PUBLIC INFORMATION COPY

APRIL 2018

PREPARED BY:

Tracy W. Albert
Regulatory Specialist

504.425.4652

tracy.albert@shell.com

REVISIONS TABLE:

Date of Request	Plan Section	What was Corrected	Date Resubmitted
Shell Amendment No.1			
4/19/2018	Sections 1, 3, 8 & 18	Added Well H-Alt	4/19/2018

INITIAL EXPLORATION PLAN
OFFSHORE LOUISIANA

TABLE OF CONTENTS

SECTION 1: PLAN CONTENTS

A. DESCRIPTION, OBJECTIVES & SCHEDULE

Shell Offshore Inc. (Shell) is submitting this initial exploration plan (EP/plan) for Walker Ridge (WR) Blocks 594 and 595, OCS-G 36087 and 36088. This initial plan is requesting to drill and complete nine subsea wells: A, B, C, D, E, F, G, H and H-Alt. The wells will be drilled, completed and temporarily abandoned in accordance with 30 CFR 250.1721 until the well(s) are developed under a future DOCD. If the wells are unsuccessful, they will be permanently plugged and abandoned in accordance with the Bureau of Safety and Environmental Enforcement (BSEE) regulations.

The leases are 184 statute miles from the nearest shoreline, 192 statute miles from the onshore support base at Port Fourchon, Louisiana and 222 statute miles from the helicopter base at Houma, Louisiana. Water depths at the well sites range from ~9,631' to ~9,766' (Attachment 1A).

The proposed rig is either a dynamically positioned (DP) semi-submersible (Atwood Condor or similar) or a Drill Ship (Noble Don Taylor or similar). Both 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 of the EP. 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 EP. 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 attached location plat (Attachments 1A and 1B) and BOEM forms (Attachments 1D through 1K).

C. RIG SAFETY AND POLLUTION FEATURES

The rig (Atwood Condor or similar DP semi-submersible or Noble Don Taylor or similar Drill Ship) 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 can be discharged directly overboard. These are mostly located around the main deck and outboard in places where it is unlikely that hydrocarbons will be found.

Drains within 50 feet of a designated chemical storage area which uses the weather deck as a primary containment means shall be designated "normally plugged." An adequate number of drains around the rig shall be designated as "normally open" to allow run-off of rain water. Normally open drains shall have a plug located in a conspicuous area near the drain which can be easily installed in the event of a spill.

The rig's drain plug program consists at a minimum of a weekly check of all deck drains leading to the sea to verify that their status is as designated. If normally open they shall verify that the drain is open and that the plug is available in the area. If normally closed they shall verify that the plug is securely installed in the drain.

In the event a leak or spill is observed, the event shall be contained (drain plug installation and/or spill kit deployment as appropriate) and reported immediately.

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 contain hydrocarbons and cannot be discharged overboard. When oil-based mud is used for drilling it will have to be collected in portable tanks and sent to shore for processing.

3) Mud Drain System

None

4) Oily Water Processing

Oily 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 has to be sent ashore for disposal. On board the MODU an oil record log has to be kept according to instructions included in the log. Any and all pollution pans are subjected to a sheen test before being pumped out. If the water passes the sheen test then it is pumped overboard. If it does not pass the sheen test then the water/oil mixture is pumped to a dirty oil tank and sent to shore for disposal. 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.

5) Lower Hull Bilge System

- The main bilge system is designed to drain the pontoons. There are Goulds electrically driven, self-priming centrifugal pumps - one for each main pump room. The aux pumps can be pump out with the bilge pump but has to be lined up manually from the main pump room.
- Bilge water is pumped overboard after a sheen test has been completed.

- The pontoon bilge pumps are operable from the Bridge and have audible and visual bilge alarms set for high and low levels.
- Portable submersible pumps are carried onboard the rig to service all column void spaces and are also used for emergency bilge pumps in the event of the main pump room flooding.
- Alternate means of pumping the bilges in each pontoon pump room include the use of:
  - The ballast system emergency bilge valve which is operated from the control panel.
  - Portable submersible pumps
  - Emergency bilge suction line connected directly to the ballast manifold. (Main Pump rooms only)

The Bilge pumps are manual/automatic type pumps. They are equipped with sensors that give a high and a high- 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.

6) Emergency Bilge System

Main ballast pumps may also be used for emergency bilge pumping directly from the pump rooms via remotely actuated direct bilge suction valves on the ballast system. These valves will operate in a fully flooded compartment. The ballast pumps can be supplied from the emergency switchboard.

7) 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 has to be sent ashore for disposal. On board all drilling Units, an oil record log has to be kept according to instructions included in the log. The rig floor has two skimmer tanks and each is subjected to a sheen test before pumping overboard to ensure environmental safety. All three anchor winch windlasses have skimmer tanks and are subjected to sheen tests before discharge as well.

8) 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.

9) Rig Floor Drainage

The rig floor is typically outfitted with a Facet International MAS 34-3 separator. The separator has coalescent plates that remove the solids from the drainage and the remaining drainage goes to a skimmer tank. From the skimmer tank it is drained to one of the column dirty oil tank systems where it is then sent through 2 separators and cleaned further to reduce oil content to less than 15 ppm.

10) Columns #3 & 4

The drains on the decks and machinery spaces are separated at mid ship and directed to either the #3 or #4 columns. The separators in these columns go through three cycles of circulation and remove oil to <15 ppm, then discharge the clean product to sea.

11) 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.

12) 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 has to be filled out.
- The oily water collection tank overflow valve is closed.
- The drill floor drains are lined-up to the drill floor skimmer tank. The kkimmer tanks have a high alarm which sounds by means of an air horn. Before tanks are pumped out a sheen test is performed. Water is pumped out the skimmer tanks down the shunt line. Oil containment side is pumped out into 550 gal tote tanks.
- The BOP test area drains are normally lined-up to drain overboard.
- 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.
- The bilge system is normally pumped directly overboard after a sheen test has been performed.
- The engine dirty oil sump can be drained down in port column oily water separator which discharges water overboard from the water side and oil being pumped out into a 550 gal tote tank oil containment side. There is a high audible alarm on the ballast control panel.

D. <u>Storage Tanks – Atwood Condor DP Semi-Submersible or similar:</u>

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		Marine Diesel (0.91 SG)
Diesel Tank in stbd 2	Drilling Rig	2713	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 3	Drilling Rig	3456	1		Marine Diesel (0.91 SG)
Diesel Tank in stbd 4	Drilling Rig	653	1		Marine Diesel (0.91 SG)
Diesel Tank in port 1	Drilling Rig	2090	1		Marine Diesel (0.91 SG)
Diesel Tank in port 2	Drilling Rig	1366	1		Marine Diesel (0.91 SG)
Diesel Tank in port 3	Drilling Rig	4787	1		Marine Diesel (0.91 SG)
Diesel Tank in port 4	Drilling Rig	3456	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	139	1		Marine Diesel (0.91 SG)
Diesel Settling Tanks	Drilling Rig	129	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	100	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	115	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	114	1		Marine Diesel (0.91 SG)
Diesel Day Tank	Drilling Rig	115	1		Marine Diesel (0.91 SG)
Lube Oil Tank	Drilling Rig	86.25	4	345	Lube Oil (0.91 SG)

Storage Tanks – Noble Don Taylor Drillship or similar:

Type of Storage Tank	Type of Facility	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (Specific)
Fuel oil	Drilling Rig	2,889	4	11,556	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	3,225	4	12,900	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	2,887	4	11,548	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	2,680	4	10,720	Marine Diesel (0.91 SG)
Fuel oil	Drilling Rig	178	8	1,424	Marine Diesel (0.91 SG)

E. Pollution Prevention Measures

Pursuant to NTL 2008-G04 the proposed operations covered by this EP 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.

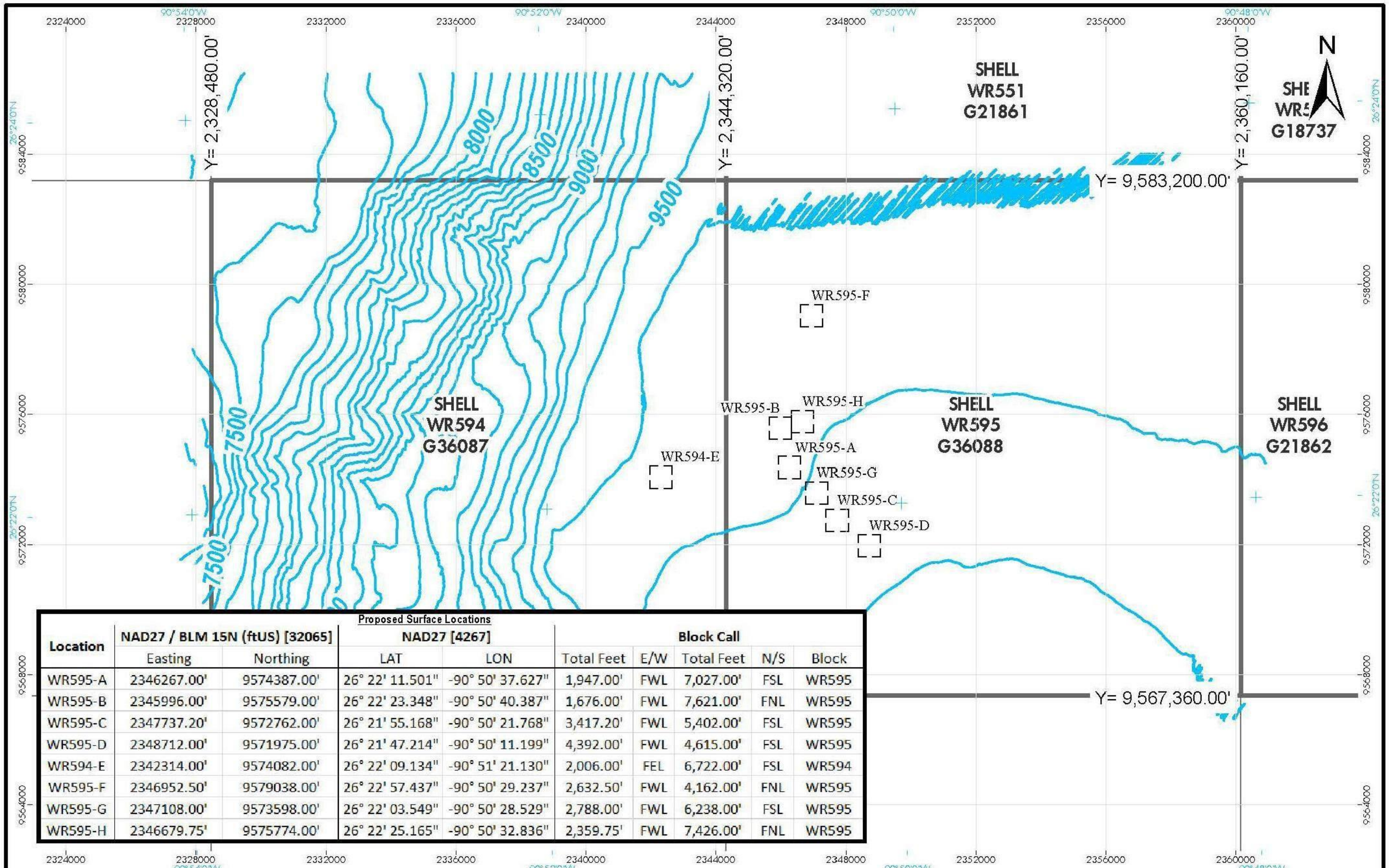
F. Additional Measures

- 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 on a checklist. The checklist is used daily to verify drain plugs are installed.
- 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.
- The rig is involved in a recycling program for cardboard, plastic, paper, glass and aluminum.
- Fuel hoses and SBM are changed on annual basis.
- TODO spill prevention fittings are installed on all liquid take on hoses.
- Waste paint thinner is recycled on board with a solvent still to reduce hazard of shipping and storage.
- All equipment on board utilizes Envirorite hydraulic fluid as opposed to hydraulic oil.
- Shell has obtained ISO14001 certification.
- Shell uses low sulfur fuel.

G. Description of Previously Approved Lease Activities

The leases covered in this plan do not have previous activity.

Attachment 1A - Bathymetry and Surface Locations



Proposed Surface Locations

Location	NAD27 / BLM 15N (ftUS) [32065]		NAD27 [4267]		Block Call				
	Easting	Northing	LAT	LON	Total Feet	E/W	Total Feet	N/S	Block
WR595-A	2346267.00'	9574387.00'	26° 22' 11.501"	-90° 50' 37.627"	1,947.00'	FWL	7,027.00'	FSL	WR595
WR595-B	2345996.00'	9575579.00'	26° 22' 23.348"	-90° 50' 40.387"	1,676.00'	FWL	7,621.00'	FNL	WR595
WR595-C	2347737.20'	9572762.00'	26° 21' 55.168"	-90° 50' 21.768"	3,417.20'	FWL	5,402.00'	FSL	WR595
WR595-D	2348712.00'	9571975.00'	26° 21' 47.214"	-90° 50' 11.199"	4,392.00'	FWL	4,615.00'	FSL	WR595
WR594-E	2342314.00'	9574082.00'	26° 22' 09.134"	-90° 51' 21.130"	2,006.00'	FEL	6,722.00'	FSL	WR594
WR595-F	2346952.50'	9579038.00'	26° 22' 57.437"	-90° 50' 29.237"	2,632.50'	FWL	4,162.00'	FNL	WR595
WR595-G	2347108.00'	9573598.00'	26° 22' 03.549"	-90° 50' 28.529"	2,788.00'	FWL	6,238.00'	FSL	WR595
WR595-H	2346679.75'	9575774.00'	26° 22' 25.165"	-90° 50' 32.836"	2,359.75'	FWL	7,426.00'	FNL	WR595

MAP INFORMATION

Legend

Proposed Surface Location
Graticule Grid Tick
Measured Grid Line
Bathymetric Contour
Lease Block (Current Lease)
Lease Block (Open)

MAP SCALE

1:48,000 — 0, 2,000, 4,000 Feet — Print size: 8.5"x11" (ANSI A)

GEODETIC PARAMETERS

Horizontal Coordinate Reference System
CRS name (ESRI): NAD 1927 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
Vertical Coordinate Reference System
Vertical datum: Mean Sea Level (MSL)
Elevation/Depth: Depth
Vertical units: Foot US

SHELL OFFSHORE INC.

EXPLORATION PLAN

Gulf of Mexico
Walker Ridge Area
Stones SW (WR594/WR595)
Proposed Surface Locations

Author: C. Chen/R. Heider | Date: 07 Mar 2018
Approved By: S. Long | EP Catalog No. EP20180320145100

Source: G:\30_Project\United_States\GOM\GOM_Rejuvenation\Paleogene_Team_Project\EP\Stones SW\StonesSW Proposed Surface Locations Exploration Plan March 2018.mxd

Attachment 1B - Bottom-Hole Locations

Proprietary Data

Attachment 1C

OCS PLAN INFORMATION FORM

General Information

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

Company Name: Shell Offshore Inc.	BOEM Operator Number: 0689
Address: 701 Poydras St., Room 2418	Contact Person: Tracy Albert
New Orleans, LA 70131	Phone Number: 504.425.4652
	Email Address: tracy.albert@shell.com

If a service fee is required under 30 CFR 550.125(a) provide:	Amount Paid: $29,384	Receipt Nos. 268R5PJ5 & 268S35LF

Project and Worst Case Discharge (WCD) Information

Lease(s) OCS-G 36088	Area: WR	Block(s): 595	Project Name: Stones SW

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

Platform/Well Name: B	Total Volume of WCD: 9,000 BOPD	API Gravity: 25°

Distance to Closest Land (Miles): 184	Volume from uncontrolled blowout: 0.49 MMBBL

Have you previously provided information to verify the calculations and assumptions of your WCD?		Yes	X	No
If so, provide the Control Number of the EP or DOCD with which this information was provided	NA			
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	See attached		
Development drilling			
Well completion	See attached		
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	See attached		
Installation of lease term pipelines			
Commence production			
Other (Specify and attach description)			

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		Other (attached description)

Drilling Rig Name (If known): Noble Don Taylor or similar, Atwood Condor or Similar

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
NA			

Attachment 1C.1 Schedule

Schedule to drill, complete and install tree:

Well	Start date	Duration	End date
A	7/01/2018	225	2/11/2019
B	1/1/2020	225	8/13/2020
C	1/1/2021	225	8/14/2021
D	1/1/2022	225	8/14/2022
E	1/1/2023	225	8/14/2023
F	1/1/2024	225	8/13/2024
G	1/1/2025	225	8/14/2025
H	1/1/2026	195	7/15/2026
H-Alt	7/16/2026	30	8/15/2026

Attachment 1D

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): A	Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	25°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 36088	OCS-G 36088	OCS OCS
Area Name	WR	WR	
Block No.	595	595	
Blockline Departure (in feet)	N/S Departure: 7,027' FSL		N/S Departure: N/S Departure:
	E/W Departure 1,947' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,346,267		X:
	Y: 9,574,387		Y:
Lat/Long	Latitude: 26° 22' 11.501"		Latitude
	Longitude: -90° 50' 37.627"		Longitude

Water Depth (Feet): 9,789'			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

Proposed Well/Structure Location								
Well or Structure Name/Number (if renaming well or structure, reference previous name): B				Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD		For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	25°		

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 36088	OCS-G 36088	OCS OCS
Area Name	WR	WR	
Block No.	595	595	
Blockline Departure (in feet)	N/S Departure: 7,621' FNL		N/S Departure: N/S Departure:
	E/W Departure 1,676' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,345,996		X:
	Y: 9,575,579		Y:
Lat/Long	Latitude: 26° 22' 23.348"		Latitude
	Longitude: -90° 50' 40.387"		Longitude

Water Depth (Feet): 9,776'			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

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): C				Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD		For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	25°	
	Surface Location		**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**		
Lease Number	OCS-G 36088		OCS-G 36088		OCS OCS		
Area Name	WR		WR				
Block No.	595		595				
Blockline Departure (in feet)	N/S Departure: 5,402' FSL				N/S Departure: N/S Departure:		
	E/W Departure 3,417' FWL				E/W Departure: E/W Departure:		
Lambert X-Y Coord.	X: 2,347,737				X:		
	Y: 9,572,762				Y:		
Lat/Long	Latitude: 26° 21' 55.168"				Latitude		
	Longitude: -90° 50' 21.768"				Longitude		
Water Depth (Feet): 9,738'					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

Proposed Well/Structure Location							
Well or Structure Name/Number (if renaming well or structure, reference previous name): D			Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	25°		
	Surface Location	**Bottom Hole Location (for Wells)**		**Completion (for multiple enter separate lines)**			
Lease Number	OCS-G 36088	OCS-G 36088		OCS OCS			
Area Name	WR	WR					
Block No.	595	595					
Blockline Departure (in feet)	N/S Departure: 4,615' FSL			N/S Departure: N/S Departure:			
	E/W Departure 4,392' FWL			E/W Departure: E/W Departure:			
Lambert X-Y Coord.	X: 2,348,712			X:			
	Y: 9,571,975			Y:			
Lat/Long	Latitude: 26° 21' 47.214"			Latitude			
	Longitude: -90° 50' 11.199"			Longitude			
Water Depth (Feet): 9,868'				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

Proposed Well/Structure Location								
Well or Structure Name/Number (if renaming well or structure, reference previous name): E				Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD		For structures, volume of all storage and pipelines (bbls): NA		API Gravity of fluid	25°		

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 36087	OCS-G 36087	OCS OCS
Area Name	WR	WR	
Block No.	594	594	
Blockline Departure (in feet)	N/S Departure: 6,722' FSL		N/S Departure: N/S Departure:
	E/W Departure 2,006' FEL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,342,314		X:
	Y: 9,574,082		Y:
Lat/Long	Latitude: 26° 22' 09.134"		Latitude
	Longitude: -90° 51' 21.130"		Longitude

Water Depth (Feet): 9,733'			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

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): F	Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	25°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 36088	OCS-G 36088	OCS OCS
Area Name	WR	WR	
Block No.	595	595	
Blockline Departure (in feet)	N/S Departure: 4,162' FNL		N/S Departure: N/S Departure:
	E/W Departure 2,632' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,346,952		X:
	Y: 9,579,038		Y:
Lat/Long	Latitude: 26° 22' 57.437"		Latitude
	Longitude: -90° 50' 29.237"		Longitude

Water Depth (Feet): 9,740'			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

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): G	Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	25°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 36088	OCS-G 36088	OCS OCS
Area Name	WR	WR	
Block No.	595	595	
Blockline Departure (in feet)	N/S Departure: 6,238' FSL		N/S Departure: N/S Departure:
	E/W Departure 2,788' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,347,108		X:
	Y: 9,573,598		Y:
Lat/Long	Latitude: 26° 22' 03.549"		Latitude
	Longitude: -90° 50' 28.529"		Longitude

Water Depth (Feet): 9,815'			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 1K

Proposed Well/Structure Location						
Well or Structure Name/Number (if renaming well or structure, reference previous name): H	Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	25°

	Surface Location	Bottom Hole Location (for Wells)	Completion (for multiple enter separate lines)
Lease Number	OCS-G 36088	OCS-G 36088	OCS OCS
Area Name	WR	WR	
Block No.	595	595	
Blockline Departure (in feet)	N/S Departure: 7,426' FNL		N/S Departure: N/S Departure:
	E/W Departure 2,360' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,346,680		X:
	Y: 9,575,774		Y:
Lat/Long	Latitude: 26° 22' 25.165"		Latitude
	Longitude: -90° 50' 32.836"		Longitude

Water Depth (Feet): 9,787'			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 1L

Proposed Well/Structure Location					
Well or Structure Name/Number (if renaming well or structure, reference previous name): H-Alt	Previously reviewed under an approved EP or DOCD?		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): 9,000 BOPD	For structures, volume of all storage and pipelines (bbls): NA	API Gravity of fluid	25°

	Surface Location	**Bottom Hole Location (for Wells)**	**Completion (for multiple enter separate lines)**
Lease Number	OCS-G 36088	OCS-G 36087	OCS OCS
Area Name	WR	WR	
Block No.	595	594	
Blockline Departure (in feet)	N/S Departure: 7,426' FNL		N/S Departure: N/S Departure:
	E/W Departure 2,360' FWL		E/W Departure: E/W Departure:
Lambert X-Y Coord.	X: 2,346,680		X:
	Y: 9,575,774		Y:
Lat/Long	Latitude: 26° 22' 25.165"		Latitude
	Longitude: -90° 50' 32.836"		Longitude

Water Depth (Feet): 9,787'			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=	

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. Prior to beginning exploration operations, an Application for Permit to Drill (APD) will be submitted and approved by the Bureau of Safety and Environmental Enforcement (BSEE).

B. Drilling Fluids

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

C. Production

Information regarding production is not included in this EP as such information is only necessary in the case of DOCDs.

D. Oil Characteristics

Information regarding oil characteristics is not included in this EP as such information is only necessary in the case of DOCDs.

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 EP.

F. Bonding

The bond requirement for the activities proposed in this EP are satisfied by an area-wide bond furnished and maintained according to 30 CFR Part 256, Subpart I-Bonding; NTL No. 2000-G16, "Guideline for General Lease Surety Bonds" and 30 CFR 256.53(d) and National NTL No. 2016-N01, "Additional Security."

G. Oil Spill Financial Responsibility (OSFR)

Shell Offshore Inc., BOEM Operator Number 0689, has demonstrated oil spill financial responsibility for the activities proposed in this EP 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., BOEM Operator Number 0689, has the financial capability to drill a relief well and conduct other emergency well control operations if required.

I. Suspension of Production

Information regarding Suspension of Production is not included in this EP as such information is only necessary in the case of DOCDs.

J. Blowout scenario

This Section 2J was prepared by Shell Offshore Inc. (Shell) pursuant to the guidance provided in the Bureau of Ocean Energy Management (BOEM) Notice to Lessees (NTL) No. 2015-N01 with respect to blowout and worst-case discharge scenario descriptions. Shell intends to comply with all applicable laws, regulations, rules and Notices to Lessees.

Shell focuses on an integrated, three-pronged approach to a blowout, including prevention, intervention/containment, and recovery.

1. Shell believes that the best way to manage blowouts is to prevent them from happening. Significant effort goes into design and execution of wells and into building and maintaining staff competence. Shell continues to invest independently in Research and Development (R&D) to improve safety and reliability of our well systems.

2. Shell is a founding member of the Marine Well Containment Company (MWCC), which provides robust well containment (shut-in and controlled flow) capabilities. Additionally, Shell is investing in R&D to improve containment systems.

3. As outlined in Shell's Oil Spill Response Plan (OSRP), and detailed in EP Section 9, Shell has contracts with Oil Spill Removal Organizations (OSROs) to provide the resources necessary to respond to this Worst-Case Discharge (WCD) scenario. The capabilities for on-water recovery, aerial and subsea dispersant application, in-situ burning, and nighttime monitoring and tracking have been significantly increased.

The WCD blowout scenario is calculated for the exploration well "WR595-B" of the target sands and based on the guidelines outlined in NTL No. 2015-N01 and subsequent Frequently Asked Questions (FAQ). The WCD for this well falls below the WCD exploratory scenario included in Shell's regional OSRP. Shell's Regional OSRP has response capabilities based on the first 30-day average daily rate; thus, 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.

The WCD scenario, in terms of both initial and the sustained rates, has a low probability of being realized. Some of the factors that are likely to reduce rates and volumes, and are not included in the WCD calculation, include but are not limited to, obstructions or equipment in the wellbore, well bridging, and early intervention, such as containment capabilities.

Uncontrolled blowout (volume first day)	9,000 bbl oil
Uncontrolled blowout rate (first 30 days average daily rate)	8,833 BOPD
Duration of flow (days) based on relief well	64 Days
Total volume of spill (bbls) until relief well drilled	0.49 mmbbl oil

Table 1: Worst Case Discharge Summary

Stones SW Project Overview

Stones SW is located in the Gulf of Mexico (GOM), approximately 192 nautical miles southwest of Port Fourchon, Louisiana, in water depths of approximately 9,700 (ft). The prospect is located 6.5 miles from the Stones FPSO facility (Turritella) and will eventually be a near-field tie in to Stones Drill Center 1.

1) Purpose

Pursuant with 30 CFR 250.213(g), 250.219, 250.250, and NTL No. 2015-N01, this document provides a blowout scenario description, further information regarding any potential oil spill, the assumptions and calculations used to determine the WCD and the measures taken to 1) enhance the ability to prevent a blowout and 2) respond and manage a blowout scenario if it were to occur. These calculations are based on best technical estimates of subsurface parameters that are derived from the offset wells, and from seismic. These 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.

2) Background

This attachment has been developed to document the additional information requirements for Exploration Plans as requested by NTL No. 2015-N01 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.

3) Information Requirements

a) Blowout scenario

All eight well locations addressed in this EP were assessed for Worst Case Discharge using the expected well path, the expected reservoir thickness, structural elevation, and rock/fluid properties for each. Stones SW "B" (WR595) well path is a vertical well near the crest of the structure with top and bottom hole locations in W595. This well represents the highest 30-day average well flow potential. The Stones SW "B" well (WR 595) will be drilled through the reservoir as outlined in the Geological and Geophysical Information Section of the Stones SW EP, and described above, utilizing a typical subsea wellhead system, conductor, surface and intermediate casing program, and using a Dynamically Positioned Drill ship rig with a marine riser and subsea Blowout Preventer. A hydrocarbon influx and a well control event is modeled to occur from the reservoirs. The simulated blowout model results in unrestricted flow from the well at the seafloor. This represents the worst-case discharge, with no restrictions in the wellbore, plus failure/loss of the subsea BOP, and a blowout to the seabed.

b) Estimated flow rate of the potential blowout

Category	EP
Type of Activity	Drilling
Facility Location (area/block)	WR595
Facility Designation	DP
Distance to Nearest Shoreline (miles)	184 statute miles
Uncontrolled blowout volume (first day)	9,000 bbl oil
Uncontrolled blowout volume (first 30 day average daily rate)	8,833 BOPD

Table 2: Estimated Flow Rates of a Potential Blowout

c) Total volume and maximum duration of the potential blowout

Duration of flow (days)	64
Total volume of spill (bbls)	0.49 mmbbl oil

Table 3: Estimated Duration and Volume of a Potential Blowout

There is usually a decline in the discharge rate as time proceeds, which is illustrated by the difference between the first 24-hour volume and 30-day average rate. The total volume calculated until a well is killed in a potential blowout further demonstrates this decline. At very short times, e.g. during the first 24 hours, the pressure profile in the reservoir changes from the moment when a 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. 2015-N01 estimates for 24-hour and 30-day rates as well as maximum duration volumes.

d) Assumptions and calculations used in determining the worst-case discharge for WR 595 (Proprietary data)

e) Potential for the well to bridge over

Mechanical failure/collapse of the borehole in a blowout scenario is influenced by several factors including in-situ stress, rock strength and fluid velocities at the sand face. Based on the nodal analysis and reservoir simulation models outlined above, a surface blowout would create a high drawdown at the sand face. Given the substantial fluid velocities inherent in the worst-case discharge, and the scenario as defined where the formation is not supported by a cased and cemented wellbore, it is possible that the borehole may fail/collapse/bridge over within the span of a few days, significantly reducing outflow rates. However, this WCD scenario does not include any bridging or consideration of solids production with the oil and gas.

f) Likelihood for intervention to stop the blowout.

Safety of operations is our top priority. Maintaining well control always to prevent 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 making 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 the Final Drilling Safety Rule with respect to Remotely Operated Vehicle (ROV) hot stab capabilities, a deadman system, and an autoshear system.

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. Shell is further analyzing these advances and incorporating them into its comprehensive approach to help prevent and, if needed, control another deepwater control incident.

Shell is a founding member of the Marine Well Containment Company (MWCC), which provides robust well containment (shut-in and controlled flow) capabilities. Pursuant to NTL No. 2010-N10, Shell will provide additional information regarding our containment capabilities in a subsequent filing.

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

There are no platforms in the vicinity of this location to drill a relief well. Blowout intervention can be conducted from an ROV equipped vessel, the existing drilling rig or from another drilling rig. The dynamically positioned rigs under contract below will be preferred rigs for blowout intervention work. However, moored rigs can also be used in some scenarios. Additionally, in the event of a blowout, there are other non-contracted rigs in the GoM which could be utilized for increased expediency or better suitability. All efforts will be made at the time to secure the appropriate rig. Shell's current contracted rigs capable of operating at Stones SW water depths and reservoir depths without technical constraints are shown in the table below.

Rig Name	Rig Type
TO Deepwater Poseidon	Dynamically Positioned Drill ship
TO Deepwater Thalassa	Dynamically Positioned Drill ship
TO Deepwater Proteus	Dynamically Positioned Drill ship

Table 4: Available Rigs in Shell's fleet

Future modifications may change the rig's capability. Rig capabilities need to be assessed on a work scope basis.

h) Time taken to contract a rig, mobilize, 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 Shell contracted rigs capable of operating at this location is shown in Table 4 above. It is expected to take an average of 10 days to safely secure the well that the rig is working on; up to the point the rig departs location, and a further 4 days transit to mobilize to the relief well site depending on distance to travel. The relief well will take approximately 36 days to drill down to the last casing string above the blowout zone plus approximately 14 days for precision ranging activity to intersect the blowout well bore. Total time to mobilize and drill a relief well would be approximately 64 days for this well.

If a moored rig is chosen to conduct the relief well operations, anchor handlers would be prioritized to prepare mooring on the relief well site while the rig is being mobilized. This activity is not expected to delay initiation of relief well drilling operations.

i) 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 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). 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, providing their specific expertise. A Drill the Well on Paper (DWOP) exercise is conducted with rig personnel and vendors involved in execution of the well. 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 Stones SW. 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 offshore drilling foremen and onshore Shell representative(s) 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 lived 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, such as by 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 to life saving rules) have created a strong safety culture in our operations.

j) 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 3f of this document, Shell is currently analyzing recent advances in containment technology and equipment and will incorporate them as they become available.

k) Arrangements for drilling a relief well

The size of the Shell contracted rig fleet in the GoM from 2018-2025 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 root cause analysis of the blowout. A generic relief well description is outlined in the WCCP.

l) Assumptions and calculations used in approved or proposed OSRP

Shell has designed a response program (Regional OSRP) 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 or development 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.

4. <u>Chemical Products</u>

Information regarding chemical products is not included in this plan as such information is not required by BOEM GoM.

SECTION 3: GEOLOGICAL AND GEOPHYSICAL INFORMATION

Proprietary Data

A. Geological description

B. Structure Contour Map(s)

C. Interpreted 2D and/or 3D Seismic line(s)

D. Geological Structure Cross-section(s)

E. Stratigraphic Column with Time vs Depth Table

F. Shallow Hazards Report

The following report (being submitted to BOEM in this plan) were used in our analysis and is being provided with this Plan: Gardline Surveys Inc, "*3D Geohazards Assessment, Shell Exploration and Production Company, Blocks WR594 & 595, Offshore Gulf of Mexico*" (Gardline Project No. 11165).

G. Shallow Hazards Assessment

See Section 6A of this plan for detailed site assessment, Power Spectrums and Top-hole Prognosis.

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

18-28 ppm

B. Classification

Based on 30 CFR 250.490 and 30 CFR 550.215, 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 confirmed.

C. H_2S Contingency Plan

Shell will 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

Information regarding Mineral Resource Conservation is not included in this EP as such information is only necessary in the case of DOCDs.

SECTION 6: BIOLOGICAL, PHYSICAL AND SOCIOECONOMIC INFORMATION

A. Wellsite, Geohazards and Archaeological Assessment

This report addresses seafloor and subsurface conditions specific to the following proposed well locations, and complies with BOEM NTL 2008-G05 (Shallow Hazards Program), NTL 2008-G04 (Information Requirements for EPs and DOCDs), NTL 2009-G40 (Deepwater Benthic Communities), and NTL 2005-G07 and Joint 2011-G01 (Archaeological Resource Surveys and Reports).

The following summary of the geohazards and archaeological assessment is based on the findings provided within the following detailed report, which is being submitted concurrently with this exploration plan:

Gardline Surveys Inc, "*3D Geohazards Assessment, Shell Exploration and Production Company, Blocks WR594 & 595, Offshore Gulf of Mexico*" (Gardline Project No. 11165)

These assessments address the seafloor and subsurface conditions within a 2,000-ft radius around the proposed wellsite locations, to the depth of the top of salt if present, or to the depth of Horizon H12 otherwise.

Available Data: Assessments are based on the analysis of the data from AUV (Autonomous Underwater Vehicle) geophysical survey data (sub-bottom profiler, side-scan sonar and multi-beam echo-sounder), and 3D seismic data volumes. All data were provided by Shell.

Existing Infrastructure and Shipping Activity: No existing infrastructure, such as pipelines, existing wells, or shipping lanes, occurs within the study area (Blocks WR594 & 595). Existing wells are located approximately 3.7 miles to the northeast, in block WR508.

Proposed Wellsite WR595-A, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the west-central region of block WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-A-Figure 001).

Table 6-1. Proposed Well Location Coordinates

Proposed Well WR595-A			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		**Line Reference**	**Block Calls (WR595)**
X: 2,346,267 ft	Latitude: 26.36986134° N	Inline 20750	1,947 ft FWL
Y: 9,574,387 ft	Longitude: -90.84378533° W	Crossline 58453	7,027 ft FSL

Water Depth and Seafloor Conditions: Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,687 ft, and the seafloor slopes at <1.0° down to the ESE.

The proposed well is located 6,324 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seafloor approximately 1,220 ft to the southeast of a mega furrow field. The possibility for seafloor currents should be anticipated, as suggested by the presence of the mega-furrows.

The smooth seafloor area contains some low-relief, winnowed depressions, and also areas of elevated backscatter response related to uneven erosion of the shallowest sediments by seafloor currents. The proposed well is not located within any of the seafloor depressions, however, the proposed well is in an area affected by erosion, as demonstrated by the increased backscatter response, and seafloor and shallow soil stiffness may be higher than expected. This could affect jet-in of the conductor at the seafloor.

The seafloor sediments are interpreted to consist of clays and silts passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-A-Figure 002). The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seafloor with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEM in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 9,060ft to the northwest and the southwest of the proposed well location. These anomalies are not corroborated by this study. A few areas of slightly higher amplitude are related to the mega-furrows, but these are not evidence of fluid venting at the seafloor or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seafloor to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-A-Figure 003). Subsurface depths are determined using a polynomial time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 129-ft thick at the proposed wellbore. The upper sediments at the seafloor are interpreted to consist of clays and silts overlying a clay and silt interval with occasional sands.

Unit B (Horizon 01 to Horizon H02). Unit B, between 129 ft and 267 ft BML (138-ft thick) presents as low-amplitude reflectors interpreted as well-layered turbidites with silts and clays, and occasional possible thin (<10-ft thick) sands.

Unit C (Horizon H02 to Horizon H03). The upper part of Unit C, between about 267 ft and 381 ft BML (114-ft thick), is interpreted as mass transport deposits and reworked strata, consisting of slightly-chaotic silts and clays, with possible thin sands. From 381 ft to 588 ft BML (207-ft thick), Unit C is interpreted as mass-transport, higher energy sediment deposits exhibiting channelized character. The sediments are interpreted as clays, silts, and numerous channelized sands. Minor wellbore stability and drilling fluid circulation problems may occur within this lower interval.

Unit D (Horizon H03 to Horizon H04). Unit D, between about 588 ft and 999 ft BML (411-ft thick), displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional thin sands.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 999 ft and 1,412 ft BML (413-ft thick), is interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is identified in the mid part of Unit E at 1,190 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between about 1,412 ft and 1,619 ft BML (207-ft thick), presents seismically as low and slightly moderate-amplitude reflectors interpreted as well layered clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. The lower interval in Unit F from 1,619 ft to 2,066ft BML (447 ft-thick) is interpreted to consist of well-layered clays and silts with occasional sands.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,066 ft and 2,519 ft BML (453-ft thick), is characterized by well-layered low amplitude reflectors interpreted as clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between 2,519 ft and 2,637 ft BML (118-ft thick), appears as slightly-chaotic and low-amplitude reflectors interpreted to represent possible clays, silts, and occasional sands. The lower interval from 2,637 ft to 3,186 ft BML (549-ft thick) is interpreted as higher energy deposits that have been slightly channelized, interpreted as clays, silts, and several possible sands. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,186 ft and 3,439 ft BML (253-ft thick), appears seismically as a well-layered, low and slightly moderate-amplitude reflectors interpreted as clays, silts, and occasional sand interbeds. A <35ft thick sand interbed occurs at 3,293 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed. From 3,439 ft to 4,176 ft BML (737-ft thick) the interval appears seismically as slightly-chaotic reflectors interpreted as mass-transport deposits with clays, silts, and occasional sands. The lower interval from 4,176 ft to 4,617 ft BML (441-ft thick) presents as well-layered, low amplitude reflectors interpreted as clays and silts.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,617 ft and 5,082 ft BML (465-ft thick), presents as slightly-chaotic, low and occasionally moderate-amplitude reflectors interpreted as mass-transport and slightly channelized deposits with clays, silts, and occasional sand interbeds. A <40ft thick sand interbed occurs at 4,749 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed. From 5,082 ft to 5,553 ft BML (471-ft thick) the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval from 5,553 ft to 5,944 ft BML (391-ft thick) displays well-layered, low and occasional slightly moderate amplitude reflectors interpreted as clays, silts, and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,944 ft and 6,100 ft BML (156-ft thick), displays well-layered, low-amplitude reflectors interpreted as clays, silts, and occasional sand interbeds. From 6,100 ft to 6,575 ft BML (475-ft thick) the interval displays well layered, low amplitude reflectors interpreted as clays and silts. The lower interval from 6,575 ft to 6,837 ft BML (262-ft thick) is well-layered and slightly-chaotic interpreted to contain, possibly channelized deposits with clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to (Horizon H12) 6,837 ft BML.

Gas Hydrates. The upper interval of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sediments at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys Inc, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay and silt rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible.**

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-A well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 2,465 ft to the southwest of the proposed well. Contacts 7001 and 7002 are located 7,505 ft and 13,121 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-A, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though seafloor and shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The possibility for an increase in seafloor currents should be anticipated at the proposed well due to the presence of current erosion features (mega-furrows) to the north. There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,837 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with increased possibility of minor sand interbeds, as well as the level of three identified <40ft thick sand interbeds.

Proposed Wellsite WR595-B, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the west-central portion of WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-B-Figure 001).

Table 6-2. Proposed Well Location Coordinates

Proposed Well WR595-B			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR595)
X: 2,345,996 ft	Latitude: 26.37315218° N	Inline 20743	1,676 ft FWL
Y: 9,575,579 ft	Longitude: -90.84455186° W	Crossline 58511	7,621 ft FNL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,674 ft, and the seafloor slopes at 2.6° to the southeast.

The proposed well is located 5,733 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seabed just to the southeast of a mega-furrow field. The possibility for seafloor currents should be anticipated, as suggested by the presence of the mega-furrows.

The smooth seafloor area contains some very low-relief, winnowed depressions, and also areas of elevated backscatter response related to uneven erosion of the shallowest sediments by seafloor currents. The proposed well is located on the margin between the furrowed and eroded, areas, and the eroded areas, as demonstrated by the increased backscatter response may exhibit seabed and shallow soil stiffness that are higher than expected. This could affect jet-in of the conductor at the seabed.

The seabed sediments are interpreted to consist of clays and silts passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-B-Figure 002). The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 8,000ft to the northwest of the proposed well location. These anomalies are not corroborated by this study. A few areas of slightly higher amplitude are related to the mega-furrows, but these are not evidence of fluid venting at the seabed or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seabed to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-B-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 139-ft thick at the proposed wellbore. The upper sediments at the seabed are interpreted to consist of clays and silt overlying a clay and silt interval with occasional sands.

Unit B (Horizon 01 to Horizon H02). Unit B, between 139 ft and 294 ft BML (155-ft thick) displays low and occasional moderate-amplitude reflectors interpreted as well-layered turbidites with clays and silts, and occasional possible thin (<10ft) sands.

Unit C (Horizon H02 to Horizon H03). The upper part of Unit C, between about 294 ft and 402 ft BML (108-ft thick), is interpreted as mass transport deposits and reworked strata, interpreted as clays and silts, with possible thin sands. From 402 ft to 511 ft BML (109-ft-thick), Unit C comprises of mass-transport, higher energy sediment deposits exhibiting channelized character. The sediments are interpreted as clays, silts, and numerous channelized sands. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval.

Unit D (Horizon H03 to Horizon H04). Unit D, between about 511 ft and 999 ft BML (488-ft thick), displays low amplitude reflectors interpreted as well-layered clays, silts, and occasional thin sands.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 999 ft and 1,416 ft BML (417-ft thick), displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is identified in the mid part of Unit E at 1,187 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between about 1,416 ft and 1,602 ft BML (186-ft thick), presents seismically as low and slightly moderate-amplitude reflectors interpreted as well-layered clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. The lower interval in Unit F from 1,602 ft to 2,069 ft BML (467 ft-thick) is interpreted to consist of well-layered clays and silts with occasional sands.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,069 ft and 2,547 ft BML (478-ft thick), is characterized by low-amplitude reflectors interpreted as clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between about 2,547 ft and 2,662 ft BML (115-ft thick), appears as slightly-chaotic and low-amplitude reflectors interpreted as possible mass transport deposits interpreted as clays, silts, and occasional sands. The lower interval from 2,662 ft to 3,210 ft BML (548-ft thick) is interpreted as higher energy deposits that have been slightly channelized, interpreted as clays, silts, and several possible sands. A <35ft thick sand interbed occurs at 2,817 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval, including at the level of the interbed.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,210 ft and 3,395 ft BML (185-ft thick), presents as low- and slightly moderate-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds. A <40ft thick sand interbed occurs at 3,315 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed. From 3,395 ft to 4,184 ft (789-ft thick) the interval appears seismically as slightly-chaotic reflectors interpreted as mass-transport deposits with clays, silts, and occasional sands. The lower interval from 4,184 ft to 4,613 ft BML (429-ft thick) displays well layered low-amplitude reflectors interpreted as clays and silts.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,613 ft and 5,086 ft BML (473-ft thick), appears seismically as slightly-chaotic, low- and occasionally moderate-amplitude reflectors interpreted as mass-transport and slightly channelized deposits with clays, silts, and occasional sand interbeds. From 5,086 ft to 5,557 ft BML (471-ft thick) the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval from 5,557 ft to 5,956 ft BML (399-ft thick) displays well-layered, low and occasional slightly moderate-amplitude reflectors interpreted as clays, silts, and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,956 ft and 6,080 ft BML (124-ft thick), appears seismically as low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds. From 6,080 ft to 6,651 ft BML (571-ft thick) the interval appears as low amplitude reflectors interpreted as well layered clays and silts. The lower interval from 6,651 ft to 6,854 ft BML (203-ft thick) presents as well-layered variable amplitude and slightly-chaotic acoustic signature interpreted as possible channelized deposits with clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,854 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys Inc, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible**.

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-B well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 3,170 ft to the southwest of the proposed well. Contacts 7001 and 7002 are located 8,305 ft and 13,056 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-B, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though seafloor and shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The possibility for an increase in currents should be expected due to the location of current erosion features (mega-furrow field) adjacent to the proposed well. There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,854 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with increased possibility of minor sand interbeds, as well as the level of two identified <40ft thick sand interbeds.

Proposed Wellsite WR595-C, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the southwest portion of WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-C-Figure 001).

Table 6-3. Proposed Well Location Coordinates

Proposed Well WR595-C			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR595)
X: 2,347,737 ft	Latitude: 26.36532438° N	Inline 20730	3,417 ft FWL
Y: 9,572,762 ft	Longitude: -90.83937988° W	Crossline 58351	5,402 ft FSL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,736 ft, and the seafloor slopes at 1.1° to the southeast.

The proposed well is located 8,335 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seafloor approximately 3,378 ft to the southeast of a mega furrow field. The possibility for seafloor currents should be anticipated, as suggested by the presence of mega-furrows.

The smooth seabed area contains some very low-relief, winnowed depressions, and areas of elevated backscatter response related to uneven erosion of the shallowest sediments by strong currents. The proposed well is not located within any of the seabed depressions, however, the eroded areas, as demonstrated by the elevated backscatter response may exhibit seabed and shallow soil stiffness that are higher than expected. This could affect jet-in of the conductor at the seabed.

The seabed sediments are interpreted to consist of clays and silts, passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-C-Figure 002). The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 8,680ft to the southwest of the proposed well location. These anomalies are not corroborated by this study. Areas of higher backscatter at and near the proposed wellsite are related to the low-relief winnowed region. These are not evidence of fluid venting at the seabed or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seabed to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-C-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 121-ft thick at the proposed wellbore. The upper sediments at the seabed are interpreted to consist of clays and silts, overlying a clay and silt interval with occasional sandy interbeds.

Unit B (Horizon 01 to Horizon H02). Unit B, between 121 ft and 249 ft BML (128-ft thick) appears seismically as low- and occasional moderate-amplitude reflectors, interpreted as possible well layered turbidites, with clays and silts, and occasional possible thin sands.

