UNITED STATES GOVERNMENT July 9, 2014
MEMORANDUM

To: Public Information (MS 5030)

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

Subject: Public Information copy of plan

Control # - N-09718

Type - Initial Development Operations Coordinations Document

Lease(s) - OCS-G17001 Block - 508 Walker Ridge Area
OCS-G18730 Block - 507 Walker Ridge Area
OCS-G21861 Block - 551 Walker Ridge Area

Operator - Shell Offshore Inc.

Description - FPSO and Subsea Wells G and N (WR 507) and J, K, L, M, O, P, Q (WR 508)

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.

Michelle Griffitt
Plan Coordinator

Site Type/Name	**Botm Lse/Area/Blk**	**Surface Location**	**Surf Lse/Area/Blk**
FPSO/FPSO		3556 FNL, 4964 FWL	G21861/WR/551
FPSO/STONES		3556 FNL, 4964 FWL	G21861/WR/551
WELL/G	G18730/WR/507	4323 FSL, 5372 FWL	G17001/WR/508
WELL/J	G17001/WR/508	4362 FSL, 5340 FWL	G17001/WR/508
WELL/K	G17001/WR/508	4502 FSL, 5384 FWL	G17001/WR/508
WELL/L	G17001/WR/508	4347 FSL, 5292 FWL	G17001/WR/508
WELL/M	G17001/WR/508	4467 FSL, 5425 FWL	G17001/WR/508
WELL/N	G18730/WR/507	4367 FSL, 5397 FWL	G17001/WR/508
WELL/O	G17001/WR/508	4447 FSL, 5475 FWL	G17001/WR/508
WELL/P	G17001/WR/508	4516 FSL, 5435 FWL	G17001/WR/508
WELL/Q	G17001/WR/508	4368 FSL, 5368 FWL	G17001/WR/508

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Public Information Copy

April 26, 2013

Ms. Liz Peuler, Section Chief
Bureau of Ocean Energy Management
1201 Elmwood Park Blvd.
New Orleans, LA 70123-2394

Attn: Plans Group GM 1053C

SUBJECT: Initial Development Operation Coordination Document (DOCD)
Walker Ridge 508 Unit No. 754306006
Offshore, Louisiana

Dear Ms. Peuler:

In compliance with 30 CFR 550.211 and NTLs 2008-G04, 2009-G27 and 2010-N06, giving plan guidelines, Shell Offshore Inc. (Shell) requests your approval of this Initial DOCD to commence production for wells drilled and completed under Exploration Plan S-7599 and for infrastructure and FPSO host installation. Operations could commence as early as November 2014.

Please note that the AQR spreadsheet (Section 8) proposes two (2) site-specific VOC emission factors that are above the BOEM AQR default emission factors. These site-specific emission factors, which were developed with process knowledge and computer simulation tools, will account for: 1) Venting from the Shuttle Tanker that occur during the transfer of crude oil from the FPSO to the Shuttle Tanker and 2) the VOC emissions that occur during the Cargo Tank Purging and Gas Freeing - Maintenance Activities on-board the FPSO. Also, we are attaching the Conceptual DWOP approval letter to the Proprietary Copy of the plan.

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 receipt is attached to the Proprietary copy of the plan.

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

Sincerely,

Sylvia A. Bellone

Sylvia A. Bellone

SHELL OFFSHORE INC.

INITIAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT (DOCD)

for

Walker Ridge 508 Unit No. 754306006

OCS-G 18730, Walker Ridge Block 507
OCS-G 17001, Walker Ridge Block 508
OCS-G 18731, Walker Ridge Block 509
OCS-G 21861, Walker Ridge Block 551
OCS-G 18737, Walker Ridge Block 552
OCS-G 17004, Walker Ridge Block 553
OCS-G 21862, Walker Ridge Block 596
OCS-G 26409, Walker Ridge Block 597

PUBLIC INFORMATION COPY

APRIL 2013

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
RFI No. 1			
6/3/2013	Section 1	Correct plans forms to reflect S-7599 & anchor length	6/17/2013
		Cost recovery fee (Proprietary only)	
		Reference to number of wells	
	Section 2	Reference to S-7599	
	Section 6	Note future PA wells and add ESR from SEP	
	Section 9	Edit OSRP statement	
	Section 13	Added ports for refineries	
	Section 17	Added MS & AL CZM	
	Section 18	Reference 9 wells	
RFI No. 2			
7/16/2013	Section 2E	New and unusual technology	1/09/2014
RFI No. 3			
1/29/2014	Section 6	Requested Arch survey	1/31/2014
RFI No. 4			
2/19/2014	Section 6	Requested Assessment Survey	2/20/2014
	Section 7	Tables 7A and 7B	2/20/2014
RFI No. 5			
3/10/2014	Section 8	AQR clarification	3/20/2014
RFI No. 6			
4/23/2013	Section 8	AQR calculations	4/24/2014
6/3/2014	Provided full copy of plan to BOEM		

INITIAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT (DOCD)
WALKER RIDGE 508 UNIT No. 754306006
OFFSHORE, LOUISIANA

TABLE OF CONTENTS

Acronyms and Abbreviations

ADIOS	Automated Data Inquiry for Oil Spills
APD	Application for Permit to Drill
bbl	barrel
BMA	Bahamas Maritime Authority
BOEM	Bureau of Ocean Energy Management
BOEMRE	Bureau of Ocean Energy Management, Regulation and Enforcement
BOPD	barrels of oil per day (bbl/day)
BPD	barrels per day
BSEE	Bureau of Safety and Environmental Enforcement
CFR	Code of Federal Regulations
CH_4	methane
CPP	controllable pitch propeller
CO	carbon monoxide
CO_2	carbon dioxide
DOCD	Development Operations Coordination Document
DPS	distinct population segment
EFH	Essential Fish Habitat
EIA	Environmental Impact Analysis
EIS	Environmental Impact Statement
ESA	Endangered Species Act
FAD	fish-attracting device
FGCI	Fugro GeoCounsulting, Inc.
FGSI	Fugro GeoServices, Inc.
FPSO	floating production, storage, and offloading vessel
GEMS	Geoscience Earth & Marine Services, Inc.
GMFMC	Gulf of Mexico Fishery Management Council
H_2S	hydrogen sulfide
HAPC	Habitat Area of Particular Concern
IPF	impact-producing factor
MARPOL	International Convention for the Prevention of Pollution from Ships
MC	Mississippi Canyon
MMC	Marine Mammal Commission
MMcfd	Million cubic feet per day
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MWCC	Marine Well Containment Company
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NO_2	nitrogen dioxide
NO_x	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NPS	National Park Service
NRC	National Research Council
NTL	Notice to Lessees and Operators
NWR	National Wildlife Refuge
OCS	Outer Continental Shelf
OCSLA	Outer Continental Shelf Lands Act
OGP	International association of Oil and Gas Producers
OCIMF	Oil Companies International Marine Forum
OSAT	Operational Science Advisory Team
OSRA	Oil Spill Risk Analysis
OSRP	Oil Spill Response Plan
PAH	polycyclic aromatic hydrocarbon
PM	particulate matter
PLET	pipeline end termination
PSD	Prevention of Significant Deterioration
ROV	remotely operated vehicle
SBM	synthetic-based mud
SEA	Site-Specific Environmental Assessment
Shell	Shell Offshore Inc.
SLWR	steel lazy ware riser
SO_2	sulfur dioxide
SO_x	sulfur oxides
SPM	single point mooring
SWSS	Sperm Whale Seismic Study
TLP	tension leg platform
TUV	Technischer Überwachungsverein, or Technical Inspection Association
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
UTA	umbilical termination assembly
VOC	volatile organic compound
WCD	worst case discharge
WCEP	Whooping Crane Eastern Partnership
WMA	Wildlife Management Area
WR	Walker Ridge

SECTION 1: PLAN CONTENTS

A. DESCRIPTION, OBJECTIVES & SCHEDULE

Shell Offshore Inc. (Shell) is submitting a Development Operations Coordination Document (DOCD) for the Stones Unit in the Walker Ridge Area. The Stones Phase 1 project will consist initially of a nine well subsea development tied back to a Floating Production Storage and Offloading vessel (FPSO). Future tie-backs would be covered under a separate filing. The drilling and completion of the Stones production wells is covered under a separate previously filed Supplemental Exploration Plan for Walker Ridge Blocks 507 and 508 (Plan S-7599).

The lease area covers Walker Ridge Blocks 507, 508, 509, 551, 552, 553, 596, and 597. The development area is 178 miles from the nearest shoreline, 193 miles from the onshore support base at Port Fourchon, Louisiana, and 221 miles from the helicopter base at Amelia, Louisiana. The water depths at the well site ranges from 9,550′ to 9,558′.

This initial DOCD will cover the installation of the subsea equipment including anchors, umbilicals, flowlines, manifolds, PLETs, UTAs and flying leads necessary to produce the subsea wells, and a seafloor artificial lift pump system. This DOCD will also cover installation of the FPSO, its buoy, associated moorings, production risers, flowlines and commence production of the wells included in this plan. Shell's plan, as detailed in this DOCD, is to begin installation activities November 2014. The proposed activity schedule is an estimate based on the best available information, and is not intended to be a limitation. Installation of the subsea equipment will be accomplished with a non-anchored pipeline lay barge supported by tug boats, supply vessels and helicopters as detailed in Section 14 of this DOCD. Installation of the FPSO will be handled by a pile installation vessel, crane vessel, and associated transport vessels and tugs as detailed in Section 14 of this DOCD.

Shell has employed or contracted with trained personnel to carry out these installation 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 developing for oil and gas in the Gulf of Mexico. Shell will draw upon this experience in organizing and carrying out its planned development. Shell believes 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) detailed in Section 9 of this DOCD. The worst case discharge does not take into account potential flow mitigating factors such as well bridging, obstructions in the wellbore, reservoir barriers, or early intervention. Shell continues to invest in Research and Development to improve safety and reliability of 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 plats (Attachments 1A and 1B) for field layout and FPSO anchors. The drilling and completing of the wells was covered in a previous plan, but we are providing the surface and bathymetry maps are found in Attachment 1C and BHL plat found in Attachment 1D of proprietary copy. BOEM forms are Attachments 1E through 1Q.

C. SAFETY AND POLLUTION FEATURES:

The FPSO and shuttle tanker will have the following features:

- The development of the Stones FPSO will include design and operational safety cases, per Shell's internal requirements, which include detailed assessments of all major hazards.

- The production facility will have drip pans under hydrocarbon equipment to minimize the potential loss of fluids through grated openings. All fluid containing vessels will have drain valves and drip pans to control and collect any potential spill as a result of maintenance activities.

- The facility will utilize an open drain system as the primary control of potential spills. In order to prevent migration of hazardous materials and flammable gas, hazardous (flammable) and non-hazardous drains will be collected independently based on their hazard classification. Hazardous drains go to an open drain pre-sump (separator); separated water is routed to the Sump Caisson. Skimmed oil will be recovered and returned (pumped) to the process. Non-hazardous drains go directly to the sump caisson.

- The hazardous and nonhazardous open drain systems shall be provided with separate collection tanks. The tanks will be fitted with weirs to promote oil and water separation before water is discharged overboard. The open drain tanks shall discharge to the sea using gravity. The deck open drain systems are designed to collect and contain rainwater, runoff, and liquid spills in drip pan areas. They are operated as an atmospheric drain system.

- Produced water (PW) will be treated by hydrocyclone, followed by flotation cell for overboard disposal. The design maximum dispersed oil in water specification will comply with the statutory limit of less than 29 mg/l. Off-Spec PW shall be discharged to a hull tank where it shall be heated and allowed to settle before being discharged overboard via gravity and oil discharge monitoring equipment (ODME) or pumped back to the process system for further treatment. Separated oil will be skimmed and pumped to the crude oil tanks.

- A marine pollution (MARPOL) compliant oily water separator will be utilized for overboard disposal of water from machinery spaces.

- In the event of an emergency, the topsides facility has a blowdown and shut-down system designed to isolate and depressurize hydrocarbons in order to limit the amount of inventory exposed to the event. Upon fire or confirmed gas detection, emergency shutdown valves strategically located to isolate critical topsides equipment will isolate the process. The emergency shutdown system also de-energizes rotating equipment (compressors, pumps, etc.) which limits any discharges emanating from these sources. If necessary a blowdown system can be activated to de-pressure the topsides via the flare system and limit the gas inventory in process vessels.

- Each riser (2 production risers and the gas import/export riser) is equipped with an shut-down valve (SDV) and a manually operated XV at the top of the buoy. The SDVs are remotely operated and tied into the emergency shutdown system on the FPSO.

- The gas import/export pipeline has a departing shutdown valve located immediately downstream of the gas pig launcher/receiver. The departing valves are remotely operated and tied to the emergency shutdown system on the FPSO.

- The FPSO will have a double hull (bottom and sides) in way of the cargo tanks and shall be compliant with OPA 90. The arrangements for fuel tanks within the hull will comply with MARPOL 12A. The space between the cargo tanks and the outer shell shall be used as water ballast tanks. A void space shall be located between cargo tanks and the turret moonpool.

- The shuttle tanker will have a double hull (bottom and sides) compliant with the requirements of OPA 90; the hull will be outfitted with segregated cargo tanks.

- Crude oil storage tanks in the hull of the FPSO and shuttle tanker will have level indicators and high level switches/alarms designed to monitor and prevent overfill of the tanks during filling operations.

- FPSO hull stresses and stability will be managed via a computerized system.

- Oil will be transferred to the shuttle tanker via a double carcass OCIMF compliant hose. An offloading emergency shutdown system (ESD) shall be included in the design that shall monitor specific system parameters on the FPSO and shuttle tanker.

- Offloading operations will be monitored by competent persons of the FPSO and shuttle tanker crews.

- The FPSO will have a Hydrocarbon Gas Cargo Blanketing System that will be supplied gas from the fuel gas system. In the event that the fuel gas is not available, the cargo tanks will be blanketed using the inert gas systems. Overpressure and underpressure of the cargo tanks will be managed by redundant devices (pressure transmitters, alarms, interlocked valves, liquid seals, etc).

- The shuttle tanker will have an inert gas system.

- The FPSO and shuttle tanker will have Crude Oil Washing (COW) Systems for the cargo tanks.

- The FPSO sewage collection and treatment system is designed to work efficiently at maximum occupancy and comply with statutory regulations. Sanitary waste will be treated in a USCG Type II marine sanitation device and discharged in compliance with NPDES Permit conditions.

- FPSO disconnections will be performed with zero hydrocarbon release to the environment; each hydrocarbon connection between the turret and buoy will be equipped with the means to isolate and purge the connection prior to release of the buoy.

- The turret/buoy connection system shall be fully tested prior to being incorporated into the FPSO spread mooring system and will allow for independent periodic scheduled in-situ testing of the connector system without disconnecting the buoy.

- The turret moonpool area will be designed with the appropriate systems and facilities to accommodate periodic occupation (ventilation, lighting, access walkways/ladders, two independent escape routes, fire and gas (F&G) detection, firefighting, etc).

- Confirmation of whether or not the turret/buoy connection devices have functioned properly will be possible via position indicators and remote video monitors.

- After reconnection of the buoy, and prior to the introduction of hydrocarbons, the integrity of all hydrocarbon flowpaths' connections will be verified (i.e. leak testing or other approved method).

- Close circuit TV (CCTV) will be located within the turret moonpool to view critical system devices during normal operations, reconnection and disconnection, and while underway.

- Some additional measures are noted in Section 2(E) – New and Unusual Technology of this DOCD.

The FPSO mooring system will have the following features:

- An ROV survey of the synthetic mooring system will be performed before the FPSO commences production, after the first year of service, after the passing of major storms, and at 5-year intervals.

- The mooring system will be designed such that the polyester rope does not come into contact with the seabed during normal operations or any extreme events within the design. To impede particle ingress, the rope design incorporates soil filters that cover the sub-ropes and an outer jacketing on the overall rope to ensure that particles larger than 5 microns cannot penetrate the double jacket to the load bearing fibers.

- Vessels requesting to enter the 500m Zone will be strictly controlled by operating procedures and checklists prior to entry being allowed. Any vessel that appears to be moving towards the FPSO mooring pattern will be contacted via Marine VHF radio on the general calling frequency (Channel 16) or dedicated frequency for the facility. The instructions on the 500 meter zone procedure will advise any vessels entering not to lower any anchor, rope, chain, or wire over the side without discussing/agreeing with the facility Offshore Installation Manager (OIM). Nautical charts will have an update provided to ensure that the facility is marked, and that the restricted areas are identified via Admiralty and USCG nautical publications and chart corrections.

- Procedures and instrumentation will be in place on the FPSO to evaluate permanent elongation of the moorings. If necessary, the re-tensioning of the mooring lines will be performed using the In Line Mooring Connector (ILMC).

- The mooring system is designed such that it can function properly in the event one mooring line is damaged or removed.

- Some additional measures are noted in Section 2(E) – New and Unusual Technology of this DOCD.

The subsea facilities and gas pipeline system will have the following features:

- Subsea equipment will be provided with pressure indicators to detect upset conditions. Provisions have been made for installing remotely operated valves at the tree and manifold capable of isolating each piece of equipment and limiting the volume of a spill in the event of loss of containment.

- The subsea system follows the BSEE barrier concept for isolation. As such, each of the two incoming flowlines is configured with a Boarding Shut-Down Valve meeting the design and testing requirements of NTL No. 2009-G36.

- The subsea control modules will use an electro hydraulic multiplexed pod with high speed fiber optic communication between topside and subsea. Controls and instrumentation for the subsea pumps system will comply with NTL 2011-N11, and will be utilized for alert, interlock, and shutdown functions for certain conditions. Testing for controls and instrumentation will be performed per regulatory requirements.

- A comprehensive motion analysis will be performed for the subsea riser system to verify the design properly accommodates dynamic performance of the FPSO and environmental conditions at the site.

- There is a manual subsea valve located on the sea floor of the gas export pipeline that can be used to isolate the pipeline from the FPSO; the operation of the valve is via a ROV.

- Some additional measures are noted in Section 2(E) – New and Unusual Technology of this DOCD.

D. Storage Tanks and Production Vessels

The table below provides information on the tanks and production vessels that store 25 barrels or more of hydrocarbons during the development plan:

Type of Storage	Type of Facility	Tank Capacity (bbls)	Number of Tanks	Total Capacity (bbls)	Fluid Gravity (API)
Production Vessels					
1st Stage Separator	Gas/Oil/Water Separation	566	1	566	27
2nd Stage Separator	Gas/Oil/Water Separation	447	1	447	27
Well Test / Unloading Separator	Gas/Oil/Water Separation	289	1	289	27
Electrostatic Treater	Oil Separation	835	1	835	27
High Pressure Flare Scrubber	Gas/Oil Separation	445	1	445	27
Low Pressure Flare Scrubber	Gas/Oil Separation	445	1	445	27
Fuel Storage					
Helicopter Fuel Tank	Helicopter Fuel Storage	36	1	36	44
Diesel Storage Tank No 1. (port & stbd)	Diesel Fuel	1,906	2	3,812	35
Diesel Storage Tank No 2. (port)	Diesel Fuel	4,543	1	4,543	35
Diesel Storage Tank No 2. (stbd)	Diesel Fuel	6,495	1	6,495	35
Settling Tanks No 1 and 2 (port)	Diesel Fuel	449	2	898	35
Service Tanks No 1 and 2 (port)	Diesel Fuel	449	2	898	35
Service Tank (port)	Diesel Fuel	239	1	239	35
Cargo Oil Tanks					
COT 2 (port)	Cargo Oil	94,102	1	94,102	27
COT 2 (stbd)	Cargo Oil	94,008	1	94,008	27
COT 3 (port)	Cargo Oil	94,599	1	94,599	27
COT 3 (stbd)	Cargo Oil	94,504	1	94,504	27
COT 4 (port)	Cargo Oil	94,599	1	94,599	27
COT 4 (stbd)	Cargo Oil	94,504	1	94,504	27
COT 5 (port)	Cargo Oil	94,599	1	94,599	27
COT 5 (stbd)	Cargo Oil	94,504	1	94,504	27
COT 6 (port)	Cargo Oil	88,479	1	88,479	27
COT 6 (stbd)	Cargo Oil	88,391	1	88,391	27

Note: The information included in table above (Storage Tanks and Production Vessels) is intended to identify the maximum amounts of hydrocarbons that may be included in the various tanks on the FPSO at any given time. The total inventories of hydrocarbons in the topsides tanks and process piping systems is estimated at 24,748 barrels (19,948 barrels for topsides tanks and 454 barrels for process piping) as described in Section 9, Worst Case Discharge Table.

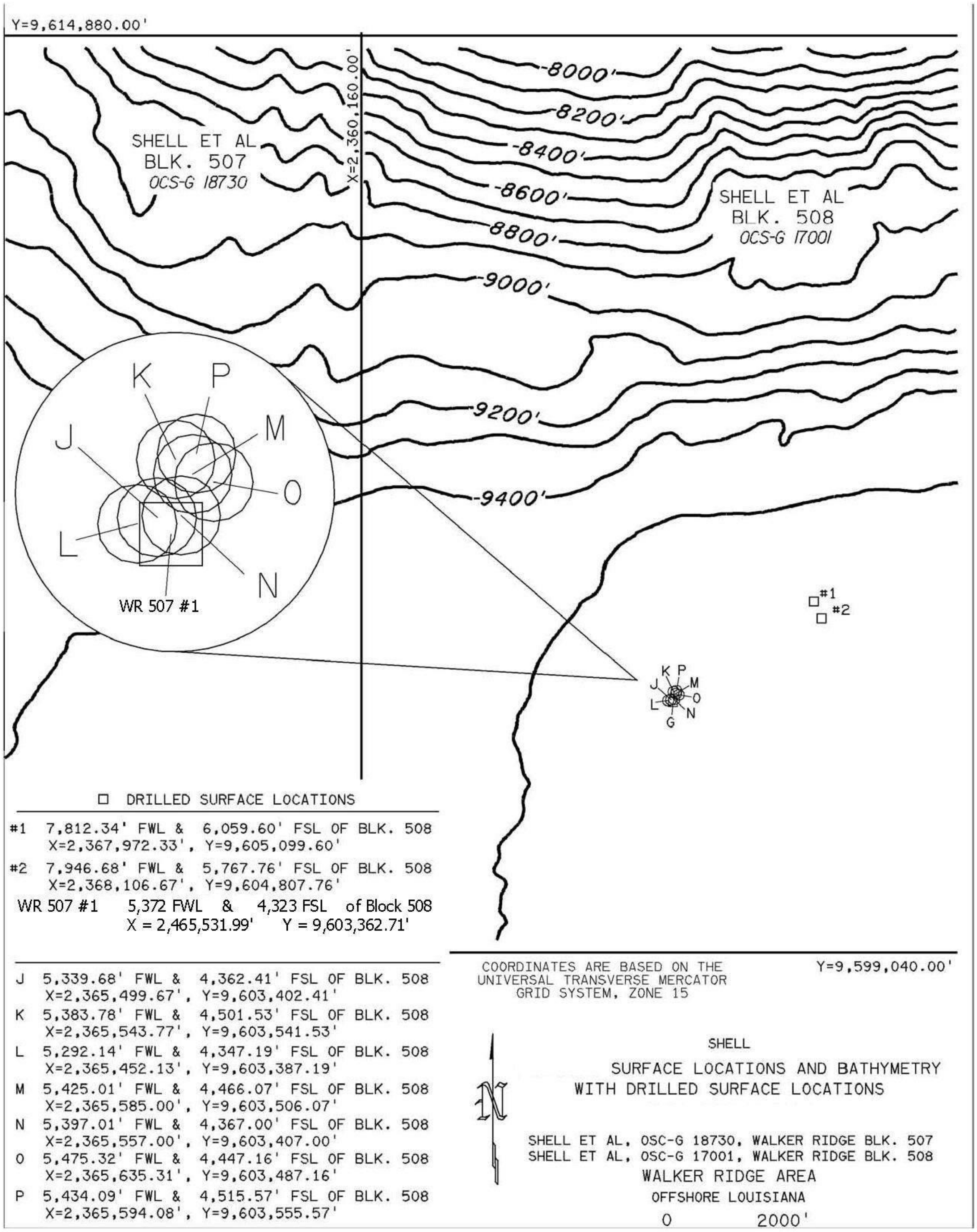
E. Pollution Prevention Measures

Florida is not an affected state for this project. As a result, a discussion of the measures to prevent the discharge of oil and greases from drilling rigs or platforms during rainfall and routine operations is not required pre NTL 2008-G04.

F. Additional Measures

- Health Safety and Environment (HSE) are key topics in pre-tour and pre-job safety meetings. No harm to people and protecting the environment are underlying commitments for the operation of the facility. 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 facility will have their pollution pans inspected, cleaned and confirmation of plugs installed prior to leaving the dock.
- Preventive maintenance of facility equipment will include visual inspection of hydraulic lines and reservoirs on routine scheduled basis.
- All pollution pans and drains on the facility will be inspected daily.
- All trash containers will be checked and emptied daily. The trash containers will be kept covered. Trash will be disposed of in a compactor and shipped in via boat.
- Fuel hoses are changed on an annual basis.
- Shell has obtained ISO14001 certification.
- Low sulfur fuel will be utilized to reduce air pollutant impacts

Attachment 1C – Surface & Bathymetry Plat



Attachment 1D – BHL Plat

PROPRIETARY DATA

Attachment 1E

U. S. Department of the Interior
Bureau of Ocean Energy Management

OMB Control Number: 1010-0151
OMB Approval Expires: December 31, 2014

OCS PLAN INFORMATION FORM

General Information

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

Company Name: Shell Offshore Inc.	BOEM Operator Number: 0689
Address: P. O. Box 61933	Contact Person: Tracy Albert
New Orleans, LA 70161-1933	Phone Number: 504.425.4652
	E-Mail Address: tracy.albert@shell.com

Lease(s): OCS-G 18730 & 17001	Area: Walker Ridge	Block(s): 507 & 508	Project Name (If Applicable): Stones

Objective(s):	X	Oil		Gas		Sulphur		Salt	Onshore Base: Fourchon & Amelia, LA	Distance to Closest Land (Miles): 178

Description of Proposed Activities (Mark all that apply)

	Exploration drilling		Development drilling
	Well completion		Installation of production platform
	Well test flaring (for more than 48 hours)	X	Installation of production facilities (FPSO)
	Installation of caisson or platform as well protection structure		Installation of satellite structure
X	Installation of subsea wellheads and/or manifolds	X	Commence production
X	Installation of lease term pipelines		Other (Specify and describe)

Have you submitted or do you plan to submit a Conservation Information Document to accompany this plan?		Yes	X	No
Do you propose to use new or unusual technology to conduct your activities?	X	Yes		No
Do you propose any facility that will serve as a host facility for deepwater subsea development?	X	Yes		No
Do you propose any activities that may disturb a BOEM-designated high-probability archaeological area?		Yes	X	No
Have all of the surface locations of your proposed activities been previously reviewed and approved by BOEM?		Yes	X	No

Tentative Schedule of Proposed Activities

Proposed Activity	Start Date	End Date	No. of Days
See attached schedule			

Description of Drilling Rig				Description of Production Platform			
	Jackup		Drillship		Caisson		Tension leg platform
	Gorilla Jackup		Platform rig		Well protector		Compliant tower
	Semisubmersible		Submersible		Fixed platform		Guyed tower
	DP Semisubmersible		Other (Attach Description)	X	Subsea manifold	X	Floating production system
Drilling Rig Name (If Known): NA					Spar		Other (Attach Description)

Description of Lease Term Pipelines

From (Facility/Area/Block)	To (Facility/Area/Block)	Diameter (Inches)	Length (Feet)
WR 508 FPSO Flowline #1	WR 551	8.625”	19,586’
WR 508 FPSO Flowline #2	WR 551	8.625”	18,973’
Umbilicals 1 & 2 WR 508	WR 551	10.7”	15,677 & 13,711
Flowline jumpers A & B (WR 508)	WR 508	8.625”	100’ & 50’
Subsea Manifold WR 508	WR 508	8.625”	50’
Well jumpers (8)	WR 508	8.625	45’ to 100’

Form BOEM-0137 (December 2011-Supercedes all previous editions of form BOEM-0137 which may not be used.)

Attachment 1F – Schedule

Activity	Start Date	End Date	Days
Stones Subsea Pre Installation of Piles, Production Manifolds, PLETs, Production Flowlines, Pipelines, Risers, PLETs, Manifolds	11/01/14	02/28/15	120
Umbilical and SDH Installation	03/01/15	4/02/2015	32
Precommissioning FPSO in shipyard, and commence turret and mooring installation	10/31/2014	04/15/15	105
Umbilical, Flowline, Pipeline Riser Recovery and Handover	07/1/15	08/10/15	42
Install flowline / Pipeline Jumpers	12/31/2014	09/23/15	27
Offshore Hookup & Commissioning	10/09/15	12/09/15	83
First Oil	1/15/2016		
Install and commission seafloor artificial lift system	11/23/2018	1/26/2019	64

Attachment 1G

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

<table>
<tr><th colspan="6">Proposed Well/Structure Location</th></tr>
<tr><td colspan="2">Well or Structure Name/Number (If renaming well or structure, reference previous name): G
(Completion only) WR 507 No. 1 (see plan S-7599)</td><td colspan="4">Subsea Completion</td></tr>
<tr><td colspan="2">Anchor Radius (if applicable) in feet: N/A</td><td>X</td><td>Yes</td><td></td><td>No</td></tr>
</table>

	Surface Location	Bottom-Hole Location (For Wells)
Lease No.	OCS-G-17001	
Area Name	Walker Ridge	
Block No.	508	
Blockline Departures (in feet)	N/S Departure: 4,323' FSL	
	E/W Departure: 5,372' FWL	
Lambert X-Y coordinates	X: 2,365,531.99	
	Y: 9,603,362.71	
Latitude/ Longitude	Latitude : 26.4487	
	Longitude : 90.7834	

	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,553'

Anchor Locations for Drilling Rig or Construction Barge (**If anchor radius supplied above, not necessary**)

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

Form BOEM-0137 (December 2011-Supercedes all previous editions of form BOEM-0137 which may not be used.)