Unit C (Horizon H02 to Horizon H03). The upper part of Unit C, between about 249 ft and 381 ft BML (132-ft thick), is interpreted as mass transport deposits and reworked strata, interpreted as clays and silts, with possible thin sands. From 381 ft to 530 ft BML (149ft-thick) Unit C comprises of mass-transport, higher energy sediment deposits exhibiting channelized character. The sediments are interpreted as clays, silts, and numerous channelized sands. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval.

Unit D (Horizon H03 to Horizon H04). The upper part of Unit D, between about 530 ft and 733 ft BML (203-ft thick), displays low-amplitude reflectors interpreted as slightly-chaotic, possible channelized deposits, containing clays, silts and occasional sands. The lower interval in Unit D from 733 ft to 968 ft BML (235-ft-thick), is interpreted to consist of well-layered clays, silts, and occasional thin sand interbeds.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 968 ft and 1,380 ft BML (412-ft thick), appears as low-amplitude, well-layered reflectors, which are interpreted as clays, silts and occasional sands. A <35ft thick sand interbed is interpreted in the mid part of Unit E at 1,161 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between 1,380 ft and 1,576 ft BML (196-ft thick), appears as low and slightly moderate-amplitude reflectors, which are interpreted as well layered, clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. From 1,576 ft to 1,787 ft BML (211-ft-thick), low amplitude seismic reflectors are interpreted as well-layered clays and silts. The lower interval in Unit F, from 1,787 ft to 2,063 ft BML (276 ft-thick), is interpreted to consist of well-layered clays and silts, with occasional sands.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,063 ft and 2,519 ft BML (456-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between 2,519 ft and 2,630 ft BML (111-ft thick), displays low-amplitude seismic reflectors interpreted as slightly-chaotic clays, silts, and occasional sands. The lower interval, from 2,630 ft to 3,138 ft (508-ft thick) is interpreted as higher energy deposits that have been slightly channelized. Sediments are interpreted as clays, silts, and several possible sands. A <35ft thick sand interbed occurs at 2,753 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval, including at the level of the sand interbed.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,138 ft and 3,322 ft BML (184-ft thick), displays low- and slightly-moderate-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds. A <40ft thick sand interbed is interpreted at 3,242 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed. From 3,322 ft to 4,115 ft (793-ft thick), the interval presents as slightly-chaotic, possible mass-transport deposits interpreted as clays, silts, and occasional sands. The lower interval from 4,115 ft to 4,582 ft (467-ft thick), displays low-amplitude reflectors interpreted as well-layered reflectors with clays, silts, and occasional sands.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,582 ft and 5,054 ft BML (472-ft thick), displays seismically as slightly-chaotic, low- and occasionally moderate-amplitude reflectors interpreted as mass-transport and slightly channelized deposits with clays, silts, and occasional sand interbeds. From 5,054 ft to 5,421 ft (367-ft thick) the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval from 5,421 ft to 5,907 ft (486-ft thick), displays low- and occasional slightly moderate-amplitude reflectors, interpreted as well-layered clays and silts, with occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,907 ft and 6,076 ft BML (169-ft thick), appears seismically as well-layered, low-amplitude reflectors interpreted as clays, silts, and occasional sand interbeds. From 6,076 ft to 6,592 ft (516-ft thick), the interval displays low-amplitude reflectors, and is interpreted to consist of well-layered clays and silts. The lower interval from 6,592 ft to 6,795 ft (203-ft thick) presents a well-layered, slightly-chaotic acoustic character, interpreted as possible channelized deposits with clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,795 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt-rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible.**

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-C well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 3,395 ft to the WSW of the proposed well. Contacts 7001 and 7002 are located 5,427 ft and 12,456 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-C, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though seafloor and shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The possibility for an increase in currents should be anticipated due to the presence of current erosion features (mega-furrow field) to the north and northwest of the proposed well. There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,795 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with several sand interbeds, as well as the level of three identified <40ft thick sand interbeds.

Proposed Wellsite WR595-D, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the southwest portion of WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-D-Figure 001).

Table 6-4. Proposed Well Location Coordinates

Proposed Well WR595-D			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR595)
X: 2,348,712 ft	Latitude: 26.36311493° N	Inline 20713	4,392 ft FWL
Y: 9,571,975 ft	Longitude: -90.83644421° W	Crossline 58296	4,615 ft FSL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,766 ft, and the seafloor slopes at 1.4° to the southeast.

The proposed well is located 9,158 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seabed approximately 4,654 ft to the southeast of a mega-furrow field. The possibility for strong currents should be anticipated at the seafloor, as suggested by the presence of the mega-furrows.

The smooth seabed area contains some very low-relief, winnowed depressions, and areas of elevated backscatter response related to uneven erosion of the shallowest sediments by seafloor currents. The proposed well is not located within any of the seabed depressions, however, the eroded areas, as demonstrated by the elevated backscatter response may exhibit seabed and shallow soil stiffness that are higher than expected. This could affect jet-in of the conductor at the seabed.

The seabed sediments are interpreted to consist of clays and silts, passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-D-Figure 002). The seafloor amplitudes from 3D seismic data, the side-scan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 8,500ft to the southwest of the proposed well location. These anomalies are not corroborated by this study. Areas of higher backscatter at and near the proposed wellsite are related to the low-relief winnowed region. These are not evidence of fluid venting at the seabed or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seabed to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-D-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 129-ft thick at the proposed wellbore. The upper sediments at the seabed are interpreted to consist of clays and silts, overlying a clay and silt interval with occasional sands.

Unit B (Horizon 01 to Horizon H02). Unit B, between 129 ft and 249 ft BML (120-ft thick), displays low amplitude reflectors and is interpreted as possible well-layered, turbidites with clays and silts, and occasional possible thin sands.

Unit C (Horizon H02 to Horizon H03). The upper part of Unit C, between about 249 ft and 339 ft BML (90-ft thick), is interpreted as mass-transport deposits with clays, silts, and occasional sands. The lower interval from 339 ft to 518 ft BML (179-ft-thick) of Unit C comprises of mass-transport, higher energy sediment deposits exhibiting channelized character. The sediments are interpreted as clays, silts, and numerous channelized sands. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval.

Unit D (Horizon H03 to Horizon H04). The upper part of Unit D, between about 518 ft and 656 ft BML (138-ft thick), displays low-amplitude reflectors interpreted as slightly-chaotic clays, silts, and occasional sands. The lower interval of Unit D, from 656 ft to 945 ft BML (289-ft-thick), displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 945 ft and 1,341 ft BML (396-ft thick), presents seismically as low-amplitude reflectors, which are interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is identified in the mid part of Unit E at 1,126 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between about 1,341 ft and 1,520 ft BML (179-ft thick), displays low- and slightly moderate-amplitude reflectors interpreted as well-layered clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. The lower interval in Unit F, from 1,520 ft to 2,002ft BML (482 ft-thick), is interpreted to consist of well-layered clays and silts, with occasional sands.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,002 ft and 2,529 ft BML (527-ft thick), presents seismically as low-amplitude reflectors interpreted as well-layered clays and silts, with occasional sand interbeds.

Unit H (Horizon H08 to Horizon H09). Unit H, between about 2,529 ft and 3,177 ft BML (648-ft thick), is characterized by chaotic low amplitude mass transport deposits that have been slightly channelized. Sediments are interpreted as clays, silts, and several possible sands. Minor wellbore stability and drilling fluid circulation problems may occur within this interval.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,177 ft and 3,417 ft BML (240-ft thick), presents as slightly-chaotic, possible mass-transport character deposits interpreted as clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems may occur within this interval. From 3,417 ft to 3,890 ft BML (473-ft-thick), the unit displays seismically as slightly-chaotic, low-amplitude reflectors, which are interpreted as clays, silts, and occasional sands. The lower interval of Unit I, from 3,890 ft to 4,555 ft (665-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,555 ft and 5,023 ft BML (468-ft thick), displays low- and occasionally moderate-amplitude reflectors, which are interpreted as slightly-chaotic mass-transport and slightly channelized deposits containing clays, silts, and occasional sand interbeds. From 5,023 ft to 5,413 ft (390-ft thick), the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval, from 5,413 ft to 5,874 ft (461-ft thick), displays seismically as low- and occasionally moderate-amplitude reflectors, interpreted as well-layered clays, silts, and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,874 ft and 6,080 ft BML (206-ft thick), displays low-amplitude reflectors, which are interpreted as well-layered clays, silts, and occasional sand interbeds. From 6,080 ft to 6,529 ft (449-ft thick) the interval displays low-amplitude reflectors interpreted as well-layered, clays and silts. The lower interval from 6,529 ft to 6,795 ft (266 ft thick) is characterized by well-layered and slightly-chaotic, possible channelized deposits interpreted as clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,795 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt-rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible**.

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-D well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 4,474 ft to the west of the proposed well. Contacts 7001 and 7002 are located 4,134 ft and 11,997 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-D, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though seabed and shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The possibility for an increase in currents should be anticipated at the proposed well due to the presence of current erosion features (mega-furrows) to the northwest. There are no potential sites for deepwater benthic communities within 2,000 ft and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,795 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with several sand interbeds, as well as the level of one thicker sand interbed.

Proposed Wellsite WR594-E, Walker Ridge Block 594 (OCS-G-36087)

The surface location of the proposed wellsite is located in the eastern portion of WR594. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR594-E-Figure 001).

Table 6-5. Proposed Well Location Coordinates

Proposed Well WR594-E			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR594)
X: 2,342,314 ft	Latitude: 26.36920379° N	Inline 20864	2,006 ft FEL
Y: 9,574,082 ft	Longitude: -90.85586955° W	Crossline 58519	6,722 ft FSL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,631 ft, and the seafloor slopes at 1.4° to the southeast.

The proposed well is located 2,806 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seabed approximately 1,706 ft to the west of an area of current-induced mega-furrows. The possibility for seafloor currents should be anticipated at the seabed, as suggested by the presence of the mega-furrows.

The smooth seafloor area contains some very low-relief, winnowed depressions, and areas of elevated backscatter response related to uneven erosion of the shallowest sediments by seafloor currents. The proposed well is not located within any of the seabed depressions, however, as indicated by the backscatter data the eroded areas may display seafloor and shallow soil stiffness that are higher than expected. This could affect jet-in of the conductor at the seabed.

The seabed sediments are interpreted to consist of clays and silts, passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (W594-E-Figure 002). The seafloor amplitudes from 3D seismic data, the side-scan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed, with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 6,750ft to the southwest of the proposed well location. These anomalies are not corroborated by this study. Areas of higher backscatter at and near the proposed wellsite are related to the low-relief winnowed region. These are not evidence of fluid venting at the seabed or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seabed to Horizon H12 are shown on the Tophole Prognosis Chart (WR594-E-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 118-ft thick at the proposed wellbore. The upper sediments at the seabed are interpreted to consist of clays and silts, overlying a clay and silt interval with occasional sands.

Unit B (Horizon 01 to Horizon H02). Unit B, between 118 ft and 234 ft BML (116-ft thick), presents seismically as low-amplitude reflectors interpreted as possible well-layered turbidites, with silts, clays, and occasional thin sands.

Unit C (Horizon H02 to Horizon H04). Unit C, between about 234 ft and 1,107 ft BML (873-ft thick), is characterized by higher energy discontinuous reflectors interpreted as mass-transport deposits consisting of clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems may occur within Unit C when traversing sand interbeds and lenses.

Unit D (Horizon H03 to Horizon H04). The well-path will not traverse Unit D at the proposed well.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 1,107 ft and 1,563 ft BML (456-ft thick), displays low and moderate-amplitude reflectors interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is interpreted in the mid part of Unit E at 1,374 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). Unit F, between about 1,563 ft and 2,093 ft BML (530-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,093 ft and 2,529 ft BML (436-ft thick), displays low-amplitude reflectors interpreted as clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between about 2,529 ft and 2,658 ft BML (129-ft thick), presents seismically as low-amplitude slightly-chaotic reflectors interpreted as possible mass-transport of clays, silts, and occasional sands. The lower interval from 2,658 ft to 3,195 ft (537-ft thick) presents a variable amplitude, slightly higher energy, slightly channelized character. Sediments are interpreted to consist of clays, silts, and several possible sands. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,195 ft and 3,428 ft BML (233-ft thick), presents seismically as low and slightly moderate-amplitude reflectors interpreted as well layered clays, silts, and several thin sands. Minor wellbore stability and drilling fluid circulation problems may occur within the upper interval. From 3,428 ft to 4,214 ft BML (786-ft-thick), the acoustic character is slightly chaotic and low amplitude reflectors interpreted as possible mass-transport deposits consisting of clays, silts, and occasional sands. The lower interval from 4,214 ft to 4,683 ft (469-ft thick) displays low-amplitude reflectors interpreted as well-layered clays and silts, with occasional sands.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,683 ft and 5,189 ft BML (509-ft thick), displays low and occasionally moderate-amplitude reflectors, which are interpreted as slightly-chaotic mass-transport deposits and slightly channelized sediments containing clays, silts, and occasional sand interbeds. From 5,189 ft to 5,513 ft (324-ft thick) the interval is interpreted to consist of well-layered clays, silts, and occasional sands. The lower interval from 5,513 ft to 5,997 ft (484-ft thick), displays low- and occasionally moderate-amplitude reflectors, which are interpreted as well-layered clays, silts, and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,997 ft and 6,187 ft BML (190-ft thick), displays low amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds. From 6,187 ft to

6,753 ft (566-ft thick), the interval presents seismically as low amplitude reflectors interpreted as well-layered clays and silts. The lower interval from 6,753 ft to 6,910 ft (157-ft thick), is interpreted as well-layered to slightly-chaotic, possible channelized deposits containing clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,910 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt-rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible**.

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000 ft of the proposed WR594-E well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 2,310 ft to the southeast of the proposed well. Contacts 7001 and 7002 are located 11,000 ft and 17,017 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR594-E, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though seafloor and shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The possibility for an increase in currents should be expected at the proposed well location due the presence of current erosion features (mega-furrow field) to the northeast. There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,910 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with several sand interbeds, as well as the level of one identified thicker sand interbed.

Proposed Wellsite WR595-F, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the northwest portion of WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-F-Figure 001).

Table 6-6. Proposed Well Location Coordinates

Proposed Well WR595-F			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR595)
X: 2,346,953 ft	Latitude: 26.38262152° N	Inline 20672	2,633 ft FWL
Y: 9,579,038 ft	Longitude: -90.84145470° W	Crossline 58645	4,162 ft FNL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,638 ft, and the seafloor slopes locally at 10° down to the northwest.

The Sigsbee Escarpment is located 5,195ft to the northwest and west. The wellsite is located within a mega-furrow field on the east flank of a furrow and seafloor gradients are estimated to be around 10°. The possibility for an increase in currents should be anticipated, as suggested by the presence of the mega-furrows.

The seafloor sediments are interpreted to consist of clays and silts, passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-F-Figure 002). The seafloor amplitudes from 3D seismic data, the side-scan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seabed with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 6,725ft to the northwest of the proposed well location. These anomalies are not corroborated by this study. The northeast-southwest trending streaks of higher backscatter response pervasive within the 2,000ft-radius area centered on the proposed wellsite are interpreted to be related strictly to mega-furrows, and are not evidence of fluid venting at the seabed, or with the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seabed to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-F-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 186-ft thick at the proposed wellbore. The upper sediments at the seabed are interpreted to consist of clays and silts, overlying a clays and silts interval with occasional sands. The upper sediments are conductive to furrowing. Underlying the upper interval, Unit A is interpreted as well-layered clays, silts, and occasional sands, with a likely stiffer consistency.

Unit B (Horizon 01 to Horizon H02). Unit B, between 186 ft and 454 ft BML (268-ft thick) displays low- and occasionally moderate-amplitude reflectors interpreted as possible well-layered turbidites containing clays, silts, and occasional thin sands.

Unit C (Horizon H02 to Horizon H03). Unit C, between about 454 ft and 551 ft BML (97-ft thick), is presents as slightly higher energy reflector character interpreted as clays, silts, and numerous channelized sands. Minor wellbore stability and drilling fluid circulation problems may occur.

Unit D (Horizon H03 to Horizon H04). The upper part of Unit D, between about 551 ft and 749 ft BML (198-ft thick), presents seismically as slightly-chaotic, low amplitude reflectors interpreted as slightly channelized clays, silts, and occasional sands. The lower interval from 749 ft to 1,008 ft BML (259 ft thick) displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 1,008 ft and 1,422 ft BML (414-ft thick), displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is interpreted in the mid part of Unit E at 1,200 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between about 1,422 ft and 1,605 ft BML (183-ft thick), displays low- and slightly moderate-amplitude reflectors, which are interpreted as well layered clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. The lower interval in Unit F, from 1,605 ft to 2,093ft BML (488 ft-thick), is interpreted to consist of well-layered clays and silts, with occasional sands.

Unit G (Horizon H07 to Horizon H08). The upper part of Unit G, between about 2,093 ft and 2,291 ft BML (198-ft thick), presents seismically as low-amplitude reflectors interpreted as well-layered clays and silts. The relatively narrow interval from 2,291 ft to 2,360 ft BML (69-ft-thick) is interpreted as a possible thin, channelized sediments or mass-transport deposits containing clays, silts, and several possible sands. Minor wellbore stability and drilling fluid circulation problems may occur within this interval. The lower interval of Unit G, from 2,360 ft to 2,537 ft BML (177-ft-thick), is interpreted to consist of clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between about 2,537 ft and 2,694 ft BML (157-ft thick), displays slightly-chaotic, low amplitude reflectors interpreted as possible mass transport deposits containing clays, silts, and occasional sands. The lower interval, from 2,694 ft to 3,250 ft (556-ft thick), presents a higher energy slightly channelized acoustic character. The constituent sediments are interpreted as clays, silts, and several possible sand interbeds. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval, including within the sand interbeds.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,250 ft and 3,475 ft BML (225-ft thick), appears seismically as low and slightly moderate-amplitude reflectors, which are interpreted as well-layered clays, silts, and several sand interbeds. Minor wellbore stability and drilling fluid circulation problems may occur within this interval. The interval between 3,475 ft and 4,184 ft (709 ft thick) presents as slightly-chaotic discontinuous possible mass-transport deposits interpreted to consist of clays, silts, and occasional sands. The lower interval, from 4,184 ft to 4,667 ft (483-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,677 ft and 5,090 ft BML (423-ft thick), is characterized by slightly-chaotic, low and occasionally moderate-amplitude reflectors interpreted as mass-transport deposits and slightly channelized sediments containing clays, silts, and several sand interbeds. Minor wellbore stability and drilling fluid circulation problems may occur within this interval. From 5,090 ft to 5,545 ft (455-ft thick) the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval, from 5,545 ft to 6,018 ft (473-ft thick), displays low and occasional slightly moderate-amplitude reflectors interpreted as well-layered clays, silts, and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 6,018 ft and 6,150 ft BML (132-ft thick), displays low-amplitude reflectors, which are interpreted as well-layered clays, silts, and occasional sand interbeds. From 6,150 ft to 6,736 ft (586-ft thick), the interval displays low-amplitude reflectors interpreted as well-layered clays and silts. The lower interval, from 6,736 ft to 6,940 ft (204-ft thick), exhibits well-layered, slightly-chaotic reflectors indicative of possible channelized deposits interpreted to consist of clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,940 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys Inc, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible**.

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-F well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 6,746 ft to the southwest of the proposed well. Contacts 7001 and 7002 are located 10,365 ft and 11,584 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-F, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The proposed well is located on the edge of a mega-furrow, characterized by a relatively high seafloor gradient (~10° to the northwest).

The possibility for an increase in currents should be expected due to the location of current erosion features (mega-furrow field) immediately at and surrounding the proposed wellsite. Seafloor sediments are expected to be composed of soft clays and silts, with firmness sufficient to create the mega-furrows under the inferred erosion/sediment reworking by prevailing currents.

There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed wellsite, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,940 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems within the sands in Unit C and several other intervals with several sand interbeds, as well as the level of some identified thick sand interbeds.

Proposed Wellsite WR595-G, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the west-central portion of WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-G-Figure 001).

Table 6-7. Proposed Well Location Coordinates

Proposed Well WR595-G			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR595)
X: 2,347,108 ft	Latitude: 26.36765263° N	Inline 20737	2,788 ft FWL
Y: 9,573,598 ft	Longitude: -90.84125805° W	Crossline 58400	6,238 ft FSL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,713 ft, and the seafloor slopes at 1.5° to the southeast.

The proposed well is located 7,414 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seafloor approximately 2,289 ft to the southeast of a mega-furrow field. The possibility for seafloor currents should be anticipated, as suggested by the presence of mega furrows.

The smooth seafloor area contains some very low-relief, winnowed depressions, and areas of elevated backscatter response related to uneven erosion of the shallowest sediments by strong currents. The proposed well is not located within any of the seafloor depressions, however, the location is within an eroded area, as demonstrated by the elevated backscatter response, and seafloor and shallow soil stiffness maybe greater than expected. This could affect jet-in of the conductor at the seafloor.

The seafloor sediments are interpreted to consist of clays and silts, passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-G-Figure 002). The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seafloor with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 9,500ft to the southwest of the proposed well location. These anomalies are not corroborated by this study. Areas of higher backscatter at and near the proposed wellsite are related to the low-relief winnowed region. These are not evidence of fluid venting at the seafloor or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seafloor to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-G-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 124-ft thick at the proposed wellbore. The upper sediments are interpreted to consist of clays and silts, overlying a lower clay and silt interval with occasional sandy interbeds.

Unit B (Horizon 01 to Horizon H02). Unit B, between 124 ft and 267 ft BML (143-ft thick) displays low- and occasional moderate-amplitude reflectors interpreted as possible well-layered turbidites, with clays, silts, and occasional sands.

Unit C (Horizon H02 to Horizon H03). The upper part of Unit C, between about 267 ft and 393 ft BML (126-ft thick), presents as low amplitude mass transport and reworked deposits, interpreted to consist of clays and silts, with possible thin sands. From 393 ft to 594 ft BML (201ft-thick), the lower interval of Unit C is characterized by higher energy mass transport deposits that appear channelized. The sediments are interpreted as clays, silts, and numerous channelized sands. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval.

Unit D (Horizon H03 to Horizon H04). The upper part of Unit D, between about 594 ft and 739 ft BML (145-ft thick), displays low-amplitude reflectors interpreted as slightly-chaotic, possible channelized sediments, containing clays, silts, and occasional sands. The lower interval in Unit D from 739 ft to 977 ft BML (207-ft-thick), is interpreted to consist of well-layered clays, silts, and occasional thin sand interbeds.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 977 ft and 1,396 ft BML (419-ft thick), displays low-amplitude reflectors, which are interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is interpreted in the mid part of Unit E at 1,184 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between about 1,396 ft and 1,592 ft BML (196-ft thick), displays low- and slightly moderate-amplitude reflectors interpreted as well-layered clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. The lower interval in Unit F, from 1,592 ft to 2,069 ft BML (477 ft-thick), is interpreted to consist of well-layered clays and silts, with occasional sands.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,069 ft and 2,495 ft BML (426-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between about 2,495 ft and 2,599 ft BML (104-ft thick), displays low-amplitude reflectors interpreted as slightly-chaotic clays, silts, and occasional sands. The lower interval, from 2,599 ft to 3,170 ft (571-ft thick), is characterized by higher energy deposits that appear locally channelized. Sediments are interpreted as clays, silts, and several possible sands. A <35ft thick sand interbed occurs at 2,799 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval, including at the level of the interbed.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,170 ft and 3,369 ft BML (199-ft thick), presents seismically as low and slightly moderate-amplitude reflectors interpreted as well layered clays, silts, and occasional sand interbeds. A <35ft thick sand interbed is interpreted at 3,271 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed. From 3,369 ft to 4,157 ft (788-ft thick) the interval is acoustically slightly chaotic and interpreted to contain, possible mass-transport deposits with clays, silts, and occasional sands. The lower interval, from 4,157 ft to 4,601 ft (444-ft thick), displays low-amplitude reflectors interpreted as well layered clays and silts, and occasional sands.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,601 ft and 5,058 ft BML (457-ft thick), displays low- and occasionally moderate-amplitude reflectors interpreted as slightly-chaotic mass-transport deposits and channelized sediments consisting of clays, silts, and occasional sand interbeds. From 5,058 ft to 5,325 ft (267-ft thick), the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval, from 5,325 ft to 5,923 ft (598-ft thick), displays low- and occasional slightly moderate-amplitude reflectors interpreted as well-layered clays and silts and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,923 ft and 6,071 ft BML (148-ft thick), displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds. From 6,071 ft to 6,596 ft (525-ft thick) the interval displays low-amplitude reflectors interpreted as well-layered clays and silts. The lower interval, from 6,596 ft to 6,808 ft (212-ft thick), is interpreted to contain well-layered and slightly-chaotic, possible channelized deposits with clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,808 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. The potential for significant gas hydrate accumulations is assessed to be negligible.

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt-rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligibl**e.

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area.

This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-G well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 2,916 ft to the west-southwest of the proposed well. Contacts 7001 and 7002 are located 6,334 ft and 12,636 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-G, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location, though seafloor and shallow soil stiffness may be higher than expected. This could affect jet-in of conductor. The possibility for an increase in seafloor currents should be anticipated due to the presence of current erosion features (mega-furrow field) to the north and northwest of the proposed well. There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,808 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with several sand interbeds, as well as the level of three interpreted thicker sand interbeds.

Proposed Wellsite WR595-H & H-Alt, Walker Ridge Block 595 (OCS-G-36088)

The surface location of the proposed wellsite is located in the west-central portion of WR595. Our assessment addresses the seafloor conditions within a 2,000-ft radius around the proposed wellsite location. A power spectrum diagram extracted from the 3-D data around the proposed wellsite is provided in (WR595-H-Figure 001).

Table 6-8. Proposed Well Location Coordinates

Proposed Well WR595-H & H-Alt			
Spheroid & Datum: Clarke 1866 NAD27 Projection: UTM Zone 15 North		Line Reference	Block Calls (WR595)
X: 2,346,680 ft	Latitude: 26.37365704° N	Inline 20721	2,360 ft FWL
Y: 9,575,774 ft	Longitude: -90.84245432° W	Crossline 58506	7,426 ft FNL

Water Depth and Seafloor Conditions. Based on the AUV multibeam echo-sounder data, the water depth at the proposed well location is 9,685 ft, and the seafloor slopes at <1.0° to the ESE.

The proposed well is located 6,247 ft from the edge of the Sigsbee Escarpment. The wellsite is located in an area of relatively smooth seafloor just to the southeast of a mega-furrow field. The possibility for seafloor currents should be anticipated, as suggested by the presence of the mega-furrows.

The smooth seafloor area contains some very low-relief, winnowed depressions, and also areas of elevated backscatter response related to uneven erosion of the shallowest sediments by seafloor currents. The proposed well is located on the smooth seafloor area, just south of the margin between the furrowed and winnowed areas. There is no indications of and significant erosion at the proposed location and backscatter amplitudes appear normal levels.

The seafloor sediments are interpreted to consist of clays and silts, passing into clays and silts with occasional sandy interbeds with depth.

Deepwater Benthic Communities. There is no potential for high-density benthic communities within 2,000 ft of the proposed location or within the study area (WR595-H-Figure 002). The seafloor amplitudes from 3D seismic data, the sidescan sonar, and the multibeam backscatter data, all show ambient amplitudes or backscatter at the seafloor with no indications of hardgrounds or fluid expulsion features. Areas of possible hard ground identified by BOEMRE in the regional seismic water bottom anomalies mapping project occur within the study area. The nearest areas are located 8,500ft to the northwest of the proposed well location. These anomalies are not corroborated by this study. A few areas of slightly higher amplitude are related to the mega-furrows, and to variably winnowed areas within the relatively smooth seafloor area, but these are not evidence of fluid venting at the seafloor or the presence of benthic communities.

Stratigraphy. Stratigraphic conditions from the seafloor to Horizon H12 are shown on the Tophole Prognosis Chart (WR595-H-Figure 003). Subsurface depths are determined using a time-to-depth conversion function provided by Shell.

Unit A (Seafloor to Horizon 01). Unit A is 135-ft thick at the proposed wellbore. The upper sediments are interpreted to consist of clays and silts, overlying a lower clay and silt interval with occasional sands.

Unit B (Horizon 01 to Horizon H02). Unit B, between 135 ft and 399 ft BML (264-ft thick) displays low- and occasional moderate-amplitude reflectors interpreted as possible well-layered turbidites, with clays, silts, and several thin sands. Minor wellbore stability and drilling fluid circulation problems may occur within this interval.

Unit C (Horizon H02 to Horizon H03). Unit C, between about 399 ft and 524 ft BML (125-ft thick), is characterized by higher energy variable amplitude reflectors and is interpreted to consist of well-layered, clays, silts, and numerous sands. Minor wellbore stability and drilling fluid circulation problems may occur within Unit C.

Unit D (Horizon H03 to Horizon H04). The upper part of Unit D, between about 524 ft and 665 ft BML (141-ft thick), displays low-amplitude reflectors interpreted as slightly-chaotic clays, silts, and occasional sands. The lower interval from 665 ft to 968 ft BML (303-ft-thick), is interpreted as a well-layered clays, silts, and occasional sand interbeds.

Unit E (Horizon H04 to Horizon H05). Unit E, between about 968 ft and 1,393 ft BML (425-ft thick), displays low-amplitude reflectors, which are interpreted as well-layered clays, silts, and occasional sands. A <35ft thick sand interbed is interpreted in the mid part of Unit E at 1,171 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed.

Unit F (Horizon H05 to Horizon H07). The upper part of Unit F, between about 1,393 ft and 1,596 ft BML (203-ft thick), displays low and slightly moderate-amplitude reflectors interpreted as well-layered clays, silts, and several <15ft thick sands. The sand interbeds may cause minor wellbore stability and drilling fluid circulation problems. The lower interval in Unit F, from 1,596 ft to 2,063 ft BML (467 ft-thick), is interpreted to consist of well-layered clays and silts, with occasional sands.

Unit G (Horizon H07 to Horizon H08). Unit G, between about 2,063 ft and 2,536 ft BML (473-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit H (Horizon H08 to Horizon H09). The upper part of Unit H, between about 2,536 ft and 2,616 ft BML (80-ft thick), displays low-amplitude reflectors interpreted as slightly-chaotic mass-transport deposits with clays, silts, and occasional sands. The lower interval, from 2,616 ft to 3,185 ft (569-ft thick), is characterized by slightly higher energy chaotic reflectors interpreted as clays, silts, and several possible sands. A <35ft thick sand interbed occurs at 2,845 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur within the lower interval including at the level of the interbed.

Unit I (Horizon H09 to Horizon H10). The upper part of Unit I, between about 3,185 ft and 3,380 ft BML (195-ft thick), presents seismically as low and slightly moderate-amplitude reflectors interpreted as well layered clays, silts, and occasional sand interbeds. A <35ft thick sand interbed is interpreted at 3,286 ft BML. Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed. From 3,380 ft to 4,123 ft (743-ft thick), the interval presents as slightly-chaotic low amplitude reflectors interpreted as possible distal mass-transport deposits with clays, silts, and occasional sands. The lower interval, from 4,123 ft to 4,605 ft (482-ft thick), displays low-amplitude reflectors interpreted as well-layered clays and silts.

Unit J (Horizon H10 to Horizon H11). The upper part of Unit J, between about 4,605 ft and 5,070 ft BML (465-ft thick), displays low and occasionally moderate-amplitude reflectors interpreted as slightly-chaotic mass-transport deposits and channelized sediments consisting of clays, silts, and occasional sand interbeds. From 5,070 ft to 5,557 ft (487-ft thick), the interval is interpreted as well-layered clays, silts, and occasional sands. The lower interval, from 5,557 ft to 5,948 ft (391-ft thick), displays low- and occasional slightly moderate-amplitude reflectors interpreted as well-layered clays and silts and occasional sands.

Unit K (Horizon H11 to Horizon H12). The upper part of Unit K, between about 5,948 ft and 6,129 ft BML (181-ft thick), displays low-amplitude reflectors interpreted as well-layered clays, silts, and occasional sand interbeds. From 6,129 ft to 6,660 ft (531-ft thick) the interval displays low-amplitude reflectors interpreted as well-layered clays and silts. The lower interval, from 6,660 ft to 6,850 ft (190-ft thick), is characterized by well-layered and slightly-chaotic, possible channelized deposits interpreted as clays, silts, and several sands. Minor wellbore stability and drilling fluid circulation problems are possible within this lower interval.

Faults. There are no mapped faults along the proposed well path to 6,850 ft BML.

Gas Hydrates. The upper portion of the shallow section at the proposed wellsite falls within the gas hydrate stability zone. However, no geophysical indications of gas hydrates or the Base of Gas Hydrate Stability (BGHS) were identified at the proposed well or within 2,000 ft. Therefore, there is a negligible potential for massive or significant gas hydrates to be present at the seafloor or within subsurface sands at or near the proposed well. **The potential for significant gas hydrate accumulations is assessed to be negligible.**

Shallow Gas. There is little significant accumulation of shallow hydrocarbons in WR595 (Gardline Surveys, 2018). There are no high-amplitude anomalies indicative of shallow gas in the predominantly clay- and silt-rich sediments at the proposed wellsite. **The potential for encountering significant shallow gas is assessed to be negligible.**

Shallow Water Flow. The proposed well is in a region with relatively low sedimentation rates compared with Green Canyon and Mississippi Canyon, and so shallow water flow potential is generally much lower in the Walker Ridge Area. This is evident in the BOEM shallow water flow database, in which there are very few shallow water flow events reported for Walker Ridge. Interpretation of the 3D seismic data indicates there are no regionally continuous, permeable sand accumulations in the shallow section at the proposed wellsite. Unit C indicates the presence of several channelized sands, but these sediments are considered too shallow to induce any water flow. Sand interbeds less than about 30-40-ft thick (below the resolution of the seismic data) are possible, but such sand lenses are unlikely to support a sustained shallow water flow. In addition to low regional sedimentation rates, there is an absence of geologically recent, thick mass transport deposits at the wellsite that could induce overpressure. For these reasons, there is unlikely to be any significant overpressured sand in the shallow section, and no shallow water flow risk is assigned at the proposed well. **The potential for shallow water flow at this well is assessed to be negligible.**

Archaeological Assessment. There are no archaeologically significant sonar contacts within 2,000ft of the proposed WR595-H/H-Alt well. Two sonar contacts were reported in block WR595 and one in WR594. These contacts were reported as likely lithological in nature. Contact 7000 is located approximately 3,714 ft to the southwest of the proposed well. Contacts 7001 and 7002 are located 8,072 ft and 12,291 ft, respectively, from the proposed well. No archeological avoidance is recommended.

Proposed Wellsite WR595-H/H-Alt, Concluding Remarks. Seafloor conditions appear favorable in the vicinity of the proposed surface location. The possibility for an increase in currents should be expected due to the location of current erosion features (mega-furrow field) adjacent to the proposed well. There are no potential sites for deepwater benthic communities within 2,000 ft, and no sonar targets of archaeological significance were identified. At the proposed location, there is negligible potential for shallow gas and negligible potential for shallow water flow (overpressured sands) within the depth limit of investigation (6,850 ft BML).

There is the potential for minor wellbore stability and drilling fluid circulation problems with the sands in Unit C and several other intervals with increased possibility of minor sand interbeds, as well as at the level of three identified thicker sand interbeds.

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 the 30 CFR 250, Subpart B, effective May 14, 2007 and further outlined in Notice to Lessees (NTL) 2008-G04, 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 proposes activities under this plan.

Currently there are no designated critical habitats for the listed species in the Gulf of Mexico Outer Continental Shelf; however, it is possible that one or more of these species could be seen in the area of our operations. The following table reflects the Federally-listed endangered and threatened species in the lease area and along the northern Gulf coast:

Common Name	Scientific Name	T/E Status
Hawksbill Turtle	*Eretmochelys imbricata*	E
Green Turtle	*Chelonia mydas*	T/E
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

The green sea turtle is threatened, except for the Florida breeding population, which is listed as endangered.

There are 29 species of marine mammals that may be found in the Gulf of Mexico (see Table 6.7 below). Of the species listed as Endangered, only the Sperm whale is commonly found in the project 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*	
Bryde's Whale	*Balaenoptera edeni*	
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*	
North Atlantic Right Whale	*Eubalaena glacialis*	E
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*	
Florida manatee	*Trichechus manatus*	E

Table 6.7 – Threatened and Endangered Marine Mammals

The blue, fin, humpback, North Atlantic right and sei whales are rare or extralimital in the Gulf of Mexico and are unlikely to be present in the lease area. The Environmental Impact Analysis found in Section 18 discusses potential impacts and mitigation measures related to threatened and endangered species.

I. Archaeological Report

See previous Section for this data.

J. Air and Water Quality Information

Drilling/completion operations will produce air pollutant emissions, but as provided in the Air Emissions Spreadsheet (see Section 8 of this Plan), these operations are below the exemption levels.

These drilling operations will result in the discharge of authorized effluents under the EPA Region VI General permit. Impacts of these discharges are expected to be minimal on water quality in the area.

For specific information relating to air and water quality information please refer to Section 18.

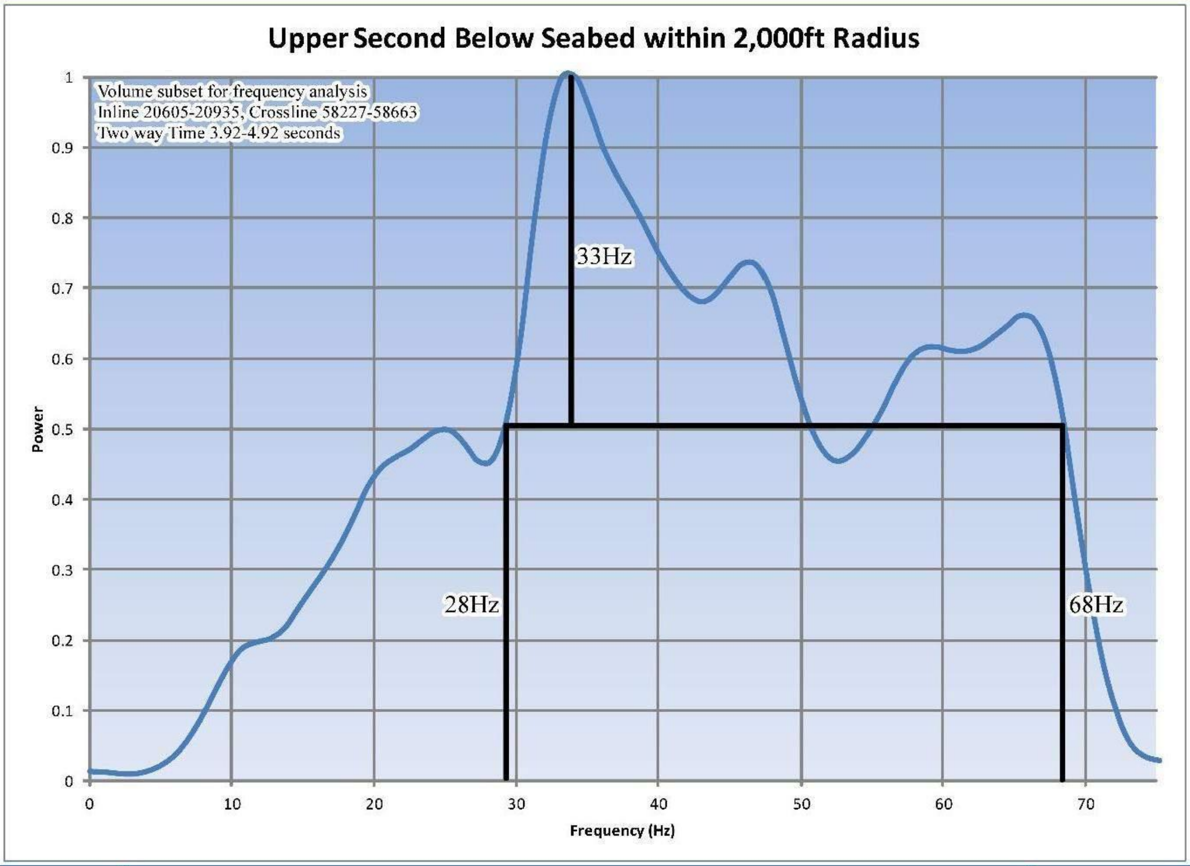
K. Socioeconomic Information

1) Shell will utilize its existing shorebase located in Fourchon, Louisiana which is fully staffed and operational and does not expect to employ persons from within the State of Florida.

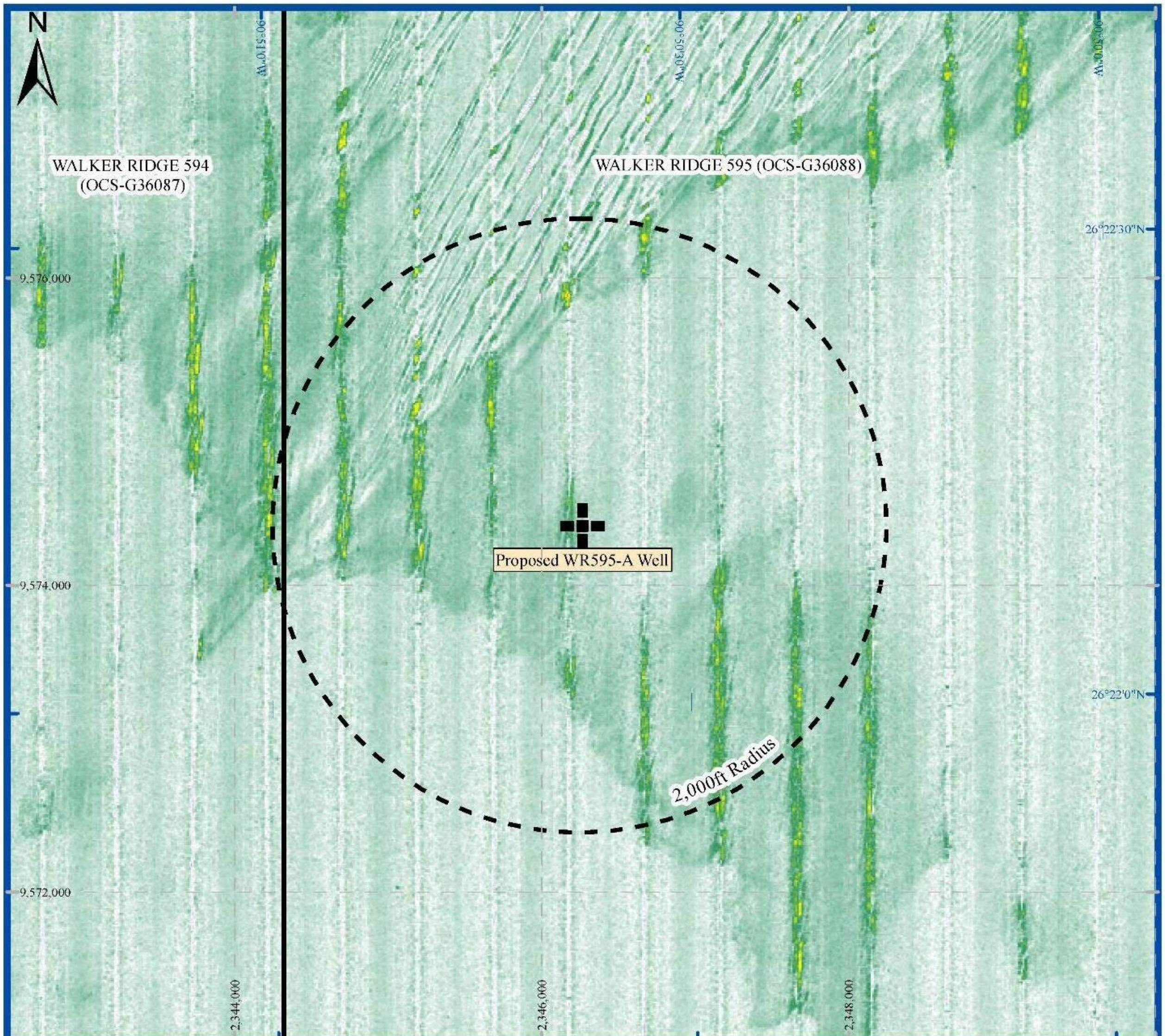
2) Shell does not expect to purchase major supplies, services, energy, water or other resources from within the State of Florida for these operations.

3) Shell does not expect to hire contractors or vendors from within the State of Florida.

For specific information relating to socioeconomic information please refer to Section 18 in this Plan.



WR595-A	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR595-A Well Location (2,346,267ft E / 9,574,387ft N)

Block boundaries

-38 -36 -34 -32 -30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4

Relative Seabed Backscatter

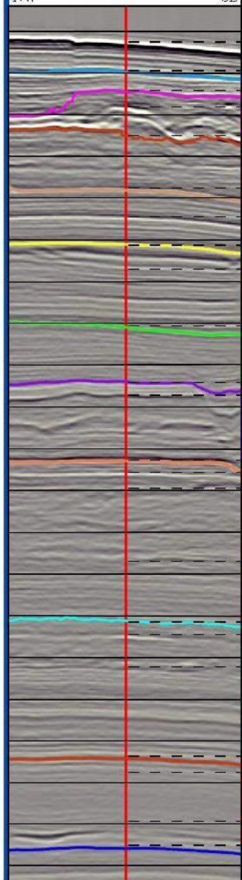
Chart Scale 1" = 1,000'

0 500 1,000 2,000 Feet

0 150 300 600 Meters

Figure 2
(WR595-A)

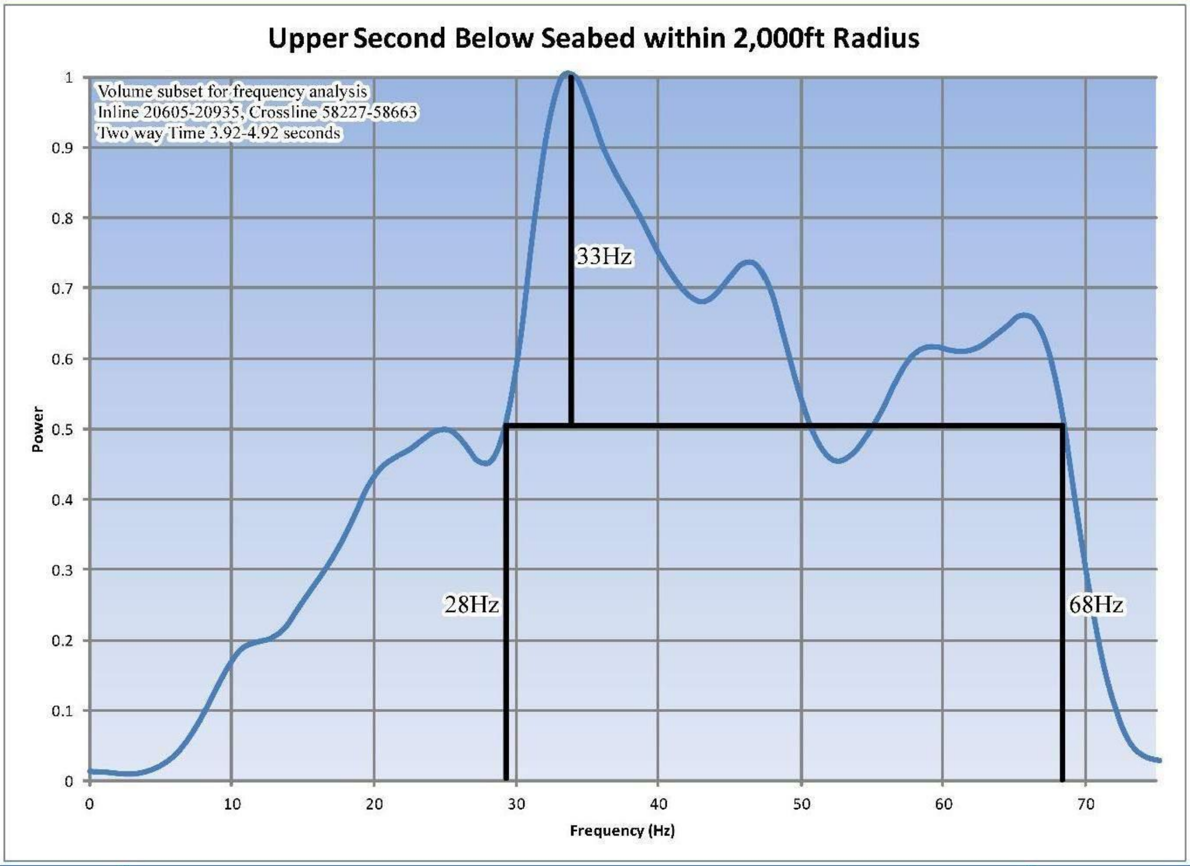
2,346,267ft E / 9,574,387ft N
NAD27 UTM15N
Inline: 20750 / Crossline: 58453
NW SE



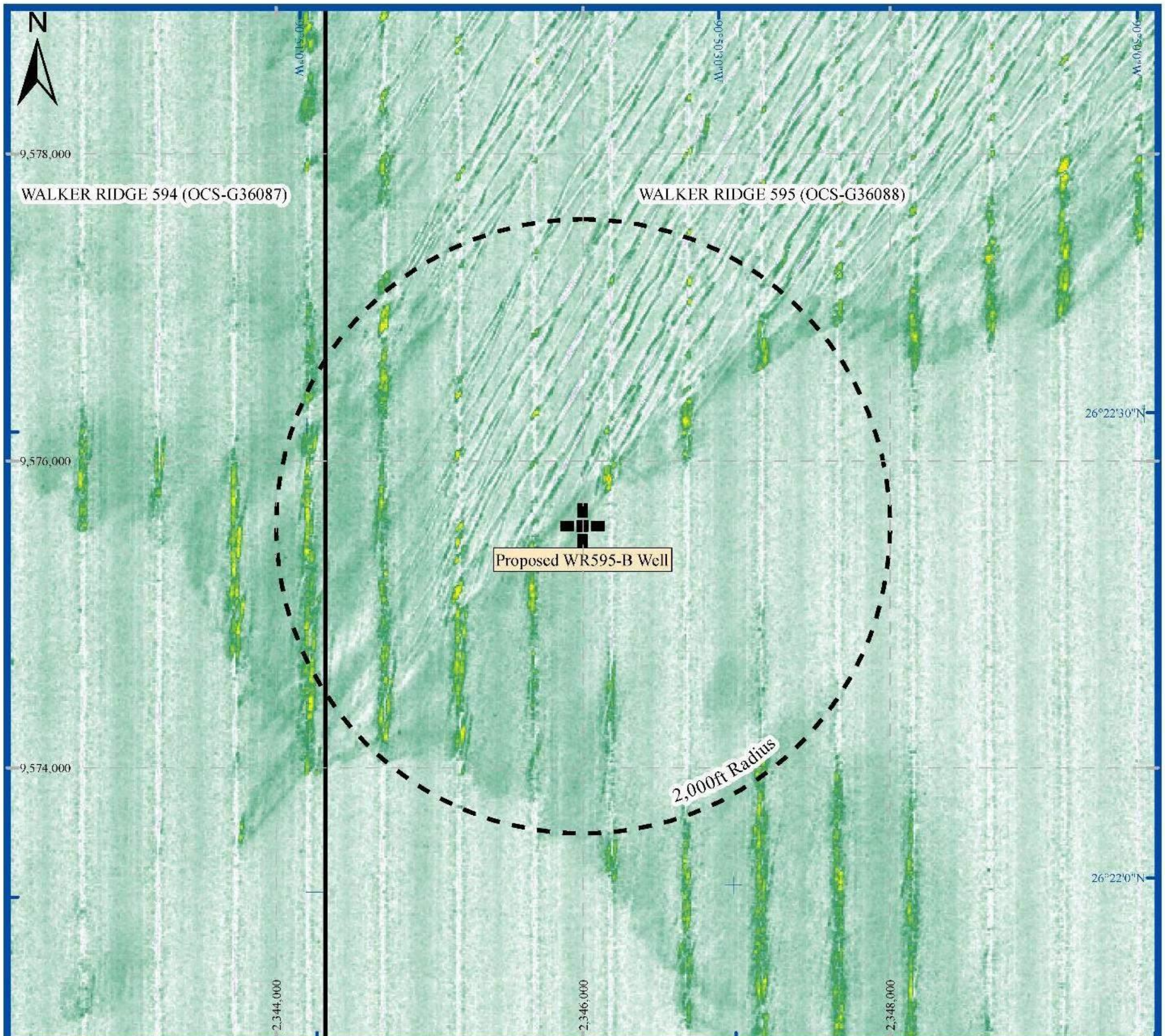
Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints	Gas Hydrate	Risk of Gas	SWF Risk
								Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
Seabed	-9,687	0	3,925							
				129	A	Seafloor is smooth sloping to the ESE at <1.0° and interpreted as soft clays and silts with occasional sand interbeds. The proposed well is 1,220ft to the southeast of a mega-furrow field	Seafloor currents should be anticipated in the area	None predicted	None predicted	None predicted
Horizon H01	-9,816	129	3,997							
				138	B	Clays and silts with occasional sand interbeds	None predicted			
Horizon H02	-9,954	267	4,043							
				114	C	Clays and silts with occasional sand interbeds	None predicted			
Interface	-10,068	381	4,081							
				207	C	Clays and silts with numerous sands	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H03	-10,275	588	4,149							
				411	D	Clays and silts and occasional sand interbeds	None predicted			
Horizon H04	-10,686	999	4,281							
				413	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-10,877	1,190	4.341							
Horizon H05	-11,099	1,412	4,410							
				207	F	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Interface	-11,306	1,619	4,473							
				447	F	Clays and silts with occasional sand interbeds	None predicted			
Horizon H07	-11,753	2,066	4,607							
				453	G	Clays and silts	None predicted			
Horizon H08	-12,206	2,519	4,739							
				118	H	Clays and silts with occasional sand interbeds	None predicted			
Interface	-12,324	2,637	4,773							
				549	H	Clays and silts and several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H09	-12,873	3,186	4,927							
				253	I	Clays and silts and occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-12,980	3,293	4,957							
Interface	-13,126	3,439	4,997							
				737	I	Clays and silts with occasional sand interbeds	None predicted			
Interface	-13,863	4,176	5,195							
				441	I	Clays and silts	None predicted			
Horizon H10	-14,304	4,617	5,310							
				465	J	Clays and silts with occasional sand interbeds <40ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-14,436	4,749	5.344							
Interface	-14,769	5,082	5,429							
				471	J	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,240	5,553	5,547							
				391	J	Clays and silts with occasional sand interbeds	None predicted			
Horizon H11	-15,631	5,944	5,643							
				156	K	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,787	6,100	5,681							
				475	K	Clays and silts	None predicted			
Interface	-16,262	6,575	5,795							
				262	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H12	-16,524	6,837	5,857							
						Base of interpretation				

Top Hole Prognosis for Proposed WR595-A Well Location

Figure 3



WR595-B	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR595-B Well Location (2,345,996ft E / 9,575,579ft N)

Block boundaries

-38 -36 -34 -32 -30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4

Relative Seabed Backscatter

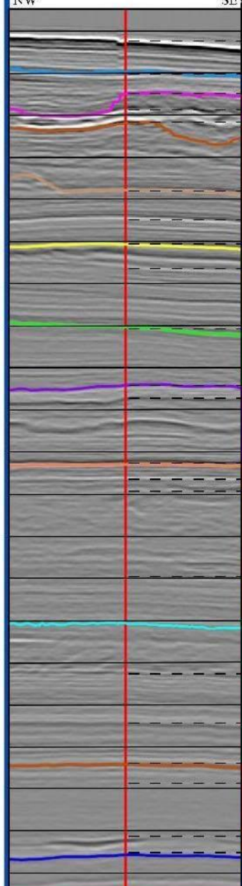
Chart Scale 1" = 1,000'

0 500 1,000 2,000 Feet

0 150 300 600 Meters

Figure 2 (WR595-B)

2,345,996ft E / 9,575,579ft N
NAD27 UTM15N
Inline: 20743 / Crossline: 58511

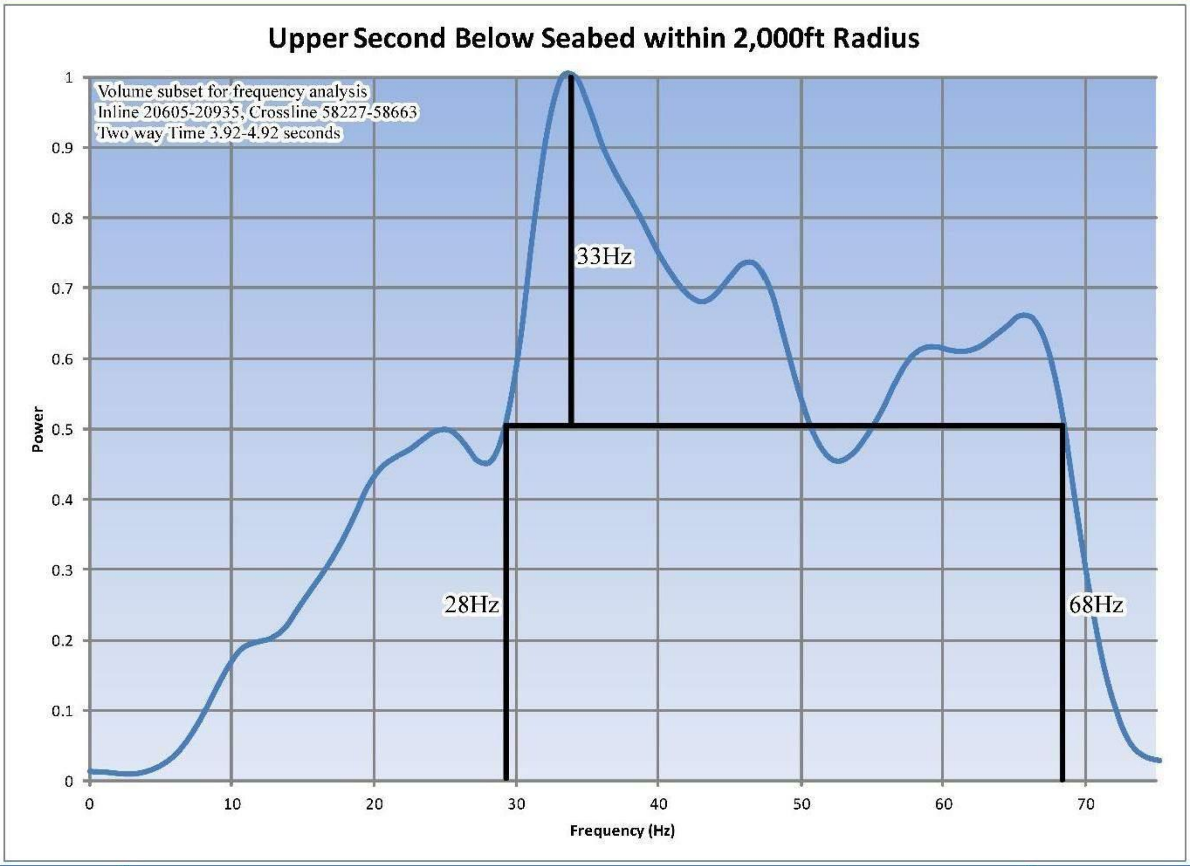


Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)
Seabed	-9,674	0	3,920
Horizon H01	-9,813	139	3,997
Horizon H02	-9,968	294	4,047
Interface	-10,076	402	4,082
Horizon H03	-10,185	511	4,119
Horizon H04	-10,673	999	4,276
Sand Interbed	-10,861	1,187	4.335
Horizon H05	-11,090	1,416	4,406
Interface	-11,276	1,602	4,463
Horizon H07	-11,743	2,069	4,603
Horizon H08	-12,221	2,547	4,742
Interface	-12,336	2,662	4,775
Sand Interbed	-12,491	2,817	4.819
Horizon H09	-12,884	3,210	4,929
Sand Interbed	-12,989	3,315	4,958
Interface	-13,069	3,395	4,980
Interface	-13,858	4,184	5,192
Horizon H10	-14,287	4,613	5,304
Interface	-14,760	5,086	5,425
Interface	-15,231	5,557	5,543
Horizon H11	-15,630	5,956	5,641
Interface	-15,754	6,080	5,671
Interface	-16,325	6,651	5,808
Horizon H12	-16,528	6,854	5,856

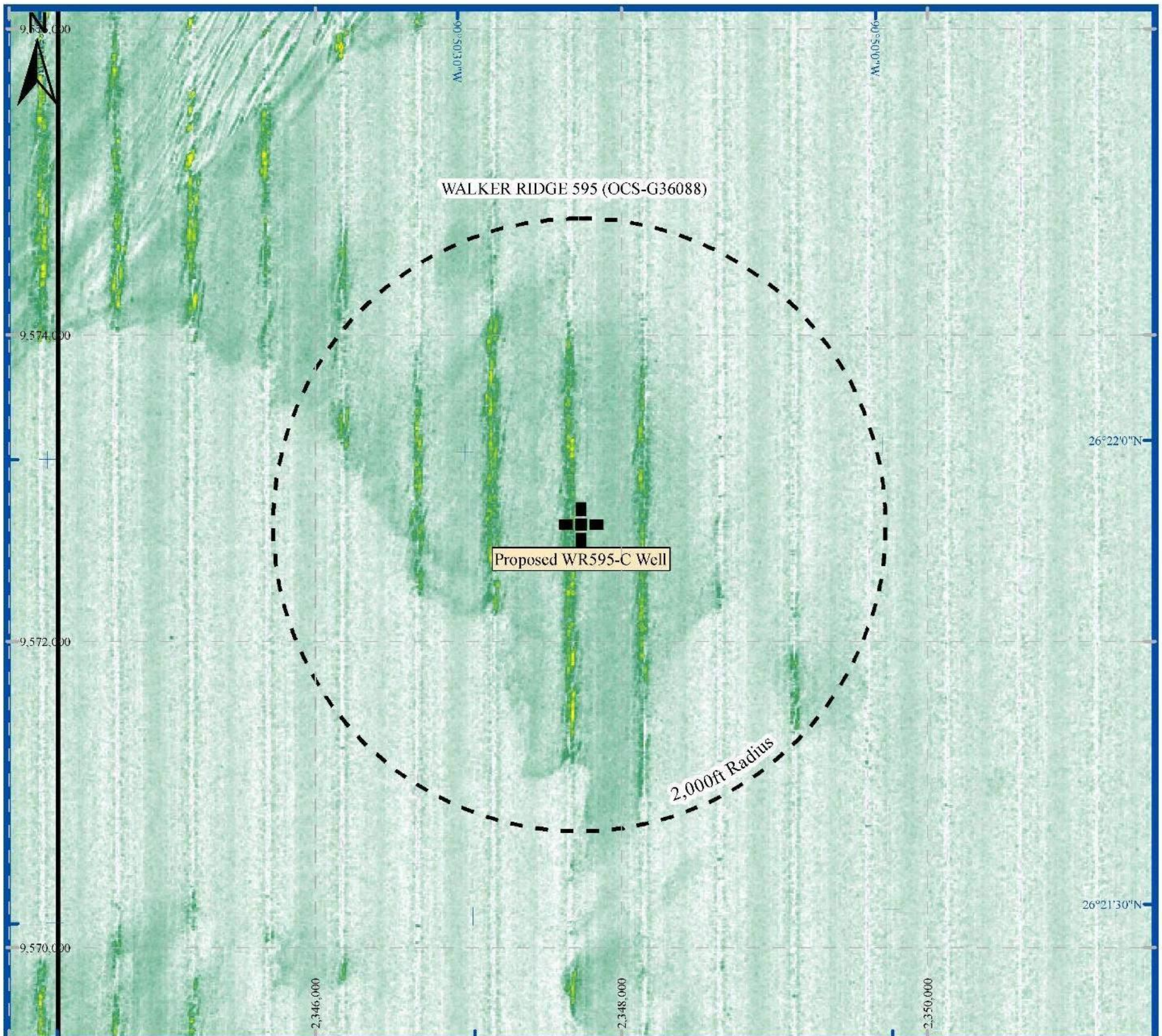
Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints	Gas Hydrate	Risk of Gas	SWF Risk
				Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
139	A	Seafloor is smooth sloping to the southeast at 2.6° and interpreted as soft clays and silts with occasional sand interbeds. The proposed well is on the southern edge of the mega-furrow field located adjacent to a mega-furrow	Seafloor currents should be anticipated in the area	None predicted	None predicted	None predicted
155	B	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
108	C	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
109	C	Clays and silts with numerous sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible	None predicted	None predicted	None predicted
488	D	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
417	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore and drilling fluid circulation problems may occur at the level of the interbed	None predicted	None predicted	None predicted
186	F	Clays and silts and several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible	None predicted	None predicted	None predicted
478	F	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
476	G	Clays and silts	None predicted	None predicted	None predicted	None predicted
115	H	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
548	H	Clays and silts and several sand interbeds <35ft thick sand interbed	Minor drilling fluid circulation and wellbore stability problems possible Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed	None predicted	None predicted	None predicted
185	I	Clays, silts and occasional sand interbeds <40ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed	None predicted	None predicted	None predicted
789	I	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
429	I	Clays and silts	None predicted	None predicted	None predicted	None predicted
473	J	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
471	J	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
399	J	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
124	K	Clays and silts with occasional sand interbeds	None predicted	None predicted	None predicted	None predicted
571	K	Clays and silts	None predicted	None predicted	None predicted	None predicted
203	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible	None predicted	None predicted	None predicted
		Base of interpretation				

Top Hole Prognosis for Proposed WR595-B Well Location

Figure 3



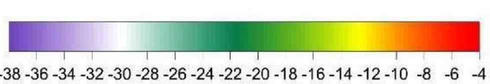
WR595-C	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR595-C Well Location
(2,347,737ft E / 9,572,762ft N)

Block boundaries



Relative Seabed Backscatter

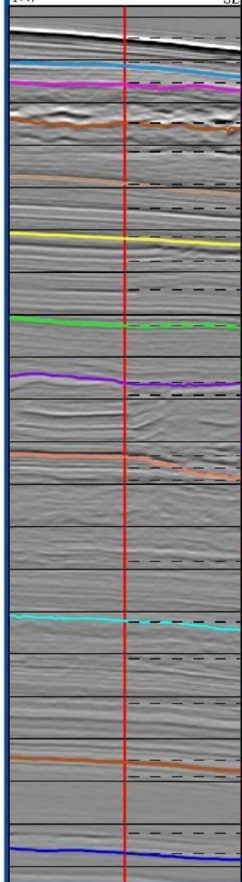
Chart Scale 1" = 1,000'

0 500 1,000 2,000 Feet

0 150 300 600 Meters

Figure 2
(WR595-C)

2,347,737ft E / 9,572,762ft N
NAD27 UTM15N
Inline: 20730 / Crossline: 58351

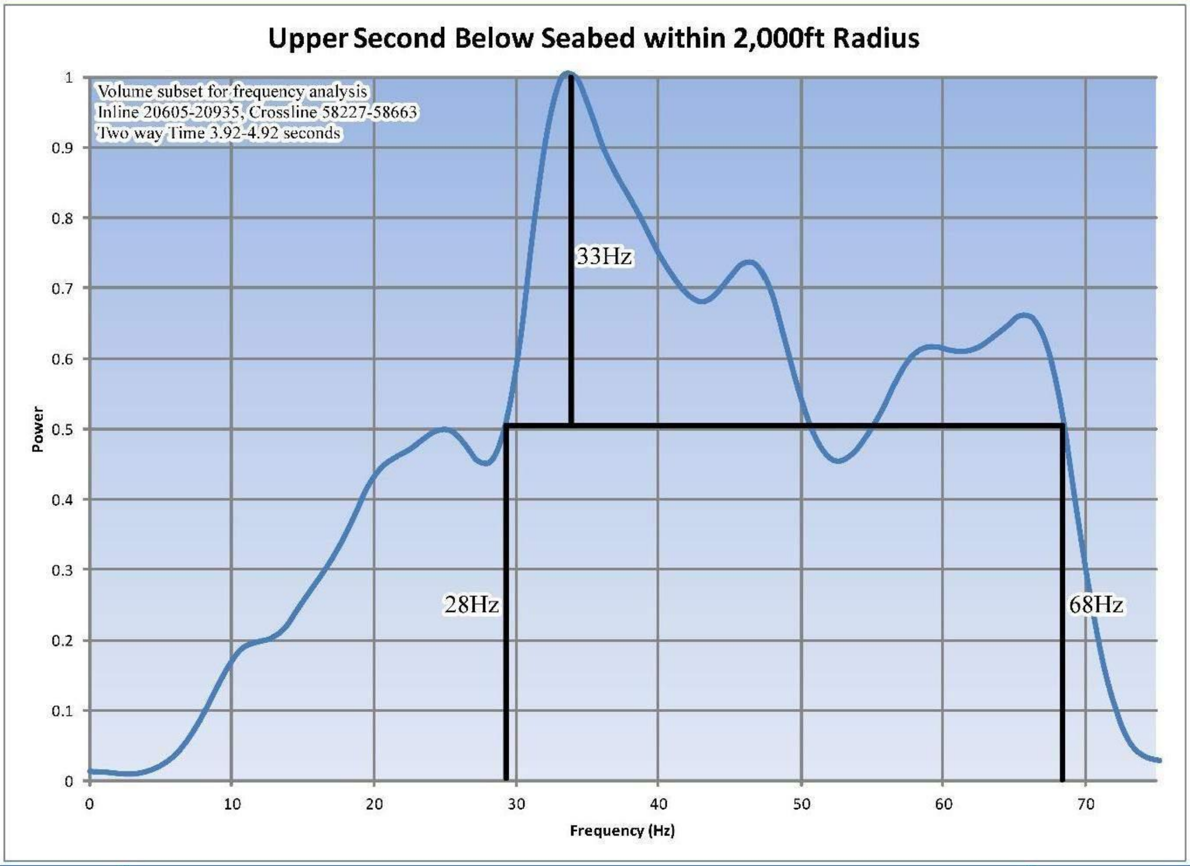


Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints
Seabed	-9,736	0	3.944				
Horizon H01	-9,857	121	4.013	121	A	Seafloor is smooth sloping to the Southeast at 1.1°. Surficial sediments interpreted as of soft clays and silts with occasional sand interbeds	Seafloor currents should be anticipated in the area
Horizon H02	-9,985	249	4.056	128	B	Clays and silts with occasional sand interbeds	None predicted
Interface	-10,117	381	4.100	132	C	Clays and silts with occasional sand interbeds	None predicted
Horizon H03	-10,266	530	4.149	149	C	Clays, silts and numerous sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Interface	-10,469	733	4.215	203	D	Clays, silts and occasional sand interbeds	None predicted
Horizon H04	-10,704	968	4.290	235	D	Clays and silts with occasional sand interbeds	None predicted
Sand Interbed	-10,897	1,161	4.351		E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed
Horizon H05	-11,116	1,380	4.419	412	E		
Interface	-11,312	1,576	4.479	196	F	Clays and silts with several sand interbeds	Minor drilling fluid circulation and minor wellbore stability problems possible
Interface	-11,523	1,787	4.543	211	F	Clays and silts	None predicted
Horizon H07	-11,799	2,063	4.625	276	F	Clays and silts with occasional sand interbeds	None predicted
Unit G							
Horizon H08	-12,255	2,519	4.758	456	G	Clays and silts	None predicted
Interface	-12,366	2,630	4.790	111	H	Clays and silts with occasional sand interbeds	None predicted
Sand Interbed	-12,489	2,753	4.825		H	Clays, silts and several sand interbeds <35ft thick sand interbed	Minor drilling fluid circulation and wellbore stability problems possible
Unit H							
Horizon H09	-12,874	3,138	4.933	508	H		
Sand Interbed	-12,978	3,242	4.962		I	Clays, silts and occasional sand interbeds <40ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed
Interface	-13,058	3,322	4.984	184	I		
Unit I							
Interface	-13,851	4,115	5.198	793	I	Clays and silts with occasional sand interbeds	None predicted
Horizon H10	-14,318	4,582	5.320	467	I	Clays and silts with occasional sand interbeds	None predicted
Interface	-14,790	5,054	5.441	472	J	Clays and silts with occasional sand interbeds	None predicted
Unit J							
Interface	-15,157	5,421	5.533	367	J	Clays and silts with occasional sand interbeds	None predicted
Horizon H11	-15,643	5,907	5.653	486	J	Clays and silts with occasional sand interbeds	None predicted
Interface	-15,812	6,076	5.694	169	K	Clays and silts with occasional sand interbeds	None predicted
Unit K							
Interface	-16,328	6,592	5.818	516	K	Clays and silts	None predicted
Horizon H12	-16,531	6,795	5.866	203	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
						Base of interpretation	

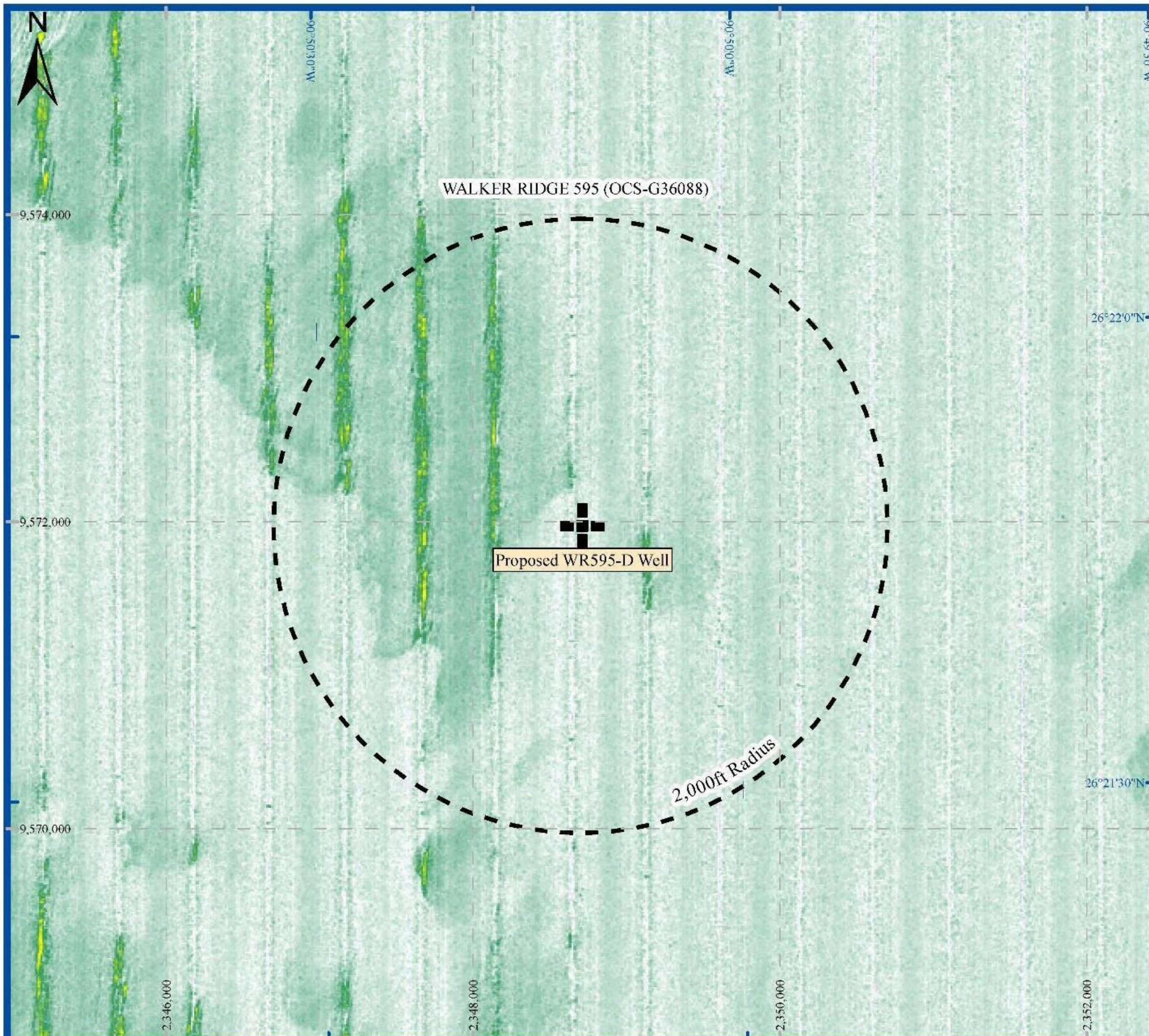
Gas Hydrate	Risk of Gas	SWF Risk
Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
None predicted	None predicted	None predicted

Top Hole Prognosis for Proposed WR595-C Well Location

Figure 3



WR595-D	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR595-D Well Location (2,348,712ft E / 9,571,975ft N)

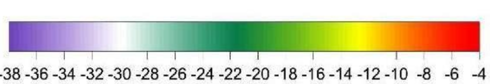


Chart Scale 1" = 1,000'

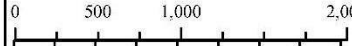
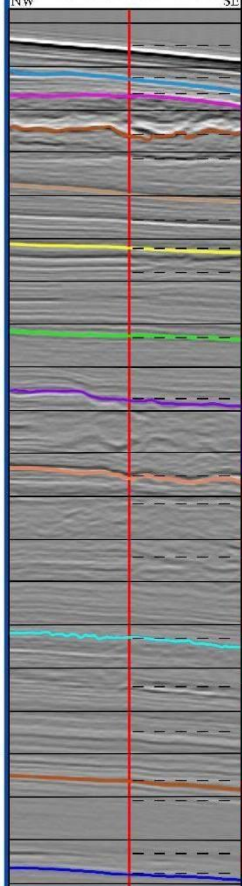


Figure 2 (WR595-D)

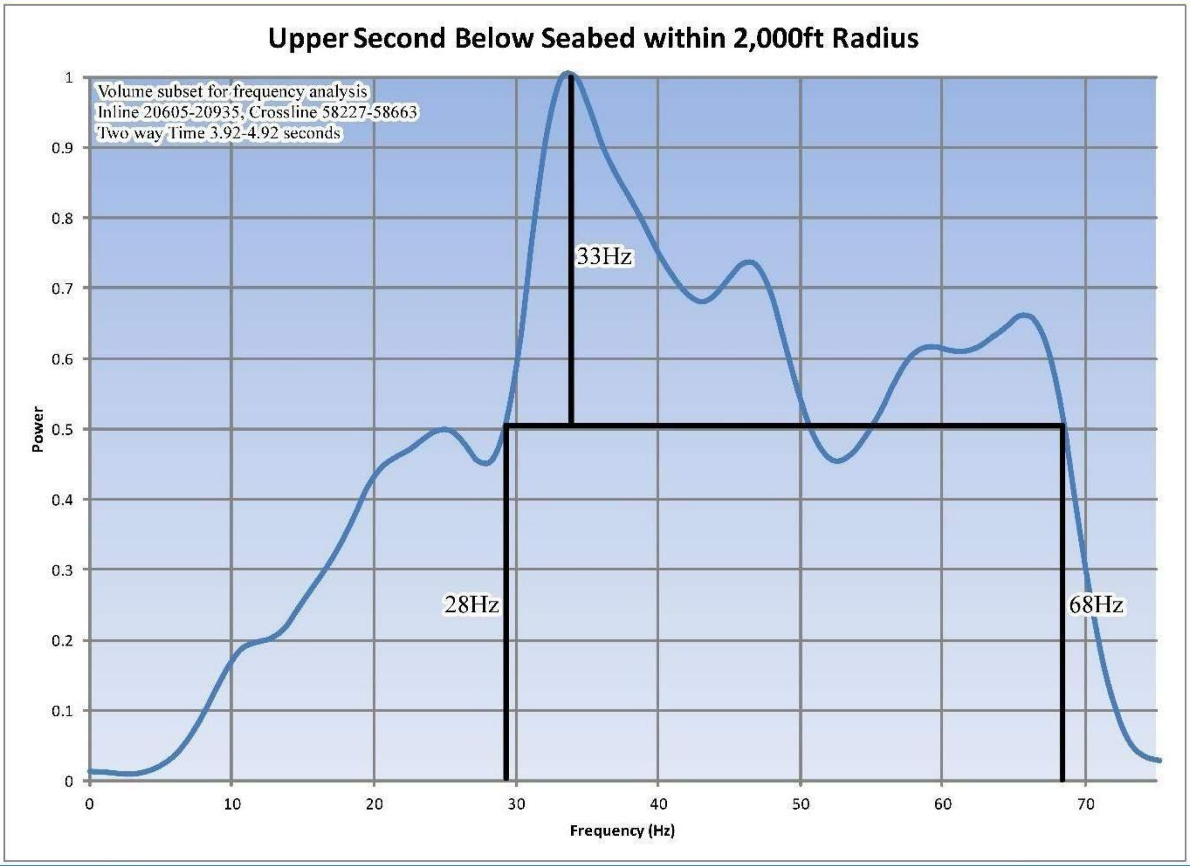
2,348,712ft E / 9,571,975ft N
NAD27 UTM15N
Inline: 20713 / Crossline: 58296
NW SE



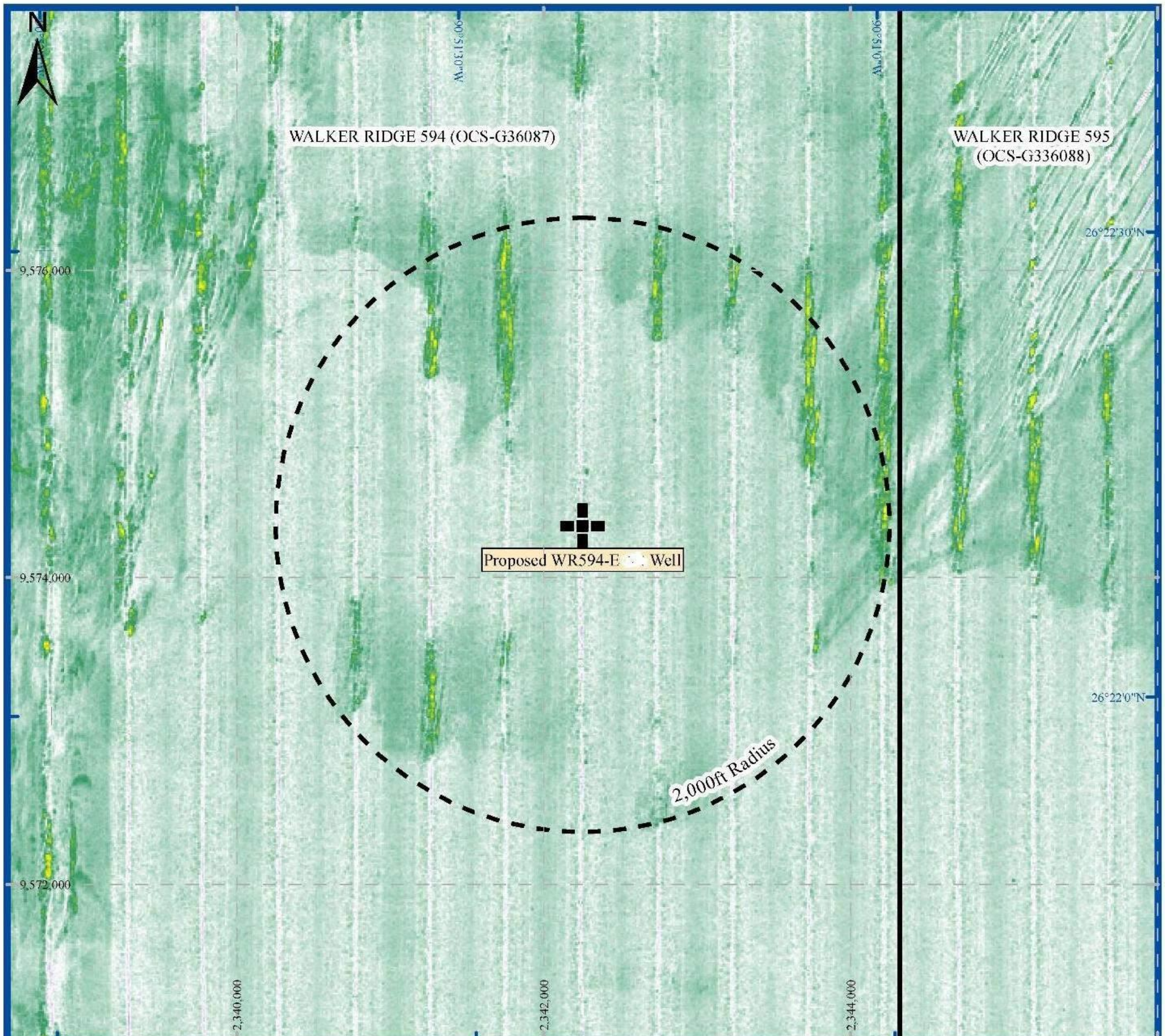
Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints	Gas Hydrate	Risk of Gas	SWF Risk
								Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
Seabed	-9,766	0	3.958							
Horizon H01	-9,895	129	4.030	129	A	Seafloor is smooth sloping to the southeast at 1.4°. Surficial sediments interpreted as of soft clays and silts with several sandy interbeds.	Seafloor currents should be anticipated in the area	None predicted	None predicted	None predicted
Horizon H02	-10,015	249	4.070	120	B	Clays and silts with occasional sand interbeds	None predicted			
Interface	-10,105	339	4.100	90	C	Clays, silts and occasional sand interbeds	None predicted			
Horizon H03	-10,284	518	4.159	179	C	Clays, silts and numerous sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Interface	-10,422	656	4.204	138	D	Clays and silts with occasional sand interbeds	None predicted			
Horizon H04	-10,711	945	4.297	289	D	Clays and silts with occasional sand interbeds	None predicted			
Sand Interbed	-10.892	1,126	4.354	396	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may ccur at the level of the interbed			
Horizon H05	-11,107	1,341	4.421							
Interface	-11,286	1,520	4.476	179	F	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H07	-11,768	2,002	4.621	482	F	Clays and silts with occasional sand interbeds	None predicted			
Horizon H08	-12,295	2,529	4.775	527	G	Clays and silts with occasional sand interbeds	None predicted			
Horizon H09	-12,943	3,177	4.958	648	H	Clays and silts and several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Interface	-13,183	3,417	5.024	240	I	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Interface	-13,656	3,890	5.152	473	I	Clays and silts and occasional sand interbeds	None predicted			
Horizon H10	-14,321	4,555	5.327	665	I	Clays and silts	None predicted			
Interface	-14,789	5,023	5.447	468	J	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,179	5,413	5.545	390	J	Clays and silts with occasional sand interbeds	None predicted			
Horizon H11	-15,640	5,874	5.659	461	J	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,846	6,080	5.709	206	K	Clays and silts with occasional sand interbeds	None predicted			
Interface	-16,295	6,529	5.817	449	K	Clays and silts	None predicted			
Horizon H12	-16,561	6,795	5.880	266	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
						Base of interpretation				

Top Hole Prognosis for Proposed WR595-D Well Location

Figure 3



WR594-E	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR594-E Well Location
(2,342,252ft E / 9,574,340ft N)

Block boundaries

-38 -36 -34 -32 -30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4

Relative Seabed Backscatter

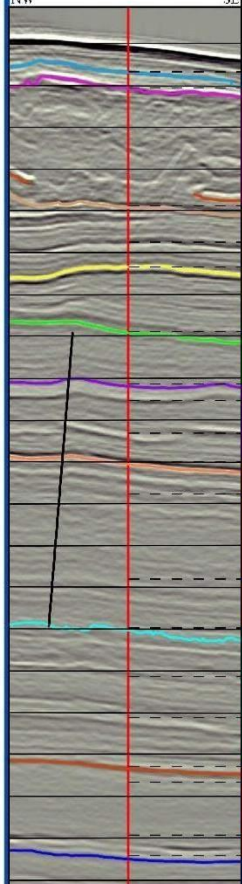
Chart Scale 1" = 1,000'

0 500 1,000 2,000 Feet

0 150 300 600 Meters

Figure 2
(WR594-E

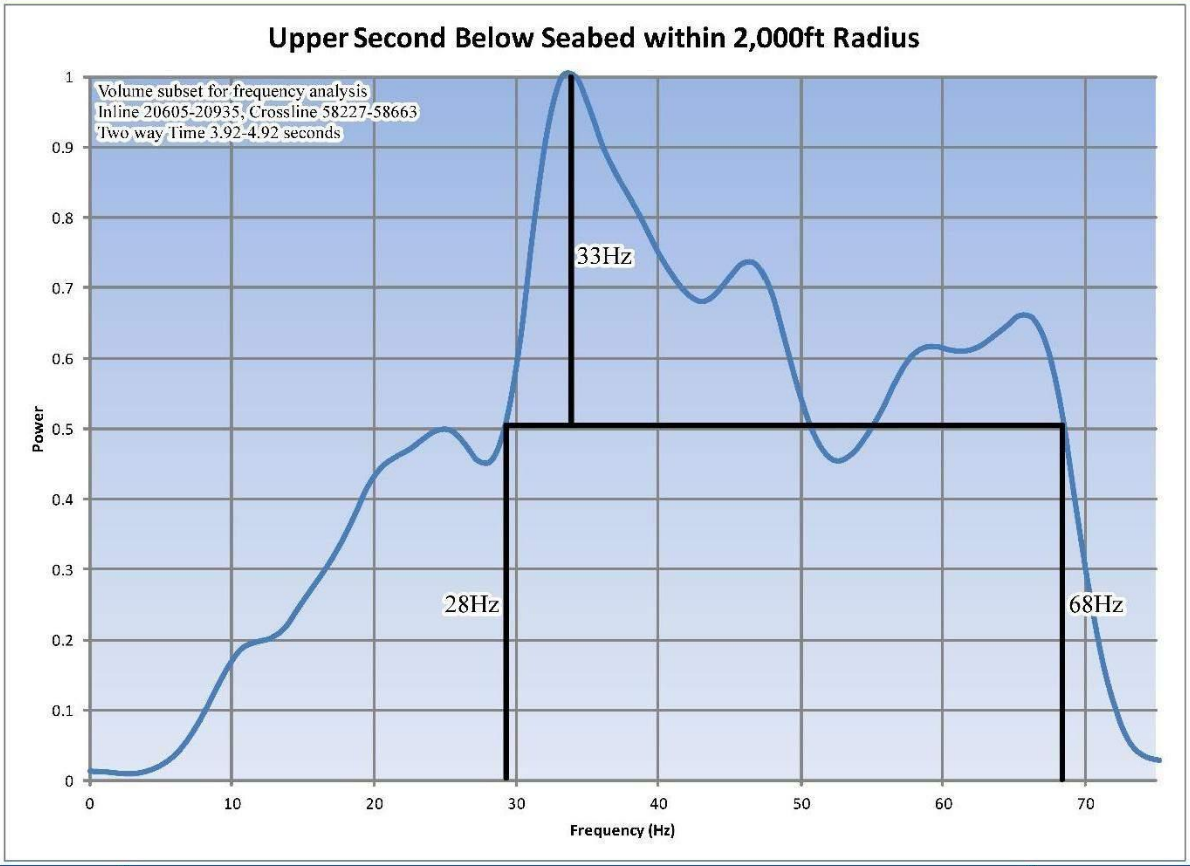
2,342,252ft E / 9,574,340ft N
NAD27 UTM15N
Inline: 20862 / Crossline: 58532