Attachment 1H

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location					
Well or Structure Name/Number (If renaming well or structure, reference previous name): J (see plan S-7599)			Subsea Completion		
Anchor Radius (if applicable) in feet: N/A			X	Yes	No

	Surface Location			**Bottom-Hole Location (For Wells)**
Lease No.	OCS-G-17001			
Area Name	Walker Ridge			
Block No.	508			
Blockline Departures (in feet)	N/S Departure: 4,362' FSL			
	E/W Departure: 5,340' FWL			
Lambert X-Y coordinates	X: 2,365,499.67			
	Y: 9,603,402.41			
Latitude/ Longitude	Latitude : 26.44876			
	Longitude : 90.783461			
	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,548'	

Anchor Locations for Drilling Rig or Construction Barge (**If anchor radius supplied above, not necessary**)

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

Paperwork Reduction Act of 1995 Statement: The Paperwork Reduction Act of 1995 (44 U.S.C. 2501 et seq.) requires us to inform you that BOEM collects this information as part of an applicant's Exploration Plan or Development Operations Coordination Document submitted for BOEM approval. We use the information to facilitate our review and data entry for OCS plans. We will protect proprietary data according to the Freedom of Information Act and 30 CFR 550.197. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid Office of Management and Budget Control Number. Responses are mandatory (43 U.S.C. 1334). The public reporting burden for this form is included in the burden for preparing Exploration Plans and Development Operations Coordination Documents. We estimate that burden to average 600 hours with an accompanying EP, or 700 hours with an accompanying DPP or DOCD, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the forms associated with subpart B. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, Bureau of Ocean Energy Management, 381 Elden Street, Herndon, VA 20170.

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Attachment 1I

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

<table>
<tr><th colspan="6">Proposed Well/Structure Location</th></tr>
<tr><td colspan="3">Well or Structure Name/Number (If renaming well or structure, reference previous name): K
(see plan S-7599)</td><td colspan="3">Subsea Completion</td></tr>
<tr><td colspan="3">Anchor Radius (if applicable) in feet: N/A</td><td>X</td><td>Yes</td><td>No</td></tr>
<tr><td></td><td>Surface Location</td><td colspan="4">Bottom-Hole Location (For Wells)</td></tr>
<tr><td>Lease No.</td><td>OCS-G-17001</td><td colspan="4"></td></tr>
<tr><td>Area Name</td><td>Walker Ridge</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td>508</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departures (in feet)</td><td>N/S Departure: 4,502’ FSL</td><td colspan="4"></td></tr>
<tr><td>E/W Departure: 5,384’ FWL</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Lambert X-Y coordinates</td><td>X: 2,365,543.77</td><td colspan="4"></td></tr>
<tr><td>Y: 9,603,541.53</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Latitude/ Longitude</td><td>Latitude : 26.44914</td><td colspan="4"></td></tr>
<tr><td>Longitude : -90.783403</td><td colspan="4"></td></tr>
<tr><td></td><td>TVD (Feet):</td><td colspan="2">MD (Feet):</td><td colspan="2">Water Depth (Feet): 9,555’</td></tr>
</table>

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

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

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Attachment 1J

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

<table>
<tr><th colspan="7">Proposed Well/Structure Location</th></tr>
<tr><td colspan="3">Well or Structure Name/Number (If renaming well or structure, reference previous name): L (see plan S-7599)</td><td colspan="4">Subsea Completion</td></tr>
<tr><td colspan="3">Anchor Radius (if applicable) in feet: N/A</td><td>X</td><td>Yes</td><td></td><td>No</td></tr>
<tr><td></td><td colspan="2">Surface Location</td><td colspan="4">Bottom-Hole Location (For Wells)</td></tr>
<tr><td>Lease No.</td><td colspan="2">OCS-G-17001</td><td colspan="4"></td></tr>
<tr><td>Area Name</td><td colspan="2">Walker Ridge</td><td colspan="4"></td></tr>
<tr><td>Block No.</td><td colspan="2">508</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Blockline Departures (in feet)</td><td colspan="2">N/S Departure: 4,347’ FSL</td><td colspan="4"></td></tr>
<tr><td colspan="2">E/W Departure: 5,292’ FWL</td><td colspan="4"></td></tr>
<tr><td>Lambert X-Y coordinates</td><td colspan="2">X: 2,365,452.13</td><td colspan="4"></td></tr>
<tr><td></td><td colspan="2">Y: 9,603,387.19</td><td colspan="4"></td></tr>
<tr><td rowspan="2">Latitude/ Longitude</td><td colspan="2">Latitude : 26.44872</td><td colspan="4"></td></tr>
<tr><td colspan="2">Longitude : -90.783689</td><td colspan="4"></td></tr>
<tr><td></td><td>TVD (Feet): 28,918’</td><td colspan="2">MD (Feet): 32,336’</td><td colspan="3">Water Depth (Feet): 9,553’</td></tr>
</table>

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

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

Paperwork Reduction Act of 1995 Statement: The Paperwork Reduction Act of 1995 (44 U.S.C. 2501 et seq.) requires us to inform you that BOEM collects this information as part of an applicant’s Exploration Plan or Development Operations Coordination Document submitted for BOEM approval. We use the information to facilitate our review and data entry for OCS plans. We will protect proprietary data according to the Freedom of Information Act and 30 CFR 550.197. An agency may not conduct or sponsor, and a person is not required to respond to, a collection of information unless it displays a currently valid Office of Management and Budget Control Number. Responses are mandatory (43 U.S.C. 1334). The public reporting burden for this form is included in the burden for preparing Exploration Plans and Development Operations Coordination Documents. We estimate that burden to average 600 hours with an accompanying EP, or 700 hours with an accompanying DPP or DOCD, including the time for reviewing instructions, gathering and maintaining data, and completing and reviewing the forms associated with subpart B. Direct comments regarding the burden estimate or any other aspect of this form to the Information Collection Clearance Officer, Bureau of Ocean Energy Management, 381 Elden Street, Herndon, VA 20170.

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Attachment 1K

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location					
Well or Structure Name/Number (If renaming well or structure, reference previous name): M (see plan S-7599)			Subsea Completion		
Anchor Radius (if applicable) in feet: N/A			X	Yes	No

	Surface Location		**Bottom-Hole Location (For Wells)**
Lease No.	OCS-G-17001		
Area Name	Walker Ridge		
Block No.	508		
Blockline Departures (in feet)	N/S Departure: 4,467' FSL		
	E/W Departure: 5,425' FWL		
Lambert X-Y coordinates	X: 2,365,585		
	Y: 9,603,506.7		
Latitude/ Longitude	Latitude : 26.44904		
	Longitude : -90.783278		
	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,558'

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)					
Anchor Name or No.	**Area**	**Block**	**X Coordinate**	**Y Coordinate**	**Length of Anchor Chain on Seafloor**

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Attachment 1L

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location				
Well or Structure Name/Number (If renaming well or structure, reference previous name): N (see plan S-7599)			Subsea Completion	
Anchor Radius (if applicable) in feet: N/A			X Yes	No

	Surface Location		Bottom-Hole Location (For Wells)
Lease No.	OCS-G-17001		
Area Name	Walker Ridge		
Block No.	508		
Blockline Departures (in feet)	N/S Departure: 4,367' FSL		
	E/W Departure: 5,397' FWL		
Lambert X-Y coordinates	X: 2,365,557		
	Y: 9,603,407		
Latitude/ Longitude	Latitude : 26.44873		
	Longitude : -90.783469		
	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,550'

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

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

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Attachment 1M

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Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location				
Well or Structure Name/Number (If renaming well or structure, reference previous name): O (see plan S-7599)			Subsea Completion	
Anchor Radius (if applicable) in feet: N/A			X Yes	No

	Surface Location		**Bottom-Hole Location (For Wells)**
Lease No.	OCS-G-17001		
Area Name	Walker Ridge		
Block No.	508		
Blockline Departures (in feet)	N/S Departure: 4,447' FSL		
	E/W Departure: 5,475' FWL		
Lambert X-Y coordinates	X: 2,365,635.31		
	Y: 9,603,487.16		
Latitude/ Longitude	Latitude : 26.44899		
	Longitude : -90.783125		
	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,556'

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

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

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Attachment 1N

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location						
Well or Structure Name/Number (If renaming well or structure, reference previous name): P (see plan S-7599)			Subsea Completion			
Anchor Radius (if applicable) in feet: N/A			X	Yes		No

	Surface Location			**Bottom-Hole Location (For Wells)**
Lease No.	OCS-G-17001			
Area Name	Walker Ridge			
Block No.	508			
Blockline Departures (in feet)	N/S Departure: 4,516' FSL			
	E/W Departure: 5,435' FWL			
Lambert X-Y coordinates	X: 2,365,594.8			
	Y: 9,603,555.57			
Latitude/ Longitude	Latitude : 26.44918			
	Longitude : -90.783244			
	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,554'	

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)					
Anchor Name or No.	**Area**	**Block**	**X Coordinate**	**Y Coordinate**	**Length of Anchor Chain on Seafloor**

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Attachment 1O

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location					
Well or Structure Name/Number (If renaming well or structure, reference previous name): Q (see plan S-7599)			Subsea Completion		
Anchor Radius (if applicable) in feet: N/A			X	Yes	No

	Surface Location		**Bottom-Hole Location (For Wells)**
Lease No.	OCS-G-17001		
Area Name	Walker Ridge		
Block No.	508		
Blockline Departures (in feet)	N/S Departure: 4,368' FSL		
	E/W Departure: 5,368' FWL		
Lambert X-Y coordinates	X: 2,365,528.09		
	Y: 9,603,408.17		
Latitude/ Longitude	Latitude : 26.448778		
	Longitude : -90.783456		
	TVD (Feet):	MD (Feet):	Water Depth (Feet): 9,554'

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)

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

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Attachment 1P

OCS PLAN INFORMATION FORM (CONTINUED)

Include one copy of this page for each proposed well/structure

Proposed Well/Structure Location						
Well or Structure Name/Number (If renaming well or structure, reference previous name): FPSO				Subsea Completion		
Anchor Radius (if applicable) in feet: 12,000' radius					Yes	No
	Surface Location		**Bottom-Hole Location (For Wells)**			
Lease No.	OCS-G 21861					
Area Name	Walker Ridge					
Block No.	551					
Blockline Departures (in feet)	N/S Departure: 3555.51' FNL					
	E/W Departure: 4964.28' FWL					
Lambert X-Y coordinates	X: 2,365,124.28					
	Y: 9,595,484.49					
Latitude/ Longitude	Latitude : 26.42700489					
	Longitude 26.42700489					
	TVD (Feet): NA	MD (Feet): NA		Water Depth (Feet): 9,554'		

Anchor Locations for Drilling Rig or Construction Barge (If anchor radius supplied above, not necessary)					
Anchor Name or No.	**Area**	**Block**	**X Coordinate**	**Y Coordinate**	**Length of Anchor Chain on Seafloor**
See attached					

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Attachment 1Q

FPSO ANCHOR COORDINATES

Anchor	Area/Block	X Coordinate	Y Coordinate	Length on seafloor*
FPSO Turret	WR 551	X = 2356124	Y = 9595484	NA
Line 1	WR 552	X = 2366028	Y = 9596993	200’
Line 2	WR 552	X = 2366119	Y = 9596124	200’
Line 3	WR 552	X = 2366138	Y = 9595250	200’
Line 4	WR 551	X = 2352484	Y = 9586166	200’
Line 5	WR 551	X = 2351686	Y = 9586519	200’
Line 6	WR 551	X = 2350921	Y = 9586941	200’
Line 7	WR 507	X = 2349866	Y = 9603307	200’
Line 8	WR 507	X = 2350570	Y = 9603825	200’
Line 9	WR 507	X = 2351319	Y = 9604277	200’

*In permanent installed position

SECTION 2: GENERAL INFORMATION

A. Application and Permits

There are no individual or site-specific permits other than those required by 30 CFR 250 (e.g., Surface Safety Application for Permit to Drill, Pipeline Permits) or USCG (e.g., Certificate of Compliance for foreign flagged FPSO, Certificate of Inspection for Shuttle Vessels). According to NTL 2008-G04, coverage under the National Pollutant Discharge Elimination System (NPDES) General Permit and Corps of Engineers (COE) permits are not described in this section.

B. Drilling Fluids

Drilling and completion operations are not proposed in this plan (see plan S-7599). See Section 7 for additional information.

C. Production

Type	Average Production Rate	Peak Production Rate	Reservoir Life
Oil	Proprietary data		
Gas			
Water			

D. Oil Characteristics

Area	Walker Ridge	Walker Ridge	Walker Ridge	Walker Ridge
Well	WR 508 #1	WR 508 #1	WR 508 #1	WR 508 #3
Well API	608124001500	608124001500	608124001500	608124003202
Sample Depth	26,666' MD	26,764' MD	27,132' MD	27,880' to 28,733' MD
Sample Date	19-Mar-05	21-Mar-05	19-Mar-05	Nov 11 to Nov 16, 2008
Sample Number	1.03	1.05	1.01	1.01 to 1.26
Gravity (API) ASTM D 1217-93 or 5002-99	25.9	28	23.5	26 to 30
Flash Point (deg C)	Not measured	Not measured	Not measured	Not measured
Pour Point (Deg F) ASTM D 97-02	7 Deg F	15 deg F	11 deg F	Not measured
Viscosity (cP) ASTM D 445-01	55 @ 70° F	26.71 @ 70° F	106.88 @ 70° F	4-5 cP at reservoir conditions
Boiling Point Distribution	Below	Below	Below	Not measured
Sulphur (wt%) ASTM D 4294-02	3.4	3.3	3.6	2.2 to 3.4
Saturates (wt%)	Not measured	Not measured	Not measured	27 to 37
Aromatics (wt%)	Not measured	Not measured	Not measured	51 to 57
Resins (wt%)	Not measured	Not measured	Not measured	7 to 10
Asphaltenes (wt%) ASTM D 4055-01	6.8	4.4	8.2	4 to 6

Boiling Point Distribution	WR508 #1 1.03	WR508 #1 1.05	WR508 #1 1.01
Fraction Recovered	Temp	Temp	Temp
Initial Boiling Point	61	81	94
5	213	209	243
10	303	291	316
15	376	352	382
20	442	416	442
25	501	472	493
30	533	515	539
35	546	542	572
40	572	552	610
45	600	589	657
50	646	623	702
55	695	667	747
60	746	713	791
65	796	759	834
70	845	805	878
75	896	850	926
80	950	898	974
85	1005	949	1024
90	1058	1003	1075
95	1112	1064	1134
Final Boiling Point	1187	1182	1221

E. New Or Unusual Technology

The following are the new or novel technologies identified for the project:

- FPSO concept with oil export to tandem moored shuttle tanker (See E.1)
- Disconnectable Turret (See E.2)
- Synthetic Mooring Lines (See E.3)
- Steel Lazy Wave Risers (See E.4)

E.1 FPSO concept with oil export to tandem moored shuttle tanker

The Stones FPSO is a disconnectable FPSO with a Buoy Turret Mooring (BTM) system. M.T Captain X. Kyriakou, a Suezmax crude oil tanker is being converted into a Floating Production Storage and Offloading (FPSO) unit by refurbishing the existing hull with modifications to hull and marine systems. Offloading of the crude oil to shuttle tankers will take place in a tandem mooring configuration. The vessel is moored at the turret by nine (9) mooring lines and anchored by suction piles. The turret provides weathervaning capability, allowing the FPSO to align itself with the resultant environment direction. The mooring lines, risers and umbilicals are connected to a disconnectable BTM buoy which is released and submerged to 100 meters below the MWL in the event of an approaching hurricane.

The main particulars and design features of the vessel are shown in Table below.

FPSO – General Parameters		
System	**Parameters**	**Comments**
Length overall (m)	274	
Length between perpendicular (m)	264.0	
Breadth (m)	48.0	
Depth (m)	23.2	
Draft (m)	16.8	
Displacement (t)	179,897	
Design Life	20 years	
FPSO Availability	95%	
Oil Production Capacity	60,000 bopd	
Water Production Capacity	30,000 bwpd	
Gas Production Capacity	15 MMscfd	
'Connected' Metocean Design Criteria	Design capable of Remaining connected through winter storms and sudden hurricanes.	
Disconnect Criteria	Hs 3.0m + wind + 1 yr loop current + 1 year TRW	Maximum environmental conditions in which disconnection can be executed with any combination of these four elements Hs=Significant Wave Height TRW=Topographic Rossby Wave
Propulsion and Maneuvering	Marine propulsion and navigation system required	FPSO shall be able to reconnect to disconnectable turret without assistance from another vessel.

FPSO – General Parameters		
System	**Parameters**	**Comments**
Classification Requirements	Hull, Marine, and Turret Mooring System	
Hull Form	Converted tanker, Double hull	
Propulsion and Maneuvering	Marine propulsion and navigation system required	FPSO shall be able to reconnect to disconnectable turret without assistance from another vessel.
Crude Storage Capacity (minimum during operation)	600,000 bbls	Export spec crude in hull. Excludes Slops Tanks, Off-Spec tanks, etc.
Dead Oil Storage Capacity	2,600 bbls	
Field Start-up / Commissioning Diesel Storage	5000 bbls	
External Hull Cathodic Protection System	Automatic ICCP System	Compatible with subsea system, flowline - riser system and BTM system. ICCP=Impressed Current Corrosion Protection

Table 1 – FPSO General Parameters Information

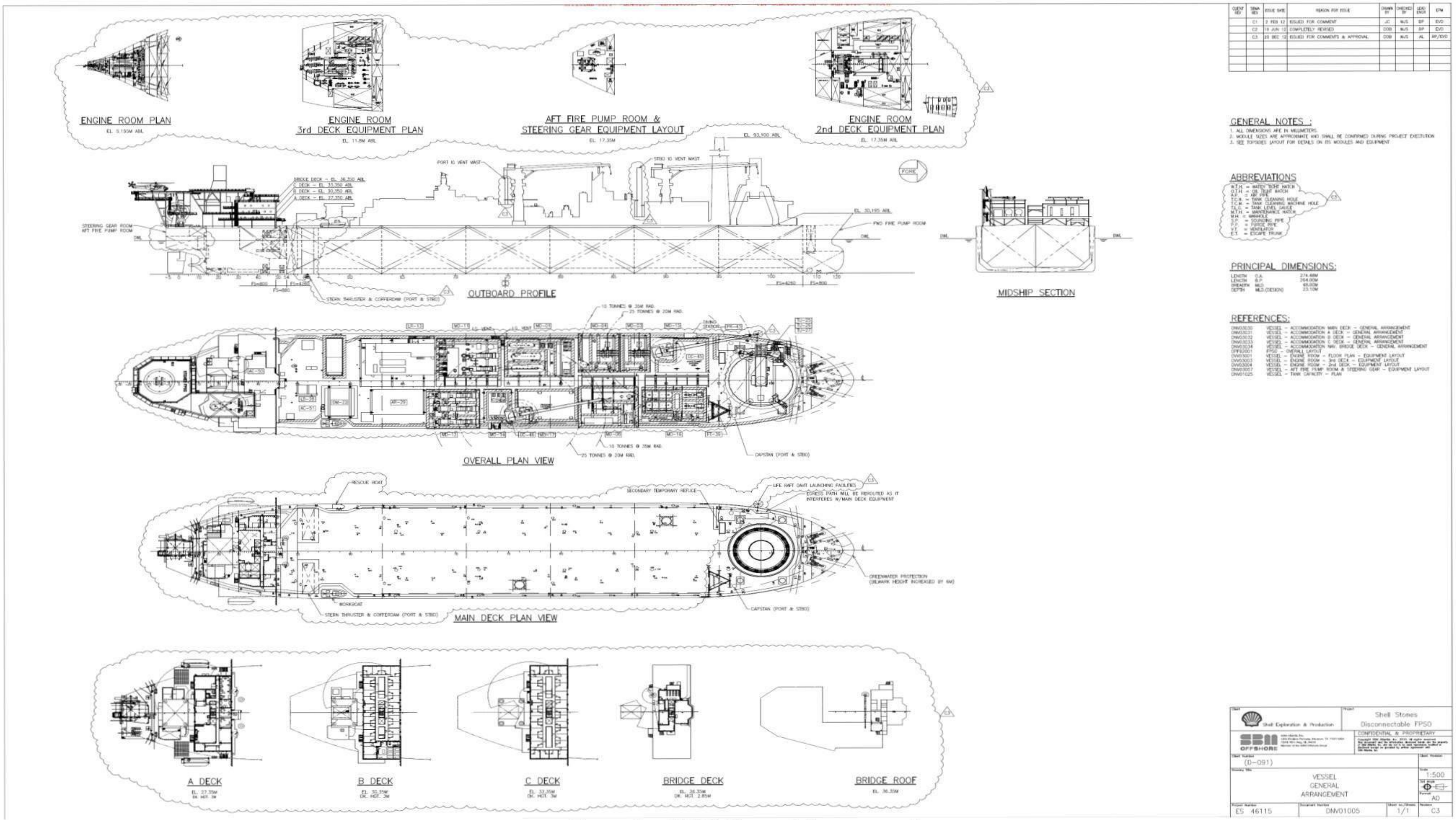


Figure 2 – FPSO General Arrangement

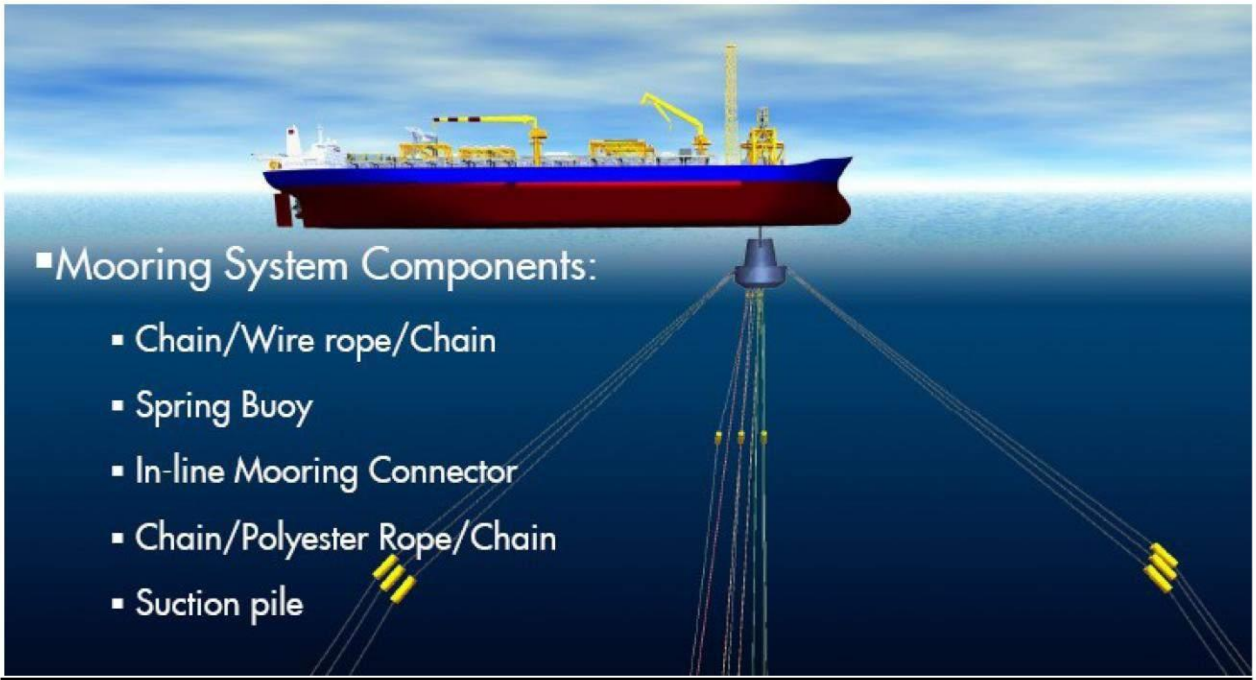


Figure 2 – Overview of Mooring System Components

E.2 Disconnectable turret

An internal disconnectable Buoyant Turret Mooring (BTM) system will be integrated to the hull into the two existing foremost cargo tanks of the vessel. The centerline of the turret will be located at Frame 99 within the moonpool, whose internal diameter is 27.0 m.

The turret will have the following attributes and design features:

- Designed to API RP-2A (WSD)
- Disconnectable internal turret with submersible buoy, full 360º rotation weathervaning capability and stationed via passive mooring system
- Utilizes a low pressure utility swivel (HP pumps on geostationary part of turret)
- Following a disconnect event, the turret buoy will be re-connected without assistance from other vessels
- Electro-optical utility swivel
- High Voltage power swivel (for future artificial lift system)
- Production/Test/Hot Oiling Swivels
- Gas export swivel
- Gas export pig launcher/receiver

Turret and Swivel Parameters		
System	**Parameters**	**Comments**
Type	Disconnectable Internal Turret – Submerged Buoy	
Number of Slots	2 x Production 1 x Gas Export 2 x Umbilical 2 x Future Production 2 x Future Umbilical	
Production Fluid Transfer System	Production header: Comingling of production is acceptable. Riser blowdown: From any riser to flare Production piping & swivels: Capability to produce and test at same time from any riser. Hot/dead oil: ability to pump hot/dead oil to a production riser and produce back through other riser.	

Table 2 – Turret and Swivels

The BTM turret comprises the following main components:

- Structural system, which transfers the load between the BTM buoy and the FPSO hull. It includes the turret cage, turret cylinder, the multi bogie bearing system, the bearing support structure, the manifold deck and the gantry.
- Weathervaning system (bearing for mooring loads and swivel stack for crude oil / gas export, hydraulic, power and utility paths).
- Fluid transfer system, transfers fluids from risers to topsides through the swivel stack
- Connection system, i.e. structural connectors (also known as locking devices), which maintains the BTM buoy connected to the turret cylinder body.
- BTM buoy, which includes the mooring chain fairleads, riser I-tubes, boarding valves, umbilical stab plates, etc. It is designed with sufficient buoyancy to support mooring lines and riser payload when BTM buoy is disconnected at and submerges to equilibrium at a depth of 100m.
- Lifting equipment.

The Disconnectable BTM turret system general arrangement is shown in Figure below.

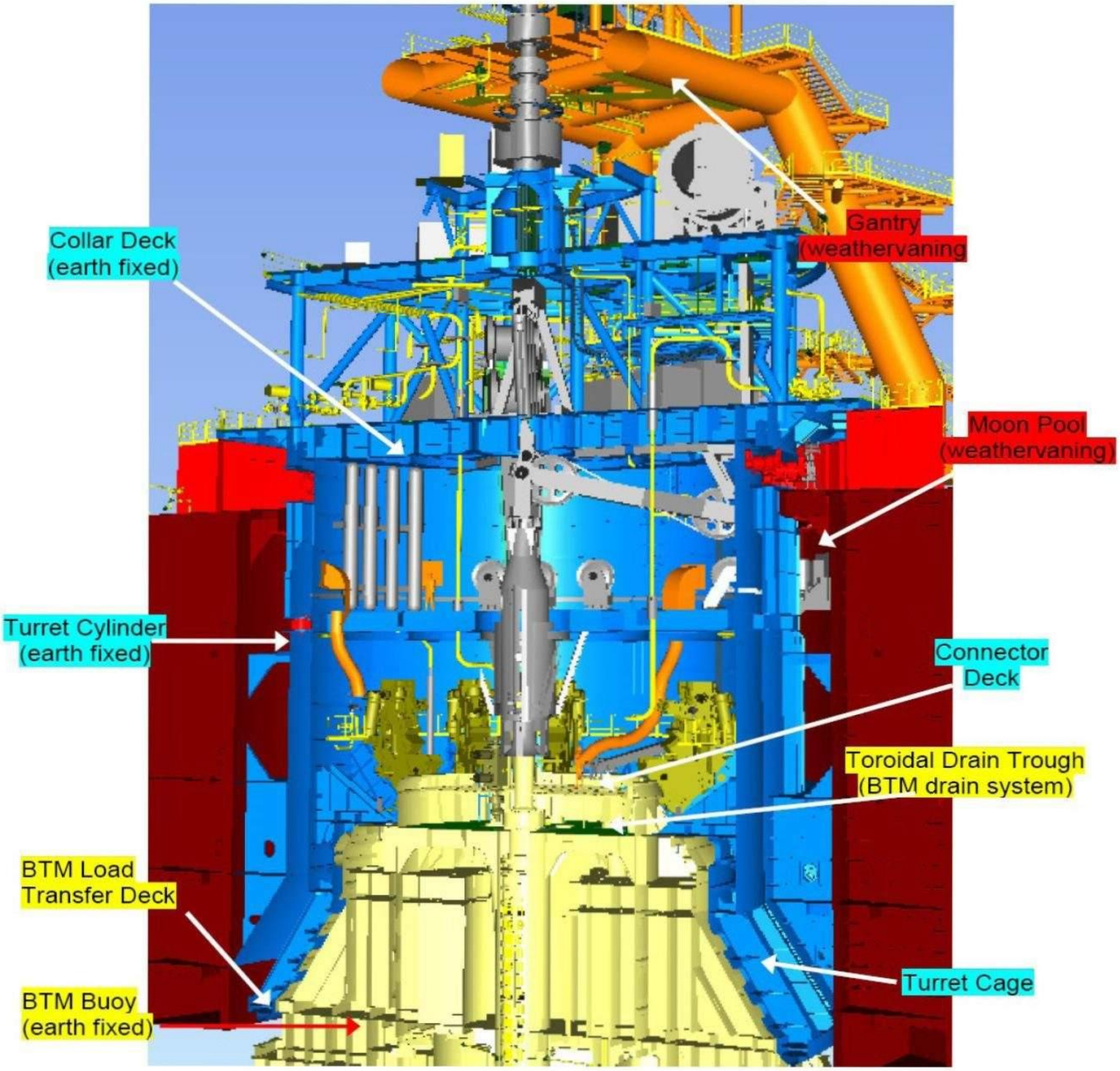


Figure 3: Disconnectable BTM General Arrangement

E.2.1 Turret Structural System

The turret structure is designed to transfer loads between the BTM buoy (the mooring lines and riser system are suspended from the buoy) and the hull structure. The turret structure is composed of the turret cage, turret cylinder the turret intermediate deck, turret collar deck, and the manifold deck.

a. Turret Cage

The turret cage is the conical member which surrounds the conical part of the buoy and transfers the load between the buoy and the turret for severe events via the bearing ring located at the bottom of the cage. In normal conditions, the buoy and turret cage are not in contact. There is an approximately 10mm gap between the cage and the BTM buoy load transfer deck. Under severe seastate, the gap will be closed along the line of action and the radial load can be transferred directly from the buoy to the turret cage.