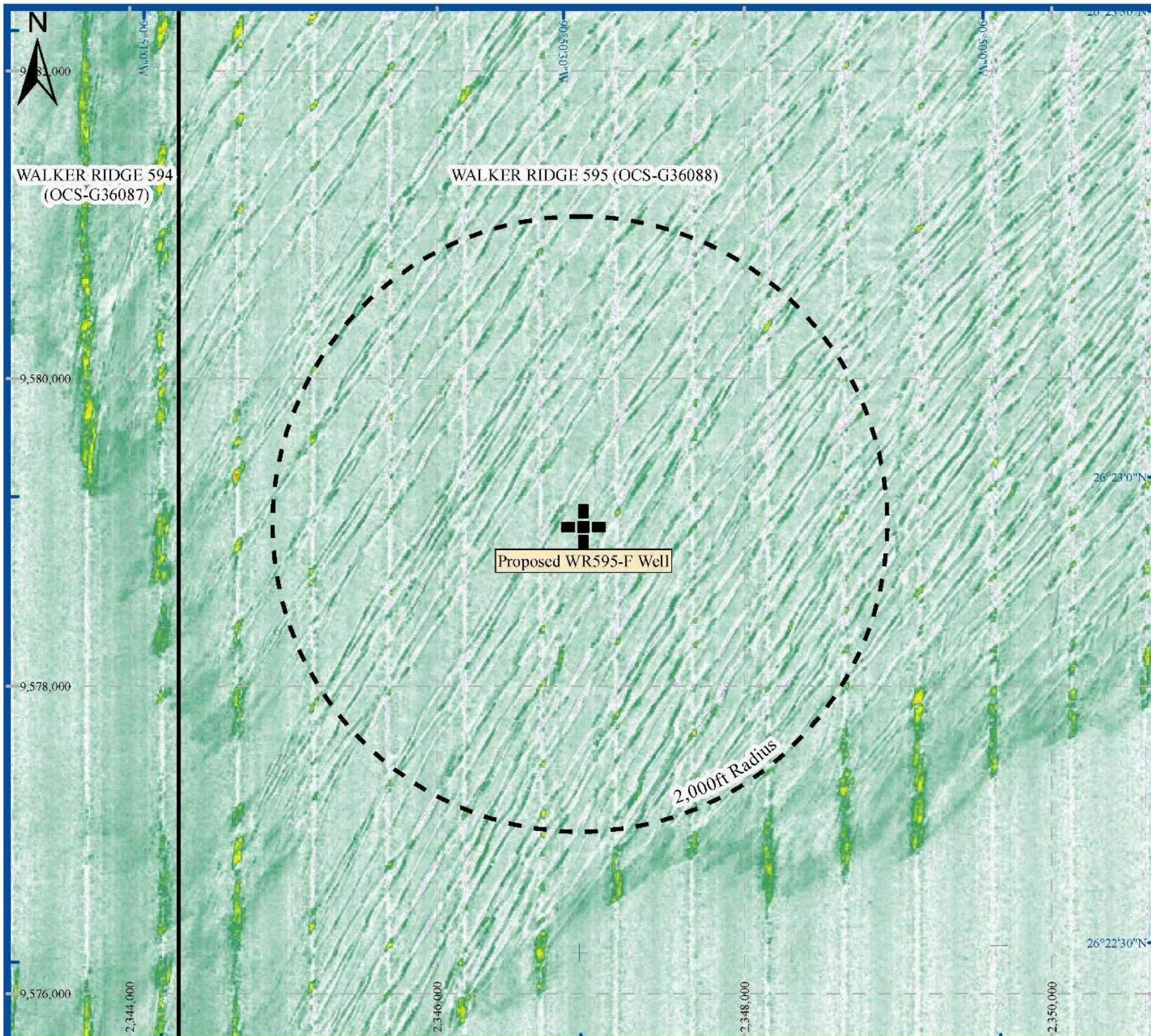
Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints	Gas Hydrate	Risk of Gas	SWF Risk
								Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
Seabed	-9,625	0	3,899					None predicted	None predicted	None predicted
				121	A	Seafloor is smooth sloping to the SE at 1.2° and interpreted as soft clays, silts with occasional sandy interbeds. The proposed well is approximately 1,725ft to the west of a mega-furrow field	Seafloor currents should be anticipated in the area			
Horizon H01	-9,746	121	3,968							
				110	B	Clays and silts with occasional sand interbeds	None predicted			
Horizon H02	-9,856	231	4.005							
				882	C	Highly-chaotic mass-transport deposits with clays, silts and several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H04	-10,738	1,113	4.291							
				463	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-11,008	1,383	4.375							
Horizon H05	-11,201	1.576	4.434							
				517	F	Clays and silts	None predicted			
Horizon H07	-11,718	2,093	4.589							
				447	G	Clays and silts	None predicted			
Horizon H08	-12,165	2,540	4.719							
				118	H	Clays and silts with occasional sand interbeds	None predicted			
Interface	-12,283	2,658	4.753							
Unit H				537	H	Clays and silts and several possible sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-12,541	2,916	4.826							
Horizon H09	-12,820	3,195	4.904							
				284	I	Clays, silts and several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Interface	-13,104	3,479	4.982							
Unit I				750	I	Clays and silts with occasional sand interbeds	None predicted			
Interface	-13,854	4,229	5.183							
				457	I	Clays and silts with occasional sand interbeds	None predicted			
Horizon H10	-14,311	4,686	5.302							
				412	J	Clays and silts with occasional sand interbeds	None predicted			
Interface (Unit J)	-14,723	5,098	5.407							
				391	J	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,114	5,489	5.505							
				517	J	Clays and silts with occasional sand interbeds	None predicted			
Horizon H11	-15,631	6,006	5.632							
				173	K	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,804	6,179	5.674							
Unit K				519	K	Clays and silts	None predicted			
Interface	-16,323	6,698	5.798							
				203	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H12	-16,526	6,901	5.846							
						Base of interpretation				

Top Hole Prognosis for Proposed WR594-E Well Location

Figure 3



WR595-F	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR595-F Well Location (2,346,953ft E / 9,579,038ft N)

Block boundaries

-38 -36 -34 -32 -30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4

Relative Seabed Backscatter

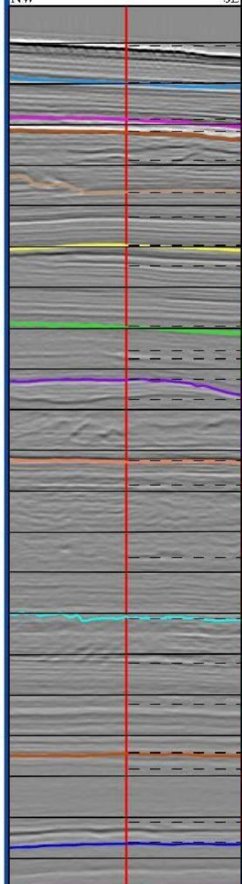
Chart Scale 1" = 1,000'

0 500 1,000 2,000 Feet

0 150 300 600 Meters

Figure 2 (WR595-F)

2,346,953ft E / 9,579,038ft N
NAD27 UTM15N
Inline: 20672 / Crossline: 58645

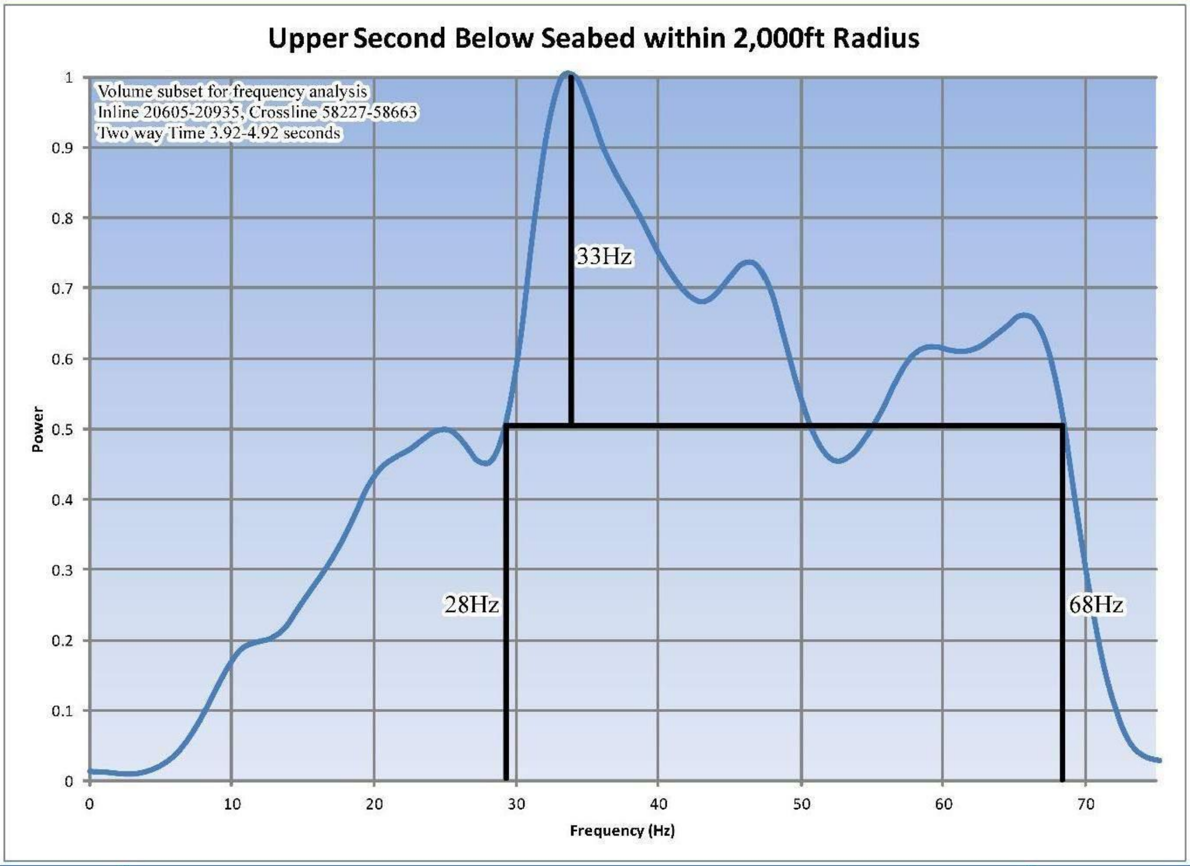


Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints
Seabed	-9,638	0	3.908				
				186	A	Seafloor is affected by mega-furrows. The proposed well is on the east flank of a furrow sloping northwest at 10°. Surficial sediments are interpreted as soft clays and silts	Seafloor currents should be anticipated in the area
Horizon H01	-9,824	186	3.999				
				268	B	Clays and silts with occasional sand interbeds	None predicted
Horizon H02	-10,092	454	4.088				
				97	C	Clays, silts and numerous channelized sands	Minor drilling fluid circulation and wellbore stability problems possible
Horizon H03	-10,189	551	4.120				
				198	D	Clays and silts with occasional sand interbeds	None predicted
Interface	-10,387	749	4.184				
				259	D	Clays and silts with occasional sand interbeds	None predicted
Horizon H04	-10,646	1,008	4.265				
				414	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the interbed
Sand Interbed	-10.838	1,200	4.327				
Horizon H05	-11,060	1,422	4.396				
				183	F	Clays and silts with occasional sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Interface	-11,243	1,605	4.452				
				488	F	Clays and silts with occasional sand interbeds	None predicted
Horizon H07	-11,731	2,093	4.598				
				198	G	Well-layered clays and silts with occasional sand interbeds	None predicted
Interface	-11,929	2,291	4.656				
				69	G	Clays, silts and numerous sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Interface	-11,998	2,360	4.676				
				177	G	Clays and silts	None predicted
Horizon H08	-12,175	2,537	4.727				
				157	H	Clays and silts with occasional sand interbeds	None predicted
Interface	-12,332	2,694	4.772				
				556	H	Clays and silts and several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Horizon H09	-12,888	3,250	4.928				
				225	I	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Interface	-13,113	3,475	4.990				
				709	I	Clays and silts with occasional sand interbeds	None predicted
Interface	-13,822	4,184	5.180				
				483	I	Clays and silts	None predicted
Horizon H10	-14,305	4,667	5.306				
				423	J	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Interface	-14,728	5,090	5.414				
				455	J	Clays and silts with occasional sand interbeds	None predicted
Interface	-15,183	5,545	5.528				
				473	J	Clays and silts with occasional sand interbeds	None predicted
Horizon H11	-15,656	6,018	5.644				
				132	K	Clays and silts with occasional sand interbeds	None predicted
Interface	-15,788	6,150	5.676				
				586	K	Clays and silts	None predicted
Interface	-16,374	6,736	5.816				
				204	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Horizon H12	-16,578	6,940	5.864				
						Base of interpretation	

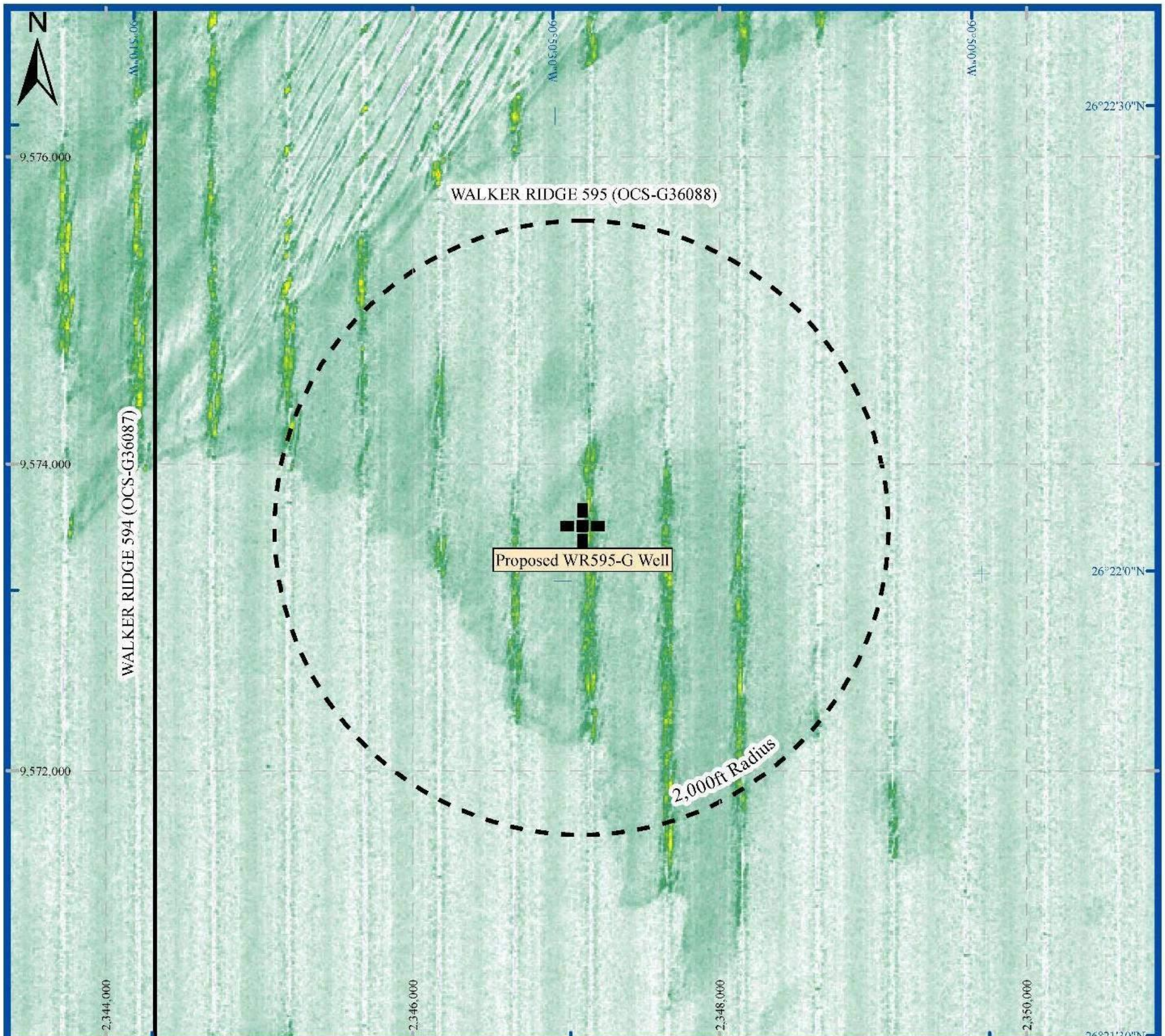
Gas Hydrate	Risk of Gas	SWF Risk
Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
None predicted	None predicted	None predicted

Top Hole Prognosis for Proposed WR595-F Well Location

Figure 3



WR595-G	Power Spectrum	Figure 1



Seabed Amplitude Extract

Proposed WR595-G Well Location (2,347,108ft E / 9,573,598ft N)

Block boundaries

Relative Seabed Backscatter

Chart Scale 1" = 1,000'

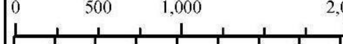
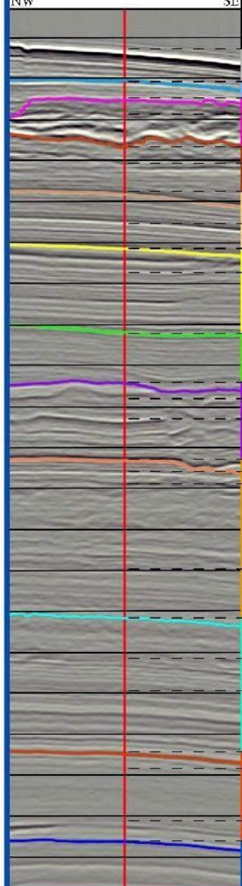


Figure 2 (WR595-G)

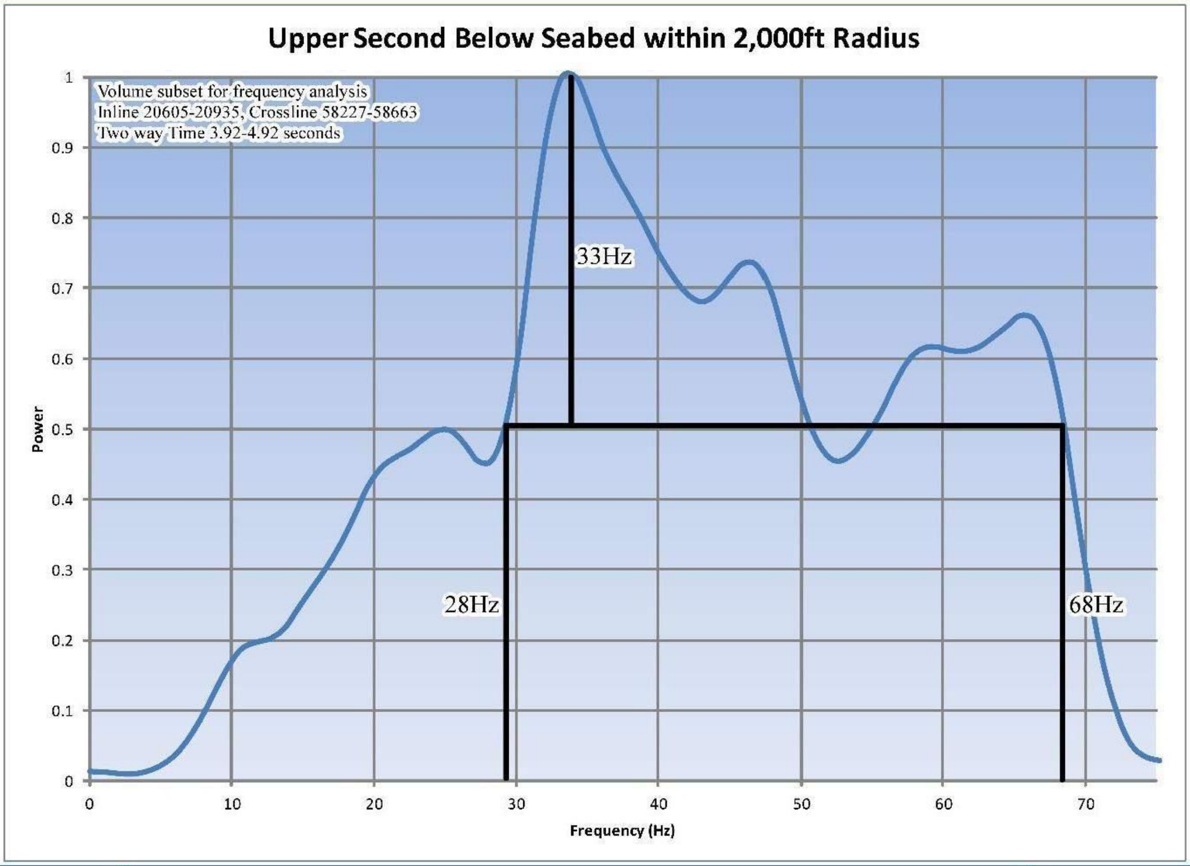
2,347,108ft E / 9,573,598ft N
NAD27 UTM15N
Inline: 20737 / Crossline: 58400
NW SE



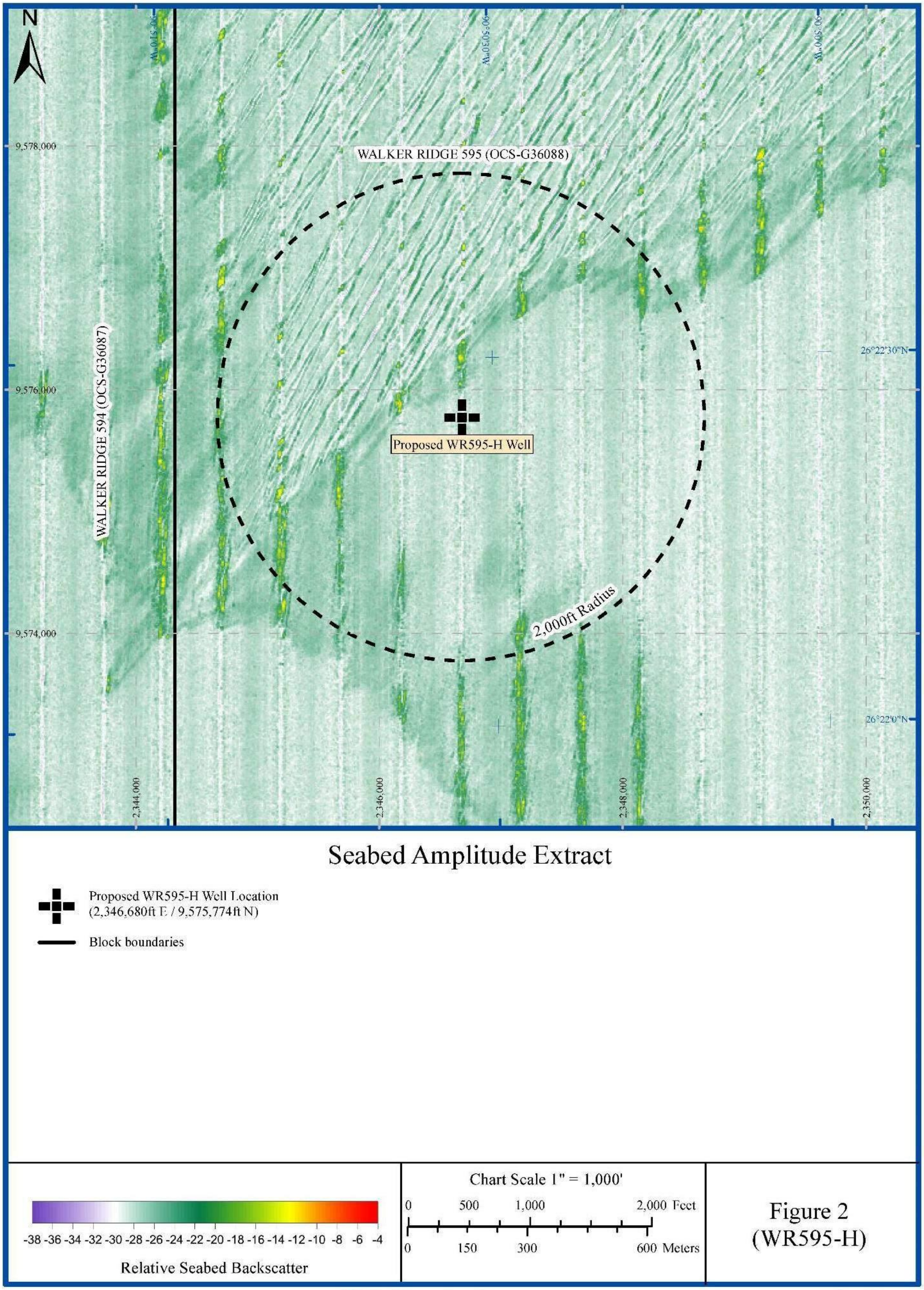
Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints	Gas Hydrate	Risk of Gas	SWF Risk
								Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
Seabed	-9,713	0	3.935							
				124	A	Seafloor is smooth sloping to the SE at 1.5°. Surficial sediments interpreted as soft clays, silts with occasional sandy interbeds, overlying clays and silts with occasional sand interbeds	Seafloor currents should be anticipated in the area			
Horizon H01	-9,837	124	4.005							
				143	B	Clays and silts with occasional sand interbeds	None predicted			
Horizon H02	-9,980	267	4.053							
				126	C	Clays and silts with occasional sand interbeds	None predicted			
Interface	-10,106	393	4.095							
				201	C	Clays, silts and numerous channelized sands	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H03	-10,307	594	4.161							
				145	D	Slightly-chaotic clays and silts with occasional sand interbeds	None predicted			
Interface	-10,452	739	4.208							
				238	D	Clays and silts with occasional sand interbeds	None predicted			
Horizon H04	-10,690	977	4.284							
				419	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-10,897	1,184	4.349							
Horizon H05	-11,109	1,396	4.415							
				196	F	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Interface	-11,305	1,592	4.475							
				477	F	Clays and silts with occasional sand interbeds	None predicted			
Horizon H07	-11,782	2,069	4.618							
				426	G	Clays and silts	None predicted			
Horizon H08	-12,208	2,495	4.742							
				104	H	Clays and silts with occasional sand interbeds	None predicted			
Interface	-12,312	2,599	4.772							
				571	H	Clays and silts with several sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-12,512	2,799	4.829							
Horizon H09	-12,883	3,170	4.933							
				199	I	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed			
Sand Interbed	-12,984	3,271	4.961							
Interface	-13,082	3,369	4.988							
				788	I	Clays and silts with occasional sand interbeds	None predicted			
Interface	-13,870	4,157	5.200							
				444	I	Clays and silts with occasional sand interbeds	None predicted			
Horizon H10	-14,314	4,601	5.316							
				457	J	Clays and silts with occasional sand interbeds	None predicted			
Interface	-14,771	5,058	5.433							
				267	J	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,038	5,325	5.500							
				598	J	Clays and silts with occasional sand interbeds	None predicted			
Horizon H11	-15,636	5,923	5.648							
				148	K	Clays and silts with occasional sand interbeds	None predicted			
Interface	-15,784	6,071	5.684							
				525	K	Clays and silts	None predicted			
Interface	-16,309	6,596	5.810							
				212	K	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible			
Horizon H12	-16,521	6,808	5.860							
						Base of interpretation		None predicted	None predicted	None predicted

Top Hole Prognosis for Proposed WR595-G Well Location

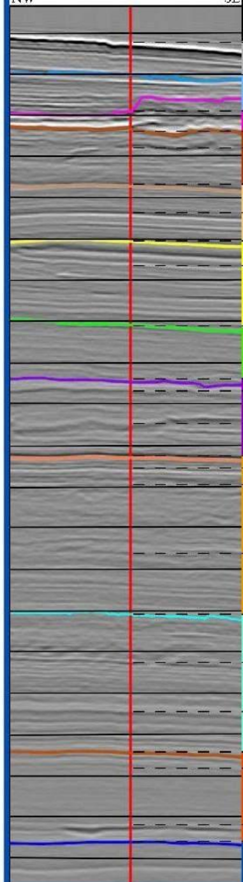
Figure 3



WR595-H	Power Spectrum	Figure 1


N
WALKER RIDGE 595 (OCS-G36088)
WALKER RIDGE 594 (OCS-G36087)
Proposed WR595-H Well
2,000ft Radius
9,578,000
9,576,000
9,574,000
2,344,000
2,346,000
2,348,000
2,350,000
26°22'30"N
26°22'0"N
Seabed Amplitude Extract
Proposed WR595-H Well Location
(2,346,680ft E / 9,575,774ft N)
Block boundaries
-38 -36 -34 -32 -30 -28 -26 -24 -22 -20 -18 -16 -14 -12 -10 -8 -6 -4
Relative Seabed Backscatter
Chart Scale 1" = 1,000'
0 500 1,000 2,000 Feet
0 150 300 600 Meters
Figure 2
(WR595-H)

2,346,680ft E / 9,575,774ft N
NAD27 UTM15N
Inline: 20721 / Crossline: 58506
NW SE



Horizon	Subsea Depth (Feet)	TVD Below Seabed (Feet)	Horizon TWT (sec)	Thickness (Feet)	Unit Name	Lithology, Structure & Stratigraphy	Potential Drilling Hazards & Constraints
Seabed	-9,685	0	3.926				
Horizon H01	-9,820	135	4.000	135	A	Seabed is smooth sloping to the ESE at <1.0°. Surficial sediments interpreted as soft clays, silts with occasional sandy interbeds overlying clays and silts with occasional sand interbeds. The proposed well is 300ft the south and southeast of a mega-furrow field	Seafloor currents should be anticipated in the area
Horizon H02	-10,084	399	4.088	264	B	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Horizon H03	-10,209	524	4.129	125	C	Clays, silts and numerous channelized sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Interface	-10,350	665	4.175	141	D	Clays, silts and occasional sand interbeds	None predicted
Horizon H04	-10,653	968	4.272	303		Clays and silts with occasional sand interbeds	None predicted
Sand Interbed	-10,856	1,171	4.336	425	E	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed
Horizon H05	-11,078	1,393	4.405				
Interface	-11,281	1,596	4.467	203	F	Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
Horizon H07	-11,748	2,063	4.607	467		Clays and silts with occasional sand interbeds	None predicted
Horizon H08	-12,221	2,536	4.745	473	G	Clays and silts with occasional sand interbeds	None predicted
Interface	-12,301	2,616	4.768	80	H	Clays and silts with occasional sand interbeds	None predicted
Sand Interbed	-12,530	2,845	4.833	569		Clays and silts and several sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed
Horizon H09	-12,870	3,185	4.928				
Sand Interbed	-12,971	3,286	4.956	195	I	Clays and silts with occasional sand interbeds <35ft thick sand interbed	Minor wellbore stability and drilling fluid circulation problems may occur at the level of the sand interbed
Interface	-13,065	3,380	4.982				
Interface	-13,808	4,123	5.182	743		Clays and silts with occasional sand interbeds	None predicted
Horizon H10	-14,290	4,605	5.308	482		Clays and silts	None predicted
Interface	-14,755	5,070	5.427	465	J	Clays and silts with occasional sand interbeds	None predicted
Interface	-15,242	5,557	5.549	487		Clays and silts with occasional sand interbeds	None predicted
Horizon H11	-15,633	5,948	5.645	391		Clays and silts with occasional sand interbeds	None predicted
Interface	-15,814	6,129	5.689	181	K	Clays and silts with occasional sand interbeds	None predicted
Interface	-16,345	6,660	5.816	531		Clays and silts	None predicted
Horizon H12	-16,535	6,850	5.861	190		Clays and silts with several sand interbeds	Minor drilling fluid circulation and wellbore stability problems possible
						Base of interpretation	

Gas Hydrate	Risk of Gas	SWF Risk
Slight / Moderate / High	Slight / Moderate / High	Slight / Moderate / High
None predicted	None predicted	None predicted

Top Hole Prognosis for Proposed WR595-H Well Location

Figure 3

SECTION 7: WASTE AND DISCHARGE INFORMATION

A. Projected Ocean Discharges

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 Downhole Disposal
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 ynthetic 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 and seafloor discharge prior to marine riser installation	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.	8180 bbls/well	409 bbls/day	Overboard discharge line below the water line	No
Synthetic based drilling fluid adhering to washed drill cuttings	Synthetic based drilling fluid adhering to washed drill cuttings	600 bbls/well	30 bbls/day	Overboard discharge line below the water line	No
Spent drilling fluids - synthetic	Synthetic-based drilling mud	N/A	N/A	N/A	No
Spent drilling fluids - water based	Synthetic-based drilling mud	N/A	N/A	N/A	No
Chemical product waste	Chemical product waste	N/A	N/A	N/A	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	45000 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	33750 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	4500 bbls/well	20 bbls/day	Drained overboard through deck scuppers	No
Will you conduct well treatment, completion, or workover?					
well treatment fluids	Linear Frac Gel Flush Fluids, Crosslinked Frac Fluids carrying ceramic proppant and acidic breaker fluid	900 bbls/well	10 bbls/day	Overboard discharge line below the water level if oil and greese free and meets LC50 requirements.	No
well completion fluids	Completion brine contaminated with WBDM and displacement spacers	1350 bbls/well	15 bbls/day	Overboard discharge line below the water level if oil and greese free and meets LC50 requirements.	No
workover fluids	NA	NA	NA	NA	No
Miscellaneous discharges. If yes, only fill in those associated with your activity.					
Desalinization unit discharge	Rejected water from watermaker unit	90000 bbls/well	400 bbls/day/well	RO Desalinization Unit Discharge Line below waterline	No
Blowout preventer fluid	Water based	45 bbls/well	0 bbls/day	Discharge Line @ Subsea BOP @ seafloor	No
Ballast water	Uncontaminated seawater	737100 bbls/well	3276 bbls/day	Discharge line overboard just above water line	No
Bilge water	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	347175 bbls/well	1543 bbls/day	Bilge and drainage water will be treated to MARPOL standards (< 15ppm oil in water).	No
Excess cement at seafloor	Cement slurry	27000 bbls/well (assume planned 100% excess is discharged)	200 bbls/day	Discharged at seafloor.	No
Fire water	Treated seawater	15000 bbls/well	2000 bbls/month	Discharged below waterline	No
Cooling water	Treated seawater	102677175 bbls/well	456343 bbls/day/well	Discharged below waterline	No
Hydrate Inhibitor	Hydrate Inhibitor	15 bbls/well methanol	15 bbls/well	Used as needed. 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.					

B. Projected Generated Wastes

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 or MiSwaco - Fourchon, LA; Ecoserv (Fourchon, La.), R360 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA)	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.	Ecoserv (Fourchon, LA), R360 Environmental Solutions (Fourchon, LA), or FCC Environmental (Fourchon, LA)	300 bbls / well	Deep Well Injection or landfarm
Cuttings wetted with oil-based fluids	NA	NA	NA	NA	NA
Completion Fluids	Used brine, acid	Storage tank on supply boat	Halliburton, Baker Hughers, Tetra, or Superior - Fourchon, LA; Ecoserv (Fourchon, La.), R360 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA)	4000 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, Inc. (Jeanereette, LA)	<8000 bbl./well	Recycled or Injection
Will you produce hydrocarbons? If yes fill in for produced sand.					
Produced sand	NA	NA	NA	NA	NA
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 Managment, W. Patterson, LA; Lamp Environmental, Hammond, LA	200 lbs/month	Recycle
Trash and debris - non-recyclables	trash and debris	various storage containers on supply boat	Republic/BFI landfill, Sorrento, LA or the parish landfill, Avondale, LA	400 lbs/month	Landfill
E&P Wastes	Completion and treatment wastes	various storage containers on supply boat	Ecoserv (Fourchon, La.), R360 Environmental Solutions (Fourchon, La.), or FCC Environmental (Fourchon, LA)	<60,000 bbl.	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 Managment, West Patterson, LA	20 bbls/month	Recycle
Non-Hazardous Waste	paints, solvents, chemicals, completion and treatment fluids	various storage containers on supply boat	Republic/BFI landfill, Sorrento, LA Lamp Environmental, Hammond, LA	60 bbls/mo	Incineration or RCRA Subtitle C landfill
Non-Hazardous Oilfield Waste	Chemicals, completion and treatment fluids	various storage containers on supply boat	Ecoserv (Port Arthur, TX)	60 bbls/mo	Deep Well Injection
Hazardous Waste	paints, solvents and unused chemicals	various storage containers on supply boat	Omega Waste Managment, West Patterson, LA or Lamp Environmental, Hammond, LA	60 bbls/mo	Recycle, treatment, incineration, or landfill
Universal Waste Items	Batteries, lamps, glass and mercury-contaminated waste	various storage containers on supply boat	Lamp Environmental, Hammond, LA	50 bbls/mo	Recycle, treatment, incineration, or landfill

C. Modeling Report

The proposed activities under this plan do not meet the U.S. Environmental Protection Agency requirements for an individual NPDES permit. Therefore, modeling report requirements per NTL No. 2008-G04 is not applicable to this EP.

SECTION 8: AIR EMISSIONS INFORMATION

A. Emissions Worksheet and Screening Questions

Screening Questions for EP's	Yes	No
Is any calculated Complex Total (CT) Emission amount (in tons) associated with your proposed exploration 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**
Are your proposed exploration activities located east of 87.5° W longitude?		**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 for more than 48 continuous hours From any proposed well?		**x**
Do you propose to burn produced hydrocarbon liquids?		**x**

If you answer *no* to all 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.

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

(2) Contact: Tracy Albert, 504.425.4652, tracy.albert@shell.com

B. Worksheets

See attached worksheets.

COMPANY	Shell Offshore Inc
AREA	Walker Ridge
BLOCK	594, 595
LEASE	OCS-G-36087, 36088
PLATFORM	DP MODU
WELL	WR595-A, WR595-B, WR595-C, WR595-D, WR594-E, WR595-F, WR595-G, WR595-H, WR595-H-Alt
DISTANCE TO LAND	184
COMPANY CONTACT	Josh O'Brien
TELEPHONE NO.	504-425-9097
REMARKS	Stones SW, WR594,595-EP AQR-MODU-20180309-BOEM.xlsx

Fuel Usage Conversion Factors	Natural Gas Turbines		Natural Gas Engines		Diesel Recip. Engine		REF.	DATE
	SCF/hp-hr	9.524	SCF/hp-hr	7.143	GAL/hp-hr	0.0483	AP42 3.2-1	4/76 & 8/84

Equipment/Emission Factors	units	PM	SOx	NOx	VOC	CO	REF.	DATE
NG Turbines	gms/hp-hr		0.00247	1.3	0.01	0.83	AP42 3.2-1& 3.1-1	10/96
NG 2-cycle lean	gms/hp-hr		0.00185	10.9	0.43	1.5	AP42 3.2-1	10/96
NG 4-cycle lean	gms/hp-hr		0.00185	11.8	0.72	1.6	AP42 3.2-1	10/96
NG 4-cycle rich	gms/hp-hr		0.00185	10	0.14	8.6	AP42 3.2-1	10/96
Diesel Recip. < 600 hp.	gms/hp-hr	1	0.1835	14	1.12	3.03	AP42 3.3-1	10/96
Diesel Recip. > 600 hp.	gms/hp-hr	0.32	0.1835	11	0.33	2.4	AP42 3.4-1	10/96
Diesel Boiler	lbs/bbl	0.084	0.3025	0.84	0.008	0.21	AP42 1.3-12,14	9/98
NG Heaters/Boilers/Burners	lbs/mmscf	7.6	0.593	100	5.5	84	AP42 1.4-1, 14-2, & 14-3	7/98
NG Flares	lbs/mmscf		0.593	71.4	60.3	388.5	AP42 11.5-1	9/91
Liquid Flaring	lbs/bbl	0.42	6.83	2	0.01	0.21	AP42 1.3-1 & 1.3-3	9/98
Tank Vapors	lbs/bbl				0.03		E&P Forum	1/93
Fugitives	lbs/hr/comp.				0.0005		API Study	12/93
Glycol Dehydrator Vent	lbs/mmscf				6.6		La. DEQ	1991
Gas Venting	lbs/scf				0.0034			

Sulphur Content Source	**Value**	**Units**
Fuel Gas	3.33	ppm
Diesel Fuel	0.05	% weight
Produced Gas(Flares)	3.33	ppm
Produced Oil (Liquid Flaring)	1	% weight

Per 40 CFR 80.510(a)(1), Locomotive and Marine (LM) diesel fuels are limited to 500 ppm maximum sulfur, effective June 1, 2007

Miscellaneous Constants and Conversions

365	days/yr - Follows FLAG 2010 Guidance
2000	lb/ton conversion factor
454	g/lb conversion factor
1000	SCF/MSCF conversion factor
1.341	hp/kW conversion factor

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL	CONTACT	PHONE	REMARKS
Shell Offshore Inc	Walker Ridge	594, 595	OCS-G-36087,	DP MODU	WR595-A, WR595-B, WR595-C, WR595-I	Josh O'Brien	504-425-9097	Stones SW, WR594,595-EP AQR-MODU-20180309-BOEM.xlsx

OPERATIONS	EQUIPMENT	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	DAYS	PM	SOx	NOx	VOC	CO	PM	SOx	NOx	VOC	CO
DRILLING	PRIME MOVER>600hp diesel	10728	518	12436	24	225	7.56	4.34	259.93	7.80	56.71	20.42	11.71	701.81	21.05	153.12
	PRIME MOVER>600hp diesel	10728	518	12436	24	225	7.56	4.34	259.93	7.80	56.71	20.42	11.71	701.81	21.05	153.12
	PRIME MOVER>600hp diesel	10728	518	12436	24	225	7.56	4.34	259.93	7.80	56.71	20.42	11.71	701.81	21.05	153.12
	PRIME MOVER>600hp diesel	10728	518	12436	24	225	7.56	4.34	259.93	7.80	56.71	20.42	11.71	701.81	21.05	153.12
	PRIME MOVER>600hp diesel	10728	518	12436	24	225	7.56	4.34	259.93	7.80	56.71	20.42	11.71	701.81	21.05	153.12
	PRIME MOVER>600hp diesel	10728	518	12436	24	225	7.56	4.34	259.93	7.80	56.71	20.42	11.71	701.81	21.05	153.12
	Emergency Generator>600hp diese	2547	123	2952	1	225	1.80	1.03	61.71	1.85	13.46	0.20	0.12	6.94	0.21	1.51
	Emergency Air Compressor< 600h	26	1	30	1	225	0.06	0.01	0.80	0.06	0.17	0.01	0.00	0.09	0.01	0.02
	All other rig-equipment is electric (e.g cranes) or negligible in emissions potential (e.g. life boats, welding equipment, etc.)															
	Supply Vessel>600hp diesel (gene	10100	488	11708	24	225	7.12	4.08	244.71	7.34	53.39	19.22	11.02	660.73	19.82	144.16
	Supply Vessel>600hp diesel (riser	10100	488	11708	24	10	7.12	4.08	244.71	7.34	53.39	0.85	0.49	29.37	0.88	6.41
	Supply Vessel>600hp diesel (riser	10100	488	11708	24	10	7.12	4.08	244.71	7.34	53.39	0.85	0.49	29.37	0.88	6.41
	Crew Vessel>600hp diesel	8000	386	9274	24	68	5.64	3.23	193.83	5.81	42.29	4.57	2.62	157.00	4.71	34.26
	Frac Boat Engines >600hp diesel	12100	584	14026	24	20	8.53	4.89	293.17	8.80	63.96	2.05	1.17	70.36	2.11	15.35
	Frac Boat-Completion Equipment	16500	797	19127	24	20	11.63	6.67	399.78	11.99	87.22	2.79	1.60	95.95	2.88	20.93
DRILLING	OIL BURN	0			24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
WELL TEST	GAS FLARE		945833		24	20		0.56	67.53	57.03	367.46		0.13	16.21	13.69	88.19
	AHV / MPS Vessel>600 hp	13500	652	15649	24	20	9.52	5.46	327.09	9.81	71.37	2.28	1.31	78.50	2.36	17.13
	Main Tug Boat Vessel>600 hp	10100	488	11708	24	20	7.12	4.08	244.71	7.34	53.39	1.71	0.98	58.73	1.76	12.81
	Tug Boat Vessel>600 hp	4500	217	5216	24	20	3.17	1.82	109.03	3.27	23.79	0.76	0.44	26.17	0.79	5.71
	Tug Boat Vessel>600 hp	4500	217	5216	24	20	3.17	1.82	109.03	3.27	23.79	0.76	0.44	26.17	0.79	5.71
	MISC.	**BPD**	**SCF/HR**	**COUNT**												
	TANK-BARGE	10000			24	20				12.50					3.00	
	TANK-500BBL	10000			24	20				12.50					3.00	
	TANK-100BBL	10000			24	20				12.50					3.00	
	FUGITIVES-			452		20				0.23					0.05	
	2018-2026 ANNUAL TOTAL						**94.38**	**54.66**	**3310.55**	**154.36**	**1075.02**	**153.04**	**87.89**	**5276.87**	**171.51**	**1235.97**
EXEMPTION CALCULATION	**DISTANCE FROM LAND IN MILES**											**6127.20**	**6127.20**	**6127.20**	**6127.20**	**109991.08**
	184.0															

NOTE - Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures). Wireline, cementing, and other eqpt. is not listed above but is included in MODU's fuel-monitored eqpt.

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Shell Offshore Inc	Walker Ridge	594, 595	OCS-G-36087, 36088	DP MODU	WR595-A, WR595-B, WR595-C, WR595-D, WR594-E, WR595-F, WR595-G, WR595-H, H-Alt
Year	**Emitted**			**Substance**	
	PM	**SOx**	**NOx**	**VOC**	**CO**
	AQR Emissions if DP MODU(Semi-sub or Drillship) is Utilized				
2018-2026	**153.04**	**87.89**	**5276.87**	**171.51**	**1235.97**
Allowable	**6127.20**	**6127.20**	**6127.20**	**6127.20**	**109991.08**

Notes

NOTE - Emissions for MODU activities are estimated at the Potential to Emit (no fuel reduction measures).

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 bi-annual review was found to be in compliance November 2, 2017.

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	EP
Type of Activity	Exploratory Drilling	Exploratory Drilling
Facility Location (area/block)	MC 812	WR595
Facility Designation	Subsea well B◇	Subsea well B
Distance to Nearest Shoreline (miles)	56	184
Volume		
Storage tanks (total)	N/A	N/A
Flowlines (on facility)	N/A	N/A
Pipelines	N/A	N/A
Uncontrolled blowout (volume per day)	468,000* BOPD	9,000** BOPD
Total Volume	468,000 Bbls	9,000 Bbls
Type of Oil(s) - (crude oil, condensate, diesel)	Crude oil	Crude oil
API Gravity(s)	31º	25º

Table 9.2 - Worst Case Scenario Determination

24-hour rate (432,000 BOPD 30-day average)** * 24-hour rate (8,833 BOPD 30-day average)**

◇This well was accepted by BOEM in plan N-9840.

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 bi-annual review was found to be in compliance November 2017. 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 exploration plan, 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 BSEE Oil Spill Risk Analysis Model (OSRAM) for the Central and Western Gulf of Mexico available on the BSEE 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	%
Exploratory WR595		50	**Matagorda, TX**	**1**
			Galveston, TX	1
			Jefferson, TX	-
			Cameron, LA	**1**
			Vermilion, LA	**1**
			Iberia, LA	-
			Terrebonne, LA	-
			Lafourche, LA	-
			Jefferson, LA	-
			Plaquemines, 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 BSEE 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 Walker Ridge 595 WCD scenario.

Onshore/Nearshore: Matagorda County, Texas has been identified as one of the probable impacted Counties within the Gulf of Mexico. Matagorda County has a total area of 1,613 square miles, of which, 1,110 square miles of it is land and 512 square miles is water. Matagorda County includes two National Wildlife Refuges: Big Boggy National Wildlife Refuge and San Bernard Wildlife Refuge.

Galveston County is located on the plains of the Texas Gulf Coast in the southeastern part of the state. The county is bounded on the northeast by Galveston Bay and on the northwest by Clear Creek and Clear Lake. Much of the county covers Galveston Bay, and is bounded to the south by the Galveston Seawall and beaches on the Gulf of Mexico. Galveston County has a total area of 873 square miles which 398 square miles is land and 474 square miles (54.35%) is water.

Cameron Parish is located in the southwest corner of Louisiana and has a total area of 1,932 square miles of which, 1,313 square miles of it is land and 619 square miles is water. Cameron Parish includes four National Wildlife Refuges including the Cameron Prairie National Wildlife Refuge, East Cove National Wildlife Refuge, Sabine National Wildlife Refuge and part of the Lacassine National Wildlife Refuge.

Vermilion Parish has a total area of 1,542 square miles, of which 1,173 square miles is land and 369 square miles is water. Vermilion Parish includes part of the Rockefeller Wildlife Refuge, the State Wildlife Refuge and the White Lake Wetlands Conservation Area.

Plaquemines Parish has a total area of 2,429 square miles of which, 845 square miles of it is land and 1,584 square miles is water. Plaquemines Parish includes two National Wildlife Refuges: Breton National Wildlife Refuge and Delta National Wildlife Refuge. This area is also a nesting ground for the brown pelican, an endangered species. Examples of Environmental Sensitivity maps for Plaquemines Parish are detailed in the following pages. Example ESI maps for Plaquemines Parish and the legend are shown in Figures 9.C.1through 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 WR 595 Worst Case Discharge as effectively as possible. Below is a table outlining the applicable evaporation and surface dispersion quantity:

Walker Ridge Block 595		Calculations (BBLS)
i.	**TOTAL WCD (based on 30 day average (per day))**	**~8,833**
ii.	Loss of volume of oil to natural surface dispersion and evaporation base (approximate bbls per day)* (14% Natural surface evaporation and dispersion in 24 hrs)	-1,237
	TOTAL REMAINING	**~7,596**

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 32 hours (based on the equipment's Estimated Daily Response Capacity (EDRC) and storage). 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 WR 595 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 544,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 297,000 barrels.

	De-rated Recovery Rate (bopd)	Storage (bbls)
Offshore Recovery and Storage	198,299	313,438
Nearshore Recovery and Storage	346,415	15,679
Total	544,714	297,759

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 2008-N05. 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.

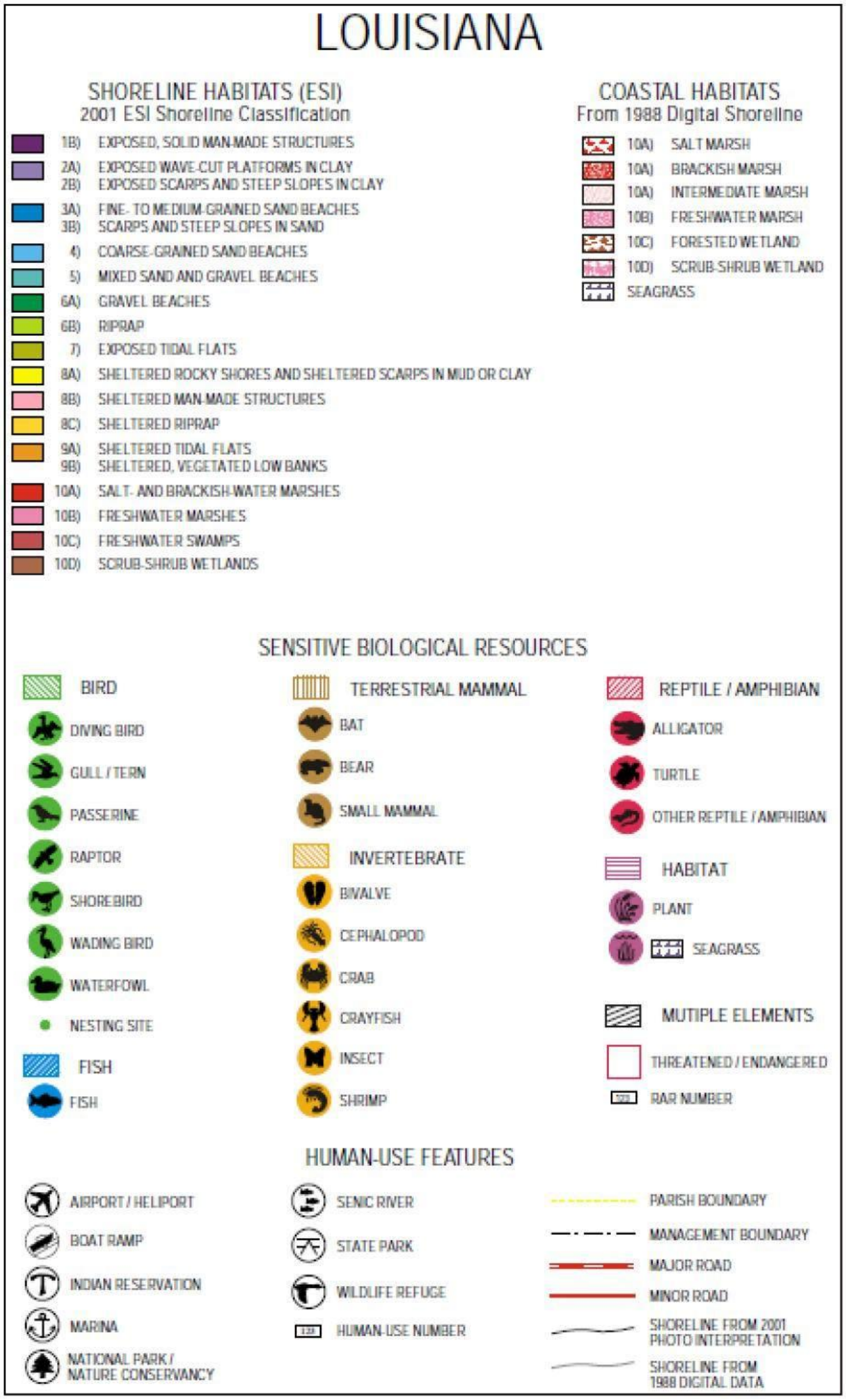


Figure 9.C.1 Environmental Sensitivity Index Map Legend

ENVIRONMENTAL SENSITIVITY INDEX MAP

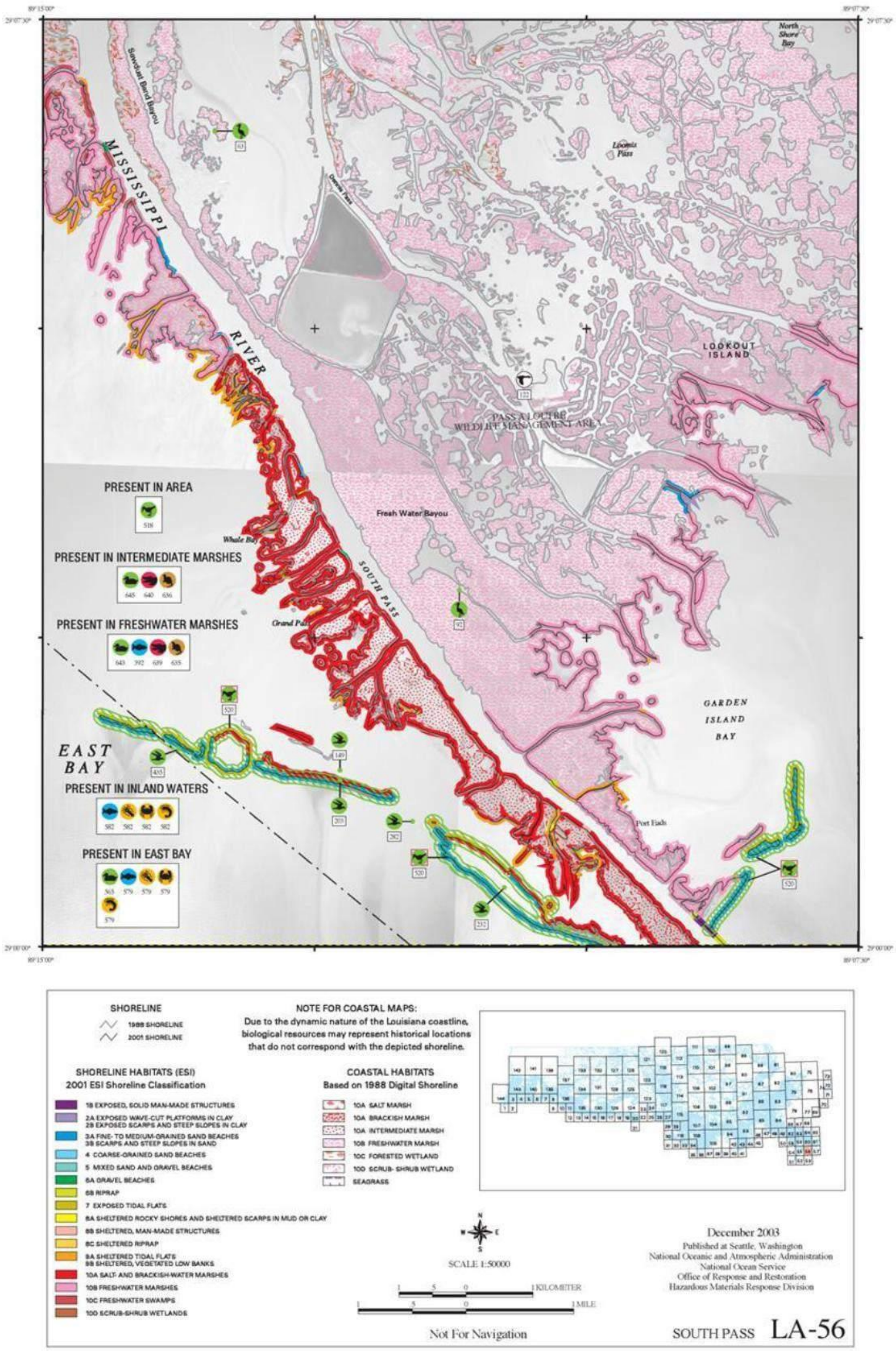


Figure 9.C.2 South Pass ESI Map

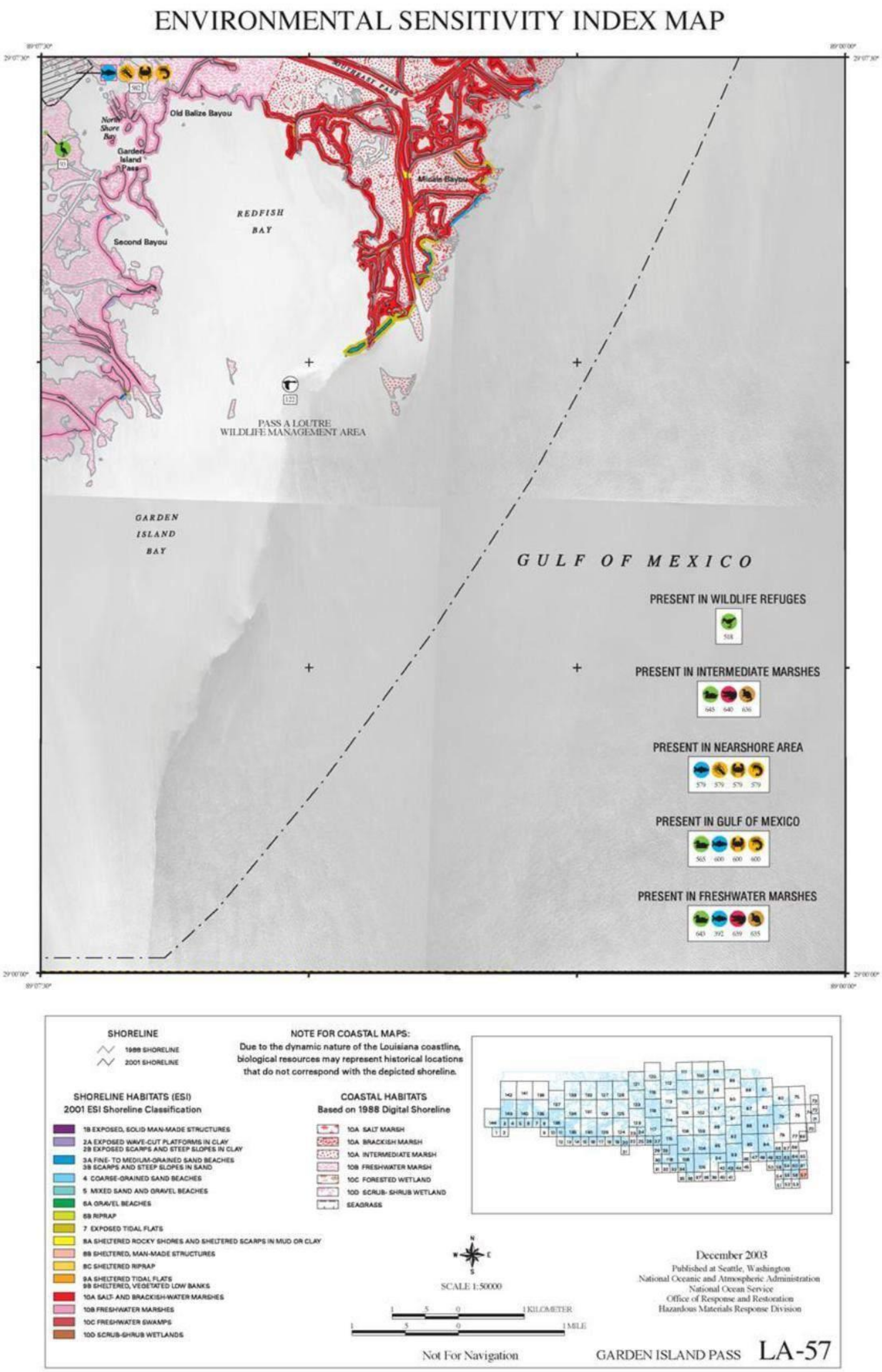


Figure 9.C.3 Garden Island Pass ESI Map

ENVIRONMENTAL SENSITIVITY INDEX MAP

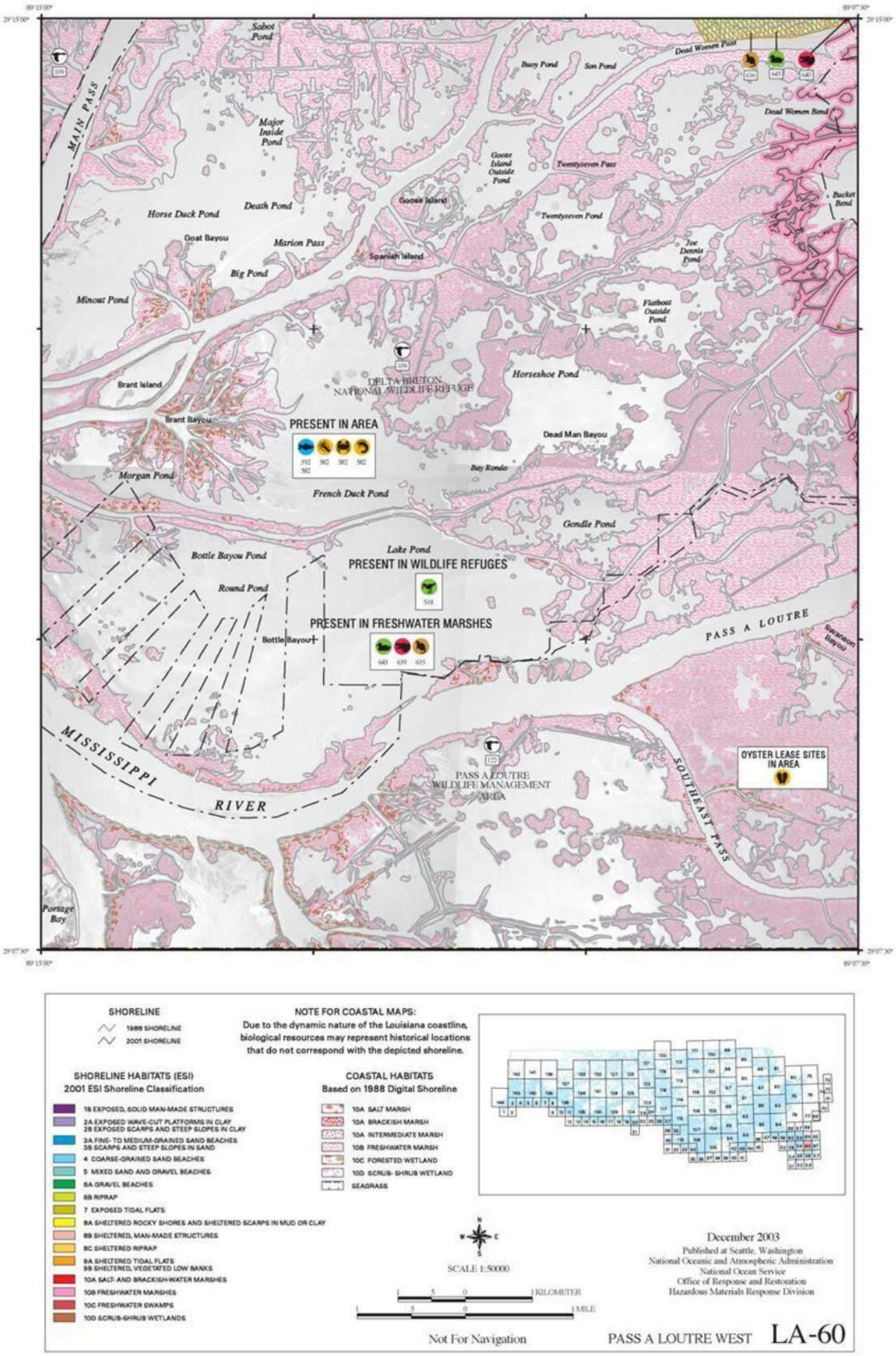


Figure 9.C.4 Pass a Loutre West ESI Map

ENVIRONMENTAL SENSITIVITY INDEX MAP

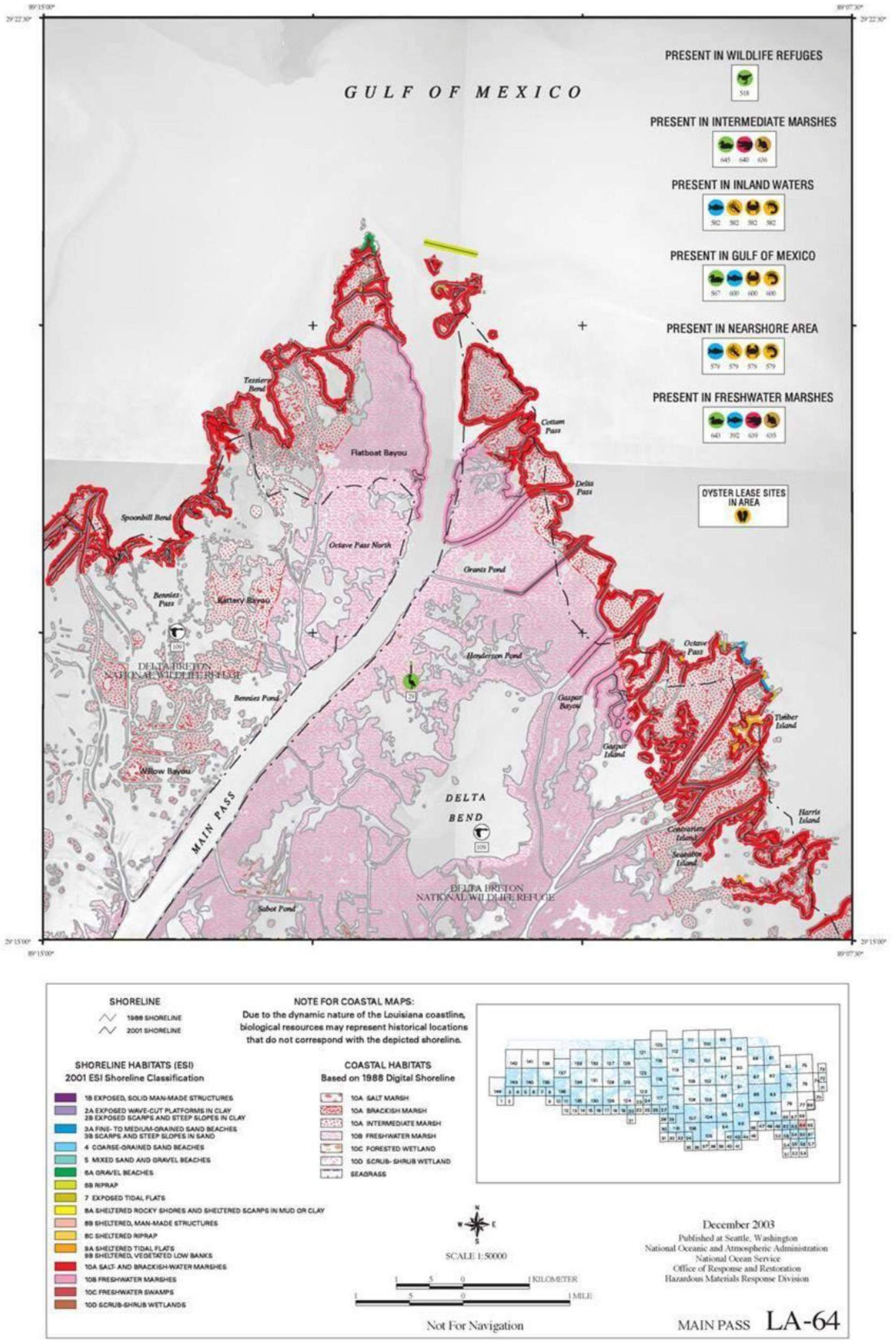


Figure 9.C.5 Main Pass ESI Map

Walker Ridge 595
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.
*** - Specific barge names may vary.

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
FRV JL O'Brien	CGA (888) 242-2007	Leeville, LA	Lamor Brush Skimmer 36" Boom 95' Vessel X Band Radar Personnel	2 64 1 1 6	22,885	249	Leeville, LA	204	2	0	12	1	15
FRV Breton Island	CGA (888) 242-2007	Venice, LA	Lamor Brush Skimmer 36" Boom 95' Vessel X Band Radar Personnel	2 64 1 1 6	22,885	249	Venice, LA	226	2	0	13.5	1	17
S.T. Benz Responder LFF 100 Brush	MSRC (800) OIL-SPIL	Port Fourchon, LA	LFF 100 Brush Skimmer Backup- Stress 1 Skimmer 67" Pressure Inflatable Boom 210' Vessel Personnel 32' Support Boat X Band Radar Infrared Camera FAES #4 "Buster"	1 1 2640' 1 10 1 1 1 1	18,086	4,000	Port Fourchon, LA	194	2	1	14	1	18
FRV H.I. Rich	CGA (888) 242-2007	Vermilion, LA	Lamor Brush Skimmer 36" Boom 95' Vessel X Band Radar Personnel	2 64 1 1 6	22,885	249	Vermilion, LA	280	2	0	16.5	1	20
Louisiana Responder Transrec 350	MSRC (800) OIL-SPIL	Fort Jackson, LA	Transrec 67" Pressure Inflatable Boom 210' Vessel Personnel 32' Support Boat X Band Radar Infrared Camera FAES #4 "Buster"	1 2640' 1 10 1 1 1 1	10,567	4,000	Fort Jackson, LA	235	2	1	17	1	21
Gulf Coast Responder Transrec-350	MSRC (800) OIL-SPIL	Lake Charles, LA	Transrec Skimmer Backup - Stress 1 Skimmer 67" Pressure Inflatable Boom 210' Vessel Personnel 32' Support Boat X Band Radar Infrared Camera FAES #4 "Buster"	1 1 2640' 1 10 1 1 1 1	10,567	4,000	Lake Charles, LA	305	2	1	22	1	26
MSRC-452 Offshore Barge	MSRC (800) OIL-SPIL	Fort Jackson, LA	Offshore Barge 67" Pressure Inflatable Boom Crucial Disc Skimmer Desmi Ocean *Appropriate Vessel Personnel * Offshore Tug X Band Radar Infrared Camera	1 2640' 1 1 1 9 2 1 1	Crucial Disc Skimmer: 11,122 Desmi Ocean: 3,017	45,000	Fort Jackson, LA	235	4	1	26	1	32
CGA-200 HOSS Barge (OSRB)	CGA (888) 242-2007	Harvey, LA	Marco Skimmer 67" Sea Sentry Personnel * Tug - 1,200 HP X Band Radar * Tug - 1,800 HP	4 2640' 12 2 1 1	76,285	4,000	Harvey, LA	288	0	4	42.5	1	48
***Moran/ Conneticut	CGA (888) 242-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	41,454	Houma, LA	224	24-72	0	27.5	1	53 to 101
***Moran/ Portland	CGA (888) 242-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	91,443	Houma, LA	224	24-72	0	27.5	1	53 to 101
***Moran/ Georgia	CGA (888) 242-2007	Houma, LA	Offshore Barge Personnel Offshore Tug	1 4 1	N/A	118,794	Houma, LA	224	24-72	0	27.5	1	53 to 101

DERATED RECOVERY RATE (BBLS/DAY)	198,299
STORAGE CAPACITY INCLUDING SKIMMING VESSELS (BARRELS)	313,438

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

Walker Ridge 595
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.													
SWS CGA-76 FRV	CGA (888) 242-2007	Leeville, LA	Lori Brush Skimmer	2	22,885	249	Leeville, LA	204	2	0	12	1	15
			36" Boom	150									
			60' Vessel	1									
			X Band Radar	1									
			Personnel	4									
SWS CGA-77 FRV	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer	2	22,885	249	Venice, LA	226	2	0	13.5	1	17
			36" Boom	150									
			60' Vessel	1									
			X Band Radar	1									
			Personnel	4									
FRV M/V Grand Bay	CGA (888) 242-2007	Venice, LA	Lori Brush Skimmer	2	15,257	65	Venice, LA	226	2	0	13.5	1	17
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
FRV M/V RW Armstrong	CGA (888) 242-2007	Morgan City, LA	Lori Brush Skimmer	2	15,257	65	Morgan City, LA	239	2	0	14	1	17
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
SW CGA-72 FRV	CGA (888) 242-2007	Morgan City, LA	Marco Belt Skimmer	2	21,500	249	Morgan City, LA	239	2	0	14	1	17
			36" Auto Boom	150'									
			Personnel	4									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
SWS CGA-53 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Leeville, LA	Marco Belt Skimmer	1	3,588	34	Port Fourchon, LA	194	4	1	11.5	1	18
			* 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	Port Fourchon, LA	194	6	1	11.5	1	20
			* 18" Boom (contractor)	100'									
			Personnel	3									
			36' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SW CGA-74 FRV	CGA (888) 242-2007	Vermilion, LA	Marco Belt Skimmer	2	21,500	249	Vermilion, LA	280	2	0	16.5	1	20
			36" Auto Boom	150'									
			Personnel	4									
			56' SW Vessel	1									
			* 14'-16' Alum. Flatboat	2									
SWS CGA-51 MARCO Shallow Water Skimmer	CGA (888) 242-2007	Lake Charles, LA	Marco Belt Skimmer	1	3,588	20	Port Fourchon, LA	194	6	1	11.5	1	20
			* 18" Boom (contractor)	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							
FRV M/V Bastian Bay	CGA (888) 242-2007	Lake Charles, LA	Lori Brush Skimmer	2	15,257	65	Lake Charles, LA	305	2	0	18	1	21
			36" Boom	46'									
			46' Vessel	1									
			Personnel	4									
SW CGA-73 FRV	CGA (888) 242-2007	Lake Charles, LA	Marco Belt Skimmer	2	21,500	249	Lake Charles, LA	305	2	0	18	1	21
			36" Auto Boom	150'									
			Personnel	5									
			56' SWS Vessel	1									
			* 14'-16' Alum. Flatboat	2									
SWS CGA-75 FRV	CGA (888) 242-2007	Galveston, TX	Lori Brush Skimmer	2	22,885	249	Galveston, TX	321	2	0	19	1	22
			36" Boom	150									
			60' Vessel	1									
			X Band Radar	1									
			Personnel	4									
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Belle Chasse, LA	Skimmer	1	905	400	Port Fourchon, LA	194	4.25	1	14	1	21
			18" Boom	50'									
			Personnel	4									
			Non-self-propelled barge	1									
			Push Boat	1									
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Belle Chasse, LA	Marco I Skimmer	1	3,588	24	Port Fourchon, LA	194	4.25	1	14	1	21
			Personnel	2									
			30' Shallow Water Vessel	1									

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

Walker Ridge 595
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.													
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Baton Rouge, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	1,371	400	Port Fourchon, LA	194	5	1	14	1	21
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Pascagoula, MS	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	5.75	1	14	1	22
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	5.75	1	14	1	22
SBS w/ AardVAC	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	3,840	400	Port Fourchon, LA	194	5.75	1	14	1	22
GT-185	MSRC (800) OIL-SPIL	Pascagoula, MS	Skimmer 18" Boom Personnel *Appropriate Vessel	1 50' 5 2	1,371	*500	Port Fourchon, LA	194	6	1	14	1	22
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	6.25	1	14	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	6.25	1	14	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	6.25	1	14	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	905	400	Port Fourchon, LA	194	6.25	1	14	1	23
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Lake Charles, LA	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	905	400	Port Fourchon, LA	194	6.25	1	14	1	23
SW CGA-71 FRV	CGA (888) 242-2007	Aransas Pass, TX	Marco Belt Skimmer 36" Auto Boom Personnel 56' SWS Vessel * 14'-16' Alum. Flatboat	2 150' 5 1 2	21,500	249	Port Fourchon, LA	194	12.5	0	11.5	1	25
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Galveston, TX	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	8.75	1	14	1	25
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Galveston, TX	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	8.75	1	14	1	25
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Galveston, TX	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	1,371	400	Port Fourchon, LA	194	8.75	1	14	1	25
MSRC "Quick Strike"	MSRC (800) OIL-SPIL	Lake Charles, LA	LORI Brush Skimmer Personnel 47' Fast Response Boat	2 3 1	5,000	50	Lake Charles, LA	305	2	1	22	1	26

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

Walker Ridge 595
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/ Queensboro	MSRC (800) OIL-SPIL	Memphis, TN	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 60' 4 1 1	905	400	Port Fourchon, LA	194	9.25	1	14	1	26
FRV CGA 58 Timbalier Bay	CGA (888) 242-2007	Aransas Pass, TX	Lori Brush Skimmer 36" Boom 46' Vessel Personnel	2 46' 1 4	15,257	65	Aransas Pass, TX	402	2	0	23.5	1	27
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Ingleside, TX	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	11.5	1	14	1	28
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Ingleside, TX	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	1,371	400	Port Fourchon, LA	194	11.5	1	14	1	28
GT-185	MSRC (800) OIL-SPIL	Jacksonville, FL	Skimmer 18" Boom Personnel *Appropriate Vessel *Temporary Storage	1 60' 5 2 1	1,371	500	Port Fourchon, LA	194	12	1	14	1	28
SBS w/ GT-185 w/adapter	MSRC (800) OIL-SPIL	Savannah, GA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	1,371	400	Port Fourchon, LA	194	13.75	1	14	1	30
GT-185 w/adapter	MSRC (800) OIL-SPIL	Tampa, FL	Skimmer 18" Boom Personnel *Appropriate Vessel *Temporary Storage	1 50' 5 2 1	1,371	500	Port Fourchon, LA	194	13	1	14	1	30
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Roxana, IL	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	14	1	14	1	30
WP-1	MSRC (800) OIL-SPIL	Miami, FL	Skimmer 18" Boom Personnel *Appropriate Vessel *Temporary Storage	1 50' 5 2 1	3,017	500	Port Fourchon, LA	194	16	1	14	1	33
AARDVAC	MSRC (800) OIL-SPIL	Miami, FL	Skimmer 18" Boom Personnel * Appropriate Vessel *Temporary Storage	1 50' 5 2 1	3,840	500	Port Fourchon, LA	194	16	1	14	1	33
AARDVAC	MSRC (800) OIL-SPIL	Miami, FL	Skimmer 18" Boom Personnel * Appropriate Vessel *Temporary Storage	1 50' 5 2 1	3,840	500	Port Fourchon, LA	194	16	1	14	1	33
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Miami, FL	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	16.25	1	14	1	33
SWS CGA-55 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Morgan City, LA	Marco Skimmer * 18" Boom (contractor) Personnel 38' Skimming Vessel Shallow Water Barge	1 100' 3 1 1	1,810	100 249	Port Fourchon, LA	194	4	1	27.5	1	34
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Whiting, IN	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 60' 4 1 1	905	400	Port Fourchon, LA	194	17.25	1	14	1	34

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

Walker Ridge 595
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.													
SBS w/ Queensboro	MSRC (800) OIL-SPIL	Toledo, OH	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	905	400	Port Fourchon, LA	194	18.75	1	14	1	35
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Virginia Beach, VA	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	20	1	14	1	36
SBS w/ AardVAC	MSRC (800) OIL-SPIL	Virginia Beach, VA	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	3,840	400	Port Fourchon, LA	194	20	1	14	1	36
SBS w/ Stress 1	MSRC (800) OIL-SPIL	Chesapeake City, MD	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 50' 4 1 1	15,840	400	Port Fourchon, LA	194	21.5	1	14	1	38
CGA-54 Egmopol Shallow Water Skimmer	CGA (888) 242-2007	Galveston, TX	Marco Belt Skimmer * 18" Boom (contractor) Personnel 34' Skimming Vessel Shallow Water Barge	1 100' 3 1 1	1,810	100 249	Port Fourchon, LA	194	9	1	27.5	1	39
SBS w/ Stress 1	MSRC (800) OIL-SPIL	Edison/Perth Amboy, NJ	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	15,840	400	Port Fourchon, LA	194	23	1	14	1	39
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Edison/Perth Amboy, NJ	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	23	1	14	1	39
SBS w/ GT-185	MSRC (800) OIL-SPIL	Bayonne, NJ	Skimmer 18" Curtain Internal Foam Personnel Non-self-propelled barge *Appropriate Vessel	1 50' 4 1 1	1,371	400	Port Fourchon, LA	194	23	1	14	1	39
MSRC "Lightning"	MSRC (800) OIL-SPIL	Tampa, FL	LORI Brush Skimmer Personnel 47' Fast Response Boat	2 3 1	5,000	50	Tampa, FL	530	2	1	38	1	42
SBS w/ GT-185	MSRC (800) OIL-SPIL	Providence, RI	Skimmer 18" Curtain Internal Foam Personnel Non-self-propelled barge Push Boat	1 60' 4 1 1	1,371	400	Port Fourchon, LA	194	26	1	14	1	42
SBS w/ GT-185	MSRC (800) OIL-SPIL	Everett, MA	Skimmer 18" Boom Personnel Non-self-propelled barge Push Boat	1 60' 4 1 1	1,371	400	Port Fourchon, LA	194	26	1	14	1	42
MSRC "Kvichak"	MSRC (800) OIL-SPIL	Portland, ME	Marco I Skimmer Personnel 30' Shallow Water Vessel	1 2 1	3,588	24	Port Fourchon, LA	194	28	1	14	1	44
SBS w/ WP-1	MSRC (800) OIL-SPIL	Portland, ME	Skimmer 18" Boom Personnel Self-propelled barge	1 50' 4 1	3,017	400	Port Fourchon, LA	194	28	1	14	1	44

DERATED RECOVERY RATE (BBLS/DAY)	346,415
SKIMMING VESSEL STORAGE CAPACITY (BARRELS)	15,679

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

Walker Ridge 595 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	221	1	0.25	0.74	2.00
			Spotter Personnel	2						
			Crew - Pilots	1						
Aztec Piper Air Speed - 150 Knots	Airborne Support (985) 851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	221	1	0.25	1.29	2.55
			Spotter Personnel	2						
			Crew - Pilots	1						
Eurocopter EC-135 Helicopter Air Speed - 141 knots	PHI (800) 235-2452	Houma, LA	Surveillance Aircraft	1	Houma, LA	221	1	0.25	1.37	2.65
			Spotter Personnel	2						
			Crew - Pilots	1						
Sikorsky S-76 Helicopter Air Speed - 141 knots	PHI (800) 235-2452	Houma, LA	Surveillance Aircraft	1	Houma, LA	221	1	0.25	1.37	2.65
			Spotter Personnel	2						
			Crew - Pilots	1						

Table 9.D.6 Aerial Surveillance Activation List

Walker Ridge 595
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
NOTE: Planholder has access to additional dispersant assets. For a comprehensive list of assets, see Section 18. * - These components are additional operational requirements that must be procured in addition to the system(s) identified. ** The second flight times listed are to demonstrate subsequent sortie and application timeframes. *** The dispersants listed is for gallon capacity only not amount stored at each location.											
Twin Commander Air Speed - 300 MPH	CGA/Airborne Support (985) 851-6391	Houma, LA	Aero Commander	1	Houma, LA	221	1	0	0.74	0	1.75
			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	221	2	0.5	1.14	0.5	4.15
			Dispersant - Gallons	2000							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	221	1.14	0.5	1.14	0.3	3.10
			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	288	3	0.0	0.84	0.5	4.35
			Dispersant - Gallons	4125							
			*Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	288	0.50	0.3	0.84	0.5	2.20
			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	221	2	0.5	1.47	0.5	4.50
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	221	1.47	0.5	1.47	0.3	3.75
			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	221	2	0.5	1.47	0.5	4.50
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	221	1.47	0.5	1.47	0.3	3.75
			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	288	3	0.00	1.35	0.20	4.60
			Dispersant - Gallons	250							
			* Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	288	1.35	0.20	1.35	0.20	3.15
			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	288	7	0.3	0.84	0.5	8.70
			Dispersant - Gallons	4125							
			*Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	288	0.50	0.3	0.84	0.5	2.20
			Crew - Pilots	2							
BE-90 King Air Aircraft Air Speed - 213 MPH	MSRC (800) OIL-SPIL	Concord, CA	BE-90 Dispersant Aircraft	1	Stennis INTL., MS 1st Flight	288	15	0.30	1.35	0.20	16.90
			Dispersant - Gallons	330							
			* Spotter Aircraft	1							
			*Spotter Personnel	2	Stennis INTL., MS 2nd Flight	288	1.35	0.20	1.35	0.20	3.15
			Crew - Pilots	2							

Table 9.D.7 Offshore Aerial Dispersant Activation List

Walker Ridge 595 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
NOTE: Planholder has access to additional dispersant assets. For a comprehensive list of assets, see Section 18. * - These components are additional operational requirements that must be procured by OSROs in addition to the system(s) identified.											
USCG SMART Team	USCG	Mobile, AL	Personnel	4	Port Fourchon, LA	194	6.25	1	14	0.5	21.75
			* Crew Boat	1							
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Harvey, LA	Dispersant Spray System	1	Port Fourchon, LA	194	4	0.5	19.5	1	25
			Dispersant (Gallons)	330							
			Personnel	4							
			* Utility Boat	1							
Vessel Based Dispersant Spray System	CGA (888) 242-2007	Aransas Pass, TX	Dispersant Spray System	1	Port Fourchon, LA	194	11.5	0.5	19.5	1	32.5
			Dispersant (Gallons)	330							
			Personnel	4							
			* Utility Boat	1							

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

Walker Ridge 595 Sample Control, Containment & 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	1	Port Fourchon, LA	194	0	1.5	14	0.5	16
			ROV's	2							
Subsea Dispersant Application	RP / MWCC	Port Fourchon, LA	Multi-Service Vessel	1	Port Fourchon, LA	194	1.5	1.5	14	2	19
			ROV's	2							
			Coil Tubing Unit	1							
		Houston, TX	Dispersant	200,000 gal							
			Manifold	1							
			Subsea Dispersant Injection System	1							
Capping Stack	RP / MWCC	Port Fourchon, LA	Anchor Handling Tug Supply Vessel	1	Port Fourchon, LA	194	2*	1.5	14	3	21*
			ROV's	1							
		Houston, TX	Hydraulic System	1							
			Capping Stack	1							
"Top Hat" Unit	RP / MWCC	Port Fourchon, LA	Anchor Handling Tug Supply Vessel	1	Port Fourchon, LA	194	13*	1	14	3	31*
			ROV's	2							
			Multi-Purpose Supply Vessel	1							
			Drill Ship (Processing Vessel)	1							
		Houston, TX	"Top Hat"	1							
			Containment Chamber	1							
			Shuttle Barge	1							

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

Walker Ridge 595
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
NOTE: Planholder has access to additional ISB assets. For a comprehensive list of those assets, see Section 19. * - These components are additional operational requirements that must be procured in addition to the system identified. ** - Teams will deploy in sections of 500' at any given time											
ISB Fire-Fighting Team	TBD	TBD	* Offshore Firefighting Vessels * Cranes * Roll-off Boxes Personnel * Air Monitoring Equipment	2 2 2 8 2	Port Fourchon, LA	194	4	1	14	1	20
SMART In-Situ Burn Monitoring Team	USCG	Mobile, AL	* Air Monitoring Equipment * Offshore Vessel Personnel	1 1 4	Port Fourchon, LA	194	4	1	14	1	20
Safety Monitoring Team	TBD	TBD	* Air Monitoring Equipment * Offshore Vessel Personnel	1 1 4	Port Fourchon, LA	194	4	1	14	1	20
Wildlife Monitoring Team	TBD	TBD	* Air Monitoring Equipment * Offshore Vessel Personnel	1 1 4	Port Fourchon, LA	194	4	1	14	1	20
Aerial Spotting Team (per 2 ISB Task Forces)	TBD	TBD	Fixed Wing Aircraft Trained ISB Spotter ISB Documenter	1 2 1	Port Fourchon, LA	194	4	1	14	1	20
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Lake Charles, LA	**Fire Boom (ft) Tow Line (ft) * Appropriate Vessel Personnel Ignition Device	2,000 600 2 2 25	Port Fourchon, LA	194	6.25	1	14	1	22.25
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Houston, TX	**Fire Boom (ft) Tow Line (ft) * Appropriate Vessel Personnel Ignition Device	16,000 600 2 2 155	Port Fourchon, LA	194	8.25	1	14	1	24.25
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Galveston, TX	**Fire Boom (ft) Tow Line (ft) * Appropriate Vessel Personnel Ignition Device	1,000 600 2 2 10	Port Fourchon, LA	194	8.75	1	14	1	24.75
Fire Team (In-Situ Burn Fire System)	MSRC (800) OIL-SPIL	Portland, ME	**Fire Boom (ft) Tow Line (ft) * Appropriate Vessel Personnel Ignition Device	1,000 600 2 2 10	Port Fourchon, LA	194	28	1	14	1	44
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft) Guide Boom/Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 400 3 20 10	Port Fourchon, LA	194	0	24	19.5	1	44.5
Fire Team (In-Situ Burn Fire System)	CGA (888) 242-2007	Harvey, LA	Fire Boom (ft) Guide Boom/Tow Line (ft) * Offshore Vessel (0.5 kt capability) Personnel Ignition Device	500 400 3 20 10	Port Fourchon, LA	194	0	24	19.5	1	44.5
Supply Team (Supply Vessel System)	MSRC (800) OIL-SPIL	Port Fourchon, LA	*Offshore Vessel 110' - 310' Personnel	1 6	Port Fourchon, LA	194	4	1	39	1	45
					TOTAL FIRE BOOM AVAILABLE (FEET)				21,000		

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

Walker Ridge 595
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
AMPOL (800) 482-6765	Harvey, LA	Containment Boom - 18" to 24"	8,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	3,000'					
CGA (888) 242-2007	Harvey, LA	Wildlife Rehab Trailer	1	Port Fourchon, LA	4	1	1	6
		Wildlife Husbandry Trailer	1					
		Support Trailer	3					
		Bird Scare Cannons	120					
		Contract Truck (Third Party)	3					
		Personnel (Responder/Mechanic)	4					
ES&H Environmental (877) 437-2634	Houma, LA	Containment Boom - 10"	2,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 18"	20,000'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	30					
		Response Boats - 22' to 25'	2					
		Response Boats - 26' to 29'	4					
		Portable Skimmers	23					
		Shallow Water Skimmers	2					
		Wildlife Hazing Cannon	57					
OMI (985) 798-1005	Houma, LA	Containment Boom - 18" to 24"	2,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	2					
		Response Boats - 25' to 28'	1					
		Response Boats - (Cabin Boat) 27' to 30'	1					
		Shallow Water Skimmers	3					
Lawson Environmental Service (985) 876-0420	Houma, LA	Containment Boom - 18"	30,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 12"	2,000'					
		Containment Boom - 10"	9,500'					
		Response Boats - 14'	10					
		Response Boats - 16'	6					
		Response Boats - 20'	5					
		Response Boats - 24'	8					
		Response Boats - 26'	4					
		Response Boats - 28'	7					
		Response Boats - 32'	4					
		Portable Skimmers	6					
USES Environmental (888) 279-9930	Hahnville, LA	Containment Boom - 18"	500'	Port Fourchon, LA	4	1	1	6
USES Environmental (888) 279-9930	Amelia, LA	Containment Boom - 18"	500'	Port Fourchon, LA	4	1	1	6
USES Environmental (888) 279-9930	Marrero, LA	Containment Boom - 18"	600'	Port Fourchon, LA	4	1	1	6
OMI (800) 645-6671	Galliano, LA	Containment Boom - 18" to 24"	2,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	1					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	3					
ES&H Environmental (877) 437-2634	Morgan City, LA	Containment Boom - 10"	2,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 18"	500'					
		Jon Boat - 12' to 16'	3					
		Response Boats - 18' to 21'	2					
		Response Boats - 22' to 25'	1					
		Portable Skimmers	2					
		Wildlife Hazing Cannon	12					
OMI (800) 645-6671	Morgan City, LA	Containment Boom - 18" to 24"	2,500	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	400'					
		Response Boats - 16'	2					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	3					
		Response Personnel	3					

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

Walker Ridge 595
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
ES&H Environmental (877) 437-2634	Port Fourchon, LA	Containment Boom - 18"	1000'	Port Fourchon, LA	4	1	1	6
		Response Boats - 22' to 25'	1					
		Portable Skimmers	1					
ES&H Environmental (877) 437-2634	Golden Meadow, LA	Containment Boom - 10"	1,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 18"	13,000					
		Jon Boat - 12' to 16'	2					
		Response Boats - 18' to 21'	1					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	1					
		Portable Skimmers	5					
		Wildlife Hazing Cannon	12					
AMPOL (800) 482-6765	New Iberia, LA	Containment Boom - 6" to 10"	4,150'	Port Fourchon, LA	4.75	1	1	7
		Containment Boom - 18" to 24"	34,050'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	27					
Clean Harbors (800) 645-8265	New Iberia, LA	Containment Boom - 18" to 24"	33,800'	Port Fourchon, LA	4.75	1	1	7
		Containment Boom - 6" to 10"	500'					
		Response Boats - 21' to 36'	4					
OMI (800) 645-6671	New Iberia, LA	Containment Boom - 18" to 24"	12,000'	Port Fourchon, LA	4.75	1	1	7
		Containment Boom - 6" to 10"	300'					
		Response Boats - 16'	3					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	8					
		Response Personnel	8					
USES Environmental (888) 279-9930	Meraux, LA	Containment Boom - 18"	6,000'	Port Fourchon, LA	4.25	1	1	7
		Containment Boom - 10"	1,000'					
		Response Boats - 16'	23					
		Response Boats - 18'	1					
		Response Boats - 24'	1					
		Response Boats - 26'	2					
		Response Boats - 28'	1					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Lafitte, LA	Containment Boom - 18"	1,000'	Port Fourchon, LA	4.5	1	1	7
		Response Boats - 18'	2					
USES Environmental (888) 534-2744	Geismar, LA	Containment Boom - 18"	1,000'	Port Fourchon, LA	4.5	1	1	7
		Response Boats - 16'	2					
		Portable Skimmers	1					
Clean Harbors (800) 645-8265	Baton Rouge, LA	Containment Boom - 18" to 24"	14,000'	Port Fourchon, LA	5	1	1	7
		Response Boats - 14' to 20'	1					
		Portable Skimmers	3					
		Response Personnel	13					
SWS Environmental (877) 742-4215	Baton Rouge, LA	Containment Boom - 18"	1,000'	Port Fourchon, LA	5	1	1	7
		Response Boats - 25' to 42'	2					
		Shallow Water Skimmers	1					
		Response Personnel	6					
Wildlife Ctr. of Texas (713) 861-9453	Baton Rouge, LA	Wildlife Specialist - Personnel	6 to 20	Port Fourchon, LA	5	1	1	7
ES&H Environmental (877) 437-2634	Belle Chasse, LA	Containment Boom - 10"	1,500'	Port Fourchon, LA	4.25	1	1	7
		Containment Boom - 18"	15,500'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	4					
		Response Boats - 18' to 21'	1					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	3					
		Portable Skimmers	10					
		Wildlife Hazing Cannon	50					