The turret cage will act as a guiding frame for the buoy during reconnection. The buoy will move inside the cage, but its inclination will be limited by the conical shape of the cage. The top of the turret cage will be a cylindrical box and will allow the full lateral alignment between the turret and buoy (25mm gap) via its steel ring centralizing system, and azimuthal alignment via a rotational key system.

b. Turret Cylinder

The Turret cage and cylinder extends from about half a meter above the keel to just below the Turret collar deck. It is a fabricated cylindrical/conical shell structure with ring stiffeners, located within a cylindrical moon pool integrated into the FPSO hull. The structural connectors are mounted on a support structure at the bottom of the turret (above the cage) on the inside of the cylinder. This structural area transfers the vertical mooring/riser loads and minimizes the moment acting at the connectors. The turret cylinder integrates with an intermediate deck that provides structural reinforcement inside the cylinder for the rail of the radial wheel.

Access is provided from the turret cylinder to the top of the BTM buoy at the elevation of the structural connectors, inside the turret. The top of the BTM provides support for the mating part of the 3 risers (2x production and 1x gas), shutdown valves, the umbilical connector assemblies (fluids, signal and optical) and the electrical connector assemblies. The turret cylinder will support structures that interface with the BTM buoy shoulder to provide sealing.

c. Turret Intermediate Deck

The turret intermediate deck is located at the radial wheel elevation, inside the turret confined space, and has an OD of approximately 21m. The intermediate deck provides strength support to the turret cylinder for the transfer of the lateral loads to the radial wheel bearing.

d. Turret Collar Deck

The turret collar deck is at the top of the turret cylinder, above the intermediate deck. It is a heavy structure that houses in its center the foundations for the pull-in winching equipment needed for buoy reconnection. This collar deck structure provides support for the axial bogie rails. The top of collar deck structure provides foundation for the manifold deck. The deck consists of a solid boxed structure with a circular opening at the center. The diameter of the collar deck is 26.3 meters.

The weight of the turret and vertical loads are transferred through the axial bogie wheels to the top of bogie support structure and the FPSO moon pool, while the horizontal loads are transmitted through the radial wheels to the bogie support structure and the FPSO moon pool.

The collar deck provides support for the following main turret equipment as a minimum:

- Turret Valves HPU
- Turret/BTM Interface HPU (actuation for stabplates, drain pumps, pipe spools, riser clamps)
- Chemical Injection Skid
- Turret SDV's (shut down valves)
- Heave compensation system cylinders and support structure
- Abandonment and rope spooling winches

e. Mezzanine Deck

The mezzanine deck or platform is located immediately above the collar deck. This deck is not continuous, and supports the electrical panels, instrument panels and spooling winch.

f. Manifold Deck

The manifold deck (also called swivel stack deck) is installed above and supported by the turret collar deck. Access from one deck to the other is provided through stairs and two sets of vertical ladders.

This deck accommodates the following:

- Manifolding of the fluid transfer system and provides support for the swivel stack
- Gas export line pig receiver/launcher(with associated piping, valves & instrumentation)
- Subsea HPU
- Main winch (525te)
- Heave compensation HPU and electrical panels (HPU provides power for winches as well)
- Chemical Injection skid (scale inhibitor, corrosion inhibitor)
- Reconnection equipment control panels

g. Overhead Gantry Structure

The overhead gantry structure is an elevated structural steel framework that bridges the turret manifold decks and surrounds the swivel stack. The fabrication has four columns that are welded to the FPSO deck and connected together near the top. The gantry structure, which rotates with the vessel, supports the process, hydraulic and utility piping, the power and signal cables connected between the FPSO and the rotating section of the swivel stack. A stairway access system and ladder access system, accessible from the deck of the FPSO, is provided to permit safe entry to the internal platforms around the swivel stack.

h. Multi Bogie Bearing System (MBBS) arrangement

The turret is supported by the vessel with a Multi Bogie Bearing System (MBBS) arrangement. The Multi-Bogie Bearing System (MBBS) forms the main weathervaning bearing system for the Turret and is designed for low friction, reliability and maintainability.

The current design is based on 16 axial bogies and 24 radial wheels. The radial wheel and axial bogie arrangements transfer the turret induced loads to the vessel structure. Turret induced loads are caused by the vessel motions and associated accelerations, the mooring loads acting at the buoy and the riser loads. The radial wheels and axial bogies will be protected against water (rain and greenwater) by a closure at the top between turret collar and the vessel upper deck and by a lower 'water barrage' and sealing arrangement. The so-called 'water barrage' functions as a labyrinth to reduce splashing of water between the well cylinder and the turret cylinder due to vessel heave motion.

The bogie support structure is integrated in the vessel as close as possible to the neutral axis (for overall bending) of the vessel, the distortion of the vessel due to hogging and sagging being the lowest at this level. The bogie support structure decouples the deflections of the vessel from the bearing arrangement. Consequently the deflections of the bogie support structure at the top are minimal, allowing all the wheels to run on the rails and take their share of the load.

E.2.2 Fluid Transfer System

The fluid transfer system consists of the following:

- Shutdown/Boarding Valves for gas and production flow lines
- Riser disconnect system (disconnectable spool pieces, automatic clamploc connectors, lifting mechanism)
- High Pressure Detection system, which protects from the incoming pressure, comprising a high pressure permissive between the riser SDV and the corresponding choke valve
- Pig launcher/receivers (intelligent pigging) for the Gas riser and provision on production riser for future pigging equipment tie-in
- Manifolding for fluid transfer and merging flow lines
- Swivel stack
- Umbilical connection and disconnection system

E.2.3 Turret Drive System

The system is activated in order to rotate the turret to align with the buoy to facilitate pull-in and engagement of the various connections between the buoy and turret. Once the buoy is installed and secure, the gear drive will be disengaged, ensuring a passive turret system. With the clutch disengaged, the gear drive is allowed to freely spin as the ship weathervanes around the turret and buoy. The drive system is only used during the buoy recovery operation.

The drive system consists of 6 hydraulic motors with pinion mounted on the bearing box (between radial wheels) acting on a gear ring welded on the outside of the turret cylinder above the radial rail. See Figure below.

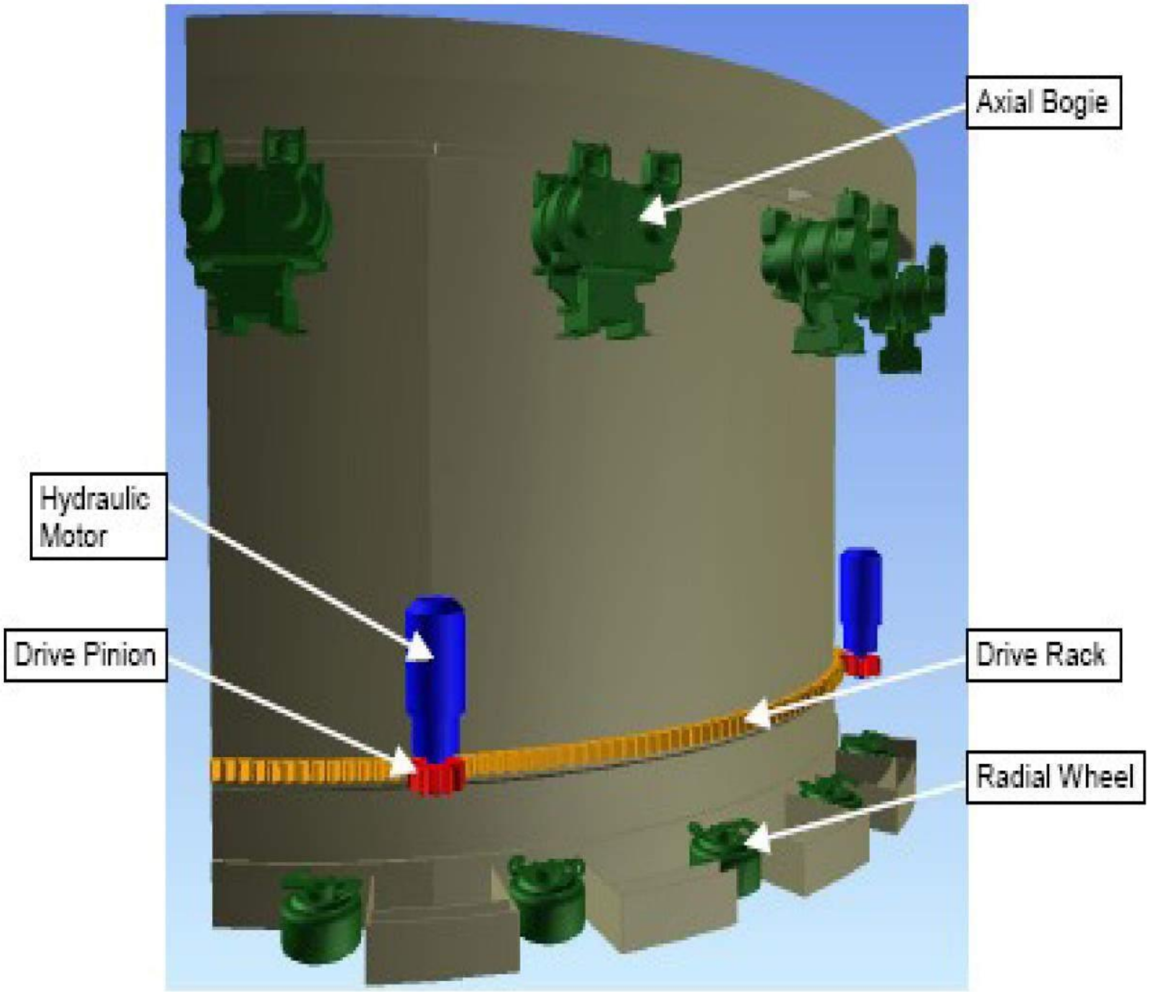


Figure 4: Turret Drive System

E.2.4 BTM Buoy System

a. Function

The BTM buoy has two functional roles.

- During FPSO connected mode, the BTM buoy transfers the mooring and riser loads from their connection points to the FPSO structure and provides the fluid transfer between subsea and FPSO.
- During FPSO disconnected mode, the BTM buoy drops to its free float depth at a predetermined distance below sea level (BTM buoy keel at ~100m from MWL) and supports the anchor lines, risers/umbilicals with corresponding connectors and associated valves.

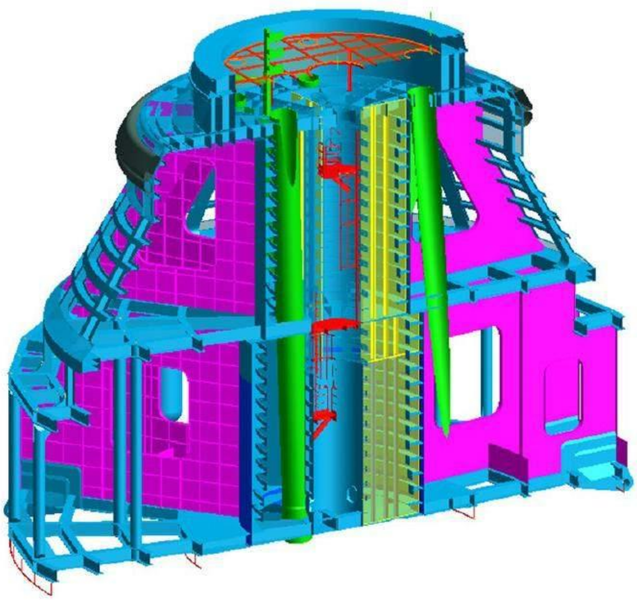


Figure 5: Buoy Layout

b. Overall Description

The buoy is composed of the following high-level components:

1. **Syntactic foam**

- Most of the BTM buoy buoyancy is generated by foam buoyancy modules rated for up to 200m water depth (crush depth up to 400m, due to a safety factor up to 2).
- The foam filling proportion, i.e. volume taken by the foam / available inner space blocks, is around 85% with a higher (up to 95%) filling in certain areas.

2. **Steel Structure**

- A ring structure is located at the top of the buoy, to which the nine structural connectors will be connected.
- SDV's and other equipment extending above the buoy top are protected by individual protection frames to protect the equipment from floating and falling objects.
- Three (3) reinforced decks from top to bottom, central structural column and radial girders to carry the riser/umbilical vertical loads and equipment on the recessed area at top of buoy, to transfer loads

to the turret, and finally to withstand the mooring loads and lateral riser/umbilical loads at the buoy keel respectively.

- Central compartments and trim tanks, designed for the full hydrostatic pressure, to provide ballast capacity during installation (i.e. to help for submergence of buoy without risers prior to FPSO arrival) but also capacity to adjust the net BTM weight for tolerances and inaccuracies, e.g. loss of buoyancy over time, riser payload inaccuracies, etc. The central compartments will be accessible when the BTM buoy is connected via a set of hatches and ladders.

- Nine (9) I-tubes (5 phase 1 and 4 future) to connect risers and umbilicals.

3. Ballast system

- Approximately 300 t ballast capacity for weight management to deal with uncertainties, inaccuracies and expected weight change with time

- Ballast weight provided through brine with a density of 1.5 t/m3 located inside central ballast compartments (~10 compartments)

- Inside trim ballast tanks (x 3), designed for full hydrostatic pressure, to provide ballast capacity for trim due to the riser loading asymmetry.

- A ballast piping system will be put in place to allow the filling or removal of liquid ballast materials from the voids, ballast compartments and trim tanks (density ranging from seawater d = 1.025 t/m3 to brine d = 1.5 t/m3)

- All ballast piping and valves will be permanent fixtures

4. Centralizing system

- A rubber bumper system is at the top cylinder of the buoy, which will absorb impact load if the buoy makes contact with the turret cage during the last stages of reconnection

- A steel ring centralizing system just below the rubber bumper system, which will provide the final radial alignment once the BTM buoy is raised in the vertical cylindrical part of the turret cage. A 25mm gap is targeted between the steel centralizing system and the turret cage vertical cylinder

- A key rotational alignment system on the cylinder at the top of the buoy, to align the yaw angle of the buoy so that the turret and buoy piping are aligned prior to full reconnection.

5. Reconnection equipment

The top center of the BTM buoy will be fitted with a stinger and flex element assembly. The stinger will serve as the connecting part between the BTM buoy and the turret during the final stages of the reconnection. The flex element underneath provides some lateral flexibility in order to minimize loads at the top of the buoy but also to ensure that the stinger will be in-line as much as possible with the reconnection force direction (created by the reconnection rope or by the suspended bell from the heave compensation system)

c. Mooring Line Termination

Each of the 9 anchor lines is connected to the external hull of the buoy at keel via a uni-joint that provides a low friction interface for the two predominant rotational degrees of freedom (roll and pitch with respect to the anchor line axis). Each uni-joint assembly consists of a main cast body with one lug (for attaching anchor lines) that is welded to integrate with the structure of the mooring buoy.
One cast fork is connected to the lug with a large diameter low friction bearing at each connection and a special shackle to connect the mooring line.

d. Buoy Instrumentation

A set of redundant hydro-acoustic transponders (3 off) is used to monitor the position of the buoy when disconnected. The transponder is mounted on the buoy and works with the transducer installed on board the FPSO to help locate the submerged buoy relative to the FPSO. The other systems on the buoy are functional only when the buoy is connected to the FPSO.
All systems to be installed in the buoy are as follows:

- 6 DOF consisting of 3 accelerometers and 3 angular rate sensors
- Depth monitoring (pressure transducer)
- Location determination (acoustic transponder)
- Battery back-up (aids information storage during disconnect)
- Mooring line load cells

The BTM buoy instrumentation equipment will be stored in two water tight/dry compartments mounted on the BTM deck.

e. BTM Reconnection/Disconnection Equipment

The BTM Reconnection/Disconnection Equipment is established by the following main components:

- 600te reconnection winch
- Synthetic rope, tapered
- Heave compensation system, which includes the cylinders, the arm, the sheaves, the suspended bell and the latching mechanism at the base of the bell
- Spooling drum winch
- Abandonment drum winch
- Stinger with latching interface at top, and flex element on buoy

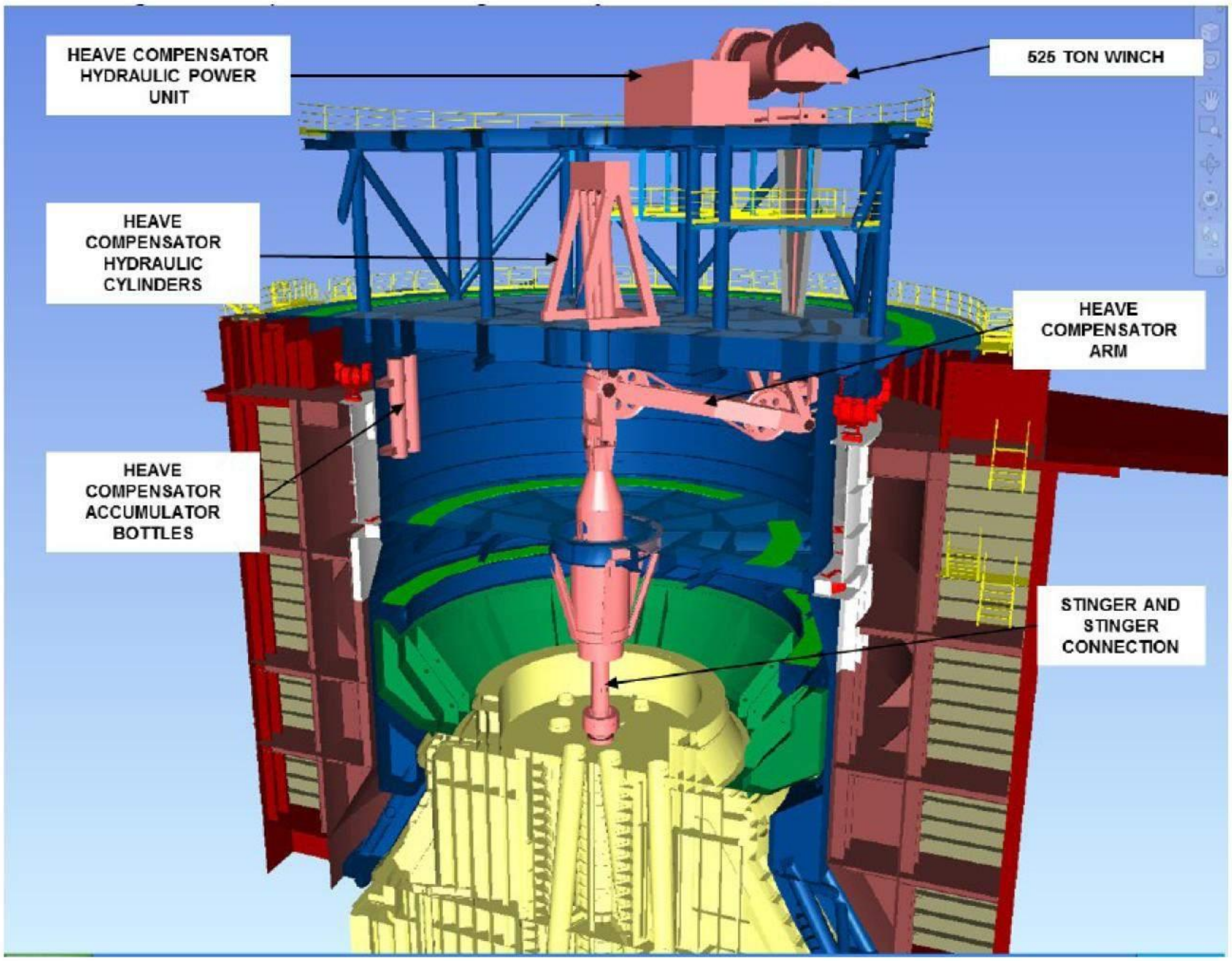


Figure 5: Buoy Layout

f. BTM Buoy Structural Connectors

The buoy connector is an arrangement of multiple locking units. The turret is equipped with nine locking units that are hydraulically activated to lock on the collar of the buoy.

The structural connector unit, a mechanical assembly designed by SBM shown in Figure 1-6, is composed of:

- 1 Hydraulic main cylinder
- 2 Hydraulic cylinders, contingency use, to rotate the unit out of the way into a parking position (not shown in picture)
- 1 Locking dog
- 1 Mechanical Locking System
- 1 Fixed support frame
- 1 Rotating support frame

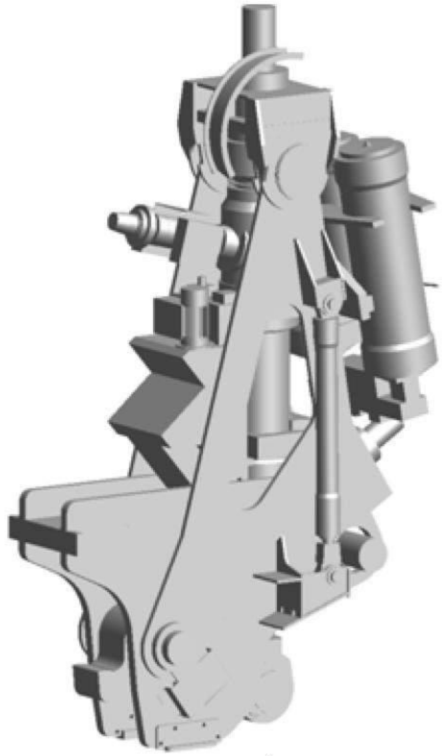


Figure 6: Structural Connector

Before the hurricane season, all the disconnection elements will/can be tested individually to confirm proper functioning. In the unlikely event where one individual unit would still not release, the emergency back-up will be activated; the mechanical shear pin will be retracted and the connector will be rotated forward by the two back-up cylinders to open the locking dog. Before a planned disconnection or during maintenance, each connector can be function tested individually. During a disconnection, all connectors will simultaneously release within one second.

For regulatory compliance reasons, the BTM buoy shall be disconnected at least once a year, if not already disconnected due to incoming hurricane.
The connector design is a fail/safe system, incorporating mechanical locking systems rather than a dependence upon constant hydraulic pressure in the cylinders to prevent accidental release.

E.2.5 Reconnection/Disconnection Philosophy

The design principles of the disconnectability of the system are as follows:

Disconnection: the system shall disconnect due to arrival of a named hurricane. The disconnection should be completed up to a defined seastate (3.0m Hs, see table below).

Reconnection: the system shall enable reconnection up to a defined seastate (2.5m Hs, see table below).

During disconnection and the reconnection the FPSO shall not require the use of external and non-dedicated means, e.g. additional tug. The FPSO will be self propelled.

The FPSO may have a dedicated standby vessel (not necessarily a tug, typically a small supply boat).

The disconnection and reconnection procedures shall be defined in detail and approved to be strictly adhered to when in operation, considering all operating scenarios.

Parameters

The parameters for the disconnection and reconnection of the BTM buoy are listed in the below table:

Item	**Criteria**	**Comments**
Minimum disconnect sea-state	· Hs 3.0 m and associated wind + 1-yr LCE + 1-yr TRW (any combination of the above)	Maximum environmental conditions in which disconnection can be executed. Disconnect operation to require less than 6 hours (excluding time to displace fluids from subsea system) Hs=Significant Wave Height LCE=Loop Current Eddy TRW=Topographic Rossby Wave
Minimum reconnect sea-state	·Hs 2.5m and associated wind + 1-yr LCE + 1-yr TRW -Any combination of the above -Tp ≤ 9.0 s -Wind heading = Θ or Θ+45°	Maximum environmental conditions in which reconnection can be executed. Reconnect operation to require less than 12 hours, defined as the elapsed time from when the pull-in line is first connected to the pull-in winch, until the point in time when ready to start production, i.e. BTM secure, umbilicals, and production spools locked in place and tested. Hs=Significant Wave Height LCE=Loop Current Eddy TRW=Topographic Rossby Wave Tp=wave period

Table 2: Disconnection and Reconnection Parameters

E.3 Synthetic Mooring System

The mooring system and components will be designed to API-RP-2SK with each mooring line terminating at suction pile anchors. The FPSO is moored by an internal disconnectable BTM turret with 9 mooring lines divided into 3 clusters. Each line consists of 5 segments – top chain segment, spring buoy, lower spring buoy chain and ILMC (In-Line Mooring Connector), middle polyester segment and bottom chain segment as depicted in Figure below.

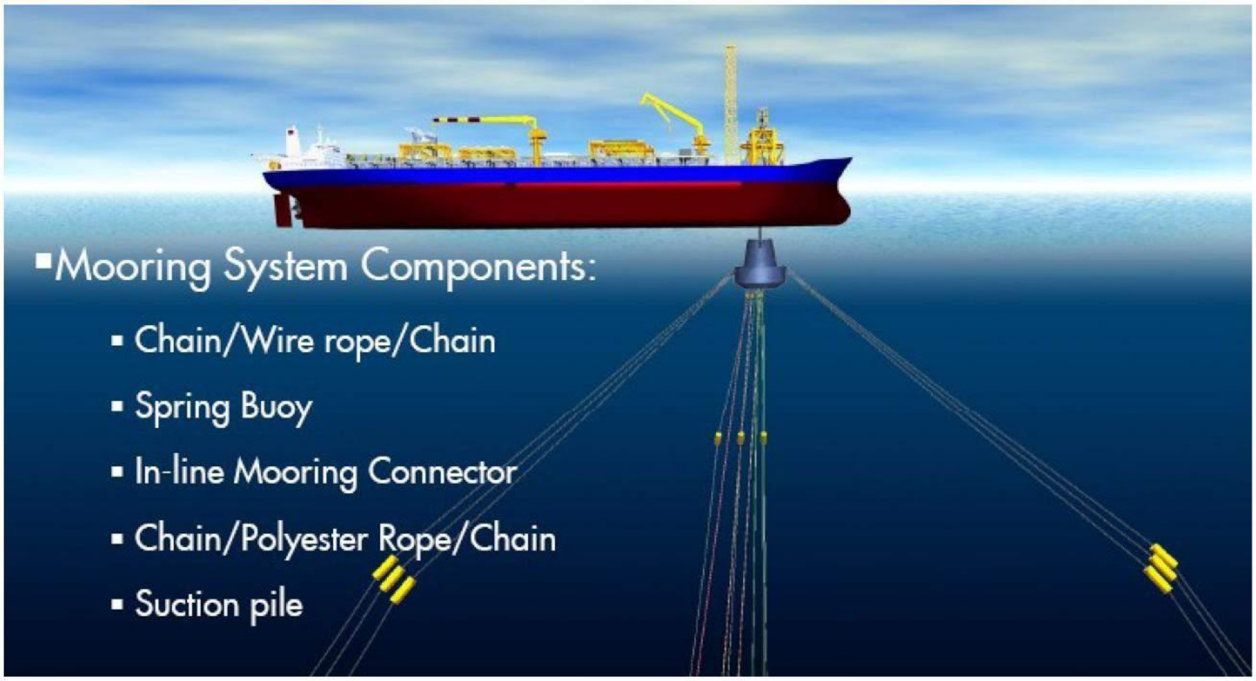


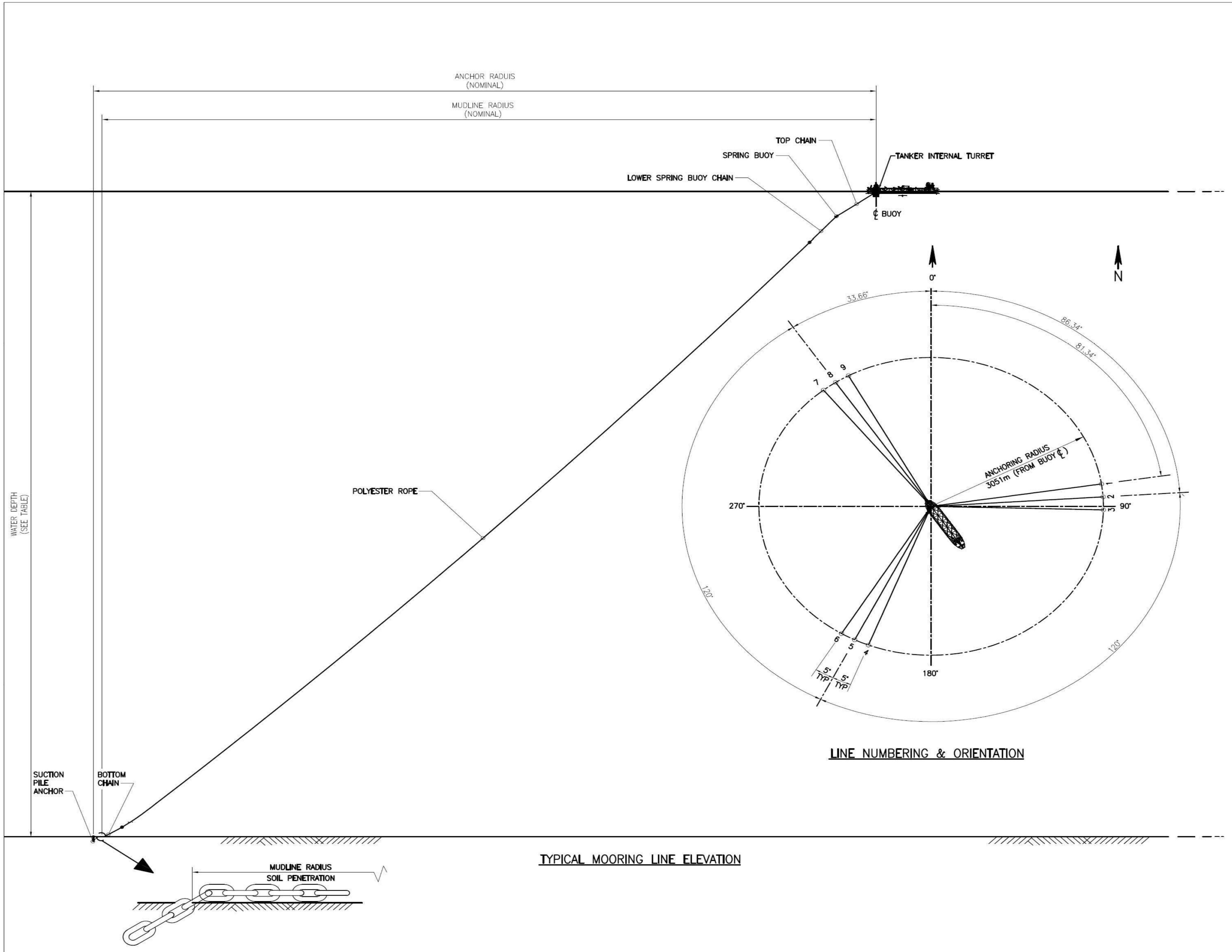
Figure 6: Mooring System Components

The mooring system will be designed to meet strength and fatigue requirements for a design configuration that accounts for the integrated mooring and riser response to combined wind, current, and wave loading.