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

Walker Ridge 595
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"	4,500'	Port Fourchon, LA	4.25	1	1	7
		Containment Boom - 6" to 10"	500'					
		Response Boats - 20'	1					
		Response Boats - 25' to 28'	2					
		Portable Skimmers	12					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	12					
		Response Personnel	24					
OMI (800) 645-6671	Port Allen, LA	Containment Boom - 18" to 24"	2500'	Port Fourchon, LA	4.75	1	1	7
		Containment Boom - 6" to 10"	500'					
		Response Boats - 16'	2					
		Response Boats - 25 to 33'	1					
		Shallow Water Skimmers	1					
		Response Personnel	6					
ES&H Environmental (877) 437-2634	Lafayette, LA	Containment Boom - 10"	500'	Port Fourchon, LA	4.25	1	1	7
		Containment Boom - 18"	13,000'					
		Jon Boat - 12' to 16'	3					
		Response Boats - 18' to 21'	1					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	1					
		Portable Skimmers	4					
		Wildlife Hazing Cannon	12					
ES&H Environmental (877) 437-2634	Venice, LA	Containment Boom - 10"	2,000'	Port Fourchon, LA	5.75	1	1	8
		Containment Boom - 18"	13,000'					
		Containment Boom - 24"	10,000					
		Jon Boat - 12' to 16'	4					
		Response Boats - 22' to 25'	1					
		Response Boats - 26' to 29'	2					
		Portable Skimmers	5					
		Wildlife Hazing Cannon	25					
AMPOL (800) 482-6765	Venice, LA	Containment Boom - 18" to 24"	2,250'	Port Fourchon, LA	5.75	1	1	8
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	2					
OMI (800) 645-6671	Venice, LA	Containment Boom - 18" to 24"	1,500'	Port Fourchon, LA	5.75	1	1	8
		Response Boats - 16'	4					
		Response Boats (Barge) - 25' to 33'	1					
		Response Boats - 25' to 28'	2					
		Response Boats - (Cabin Boat) 27' to 30'	1					
		Shallow Water Skimmers	3					
		Portable Skimmers	2					
USES Environmental (888) 279-9930	Venice, LA	Containment Boom - 18"	10,000'	Port Fourchon, LA	5.75	1	1	8
		Response Boats - 16'	15					
		Response Boats - 26'	2					
		Response Boats - 30'	1					
		Portable Skimmers	2					
		Shallow Water Skimmers	1					
USES Environmental (888) 279-9930	Biloxi, MS	Containment Boom - 18"	2,000'	Port Fourchon, LA	5.25	1	1	8
		Response Boats - 16'	1					
USES Environmental (888) 279-9930	Lake Charles, LA	Containment Boom - 10"	100'	Port Fourchon, LA	6.25	1	1	9
		Containment Boom - 18"	7,700'					
		Response Boats - 16'	3					
		Response Boats - 27'	1					
		Response Boats - 37'	1					

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

Walker Ridge 595
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
ES&H Environmental (877) 437-2634	Lake Charles, LA	Containment Boom - 10"	500'	Port Fourchon, LA	6.25	1	1	9
		Containment Boom - 18"	15,000'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	3					
		Response Boats - 18' to 21'	2					
		Response Boats - 26' to 29'	2					
		Portable Skimmers	13					
		Wildlife Hazing Cannon	40					
Miller Env. Services (800) 929-7227	Sulphur, LA	Containment Boom - 10"	600'	Port Fourchon, LA	6.25	1	1	9
		Containment Boom - 18"	14,000'					
		Jon Boats - 14' to 16'	2					
		Jon Boats - 16' w/25hp HP Outboard Motor	2					
		Air Boat - 18'	1					
		Work Boat - 18'	2					
		Response Boats - 24' - 28'	4					
		Portable Skimmers	5					
		Shallow Water Skimmers	1					
		Response Personnel	49					
Miller Env. Services (800) 929-7227	Beaumont, TX	Containment Boom - 18"	14,000'	Port Fourchon, LA	7	1	1	9
		Response Boats - 18'	2					
		Response Boats - 24'	2					
		Shallow Water Skimmers	1					
		Response Personnel	47					
USES Environmental (888) 279-9930	Mobile, AL	Containment Boom - 10"	800'	Port Fourchon, LA	6.25	1	1	9
		Containment Boom - 18"	5,000'					
		Response Boats - 16'	1					
		Response Boats - 18'	1					
		Response Boats - 20'	1					
		Response Boats - 26'	1					
		Portable Skimmers	2					
SWS Environmental (877) 742-4215	Pensacola, FL	Containment Boom - 18"	2,500'	Port Fourchon, LA	7	1	1	9
		Response Boats - 16' to 25'	2					
		Shallow Water Skimmers	1					
		Response Personnel	2					
AMPOL (800) 482-6765	Port Arthur, TX	Containment Boom - 18" to 24"	16,000'	Port Fourchon, LA	7.25	1	1	10
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
Clean Harbors (800) 645-8265	Port Arthur, TX	Containment Boom - 18" to 24"	3,000'	Port Fourchon, LA	7.25	1	1	10
		Response Boats - 21' to 36'	2					
		Portable Skimmers	2					
		Response Personnel	54					
Garner Environmental (800) 424-1716	Port Arthur, TX	Containment Boom - 6"	22,000'	Port Fourchon, LA	7.25	1	1	10
		Response Boats - 14' to 20'	8					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
OMI (800) 645-6671	Port Arthur, TX	Containment Boom - 18" to 24"	4000'	Port Fourchon, LA	7.25	1	1	10
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
		Shallow Water Skimmers	1					
Phoenix Pollution Control & Environmental Services (281) 838-3400	Baytown, TX	Containment Boom - 18"	13,000'	Port Fourchon, LA	8	1	1	10
		Containment Boom - 10"	1,150'					
		Response Boats - 16'	6					
		Response Boats - 20'	3					
		Response Boats - 24'	1					
		Response Boats - 35'	2					
		Portable Skimmers	24					
Clean Harbors (800) 645-8265	Houston, TX	Containment Boom - 18" to 24"	4,500'	Port Fourchon, LA	8.25	1	1	11
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	1					
		Response Personnel	14					

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

Walker Ridge 595
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
ES&H Environmental (877) 437-2634	Houston, TX	Containment Boom - 10"	500'	Port Fourchon, LA	8.25	1	1	11
		Containment Boom - 18"	13,000'					
		Containment Boom - 24"	5,000'					
		Jon Boat - 12' to 16'	2					
		Response Boats - 26' to 29'	2					
		Portable Skimmers	2					
		Wildlife Hazing Cannon	12					
SWS Environmental (877) 742-4215	Houston, TX	Containment Boom - 18"	20,000	Port Fourchon, LA	8.25	1	1	11
		Response Boats - 16' to 25'	1					
		Response Boats - 25' to 42'	2					
		Portable Skimmers	2					
		Response Personnel	19					
Miller Env. Services (800) 929-7227	Houston, TX	Containment Boom - 18"	12,000'	Port Fourchon, LA	8.25	1	1	11
		Shallow Water Skimmers	1					
		Response Boats - 28'	1					
		Responder Personnel	38					
OMI (800) 645-6671	Houston, TX	Containment Boom - 18" to 24"	4000'	Port Fourchon, LA	8.25	1	1	11
		Response Boats - 16'	3					
		Response Boats - 25' to 28'	1					
		Portable Skimmers	1					
USES Environmental (888) 279-9930	Houston, TX	Containment Boom - 6"	500'	Port Fourchon, LA	8.25	1	1	11
		Containment Boom - 20"	10,000'					
		Response Boats - 16'	4					
		Response Boats - 26'	1					
		Portable Skimmers	1					
Wildlife Ctr. of Texas (713) 861-9453	Houston, TX	Wildlife Specialist - Personnel	6 to 20	Port Fourchon, LA	8.25	1	1	11
Garner Environmental (800) 424-1716	Deer Park, TX	Containment Boom - 6"	18,900'	Port Fourchon, LA	8.25	1	1	11
		Response Boats - 12'	2					
		Response Boats - 16' to 20'	5					
		Respons Boats - 30'	2					
		Portable Skimmers	25					
		Shallow Water Skimmers	3					
Garner Environmental (800) 424-1716	La Marque, TX	Containment Boom - 6"	9,500'	Port Fourchon, LA	8.75	1	1	11
		Response Boats - 16'	5					
		Response Boats - 24'	1					
		Portable Skimmers	7					
SWS Environmental (877) 742-4215	Panama City, FL	Containment Boom - 18"	7,000'	Port Fourchon, LA	9	1	1	11
		Response Boats - 16' to 25'	3					
		Response Boats - 25' to 42'	1					
		Portable Skimmers	6					
		Response Personnel	10					
SWS Environmental (877) 742-4215	Memphis, TN	Containment Boom - 6"	100'	Port Fourchon, LA	9.25	1	1	12
		Containment Boom - 12"	800'					
		Containment Boom - 18"	800'					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	9					
USES Environmental (888) 279-9930	Memphis, TN	Containment Boom - 6"	850'	Port Fourchon, LA	9.25	1	1	12
		Containment Boom - 12"	300'					
		Containment Boom - 18"	5,000'					
		Response Boats - 12'	3					
		Response Boats - 14'	5					
		Response Boats - 16'	2					
		Response Boats - 24'	1					
		Response Boats - 28'	1					
		Portable Skimmers	2					

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

Walker Ridge 595 Sample Shoreline Protection & Wildlife Support List								
					Response Times (Hours)			
Supplier & Phone	Warehouse	Equipment Listing	Quantity	Staging Area	Staging ETA	Loadout Time	Deployment Time	Total ETA
Miller Env. Services (800) 929-7227	Corpus Christi, TX	Containment Boom - 10"	2,000'	Port Fourchon, LA	11.5	1	1	14
		Containment Boom - 18"	30,000'					
		Jon Boats - 14' to 16' w/25hp motor	4					
		Jon Boats - 16' to 18' w/Outboard motor	4					
		Air Boat - 14'	1					
		Response Boats - 24' to 26'	4					
		Portable Skimmers	6					
		Shallow Water Skimmers	2					
		Response Personnel	142					
SWS Environmental (877) 742-4215	Jacksonville, FL	Containment Boom - 18"	1,500'	Port Fourchon, LA	12	1	1	14
		Response Boats - 16' to 25'	2					
		Shallow Water Skimmers	1					
		Response Personnel	8					
SWS Environmental (877) 742-4215	Tampa, FL	Containment Boom - 18"	2,000'	Port Fourchon, LA	13.25	1	1	16
		Response Boats - 16' to 25'	2					
		Response Boats - 25' to 42'	1					
		Portable Skimmers	1					
		Response Personnel	10					
SWS Environmental (877) 742-4215	Tampa, FL	Containment Boom - 18"	2,000'	Port Fourchon, LA	13.25	1	1	16
		Response Boats - 16' to 25'	2					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	10					
SWS Environmental (877) 742-4215	St. Petersburg, FL	Containment Boom - 18"	10,800	Port Fourchon, LA	13.75	1	1	16
		Response Boats - 16' to 25'	1					
		Response Boats - 25' to 42'	1					
		Portable Skimmers	1					
		Response Personnel	8					
SWS Environmental (877) 742-4215	Savannah, GA	Containment Boom - 18"	1,400'	Port Fourchon, LA	13.75	1	1	16
		Response Boats - 16' to 25'	3					
		Shallow Water Skimmers	1					
		Response Personnel	7					
SWS Environmental (877) 742-4215	Fort Lauderdale, FL	Containment Boom - 18"	1,000'	Port Fourchon, LA	16	1	1	18
		Response Boats - 16' to 25'	2					
		Response Boats - 25' to 42'	1					
		Shallow Water Skimmers	1					
		Response Personnel	8					
Tri-State Bird Rescue & Research, Inc. (800) 261-0980	Newark, DE	Wildlife Specialist - Personnel	6 to 12	Port Fourchon, LA	21.5	1	1	24

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 EP 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"

C. Flower Garden Banks National Marine Sanctuary

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

SECTION 11: LEASE STIPULATIONS INFORMATION

Walker Ridge Block 594, OCS-G 36087:

Lease OCS-G 36087 was acquired in Lease Sale #247 held on March 22, 2017 and has an expected expiration date of June 30, 2027.

This lease is not part of a biological sensitive area, known chemosynthetic area, or shipping fairway. See Section 6 of this plan for site specific archeological information. The following stipulations are associated with this lease:

Stipulation No. 8 – Protected Species
This Stipulation is addressed in the following sections of this plan:
Section 6, Threatened or endangered species, critical habitat and marine mammal information
Section 10, Environmental Monitoring Information, Incidental takes
Section 12, Environmental Mitigation Measures Information, Incidental takes
Section 18, Environmental Impact Assessment

Walker Ridge Block 595, OCS-G 36088:

Lease OCS-G 36088 was acquired in Lease Sale #247 held on March 22, 2017 and has an expected expiration date of June 30, 2027.

This lease is not part of a biological sensitive area, known chemosynthetic area, or shipping fairway. See Section 6 of this plan for site specific archeological information. The following stipulations are associated with this lease:

Stipulation No. 8 – Protected Species
This Stipulation is addressed in the following sections of this plan:
Section 6, Threatened or endangered species, critical habitat and marine mammal information
Section 10, Environmental Monitoring Information, Incidental takes
Section 12, Environmental Mitigation Measures Information, Incidental takes
Section 18, Environmental Impact Assessment

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	"NTL 2012-Joint-G02 "Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

SECTION 13: RELATED FACILITIES AND OPERATIONS INFORMATION

Information regarding Related Facilities and Operations Information, transportation systems & produced liquid hydrocarbon transportation vessels are not included in this EP as such information is only necessary in the case of DOCDs.

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	8,000	1	Twice per week
Offshore Support Vessels	120,000	2	Twice per week
Helicopter	760	1	Once per day

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 foot length	100,000 gals.	1 week	6 miles from Port Fourchon to the mouth of Bayou Lafourche, then to WR 594/595

C. Drilling Fluids Transportation

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

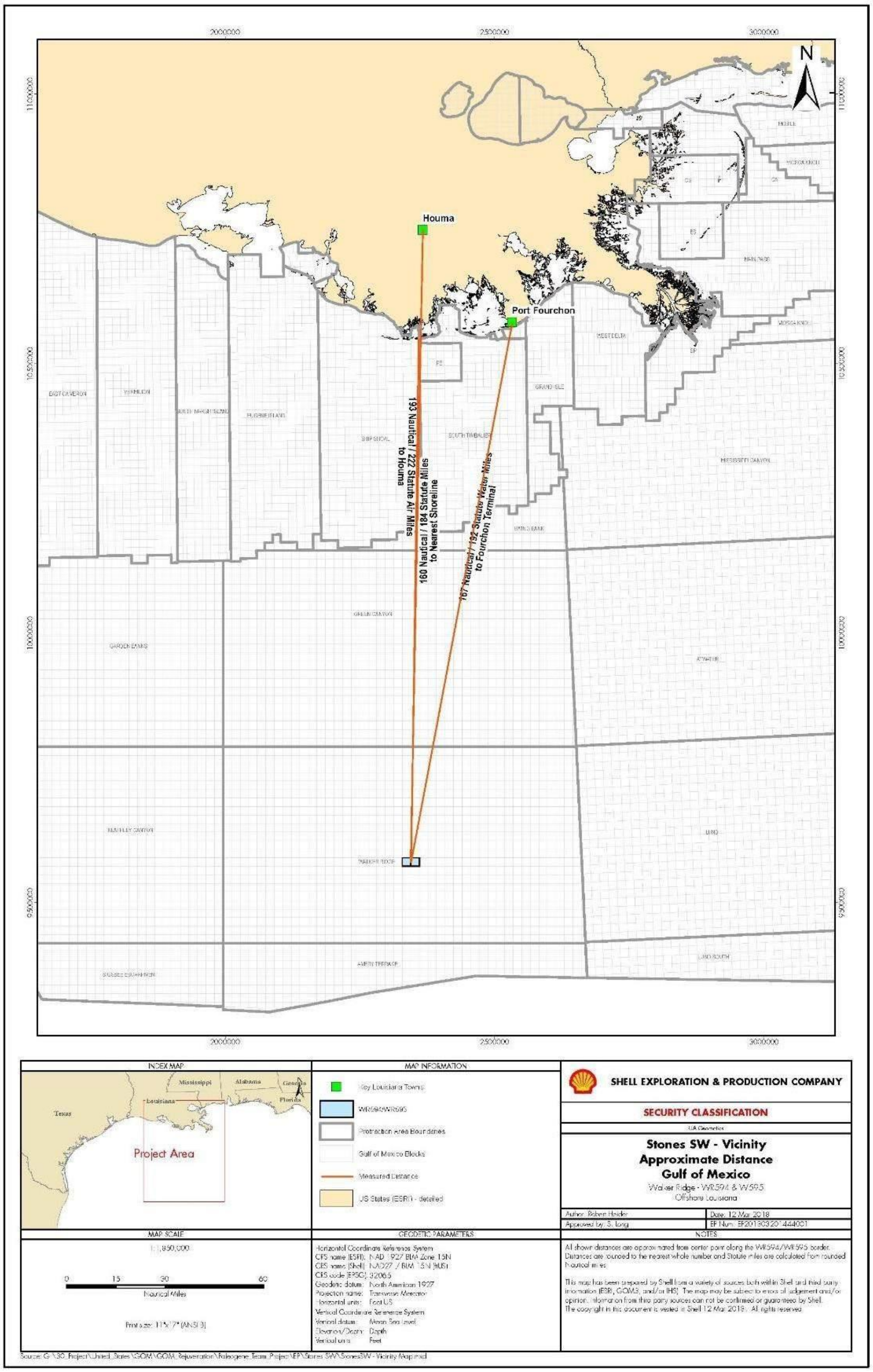
D. Solid and Liquid Wastes Transportation

See Section 7, Table 7B.

E. Vicinity Map

See Attachment 14A for Vicinity Map.

Attachment 14A – Vicinity Map



SECTION 15: ONSHORE SUPPORT FACILITIES INFORMATION

A. General

Name	Location	Existing/New/Modified
Fourchon	Port Fourchon, LA	Existing
PHI Heliport	Houma, LA	Existing

The onshore support bases for water and air transportation will be the existing terminals in Houma and Fourchon, Louisiana. The Fourchon boat facility is operated by Shell and is located on Bayou Lafourche, south of Leeville, LA approximately 3 miles from the Gulf of Mexico. The existing onshore air support base in Houma, LA is located at 3550 Taxi Rd, Houma, LA 70363.

B. Support Base Construction or Expansion

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

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 EP as we are not proposing to conduct sulphur operations.

SECTION 17: COASTAL ZONE MANAGEMENT ACT (CZMA) INFORMATION

LOUISIANA
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

EXPLORATION PLAN
Type of Plan

Walker Ridge Blocks 594 & 595
Area and Blocks

OCS-G 36087 & OCS-G 36088)
Lease Numbers

The proposed activities described in detail in this Plan will comply with Louisiana's State and Local Coastal Resources Management Act of 1978, Coastal Resources Program and Coastal Area Management Enforceable Policies.

We have considered all of Louisiana's Enforceable Policies in making this certification of consistency.

SHELL OFFSHORE INC.
Operator

____
Sylvia Bellone
Certifying Official

04/09/2018
Date

TEXAS
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

EXPLORATION PLAN
Type of Plan

Walker Ridge Blocks 594 & 595
Area and Blocks

OCS-G 36087 & OCS-G 36088
Lease Numbers

The proposed activities described in detail in this Plan will comply with the Texas approved Coastal Resources Program and Coastal Area Management Program Policies.

SHELL OFFSHORE INC.
Operator

Sylvia A. Bellone
Certifying Official

04/09/2018
Date

Coastal Zone Management Consistency Information
For the State of Texas

In accordance with Subpart E of 15 CFR 903 "Consistency for Outer Continental Shelf (OCS) Exploration, Development and Production Activities" and as required by 15 CFR 930.58, Shell is hereby providing the following information in support of the Environmental Impact Analysis submitted as Section 18 of this plan.

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

CONSISTENCY CERTIFICATION

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

OTHER INFORMATION

A detailed description of the proposed activities, coastal effects, and comprehensive information sufficient to support this Consistency Certification is presented in Section 17 of the EP. As per NTL 2008-G04, the following items have been identified as being required:

- A discussion of the method of disposal of wastes and discharges is provided in Section 7 of the EP.
- Oil Spill Information is provided in Section 9 of the EP. All operations are covered by Shell's Regional Oil Spill Response Plan. The Plan is available upon request.

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 Texas' Coastal Management Program (TCMP), Title 31, Part 16, Chapter 501, Subchapter B.:

(Category 2)
Construction, Operation & Maintenance of Oil & Gas Exploration & Production Facilities

No operations are proposed in or near any critical areas. The proposed activities are of a development in nature, but no facility construction is proposed. The proposed activities are located >100 miles from the Texas shoreline; therefore, we expect no adverse impacts to CNRAs or beach access and use rights of the public. All activities shall be conducted in a manner that minimizes significant impacts to coastal resources. No adverse effects to Texas' coastal area are expected in association with the proposed activities.

(Category 3)
Discharges of Wastewater and Disposal of Waste from Oil and Gas Exploration and Production Activities

No discharge of wastewater or disposal of waste from the proposed activities will occur in the Texas' coastal zone, therefore no impact to Texas' coastal waters is expected.

(Category 4)
Construction and Operation of Solid Waste Treatment, Storage, and Disposal Facilities

No construction of solid waste facilities or expansion of existing facilities in the coastal zone are proposed in the attached plan, therefore, no adverse effects on any features of Texas' coastal cone are expected.

(Category 5)
Prevention, Response, and Remediation of Oil Spills

The proposed activities will be covered under an approved Regional Oil Spill Response Plan. The plan is 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. All involved vessels and facilities are designed to be capable of prompt response and adequate removal of accidental discharges of oil. In addition, the proposed activities are >100 from shore; therefore, no damages to natural resources are expected as the result of an unauthorized discharge of oil into coastal waters.

(Category 6)
Discharge of Municipal and Industrial Waster Water to Coastal Waters

No discharges from the proposed activities will occur in coastal waters. The proposed activities are >100 from shore, therefore there will be no effect on coastal waters.

(Category 8)
Development in Critical Areas

None of the proposed activities will occur in a critical area; therefore, no effects to Texas' coastal zone are expected. The activity will not jeopardize the continued existence of species listed as endangered or threatened, and will not result in likelihood of the destruction or adverse modification of a habitat determined to be a critical habitat under the Endangered Species Act. The activity will not cause or contribute to violation of any applicable surface water quality standards. The activity will not violate any requirement imposed to protect a marine sanctuary.

(Category 9)
Construction of Waterfront Facilities and Other Structures on Submerged lands

No waterfront facilities or other structures are proposed on submerged lands in the Texas coastal zone, therefore the proposed activities are not expected to have any adverse impacts on submerged lands.

(Category 10)
Dredging and Dredged Material Disposal and Placement

No dredging or disposal/placement of dredged material is proposed, therefore no adverse effects to coastal waters, submerged lands, critical areas, coastal shore areas, or Gulf beaches are expected.

(Category 11)
Construction in the Beach / Dune System

The proposed activities do not include any construction projects in critical dune areas or areas adjacent to or on Gulf beaches, therefore, no impact to Texas' beach or dune systems are expected.

(Category 15)
Alteration of Coastal Historic Areas

The proposed activities do not include any alteration or disturbance of a coastal historic area; therefore, no impacts to are expected to adversely affect any historical, architectural, or archaeological site in Texas' coastal zone.

(Category 16)
Transportation

The proposed activities do not include any transportation construction projects within the coastal zone; therefore, no impacts to Texas' coastal zone are expected.

(Category 17)
Emission of Air Pollutants

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. The proposed activities will occur >100 from shore and will be within the exemption limits set by BOEM, therefore, no impacts to Texas' coastal zone is expected.

(Category 18)
Appropriations of Water

The proposed activities do not include the impoundment or diversion of state water, therefore, no impacts to Texas' coastal zone is expected.

(Category 20)
Marine Fishery Management

The proposed activities are located >100 from shore and are not expected to have any effect on marine fishery management or fishery migratory patterns within waters in the coastal zone of Texas.

(Category 22)
Administrative Policies

The necessary information for applicable agencies to make an informed decision on the proposed activities has been provided

In conclusion, all activities shall be consistent with Texas' coastal management program and shall comply with all relevant rules and regulations. No activities are planned within any critical areas. Activities will be carried out avoiding unnecessary conflicts with other uses of the vicinity.

SECTION 18: ENVIRONMENTAL IMPACT ANALYSIS (EIA)

Environmental Impact Analysis

for
Exploration Plan
Walker Ridge Blocks 594 and 595

(OCS-G 36087 and 36088)
Offshore Louisiana

April 2018

Prepared for:

Shell Offshore Inc.
P.O. Box 61933
New Orleans, Louisiana 70161

Prepared by:

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Stuart, Florida 34997
Telephone: (772) 219-3000

Acronyms and Abbreviations

ABS	American Bureau of Shipping
ac	acre
ADIOS	Automated Data Inquiry for Oil Spills
AQR	Air Quality Emissions Report
bbl	barrel
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOPD	barrels of oil per day
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CH_4	methane
CO	carbon monoxide
CO_2	carbon dioxide
dB	decibel
DNV	Det Norske Veritas
DP	dynamically positioned
DPS	distinct population segment
EEZ	exclusive economic zone
EFH	Essential Fish Habitat
EIA	Environnemental Impact Analysis
EIS	Environmental Impact Statement
EP	Exploration Plan
ESA	Endangered Species Act
FAA	Federal Aviation Administration
FAD	fish-aggregating device
FR	*Federal Register*
GMFMC	Gulf of Mexico Fishery Management Council
H_2S	hydrogen sulfide
ha	hectare
HAPC	Habitat Area of Particular Concern
Hz	hertz
IPF	impact-producing factor
kHz	kilohertz
LARS	launch and recovery system
MARPOL	International Convention for the Prevention of Pollution from Ships
MMC	Marine Mammal Commission
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MODU	mobile offshore drilling unit
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
ND	no data
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRC	National Research Council
NRDC	Natural Resources Defense Council
NTL	Notice to Lessees and Operators
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OSAT	Operational Science Advisory Team
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
SBM	synthetic-based mud
Shell	Shell Offshore Inc.
SO_x	sulfur oxides
UME	unusual mortality event
U.S.C	United States Code
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
WMA	Wildlife Management Area
WR	Walker Ridge

Introduction

Project Summary

Shell Offshore Inc. (Shell) is submitting an Exploration Plan (EP) for Walker Ridge (WR) Blocks 594 and 595 for nine wells (WR595-A, WR595-B, WR595-C, WR595-D, WR594-E, WR595-F, WR595-G, WR595-H and H-Alt). This Environmental Impact Analysis (EIA) provides information on potential impacts to environmental resources that could be affected by Shell's proposed activities in the lease area under this EP.

The lease area is in the Central Planning Area, 184 miles (296 km) from the nearest shoreline (Louisiana), 192 miles (309 km) from the onshore support base at Port Fourchon, Louisiana, and 222 miles (319 km) from the helicopter base in Houma, Louisiana. Estimated water depths at the proposed wellsites range from 9,631 to 9,766 ft (2,936 to 2,977 m). All distances are in statute miles.

The wells are scheduled to be drilled and completed from 2018 to 2026 with one well drilled and completed each year. A mobile offshore drilling unit (MODU), which will be either a dynamically positioned (DP) drillship or a DP semisubmersible rig, will be selected for this project. Each well is estimated to take ~225 days for drilling and completion. The EIA addresses the environmental impacts from the proposed EP 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 (U.S.C.) §§ 1331-1356 as well as regulations including 30 Code of Federal Regulations (CFR) 550.212 and 550.227. The EIA is a project- and site-specific analysis of Shell's planned activities under this EP.

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 also analyzed.

Potential impacts have been analyzed at a broader 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, 2014a, 2015, 2016b, 2017a, b).

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

OCS 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 2017-2022 (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 regulations (e.g., the ESA, MMPA, Coastal Zone Management Act of 1972, and the Magnuson-Stevens Fishery Conservation and Management Act) establish the consultation and coordination processes with federal, state, and local agencies.

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-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. Supersedes NTL 2012-JOINT-G01.
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. Supersedes and replaces NTL 2012-G01.

Table 1. (Continued).

NTL	Title	Summary
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.
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. Supersedes NTL 2010-N06.
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-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.
2011-JOINT-G01	Revisions to the List of OCS Blocks Requiring Archaeological Resource Surveys and Reports	Provides new information on which OCS blocks require archaeological surveys and reports and line spacing required in each block. This NTL augments NTL 2005-G07.
2010-N10	Statement of Compliance with Applicable Regulations and Evaluation of Information Demonstrating Adequate Spill Response and Well Containment Resources	Informs operators using subsea blowout preventers (BOPs) or surface BOPs 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* [FR] 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.

Table 1. (Continued).

NTL	Title	Summary
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.

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 **EP Section 9**). The OSRP demonstrates Shell's capability to rapidly and effectively manage oil spills that may result from drilling operations. 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.

EIA Organization

The EIA is organized into **Sections A** through **I** corresponding to the requirements of NTL 2008-G04 (as extended by NTL 2015-N02), 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 impact-producing factors (IPFs) have been identified. **Table 2** identifies the environmental resources that may be affected in the left column, and identifies sources of impacts associated with the proposed project across the top. **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. Where there may be an effect, an analysis is provided in **Section C**. Potential IPFs for the proposed activities are listed below and briefly discussed in the following sections.

- MODU 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									
	MODU Presence (incl. 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)
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)**
Gulf sturgeon (threatened)	--	--	--	--	--	--	--	--	--	**X**(6)
Beach mice (endangered)	--	--	--	--	--	--	--	--	--	**X**(6)
Threatened coral species	--	--	--	--	--	--	--	--	--	**X(6)**
Coastal and Marine Birds										
Marine and pelagic birds	**X**	--	--	--	--	--	--	**X**	**X**(6)	**X**(6)
Shorebirds and coastal nesting 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										
Barrier beaches and dunes	--	--	--	--	--	--	--	**X**	--	**X**(6)
Wetlands and seagrass beds	--	--	--	--	--	--	--	**X**	--	**X**(6)
Coastal wildlife refuges and wilderness areas	--	--	--	--	--	--	--	--	--	**X**(6)
Socioeconomic and Other Resources										
Recreational and commercial fishing	**X**	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Public health and safety	--	--	--	--	--	--	--	--	**--**	**X**(5,6)
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. MODU = mobile offshore drilling unit.

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-m, 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-ft 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 lease 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 lease block.

(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 lease 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 lease area.

(4) *Activities on blocks designated by the BOEM as being in water depths 300 m or greater.*
   - No impacts on high-density deepwater benthic communities are anticipated. A wellsite assessment found that no features indicative of high-density chemosynthetic communities or coral communities were identified within 2,000 ft (610 m) of the proposed well locations (Gardline Surveys, 2018).

(5) *Exploration or production activities where hydrogen sulfide (H_2S) concentrations greater than 500 ppm might be encountered.*
   - **EP Section 4** contains Shell's receipt of classification of WR-594 and WR-595 as H_2S present.

(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 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 your planned activity will occur. If the proposed activities are located a sufficient distance from a shipwreck or prehistoric site that no impact would occur, the EIA can note that in a sentence or two.*
   - No impacts on archaeological resources are expected from routine activities. As discussed in **Section C.6**, the wellsite assessment did not detect any archaeologically significant sonar contacts within 2,000 ft (610 m) of the proposed wellsites (Gardline Surveys, 2018). The lease area is 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, prehistoric archaeological sites are not likely to be present.

(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 MODU 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 MODU Presence (including noise and lights)

The MODU to be used for the wells will be either a DP drillship or a DP semisubmersible drilling rig that will be on site for an estimated 225 days per year from 2018 to 2025. DP MODUs are self-propelled and maintain 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 MODU include the physical presence of the MODU in the ocean, increased light from working and safety lighting on the vessel, and noise audible above and below the water surface.

The physical presence of a MODU in the ocean can attract pelagic fishes and other marine life. The MODU would be a single structure that may concentrate small epipelagic fish species, resulting in the attraction of epipelagic predators. See **Section C.5.1** for further discussion.

The MODU 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 can be expected to produce noise from station keeping, drilling, 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 and operational requirements. Representative source levels for vessels in DP mode range from 184 to 190 decibels (dB) relative to one micropascal (re 1 µPa) at 1 m from the source, with a primary frequency below 600 hertz (Hz) (Blackwell and Greene Jr., 2003, Kyhn et al., 2014, McKenna et al., 2012). Drilling operations produce noise that includes strong tonal components at low frequencies (Minerals Management Service [MMS], 2000). When drilling, the drill string represents a long vertical sound source (McCauley, 1998). Sound pressure levels associated with drilling activities have a maximum broadband (10 Hz to 10 kilohertz [kHz]) energy of approximately 190 dB re 1 µPa at 1 m (Hildebrand, 2005). Based on available data, marine sound generated from MODUs during drilling and in the absence of thrusters can be expected to range between 154 and 176 dB re 1 µPa at 1 m (Nedwell et al., 2001). The use of thrusters, whether drilling or not, can elevate sound source levels from a drillship or semisubmersible to approximately 188 dB re 1 µPa at 1 m (Nedwell and Howell, 2004).

The response of marine mammals, sea turtles, and fishes to a perceived marine sound depends on a range of factors, including 1) the sound pressure level, frequency, duration, and novelty of the sound; 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

The wells will be drilled using a DP MODU. Therefore, there will be minimal disturbance to the seafloor and soft bottom communities during positioning of the wellbore and blowout preventers. 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.

A.3 Air Pollutant Emissions

Estimates of air pollutant emissions are provided in **EP Section 8**. Offshore air pollutant emissions will result from operations of the MODU 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), sulfur oxides (SO_x), nitrogen oxides (NO_x), volatile organic compounds (VOCs), and carbon monoxide (CO).

The project 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 **EP Section 8**) prepared in accordance with BOEM requirements provided in 30 CFR 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 operations are summarized in **EP Section 7**. Discharges from MODUs are required to comply with the National Pollutant Discharge Elimination System (NPDES) General Permit for Oil and Gas Activities (Permit No. GMG290103). Support vessel discharges are expected to be in accordance with USCG regulations.

Water-based drilling muds and cuttings will be released at the seafloor during the initial well intervals before the marine riser is set, which allows their return to the surface vessel. Excess cement slurry and blowout preventer 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. 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 **EP Section 7**.

Other effluent discharges from the MODU and support vessels are expected to include treated sanitary and domestic wastes, deck drainage, non-contaminated well treatment and completion fluids, desalination unit discharge, blowout preventer fluid, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, 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 (**EP 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. GMG290103 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 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.

A.6 Onshore Waste Disposal

Wastes generated during exploration activities are tabulated in **EP Section 7**. Used SBMs and additives as well as Exploration and Production wastes will be transported to shore for recycling or deep well injection at Ecoserv, R360 Environmental Solutions, or FCC Environmental in Port Fourchon, Louisiana. Recyclable trash and debris and used oil will be generated during the proposed project and will be recycled at Omega Waste Management in West Patterson, Louisiana, Lamp Environmental in Hammond, LA, or at a similarly permitted facility. Non-recyclable trash and debris will be transported to the Republic/BFI landfill in Sorrento, Louisiana; the parish landfill in Avondale, Louisiana; or to a similarly permitted facility. Used oil and glycol will be transported to Omega Waste Management in West Patterson, Louisiana. Non-hazardous waste will be transported to the Republic/BFI landfill in Sorrento, Louisiana; Lamp Environmental in Hammond, Louisiana; or to a similarly permitted facility. Non-hazardous Oilfield Waste will be transported to Ecoserv in Port Arthur, Texas. Universal waste items such as batteries, lamps, glass, and mercury contaminated waste will be sent to Lamp Environmental Services in Hammond, Louisiana, for processing. Hazardous waste will be sent to Omega Waste Management in West Patterson, Louisiana; Lamp Environmental in Hammond, Louisiana; 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 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 and 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. 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 at Port Fourchon, Louisiana, for onshore support of vessels and at Amelia, Louisiana, for air transportation support. No terminal expansion or construction is planned at either location.

The supply base at Port Fourchon 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. 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 Amelia, Louisiana, and the lease 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 300 ft (91 m) of marine mammals (BOEM, 2017a).

Vessel noise is one of the main contributors to overall noise in the sea (National Research Council [NRC], 2003a, 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 sound (Richardson et al., 1995, Hildebrand, 2009, McKenna et al., 2012). The vessel tonal noise typically dominates frequencies up to approximately 50 Hz, whereas broadband sounds 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 unladed 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 for most small ships (a category that includes support vessels) are anticipated to be in the range of 150 to 180 dB re 1 µPa at 1 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 sound pressure levels in water of 109 dB re 1 µPa from a Bell 212 helicopter flying at an altitude of 500 ft (152 m). Penetration of aircraft noise below the sea surface is greatest directly below the aircraft; at angles greater than 13 degrees from vertical, much of the sound is reflected from the sea surface and so does not penetrate into the water (Richardson et al., 1995). The duration of underwater sound 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 **EP Section 2j**.

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

The lease sale EISs (BOEM, 2014b, 2015, 2016b, 2017a, b) 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 for these topics 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, 2017c). 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, b). BOEM (2016a) noted that most OCS blowouts have resulted in the release of gas.

Shell has a robust system in place to prevent loss of well control. Included in this EP 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, as well as the Final Drilling Safety Rule, which specify additional safety measures for OCS activities. See **EP 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 exploration drilling (Gardline Surveys, 2018).

Vessel Collisions. BSEE data show that there were 119 OCS-related collisions between 2009 and 2016 (BSEE, 2017). 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 lease 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 Spill. 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, 2017a). 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).

Drilling Fluid Spills. There is the potential for drilling fluids, specifically SBFs to be spilled due to an accidental riser disconnect (BOEM, 2017a). SBFs are relatively nontoxic to the marine environment and have the potential to biodegrade (BOEM, 2014a). The majority of SBF releases are <50 bbl in size, but accidental riser disconnects may result in the release of medium (238 to 2,380 bbl) to large (>2,381 bbl) quantities of drilling fluids. In the event of an SBF spill, there could be short-term localized impacts on water quality and the potential for localized benthic impacts due to SBF deposition on the seafloor. Benthic impacts would be similar to those described in **Section C.2.1**. The potential for riser disconnect SBF spills will be minimized by adhering to the requirements of applicable regulations.

H_2S Release. Based on CFR 550.215, Shell received the classification of H_2S absent for WR-594 and WR-595. Based on the H_2S absent classification, no further discussion on impacts of H_2S is needed. See **EP Section 4** for more details.

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 lease 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 lease 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 (NRC, 2003b). 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. Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high-suspended solids loads (NRC, 2003b). Adherence to suspended sediments is not expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico. Diesel oil is readily and completely degraded by naturally occurring microbes (NOAA, 2006).

The fate of a small diesel fuel spill was estimated using NOAA's Automated Data Inquiry for Oil Spills (ADIOS) 2 model (NOAA, 2016a). 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. The area of diesel fuel on the sea surface would range from 1.2 to 12 acres (ac) (0.5 to 5 hectares [ha]), depending on sea state and weather conditions.

The ADIOS 2 model results, coupled with spill trajectory information discussed in the next section regarding large spills, indicate that a small fuel spill would not affect coastal or shoreline resources. The lease area is 184 miles (296 km) from the nearest shoreline (Louisiana). Slicks from 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, 2017a).

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. **EP Section 9b** provides a detailed discussion of Shell's oil spill response.

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 **EP 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 barrels.

Spill Size. Shell has calculated the WCD for this EP using the requirements prescribed by NTL 2015-N01. The calculated initial release volume is 9,000 bbl of oil during the first day, and the calculated 30-day average WCD rate is 8,833 barrels of oil per day (BOPD). The total potential spill volume along with a detailed analysis of this calculation can be found in **EP Section 2j**. The WCD scenario for this EP 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 **EP Sections 2j** and **9b**. Shell will also comply with NTL 2010-N10 and the Final Drilling Safety Rule, which specify additional safety measures for OCS activities.

Spill Trajectory. The fate of a large oil spill in the lease 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 results for Launch Areas C049 and C050 (the launch areas which include the lease area) are presented in **Tables 3** and **4**. The model does not predict shoreline contact within the first ten days following a spill. The 30-day OSRA model for Launch Area C049 estimates shoreline contact in five Texas counties and four Louisiana parishes within 30 days. The 30-day OSRA model for Launch Area C050 estimates shoreline contact in two Texas Counties and three Louisiana parishes within 30 days. The conditional probability is predicted to range between 1% to 2% chance of shoreline contact. The highest conditional probabilities are Matagorda County, Texas (2%) and Cameron Parish, Louisiana (2%).

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.

Table 3. Conditional probabilities of a spill in the lease area (WR-594) 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 lease area (represented by OSRA Launch Area C049) 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
C07	Calhoun, Texas	--	--	1
C08	Matagorda, Texas	--	--	2
C09	Brazoria, Texas	--	--	1
C10	Galveston, Texas	--	--	1
C12	Jefferson, Texas	--	--	1
C13	Cameron, Louisiana	--	--	2
C14	Vermilion, Louisiana	--	--	1
C17	Terrebonne, Louisiana	--	--	1
C20	Plaquemines, Louisiana	--	--	1

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

Table 4. Conditional probabilities of a spill in the lease area (WR-595) 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 lease area (represented by OSRA Launch Area C050) 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
C08	Matagorda, Texas	--	--	1
C10	Galveston, Texas	--	--	1
C13	Cameron, Louisiana	--	--	1
C14	Vermilion, Louisiana	--	--	1
C20	Plaquemines, Louisiana	--	--	1

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

BOEM (2017c) presented additional OSRA modeling to simulate a spill that continues for 90 consecutive days, with each trajectory tracked for 60 days during four seasons. In this updated OSRA model (herein referred to as the 60-day OSRA model), 60 days was chosen as a conservative estimate of the maximum duration that spilled oil would persist on the sea surface following a spill (BOEM, 2017c). The spatial resolution is limited, with seven launch points to represent the entire northern Gulf of Mexico. These launch points were deliberately located in areas identified as having a high possibility of containing large oil reserves. The 60-day OSRA model launch point most appropriate for modeling a spill in the lease area is Launch Point 3. The 60-day OSRA results for Launch Point 3 are presented in **Table 5**.

From Launch Point 3, potential shoreline contacts within 60 days range from Cameron County, Texas (at the Texas-Mexico border), to Miami-Dade County, Florida. Based on statewide contact probabilities within 60 days, Texas and Louisiana have the highest likelihood of contact during all four seasons, with Louisiana having higher probabilities in spring (52%) and Texas having higher probabilities during summer, fall, and winter (21% to 44%). The model predicts a 1% probability of a spill contacting Mississippi shorelines during spring and summer, and a 1% probability of a spill contacting Alabama shorelines during spring. Florida shorelines are predicted to be contacted in any season with a maximum probability up to 5% in spring. Based on the 60-day trajectories, counties or parishes with greater than 10% contact probability during any season include Matagorda County, Texas; and Cameron, Terrebonne, and Plaquemines Parishes in Louisiana (**Table 5**).

Table 5. Shoreline segments with 1% or greater conditional probability of contact from a spill starting at Launch Point 3 based on the 60-day Oil Spill Risk Analysis (OSRA). Values are conditional probabilities that a hypothetical spill in the lease area could contact shoreline segments within 60 days. Modified from: BOEM (2017c).

Season	Spring				Summer				Fall				Winter			
Day	3	10	30	60	3	10	30	60	3	10	30	60	3	10	30	60
County or Parish	Conditional Probability of Contact[1] (%)															
Cameron, Texas	--	--	--	--	--	--	--	2	--	--	--	1	--	--	--	1
Willacy, Texas	--	--	--	--	--	--	--	1	--	--	--	1	--	--	--	2
Kenedy, Texas	--	--	--	--	--	--	1	5	--	--	--	2	--	--	--	3
Kleberg, Texas	--	--	--	--	--	--	1	3	--	--	1	2	--	--	--	2
Nueces, Texas	--	--	--	--	--	--	--	2	--	--	1	2	--	--	--	3
Aransas, Texas	--	--	--	--	--	--	--	2	--	--	1	2	--	--	--	3
Calhoun, Texas	--	--	--	--	--	--	--	3	--	--	1	2	--	--	1	4
Matagorda, Texas	--	--	3	5	--	--	1	4	--	--	2	5	--	--	3	10
Brazoria, Texas	--	--	3	3	--	--	2	5	--	--	1	2	--	--	3	8
Galveston, Texas	--	--	3	5	--	--	2	3	--	--	1	2	--	--	2	5
Jefferson, Texas	--	--	4	5	--	--	1	1	--	--	--	--	--	--	1	2
Cameron, Louisiana	--	--	9	11	--	--	1	3	--	--	--	2	--	--	1	3
Vermilion, Louisiana	--	1	5	6	--	--	1	1	--	--	--	--	--	--	1	2
Iberia, Louisiana	--	1	3	3	--	--	--	--	--	--	--	--	--	--	--	1
St. Mary, Louisiana		--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Terrebonne, Louisiana	--	5	12	13	--	--	1	2	--	--	1	1	--	1	2	2
Lafourche, Louisiana	--	2	5	6	--	--	1	2	--	--	--	--	--	--	1	2
Jefferson, Louisiana	--	--	1	1	--	--	--	1	--	--	--	--	--	--	--	--
Plaquemines, Louisiana	--	3	10	10	--	--	2	3	--	--	--	--	--	--	2	2
St. Bernard, Louisiana	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Baldwin, Alabama	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Escambia, Florida	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Okaloosa, Florida	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Bay, Florida	--	--	--	1	--	--	--	--	--	--	--	--	--	--	--	--
Miami-Dade, Florida	--	--	--	--	--	--	--	1	--	--	--	--	--	--	--	--
State Coastline	Conditional Probability of Contact[1] (%)															
Texas	--	--	13	19	--	--	7	30	--	--	7	21	--	--	11	44
Louisiana	--	12	46	52	--	2	6	12	--	1	2	4	--	2	8	12
Mississippi	--	--	1	1	--	--	--	1	--	--	--	--	--	--	--	--
Alabama	--	--	1	1	--	--	--	--	--	--	--	--	--	--	--	--
Florida	--	--	2	5	--	--	--	2	--	--	--	3	--	--	--	1

[1] Conditional probability refers to the probability of contact within the stated time period, assuming that a spill has occurred (-- indicates <0.5%). Values are conditional probabilities that a hypothetical spill in the lease area could contact shoreline segments within 60 days.

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 (NRC, 2003b).

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 (LARS), 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 (DNV) and the American Bureau of Shipping (ABS). The LARS is a combined winch, A-frame, and 3,000-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 **EP Section 9b** for a detailed description of spill response measures.

B. Affected Environment

The lease area is in the Central Planning Area in the central Gulf of Mexico, 184 miles (296 km) from the nearest shoreline (Louisiana), 192 miles (309 km) from the onshore support base for vessels at Port Fourchon, Louisiana, and 198 miles (319 km) from the helicopter base at Amelia, Louisiana. The water depths at the proposed wellsites range from 9,631 to 9,766 ft (2,936 to 2,977 m).