FPSO Mooring System Parameters		
System	**Parameters**	**Comments**
Type	Passive	
Water depth	9,500 ft (2900 m)	
Maximum excursion Intact	10% water depth	
Maximum excursion One-Line Damaged	12% water depth	

Table 3 – FPSO Mooring System parameters

The mooring line arrangement from fairlead to anchor follows the field layout depicted in Figure below.



CLIENT REV	SBMA REV	ISSUE DATE	REASON FOR ISSUE	DRAWN BY	CHECKED BY	LEAD ENGR	EPM
	P1	12APR'12	PRELIMINARY FOR INFORMATION	THP	VK	VK	XC
	C1	13JUN12	COMMENTS AND APPROVAL	BTP	HP	VK	XCO/EVD

NOTES

1. ANCHOR RADIUS IS FROM THE TURRET CENTER TO THE PILE CENTER.
2. THIS DRAWING IS TO BE READ IN CONJUNCTION WITH: DCM92033 – TURRET MOORING LINE DETAIL DRAWING

LINE NO.	AZIMUTH C.W. /N (DEG)	ANCHOR U.T.M. COORDINATES		MDL U.T.M. COORDINATES		WATER DEPTH (M)
		NORTHING(M)	EASTING(M)	NORTHING(M)	EASTING(M)	
1	81.34	2925163	721163	2925159	721139	2910
2	86.34	2924898	721191	2924897	721167	2912
3	91.34	2924632	721197	2924633	721173	2914
4	201.34	2921862	717036	2921884	717045	2911
5	206.34	2921970	716793	2921991	716804	2908
6	211.34	2922098	716560	2922118	716572	2906
7	321.34	2927086	716241	2927067	716256	2834
8	326.34	2927243	716456	2927223	716469	2835
9	331.34	2927381	716683	2927360	716695	2836

TURRET CENTER:
NORTHING = 2924704m
EASTING = 718147m

Client: Shell Exploration & Production

Project: Shell Stones Disconnectable FPSO

SBM Atlantia, Inc.
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TBPE Firm Reg. No. F-519
Member of the SBM Offshore Group

CONFIDENTIAL & PROPRIETARY

Client Number: (D–113)

Client Revision:

Drawing Title: TURRET MOORING LINE GENERAL ARRANGEMENT DRAWING

Scale: 1:7500

3rd Angle

Format: A1

Project Number: ES 46115

Document Number: DCM92031

Sheet no./Sheets: 1/1

Revision: C1

Figure 6: Mooring System Layout

E.3.1 Mooring Line Length

Tolerances are defined for the uncertainties related to the fabrication of mooring line components and installation. Any deviation from the nominal case will be compensated by adjusting the length of one of the line segments to maintain the FPSO at the design location. Usually this adjustment is done at the top chain; however, for the Stones FPSO this adjustment in the chain section is provided via an In-Line Mooring Connector (ILMC) loctated between the spring buoy and the polyester rope, about 15m from the top end of the polyester rope . The length of the lower spring buoy chain can be shortened using the ILMC without disconnecting the line.

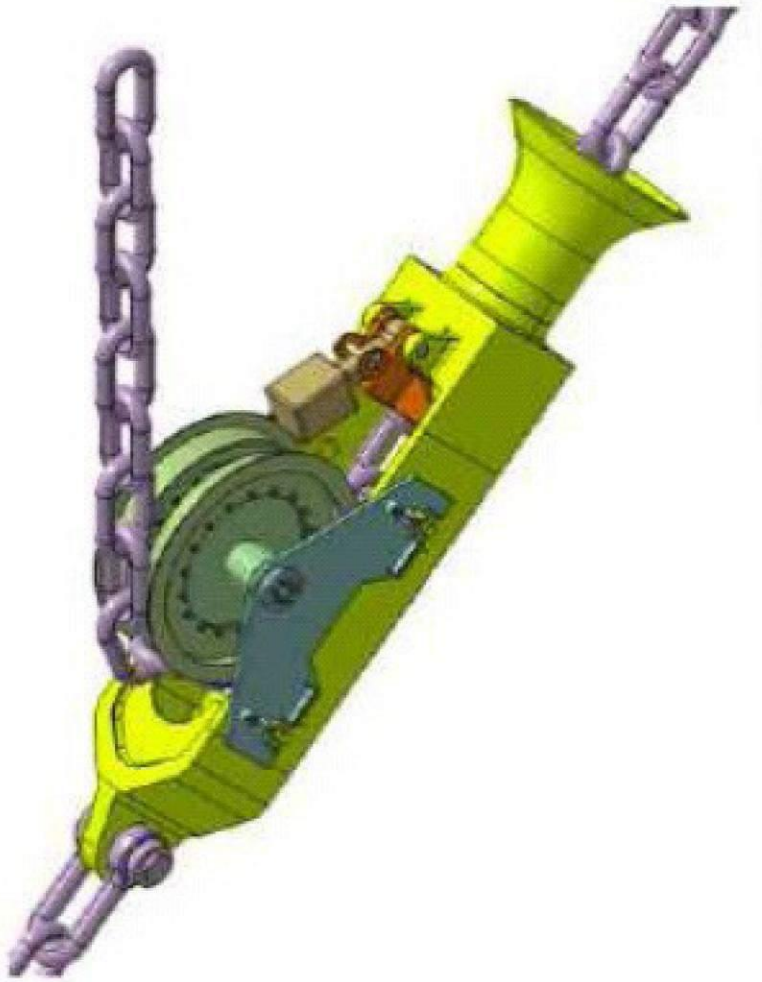


Figure 7: In-Line Mooring Connector (ILMC)

E.4 Steel Lazy Wave Risers - General Overview

The selected riser system for the development is a Steel Lazy Wave Riser (SLWR) system. The SLWR is a simple adaptation of the Steel Catenary Riser (SCR) where buoyancy modules are added to the riser to de-couple the host motions from the riser touch down point. A SLWR is a Steel Catenary Riser (SCR) with a lazy-wave added in the lower section of the SCR. Force balance of the buoyancy modules against the submerged weight of the riser pipe determines the lazy wave profile. The purpose of the lazy-wave is to disconnect the touchdown zone of the riser from the hostile host dynamics at the top of the riser, thereby controlling the dynamic stresses and the material fatigue damages in the sagbend and the touchdown regions of the riser..

The SLWR consists of 4 sections: an upper catenary section, a buoyant section, a lower catenary section, and a bottom section. The concept is illustrated in the figure below.

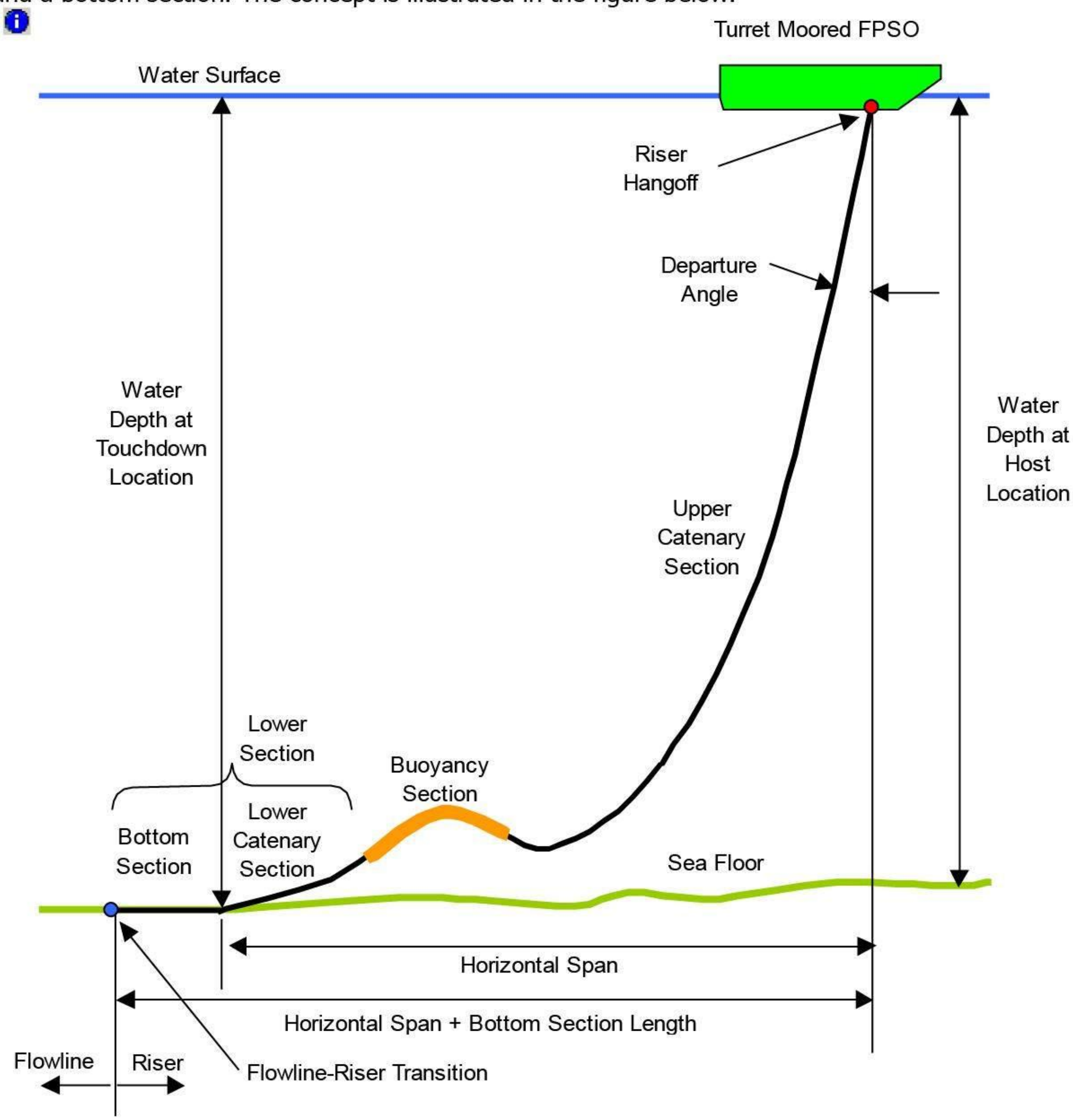


Figure 8: SLWR Concept Design Adopted for Stones Risers

The upper catenary section usually constitutes the majority of the riser length and it interfaces with the host. The buoyant section is fitted with syntactic foam buoyancy modules and their negative weight in water creates a wave in the riser. The lower catenary is a short section below the buoyant length and it interfaces with the sea floor. The bottom section lays on the sea floor most of the time and it extends to the flowline-riser transition point.

For Phase 1 of the development there will be three SLWRs used for the field development:

2 X 8" Production Risers
1 X 8" Gas Export Riser

Each of the flowlines will have a "dynamic" or "riser" portion and a "static" or "flowline" portion. The dynamic portion includes the suspended portion off the host vessel and the on-bottom portion that extends beyond the touchdown point to the riser/flowline transition point. The on-bottom portion of the riser stays on the seabed but is near enough to the host to experience the dynamic tension from the suspended span. The SLWR design discussion is limited to the dynamic portions of the lines from the hang off point at the host to the start of the flowline.

The Stones risers are attached to the host via stress joints. The riser interface components include the hang-off hub, journal, and the stress joint which are attached at the top of the riser, and the pull tube and the clamp-casting piece which is attached at the bottom of the pull tube.

The stress joint body is designed to be locked into place at the bottom of the riser's pull tube and moves with the host, while the tapered section of the stress joint is allowed to bend as it moves with the riser. A typical stress joint develops a significant amount of bending moment at the host attachment point of the stress joints in addition to the riser tension and shear loads. The host supporting structure of the riser stress joint has been designed sturdy enough to conservatively support these loads.
Identical stress joint design is utilized for the two production risers. The stress joint material is 80 ksi. steel .

Figure 9 shows the Stones Field Layout.

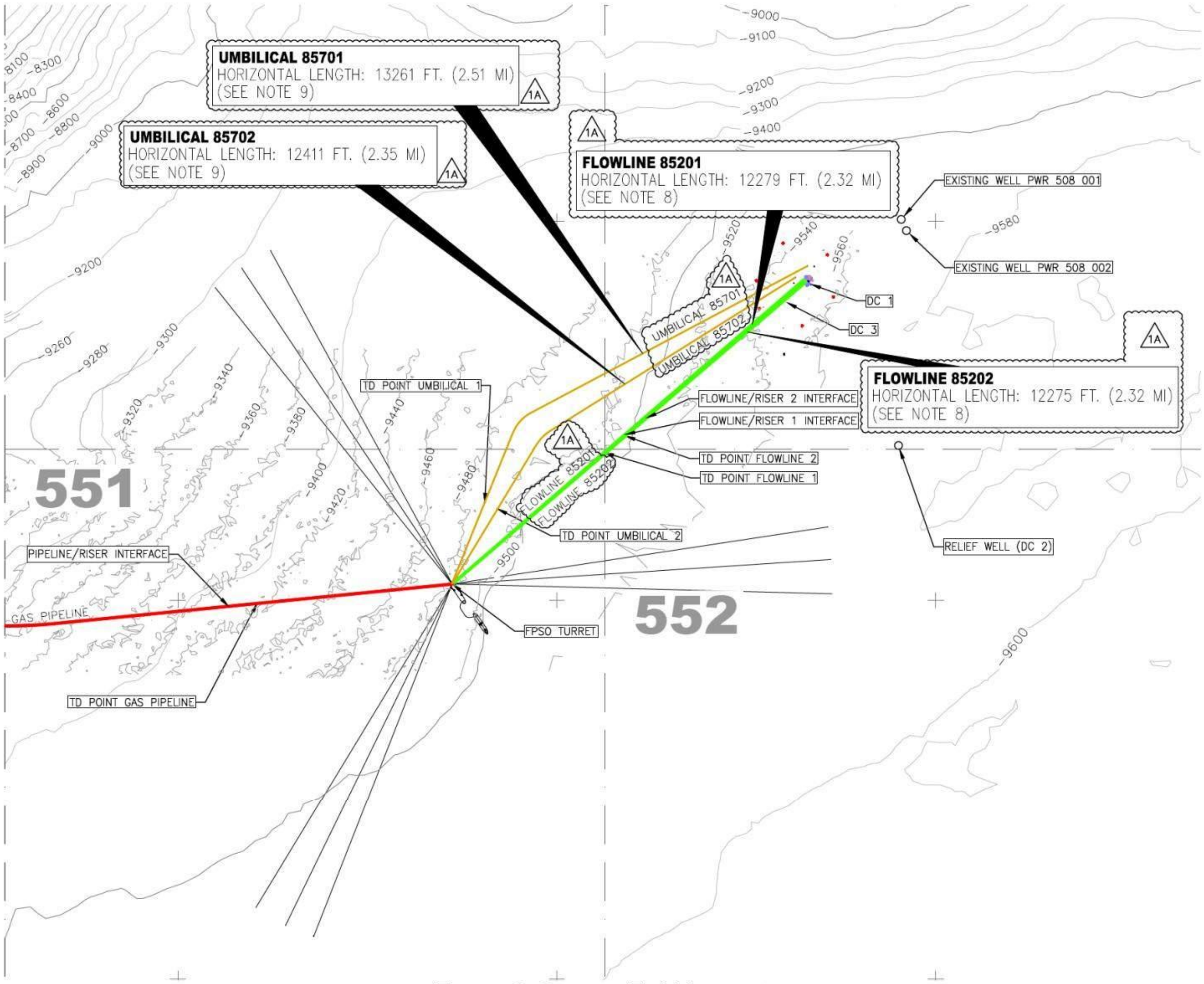


Figure 9: Stones Field Layout

Figure 10 below shows the horizontal departure headings of the Stones moorings, risers, and umbilicals.

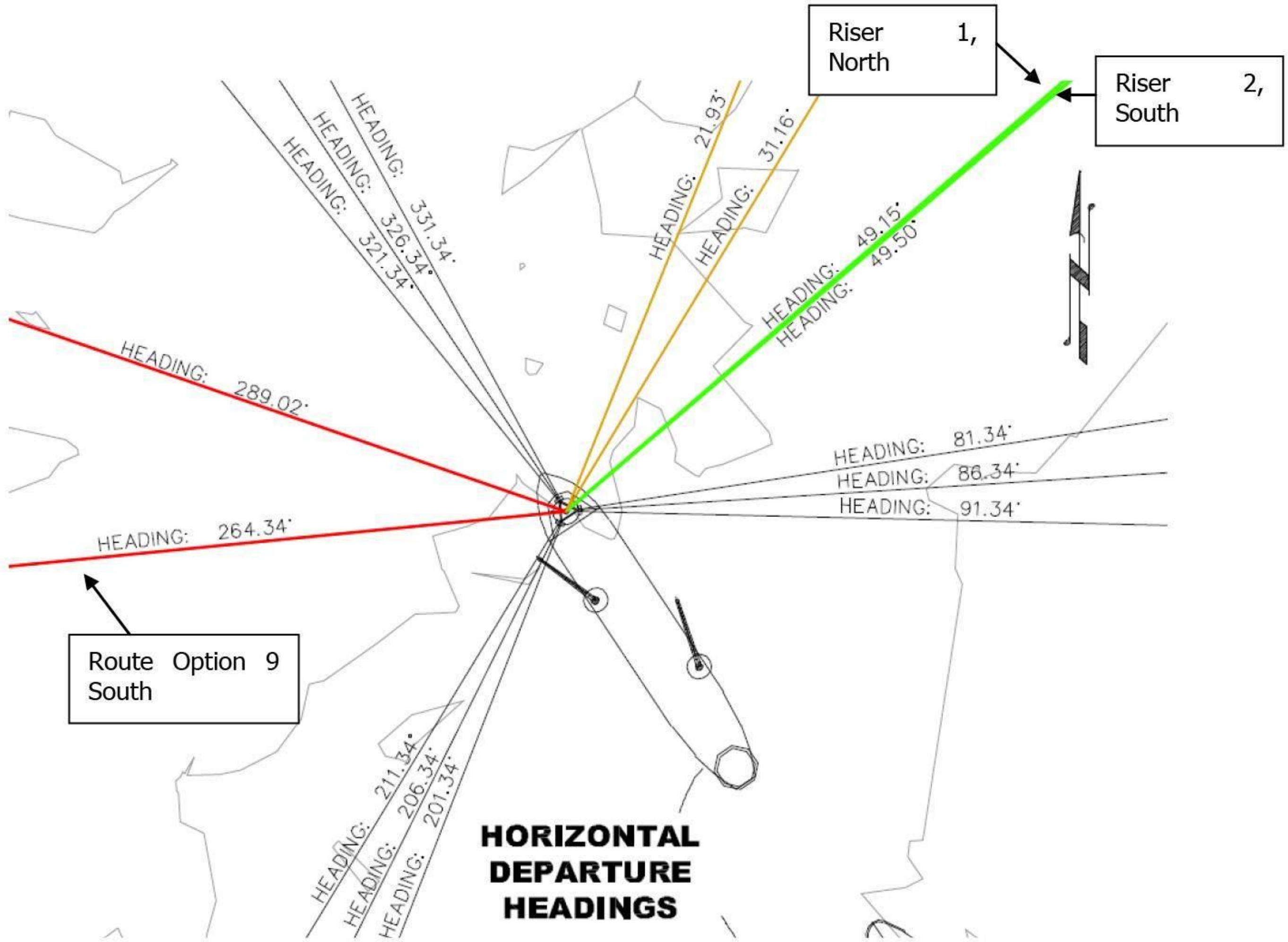


Figure 10: Horizontal Departure Headings

E.4.1 Functional Requirements and Project Parameters for Stones SLWRs

The Stones riser system must:

- Enable safe and effective transport of produced fluid,
- Allow internal pigging for the gas export system,
- Withstand environmental, operational, and accidental loads,
- Not interfere with host hull and mooring lines,
- Allow maintenance-free operation except for regular inspections, and
- Be installable from a pipe-laying vessel.

Riser ID	**Production Riser 1**	**Production Riser 2**	**Gas Export Riser**
Design Life (yrs)	20	20	20
Nominal Pipe OD (in)	8.625	8.625	8.625
Nominal Pipe WT (in)	1.394	1.394	0.812
MAOP and SIP @ 115 ft above MSL (psig)	13700	13700	3640
Corrosion Allowance (mm)	3.0	3.0	0.0
Vertical Departure Angle (deg, from vertical)	5	7	5

Riser ID	Production Riser 1	Production Riser 2	Gas Export Riser
Horizontal Departure Angle (deg, CW from North)	49.15	49.50	264.34
WD at FPSO location (ft)	9500	9500	9500
Upper Catenary Section Length (ft)	7400	6600	9800
Buoyancy Section Length (ft)	2800	3200	1300
Lower Catenary Section Length (ft)	2463	2967	1337
Bottom Section Length on Seabed (ft)	737	733	763
Total Riser Length (ft)	13400	13500	13200

Table 4: Stones SLWR's Quantitative Requirements and Project Parameters

E.4.2 VIV Suppression

Each of the Stones SLWRs will be fitted with devices over the upper and the lower portions of the risers for suppressing the vortex-induced vibration (VIV) motions. All risers will have the suppressions in the form of fairings and triple-start strakes as shown in Table 1.4.1-2. Note that the top 600 feet of VIV suppression on each riser is to include anti-fouling components.

Riser ID	Production Riser 1	Production Riser 2	Gas Export Riser
Bare section at riser top (ft)	70	70	70
Faired section at top (ft)	1130	1130	1130
Straked section at top (ft)	2800	2800	2800
Straked section above buoyancy (ft)	0	0	2000
Straked section below buoyancy (ft)	3500	3000	2200
Total Length of VIV Suppression (ft)	7430	6930	8130

Table 5: Stones SLWR's and Umbilicals VIV Suppression Data

E.4.3 Fatigue Design

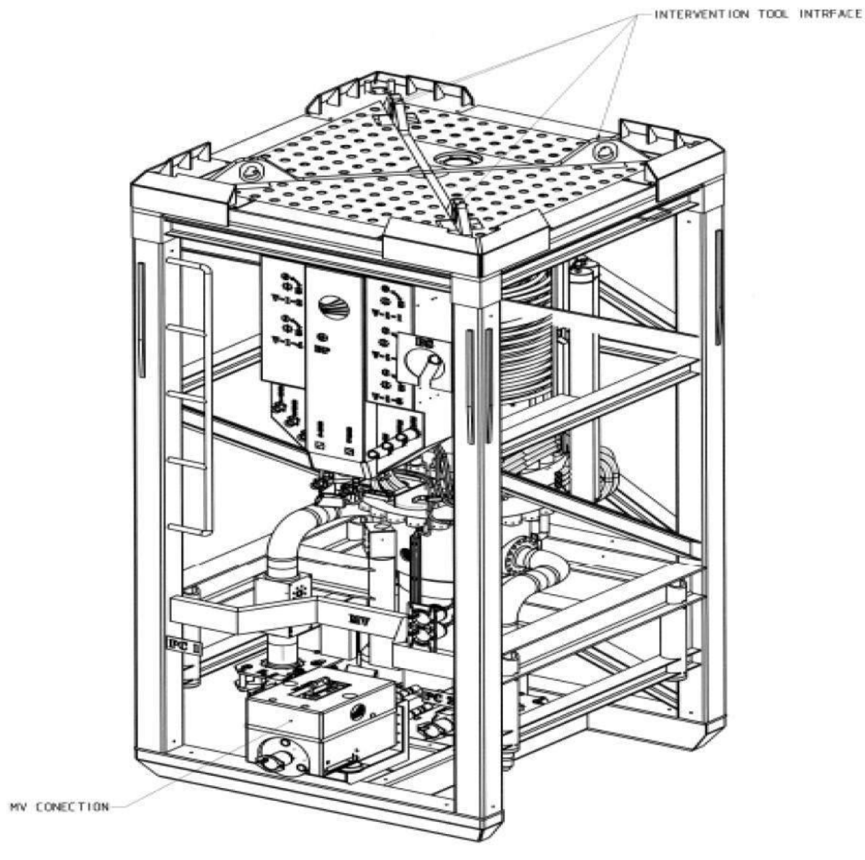
The fatigue analysis will be completed to verify that the SLWRs will have acceptable fatigue life which is to exceed 200 years (10 times the service life).

E.5 Subsea artificial lift

The Stones system is designed to boost the process fluids from the sea floor to the FPSO in single phase. The pumps will be driven by variable frequency drives located on the topsides facility, and will have a dedicated controller located topsides as well. Stones' modular mud-line boosting system consists of three pumps configured in a single pumping station with 3x50% pump units. Each pump module on the pumping station will be retrievable and is shown below.

The subsea control modules will use an electro hydraulic multiplexed pod with high speed fiber optic communication between topside and subsea. Controls and instrumentation for the booster pumps system will comply with NTL 2011-N11, and will be available for alert, interlock, and shutdown function for certain conditions (e.g. seal failure, loss of communications, high and low pressure). Testing for controls and instrumentation will be performed per regulatory requirements.

The barrier fluid system is designed to ensure positive overpressure of the mechanical seals towards the hydrocarbon process.



E.6 Topsides

The topsides process facilities are similar to existing deepwater facilities in the Gulf of Mexico except they are designed to consider the dynamic motions of the FPSO and include a swivel to allow for vessel weathervaning. The topsides modules will be installed on the FPSO and will provide full offshore processing capabilities including heat exchangers, separation equipment, gas dehydration equipment, power generation equipment, compression equipment, pumps, flare, water treatment equipment, bulk oil treating equipment, and hull storage.

A Distributed Control System (DCS) will be utilized for process safety controls. The Emergency Support System (ESS) and fire and gas detection will be Technischer Überwachungsverein, or Technical Inspection Association (TUV) Certified SIL-3.

The major utility services provided by the FPSO are electrical power and process cooling/heating. Cooling will be performed using water. Dual fuelled turbine driven generating sets will provide power to all consumers of electricity. Emergency power generation will be provided by a diesel engine driven generator set capable of providing power to all safety systems and control functions. Process heat will be provided through a closed loop heat medium system. Process gas will be the primary fuel for the FPSO, with gas buy back required sometime in the future. A diesel fuel system with adequate storage will be provided. Chemical injection systems for the topsides production system and subsea system will be provided. These will inhibit formation of hydrates, corrosion products, foaming, emulsions and scale.