The wellsites shallow hazards and archaeological assessment performed by Gardline Surveys Inc. (2018) did not identify any seafloor anomalies within 2,000 ft (610 m) of the proposed wellsites that would indicate the potential for chemosynthetic or high-density deepwater benthic communities (Gardline Surveys, 2018). In addition, no archaeologically significant potential sonar contacts within 2,000 ft (610 m) of the proposed wellsites were observed during the wellsite assesment (Gardline Surveys, 2018).

A detailed description of the regionally affected environment is provided by BOEM (2012a, 2013, 2014a, 2015, 2016b, 2017a, b), 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 lease 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 lease area are expected to be consistent with the regional description of the locations evaluated by BOEM (2012a, 2013, 2014a, 2015, 2016b, 2017a, b).

C. Impact Analysis

This section analyzes the potential direct and indirect environmental impacts of routine activities and accidents; cumulative impacts 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, 2014a, 2015, 2016b, 2017a, b). Site-specific issues are addressed in this section as appropriate.

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 on coastal counties along the Gulf of Mexico is relatively good (BOEM, 2012a). As of March 2018, Mississippi, Alabama, and Florida Panhandle coastal counties are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants. St. Bernard Parish in Louisiana and Hillsborough County in Florida are nonattainment areas 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. One coastal metropolitan area in Florida (Tampa) is a nonattainment area for lead based on the 2008 Standard (USEPA, 2018).

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 associated with both types of accidents: a small fuel spill (<1,000 bbl) and a large oil spill (≥1,000 bbl).

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 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, and CO.

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 (2017b), 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.

WR-594 and WR-595 are 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 550 Subpart C. The AQR (see **EP 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 EP 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. The BOEM coordinates with the USFWS if emissions from proposed projects may affect the Breton Class I area. The lease area is approximately 232 to 234 miles (374 to 376 km) from the Breton Wilderness Area. Shell will comply with emissions requirements as directed by BOEM.

Greenhouse gas emissions contribute to climate change, with impacts on temperature, rainfall, frequency of severe weather, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2014). 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 Programmatic and OCS lease sale EISs (BOEM, 2012a, 2016a), 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, b). **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the extent and duration of air quality impacts at the lease 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 ADIOS 2 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.

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, 2016a, 2017a, b).

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 lease 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 predictions (**Tables 3** and **4**), Matagorda County in Texas and Cameron Parish in Louisiana are the coastal areas most likely to be affected (2% probability within 30 days). Five Texas counties and four Louisiana parishes, have a 1% to 2% probability of shoreline contact within 30 days of a spill. However, the 60-day OSRA estimates potential shoreline contacts ranging from Cameron County, Texas, to Miami-Dade County, Florida, depending on the season (**Table 5**).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on air quality are expected.

C.1.2 Water Quality

There are no site-specific baseline water quality data for the lease 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 (a small fuel spill and a large oil spill).

Impacts of Effluent Discharges

As described in **Section A.4**, NPDES General Permit No. GMG290103 establishes permit limits and monitoring requirements for effluent discharges from the MODU and support vessels.

Water-based drilling muds and cuttings will be released at the seafloor during the initial well intervals before the marine riser is set, which allows their return to the surface vessel. Excess cement slurry and blowout preventer fluid will also be released at the seafloor. Impacts will be limited to the immediate discharge area with little or no impact to regional water quality.

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). Recent EISs have concluded that the discharge of treated SBM cuttings will not cause persistent impacts on water quality in the lease area (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 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 will flow overboard without treatment. However, rainwater that falls on the MODU deck 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 and support vessels are expected to include non-contaminated well treatment and completion fluids, desalination unit discharge, blowout preventer fluid, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and non-contact cooling water. The MODU 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, 2016a, 2017a, b). **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease 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 (NRC, 2003b). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel oil 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 oil 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 oil 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, 2017). It is possible for diesel oil that is dispersed by wave action to form droplets that are small enough 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 (NRC, 2003b) and would not be expected to occur to any appreciable degree in offshore waters of the Gulf of Mexico.

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 oil are readily and completely degraded by naturally occurring microbes (NOAA, 2006). Given the open ocean location of the lease area, the extent and duration of water quality impacts from a small spill would not be significant.

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, 2016a, 2017a, b). 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 Macondo spill 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 Macondo spill 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 Macondo spill 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). 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, 2012a).

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 (NRC, 2003b). 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 Macondo spill, the hydrocarbon levels were reduced in the surface waters from May 2010 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 (NOAA, 2017).

A large oil spill could result in a release of gaseous hydrocarbons that could affect water quality. During the Macondo spill, large volumes of CH_4 were released, causing localized oxygen depletion as methanotrophic bacteria rapidly metabolized the hydrocarbons (Kessler et al., 2011, Dubinsky et al., 2013). 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 [OSAT], 2010). Stations revisited around the Macondo wellhead in October 2010, approximately 6 months after the beginning of the event showed no measurable oxygen depressions (OSAT, 2010).

Due to the lease 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 predictions (**Tables 3** and **4**), the nearshore waters and embayments of Matagorda County in Texas and Cameron Parish in Louisiana are the coastal areas most likely to be affected, with a 2% probability of shoreline contact within 30 days. However, the 60-day OSRA estimates potential shoreline contacts ranging from Cameron County, Texas, to Miami-Dade County, Florida, depending on the season (**Table 5**).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce any resultant impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on water quality are expected.

C.2 Seafloor Habitats and Biota

The water depths at the proposed wellsites range from approximately 9,631 to 9,766 ft (2,936 to 2,977 m). See **EP Section 6a** for further information.

According to BOEM (2016a), 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. Gardline Surveys (2018) conducted shallow hazard and archeological assessment surveys of WR-594 and WR-595. No features or areas that could support significant, high-density benthic communities were found within 2,000 ft (610 m) of the proposed wellsites.

C.2.1 Soft Bottom Benthic Communities

There are no site-specific benthic community data from the lease 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), which can be used to describe typical baseline benthic communities that could be present in vicinity of the wellsites. **Table 6** summarizes data from two nearby stations within the same faunal zone as the proposed wells. Sediments at these two stations were similar, predominantly clay (53% at Station GKF and 55% at Station NB5) and silt (45% at Station GKF and 41% at Station NB5) (Rowe and Kennicutt, 2009).

Table 6. Baseline benthic community data from stations near to the lease 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	Location Relative to Lease Area	Water Depth (m)	Abundance		
			Meiofauna (individuals m^{-2})	Macroinfauna (individuals m^{-2})	Megafauna (individuals ha^{-1})
GKF	53 mi (85 km) NW	2,465	84,348	737	ND
NB5	23 mi (37 km) W	2,063	117,263	706	1,600

Meiofaunal and megafaunal abundance from Rowe and Kennicutt (2009); macroinfaunal abundance from Wei (2006).

ND = no data

Densities of meiofauna (animals that pass through a 0.5-mm sieve but are retained on a 0.062-mm sieve) in sediments collected at water depths representative of the lease area ranged from approximately 84,000 to 117,000 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 wellsites is expected to range approximately between 750 to 773 individuals m^{-2}; however, actual densities at the proposed wellsites 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. 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 lease area is in Zone 3W, which consists of stations ranging in depth from 6,152 to 9,869 ft (1,875 to 3,008 m) and extends along the mid Texas-Louisiana slope. The most abundant species in this zone were the polychaetes *Levinsenia uncinata*, *Paraonella monilaris*, and *Tachytrypane* sp. A; the bivalve *Heterodonta* sp. B; and the isopod *Macrostylis* sp. (Wei, 2006, Wei et al., 2010).

Megafaunal density at the station closest to the proposed well sites was 1,600 individuals ha^{-1} (**Table 6**). Common megafauna included motile groups such as decapods, holothurians, and demersal fishes as well as sessile groups such as sponges, gorgonians, and alcyonaria (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). In deep-sea sediments, Main et al. (2015) observed that microbial oxygen consumption rates increased and bacterial biomass decreased with hydrocarbon contamination. Bacterial biomass at the depth range of the lease area typically is approximately 0.5 to 1.5 grams of carbon per square meter ($g\ C\ m^{-2}$) in the top 6 in. (15 cm) of sediments (Rowe and Kennicutt, 2009).

IPFs that could potentially affect benthic communities are physical disturbance, 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

In water depths such as those that are encountered in the lease area, DP MODUs disturb the seafloor only around the wellbore (seafloor surface hole location) where the bottom template and blowout preventer are located. Depending upon the specific well configuration, this area is generally about 0.62 ac (0.25 ha) per well (BOEM, 2012a).

The areal extent of these impacts will be small compared to the lease area itself. Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway, 1988, Gallaway et al., 2003, Rowe and Kennicutt, 2009). Physical disturbance to the seafloor during this project will be localized and are likely to have no significant impact on soft bottom benthic communities on a regional basis.

Impacts of Effluent Discharges

Drilling mud and cuttings are the only effluents likely to affect these soft bottom benthic communities that could be present in vicinity of the wellsites. During initial well interval(s) before the marine riser is set, cuttings and seawater-based "spud mud" will 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 water-based drilling mud (Boehm et al., 2001). 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 blowout preventer fluid will be released at the seafloor and are expected to be rapidly diluted and dispersed. Soft bottom sediments disturbed by cuttings, drilling mud, cement slurry, and blowout preventer 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 (2002, 2004). In general, cuttings with adhering SBM tend to clump together and form thick piles close to the drillsites. 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 numbers 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 synthetic fluid 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 have no 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, 2016a, 2017a, b). Impacts from a subsea blowout could likely 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 (2012b) 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 nearest to the proposed wellsites. Sediments at these two stations were similar, predominantly clay (53% at Station GFK and 55% at Station NB5) and silt (45% at Station GKF and 41% at Station NB5) (Rowe and Kennicutt, 2009).

Previous analyses by BOEM (2016b) 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 Macondo spill, the use of subsea dispersants at the wellhead caused the formation of subsurface plumes (NOAA, 2011c, Spier et al., 2013). 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 Macondo spill 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, 2011c, 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 Macondo spill 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 (2016b) documented a footprint of over 772 miles^2 (2,000 km^2) of impacts to benthic habitats surrounding the Macondo spill 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, 2016b).

Baguley et al. (2015) noted that nematode abundance increased significantly with proximity to the Macondo wellhead, and copepod abundance, relative species abundance, and diversity decreased. The increase in nematode abundance with the proximity to the spill location could potentially represent a balance between organic enrichment and toxicity. Washburn et al. (2017) noted that richness, diversity, and evenness were affected within a radius of 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. There are some indications of partial recovery in the benthic fauna, however, as of 2015, full recovery has 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will minimize potential impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on soft bottom communities are 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 (Brooke and Schroeder, 2007, CSA International, 2007, Brooks et al., 2012). These communities occur almost exclusively on exposed authigenic carbonate rock created by a biogeochemical (microbial) process (BOEM, 2012a).

Monitoring programs on the Gulf of Mexico continental slope have shown that benthic impacts from drilling discharges typically are concentrated within approximately 1,640 ft (500 m) of the wellsite, although detectable deposits may extend beyond this distance (Continental Shelf Associates, 2004, Neff et al., 2005, Continental Shelf Associates, 2006). The nearest known high-density deepwater benthic communities are found in GC-287, approximately 87 miles (140 km) north of the lease area (MacDonald et al., 1995, BOEM, nd).

No features or areas that could support significant, high-density benthic communities were found within 2,000 ft (610 m) of the proposed wellsite locations (Gardline Surveys, 2018). As a result, high-density deepwater benthic communities are not expected to be present.

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

The wellsite assessment did not identify high-density deepwater benthic communities within 2,000 ft (610 m) of the proposed wellsites (Gardline Surveys, 2018).

BOEM (2012a, 2015, 2016a, 2017a, b) 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 Macondo spill, 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 Macondo spill persisted for up to 2 months and were detectable up to 186 miles (300 km) from the wellsite at a 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 (2012a), 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, 2016a, 2017a, b). Oil plumes that directly contact localized patches of sensitive benthic communities before degrading could potentially impact the resource (BOEM, 2017a). 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 (2012a, 2017a, b), 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 and loss of tissue mass) or long lasting and affect the resilience of coral colonies to natural disturbances (e.g., elevated water temperature and diseases) (BOEM, 2012a, 2015, 2016b, 2017a, b). 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 by 130 ft (15 m by 40 m) was covered by a brown flocculent material (Bureau of Ocean Energy Management, Regulation, and Enforcement [BOEMRE], 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 Macondo spill. 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, b) studied five previously unknown deepwater coral communities in the vicinity of the Macondo spill from 2010 to 2011. Two of the communities demonstrated impacts similar to the observations by White et al. (2012), with one community in a water depth from 6,070 to 6,398 ft (1,850 to 1,950 m). This community extended the maximum depth range of observed significant impacts to coral communities and distance from the Macondo spill (14 miles [22 km] away) (Fisher et al., 2014a, b). However, Fisher et al. (2014a, b) stated no acute impacts were observed more than 19 miles (30 km) from the spill, based on other observations from different coral communities in the Northern Gulf of Mexico. Prouty et al. (2016) found evidence that corals located northeast of the Macondo spill were 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).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP 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. Therefore, no significant spill impacts on deepwater benthic communities are expected.

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 EW-947, located approximately 111 miles (179 km) north of the lease 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 lease area.

Due to the distance from the lease area, it is unlikely that topographic features would be affected by accidental spills. A small fuel spill would float and dissipate on the surface and would not reach these seafloor features.

In the event of an oil spill from a well blowout, a surface slick would not contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely because of the distance of the spill from these features, the depth of the features, and the currents that surround the features. Near-bottom currents in the region generally flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Felder et al. (2014) hypothesized that the Macondo spill may have affected two topographic features located 96 miles (155 km) and 168 miles (270 km) west of the Macondo site (Sackett Bank and Ewing Bank, respectively) but there was no definitive evidence of Macondo oil found on either bank. Although there are mechanisms that could result in oil contacting topographic features, it is expected that most of the oil would rise to the surface and that the most heavily oiled sediments would likely be deposited before reaching these features (BOEM, 2012a). In the unlikely event oil does contact topographic features, any contact with spilled oil would likely cause sublethal effects to benthic organisms because the distance from the spill source would prevent contact with concentrated oil.

C.2.4 Pinnacle Trend Area Live Bottoms

The lease area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined in NTL 2009-G39, the nearest pinnacle trend block is located approximately 241 miles (388 km) northeast of the lease area in Main Pass Block 290. 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 lease area.

Due to their distance from the lease area, it is unlikely that pinnacle trend live bottom areas would be affected by an accidental spill. A small diesel fuel spill would float on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would be unlikely to contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due to the difference in water depth. Near-bottom currents in the region are predicted to flow along the isobaths (Nowlin et al., 2001) and would not be expected to carry a plume up onto the continental shelf edge. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Although there are mechanisms that could result in oil contacting these features, it is expected that most of the oil would rise to the surface and thereby reducing potential impacts to these features.

C.2.5 Eastern Gulf Live Bottoms

The lease 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 276 miles (445 km) northeast of the lease 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 lease area.

Because of their distance from the lease area, it is unlikely that Eastern Gulf live bottom areas would be affected by an accidental spill. A small diesel fuel spill would float and dissipate on the surface and would not reach these seafloor features. In the event of an oil spill from a well blowout, a surface slick would not likely contact these seafloor features. If a subsurface plume were to occur, impacts on these features would be unlikely due 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 be expected to carry a plume up onto the continental shelf. This assumption is consistent with the deposition patterns inferred by Valentine et al. (2014) for the subsurface plume from the Macondo spill. Although there are mechanisms that could result in oil contacting these features, it is expected that most of the oil would rise to the surface thereby reducing potential impacts to benthic communities.

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.

Endangered, threatened, or species of concern that may occur in the project area and/or along the northern Gulf Coast are listed in **Table 7**. 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. These two agencies share federal jurisdiction over sea turtles, with NMFS having lead responsibility at sea and USFWS on nesting beaches.

In 2007, NMFS and the USFWS issued a Biological Opinion in response to ESA consultations with MMS for previous EISs (NMFS, 2007). Following the Macondo spill on July 30, 2010, BOEM reinitiated ESA consultation with NMFS and the USFWS. BOEM, NMFS, and USFWS are currently in the process of collecting and awaiting additional information being gathered as part of the Natural Resource Damage Assessment process, in order to update the environmental baseline information as needed for the reinitiated Section 7 consultation. Consultation is ongoing, and BOEM is acting as lead agency, with BSEE involvement, in the reinitiated consultation (BOEM, 2016b). BOEM and BSEE have developed an interim coordination and review process with NMFS and USFWS for specific activities leading up to or resulting from upcoming lease sales. The purpose of this coordination is to ensure that NMFS and USFWS have the opportunity to review post-lease exploration, development, and production activities prior to BOEM's approval. The reviews ensure that all approved plans and permits contain all necessary measures to avoid jeopardizing the existence of ESA-listed species and implementation of reasonable and prudent alternative measures. This interim coordination program remains in place while formal consultation and the development of a Biological Opinion are ongoing (BOEM, 2016b).

Coastal endangered or threatened species that may occur along the U.S. Gulf Coast include the West Indian manatee, Piping Plover, Whooping Crane, Gulf sturgeon, and four subspecies of beach mouse. Critical habitat has been designated for all of these species as indicated in **Table 7** and discussed in individual sections. Two other coastal bird species (Bald Eagle and Brown Pelican) are no longer federally listed as endangered or threatened; these are discussed in **Section C.4.2**.

Table 7. Federally listed endangered, threatened, and candidate species potentially present in the lease area and along the northern Gulf Coast.

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Marine Mammals					
Sperm whale	*Physeter macrocephalus*	E	X	--	None
Bryde's whale	*Balaenoptera edeni*[a]	P	X	--	None
West Indian manatee	*Trichechus manatusa*[b]	E	--	X	Florida (Peninsular)
Sea Turtles					

Table 7. (Continued).

Species	Scientific Name	Status	Potential Presence		Critical Habitat Designated in Gulf of Mexico
			Lease Area	Coastal	
Loggerhead turtle	*Caretta caretta*	T, E[c]	X	X	Nesting beaches and nearshore reproductive habitat in Mississippi, Alabama, and Florida (Panhandle); *Sargassum* habitat including most of the central and 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 (Panhandle)
Whooping Crane	*Grus americana*	E	--	X	Coastal Texas (Aransas National Wildlife Refuge)
Fishes					
Oceanic whitetip shark	*Carcharhinus longimanus*	T	X	--	None
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Invertebrates					
Elkhorn coral	*Acropora palmata*	T	--	X	Florida Keys and the Dry Tortugas
Lobed star coral	*Orbicella annularis*	T	--	X	None
Mountainous star coral	*Orbicella faveolata*	T	--	X	None
Boulder star coral	*Orbicella franksi*	T	--	X	None
Terrestrial Mammals					
Beach mice (subspecies: Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches

Abbreviations: E = endangered; P = proposed; T = threatened; X = potentially present; -- = not present.

a Gulf of Mexico Bryde's whales are protected by the Marine Mammal Protection Act (MMPA). There is currently a proposed rule to list this stock as 'endangered' under the Endangered Species Act (ESA).

b 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.

c The Northwest Atlantic Ocean distinct population segment (DPS) of loggerhead turtles is designated as threatened (76 *Federal Register* [FR] 58868). NMFS and USFWS designated critical habitat for this DPS, including beaches and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as *Sargassum* habitat throughout most of the central and western Gulf of Mexico (79 FR 39756 and 79 FR 39856).

The sperm whale, five sea turtle species, and the oceanic whitetip shark are the only species known to occur within OCS and slope waters of the Gulf of Mexico that are currently listed as endangered or threatened by the ESA. The listed sea turtles include the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, loggerhead turtle, and green turtle. 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 (see **Section C.3.4**). No critical habitat has been designated in the Gulf of Mexico for the leatherback turtle, Kemp's ridley turtle, hawksbill turtle, green turtle, sperm whale, or oceanic whitetip shark.

Listed marine mammal species include one odontocete (sperm whale) which is known to occur in the Gulf of Mexico (Würsig et al., 2000). The Bryde's whale exists in the Gulf of Mexico as a small, resident population. It is the only baleen whale known to be resident to the Gulf. The genetically distinct Northern Gulf of Mexico stock is severely restricted in range, being found only in the northeastern Gulf, more specifically in the waters of the DeSoto Canyon and therefore not likely to occur within the lease area (Waring et al., 2016).

Five endangered mysticete whales (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) have been reported from the Gulf of Mexico but are considered rare or extralimital and therefore, are not considered further in the EIA (Würsig et al., 2000, BOEM, 2017a). These species are not included in the most recent NMFS stock assessment reports (Hayes et al., 2017) nor in the most recent BOEM multisale EIS (BOEM, 2017a). Therefore, they are not considered further in the EIA.

There are no other endangered animals or plants in the Gulf of Mexico that are reasonably likely to be affected by either routine or accidental events. Other species occurring at certain locations in the Gulf of Mexico, such as the smalltooth sawfish (*Pristis pectinata*) and Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*), are remote from the lease area and highly unlikely to be affected. Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral (*Acropora palmata*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). None of these species are expected to be present in the lease area (see **Section C.3.9**).

C.3.1 Sperm Whale (Endangered)

The only endangered marine mammal likely to be present at or near the project area is the sperm whale (*Physeter macrocephalus*). Resident populations of sperm whales occur within the Gulf of Mexico. A species description is presented in the recovery plan for this species (NMFS, 2010a). Gulf of Mexico sperm whales are classified as an endangered species and a strategic stock (defined as a stock that may have unsustainable human-caused impacts) 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).

In 2013, NMFS conducted a status review to consider designating the Gulf of Mexico population of the sperm whale as a DPS under the ESA. The designation would have listed the DPS as a separate endangered or threatened population that is "significant to the species and faces additional unique threats to its survival." On November 13, 2013, NMFS concluded that the designation of a Gulf of Mexico DPS for sperm whales is not warranted (78 FR 68032).

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., 2000a). Results of a multi-year tracking study show female sperm whales typically concentrated along the upper continental slope between the 656- and 3,280-foot (200- and 1,000-meter) 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 MMS-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 lease 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 MODU presence, noise, and lights; support vessel and helicopter traffic noise; support vessel strikes; 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. Compliance with BSEE NTL 2015-G03 will minimize the potential for marine debris-related impacts on sperm whales.

Impacts of MODU Presence, Noise, and Lights

Some sounds produced by the MODU 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 noise exposure would be transient. As discussed in **Section A.1**, sounds generated by an actively drilling MODU are maximum broadband (10 Hz to 10 kHz) energy of approximately 190 dB re 1 µPa at 1 m (Hildebrand, 2005).

NMFS (2016a) 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. Sperm whale sounds generally consist of clicks that have a bandwidth of 100 Hz to 30 kHz (Erbe et al., 2017). 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 (Weilgart and Whitehead, 1993, Goold and Jones, 1995, Møhl et al., 2003, Erbe et al., 2017), with source levels up to 236 dB re 1 µPa at 1 m (Møhl et al., 2003, Mathias et al., 2013).

It is expected that, due to the relatively stationary nature of the MODU operations, 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 sound (Jochens et al., 2008). Most observations of behavioral responses of marine mammals to anthropogenic sounds, in general, have been limited to short-term behavioral responses, which included the cessation of feeding, resting, or social interactions (NMFS, 2009a, Gomez et al., 2016). Animals can determine the direction from which a sound arrives based on cues, such as differences in arrival times, sound levels, and phases at the two ears. Thus, an animal's directional hearing capabilities have a bearing on its ability to avoid noise sources (NRC, 2003a).

The most recent acoustic criteria (NMFS, 2016a) are based on received sound level accumulations that equate to the onset of marine mammal auditory threshold shifts. For mid frequency cetaceans exposed to a non-impulsive source (such as installation vessel operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 dB re 1 $\mu Pa^{2}\cdot s$ over a 24 hour period. Similarly, temporary threshold shifts are estimated to occur when the mammal has received a cumulative noise exposure level of 178 dB re 1 $\mu Pa^{2}\cdot s$ over a 24 hour period. Based on transmission loss calculations, typical sources with DP thrusters are not expected to produce received sound levels greater than 160dB re 1 µPa beyond 25 m from the source. Due to the short propagation distance of high sound pressure levels, 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.

The MODU will be located within a deepwater, open ocean environment. Sounds generated by drilling operations will be generally non-impulsive, with some variability in sound level. This analysis assumes that the continuous nature of sounds produced by the MODU will provide individual whales with cues relative to the direction and relative distance (sound intensity) of the sound source, and the fixed position of the MODU will allow for active avoidance of potential physical impacts. Drilling-related noise associated with this project 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.

MODU lighting and rig presence are not identified as IPFs for sperm whales (NMFS, 2007, BOEM, 2012a, 2016b, 2017a, b).

Impacts of Support Vessel and Helicopter Traffic

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, 2010a). 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 300 ft (91 m) or greater whenever possible. Vessel operators are required to reduce vessel speed to 10 knots or less, when safety permits, when mother/calf pairs, pods, or large assemblages of cetaceans are observed near an underway vessel. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sperm whales.

NMFS (2007) analyzed the potential for vessel strikes and harassment of sperm whales in its Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico. With implementation of the mitigation measures in NTL BOEM-2016-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. NMFS also 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 implementation of the vessel strike avoidance measures, NMFS concluded that the potential for harassment of sperm whales would be reduced to discountable levels.

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 (12%) of 24 sightings. 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 sound, the authors concluded that the observed reactions to brief overflights by the aircraft were short-term and limited to behavioral disturbances.

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 300 ft (91 m) of marine mammals (BOEM, 2016a, 2017a). Although whales may respond to helicopters, Smultea et al. (2008) and NMFS (2007) 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 (2007) and BOEM (2017a, b). 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. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease 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.

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 (Marine Mammal Commission [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 (2017a, b), and NMFS (2007). 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, and 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 (Hayes et al., 2017). 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 Macondo spill in 2010.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on sperm whales are expected.

C.3.2 West Indian Manatee (Endangered)

Most of the Gulf of Mexico West Indian manatee (*Trichechus manatus*) population is located in peninsular Florida (USFWS, 2001). 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 (Wilson, 2003, Hieb et al., 2017) into Alabama and Louisiana coastal environs, with some individuals traveling as far west as Texas (Fertl et al., 2005). A species description is presented in the recovery plan for this species (USFWS, 2001).

IPFs that could potentially affect manatees include support vessel and helicopter traffic and a large oil spill. A small fuel spill in the lease area would be unlikely to affect manatees because the lease area is approximately 184 miles (296 km) from the nearest shoreline (Louisiana). As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Compliance with NTL BSEE 2015-G013 (see **Table 1**) will minimize the potential for marine debris-related impacts on manatees. 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 MODU 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, 2001). 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. Compliance with NTL BOEM-2016-G01 will minimize the likelihood of vessel strikes, and no significant impacts on manatees are expected.

Helicopter traffic, if present, 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 300 ft (91 m) of marine mammals (BOEM, 2012a, b). This mitigation measure will minimize the potential for disturbing manatees, and no significant impacts are expected.

Impacts of a Large Oil Spill

The 30-day OSRA modeling results summarized in **Tables 3** and **4** predict that shorelines in five Texas counties and four Louisiana parishes could be contacted by a large oil spill within 30 days. There is no critical habitat designated in these areas, and the number of manatees potentially present is a small fraction of the population in peninsular Florida. The 60 day OSRA (**Table 5**) estimates potential shoreline contacts ranging from Cameron County, Texas, to Miami-Dade County, Florida. This range includes some areas of critical habitat in southwest Florida; however, the conditional probabilities of oil contacting these areas within 60 days of a spill is <0.5%.

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, and 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on manatees are expected.

C.3.3 Non-Endangered Marine Mammals (Protected)

All marine mammal species are protected under the MMPA. In addition to the two endangered species of marine mammals that were cited in **Sections C.3.1 and C.3.2**, 21 additional species of marine mammals may be found in the Gulf of Mexico. These include one species of mysticete whale, the dwarf and pygmy sperm whales, four species of beaked whales, and 14 species of delphinid whales and dolphins (see **EP 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, spinner dolphin, and Clymene dolphin. A brief summary is presented in this section, and additional information on these groups is presented by BOEM (2017a).

Bryde's whale. The_Bryde's whale (*Balaenoptera edeni*) is the only year-round resident baleen whale in the northern Gulf of Mexico. In 2014, a petition was submitted to designate the northern Gulf of Mexico population as a DPS and list it as endangered under the ESA (Natural Resources Defense Council [NRDC], 2014). This petition received a 90-day positive finding by NMFS in 2015 and is currently under consideration for listing. The Bryde's whale is sighted most frequently between the 328 ft (100 m) and 3,280 ft (1,000 m) isobaths (Davis and Fargion, 1996, Davis et al., 2000a). 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. Based on the available data, it is possible that Bryde's whales could occur in the lease area.

Dwarf and pygmy sperm whales. At sea, it is difficult to differentiate dwarf sperm whales (*Kogia sima*) from pygmy sperm whales (*Kogia breviceps*), 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, Waring et al., 2016). Either species could occur in the lease area.

Beaked whales. 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 only one documented stranding in the Gulf of Mexico (Bonde and O'Shea, 1989). Blainville's beaked whales are rare, with only four documented strandings in the northern Gulf of Mexico (Würsig et al., 2000).

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., 2000a). Any of these species could occur in the lease area (Waring et al., 2016).

Delphinids. Fourteen species of delphinids are known to occur in the Gulf of Mexico: Atlantic spotted dolphin (*Stenella frontalis*), bottlenose dolphin (*Tursiops truncatus*), Clymene dolphin (*Stenella clymene*), false killer whale (*Pseudorca crassidens*), Fraser's dolphin (*Lagenodelphis hosei*), killer whale (*Orcinus orca*), melon-headed whale (*Peponocephala electra*), pantropical spotted dolphin (*Stenella attenuata*), pygmy killer whale (*Feresa attenuata*), short-finned pilot whale (*Globicephala macrorhynchus*), Risso's dolphin (*Grampus griseus*), rough-toothed dolphin (*Steno bredanensis*), spinner dolphin (*Stenella longirostris*), 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. However, any of these species could occur in the lease area (Waring et al., 2016).

The bottlenose dolphin (*Tursiops truncatus*) 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 lease 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., 2017).

Bottlenose dolphins in the Northern Gulf of Mexico are categorized into three stocks by NMFS (2016b): Bay, Sound, and Estuary; Continental Shelf; and Coastal and Oceanic. The Bay, Sound, and Estuary Stocks are considered to be strategic stocks. The strategic stock designation in this case was based primarily on the occurrence of an "unusual mortality event" (UME) of unprecedented size and duration (from April 2010 through July 2014)(NOAA, 2016c) 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 Macondo spill 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. (2014) reported that 1 year after the Macondo spill, 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 UME 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 Macondo spill are proposed as a cause.

IPFs that could potentially affect non-endangered marine mammals include MODU 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 MODU Presence, 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 21 non-endangered cetaceans found in the Gulf of Mexico (NMFS, 2016a). Eighteen of the 20 odontocete species are considered to be in the mid-frequency functional hearing group, two species (*Kogia*) are in the high frequency functional hearing group, and one species (Bryde's whale) is in the low frequency functional hearing group. (NMFS, 2016a). Thruster and installation 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 installation operations), permanent threshold shifts are estimated to occur when the mammal has received a cumulative exposure level of 198 dB re 1 $\mu Pa^2 \cdot s$ over a 24 hour period (NMFS, 2016a). Simlarly, temporary threshold shifts are estimated to occur when the mammal has received a cummulative noise exposure level of 178 dB re 1 $\mu Pa^2 \cdot s$ over a 24 hour period. For low frequency cetaceans, specifically the Bryde's whale, permant and temporary threshold shift onset is estimated to occur at 199 dB re 1 $\mu Pa^2 \cdot s$ and 179 dB re 1 $\mu Pa^2 \cdot s$, repectively. Based on transmission loss calculations, open water propagation of noise produced by typical sources with intermittent use of DP thrusters during offshore operations, are not expected to produce received levels greater than 160 dB re 1 µPa beyond 25 m from the source. Due to the short propagation distance of high sound pressure levels, 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. NOAA Fisheries West Coast Region (2018) present criteria are used in the interim to determine behavioral disturbance thresholds for marine mammals and are applied equally across all functional hearing groups. Received sound pressure levels of 120 dB re 1 µPa from a non-impulsive source are 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.

There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources. Marine mammal species in the northern Gulf of Mexico have been exposed to noise from anthropogenic sources for a long period of time and over large geographic areas and likely do not represent a naïve population with regard to sound (NRC, 2003a). It is expected that marine mammals within or near the lease area would be able to detect the presence of the DP installation vessel or MODU and avoid exposure to higher energy sounds, particularly within an open ocean environment.

Some odontocetes have shown increased feeding activity around lighted platforms at night (Todd et al., 2009). Even temporary MODUs 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 lease area, and the region as a whole has a large number of similar sources. Marine mammal species in the northern Gulf of Mexico have been exposed to noise from anthropogenic sources for a long period of time and over large geographic areas and likely do not represent a naïve population with regard to sound (NRC, 2003a). 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.

MODU lighting and presence are not identified as IPFs for marine mammals by BOEM (2016b, 2017a). Therefore, no significant impacts are expected.

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 when whales are sighted and 150 ft (45 m) when small cetaceans are sighted. 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. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing marine mammals, and therefore no significant impacts are expected.

Aircraft 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 300 ft (91 m) of marine mammals (BOEM, 2017a). 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 (2017a, b), 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.

Section A.9.1 discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area and the duration of a small spill, the 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 (MMC, 2011). 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. Therefore, 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 (2017a, b). 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, and 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., 2017); 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 Macondo spill, as analyzed and summarized by NOAA (2016b) 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, 2016b, Takeshita et al., 2017). Nearly all of the 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, 2016b). According to the National Wildlife Federation (2016), nearly all of the 21 species of dolphins and whales that live in the northern Gulf of Mexico had demonstrable, quantifiable injuries. NMFS (2014a) documented 13 dolphins and whales live-stranded, and over 150 dolphins and whales dead during the oil spill response. Because of known low detection rates of carcasses (Williams et al., 2011), it is possible that the number of marine mammal deaths is 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 are likely attributable to oil interaction. Schwacke et al. (2014) 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, b). 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. The application of dispersants is likely to reduce the chances of harmful impacts as the dispersants would remove oil from the surface, thereby reducing the risk of contact and rendering it less likely to adhere to skin, baleen plates, or other body surfaces (BOEM, 2017a). The use of trained observers during remediation activities will reduce the likelihood of capture and/or entrainment (BOEM, 2017a, b). It is expected that impacts to non-listed marine mammals from a large oil spill resulting in the death of individuals would be adverse but not significant 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on marine mammals are expected.

C.3.4 Sea Turtles (Endangered/Threatened)

As listed in **EP Section 6h**, five species of endangered or threatened sea turtles may be found near the lease area. Endangered species are the leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) turtles. As of May 6, 2016, the entire North Atlantic DPS of the green turtle (*Chelonia mydas*) is listed as threatened (81 *Federal Register* [FR] 20057). The DPS of loggerhead turtle (*Caretta caretta*) that occurs in the Gulf of Mexico is listed as threatened, although other DPSs are endangered. 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 1**. 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 291 miles (469 km) north northeast of the lease area.

Loggerhead turtles in the Gulf of Mexico are part of the Northwest Atlantic Ocean DPS 76 FR 58868). 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 one 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 pelagic existence. Rafts of *Sargassum* serve as important foraging and developmental habitat for numerous fishes, and young sea turtles, including loggerhead 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, 2014b).

On February 17, 2010, NOAA Fisheries and the USFWS were jointly petitioned to designate critical habitat for the Kemp's ridley turtle for nesting beaches along the Texas coast and marine habitats in the Gulf of Mexico and Atlantic Ocean (WildEarth Guardians, 2010). As of March 2018, critical habitat has not been designated for the Kemp's ridley sea turtle (NMFS, 2015a).

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

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, 2016a) 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, 2016b, c);
- Kemp's ridley turtles— Of the sea turtle species that may be found in the lease area, only the Kemp's ridley relies on the Gulf of Mexico as its sole breeding ground. The main nesting site of the Kemp's ridley turtle is Rancho Nuevo beach in Tamaulipas, Mexico (NMFS et al., 2011). A much smaller but growing population nests in Padre Island National Seashore, Texas, mostly as a result of reintroduction efforts (NMFS et al., 2011). A total of 353 Kemp's ridley turtle nests were counted on Texas beaches in 2017, an increase from 185 counted in 2016; 159 counted in 2015; and 118 counted in 2014 (Turtle Island Restoration Network, 2017). 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. Kemp's ridley turtles typically do not nest anywhere near the project area, although there have been occasional reports of nesting in Alabama (Share the Beach, 2015); 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 Yucatan Peninsula (USFWS, 2015a).

IPFs that could potentially affect sea turtles include MODU 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. Compliance with NTL BSEE 2015-G013 (See **Table 1**) will minimize the potential for marine debris-related impacts on sea turtles.

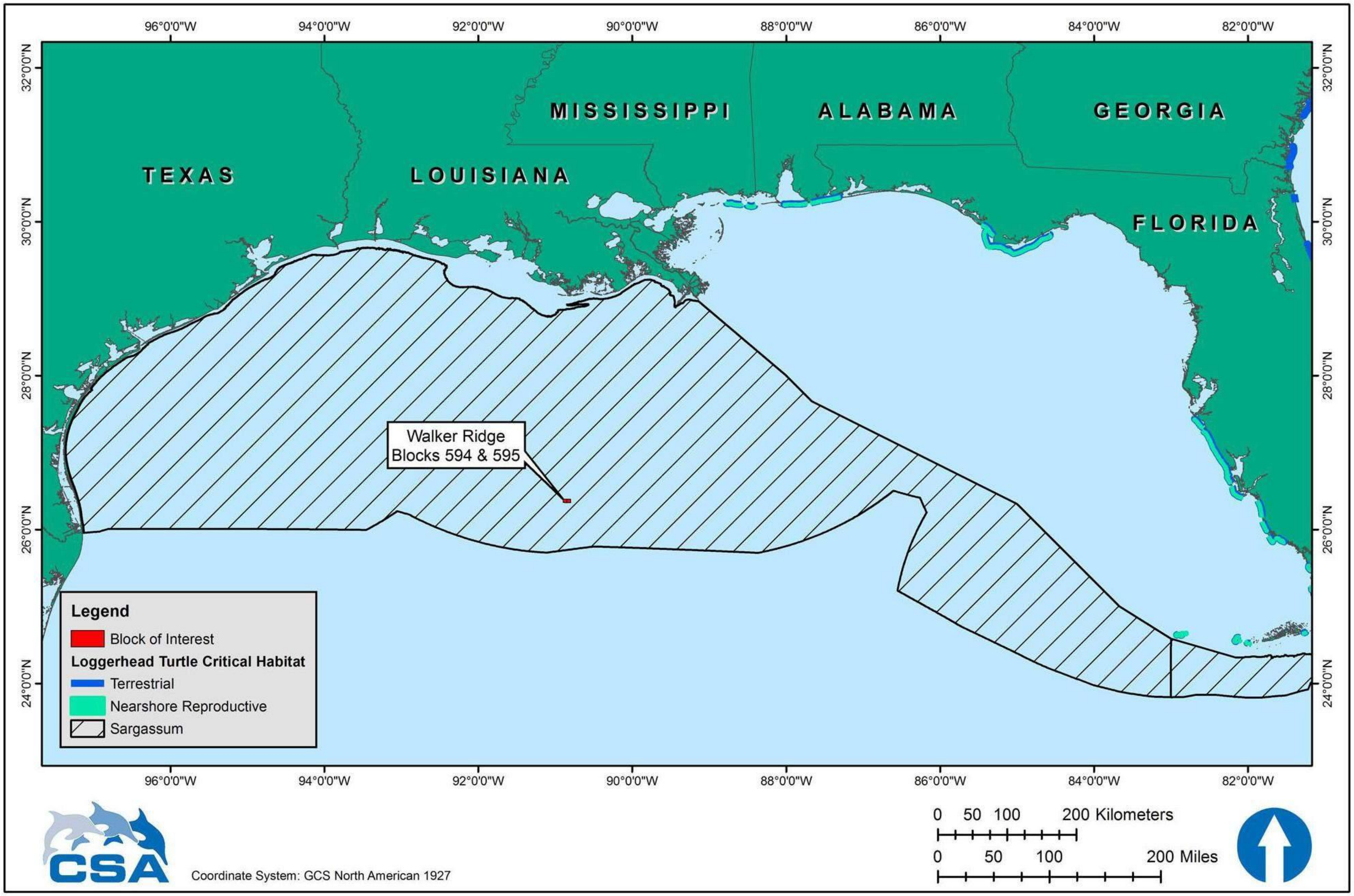

Figure 1. Location of loggerhead turtle critical habitat in the northern Gulf of Mexico in relation to the lease area. The critical habitat includes terrestrial habitat (nesting beaches) and nearshore reproductive habitat in Mississippi, Alabama, and the Florida Panhandle as well as *Sargassum* habitat.

Impacts of MODU Presence, Noise, and Lights

Offshore drilling activities produce a broad array of sounds 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 sound source. There is scarce information regarding hearing and acoustic thresholds for marine turtles. 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). NMFS Biological Opinions (NMFS, 2015b) list sea turtle underwater acoustic injury and behavioral thresholds at 207 dB re 1 µPa and 166 dB re 1 µPa, respectively. No distinction is made between impulsive and continuous sources for these thresholds. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during drilling, are not expected to produce received levels greater than 160dB re 1 µPa beyond 25 m from the source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990; Gitschlag et al., 1997) and thus may be more susceptible to impacts from sounds produced during routine operations. Helicopters and service 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 and short duration of drilling activities, these short-term impacts are not expected to be biologically significant to sea turtle populations.

Artificial lighting can disrupt the nocturnal orientation of sea turtle hatchlings (Witherington, 1997, Tuxbury and Salmon, 2005). 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.

Impacts of Support Vessel and Helicopter Traffic

Noise generated from support vessel traffic has the potential to disturb sea turtles, and there is also a risk of vessel strikes. Data show that a vessel strike is one cause of sea turtle mortality in the Gulf of Mexico (Lutcavage et al., 1997). 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 and BSEE have issued NTL BOEM-2016-G01 (See **Table 1**), which recommends protected species identification training for vessel operators and crews; recommends that vessel 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 150 ft (45 m) or greater whenever possible. Compliance with this NTL will reduce the potential for vessel strikes during periods of daylight and during sea and weather conditions that permit sighting of turtles on the sea surface. If a project-related vessel strikes a sea turtle, it is likely that it will result in the death of the individual turtle.

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, 2007; BOEM, 2012a).

Impacts of a Small Fuel Spill

Potential spill impacts on sea turtles are discussed by BOEM (2017a, b) and NMFS (2007). For this EP, 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. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease 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 (BOEM, 2012a, NOAA, nd, NMFS, 2014a). 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.

<u>Loggerhead Critical Habitat – *Sargassum*</u>. The lease area is within the Sargassum portion of the loggerhead turtle critical habitat (Figure 1). A small fuel spill could affect *Sargassum* and juvenile turtles by contaminating this habitat. Juvenile sea turtles could come into contact with or ingest oil, resulting in death, injury, or other sublethal effects. Affects would be limited to the small area (0.5 to 5 ha [1.2 to 12 ac]) likely to be impacted by a small spill. A 5-ha (12-ac) impact would represent a negligible portion of the 39,164,246 ha (96,776,959 ac) designated *Sargassum* critical habitat for loggerhead turtles in the northern Gulf of Mexico.

<u>Loggerhead Critical Habitat – Nesting Beaches</u>. A small fuel spill in the lease area would be unlikely to affect sea turtle nesting beaches because the lease area is 184 miles (296 km) from the nearest shoreline (Louisiana). Loggerhead turtle nesting beaches and nearshore reproductive habitat designated as critical habitat are located in Mississippi, Alabama, and the Florida Panhandle, at least 291 miles (469 km) from the lease 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 breaking up.

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, and 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 (NOAA, 2010, 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. **EP Section 9b** provides detail on spill response measures.

Studies of oil effects on loggerheads in a controlled setting (Lutcavage et al., 1995, NOAA, 2010) 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, 2007).

Results of the Macondo spill provide an indication of potential effects of a large oil spill on sea turtles. NOAA (2016b) 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 Macondo spill. Nearly 35,000 hatchling sea turtles (loggerheads, Kemp's ridleys, and green turtles) were also injured by response activities (NOAA, 2016b). Evidence from (McDonald et al., 2017b) suggests 402,000 turtles were exposed to oil in the aftermath of the Macondo spill, including 54,800 which were likely to have been heavily oiled.

Spill response activities could also kill sea turtles and interfere with nesting. NOAA (2016b) concluded that after the Macondo spill, 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, 2016b, 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.

<u>Loggerhead Critical Habitat – Nesting Beaches</u>. Spilled oil reaching sea turtle nesting beaches could affect nesting sea turtles and egg development (NMFS, 2007). 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).

The 30-day OSRA results summarized in **Tables 3** and **4** estimate that the Louisiana and Texas shorelines that support limited sea turtle nesting could be contacted within 30 days (<0.5% to 2% conditional probability) of a spill. The 60-day OSRA modeling (**Table 5**) predicts the conditional probability of oil contacting the Mississippi, Alabama, and Florida Panhandle shorelines that support significant loggerhead sea turtle nesting is 5% or less. The nearest nearshore reproductive critical habitat for loggerhead turtles is 291 miles (469 km) (Jackson County, Mississippi) from the lease area and is predicted by the 60-day OSRA model to a have <0.5% conditional probability of contact within 60 days of a spill.

<u>Loggerhead Critical Habitat – *Sargassum*</u>. The lease area is within the *Sargassum* habitat portion of the loggerhead turtle critical habitat (**Figure 1**). 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 catastrophic 2010 Macondo spill affected approximately one-third of the *Sargassum* habitat in the northern Gulf of Mexico (BOEM, 2014a, b). It is extremely unlikely that the entire *Sargassum* critical habitat would be affected by

a large spill. Because *Sargassum* is a floating, pelagic species, it would only be affected by oil that is present near the surface.

The effects of oiling on *Sargassum* vary with severity, but moderate to heavy oiling as could occur during a large spill could cause complete mortality to *Sargassum* and its associated communities (BOEM, 2016a, b). *Sargassum* 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 affects, including reduced growth, productivity, and recruitment of organisms associated with *Sargassum*. The *Sargassum* 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* has 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* community would be expected to take one to two years (BOEM, 2016a).

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 **EP Section 2j**. 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. **EP Section 9b** provides detail on spill response measures.

C.3.5 Piping Plover (Threatened)

The Piping Plover (*Charadrius melodus*) is a migratory shorebird that overwinters along the southeastern U.S. and Gulf of Mexico coasts. This threatened species is in decline as a result of hunting, habitat loss and modification, predation, and disease (USFWS, 2003). Critical overwintering habitat has been designated, including beaches in Texas, Louisiana, Mississippi, Alabama, and Florida (**Figure 2**). 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 (USFWS, 2003).