Oil export will be via a dedicated shuttle tanker with a double hull. The shuttle tanker will be Jones Act and OPA 90 compliant. The shuttle tanker will be a "Veteran" class, or equivalent, tankship, with a nominal crude storage capacity of 330,000 barrels oil, converted for shuttle service. The converted tanker will be equipped with a bow loading system and a conventional diesel engine. A single Controllable Pitch Propeller (CPP) and a bow thruster will be provided for enhanced maneuverability. The shuttle tanker will be moored in a tandem configuration, approximately 150 meters from the stern of the FPSO, using a mooring hawser which will be retrieved back to the FPSO when not in use. The produced oil will be offloaded from the FPSO using the cargo pumps via the export hose to the shuttle tanker's bow loading system. The export hose will be stored on a reel located on the stern of the FPSO when not in use. The offloading operation is estimated to take approximately 14 hours not including approach, mooring or disconnect time. Offloading of oil will be performed approximately every 5 days when producing at full capacity.

A secondary (back up) system for offloading produced oil will be provided capable of offloading oil to a tanker equipped with a conventional an Oil Companies International Marine Forum (OCIMF) midship manifold in a tandem mooring configuration. This back-up system may be used with a non-dedicated Jones Act tanker when the dedicated shuttle tanker is not available.

An ESD (Emergency Shutdown) system shall be incorporated into the design of the systems located on the FPSO and shuttle tanker to manage the offloading operation.

A field support vessel, with sufficient bollard pull to serve as a pullback tug, will be deployed at Stones and used during offloading operations, primarily as a redundancy measure for the shuttle tanker's main propulsion system.

F. Bonding

The bond requirement for the activities proposed in this DOCD are satisfied by an area-wide bond furnished and maintained according to 30 CFR Part 256, subpart I; NTL No. 2000-G16, Guideline for General Lease Surety Bonds;" and National NTL No. 2008-N07, "Supplemental Bond Procedures."

G. Oil Spill Financial Responsibility (OSFR)

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

H. Deepwater well control statement

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

I. Suspension of Production

The WR 508 Unit is currently held by drilling operations.

J. Blowout Scenario

There are no drilling/completion operations proposed in this plan. This Section 2J was prepared by Shell pursuant to the guidance provided in the Bureau of Ocean Energy Management (BOEM) Notice to Lessees (NTL) No. 2010-N06 with respect to blowout and worst case discharge scenario descriptions and provided in plan S-7599, accepted by BOEM on January 8, 2013. 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 research and development to improve containment systems.

3. As outlined in Shell's Oil Spill Response Plan (OSRP), and detailed in 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 penetration of Well K of the target sand and based on the guidelines outlined in NTL No. 2010-N06 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)	47,114 BOPD
Uncontrolled blowout rate (first 30 days average daily rate)	37,318 BOPD
Duration of flow (days) based on relief well	180 Days
Total volume of spill (bbls) until relief well drilled	5.8 MMBO

Table 1: Worst Case Discharge Summary

Stones Project Overview

The Stones discovery is located in the Gulf of Mexico (GOM), approximately 200 miles south of New Orleans, Louisiana, in water depths of 7,500 to 9,500 feet across the discovery. Additional WCD scenarios were evaluated for all proposed well locations at Stones; however, the WCD numbers for these wells are lower than the WCD number calculated for the Stones K well, as these wells are expected to encounter less net pay and/or encounter the target formation at a deeper TVD depth, thus generating greater flowing bottom hole pressures. Therefore, Stones K was selected as the well which represented the highest possible worst case discharge rate.

A structural reservoir model has been constructed for the target horizons at Stones based on interpretation of a wide azimuth seismic survey. Stratigraphically, the target section was subdivided into 14 individual reservoir packages based on log correlations of the Stones #1 and #3 wells. The 14 reservoir packages can be grouped into 5 hydraulic units, based on MDT pressure and seismic interpretation.

The reservoir model was populated with rock and fluid properties based on data from the Stones #1, #3, and other regional penetrations. This model was then used in the CMG simulation software to develop a dynamic simulation of hydrocarbon production from the Stones reservoir at the proposed well locations. An out-flow model for the Stones K well was constructed in Petroleum Experts' Prosper software, and was coupled with the dynamic reservoir simulation.

This document is a summary of the results of this modeling. Electronic copies of the reservoir model and its output can be provided to the BOEM upon request. For the Stones K WCD scenario, the model did not constrain the well's drainage area, with the exception that the large trapping fault up dip from the Stones K location is sealing. The aquifer extent was modeled as per the expectation extent and magnitude.

1) Purpose

Pursuant with 30 CFR 250.213(g), 250.219, 250.250, and NTL No. 2010-N06, this document provides a blowout scenario description, further information regarding any potential oil spill, the assumptions and calculations used to determine the 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 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 plans as requested by NTL No. 2010-N06 in response to the explosion and sinking of the Mobile Offshore Drilling Unit (MODU) Deepwater Horizon and the resulting subsea well blowout and recovery operations of the exploration well at the MC-252 Macondo location.

3) Information Requirements

a) Blowout scenario

All well locations addressed in this plan were assessed for Worst Case Discharge using the expected well path, the expected reservoir thickness, structural elevation, and rock/fluid properties for each. The Stones K well represented the highest 30 day average well flow potential. The Stones K well will be drilled through the reservoirs as outlined in the Geological and Geophysical Information Section of the Stones EP (see plan S-7599), and described above, utilizing a typical subsea wellhead system, conductor, surface and intermediate casing program, and using a dynamically positioned (DP) rig with a marine riser and subsea Blowout Preventer (BOP). A hydrocarbon influx and a well control event are 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, failure/loss of the subsea BOP, and a blowout to the seabed.

b) Estimated flow rate of the potential blowout

Category	EP (see plan S-7599)
Type of Activity	Drilling
Facility Location (area/block)	WR-508
Facility Designation	DP
Distance to Nearest Shoreline (miles)	178 statute miles
Uncontrolled blowout volume (first day)	47,114 BBL
Uncontrolled blowout volume (first 30 day average daily rate)	37,318 BOPD

Table 2: Estimated Flow Rates of a Potential Blowout

c) Total volume and maximum duration of the potential blowout

Duration of flow (days)	180 days total duration to drill relief well (14 rig mob, 3 transit, 130 spud to top of target, 33 ranging)
Total volume of spill (bbls)	5.8 MMBO based on 180 days flowing. Note: From CMG dynamic reservoir model

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. 2010-N06 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 (Proprietary)

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 at all times 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 Interim Final Drilling Safety Rule with respect to Remotely Operated Vehicle (ROV) hot stab capabilities, a deadman system, and an autoshear system.

The rig to be used on Stones will be the Noble Danny Adkins, a dynamically positioned MODU. The BOP stack on this rig has two shearing rams for additional redundancy. Also the Noble Danny Adkins is equipped with a deadman system, an autoshear system, and an additional acoustic backup system for disconnecting and closing the shear rams.

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

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, the Noble Danny Adkins and the Bully 1, 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 (e.g. Transocean Discoverer Clear Leader etc.) All efforts will be made at the time to secure the appropriate rig. Shell's current contracted rigs capable of operating at Stones water depths and reservoir depths without technical constraints are shown in the table below.

Rig Name	Rig Type
Noble Don Taylor	Dynamically positioned drill ship
Noble Bully 1*	Dynamically positioned drill ship

Future modifications may change the rig's capability.
* Rig capabilities need to be assessed on a work scope specific 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 tabled above. It is expected to take an average of 14 days to safely secure the well that the rig is working on; up to the point the rig departs location, and a further 3 days transit to mobilize to the relief well site depending on distance to travel. The relief well will take approximately 130 days to drill down to the last casing string above the blowout zone plus approximately 33 days for precision ranging activity to intersect the blowout well bore. Total time to mobilize and drill a relief well would be approximately 180 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. Shell has 3 deepwater anchor handlers (the Laney, Dino, and Ross Chouest) on long term contract to support its moored rigs.

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. 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 2013-2018 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.

SECTION 3: GEOLOGICAL AND GEOPHYSICAL

A. Geological description

Proprietary data.

B. Structure Contour Map(s)

Proprietary data.

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

Proprietary data.

D. Geological Structure Cross-section(s)

Proprietary data.

E. Shallow Hazards Report

The following reports were used for our analysis:

- Gardline Surveys prepared a 3D Geohazard Assessment Walker Ridge Blocks 463-465, 506-510, 550-554, and 594-598, Volumes 1 and 2, (Report Number 6092) dated March 2004 for BP.
- GEMS prepared a Wellsite Descriptions, Proposed Wellsites C & D, Walker Ridge 508 (Report Number 0306-1151) dated May 2006 for Shell.
- Fugro GeoConsulting, Inc. wrote an Integrated Geophysical and Geotechnical Field Development Planning Study (Report Number 27.2009-2328) dated May 2010 for Shell.
- Fugro prepared an AUV Archaeological Assessment Stones Development Area Blocks 420, 464, 508 and 552 Walker Ridge Area (Report Number 2411-1019) dated July 2011 for Shell.
- C&C Technologies prepared an Archeological Assessment Survey for Stones Development Prospect (Report 110394) on Blocks 507, 508, 551, and 552 and vicinity in Walker Ridge Area dated August 2011 for Shell.
- C&C Technologies (C&C) prepared a Hazard Assessment Site Clearance and Drill Center, Blocks 507, 508, 550, 551, and 552 and Vicinity Walker Ridge, Volumes 1-3 (Number 110394) dated November 2011 for Shell.
- C&C Technologies prepared an Archaeological, Engineering & Hazard Assessment Proposed 8" Gas Export Pipeline, Flowline and Umbilical Routes (Report 110394) Dated December 2011 for Shell.
- C&C Technologies prepared a Geotechnical Laboratory Testing Data Report, Stones Export Line Survey (Report No. 110394) dated February 3, 2012 for Shell Offshore Gas Pipeline.

F. Shallow Hazards Assessment – See Section 6 for assessment

G. High-Resolution Seismic Lines

Proprietary data.

H & I Stratigraphic Column with Time vs depth table

Proprietary data.

J. Geochemical Information

This information is not required for Plans submitted in the GOM Region.

K. Future G&G Activities

This information is not required for Plans submitted in the GOM Region.

SECTION 4: HYDROGEN SULFIDE

A. Concentration

0 ppm.

B. Classification

Based on CFR 250.550.215 Shell requests that the Regional Supervisor, Field Operations, determine the zones in the proposed drilling and completion operations in this plan to be classified as an area where the absence of H_2S has been confirmed.

C. Modeling Report

We do not anticipate to encounter or handle 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

A. Technology and Reservoir Engineering practices and procedures

Proprietary data.

B. Technology and recovery practices and procedures

Proprietary data.

C. Reservoir Development

Proprietary data.

SECTION 6: BIOLOGICAL, PHYSICAL, AND SOCIOECONOMIC INFORMATION

A. Chemosynthetic Communities Report

ANCHOR CLEARANCE AND CHEMOSYNTHETIC ORGANISMS COMMENTS

The following reports were used for our analysis:

- Gardline Surveys prepared a 3D Geohazard Assessment Walker Ridge Blocks 463-465, 506-510, 550-554, and 594-598, Volumes 1 and 2, (Report Number 6092) dated March 2004 for BP.
- GEMS prepared a Wellsite Descriptions, Proposed Wellsites C & D, Walker Ridge 508 (Report Number 0306-1151) dated May 2006 for Shell.
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<u>The following existing wells are in the vicinity of the planned activities:</u>

*Walker Ridge 508 Well 01	X = 2,376,971	Y= 9,605,100
*Walker Ridge 508 Well 02	X = 2,368,107	Y= 9,604,808
*Walker Ridge 508 Well 03	X = 2,367,381	Y= 9,617,757
**Walker Ridge 507 Well 01	X = 2,654,532	Y= 9,603,363

*Future PA projects.
**Well drilled.

<u>Currently Planned Operations:</u>

Note: Wells will be drilled and completed under plan S-7599.

Walker Ridge 507 Well 01	X = 2,654,532	Y= 9,603,363
Proposed Well J	X = 2365499	Y = 9603402
Proposed Well K	X = 2365543	Y = 9603541
Proposed Well L	X = 2365452	Y = 9603387
Proposed Well M	X = 2365585	Y = 9603506
Proposed Well N	X = 2365557	Y = 9603407
Proposed Well O	X = 2365635	Y = 9603487
Proposed Well P	X = 2365594	Y = 9603555
Proposed Well Q	X = 2365528	Y = 9603408

Installation of Proposed New Equipment:

See Section 1, Attachment 1A for field Layout showing location of seafloor equipment. Also at the end of this section, Attachment 6A shows drill center and red circle with clearance.

FPSO WR 551:	X = 2356124.28	Y = 9595484.49
MFD-85501	X = 2365522.80	Y = 9603473.97
UTA-85701 (UTH Flange):	X = 2365492.46	Y = 9603817.92
UTA-85702 (UTH Flange):	X = 2365221.33	Y = 9603616.89
EDM-85701:	X = 2365511.69	Y = 9603741.69
EDM-85702:	X = 2365263.44	Y = 9603516.21
PLET-85202:	X = 2365458.02	Y = 9603456.47
PLET-85201:	X = 2365412.79	Y = 9603515.38
Artificial Lift Manifold (ALM)	X = 2365459.74	Y = 9603584.12

FPSO Anchors:

FPSO Turret	X = 2356124	Y = 9595484
Line 1	X = 2366028	Y = 9596993
Line 2	X = 2366119	Y = 9596124
Line 3	X = 2366138	Y = 9595250
Line 4	X = 2352484	Y = 9586166
Line 5	X = 2351686	Y = 9586519
Line 6	X = 2350921	Y = 9586941
Line 7	X = 2349866	Y = 9603307
Line 8	X = 2350570	Y = 9603825
Line 9	X = 2351319	Y = 9604277

Shell examined 500' of seafloor around each FPSO anchor. None of the anchors have chemosynthetic communities within 500' of the anchors.

Sonar contact 8 is near Anchor 7 and has coordinates of X -= 2349861.75 and Y = 9603051. It is classified debris thus no archaeological avoidance. Sonar contact 5 is near Anchor 8 and has coordinates of X = 235-570.50 and Y = 9603682. It is classified debris thus has no archaeological avoidance.

Regional Overview

Walker Ridge Block 508 straddles the Sigsbee Escarpment and abyssal plain. The southern half of the block is in an area of seafloor furrows that make for variable seafloor strength. At the proposed locations, the soils at the base of the furrows are of higher than normal sheer strength due to active erosion. The ridges between the furrows have not experienced the maximum erosion forces, thus, the soils are relatively soft. Proposed Locations G, H, and I are positioned between seafloor furrows. There are no fluid expulsion features, faults, or chemosynthetic communities within 2000 feet of the proposed wells. The WR 507 001 well (Well #4) was drilled at the drill center in 2012 and will be avoided when placing new subsea infrastructure at the drill center. No other subsea infrastructure exists within 500 ft of planned activities. Shell will avoid all drilled wells per NTL guidelines.

Per NTL No. 2009-G40, there are no high-density deepwater benthic communities located within 2,000' of the proposed mud and cuttings discharge location and there are no high-density deepwater benthic communities located within 500' of the proposed equipment locations.

There is no evidence of seafloor or near-surface hydrocarbon-charged sediments associated with surface faulting, acoustic void zones associated with surface faulting, mounds, knolls, gas seeps, oil seeps, or hard bottom within this area. Currently, there are no pipelines or communications cables in the vicinity of the proposed wells.

Conclusion

Based on a high-resolution geophysical survey, consisting of frequency enhanced 3-D seismic, ESRs, ESRs with amplitudes applied and AUV high-resolution data, these locations appear suitable for the planned activity.

Vernessa Bradford, Shallow Hazards Interpreter

B - F

Pursuant to NTL No. 2008-G04 the proposed operations covered by this SEP do not involve operations impacting the following: Topographic features map, Topographic features statement (shunting), Live bottoms, (Pinnacle Trend) map, Live bottoms (low relief) map, or potentially sensitive biological features map.

i. Remotely Operated Vehicle (ROV) Monitoring Plan

In accordance with the provisions of NTL 2008-G06, Remotely Operated Vehicle Surveys in Deepwater, Walker Ridge 508 is located in Grid 11. Grid 11 is an area that has adequate ROV survey coverage; therefore we are not proposing to run the pre- and post-ROV survey in accordance with the NTL.

j. Threatened and Endangered Species Information

There are 5 species of sea turtles that may be found in the Gulf of Mexico (see table). No critical habitat for these species has been designated in the Gulf of Mexico.

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

Table 6.1 – Threatened and Endangered Sea Turtles

There are 29 species of marine mammals that may be found in the Gulf of Mexico (see table). 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*	
Northern 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*	
West Indian manatee	*Trichechus manatus*	E

Table 6.1 – Threatened and Endangered Marine Mammals

Section 18 discusses potential impacts and mitigation measures related to threatened and endangered species.

k. Archaeological Report

Per the C&C Archaeological report referenced above, none of the sonar contacts within the requested 12,000' anchor radius (for FPSO) are deemed historically significant. (See reports for details.) Note: Wells will be drilled and completed under plan S-7599.

The Stones development will use an FPSO to store then separate the oil and gas production. Oil production will be shipped to shore by tanker. Gas production will tie-in to a future subsea pipeline in WR 457.

Walker Ridge 507 Well 01	X = 2,654,532	Y= 9,603,363
Proposed Well J	X = 2365499	Y = 9603402
Proposed Well K	X = 2365543	Y = 9603541
Proposed Well L	X = 2365452	Y = 9603387
Proposed Well M	X = 2365585	Y = 9603506
Proposed Well N	X = 2365557	Y = 9603407
Proposed Well O	X = 2365635	Y = 9603487
Proposed Well P	X = 2365594	Y = 9603555
Proposed Well Q	X = 2365528	Y = 9603408

Installation of Proposed New Equipment:

See Section 1, Attachment 1A for field Layout showing location of seafloor equipment. Also at the end of this section, Attachment 6B shows drill center and red circle with clearance.

MFD-85501	X = 2365522	Y = 9603473
UTA-85701 (UTH Flange):	X = 2365492	Y = 9603817
UTA-85702 (UTH Flange):	X = 2365221	Y = 9603616
EDM-85701:	X = 2365511	Y = 9603741
EDM-85702:	X = 2365263	Y = 9603516
PLET-85202:	X = 2365458	Y = 9603456
PLET-85201:	X = 2365412	Y = 9603515
Artificial Lift Manifold (ALM)	X = 2365459	Y = 9603584

FPSO Anchors:

FPSO Turret	X = 2356124	Y = 9595484
Line 1	X = 2366028	Y = 9596993
Line 2	X = 2366119	Y = 9596124
Line 3	X = 2366138	Y = 9595250
Line 4	X = 2352484	Y = 9586166
Line 5	X = 2351686	Y = 9586519
Line 6	X = 2350921	Y = 9586941

Line 7	X = 2349866	Y = 9603307
Line 8	X = 2350570	Y = 9603825
Line 9	X = 2351319	Y = 9604277

Shell examined 500' of seafloor around each FPSO anchor. None of the anchors have chemosynthetic communities within 500' of the anchors.

Sonar contact 8 is near Anchor 7 and has coordinates of X -= 2349861.75 and Y = 9603051. It is classified debris thus no archaeological avoidance. Sonar contact 5 is near Anchor 8 and has coordinates of X = 235-570.50 and Y = 9603682. It is classified debris thus has no archaeological avoidance.

There are two flowlines planned on this project. Flowline 85201 will connect to PLET-85201, and flowline 85202 will connect to PLET-85202. There will also be a gas export pipeline, which will connect the FPSO to a gas transport pipeline in WR 457.

Based on a high-resolution geophysical survey, consisting of frequency enhanced 3-D seismic, ESRs, ESRs with amplitudes applied and AUV high-resolution data, these locations appear suitable for the planned activity.

Vernessa Bradford, Shallow Hazards Interpreter

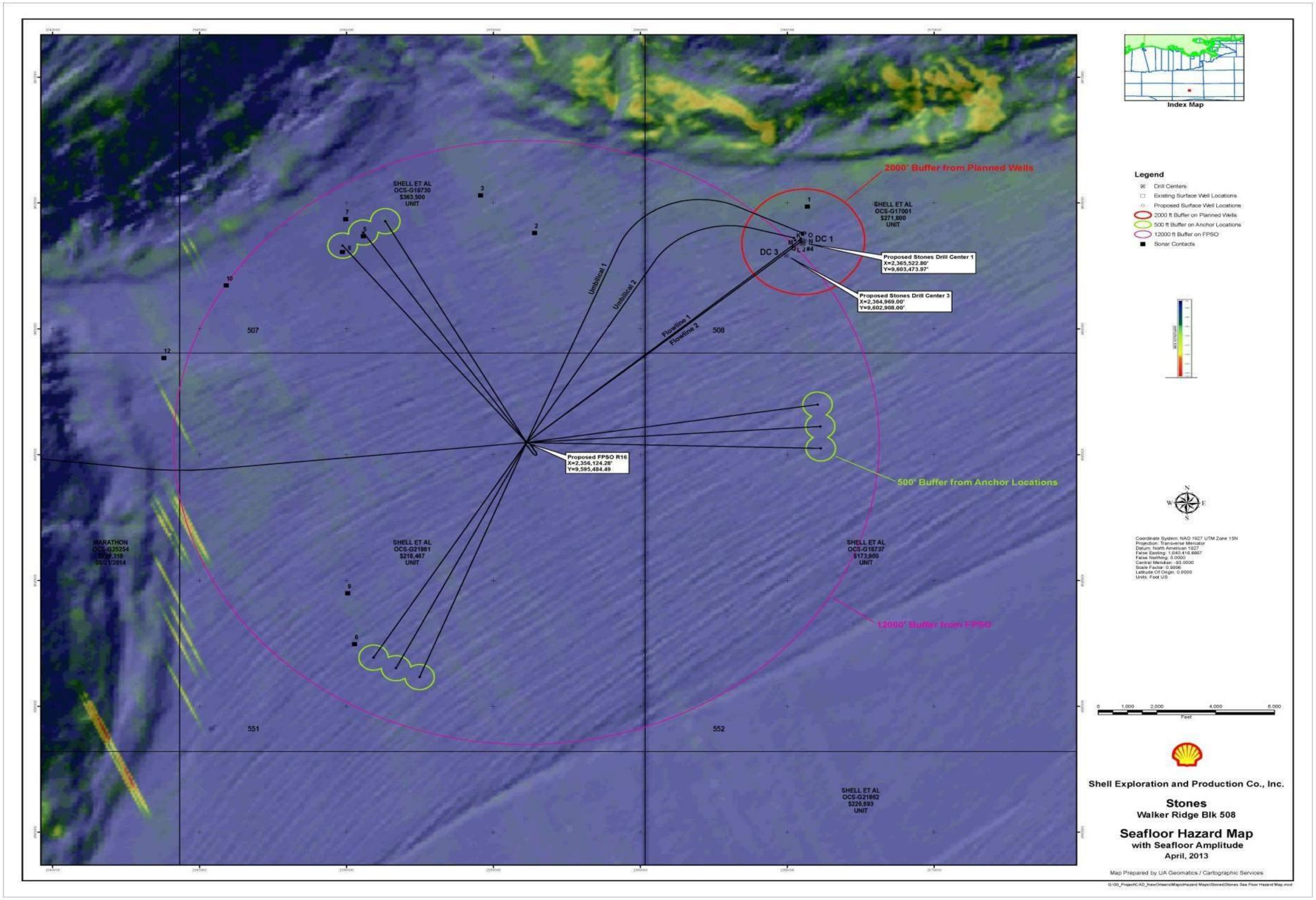
l. Air and Water Quality Information

Pursuant to NTL 2008-G04 the proposed operations covered by this plan do not require Shell to provide additional information relating to air and water quality information. For specific information relating to air and water quality information please refer to Section 18.

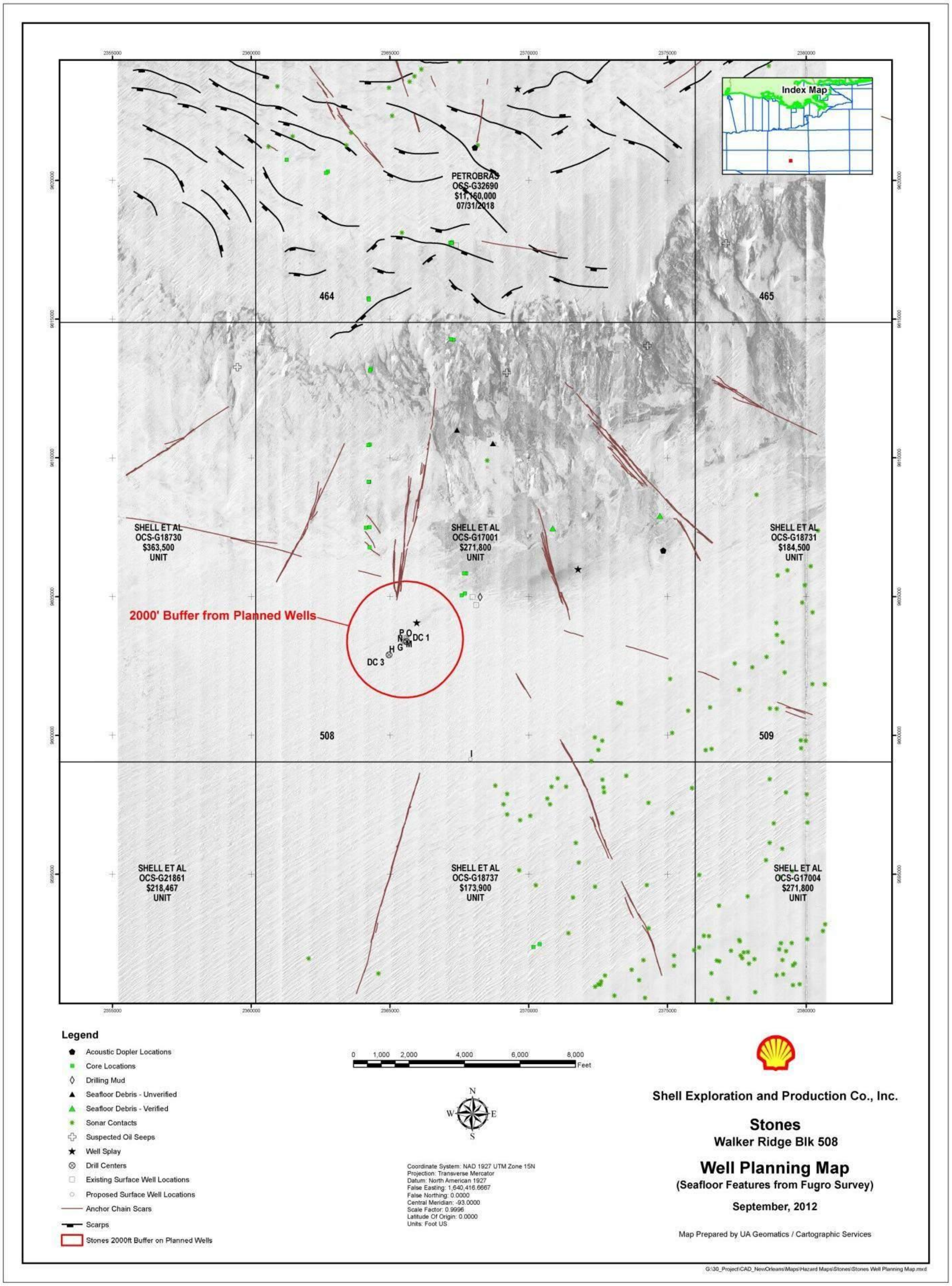
m. Socioeconomic Information

Pursuant to NTL 2008-G04 the proposed operations covered by this plan do not require Shell to provide additional information relating to air and water quality information. For specific information relating to socioeconomic information please refer to Section 18.

Attachment 6A



Attachment 6B



SECTION 7: WASTE AND DISCHARGE INFORMATION

A. Projected Ocean Discharges

The drilling and completion of the wells in this plan were covered in S-7599.

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				**Walker Ridge 507, 508, 509, 551, 552, 553, 586, 597**	
Projected generated waste			**Projected ocean discharges**		**Projected Downhole Disposal**
Type of Waste and Composition	**Composition**	**Projected Amount (Total)**	**Discharge rate**	**Discharge Method**	**Answer yes or no**
Domestic waste (kitchen water, shower water)	grey water	3,299,600 x 20 years = 65,992,000 liters	9,040 liter/day	Grinded to less than 25 mm mesh size and discharge overboard	No
Sanitary waste (toilet water)	treated sanitary waste	2,423,600 x 20 years = 48,472,000 liters	6,640 liter/day	Treated in the MSD prior to discharge	No
Deck Drainage	Wash and rainwater	709,560 bbls x 20 years = 14,191,200 bbls	1944 bbls day	Retained in Hazardous and Non hazardous drain tanks for 25 min for gravity separation and drained overboard.	No
Desalinization unit discharge	Rejected water from watermaker unit	344,195 bbls x 20 years = 6,883,900 bbls	943 bbls day	Discharged overboard below 300MM water line.	No
Miscellaneous Discharge	Uncontaminated Bilge Water	11,315 x 20 years = 226,300 bbls	<31 Bbl/d	Discharge overboard after treating	No
Miscellaneous Discharge	Uncontamined/Untreated seawater during turret connect and reconnect processes	16,000 bbls x 20 years = 320,000 bbls	16,000 bbls/event	Discharged at waterline in turret/hull annulus	No
Fire water (jockey pump)	Uncontaminated seawater	7,708,800 bbls x 20 = 154,175,000 bbls	21,120 bbls/day	Discharged overboard below waterline	No
Cooling water	Uncontaminated seawater	35,040,000 m3/hr x 20 years = 700,800,000 m3	4000 m3/hr	Discharged overboard below waterline	No
Produced water	Produced Water	10,950,000 bbls x 20 years = 219,000,000 bbls	30,000 Bbl/d	1. Discharged directly overboard after treating 2. Gravity Discharge to overboard from slop tank through Oil content monitor	No
Ballast water	Uncontaminated seawater	35,040,000 m3/year x 20 years = 700,800,000 m3	Discharge rate = 96,000m3/day	Discharged overboard No treating	No
Well treatment fluids	CaBr2/CaCl2	96,725 bbls	265 bbls/year	Discharge overboard after treating	No
Will you be covered by an individual/general NPDES permit ?			**GENERAL PERMIT**	*290000*	

B. Projected Generated Wastes

TABLE 7B: WASTES YOU WILL TRANSPORT AND /OR DISPOSE OF ONSHORE					
Projected generated waste		**Solid and Liquid Wastes transportation**	**Waste Disposal**		
Type of Waste	**Composition**	**Transport Method**	**Name/Location of Facility**	**Total Amount**	**Disposal Method**
EXAMPLE: Oil-based drilling fluid or mud	***NA***	**NA**	**NA**	**NA**	**NA**
Completion fluids	NA	NA	NA	NA	NA
Synthetic-based drilling fluid or mud	NA	NA	NA	NA	NA
Cuttings wetted with Water-based fluid	NA	NA	NA	NA	NA
Cuttings wetted with Synthetic-based fluid	NA	NA	NA	NA	NA
Cuttings wetted with oil-based fluids	NA	NA	NA	NA	NA
Produced sand	NA	NA	NA	NA	NA
Trash and debris - recyclables	trash and debris	storage bins on supply boat	Omega Waste Management, W. Patterson, LA or ARC, New Iberia, LA	24,000 lbs/yr x 20 years = 480,000 lbs	recycle
Non-Hazardous trash and debris - non-recyclables	trash and debris	storage bins on supply boat	Republic/BFI landfill, Sorrento, LA or the parish landfill, Avondale, LA.	72,000 lbs/yr x 20 years = 1,440,000 lbs	landfill
Hazardous waste	paints, solvents and unused chemicals	drums on supply boat	Safety Kleen, Denton, TX	3000 lbs/yr x 20 years = 60,000 lbs	recycle
Used oil & glycol	used oil, oily rags and pads, empty drums and cooking oil	drums and Bins on supply boat	Omega Waste Management, W. Patterson, LA or ARC, New Iberia, LA	48 bbls/yr x 20 yrs = 960 bbls & 4800 lbs/yr x 20 yrs = 96,000 lbs	recycle
Universal waste items	Batteries, lamps, glass and mercury-contaminated waste	bins on supply boat	Lamp Environmental, Hammond, LA	360 lbs/yr x 20 =7,200 lbs	Recycled and/or disposed

C. Modeling Report

Shell did not model the trajectory for discharges because it is not required in the GOM.

SECTION 8: AIR EMISSIONS

A. Emissions Worksheet and Screening Questions

Screening Questions for DOCD's	Yes	No
Is any calculated Complex Total (CT) Emission amount (in tons) associated with your proposed 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
Does or will the facility complex associated with your proposed development and production activities process production from eight or more wells?	X	
Do you expect to encounter H_2S at concentrations greater than 20 parts per million (ppm)?		X
Do you propose to flare or vent natural gas in excess of the criteria set forth under 250.1105(a)(2) and (3)?		X
Do you propose to burn produced hydrocarbon liquids?		X
Are your proposed development and production activities located within 25 miles from shore?		X
Are your proposed development and production activities located within 200 kilometers of the Breton Wilderness Area?		X

Note: The BOEM provided AQR default emission factors do not specifically account for VOC emissions associated with 1) Venting from the Shuttle Tanker that occur during the transfer of crude oil from the FPSO to the Shuttle Tanker or 2) the VOC emissions that occur during the Cargo Tank Purging and Gas Freeing - Maintenance Activities on-board the FPSO.

B. 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) 728-4652, tracy.albert@shell.com

(1) Worksheets

See attached. The Excel file can be found on the Proprietary CD.

COMPANY	Shell Offshore Inc.
AREA	Walker Ridge
BLOCK	507, 508, 551, 552
LEASE	18730, 17001, 21861, 18737
PLATFORM	FPSO
WELL	
COMPANY CONTACT	Jeffrey McMenis
TELEPHONE NO.	504-425-6021
REMARKS	SEPCo Env File Name - Stones-AQR-DOCD-031913-rev1.xlsx

Additional Emission Factors for Stones DOCD AQR
jbm - 1/3/12

Purpose

The BOEM provided AQR default emission factors do not specifically account for VOC emissions associated with 1) Venting from the Shuttle Tanker that occur during the transfer of crude oil from the FPSO to the Shuttle Tanker or 2) the VOC emissions that occur during the Cargo Tank Purging and Gas Freeing - Maintenance Activities on-board the FPSO. The below provides site-specific emission factors developed for this AQR.

Description of FPSO Activities

In the case of FPSO operations, oil is stored aboard the FPSO in cargo tanks and then transferred to shore via shuttle tanker. The process of storing the crude oil and then unloading it to a traditional shuttle tanker can be divided into two steps. The first step is transferring the crude oil from the process into the cargo tanks and storing it on the FPSO. The second step is loading the crude oil onto the shuttle tanker. These are discussed in detail below.

First Step - Storage of Crude Oil aboard the FPSO

Cargo Tanks aboard the FPSO for storage of crude oil will be blanketed with hydrocarbon. The hydrocarbon blanket and any resulting vapors from the cargo tanks is compressed and recycled to the process. As such, emissions to atmosphere will be minimized when the hydrocarbon blanket is present.

As part of normal maintenance procedures, the cargo tanks will be deinventoried and washed down. During these activities, the hydrocarbon blanket will not be present and venting from the cargo tanks to the atmosphere may occur. The below provides estimates of emissions:

1. Assume entire volume of cargo tank is displaced during tank washing and that 100% of expelled vapor is VOC.
2. Assume one tank washing occurs every 3 mos. Largest tank volume is 92707 bbls, which would be displaced to atmosphere.
3. Use gas density of 29 tonne/MMSCF (0.06 lb/scf) from GHG and Energy Management Plan, emissions per tank washing would be 15.62 tons (92707 bbl * 42 gal/bbl / 7.48 gal/ft3 * 0.06 lb/scf / 2000 lb/ton).
4. Assuming 100% VOC (for conservatism), AQR emissions equal to 62.47 tons/yr (15.62 tons * 4 activities/yr). Assuming each washing occurs of a 24-hr period, emissions would be equal to 1301.67 lb/hr (62.47 ton/yr * 2000 lb/ton / (4 activities/yr * 24 hr/activity).

Second Step - Transfer of Crude Oil from the FPSO to the Shuttle Tanker

VOC emissions from the shuttle tanker will be generated as the shuttle tanker cargo tanks are filled and vapors are expelled. Shell contracted with 3rd party to estimate VOC emissions during these activities. The 3rd party utilized VOCsim, which is computer simulation tool developed by SINTEF, to estimate the VOC emission factor. Input parameters into the VOCsim include (but not limited to): cargo tank configurations, cargo temperature, crude oil compositions, vessel motion, loading rates and durations, etc.

1. 3rd party estimates Non Methane VOC as 0.759 kg NMVOC/Sm3.
2. Using conversion factors of 2.20462 lb/kg, and 6.2898 bbl/Sm3, the emission factor converts to **0.266 lb/bbl.**
3. VOC emissions are equal to 2,913 ton/yr (60K bopd production * 365 day/yr * 0.266 lb/bbl / 2000 lb/ton).

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			

Additional Emission Factors

		PM	SO2	NOx	VOC	CO	REF.	DATE
Distillate Turbines	lbs/MMBtu	0.012	0.05050	0.88	0.00041	0.0033	AP42, 3.1, Tables 3.1-1 and 3.1-2a	4/00
Shuttle Tanker Venting	lb/bbl				0.266		See Separate Worksheet tab	
Cargo Tank Washing	ton/washing				15.62		See Separate Worksheet tab	
Low Sulfur Fuel Oil - Recip > 600 hp	lb/hp-hr	0.0007	0.00809	0.024	0.000705	0.0055	AP42, 3.1, Tables 3.1-1 and 3.1-2a	Oct-96

Sulphur Content Source	Value	Units
Fuel Gas	3.33	ppm
Diesel Fuel	0.05	% weight
Low Sulfur Fuel Oil	1	% 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.

Low Sulfur Fuel Oil is utilized for the Shuttle Tanker Main Engines

AREA	BLOCK	LEASE	PLATFORM	WELL		CONTACT	PHONE	REMARKS
Walker Ridge	07, 508, 551, 55	18730, 17001,	FPSO	0		Jeffrey McMenis	504-425-6021	SEPCo Env File Name - Stones-AQR-DOCD-031913-rev1.xlsx

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
SURF PFR Installation Campaign - 1 - Pile Installation Vessel	13250	640	15359	24	16	9.34	5.36	321.04	9.63	70.04	1.79	1.03	61.64	1.85	13.45
FPSO Piling Installation Campaign - Pile Installation Vessel	13250	640	15359	24	15	9.34	5.36	321.04	9.63	70.04	1.68	0.96	57.79	1.73	12.61
SURF PFR Installation Campaign - 1 - Installation Vessel	13250	640	15359	24	22	9.34	5.36	321.04	9.63	70.04	2.47	1.41	84.75	2.54	18.49
SURF PFR Installation Campaign - 1 - Flowline LCV	12600	609	14606	24	36	8.88	5.09	305.29	9.16	66.61	3.84	2.20	131.88	3.96	28.77
SURF PFR Installation Campaign - 1 - Flowline Cargo Tug	25200	1217	29212	24	15	17.76	10.19	610.57	18.32	133.22	3.20	1.83	109.90	3.30	23.98
SURF PFR Installation Campaign - 1 - Flowline Support Vessels	25200	1217	29212	24	20	17.76	10.19	610.57	18.32	133.22	4.26	2.44	146.54	4.40	31.97
SURF PFR Installation Campaign - 1 - Flowline Heading Tug	25200	1217	29212	24	9	17.76	10.19	610.57	18.32	133.22	1.92	1.10	65.94	1.98	14.39
SURF Umbilical Installation Campaign -2- Umbilical Vessel	45000	2174	52164	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SURF Umbilical Installation Campaign -2- Umbilical Support	12600	609	14606	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Vessel Installation Campaign - Anchor Handling Tug	37800	1826	43818	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Vessel Installation Campaign - Support Vessel	12600	609	14606	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Vessel Installation Campaign - Mooring Line Installation Vessel	45000	2174	52164	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Vessel Installation Campaign - Tow Tug	25200	1217	29212	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Vessel Installation Campaign - Heavy Lift Transport	45000	2174	52164	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Vessel Installation Campaign - Pile Installation Vessel	13250	640	15359	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Post Installation Campaign - Recovery Vessel	45000	2174	52164	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Post Installation Campaign - Diving Vessel	9440	456	10943	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SURF Jumper & Metrology Campaign - 3 - Jumper Metrology Vessel	22000	1063	25502	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SURF Jumper & Metrology Campaign - 3 - Jumper Installation Vessel	22000	1063	25502	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drilling Campaign #3 Well 5, 6, 7, 8, 9, 10, & 11 - Jumper Metrology Vessel	22000	1063	25502	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drilling Campaign #3 Well 5, 6, 7, 8, 9, 10, & 11 - Jumper Installation Vessel	22000	1063	25502	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Power Generation Turbine - Diesel Fired (MMBtu/hr)	230	1667	40000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Power Generation Turbine - Diesel Fired (MMBtu/hr)	230	1667	40000	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Steam Boiler - Diesel Fired (bbl/hr)	19.2	806	19354	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Steam Boiler - Diesel Fired (bbl/hr)	19.2	806	19354	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Misc Equipment - Diesel Fired (bhp)	1000	48	1159	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Facility Commisioning - Crew Boat - Diesel Fired (bhp)	5400	261	6260	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

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Power Generation Turbine No. 1 - Fuel Gas Fired (bhp)	25345	241386	5793259	24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 1 - Diesel Fired (MMBtu/hr)	230	1667	40000	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 2 - Fuel Gas Fired (bhp)	25345	241386	5793259	24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 2 - Diesel Fired (MMBtu/hr)	230	1667	40000	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 3 - Fuel Gas Fired (bhp)	25345	241386	5793259	24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 3 - Diesel Fired (MMBtu/hr)	230	1667	40000	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 4 - Fuel Gas Fired (bhp)	25345	241386	5793259	24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 4 - Diesel Fired (MMBtu/hr)	230	1667	40000	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 5 - Fuel Gas Fired (bhp)	25345	241386	5793259	24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 5 - Diesel Fired (MMBtu/hr)	230	1667	40000	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emergency Generator - Diesel Fired Fired (bhp)	970	47	1124	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deck Crane No. 1 - Diesel Fired (bhp)	580	28	672	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deck Crane No. 2 - Diesel Fired (bhp)	580	28	672	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Firewater Pump No. 1 - Diesel Fired (bhp)	1379	67	1599	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Firewater Pump No. 2 - Diesel Fired (bhp)	1379	67	1599	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Misc diesel driven equipment (bhp)	1000	48	1159	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Essential Generator No. 1 - Diesel Fired (bhp)	1218	59	1412	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Essential Generator No. 2 - Diesel Fired (bhp)	1218	59	1412	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Essential Generator No. 3 - Diesel Fired (bhp)	1218	59	1412	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Main Engine - Diesel Fired (bhp)	25320	1223	29351	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inert Gas Generator - Diesel Fired (bhp)	400	19	464	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 1 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 1 - Diesel Fired (bbl/hr)	19.2	806	19354	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 2 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 2 - Diesel Fired (bbl/hr)	19.2	806	19354	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Main Engine - Diesel Fired (bhp)	11640	562	13493	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Generator No. 1 - Diesel Fired (hp)	993	48	1151	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Generator No. 2 - Diesel Fired (hp)	993	48	1151	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Generator No. 3 - Diesel Fired (hp)	993	48	1151	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Emergency Generator - Diesel Fired (hp)	161	8	187	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Auxiliary Generator - Diesel Fired (hp)	3018	146	3498	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Boiler - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Shuttle Tanker Incinerator - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crew Boat - Diesel Fired (bhp)	5400	261	6260	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
General Vessel Support - Diesel Fired (bhp)	30000	1449	34776	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MISC.	**BPD**	**SCF/HR**	**COUNT**												
FPSO TANK-MGO/Diesel Storage (bbls/day)	500			24	0				0.00					0.00	
FPSO TANK-Lube Oil , Chemical totes, bilge water, other miscellaneous storage - Emissions are minimal given low throughputs and/or negligible vapor pressures															
FPSO TANK-Methanol (bbls/day) - Emissions would occur when N2 blanket not present (anticipated 3 day/yr part of turret disconnect/reconnect)	3000			24	0				0.00					0.00	
FPSO Cargo Oil / Slop Oil Tanks - Routine Operation (No Emissions to Atmosphere) -hydrocarbon blanket is present and cargo tank vapors are recovered and recycled to process except during cargo tank washing (see below)															
FPSO Cargo Tank Purging and Gas Freeing - Maintenance Activity (15.62 tons per washing activity)				24	0				0.00					0.00	
Shuttle Tanker Cargo Tank Venting during Loading - (300,000 bbls loaded per tanker and loading potentially occurs every 5 days)				24	0				0.00					0.00	
HP FLARE - Pilot/Purge Gas (scf/hr)		400		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
LP FLARE - Pilot/Purge Gas (scf/hr)		200		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
HP Flare - Flared Gas (scf/hr)		875000		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
LP Flare - Flared Gas (scf/hr)		291667		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
PROCESS VENT- (scf/hr)		2083		24	0				0.00					0.00	
FUGITIVES- (counts)			11420	24	0				0.00					0.00	
GLYCOL STILL VENT-emissions controlled				24	0										
YEAR TOTAL						**90.19**	**51.72**	**3100.11**	**93.00**	**676.39**	**19.15**	**10.98**	**658.44**	**19.75**	**143.66**
DISTANCE FROM LAND IN MILES											**5927.40**	**5927.40**	**5927.40**	**5927.40**	**107586.78**

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AREA	BLOCK	LEASE	PLATFORM	WELL			CONTACT		PHONE	REMARKS					
Walker Ridge	07, 508, 551, 55	18730, 17001,	FPSO	0			Jeffrey McMenis		504-425-6021	SEPCo Env File Name - Stones-AQR-DOCD-031913-rev1.xlsx					
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**
SURF PFR Installation Campaign - 1 - Pile Installation Vessel	13250	640	15359	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
FPSO Piling Installation Campaign - Pile Installation Vessel	13250	640	15359	0	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
SURF PFR Installation Campaign - 1 - Installation Vessel	13250	640	15359	24	23	9.34	5.36	321.04	9.63	70.04	2.58	1.48	88.61	2.66	19.33
SURF PFR Installation Campaign - 1 - Flowline LCV	12600	609	14606	24	36	8.88	5.09	305.29	9.16	66.61	3.84	2.20	131.88	3.96	28.77
SURF PFR Installation Campaign - 1 - Flowline Cargo Tug	25200	1217	29212	24	15	17.76	10.19	610.57	18.32	133.22	3.20	1.83	109.90	3.30	23.98
SURF PFR Installation Campaign - 1 - Flowline Support Vessels	25200	1217	29212	24	21	17.76	10.19	610.57	18.32	133.22	4.48	2.57	153.86	4.62	33.57
SURF PFR Installation Campaign - 1 - Flowline Heading Tug	25200	1217	29212	24	10	17.76	10.19	610.57	18.32	133.22	2.13	1.22	73.27	2.20	15.99
SURF Umbilical Installation Campaign -2- Umbilical Vessel	45000	2174	52164	24	32	31.72	18.19	1090.31	32.71	237.89	12.18	6.98	418.68	12.56	91.35
SURF Umbilical Installation Campaign -2- Umbilical Support	12600	609	14606	24	32	8.88	5.09	305.29	9.16	66.61	3.41	1.96	117.23	3.52	25.58
FPSO Vessel Installation Campaign - Anchor Handling Tug	37800	1826	43818	24	21	26.64	15.28	915.86	27.48	199.82	6.71	3.85	230.80	6.92	50.36
FPSO Vessel Installation Campaign - Support Vessel	12600	609	14606	24	45	8.88	5.09	305.29	9.16	66.61	4.80	2.75	164.85	4.95	35.97
FPSO Vessel Installation Campaign - Mooring Line Installation Vessel	45000	2174	52164	24	21	31.72	18.19	1090.31	32.71	237.89	7.99	4.58	274.76	8.24	59.95
FPSO Vessel Installation Campaign - Tow Tug	25200	1217	29212	24	14	17.76	10.19	610.57	18.32	133.22	2.98	1.71	102.58	3.08	22.38
FPSO Vessel Installation Campaign - Heavy Lift Transport	45000	2174	52164	24	5	31.72	18.19	1090.31	32.71	237.89	1.90	1.09	65.42	1.96	14.27
FPSO Vessel Installation Campaign - Pile Installation Vessel	13250	640	15359	24	14	9.34	5.36	321.04	9.63	70.04	1.57	0.90	53.93	1.62	11.77
FPSO Post Installation Campaign - Recovery Vessel	45000	2174	52164	24	42	31.72	18.19	1090.31	32.71	237.89	15.99	9.17	549.52	16.49	119.89
FPSO Post Installation Campaign - Diving Vessel	9440	456	10943	24	2	6.65	3.82	228.72	6.86	49.90	0.16	0.09	5.49	0.16	1.20
SURF Jumper & Metrology Campaign - 3 - Jumper Metrology Vessel	22000	1063	25502	24	14	15.51	8.89	533.04	15.99	116.30	2.61	1.49	89.55	2.69	19.54
SURF Jumper & Metrology Campaign - 3 - Jumper Installation Vessel	22000	1063	25502	24	27	15.51	8.89	533.04	15.99	116.30	5.02	2.88	172.70	5.18	37.68
Facility Commisioning - Power Generation Turbine - Diesel Fired (MMBtu/hr)	230	1667	40000	24	83	2.76	11.62	202.40	0.09	0.76	2.75	11.57	201.59	0.09	0.76
Facility Commisioning - Power Generation Turbine - Diesel Fired (MMBtu/hr)	230	1667	40000	24	83	2.76	11.62	202.40	0.09	0.76	2.75	11.57	201.59	0.09	0.76
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	24	83	0.86	0.49	29.51	0.89	6.44	0.86	0.49	29.39	0.88	6.41
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	24	83	0.86	0.49	29.51	0.89	6.44	0.86	0.49	29.39	0.88	6.41
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	24	83	0.86	0.49	29.51	0.89	6.44	0.86	0.49	29.39	0.88	6.41
Facility Commisioning - Steam Boiler - Diesel Fired (bbl/hr)	19.2	806	19354	24	83	1.61	5.81	16.13	0.15	4.03	1.61	5.78	16.06	0.15	4.02
Facility Commisioning - Steam Boiler - Diesel Fired (bbl/hr)	19.2	806	19354	24	83	1.61	5.81	16.13	0.15	4.03	1.61	5.78	16.06	0.15	4.02
Facility Commisioning - Misc Equipment - Diesel Fired (bhp)	1000	48	1159	24	83	0.70	0.40	24.23	0.73	5.29	0.70	0.40	24.13	0.72	5.27
Facility Commisioning - Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	83	5.22	2.99	179.30	5.38	39.12	5.19	2.98	178.58	5.36	38.96
Facility Commisioning - Crew Boat - Diesel Fired (bhp)	5400	261	6260	24	83	3.81	2.18	130.84	3.93	28.55	3.79	2.17	130.31	3.91	28.43

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Power Generation Turbine No. 1 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 1 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 2 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 2 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 3 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 3 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 4 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 4 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Power Generation Turbine No. 5 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
Power Generation Turbine No. 5 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Emergency Generator - Diesel Fired Fired (bhp)	970	47	1124	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deck Crane No. 1 - Diesel Fired (bhp)	580	28	672	12	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Deck Crane No. 2 - Diesel Fired (bhp)	580	28	672	12	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Firewater Pump No. 1 - Diesel Fired (bhp)	1379	67	1599	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Firewater Pump No. 2 - Diesel Fired (bhp)	1379	67	1599	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Misc diesel driven equipment (bhp)	1000	48	1159	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Essential Generator No. 1 - Diesel Fired (bhp)	1218	59	1412	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Essential Generator No. 2 - Diesel Fired (bhp)	1218	59	1412	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Essential Generator No. 3 - Diesel Fired (bhp)	1218	59	1412	2	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Main Engine - Diesel Fired (bhp)	25320	1223	29351	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Inert Gas Generator - Diesel Fired (bhp)	400	19	464	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 1 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 1 - Diesel Fired (bbl/hr)	19.2	806	19354	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 2 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Steam Boiler No. 2 - Diesel Fired (bbl/hr)	19.2	806	19354	1	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Main Engine - Diesel Fired (bhp)	11640	562	13493	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Generator No. 1 - Diesel Fired (hp)	993	48	1151	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Generator No. 2 - Diesel Fired (hp)	993	48	1151	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Generator No. 3 - Diesel Fired (hp)	993	48	1151	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Emergency Generator - Diesel Fired (hp)	161	8	187	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Auxiliary Generator - Diesel Fired (hp)	3018	146	3498	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Shuttle Tanker Boiler - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Shuttle Tanker Incinerator - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Crew Boat - Diesel Fired (bhp)	5400	261	6260	8	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
General Vessel Support - Diesel Fired (bhp)	30000	1449	34776	24	0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MISC.	**BPD**	**SCF/HR**	**COUNT**												
FPSO TANK-MGO/Diesel Storage (bbls/day)	500			24	0				0.00					0.00	
FPSO TANK-Lube Oil , Chemical totes, bilge water, other miscellaneous storage - Emissions are minimal given low throughputs and/or negligible vapor pressures															
FPSO TANK-Methanol (bbls/day) - Emissions would occur when N2 blanket not present (anticipated 3 day/yr part of turret disconnect/reconnect)	3000			24	0				0.00					0.00	
FPSO Cargo Oil / Slop Oil Tanks - Routine Operation (No Emissions to Atmosphere) -hydrocarbon blanket is present and cargo tank vapors are recovered and recycled to process except during cargo tank washing (see below)															
FPSO Cargo Tank Purging and Gas Freeing - Maintenance Activity (15.62 tons per washing activity)				24	0				0.00					0.00	
Shuttle Tanker Cargo Tank Venting during Loading - (300,000 bbls loaded per tanker and loading potentially occurs every 5 days)				24	0				0.00					0.00	
HP FLARE - Pilot/Purge Gas (scf/hr)		400		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
LP FLARE - Pilot/Purge Gas (scf/hr)		200		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
HP Flare - Flared Gas (scf/hr)		875000		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
LP Flare - Flared Gas (scf/hr)		291667		24	0		0.00	0.00	0.00	0.00		0.00	0.00	0.00	0.00
PROCESS VENT- (scf/hr)		2083		24	0				0.00					0.00	
FUGITIVES- (counts)			11420	0	0				0.00					0.00	
GLYCOL STILL VENT-emissions controlled				24	0										
YEAR TOTAL						**328.60**	**218.26**	**11432.06**	**330.35**	**2408.49**	**102.51**	**88.49**	**3659.54**	**97.22**	**713.01**
DISTANCE FROM LAND IN MILES											**5927.40**	**5927.40**	**5927.40**	**5927.40**	**107586.78**
178.0															

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AREA	BLOCK	LEASE	PLATFORM	WELL		CONTACT	PHONE	REMARKS
Walker Ridge	07, 508, 551, 55	18730, 17001,	FPSO	0		Jeffrey McMenis	504-425-6021	SEPCo Env File Name - Stones-AQR-DOCD-031913-rev1.xlsx

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 Campaign #3 Well 5, 6, 7, 8, 9, 10, & 11 - Jumper Metrology Vessel	22000	1063	25502	24	2	15.51	8.89	533.04	15.99	116.30	0.37	0.21	12.79	0.38	2.79
Drilling Campaign #3 Well 5, 6, 7, 8, 9, 10, & 11 - Jumper Installation Vessel	22000	1063	25502	24	2	15.51	8.89	533.04	15.99	116.30	0.37	0.21	12.79	0.38	2.79
Facility Commisioning - Power Generation Turbine - Diesel Fired (MMBtu/hr)	230	1667	40000	24	15	2.76	11.62	202.40	0.09	0.76	0.50	2.09	36.43	0.02	0.14
Facility Commisioning - Power Generation Turbine - Diesel Fired (MMBtu/hr)	230	1667	40000	24	15	2.76	11.62	202.40	0.09	0.76	0.50	2.09	36.43	0.02	0.14
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	24	15	0.86	0.49	29.51	0.89	6.44	0.15	0.09	5.31	0.16	1.16
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	24	15	0.86	0.49	29.51	0.89	6.44	0.15	0.09	5.31	0.16	1.16
Facility Commisioning - Essential Generator - Diesel Fired (bhp)	1218	59	1412	24	15	0.86	0.49	29.51	0.89	6.44	0.15	0.09	5.31	0.16	1.16
Facility Commisioning - Steam Boiler - Diesel Fired (bbl/hr)	19.2	806	19354	24	15	1.61	5.81	16.13	0.15	4.03	0.29	1.05	2.90	0.03	0.73
Facility Commisioning - Steam Boiler - Diesel Fired (bbl/hr)	19.2	806	19354	24	15	1.61	5.81	16.13	0.15	4.03	0.29	1.05	2.90	0.03	0.73
Facility Commisioning - Misc Equipment - Diesel Fired (bhp)	1000	48	1159	24	15	0.70	0.40	24.23	0.73	5.29	0.13	0.07	4.36	0.13	0.95
Facility Commisioning - Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	15	5.22	2.99	179.30	5.38	39.12	0.94	0.54	32.27	0.97	7.04
Facility Commisioning - Crew Boat - Diesel Fired (bhp)	5400	261	6260	24	15	3.81	2.18	130.84	3.93	28.55	0.69	0.39	23.55	0.71	5.14