IPFs potentially affecting Piping Plovers include helicopter traffic crossing over selected coastal habitats and a large oil spill. It is assumed that helicopters will maintain an altitude of 305 m (1,000 ft) over unpopulated areas or across coastlines. Therefore, it is not likely that the crossing of helicopters over coastlines will significantly impact overwintering Piping Plovers.

A small fuel spill in the lease 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 breaking up (see explanation in **Section A.9.1**). A large oil spill IPF with potential impacts listed in **Table 2** is discussed below.

Impacts of a Large Oil Spill

The lease area is 184 miles (296 km) from the nearest shoreline designated as Piping Plover critical habitat. Based on the 30-day OSRA modeling results summarized in **Tables 3** and **4**, shorelines designated as critical habitat for the wintering Piping Plover could be contacted by a spill within

30 days (1% to 2% probability of shoreline contact). The highest conditional probability of shoreline contact within 30 days is 2% for Matagorda County, Texas, and Cameron Parish, Louisiana. The 60-day OSRA results summarized in Table 5 predict that during the winter there is up to a 13% probability that an oil spill from the lease area would reach a shoreline designated as critical habitat for the Piping Plover within 60 days of a spill.

Piping Plovers could physically oil themselves while foraging on oiled shores or secondarily contaminate themselves through ingestion of oiled intertidal sediments and prey (BOEM, 2017a). Plovers 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 these birds are most common along the coastal Gulf or if spills contact their critical habitat. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Impacts resulting in the deaths of individual Piping Plovers may be significant to the local population, based on the numbers of individuals lost.

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

Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP. 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Piping Plovers are expected.

C.3.6 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is a large omnivorous wading bird and a listed endangered species. Three wild populations live in North America (National Wildlife Federation, 2016b). One of these populations 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 431 at Aransas NWR during winter 2016 to 2017 winter (USFWS, 2017). A non-migratory population was reintroduced in central Florida and another reintroduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter (USFWS, 2015b). 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 2**). A species description is presented by (BOEM, 2012a).

A large oil spill is the only IPF that could potentially affect Whooping Cranes. A small fuel spill in the lease area would be unlikely to affect Whooping Cranes because of the distance from Aransas NWR. As explained in **Section A.9.1**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. The large oil spill IPF with potential impacts listed in **Table 2** is discussed below.

Impacts of a Large Oil Spill

The 30-day OSRA modeling results summarized in **Tables 3** and **4** predict that a large oil spill has a 1% probability of reaching critical habitat for Whooping Cranes within 30 days in the Aransas NWR located in Aransas and Calhoun Counties in Texas, approximately 367 miles (590 km) from the lease area. The 60-day OSRA modeling (**Table 5**) predicts that during the winter, there is up to a 4% conditional probability that an oil spill from the lease area would reach a shoreline designated as critical habitat for the Whooping Crane within 60 days of a spill.

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 a species level.

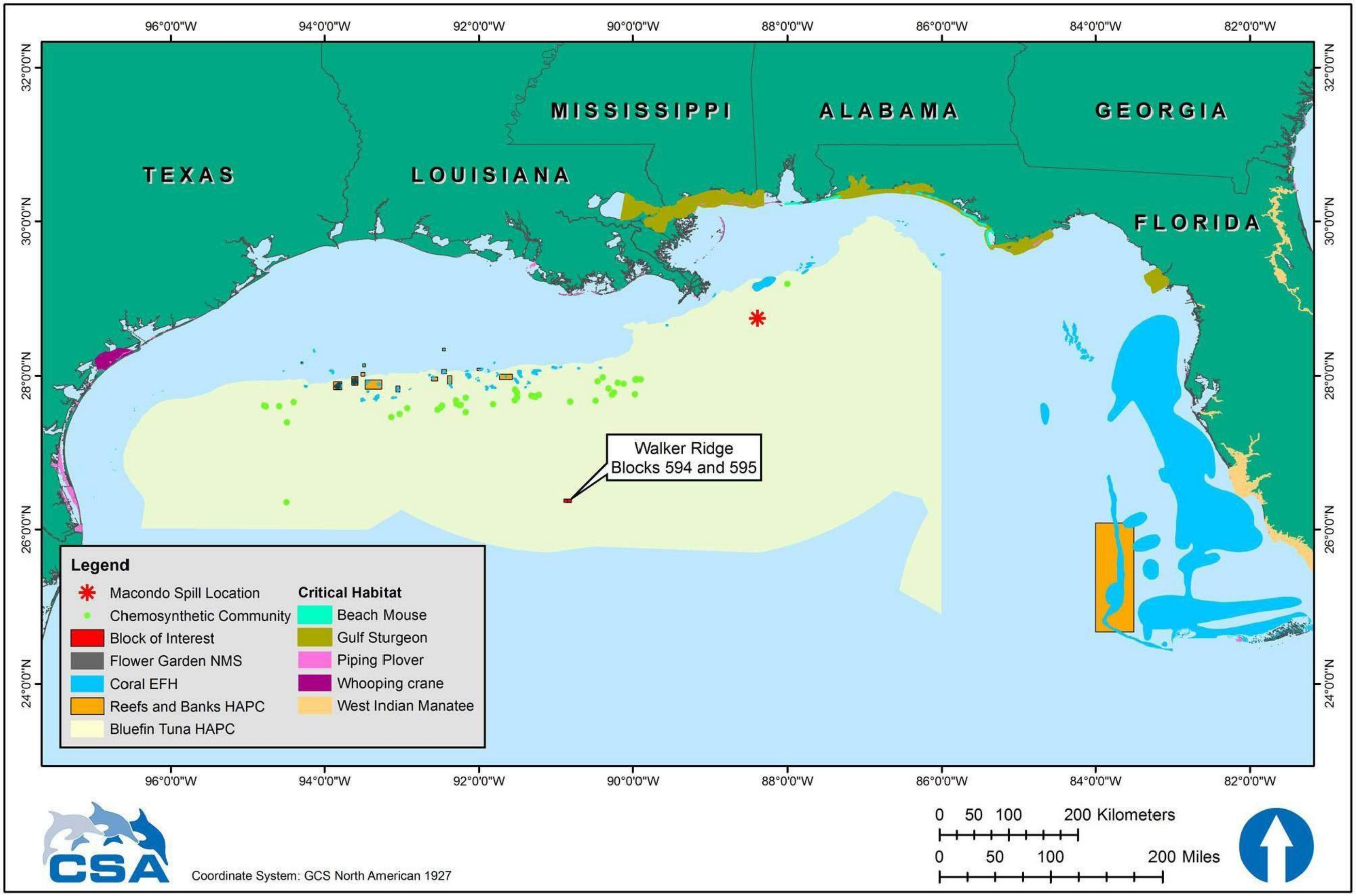

Figure 2. Location of selected environmental features in relation to the lease area. EFH = Essential Fish Habitat; HAPC = Habitat Area of Particular Concern.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Whooping Cranes are expected.

C.3.7 Oceanic Whitetip Shark (Threatened)

The oceanic whitetip shark (*Carcharhinus longimanus*) was listed as threatened under the ESA on 30 January 2018 (effective 30 March 2018) by NMFS (83 FR 4153). Oceanic whitetip sharks are found worldwide in offshore waters between approximately 30° N and 35° S latitude, and have generally been described as one of the most abundant species of oceanic sharks (Compagno, 1984). However, the population trend appears to be decreasing as the species is now only occasionally reported in the Gulf of Mexico (Baum et al., 2015).

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 (2018) 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 MODU presence, noise, and lights, and a large oil spill. A small diesel fuel spill in the lease area 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 lease area.

Impacts of MODU Presence, Noise, and Lights

Offshore drilling activities produce a broad array of sounds at frequencies and intensities that may be detected by sharks including the threatened oceanic whitetip shark. Shark hearing abilities have the highest sensitivity to low frequency sounds between approximately 40 Hz and 800 Hz (Myrberg, 2000). Sharks are most attracted to sounds in broadband frequencies below 80 Hz (Myrberg, 2000), a frequency that overlaps with sound pressure levels associated with drilling activities (typically 10 Hz to 10 kHz) (Hildebrand, 2005). MODU noise could also influence prey 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). However, because of the limited propagation distances of high sound pressure levels from the MODU, impacts would be limited in geographic scope and 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. However, 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. However, 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 result in population level effects.

C.3.8 Gulf Sturgeon (Threatened)

The Gulf sturgeon (*Acipenser oxyrinchus desotoi*) 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 Mississippi River to Charlotte Harbor, Florida (Wakeford, 2001). 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, 2014c) (**Figure 2**). 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 lease 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 breaking up (see explanation in **Section A.9.1**). 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 (2012a) and NMFS (2007). For this EP, there are no unique site-specific issues with respect to this species.

The lease area is approximately 281 miles (452 km) from the nearest Gulf sturgeon critical habitat. The 30-day OSRA modeling (**Tables 3** and **4**) estimates a 1% probability of contact with coastal areas containing Gulf sturgeon critical habitat. The 60-day OSRA modeling (**Table 5**) predicts that a spill in the lease area has 2% or less conditional probability of contacting any coastal areas containing Gulf sturgeon critical habitat within 60 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 only during winter months (from September 1 through April 30) when this species is foraging in estuarine and marine habitats (NMFS, 2007).

NOAA (2016b) estimated that 1,100 to 3,600 Gulf sturgeon were exposed to oil from the Macondo spill. 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, 2016b). Impacts resulting in the deaths of individual Gulf sturgeons may be significant to the local population, based on the number of individuals lost.

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 **EP Section 2j**. 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. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Gulf sturgeon are expected.

C.3.9 Beach Mouse (Endangered)

Four subspecies of endangered beach mouse (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle: the Alabama, Choctawhatchee, Perdido Key, and St. Andrew beach mouse. Critical habitat has been designated for all four subspecies and is shown combined for all four subspecies in **Figure 2**. Species descriptions are presented by (BOEM, 2012a).

A large oil spill is the only IPF that could potentially affect 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. A small fuel spill in the lease area would not affect the beach mouse because a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up (See **Section A.9.1**). 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 endangered beach mouse subspecies are discussed by BOEM (2017a). For this EP, there are no unique site-specific issues with respect to these animals.

The lease area is approximately 313 miles (504 km) from the nearest beach mouse critical habitat. The 30-day OSRA modeling results (**Tables 3** and **4)** predict a 2% conditional probability of oil contact with beach mouse critical habitat within 30 days of a spill. The 60-day OSRA modeling (**Table 5**) predicts that a spill in the lease area has a 1% or less conditional probability of reaching either the Alabama or Florida shorelines inhabited by beach mice within 60 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, b).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on beach mice are expected.

C.3.10 Threatened Coral Species

Four threatened coral species are known from the northern Gulf of Mexico: elkhorn coral (*Acropora palmata*), lobed star coral (*Orbicella annularis*), mountainous star coral (*Orbicella faveolata*), and boulder star coral (*Orbicella franksi*). These species have been reported from the coral cap region of the Flower Garden Banks (NOAA, 2014), but are unlikely to be present as regular residents in the northern Gulf of Mexico because they typically inhabit coral reefs in shallow, clear tropical, or subtropical waters. 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. Critical habitat has been designated for elkhorn coral in the Florida Keys, but none has been designated for the other threatened coral species included here.

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). The 30-day and 60-day OSRA modeling (**Tables 3, 4 and 5**) predicts the conditional probability of oil contacting the Florida Keys is <0.5%. 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 Macondo spill 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 and diseases) (BOEM, 2017a).

Due to the distance between the lease area and coral habitats, there is a low chance of oil contacting threatened coral habitat in the event of a spill. Therefore, 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, Clapp et al., 1982b, 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 shorebirds and coastal nesting birds, see **Section C.4.2**.

Seabirds of the northern Gulf of Mexico were surveyed from ships during the GulfCet II program (Hess and Ribic, 2000). Hess and Ribic (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, Least Tern, Sandwich Tern, Magnificent Frigatebird); winter residents (gannets, gulls, jaegers); and permanent resident species (Laughing Gulls, Royal Terns, Bridled Terns) (Hess and Ribic, 2000). The GulfCet II study did not estimate bird densities; however, Powers (1987) indicated that seabird densities over the open ocean typically are less than 10 birds km^{-2}.

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., 2000b, Hess and Ribic, 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 (Hess and Ribic, 2000).

Trans-Gulf migratory birds including shorebirds, wading birds, and terrestrial birds may also be present in the lease area. Migrant birds may use offshore structures and vessels for resting, feeding, or as temporary shelter from inclement weather. Some birds may be attracted to offshore structures and vessels because of the lights and the fish populations that aggregate around these structures (Russell, 2005).

IPFs that could potentially affect marine and pelagic birds include MODU 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 MODU Presence, Noise, and Lights

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). However, offshore structures may in some cases serve as suitable stopover habitats for trans-Gulf migrant species, particularly in spring (Russell, 2005).

Overall, potential negative impacts to birds from MODU lighting, potential collisions, or other adverse effects are highly localized, temporary in nature, 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 or species level and are not significant (BOEM, 2012a).

Impacts of Support Vessel and Helicopter Traffic

Support vessels and helicopters are unlikely to significantly disturb pelagic birds in open, offshore waters. 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 (2017a, b). For this EP, there are no unique site-specific issues with respect to spill impacts on these animals.

Section A.9.1 discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area and the short duration of a small spill, the potential exposure for pelagic marine birds would be brief.

Birds exposed to oil 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 and pelagic birds are expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine birds are discussed by BOEM (2017a, b). For this EP, 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 (>200 m). Powers (1987) indicates that seabird densities over the open ocean typically are <10 birds km^{-2}. The number of pelagic birds that could be affected in open, offshore waters would depend on the extent and persistence of the oil slick.

Data following the Macondo spill provide relevant information about the species of pelagic 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, Magnificent Frigatebird, and Masked Booby (USFWS, 2011). 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 Macondo spill in multiple habitats, including offshore/open waters, island waterbird colonies, barrier islands, beaches, bays, and marshes (NOAA, 2016b). 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, 2016b). It is expected that impacts to marine birds from a large oil spill resulting in the death of individual birds would be adverse but not significant at population levels.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on marine and pelagic birds are expected.

C.4.2 Coastal Birds

Threatened and endangered bird species (Piping Plover and Whooping Crane) have been discussed previously in **Sections C.3.5** and **C.3.6**. The Brown Pelican (*Pelecanus occidentalis*) was delisted from federal endangered status in 2009 (USFWS, 2016) and was delisted from state species of special concern status by the State of Florida in 2017 (Florida Fish and Wildlife Conservation Commission, 2017). However, this species remains listed as endangered by both Louisiana (Louisiana Department of Wildlife and Fisheries, 2018) and 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., 2000b), indicate that Brown Pelicans do not occur over deep, offshore waters (Fritts and Reynolds, 1981, Peake, 1996, Hess and Ribic, 2000). Nearly half the southeastern population of Brown Pelicans lives in the northern Gulf Coast, generally nesting on protected islands (USFWS, 2010b).

The Bald Eagle (*Haliaeetus leucocephalus*) was delisted from its threatened status in the lower 48 states in June 2007. However, this species is listed as endangered in both Louisiana (Louisiana Department of Wildlife and Fisheries, 2018) and Mississippi (Mississippi Natural Heritage Program, 2018). The bald eagle is also listed as threatened in Texas (Texas Parks and Wildlife Department, 2017). 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, 2015c). 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 (Johnsgard, 1990, Ehrlich et al., 1992, Proctor and Lynch, 2012).

Various species of non-endangered 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, Black Skimmer, Forster's Tern, Gull-Billed Tern, Laughing Gull, Least Tern, and Royal Tern (USFWS, 2010b). Additional information is presented by BOEM (2012a, 2017a).

IPFs that could potentially affect coastal birds include support vessel and helicopter traffic and a large oil spill. A small fuel spill in the lease area would be unlikely to affect shorebirds or coastal nesting birds due to the lease area's distance from the nearest shoreline. 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. Compliance with NTL BSEE 2015-G013 (See **Table 1**) will minimize the potential for marine debris-related impacts on shorebirds. The IPFs with potential impacts listed in **Table 2** are discussed below.

Impacts of Support Vessel and Helicopter Traffic

Support vessels will transit coastal areas near Port Fourchon, Louisiana, and helicopters will transit coastal areas near Amelia, Louisiana, where shorebirds and coastal nesting 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. The disturbances will be limited to flushing birds away from vessel pathways. Flushing distances vary among species and individuals; 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 disturbance to nesting birds, eggs, and chicks is not expected. 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 drilling activities, any short-term impacts are not expected to be significant to coastal bird populations.

Aircraft traffic can cause some disturbance to birds on shore and off shore. 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., 2000). Helicopters seem to cause the most intense responses compared to other human disturbances for some species (Bélanger and Bédard, 1989). Federal Aviation Administration (FAA) 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 (Efroymson et al., 2000). 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 or species in the project area.

Impacts of Large Oil Spill

The 30-day OSRA modeling results summarized in **Tables 3** and **4** estimate that some shorelines of Texas and Louisiana, which include habitat for shorebirds and coastal nesting birds, could be affected within 10 days. Matagorda County, Texas, and Cameron Parish, Louisiana, are the coastal areas most likely to be affected (2% probability of shoreline contact within 30 days). The 60-day OSRA modeling (Table 5) predicts that shorelines from Cameron County, Texas, to Miami-Dade County, Florida, have up to a 13% conditional probability of contact within 60 days of a spill (Terrebonne Parish, Louisiana).

Coastal birds can be exposed to oil as they float on the water's surface, dive during foraging, or wade in oiled coastal waters. Oiled birds can lose the ability to fly, dive for food, or float on the water, which could lead to drowning (U.S. Fish and Wildlife Service, 2010a). Oil interferes with the water repellency of feathers and can cause hypothermia in the right conditions. As birds groom themselves, they can ingest and inhale the oil on their bodies. Scavengers such as Bald Eagles and gulls can be exposed to oil by feeding on carcasses of oiled fish and wildlife. While ingestion can kill animals immediately, more often it results in lung, liver, and kidney damage, which can lead to death (BOEM, 2017a). Bird eggs may be harmed if an oiled adult sits on the nest.

Brown Pelicans are especially at risk from direct and indirect impacts from spilled oil within inner shelf and inshore waters, such as embayments. The range of this species is generally limited to these waters and surrounding coastal habitats. Brown Pelicans feed on mid-size fish that they capture by diving from above ("plunge diving") and then scooping the fish into their expandable gular pouch. This behavior makes them susceptible to plumage oiling if they feed in areas with surface oil or an oil sheen. They may also capture prey that has been physically contaminated with oil or has ingested oil. Issues for Brown Pelicans include direct contact with oil, disturbance from cleanup activities, and long-term habitat contamination (BOEM, 2012a).

The Bald Eagle also may be especially at risk from direct and indirect impacts from spilled oil. This species often captures fish within shallow water areas (snatching prey from the surface or wading into shallow areas to capture prey with their bill) and so may be susceptible to plumage oiling and, as with the Brown Pelican, they may also capture prey that has been physically contaminated with oil or has ingested oil (BOEM, 2012a).

Studies concerning the Macondo spill provide additional information regarding impacts of a large spill on coastal bird populations. 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, 2016b). Species with the largest numbers of estimated mortalities were American White Pelican, Black Skimmer, Black Tern, Brown Pelican, Laughing Gull, Least Tern, Northern Gannet, and Royal Tern (NOAA, 2016b).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on shorebirds and coastal nesting birds are expected.

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 MODU presence, noise, and lights; effluent discharges; water intakes; and two types of accidents (a small fuel spill and a large oil spill).

Impacts of MODU Presence, Noise, and Lights

The MODU, as a floating structure in the deepwater environment, will act as a fish-aggregating device (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). The FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. MODU 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 continuous 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 levels 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, Nedelec et al., 2017). Because the MODU is a single, temporary structure, impacts on fish populations, whether beneficial or adverse, are not expected to be significant.

Few 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 sounds by Bolle et al. (2012). The controlled playbacks produced cumulative exposures of 206 dB re 1 $\mu Pa^2 \cdot s$ 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 impulsive noise. Based on transmission loss calculations, open water propagation of noise produced by typical sources with DP thrusters in use during drilling, are not expected to produce received levels greater than 160dB re 1 µPa beyond 82 ft (25 m) from the source. Because of the limited propagation distances of high sound pressure levels 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 (NRC, 1983, Neff, 1987). NPDES permit limits and requirements will be met.

Water-based drilling muds and cuttings will be released at the seafloor during the initial well intervals before the marine riser is set, that allows their return to the surface vessel. Excess cement slurry and blowout preventer 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 and support vessels are expected to include desalination unit discharge, non-contaminated well treatment and completion fluids, blowout preventer fluid, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and non-contact cooling water. The MODU 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 (**EP 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. GMG290103 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 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 biologically significant to plankton or ichthyoplankton populations (BOEM, 2017a).

Impacts of a Small Fuel Spill

Potential spill impacts on fisheries resources are discussed by BOEM (2017a, b). For this EP, there are no unique site-specific issues with respect to spill impacts.

Section A.9.1 discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

A small fuel spill could have localized impacts (i.e., hydrocarbon contamination) 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 (2017a, b). For this EP, 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, 2016b). Adult and juvenile fishes could also be impacted through the ingestion of oiled prey. It is expected that impacts to pelagic communities and ichthyoplankton from a large oil spill resulting in the death of individual fishes would be adverse but not significant at population 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on pelagic communities and ichthyoplankton are expected.

C.5.2 Essential Fish Habitat

Essential Fish Habitat (EFH) is defined as those waters and substrate necessary to fish for spawning, breeding, feeding, and 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. 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 104 miles (167 km) northwest of the lease area.

EFH has been identified in the deepwater Gulf of Mexico for highly migratory pelagic fishes, which occur as transients in the lease area. Species in this group, including tunas, swordfishes, billfishes, and sharks, are managed by NMFS. Highly migratory species with EFH within or near the lease area include the following (NMFS, 2009b):

- Albacore tuna (adults)
- Atlantic Bluefin tuna (spawning, eggs, larvae, adults)
- Bigeye tuna (adults)
- Oceanic whitetip shark (all)
- Skipjack tuna (spawning, adult)
- Swordfish (larvae, juveniles, adults)
- White marlin (juveniles, adults)

- Blue marlin (juveniles, adults)
- Common thresher shark (all)
- Longbill spearfish (juveniles, adults)
- Longfin mako shark (all)
- Yellowfin tuna (spawning, juveniles, adults)

Research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna (*Thunnus thynnus*), 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 lease area (**Figure 2**). The areal extent of the HAPC is approximately 115,830 miles^2 (300,000 km^2). The prevailing assumption is that 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).

An amendment to the original EFH Generic Amendment was finalized in 2005 (GMFMC, 2005). One of the most significant proposed changes in this amendment reduced the extent of EFH relative to the 1998 Generic Amendment by removing the EFH description and identification from waters between 100 fathoms and the seaward limit of the Exclusive Economic Zone (EEZ). The Highly Migratory Species Fisheries Management Plan was amended in 2009 to update EFH and HAPC to include the bluefin tuna spawning area (NMFS, 2009b).

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 WPA/CPA 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 have been designated in the Gulf of Mexico (GMFMC, 2005). 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 2**). The nearest HAPC is Jakkula Bank, which is located approximately 115 miles (185 km) northwest of the lease area.

Routine IPFs that could potentially affect EFH and fisheries resources include MODU 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 MODU Presence, Noise, and Lights

The MODU, as a floating structure 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). The FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species.

MODU 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 sound 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 drilling muds and cuttings, treated sanitary and domestic wastes, deck drainage, and miscellaneous discharges such as desalination unit discharge, blowout preventer fluid, non-contaminated well treatment and completion fluids, ballast water, bilge water, cement slurry, fire water, hydrate inhibitor, and cooling 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 are expected from these discharges.

Impacts of Water Intakes

As noted previously, cooling water intake will entrain and impinge 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 due to water intake are not expected to be biologically significant if operated in compliance with USEPA requirements. No significant impacts on EFH for highly migratory pelagic fishes are expected from these discharges if discharged according to NPDES permit conditions.

Impacts of a Small Fuel Spill

Potential spill impacts on EFH are discussed by BOEM (2016c, 2017a). For this EP, there are no unique site-specific issues with respect to spill impacts.

Section A.9.1 discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides detail on spill response measures. Given the open ocean location of the lease area, the duration of a small spill and opportunity for impacts to occur would be very brief.

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 lease area. A spill would also produce short-term impact 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 104 miles (167 km) northwest of the lease 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 (2016c, 2017a). For this EP, 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 lease area is within the HAPC for spawning Atlantic 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 104 miles (167 km) northwest of the lease 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on EFH are expected.

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 lease areas >200 m (656 ft) 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.

Based on NTL 2011-JOINT-G01, the lease area is not on BOEM's list of archaeological survey blocks determined to have a high potential for containing archaeological properties (BOEM, 2011). The wellsite assessment did not detect any archaeologically significant sonar contacts within 2,000 ft (610 m) of the proposed wellsites (Gardline Surveys, 2018). No archaeological impacts are expected from routine activities in the lease area.

Because no historic shipwreck sites are present in the lease area (see **EP 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 historic shipwrecks in the lease 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 as well as alteration of the rates of microbial activity (BOEM, 2017a). During the Macondo spill, 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, 2011c). 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 come in contact with wooden shipwrecks on the seafloor, it could adversely affect their condition or preservation.

A spill entering shallow coastal waters could conceivably contaminate undiscovered or known historic shipwreck sites. The 30-day OSRA modeling summarized in **Tables 3** and **4** predicts that some Texas and Louisiana shorelines could be contacted by a spill within 30 days of a spill. The coastal areas most likely to be affected would be Matagorda County, Texas, and Cameron Parish, Louisiana (2% probability of shoreline contact within 30 days). The 60-day OSRA (**Table 5**) predicts that shorelines between Cameron County, Texas, and Miami-Dade County, Florida, have up to a 13% condition of probability of contact within 60 days of a spill (Terrebonne Parish, Louisiana). 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).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on historic shipwrecks are expected.

C.6.2 Prehistoric Archaeological Sites

With a water depth of 9,631 to 9,766 ft (2,936 to 2,977 m), the lease 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 lease 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 lease 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, 2012b). The 30-day OSRA modeling summarized in **Tables 3** and **4** predicts that some Texas and Louisiana shorelines could be contacted by a spill within 30 days of a spill. The coastal areas most likely to be affected would be Matagorda County, Texas, and Cameron Parish, Louisiana (2% probability of shoreline contact within 30 days). The 60-day OSRA (**Table 5**) predicts that shorelines between Cameron County, Texas, and Miami-Dade County, Florida, have up to a 13% conditional probability of contact within 60 days of a spill occurring (Terrebonne Parish, Louisiana). 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., by destroying fragile artifacts and disturbing the provenance of artifacts or site features). BOEM (2017c) notes that some unavoidable direct and indirect impacts on coastal historic resources could occur, resulting in the loss of information.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on archaeological resources are expected.

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, 2016a, 2017a, b) 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 lease 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 and Amelia, Louisiana, 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 lease area would be unlikely to affect coastal habitats because the lease area is 182 mi (293 km) from the nearest shoreline. 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 **EP 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, b)

Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed by BOEM (2017a). Coastal habitats inshore of the project area include coastal and barrier island beaches, wetlands, oyster reefs, and submerged seagrass beds. For this EP, there are no unique site-specific issues with respect to coastal habitats.

The 30-day OSRA modeling (**Tables 3** and **4)** predicts that some Texas and Louisiana shorelines could be contacted by a spill within 30 days of a spill. The coastal areas most likely to be affected would be Matagorda County, Texas, and Cameron Parish, Louisiana (2% probability of shoreline contact within 30 days). The 60-day OSRA (**Table 5**) predicts that shorelines between Cameron County, Texas, and Miami-Dade County, Florida, have up to a 13% conditional probability of contact within 60 days of a spill occurring (Terrebonne Parish, Louisiana).

The shorelines within the geographic range predicted by the 60-day OSRA modeling (**Table 5**) include extensive barrier beaches and wetlands, oyster reefs, with submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries. NWRs and other protected areas such as Wildlife Management Areas (WMAs) 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 8.**

Table 8. Wildlife refuges, wilderness areas, and state and national parks and preserves within the geographic range of 1% or greater conditional probability of shoreline contacts within 30 days of a hypothetical spill from Launch Points C049 and C050 based on the 30-day Oil Spill Risk Analysis (OSRA) model.

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
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
	Robert Point Park
Aransas, Texas	Aransas National Wildlife Refuge
	Goose Island State Park
	Lydia Ann Island Audubon Sanctuary
	Mission-Aransas National Estuarine Research Reserve
	Rattlesnake Island, Ayres Island, and Roddy Island Audubon Sanctuary
	Redfish Bay State Scientific Area
Calhoun Texas	Aransas National Wildlife Refuge
	Chester Island Bird Sanctuary
	Guadaloupe Delta Wildlife Management Area

Table 8. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
	Matagorda Island Wildlife Management Area
	Welder Flats Wildlife Management Area
Matagorda, Texas	Big Boggy National Wildlife Refuge
	Chamber Park
	Matagorda Bay Nature Park
	Oyster Lake 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
	Apfell Park
	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
Chambers, Texas	Anahuac National Wildlife Refuge
	Atkinson Island Wildlife Management Area
	Candy Abshier Wildlife Management Area
	McFaddin National Wildlife Refuge
	Moody National Wildlife Refuge
Jefferson, Texas	McFaddin National Wildlife Refuge
	Sea Rim State Park
	Texas Point National Wildlife Refuge
Cameron, Louisiana	Peveto Woods Sanctuary
	Rockefeller State Wildlife Refuge and Game Preserve
	Sabine National Wildlife Refuge
Vermilion, Louisiana	Paul J. Rainey Wildlife Refuge and Game Preserve
	Rockefeller State Wildlife Refuge and Game Preserve
	State Wildlife Refuge
Iberia, Louisiana	Attakapas Island Wildlife Management Area
	Lake Fausse Pointe State Park
	Marsh Island Wildlife Refuge
	Shell Key National Wildlife Refuge
St. Mary, Louisiana	Atchafalaya Delta Wildlife Management Area
	Attakapas Island Wildlife Management Area
	Bayou Teche National Wildlife Refuge
	Cypremont Point State Park
Terrebonne, Louisiana	Isles Dernieres Barrier Islands Refuge
	Pointe aux Chenes Wildlife Management Area
Lafourche, Louisiana	East Timbalier Island National Wildlife Refuge
	Pointe aux Chenes Wildlife Management Area
	Wisner WMA (Includes Picciola Tract)

Table 8. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
Jefferson, Louisiana	Grand Isle State Park
Plaquemines, Louisiana	Breton National Wildlife Refuge
	Delta National Wildlife Refuge
	Pass a Loutre Wildlife Management Area
St. Bernard, Louisiana	Biloxi Wildlife Management Area
	Breton National Wildlife Refuge
	Saint Bernard State Park
Hancock, Mississippi	Bayou La Croix Preserve
	Buccaneer State Park
	Grand Bayou Preserve
	Hancock County Marshes Preserve
	Jourdan River Preserve
Harrison, Mississippi	Bayou Portage Preserve
	Biloxi River Marshes Preserve
	Cat Island Preserve
	Deer Island Preserve
	Gulf Islands National Seashore
	Hiller Park Recreation Area
	Jourdan River Preserve
	Sandhill Crane Refuge Preserve
	Ship Island Preserve
	Wolf River Preserve
Jackson, Mississippi	Bellefontaine Marsh Preserve
	Davis Bayou Preserve
	Escatawpa River Marsh Preserve
	Grand Bay National Estuarine Research Reserve
	Grand Bay Savanna Preserve
	Graveline Islands National Seashore
	Gulf Islands Wilderness
	Horn Island Preserve
	Old Fort Bayou Preserve
	Pascagoula River Marsh Preserve
	Petit Bois Island Preserve
	Round Island Preserve
	Shepard State Park
Mobile, Alabama	Grand Bay National Wildlife Refuge
	Grand Bay Savanna State Nature Preserve
	Mobile-Tensaw Delta WMA
	Penalver Park
	The Grand Bay Savanna Tract (and Addition Tract)
	W.L. Holland WMA
Baldwin, Alabama	Betty and Crawford Rainwater Perdido River Nature Reserve
	Bon Secour NWR
	Gulf State Park
	Meaher State Park
	Mobile-Tensaw Delta CIAP Parcel State Habitat Area
	Mobile-Tensaw Delta WMA
	Perdido River Water Management Area

Table 8. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
	W.L. Holland WMA
	Weeks Bay Harris and Worcester Tracts
	Weeks Bay National Estuarine Research Reserve
	Weeks Bay Reserve Addition – Beck Tract
Escambia, Florida	Bay Bluffs Park
	Bayou Marcus Wetlands
	Big Lagoon State Park
	Blue Angel Recreation Park
	Ft. Pickens Aquatic Preserve
	Gulf Islands National Seashore
	Mallory Heights Park #3
	Perdido Bay/Crown Pointe Preserve
Escambia, Florida (cont'd)	Perdido Key State Park
	Tarkiln Bayou Preserve State Park
	USS Massachusetts (BB-2) Underwater Archaeological Preserve
	Wayside Park
Okaloosa, Florida	Eglin Beach Park
	Fred Gannon Rocky Bayou State Park
	Gulf Islands National Seashore
	Henderson Beach State Park
	Rocky Bayou Aquatic Preserve
	Yellow River Wildlife Management Area
Walton, Florida	Choctawhatchee River Delta Preserve
	Choctawhatchee River Water Management Area
	Deer Lake State Park
	Grayton Beach State Park
	Point Washington State Forest
	Topsail Hill Preserve State Park
Bay, Florida	Camp Helen State Park
	SS Tarpon Underwater Archaeological Preserve
	St. Andrews Aquatic Preserve
	St. Andrews State Park
	Vamar Underwater Archaeological Preserve
Gulf, Florida	Apalachicola Bay Aquatic Preserve
	Apalachicola National Estuarine Research Reserve
	Apalachicola River Water Management Area
	Apalachicola River Wildlife and Environmental Area
	Box-R Wildlife Management Area
	Constitution Convention Museum State Park
	St. Joseph Bay Aquatic Preserve
	St. Joseph Bay State Buffer Preserve
	T.H. Stone Memorial St. Joseph Peninsula State Park
Franklin, Florida	Alligator Harbor Aquatic Preserve
	Apalachicola Bay Aquatic Preserve
	Apalachicola National Estuarine Research Reserve
	Bald Point State Park
	Cape St. George State Island State Reserve

Table 8. (Continued).

County or Parish, State	Wildlife Refuge, Wilderness Area, or State/National Park
	Dr. Julian G. Bruce St. George Island State Park
	Jeff Lewis Wilderness Preserve
	John S. Phipps Preserve
	St. Marks National Wildlife Refuge
	St. Vincent National Wildlife Refuge
	Tate's Hell State Forest

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 adverse.

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 (Beazley et al., 2012, Lin and Mendelssohn, 2012, 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). Impacts associated with an extensive oiling of coastal wetland habitat are expected to be significant.

A review of studies by BOEM (2012a) determined that effects of oil on marsh vegetation depend on the type of oil, the type of vegetation, and environmental factors of the area. Impacts to slightly oiled vegetation are considered short term and reversible as recent studies suggest that they will experience plant die-back, followed by recovery without replanting (BOEM, 2012a). Vegetation coated with oil experiences the highest mortality rates due to decreased photosynthesis (BOEM, 2012a). A recent 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).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on coastal habitats are expected.

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, 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). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

Longline gear consists of monofilament line deployed from a moving vessel and generally allowed to drift for 4 to 5 hours. As the mainline is put out, baited leaders and buoys are clipped in place at regular intervals. It takes 8 to 10 hours to deploy a longline and approximately the same time to retrieve it. Longlines are often set near oceanographic features such as fronts or downwellings, with the aid of sophisticated on-board temperature sensors, depth finders, and positioning equipment. Vessels typically are 10 to 30 m (33 to 98 ft) long, and their trips last 1 to 3 weeks.

It is unlikely that any commercial fishing activity other than longlining occurs at or near the project area due to the water depth at the project area. 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). Tilefishes (primarily *Lophalotilus chamaeleonticeps*) are caught by bottom longlining in water depths from approximately 540 to 1,476 ft (165 to 450 m) (Continental Shelf Associates, Inc., 2002). The water depths at the proposed wellsites range from 9,631 to 9,766 ft (2,936 to 2,977 m). No conflict with commercial fishing activity other than longlining is expected to occur.

Most recreational fishing activity in the region occurs in water depths less than 656 ft (200 m) (Continental Shelf Associates, 1997, 2002). In deeper water, the main attraction to recreational fishers is petroleum platforms in offshore waters of Texas and Louisiana. Due to the project's distance from shore, it is unlikely that recreational fishing activity is occurring in the lease area.

The only routine IPF that could potentially affect fisheries (commercial and recreational) is MODU 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 MODU Presence, Noise, and Lights

There is a slight possibility of pelagic longlines becoming entangled in the MODU. 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.

Because it is unlikely that any recreational fishing activity is occurring in the project area, no adverse impacts are anticipated. The presence of the MODU 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

Pelagic longlining activities in the lease area, if any, could be interrupted in the event of a small fuel spill. Fishing activities could be interrupted due to the activities of response vessels operating in the lease area. Given the open ocean location of the lease area and the short duration of a small spill, the opportunity for impacts to occur would be very brief. **Section A.9.1** discusses the size and fate of a potential small diesel fuel spill as a result of Shell's proposed activities. **EP Section 9b** provides details on Shell's spill response measures.

Impacts of a Large Oil Spill

Potential spill impacts on fishing activities are discussed by BOEM (2017a). For this EP, there are no unique site-specific issues with respect to this activity.

Table 8. (Continued).

Pelagic longlining activities in the lease 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 Macondo spill provide information about the maximum potential extent of fishery closures in the event of a large oil spill in the Gulf of Mexico (NMFS, 2010b). At its peak on 12 July 2010, closures encompassed 84,101 miles2 (217,821 km2), or 34.8% of the U.S. Gulf of Mexico EEZ. 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, b), 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, b). An analysis of the effects of the Macondo spill 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on fishing activities are expected.

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, 182 mi (293 km) from the nearest shoreline. 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 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.

Studies conducted after the Macondo spill provide relevant information about the types of health issues that may occur in the event of a large oil spill. Wildlife cleaning and rehabilitation workers have reported concerns including scrapes and cuts, itchy or red skin or rash, and symptoms of headache or feeling faint, dizzy, or fatigued (King and Gibbins, 2011). Hand, shoulder, or back pain was also reported

Table 8. (Continued).

by some wildlife-cleaning workers as well. Awkward postures, repetitive motions, and heavy lifting tasks were noted by investigators as contributing to musculoskeletal symptoms. Personnel working on offshore vessels or providing direct oversight to offshore vessels, including USCG personnel, civilian contractors, and other responders who were exposed to oil and dispersants, had a 7 to 12 times higher prevalence of upper respiratory symptoms and cough than those not exposed (Centers for Disease Control and Prevention, 2010). Another potential occupational hazard for spill response workers in general was heat stress from work in a hot and humid environment (King and Gibbins, 2011). Initial symptoms from cleanup workers who sought medical care in Louisiana were typical of acute exposure to hydrocarbons or H_2S (e.g., headaches, dizziness, nausea, vomiting, cough, respiratory distress, and chest pain) (Solomon and Janssen, 2010). Impacts associated with a large oil spill to public safety are expected to be adverse but not 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, 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. 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 (2017a, b). For this EP, 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.

In addition to the analyses presented by BOEM (2012a), a study explored the economic impacts of the Macondo spill on oil and gas industry employment due to suspension of deepwater drilling (U.S. Department of Commerce, 2010). The study indicates that during the moratorium, the number of oil industry workers in the Gulf of Mexico fell by approximately 2,000, and may have indirectly caused a temporary loss of 8,000 to 12,000 jobs along the Gulf Coast. The total spending by drilling operators is estimated to have declined by $1.8 billion over a 6-month period; this direct reduction in spending affected employment in the industries that supply the Gulf drilling industry and in all other industries affected by declines in consumer and business spending (U.S. Department of Commerce, 2010).

As noted by BOEM (2012a), the potential short-term social and economic consequences for the Gulf Coast region should a large spill occur include the opportunity cost of employment and expenditures that could have gone to production or consumption rather the spill cleanup efforts. 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

Table 8. (Continued).

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).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Considering that a large spill is unlikely, no significant spill impacts on employment and infrastructure are expected.

C.8.4 Recreation and Tourism

For this EP, there are no unique site-specific issues with respect to recreation and tourism. There are no known recreational or tourism uses in the lease 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 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 breaking up. Therefore, a small fuel spill in the lease 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, b). For this EP, 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. The 30-day OSRA modeling (**Tables 3** and **4)** predict that some Texas and Louisiana shorelines could be contacted by a spill within 30 days of a spill. The coastal areas most likely to be affected would be Matagorda County, Texas, and Cameron Parish, Louisiana (2% probability of shoreline contact within 30 days). The 60-day OSRA (**Table 5**) predicts that shorelines between Cameron County, Texas, and Miami-Dade County, Florida, have up to a 13% conditional probability of contact within 60 days of a spill occurring (Terrebonne Parish, Louisiana).

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. In the unlikely event that a spill occurs that is sufficiently large to affect 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 Macondo spill on recreation and tourism provide some insight into the potential effects of a large spill. NOAA (2016b) 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 Macondo spill 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).

Table 8. (Continued).

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on recreation and tourism are expected.

C.8.5 Land Use

Land use along the northern Gulf Coast is discussed by BOEM (2017a). There are no routine IPFs potentially affecting land use. The project will use existing onshore support facilities in Louisiana. 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 Macondo spill, 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 lease 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) state 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 Macondo spill 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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on land use are expected.

C.8.6 Other Marine Uses

The lease area is not located within any USCG-designated fairway, shipping lane, or military warning area. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircrafts.

No man-made infrastructure was found within 2,000 ft (610 m) of the proposed wellsites for this project (Gardline Surveys, 2018). There are no IPFs from routine project activities that are likely to affect shipping or other marine uses. A large oil spill is the only relevant accident IPF. A small fuel spill would not have impacts on other marine uses because the spill and response activities would be mainly within the lease area, and the duration would be brief.

Table 8. (Continued).

Impacts of a Large Oil Spill

An accidental spill would be unlikely to significantly affect shipping or other marine uses. The lease block is not located within any USCG-designated fairway, shipping lane, or military warning area. In the event of a large spill requiring numerous response vessels, coordination would be required to manage the vessel traffic for safe operations. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

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 **EP Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **EP Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on other marine uses are expected.

C.9 Cumulative Impacts

For purposes of NEPA, cumulative impact is defined as "the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions" (40 CFR 1508.7). Any single activity or action may have a negligible impact(s) by itself, but when combined with impacts from other activities in the same area and/or time period, substantial impacts may result.

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 cumulative impacts of OCS exploration activities similar to those planned in this EP in several documents. The level and types of activities planned in Shell's EP are within the range of activities described and evaluated by BOEM (2012a, 2012b, 2013, 2014a, 2015, 2016a, 2016b, 2017a, b). Past, present, and reasonably foreseeable activities were identified in the cumulative effects scenario of 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 Activities Reasonably Expected 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, 2014a, 2015, 2016b, 2017a, b).

Cumulative Impacts of Activities in the Supplemental Exploration Plan. The BOEM (2017a) Final EIS included a lengthy discussion of cumulative impacts, which analyzed the environmental and socioeconomic impacts from the incremental impact of the 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 cumulative effects 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 EP, 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 cumulative impacts analysis in these prior analyses is not significant.

C.9.1 Cumulative Impacts to Physical/Chemical Resources

The work planned in this EP is limited in geographic scope and the impacts on the physical/chemical environment will be correspondingly limited.

Table 8. (Continued).

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 to the cumulative impacts is not significant and will not cause or contribute to a violation of NAAQS (BOEM, 2012a, 2013, 2014a, 2015, 2016b, 2017a, b). In addition, the cumulative 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 cumulative impacts 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 EP 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 water based drilling fluids and associated cuttings, cuttings wetted with SBM, treated sanitary and domestic wastes, deck drainage, desalination unit discharge, blowout preventer fluid, non-contaminated well treatment and completion fluids, ballast water, bilge water, hydrate inhibitor, excess cement slurry, fire water and non-contact cooling water. These effects are expected to be minor (localized to the area within a few hundred meters of the MODU) and temporary (lasting only hours longer than the disturbance or discharge). Any cumulative effects to water quality are expected to be negligible.

Archaeological Resources. The lease blocks are not on the list of archaeology survey blocks (BOEM, 2011). No known shipwrecks or other archaeological artifacts were identified during the wellsite geohazard assessment (Gardline Surveys, 2018). The lease area is well beyond the 60 m (197 ft) 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 cumulative impacts on historic shipwrecks or prehistoric archaeological resources.

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2012a, 2013, 2014a, 2015, 2016a, b, 2017a, b) has been incorporated into the EIA, where applicable.

C.9.2 Cumulative Impacts to Biological Resources

The work planned in this EP 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 geophysical survey data did not identify any features that could support high-density deepwater benthic communities within 2,000 ft (610 m) of the proposed drilling locations.

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

Table 8. (Continued).

cumulative impacts is not determined to be significant (BOEM, 2012a, b, 2013, 2014a, 2015, 2016b, 2017a, b).

Threatened, Endangered, and Protected Species. Threatened, endangered, and protected species that could occur in the lease area include one species of marine mammal, one species of shark, and five species of sea turtles. Potential impact sources include MODU presence including noise and lights, marine debris, and support vessel and aircraft 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. No significant cumulative impacts 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 drilling activities, collisions or other adverse effects are unlikely, and no significant cumulative impacts are expected.

Fisheries Resources. Exploration and production structures occur in the vicinity of the lease area. The additional effect of the proposed drilling activity would be negligible.

Coastal Habitats. Due to the distance of the wellsites 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, 2014a, 2015, 2016a, b, 2017a, b) has been incorporated into the EIA, where applicable.

C.9.3 Cumulative Impacts to Socioeconomic Resources

The work planned in this EP 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 cumulative impacts of oil and gas exploration and development in the lease 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, 2014a, 2015, 2016b, 2017a, b). 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 cumulative impacts 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.

Table 8. (Continued).

New Information. New information included in the most recent Programmatic, Supplemental, and Final EISs (BOEM, 2012a, b, 2013, 2014a, 2015, 2016a, b, 2017a, b) has been incorporated into the EIA, where applicable.

D. Environmental Hazards

D.1 Geologic Hazards

The wellsite assessment report prepared by Gardline Surveys (2018) concluded that wellsite locations are suitable for the proposed exploratory drilling activities, and no seafloor obstructions or conditions were found that would constrain the proposed project activities.

See **EP 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. 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 for safety reasons until the storm or weather event passes. 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 states, 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. 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 for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in this EP. However, various technical and operational options, including the location of the wellsites and the selection of a MODU, 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

Table 8. (Continued).

activities will be conducted under Shell's OSRP and will include the measures described in **EP 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:

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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 depth
Section 2J Blowout Scenario – confidential information for NTL 2015 N01 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 with Time vs. depth table

B. Bibliography

CSA Environmental Impact Analysis

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