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Power Generation Turbine No. 1 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	350		0.14	72.57	0.56	46.34		0.56	292.11	2.25	186.50
Power Generation Turbine No. 1 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	350	2.76	11.62	202.40	0.09	0.76	0.48	2.03	35.42	0.02	0.13
Power Generation Turbine No. 2 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	350		0.14	72.57	0.56	46.34		0.56	292.11	2.25	186.50
Power Generation Turbine No. 2 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	350	2.76	11.62	202.40	0.09	0.76	0.48	2.03	35.42	0.02	0.13
Power Generation Turbine No. 3 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	350		0.14	72.57	0.56	46.34		0.56	292.11	2.25	186.50
Power Generation Turbine No. 3 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	350	2.76	11.62	202.40	0.09	0.76	0.48	2.03	35.42	0.02	0.13
Power Generation Turbine No. 4 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	350		0.14	72.57	0.56	46.34		0.56	292.11	2.25	186.50
Power Generation Turbine No. 4 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	350	2.76	11.62	202.40	0.09	0.76	0.48	2.03	35.42	0.02	0.13
Power Generation Turbine No. 5 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	350		0.14	72.57	0.56	46.34		0.56	292.11	2.25	186.50
Power Generation Turbine No. 5 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	350	2.76	11.62	202.40	0.09	0.76	0.48	2.03	35.42	0.02	0.13
Emergency Generator - Diesel Fired Fired (bhp)	970	47	1124	2	52	0.68	0.39	23.50	0.71	5.13	0.04	0.02	1.22	0.04	0.27
Deck Crane No. 1 - Diesel Fired (bhp)	580	28	672	12	350	1.28	0.23	17.89	1.43	3.87	2.68	0.49	37.56	3.00	8.13
Deck Crane No. 2 - Diesel Fired (bhp)	580	28	672	12	350	1.28	0.23	17.89	1.43	3.87	2.68	0.49	37.56	3.00	8.13
Firewater Pump No. 1 - Diesel Fired (bhp)	1379	67	1599	2	52	0.97	0.56	33.41	1.00	7.29	0.05	0.03	1.74	0.05	0.38
Firewater Pump No. 2 - Diesel Fired (bhp)	1379	67	1599	2	52	0.97	0.56	33.41	1.00	7.29	0.05	0.03	1.74	0.05	0.38
Misc diesel driven equipment (bhp)	1000	48	1159	24	350	0.70	0.40	24.23	0.73	5.29	2.96	1.70	101.76	3.05	22.20
Essential Generator No. 1 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
Essential Generator No. 2 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
Essential Generator No. 3 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
Main Engine - Diesel Fired (bhp)	25320	1223	29351	24	7	17.85	10.23	613.48	18.40	133.85	1.50	0.86	51.53	1.55	11.24
Inert Gas Generator - Diesel Fired (bhp)	400	19	464	24	7	0.88	0.16	12.33	0.99	2.67	0.07	0.01	1.04	0.08	0.22
Steam Boiler No. 1 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	350	0.82	0.06	10.79	0.59	9.06	3.30	0.26	43.43	2.39	36.48
Steam Boiler No. 1 - Diesel Fired (bbl/hr)	19.2	806	19354	1	350	1.61	5.81	16.13	0.15	4.03	0.28	1.02	2.82	0.03	0.71
Steam Boiler No. 2 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	350	0.82	0.06	10.79	0.59	9.06	3.30	0.26	43.43	2.39	36.48
Steam Boiler No. 2 - Diesel Fired (bbl/hr)	19.2	806	19354	1	350	1.61	5.81	16.13	0.15	4.03	0.28	1.02	2.82	0.03	0.71
Shuttle Tanker Main Engine - Diesel Fired (bhp)	11640	562	13493	24	73	8.15	94.17	279.36	8.21	64.02	7.14	82.49	244.72	7.19	56.08
Shuttle Tanker Generator No. 1 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
Shuttle Tanker Generator No. 2 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
Shuttle Tanker Generator No. 3 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
Shuttle Tanker Emergency Generator - Diesel Fired (hp)	161	8	187	24	73	0.35	0.07	4.96	0.40	1.07	0.31	0.06	4.35	0.35	0.94
Shuttle Tanker Auxiliary Generator - Diesel Fired (hp)	3018	146	3498	24	73	2.13	1.22	73.12	2.19	15.95	1.86	1.07	64.06	1.92	13.98
Shuttle Tanker Boiler - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Shuttle Tanker Incinerator - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	350	5.22	2.99	179.30	5.38	39.12	21.91	12.56	753.04	22.59	164.30
Crew Boat - Diesel Fired (bhp)	5400	261	6260	8	350	3.81	2.18	130.84	3.93	28.55	5.33	3.06	183.17	5.50	39.96
General Vessel Support - Diesel Fired (bhp)	30000	1449	34776	24	3	21.15	12.13	726.87	21.81	158.59	0.76	0.44	26.17	0.79	5.71
MISC.	**BPD**	**SCF/HR**	**COUNT**												
FPSO TANK-MGO/Diesel Storage (bbls/day)	500			24	350				0.63					2.63	
FPSO TANK-Lube Oil , Chemical totes, bilge water, other miscellaneous storage - Emissions are minimal given low throughputs and/or negligible vapor pressures															
FPSO TANK-Methanol (bbls/day) - Emissions would occur when N2 blanket not present (anticipated 3 day/yr part of turret disconnect/reconnect)	3000			24	3				3.75					0.14	
FPSO Cargo Oil / Slop Oil Tanks - Routine Operation (No Emissions to Atmosphere) -hydrocarbon blanket is present and cargo tank vapors are recovered and recycled to process except during cargo tank washing (see below)															
FPSO Cargo Tank Purging and Gas Freeing - Maintenance Activity (15.62 tons per washing activity)				24	4				1301.67					62.48	
Shuttle Tanker Cargo Tank Venting during Loading - (300,000 bbls loaded per tanker and loading potentially occurs every 5 days)				24	73				3325.44					2913.08	
HP FLARE - Pilot/Purge Gas (scf/hr)		400		24	350		0.00	0.03	0.02	0.16		0.00	0.12	0.10	0.65
LP FLARE - Pilot/Purge Gas (scf/hr)		200		24	350		0.00	0.01	0.01	0.08		0.00	0.06	0.05	0.33
HP Flare - Flared Gas (scf/hr)		875000		24	72		0.52	62.48	52.76	339.94		0.45	53.98	45.59	293.71
LP Flare - Flared Gas (scf/hr)		291667		24	72		0.17	20.83	17.59	113.31		0.15	17.99	15.20	97.90
PROCESS VENT- (scf/hr)		2083		24	72				7.08					6.12	
FUGITIVES- (counts)			11420	0	350				5.71					23.98	
GLYCOL STILL VENT-emissions controlled				24	350										
YEAR TOTAL						**140.81**	**259.09**	**5769.38**	**4837.00**	**1561.22**	**63.43**	**128.49**	**3560.17**	**3139.84**	**1770.77**
DISTANCE FROM LAND IN MILES											**5927.40**	**5927.40**	**5927.40**	**5927.40**	**107586.78**
178.0															

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COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL		CONTACT	PHONE	REMARKS
Shell Offshore Inc.	Walker Ridge	07, 508, 551, 55	18730, 17001,	FPSO	0		Jeffrey McMenis	504-425-6021	SEPCo Env File Name - Stones-AQR-DOCD-031913-rev1.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																
FACILITY	Drilling Campaign #3 Well 5, 6, 7, 8, 9, 10, & 11 - Jumper Metrology Vessel	22000	1063	25502	24	2	15.51	8.89	533.04	15.99	116.30	0.37	0.21	12.79	0.38	2.79
INSTALLATION	Drilling Campaign #3 Well 5, 6, 7, 8, 9, 10, & 11 - Jumper Installation Vessel	22000	1063	25502	24	2	15.51	8.89	533.04	15.99	116.30	0.37	0.21	12.79	0.38	2.79
PRODUCTION	Power Generation Turbine No. 1 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
FPSO Topsides Equipment	Power Generation Turbine No. 1 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 2 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 2 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 3 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 3 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 4 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 4 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 5 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 5 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Emergency Generator - Diesel Fired Fired (bhp)	970	47	1124	2	52	0.68	0.39	23.50	0.71	5.13	0.04	0.02	1.22	0.04	0.27
	Deck Crane No. 1 - Diesel Fired (bhp)	580	28	672	12	365	1.28	0.23	17.89	1.43	3.87	2.80	0.51	39.17	3.13	8.48
	Deck Crane No. 2 - Diesel Fired (bhp)	580	28	672	12	365	1.28	0.23	17.89	1.43	3.87	2.80	0.51	39.17	3.13	8.48
	Firewater Pump No. 1 - Diesel Fired (bhp)	1379	67	1599	2	52	0.97	0.56	33.41	1.00	7.29	0.05	0.03	1.74	0.05	0.38
	Firewater Pump No. 2 - Diesel Fired (bhp)	1379	67	1599	2	52	0.97	0.56	33.41	1.00	7.29	0.05	0.03	1.74	0.05	0.38
	Misc diesel driven equipment (bhp)	1000	48	1159	24	365	0.70	0.40	24.23	0.73	5.29	3.09	1.77	106.12	3.18	23.15
FPSO Hull Equipment	Essential Generator No. 1 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
	Essential Generator No. 2 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
	Essential Generator No. 3 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
	Main Engine - Diesel Fired (bhp)	25320	1223	29351	24	7	17.85	10.23	613.48	18.40	133.85	1.50	0.86	51.53	1.55	11.24
	Inert Gas Generator - Diesel Fired (bhp)	400	19	464	24	7	0.88	0.16	12.33	0.99	2.67	0.07	0.01	1.04	0.08	0.22
	Steam Boiler No. 1 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	365	0.82	0.06	10.79	0.59	9.06	3.44	0.27	45.29	2.49	38.05
	Steam Boiler No. 1 - Diesel Fired (bbl/hr)	19.2	806	19354	1	365	1.61	5.81	16.13	0.15	4.03	0.29	1.06	2.94	0.03	0.74
	Steam Boiler No. 2 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	365	0.82	0.06	10.79	0.59	9.06	3.44	0.27	45.29	2.49	38.05
	Steam Boiler No. 2 - Diesel Fired (bbl/hr)	19.2	806	19354	1	365	1.61	5.81	16.13	0.15	4.03	0.29	1.06	2.94	0.03	0.74
Shuttle Tanker Equipment	Shuttle Tanker Main Engine - Diesel Fired (bhp)	11640	562	13493	24	73	8.15	94.17	279.36	8.21	64.02	7.14	82.49	244.72	7.19	56.08
	Shuttle Tanker Generator No. 1 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
	Shuttle Tanker Generator No. 2 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
	Shuttle Tanker Generator No. 3 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
	Shuttle Tanker Emergency Generator - Diesel Fired (hp)	161	8	187	24	73	0.35	0.07	4.96	0.40	1.07	0.31	0.06	4.35	0.35	0.94
	Shuttle Tanker Auxiliary Generator - Diesel Fired (hp)	3018	146	3498	24	73	2.13	1.22	73.12	2.19	15.95	1.86	1.07	64.06	1.92	13.98
	Shuttle Tanker Boiler - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
	Shuttle Tanker Incinerator - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Support Vessels	Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	365	5.22	2.99	179.30	5.38	39.12	22.85	13.10	785.31	23.56	171.34
	Crew Boat - Diesel Fired (bhp)	5400	261	6260	8	365	3.81	2.18	130.84	3.93	28.55	5.56	3.19	191.02	5.73	41.68
	General Vessel Support - Diesel Fired (bhp)	30000	1449	34776	24	3	21.15	12.13	726.87	21.81	158.59	0.76	0.44	26.17	0.79	5.71
	MISC.	BPD	SCF/HR	COUNT												
	FPSO TANK-MGO/Diesel Storage (bbls/day)	500			24	365				0.63					2.74	
	FPSO TANK-Lube Oil , Chemical totes, bilge water, other miscellaneous storage - Emissions are minimal given low throughputs and/or negligible vapor pressures															
	FPSO TANK-Methanol (bbls/day) - Emissions would occur when N2 blanket not present (anticipated 3 day/yr part of turret disconnect/reconnect)	3000			24	3				3.75					0.14	
	FPSO Cargo Oil / Slop Oil Tanks - Routine Operation (No Emissions to Atmosphere) -hydrocarbon blanket is present and cargo tank vapors are recovered and recycled to process except during cargo tank washing (see below)															
	FPSO Cargo Tank Purging and Gas Freeing - Maintenance Activity (15.62 tons per washing activity)				24	4				1301.67					62.48	
	Shuttle Tanker Cargo Tank Venting during Loading - (300,000 bbls loaded per tanker and loading potentially occurs every 5 days)				24	73				3325.44					2913.08	
	HP FLARE - Pilot/Purge Gas (scf/hr)		400		24	365		0.00	0.03	0.02	0.16		0.00	0.13	0.11	0.68
	LP FLARE - Pilot/Purge Gas (scf/hr)		200		24	365		0.00	0.01	0.01	0.08		0.00	0.06	0.05	0.34
	HP Flare - Flared Gas (scf/hr)		875000		24	72		0.52	62.48	52.76	339.94		0.45	53.98	45.59	293.71
	LP Flare - Flared Gas (scf/hr)		291667		24	72		0.17	20.83	17.59	113.31		0.15	17.99	15.20	97.90
	PROCESS VENT- (scf/hr)		2083		24	72				7.08					6.12	
	FUGITIVES- (counts)			11420	0	365				5.71					25.01	
	GLYCOL STILL VENT-emissions controlled				24	365										
2017-2018	YEAR TOTAL						119.77	217.19	4909.43	4823.82	1459.37	61.58	122.40	3527.24	3140.90	1806.06
EXEMPTION CALCULATION	DISTANCE FROM LAND IN MILES											5927.40	5927.40	5927.40	5927.40	107586.78
	178.0															

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL			CONTACT		PHONE	REMARKS					
Shell Offshore Inc.	Walker Ridge	07, 508, 551, 55	18730, 17001	FPSO	0			Jeffrey McMenis		504-425-6021	SEPCo Env File Name - Stones-AQR-DOCD-031913-rev1.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																
PRODUCTION	Power Generation Turbine No. 1 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
FPSO Topsides Equipment	Power Generation Turbine No. 1 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 2 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 2 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 3 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 3 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 4 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 4 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Power Generation Turbine No. 5 - Fuel Gas Fired (bhp)	25345	241386	5793259	23	365		0.14	72.57	0.56	46.34		0.58	304.63	2.34	194.49
	Power Generation Turbine No. 5 - Diesel Fired (MMBtu/hr)	230	1667	40000	1	365	2.76	11.62	202.40	0.09	0.76	0.50	2.12	36.94	0.02	0.14
	Emergency Generator - Diesel Fired Fired (bhp)	970	47	1124	2	52	0.68	0.39	23.50	0.71	5.13	0.04	0.02	1.22	0.04	0.27
	Deck Crane No. 1 - Diesel Fired (bhp)	580	28	672	12	365	1.28	0.23	17.89	1.43	3.87	2.80	0.51	39.17	3.13	8.48
	Deck Crane No. 2 - Diesel Fired (bhp)	580	28	672	12	365	1.28	0.23	17.89	1.43	3.87	2.80	0.51	39.17	3.13	8.48
	Firewater Pump No. 1 - Diesel Fired (bhp)	1379	67	1599	2	52	0.97	0.56	33.41	1.00	7.29	0.05	0.03	1.74	0.05	0.38
	Firewater Pump No. 2 - Diesel Fired (bhp)	1379	67	1599	2	52	0.97	0.56	33.41	1.00	7.29	0.05	0.03	1.74	0.05	0.38
	Misc diesel driven equipment (bhp)	1000	48	1159	24	365	0.70	0.40	24.23	0.73	5.29	3.09	1.77	106.12	3.18	23.15
FPSO Hull Equipment	Essential Generator No. 1 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
	Essential Generator No. 2 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
	Essential Generator No. 3 - Diesel Fired (bhp)	1218	59	1412	2	52	0.86	0.49	29.51	0.89	6.44	0.04	0.03	1.53	0.05	0.33
	Main Engine - Diesel Fired (bhp)	25320	1223	29351	24	7	17.85	10.23	613.48	18.40	133.85	1.50	0.86	51.53	1.55	11.24
	Inert Gas Generator - Diesel Fired (bhp)	400	19	464	24	7	0.88	0.16	12.33	0.99	2.67	0.07	0.01	1.04	0.08	0.22
	Steam Boiler No. 1 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	365	0.82	0.06	10.79	0.59	9.06	3.44	0.27	45.29	2.49	38.05
	Steam Boiler No. 1 - Diesel Fired (bbl/hr)	19.2	806	19354	1	365	1.61	5.81	16.13	0.15	4.03	0.29	1.06	2.94	0.03	0.74
	Steam Boiler No. 2 - Fuel Gas Fired (mmbtu/hr)	113.3	107905	2589714	23	365	0.82	0.06	10.79	0.59	9.06	3.44	0.27	45.29	2.49	38.05
	Steam Boiler No. 2 - Diesel Fired (bbl/hr)	19.2	806	19354	1	365	1.61	5.81	16.13	0.15	4.03	0.29	1.06	2.94	0.03	0.74
Shuttle Tanker Equipment	Shuttle Tanker Main Engine - Diesel Fired (bhp)	11640	562	13493	24	73	8.15	94.17	279.36	8.21	64.02	7.14	82.49	244.72	7.19	56.08
	Shuttle Tanker Generator No. 1 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
	Shuttle Tanker Generator No. 2 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
	Shuttle Tanker Generator No. 3 - Diesel Fired (hp)	993	48	1151	24	73	0.70	0.40	24.06	0.72	5.25	0.61	0.35	21.08	0.63	4.60
	Shuttle Tanker Emergency Generator - Diesel Fired (hp)	161	8	187	24	73	0.35	0.07	4.96	0.40	1.07	0.31	0.06	4.35	0.35	0.94
	Shuttle Tanker Auxiliary Generator - Diesel Fired (hp)	3018	146	3498	24	73	2.13	1.22	73.12	2.19	15.95	1.86	1.07	64.06	1.92	13.98
	Shuttle Tanker Boiler - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
	Shuttle Tanker Incinerator - Equipment on-board Shuttle Tanker but not in use during loading activities from FPSO															
Support Vessels	Field Support Vessel - Diesel Fired (bhp)	7400	357	8578	24	365	5.22	2.99	179.30	5.38	39.12	22.85	13.10	785.31	23.56	171.34
	Crew Boat - Diesel Fired (bhp)	5400	261	6260	8	365	3.81	2.18	130.84	3.93	28.55	5.56	3.19	191.02	5.73	41.68
	General Vessel Support - Diesel Fired (bhp)	30000	1449	34776	24	3	21.15	12.13	726.87	21.81	158.59	0.76	0.44	26.17	0.79	5.71
	MISC.	**BPD**	**SCF/HR**	**COUNT**												
	FPSO TANK-MGO/Diesel Storage (bbls/day)	500			24	365				0.63					2.74	
	FPSO TANK-Lube Oil , Chemical totes, bilge water, other miscellaneous storage - Emissions are minimal given low throughputs and/or negligible vapor pressures															
	FPSO TANK-Methanol (bbls/day) - Emissions would occur when N2 blanket not present (anticipated 3 day/yr part of turret disconnect/reconnect)	3000			24	3				3.75					0.14	
	FPSO Cargo Oil / Slop Oil Tanks - Routine Operation (No Emissions to Atmosphere) -hydrocarbon blanket is present and cargo tank vapors are recovered and recycled to process except during cargo tank washing (see below)															
	FPSO Cargo Tank Purging and Gas Freeing - Maintenance Activity (15.62 tons per washing activity)				24	4				1301.67					62.48	
	Shuttle Tanker Cargo Tank Venting during Loading - (300,000 bbls loaded per tanker and loading potentially occurs every 5 days)				24	73				3325.44					2913.08	
	HP FLARE - Pilot/Purge Gas (scf/hr)		400		24	365		0.00	0.03	0.02	0.16		0.00	0.13	0.11	0.68
	LP FLARE - Pilot/Purge Gas (scf/hr)		200		24	365		0.00	0.01	0.01	0.08		0.00	0.06	0.05	0.34
	HP Flare - Flared Gas (scf/hr)		875000		24	72		0.52	62.48	52.76	339.94		0.45	53.98	45.59	293.71
	LP Flare - Flared Gas (scf/hr)		291667		24	72		0.17	20.83	17.59	113.31		0.15	17.99	15.20	97.90
	PROCESS VENT- (scf/hr)		2083		24	72				7.08					6.12	
	FUGITIVES- (counts)			11420	0	365				5.71					25.01	
	GLYCOL STILL VENT-emissions controlled				24	365										
2019-2046	**YEAR TOTAL**						**88.75**	**199.41**	**3843.35**	**4791.83**	**1226.77**	**60.83**	**121.97**	**3501.65**	**3140.14**	**1800.48**
EXEMPTION CALCULATION	**DISTANCE FROM LAND IN MILES**											**5927.40**	**5927.40**	**5927.40**	**5927.40**	**107586.78**
	178.0															

COMPANY	AREA	BLOCK	LEASE	PLATFORM	WELL
Shell Offshore Inc.	Walker Ridge	507, 508, 551, 552	18730, 17001, 21861, 18737	FPSO	0

Year	Emitted			Substance	
	PM	**SOx**	**NOx**	**VOC**	**CO**
2014	**19.15**	**10.98**	**658.44**	**19.75**	**143.66**
2015	**102.51**	**88.49**	**3659.54**	**97.22**	**713.01**
2016	**63.43**	**128.49**	**3560.17**	**3139.84**	**1770.77**
2017-2018	**61.58**	**122.40**	**3527.24**	**3140.90**	**1806.06**
2019-2046	**60.83**	**121.97**	**3501.65**	**3140.14**	**1800.48**
Allowable	**5927.40**	**5927.40**	**5927.40**	**5927.40**	**107586.78**

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 550 and 254. Shell's Regional OSRP was approved by BSEE on April 11, 2013.

Spill Response Sites:

Primary Response Equipment Locations	Preplanned Staging Location(s)
Fourchon, LA; Cameron, LA; Houma, LA; Lake Charles, LA	Lake Charles, LA ; Cameron, LA ; Fourchon ; LA

The names of the oil spill removal organizations (OSRO's) under contract include Clean Gulf Associates (CGA), Marine Spill Response Company (MSRC), Clean Caribbean America (CCA), and OSRL/EARL.

Category	Regional OSRP	DOCD	OSRP >10 Miles	DOCD Production
Type of Activity[1]	Subsea Drilling	Stones Drilling (Covered in plan S-7599)	Production >10 miles to shore	Production >10 miles to shore
Facility Location (area/block)	MC 391	WR 508	MC 807	WR 508
Facility Designation[2]	Subsea well 1◊	Subsea well K◊◊◊	MB001◊◊	FPSO
Distance to Nearest Shoreline (miles)	70	178	53	178
Volume[3]				
Storage tanks (total)	N/A	N/A	11,163	19,948
Flowlines (on facility)	N/A	N/A	100	454
Pipelines	N/A	N/A	1,604	775
Uncontrolled blowout (volume per day)	416,414* BOPD	47,114** BOPD	446,000 BOPD	47,114 BOPD
Total Volume	416,414 Bbls	47,114 Bbls	458,867 bbls	68,291 Bbls
Type of Oil(s) - (crude oil, condensate, diesel)	Crude oil	Crude oil	Crude Oil	Crude Oil
API Gravity(s)[4]	26º	28º	26º	28º

***24 hour rate (391,808 BOPD 30 day average)**
****24 hour rate (37,318 BOPD 30 day average)**

◊This well was reviewed and accepted by BOEM in plan S-7444 (May 2011) and accepted by BSEE during the drilling of the well. The 30-day average was updated in update to the OSRP July 2012.
◊◊This well was reviewed and accepted by BOEM on in plan S-7499.
◊◊◊ This well was reviewed and accepted by BOEM on in plan S-7599.

Since Shell Offshore Inc. has the capability to respond to the appropriate worst-case spill scenario included in its regional OSRP, approved by BSEE on April 11, 2013, and 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.

B. Oil Spill Response Discussion

1. Volume of the Worst Case Discharge

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

2. Trajectory Analysis

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

Area/Block	OCS-G	Launch Area	Land Segment Contact	%
MC 508	17001	48	Calhoun, TX	-
			Matagorda, TX	1
			Brazoria, TX	1
			Galveston, TX	**2**
			Jefferson, TX	1
			Cameron, LA	**2**
			Vermilion, LA	1
			Iberia, LA	-
			St. Mary, LA	-
			Terrebonne, LA	1
			Lafourche, LA	-
			Jefferson, LA	-
			Plaquemines, LA	**2**

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 BOEMRE 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 508 WCD scenario.

Onshore/Nearshore: Plaquemines Parish has been identified as the most probable impacted Parish within the Gulf of Mexico for the Greater than 10 Mile Worst Case Discharge and the Exploratory Worst Case Discharge. 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.

Cameron Parish is identified as the most probable impacted Parish within the Gulf of Mexico for the Exploratory Worst Case Discharge. 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.

Galveston County has been identified as the most probable impact Parish within Gulf of Mexico for the Exploratory Worst Case Discharge at 2%. 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.

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 508 Worst Case Discharge as effectively as possible. Below is a table outlining the applicable evaporation and surface dispersion quantity:

	Walker Ridge Block 508	Calculations (BBLS)
i.	**TOTAL WCD (based on 30 day average (per day))**	**~37,500**
ii.	Loss of volume of oil to natural surface dispersion and evaporation base (approximate bbls per day)* (20% Natural surface evaporation and dispersion in 24 hrs)	-7,500
	TOTAL REMAINING	**~30,000**

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

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

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

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

Table 9.D.2 Operational Limitations of Response Equipment

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

Based on the anticipated worst case discharge scenario, Shell can be onsite with dedicated, contracted on water oil spill recovery equipment with adequate response capacity to contain and recover surface oil, and prevent land impact, within 26 hours (based on the equipment's Estimated Daily Response Capacity (EDRC)). Shell will continue to ramp up additional on-water mechanical recovery resources as well as apply dispersants and in-situ burning as needed and as approved under the supervision of the USCG Captain of the Port (COTP) and the Regional Response Team (RRT).

Subsea Control and Containment: Shell, as a founding member of the MWCC, will have access to the IRCS that can be rapidly deployed through the MWCC. The IRCS is designed to contain oil flow in the unlikely event of an underwater well blowout, and is designed, constructed, tested, and available for rapid response. Shell's specific containment response for WR 508 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 402,000 barrels/day. Temporary storage associated with the identified skimming and temporary storage equipment equals approximately 198,000 barrels.

	De-rated Recovery Rate (bopd)	Storage (bbls)
Offshore Recovery and Storage	161,322	186,847
Nearshore Recovery and Storage	240,903	11,668
Total	402,225	198,515

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 and 2012-N06. 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.

Additionally, in the event of a sustained well control event, Shell will deploy a capping stack and can be in position to commence capping and containment operations in an estimated 10-14 days.

This is Shell's best estimates with full recognition that times to respond and effectiveness can be affected by uncontrollable factors such as weather and sea state.

Shell estimates the time to contain the WCD to the maximum extent practicable, and prevent impacts to coastal resources, is approximately 24 hours.

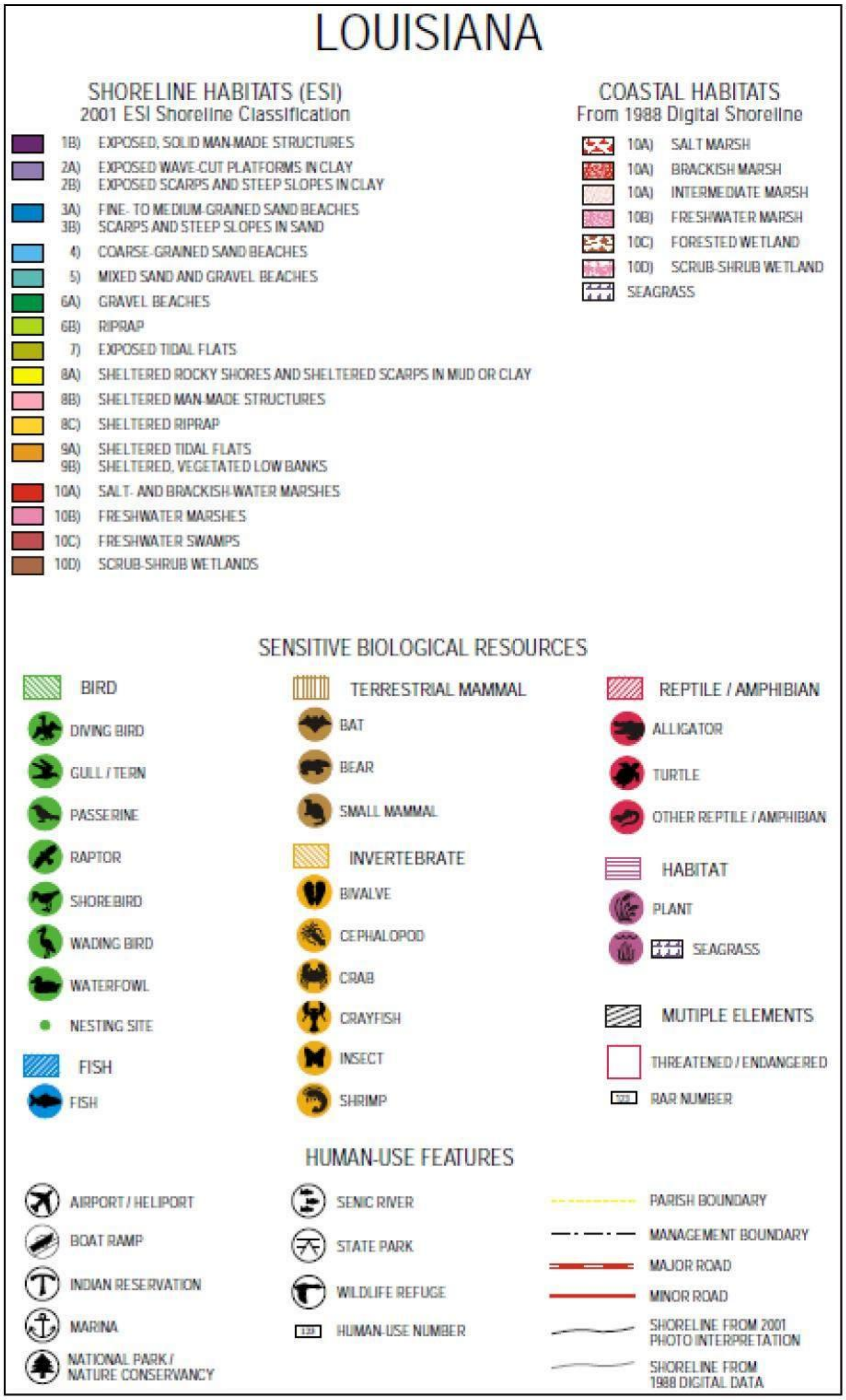


Figure 9.C.1 Environmental Sensitivity Index Map Legend

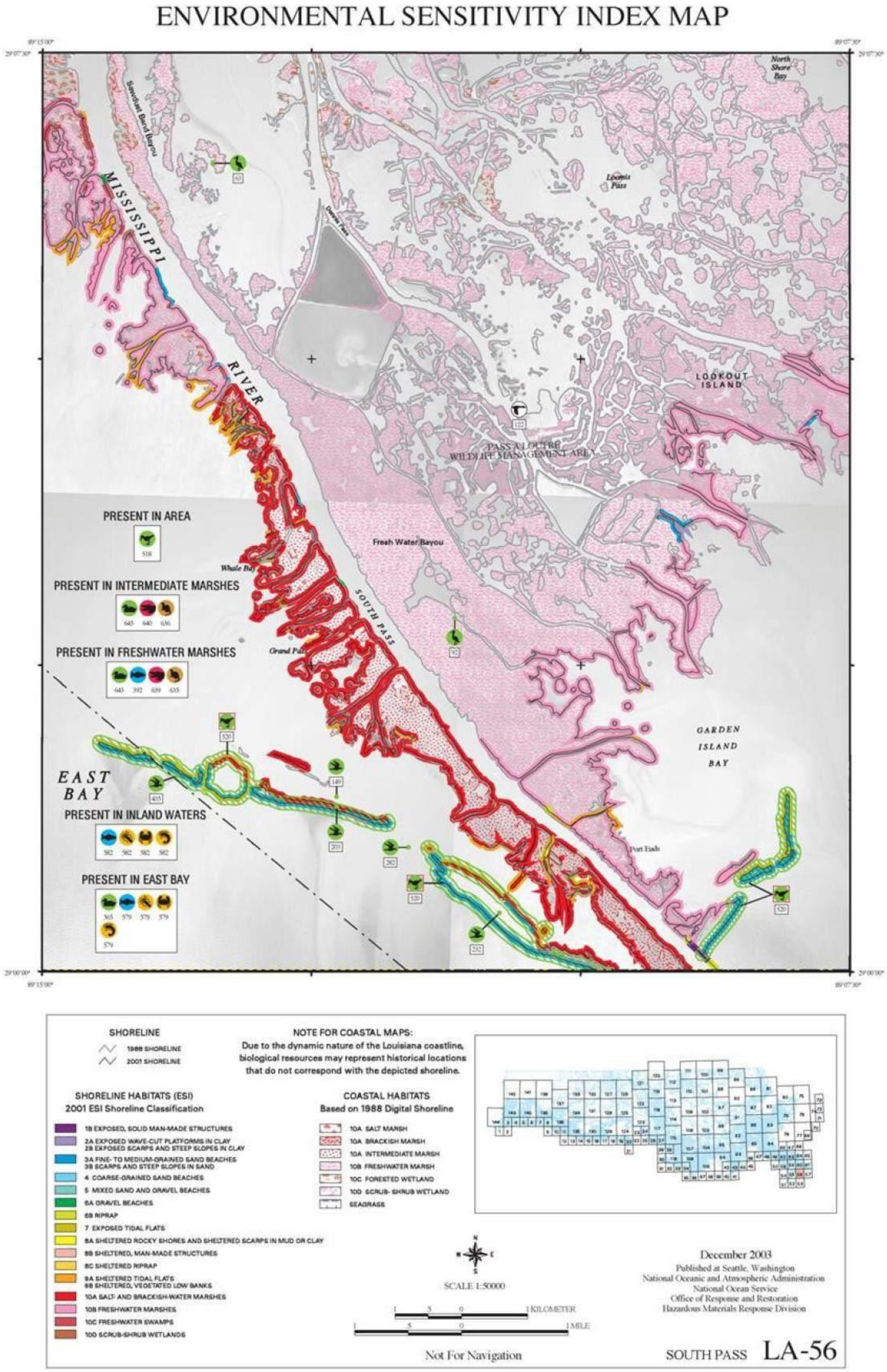


Figure 9.C.2 South Pass ESI Map

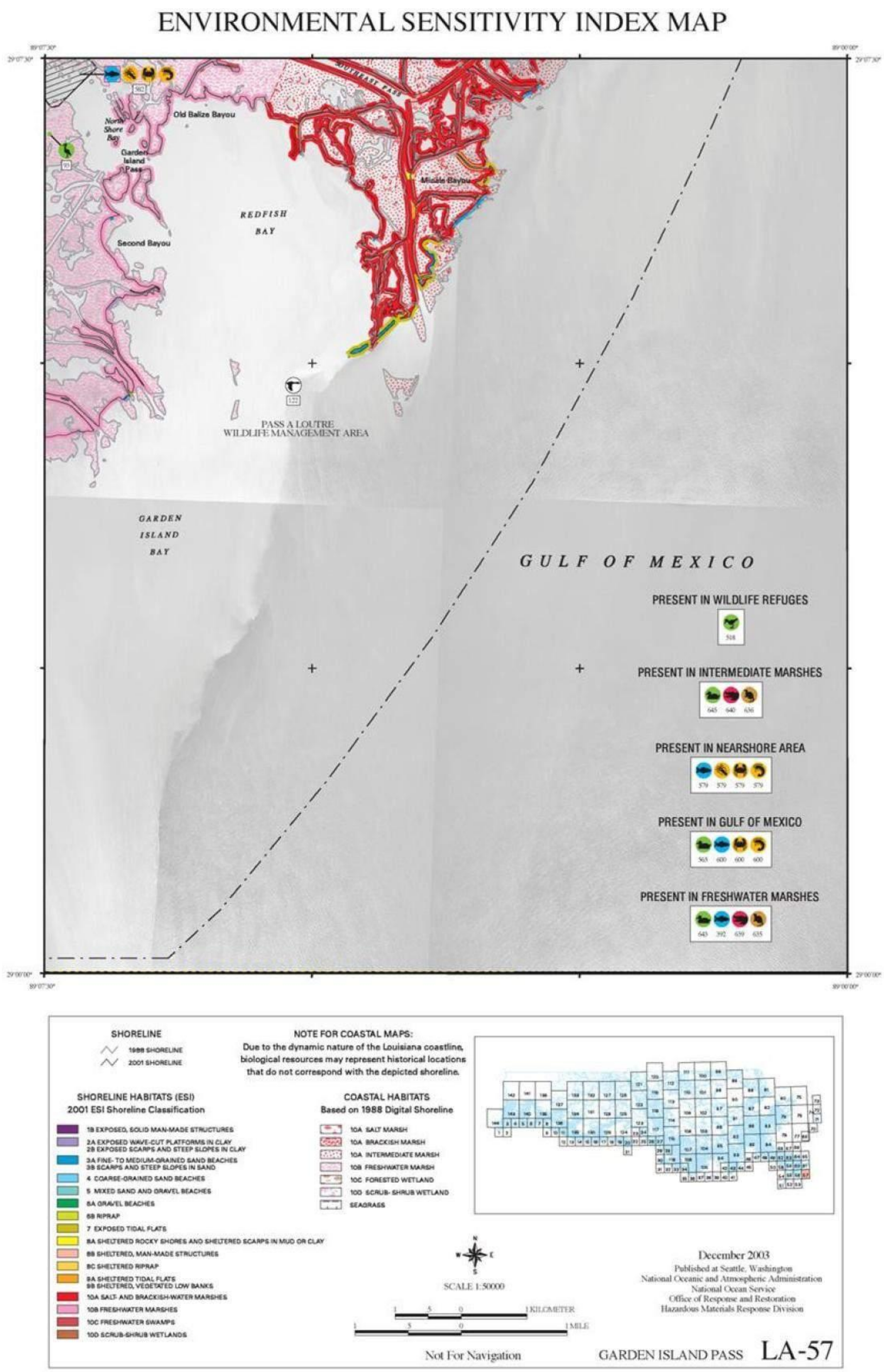


Figure 9.C.3 Garden Island Pass ESI Map

ENVIRONMENTAL SENSITIVITY INDEX MAP

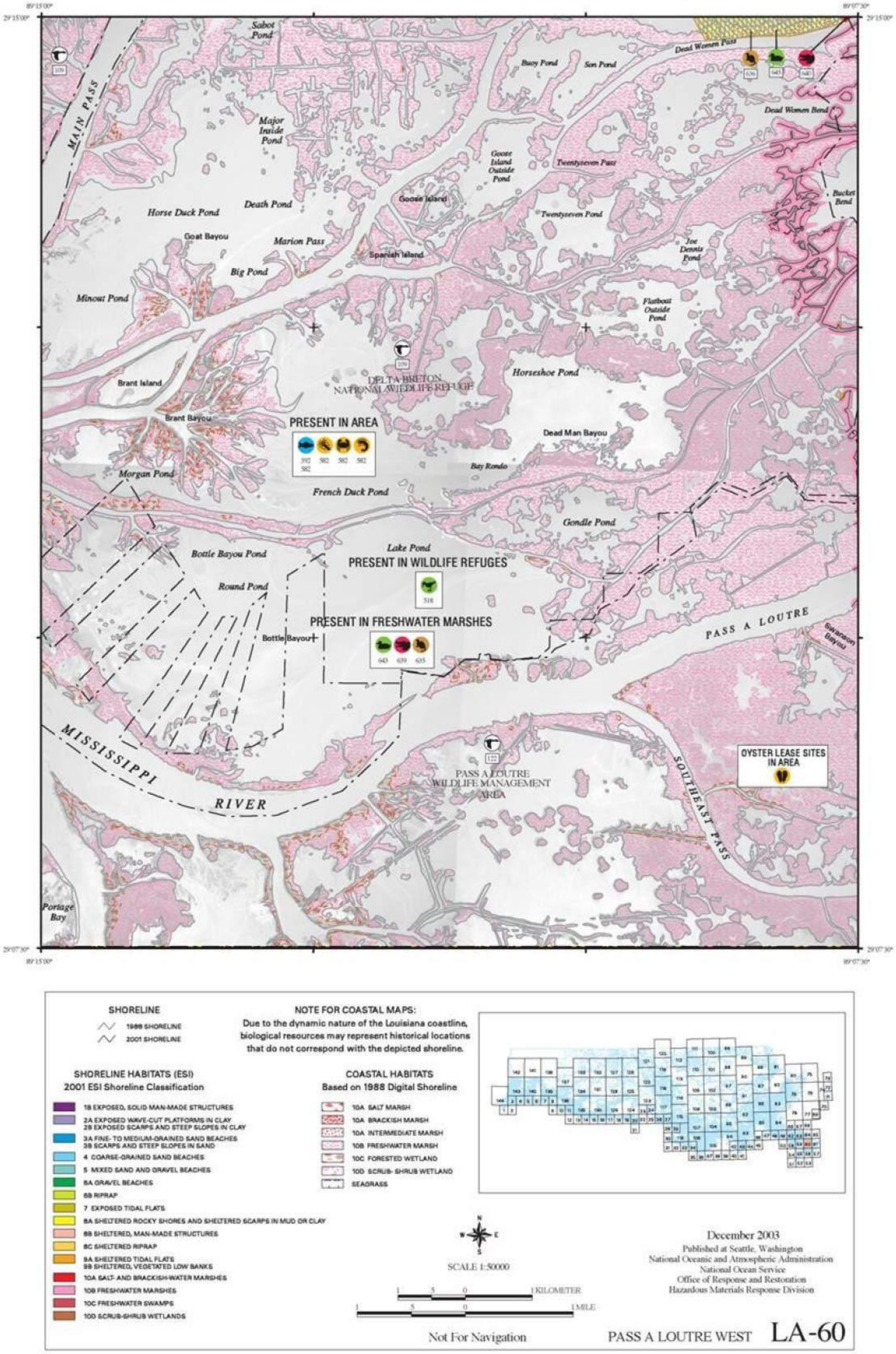


Figure 9.C.4 Pass a Loutre West ESI Map

ENVIRONMENTAL SENSITIVITY INDEX MAP

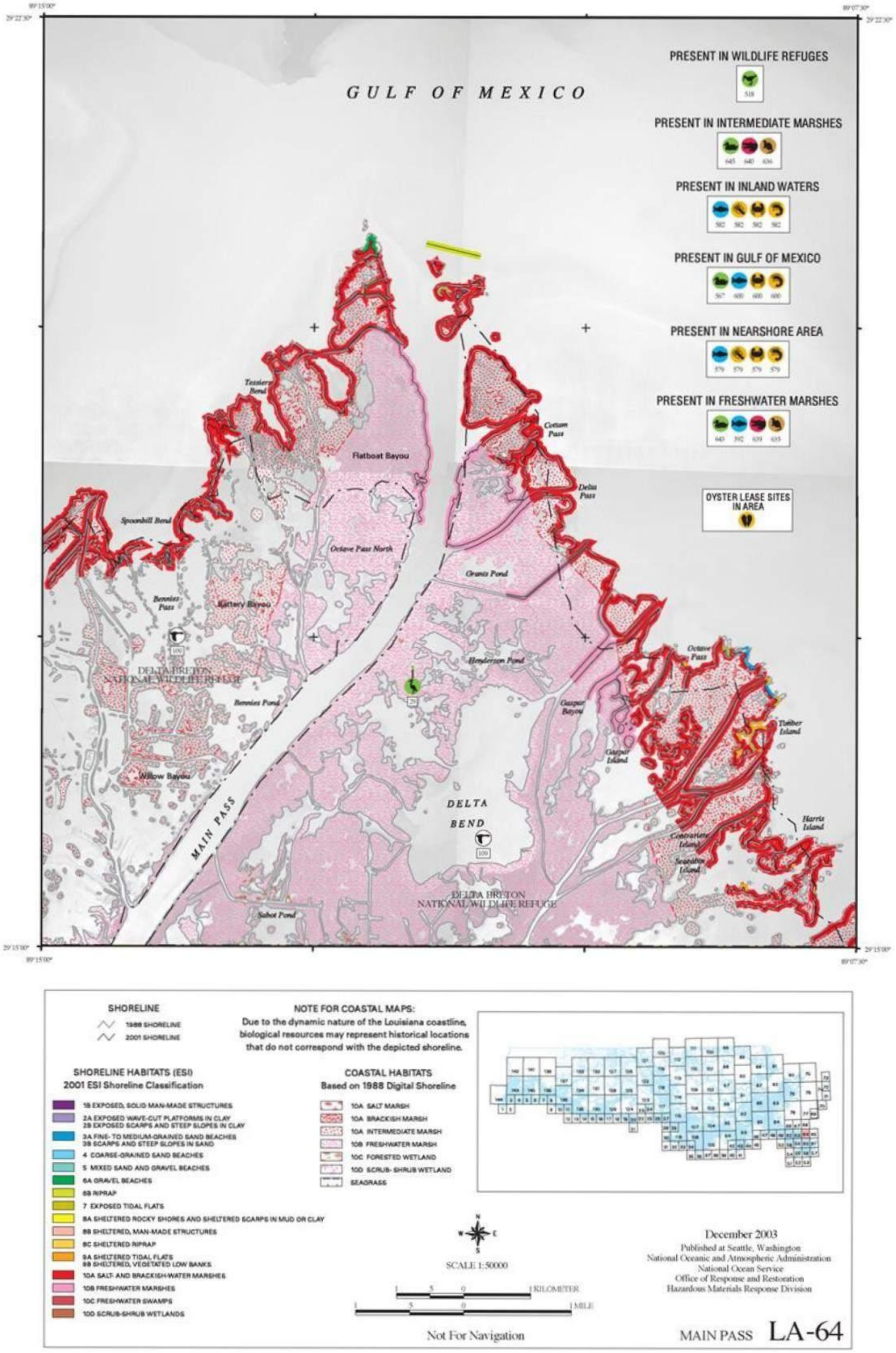


Figure 9.C.5 Main Pass ESI Map

Walker Ridge 508
Sample Offshore On-Water Recovery & Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated 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 H.I. Rich	CGA 888-CGA-2007	Leeville, LA	Lamor Brush Skimmer	2	12,342	249	Leeville, LA	188	2	0	8.5	1	11.5
			42" Boom	40									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	4									
FRV Breton Island	CGA 888-CGA-2007	Venice, LA	Lamor Brush Skimmer	2	12,342	249	Venice, LA	219	2	0	10	1	13
			42" Boom	40									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	4									
Deep Blue Responder LFF 100 Brush	MSRC 800-OIL-SPIL	Port Fourchon, LA	LFF 100 Brush Skimmer	1	18,086	4,000	Port Fourchon, LA	188	2	1	13.5	1	17.5
			67" Boom	7260'									
			210' Vessel	1									
			Personnel	12									
			32' Support Boat	1									
FRV Galveston Island	CGA 888-CGA-2007	Galveston, TX	Lamor Brush Skimmer	2	12,342	249	Galveston, TX	320	2	0	14.5	1	17.5
			42" Boom	40									
			95' Vessel	1									
			X Band Radar	1									
			Personnel	4									
M/V Recovery MOSS Unit w/ GT-185	AMPOL 800-482-6765	Port Fourchon, LA	GT-185 Skimmer	1	1,371	200	Port Fourchon, LA	188	2	1	13.5	1	17.5
			36" Expandi Boom	720'									
			Personnel	8									
			110' Utility Boat	1									
			Crew Boat - >65'	1									
FOILEX 250	MSRC 800-OIL-SPIL	Belle Chasse, LA	Offshore Skimmer	1	3,977		Port Fourchon, LA	188	4.25	1	13.5	1	19.75
			43' Offshore Boom	100'									
			Personnel	4									
			* >110' Utility Boat	1									
			Towable Bladder	1		500							
DESMI OCEAN	MSRC 800-OIL-SPIL	Belle Chasse, LA	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	4.25	1	13.5	1	19.75
			67" Offshore Boom	330'									
			Personnel	4									
			* Crew Boat	1									
			* >110' Utility Boat	1									
			Towable Bladder	1		500							
W-4	MSRC 800-OIL-SPIL	Belle Chasse, LA	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	4.25	1	13.5	1	19.75
			67" Offshore Boom	330'									
			Personnel	4									
			* Crew Boat	1									
			>110' Utility Boat w/crane	1									
			Towable Bladder	1		500							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Harvey, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	4	1	13.5	1	20
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Leeville, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	4	1	13.5	1	20
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Leeville, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	4	1	13.5	1	20
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Morgan City, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	4	1	13.5	1	20
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Louisiana Responder LFF 100 Brush	MSRC 800-OIL-SPIL	Fort Jackson, LA	LFF 100 Brush Skimmer	1	18,086	4,000	Fort Jackson, LA	228	2	1	16.5	1	20.5
			67" Boom	7920'									
			210' Vessel	1									
			Personnel	12									
			32' Support Boat	1									

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

Walker Ridge 508
Sample Offshore On-Water Recovery & Storage Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated 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
WP-1	MSRC 800-OIL-SPIL	Pascagoula, MS	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	5.75	1	13.5	1	21.25
			67" Offshore Boom	330'									
			Personnel	4									
			* Crew Boat	1									
			* >110' Utility Boat	1									
			Towable Bladder	1		500							
Stress 1	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	15,840		Port Fourchon, LA	188	6.25	1	13.5	1	21.75
			67" Offshore Boom	330'									
			Personnel	4									
			* Crew Boat	1									
			* >110' Utility Boat	1									
			Towable Bladder	1		500							
FOILEX 250	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	3,977		Port Fourchon, LA	188	6.25	1	13.5	1	21.75
			43" Offshore Boom	100'									
			Personnel	4									
			* >110' Utility Boat	1									
			Towable Bladder	1		500							
DESMI OCEAN	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	6.25	1	13.5	1	21.75
			67" Offshore Boom	330'									
			* Crew Boat	1									
			Personnel	4									
			* >110' Utility Boat	1									
			Towable Bladder	1		500							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Venice, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	5.75	1	13.5	1	22
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Lake Charles, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	6.25	1	13.5	1	22
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Fast Response Unit "FRU" 1.0	CGA 888-CGA-2007	Venice, LA	Foilex 250 Skimmer	1	4,251	100	Port Fourchon, LA	188	5.75	1	13.5	1	22
			Personnel	4									
			Utility Boat	1									
			** 67" Sea Sentry	440'									
			** Crew Boat	1									
			** Add'l Storage	1		100							
Gulf Coast Responder Transrec-350	MSRC 800-OIL-SPIL	Lake Charles, LA	Transrec/Stress 1 Skimm	2	10,567	4,000	Lake Charles, LA	302	2	1	21.5	1	25.5
			67" Boom	2640'									
			210' Vessel	1									
			Personnel	12									
			32' Support Boat	1									
Mississippi Responder Transrec-350	MSRC 800-OIL-SPIL	Pascagoula, MS	Transrec/Stress 1 Skimm	2	10,567	4,000	Pascagoula, MS	316	2	1	22.5	1	26.5
			67" Boom	2640'									
			210' Vessel	1									
			Personnel	12									
			32' Support Boat	1									
OSG 192 Offshore Barge	MSRC 800-OIL-SPIL	New Orleans, LA	Offshore Barge	1	N/A	165,000	New Orleans, LA	302	4	0	36	1	41
			Personnel	11									
			* Offshore Tug	1									

DERATED RECOVERY RATE (BBLS/DAY)	161,322
STORAGE CAPACITY INCLUDING SKIMMING VESSELS (BARRELS)	186,847

* - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.
** - These components are required to use the associated packages in an "enhanced skimming" configuration.

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

Walker Ridge 508
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated 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
FRV M/V RW Armstrong	CGA 888-CGA-2007	Leeville, LA	Lori Brush Skimmer 32" Boom 46' Vessel Personnel	2 50' 1 4	5,000	65	Leeville, LA	198	2	0	9	0.5	**11.5**
SWS CGA-73 Trinity Shallow Water Skimmer	CGA 888-CGA-2007	Leeville, LA	Marco Belt Skimmer 30" Auto Boom Personnel 56' SWS Vessel 14'-16' Aluminum Flatboa	2 150' 5 1 2	21,500	249	Leeville, LA	198	2	1	9	1	**13**
FRV M/V Grand Bay	CGA 888-CGA-2007	Venice, LA	Lori Brush Skimmer 32" Boom 46' Vessel Personnel	2 50' 1 4	5,000	65	Venice, LA	219	2	0	10	1	**13**
SWS CGA-74 Trinity Shallow Water Skimmer	CGA 888-CGA-2007	Venice, LA	Marco Belt Skimmer 30" Auto Boom Personnel 56' SWS Vessel 14'-16' Aluminum Flatboa	2 150' 5 1 2	21,500	249	Venice, LA	219	2	1	10	1	**14**
SWS CGA-72 Trinity Shallow Water Skimmer	CGA 888-CGA-2007	Morgan City, LA	Marco Belt Skimmer 30" Auto Boom Personnel 56' SWS Vessel 14'-16' Aluminum Flatboa	2 150' 5 1 2	21,500	249	Morgan City, LA	234	2	1	10.5	1	**14.5**
FRV M/V Bastian Bay	CGA 888-CGA-2007	Lake Charles, LA	Lori Brush Skimmer 32" Boom 46' Vessel Personnel	2 50' 1 4	5,000	65	Lake Charles, LA	302	2	0	13.5	1	**16.5**
FRV CGA 58 Timbalier Bay	CGA 888-CGA-2007	Galveston, TX	Lori Brush Skimmer 32" Boom 46' Vessel Personnel	2 50' 1 4	5,000	65	Galveston, TX	320	2	0	14.5	1	**17.5**
SWS CGA-71 Trinity Shallow Water Skimmer	CGA 888-CGA-2007	Galveston, TX	Marco Belt Skimmer 30" Auto Boom Personnel 56' SWS Vessel 14'-16' Aluminum Flatboa	2 150' 5 1 2	21,500	249	Galveston, TX	320	2	1	14.5	1	**18.5**
MSRC "Kvichak"	MSRC 800-OIL-SPIL	Fort Jackson, LA	Marco Skimmer Personnel 30' Fast Response Boat	1 4 1	3,588	24	Fort Jackson, LA	228	2	1	16.5	1	**20.5**
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Pascagoula, MS	Skimmer 20" Boom Personnel * Push Boat Towable Bladder	1 50' 4 1 1	905	400	Port Fourchon, LA	188	6	1	13.5	1	**21.25**
SBS w/ GT-185	MSRC 800-OIL-SPIL	Pascagoula, MS	Skimmer 20" Boom Personnel * Push Boat Towable Bladder	1 50' 4 1 1	1,371	400	Port Fourchon, LA	188	6	1	13.5	1	**21.25**
VOSS w/ AARDVAC	MSRC 800-OIL-SPIL	Pascagoula, MS	Skimmer 20" Boom Personnel * Utility Boat Towable Bladder	1 50' 4 1 1	3,840	500	Port Fourchon, LA	188	6	1	13.5	1	**21.25**
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Skimmer 20" Boom Personnel * Push Boat	1 50' 4 1	905	400	Port Fourchon, LA	188	6.25	1	13.5	1	**21.75**
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer 20" Boom Personnel * Push Boat Towable Bladder	1 50' 4 1 1	905	400	Port Fourchon, LA	188	6	1	13.5	1	**21.75**
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Skimmer 20" Boom Personnel * Push Boat Towable Bladder	1 50' 4 1 1	905	500	Port Fourchon, LA	188	6	1	13.5	1	**21.75**

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

Walker Ridge 508
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated 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
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Lake Charles, LA	Offshore Skimmer	1	905	400	Port Fourchon, LA	188	6	1	13.5	1	21.75
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	905	400	Port Fourchon, LA	188	8.75	1	13.5	1	24.25
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SBS w/ Stress 1	MSRC 800-OIL-SPIL	Galveston, TX	Offshore Skimmer	1	15,840	400	Port Fourchon, LA	188	8.75	1	13.5	1	24.25
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Memphis, TN	Offshore Skimmer	1	905		Port Fourchon, LA	188	9	1	13.5	1	24.75
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
MSRC "Quick Strike"	MSRC 800-OIL-SPIL	Lake Charles, LA	LORI Brush Skimmer	1	5,000	50	Lake Charles, LA	302	2	1	21.5	1	25.5
			Personnel	4									
			47' Fast Response Boat	1									
MSRC "Kvichak"	MSRC 800-OIL-SPIL	Pascagoula, MS	Marco Skimmer	1	3,588	24	Pascagoula, MS	316	2	1	22.5	1	26.5
			Personnel	4									
			30' Fast Response Boat	1									
SWS CGA-55 Egmopol Shallow Water Skimmer	CGA 888-CGA-2007	Morgan City, LA	Belt Skimmer	1	3,000	90	Port Fourchon, LA	188	4	1	21	1	27
			18" Boom (contractor)	100'									
			Personnel	3									
			38' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SBS w/ Stress 1	MSRC 800-OIL-SPIL	Ingleside, TX	Offshore Skimmer	1	15,840	400	Port Fourchon, LA	188	11.50	1	13.5	1	27
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
			Towable Bladder	1									
SWS CGA-53 MARCO Shallow Water Skimmer	CGA 888-CGA-2007	Leeville, LA	Marco Belt Skimmer	1	3,588	34	Port Fourchon, LA	188	4	1	21	1	27
			18" Boom (contractor)	100'									
			Personnel	3									
			38' Skimming Vessel	1									
WP-1	MSRC 800-OIL-SPIL	Ingleside, TX	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	11.50	1	13.5	1	27
			20" Boom	50'									
			Personnel	4									
			* Crew Boat	1									
			* Utility Boat	1									
			Towable Bladder	1		500							
WP-1	MSRC 800-OIL-SPIL	Tampa, FL	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	13	1	13.5	1	28.75
			20" Boom	50'									
			Personnel	4									
			* Crew Boat	1									
			Towable Bladder	1		500							
SWS CGA-52 MARCO Shallow Water Skimmer	CGA 888-CGA-2007	Venice, LA	Marco Belt Skimmer	1	3,588	34	Port Fourchon, LA	188	6	1	21	1	28.75
			18" Boom (contractor)	100'									
			Personnel	3									
			36' Skimming Vessel	1									
			Shallow Water Barge	1		249							
SWS CGA-51 MARCO Shallow Water Skimmer	CGA 888-CGA-2007	Lake Charles, LA	Marco Belt Skimmer	1	3,588	20	Port Fourchon, LA	188	6	1	21	1	29.25
			18" Boom (contractor)	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							
CGA-54 Egmopol Shallow Water Skimmer	CGA 888-CGA-2007	Galveston, TX	Egmopol Belt Skimmer	1	3,000	90	Port Fourchon, LA	188	9	1	21	1	31.75
			18" Boom (contractor)	100'									
			Personnel	3									
			34' Skimming Vessel	1									
			Shallow Water Barge	1		249							

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

Walker Ridge 508
Sample Nearshore On-Water Recovery Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Est. Derated 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
WP-1	MSRC 800-OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,017		Port Fourchon, LA	188	16	1	13.5	1	31.75
			20" Boom	50'									
			Personnel	4									
			* Utility Boat	2									
			Towable Bladder	1		500							
Barge Boat w/ AARDVAC	MSRC 800-OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,840		Port Fourchon, LA	188	16	1	13.5	1	31.75
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
Barge Boat w/ AARDVAC	MSRC 800-OIL-SPIL	Miami, FL	Offshore Skimmer	1	3,840		Port Fourchon, LA	188	16	1	13.5	1	31.75
			20" Boom	50'									
			Personnel	4									
			* Barge Boat	1									
			Towable Bladder	1		500							
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Whiting, IN	Offshore Skimmer	1	905	400	Port Fourchon, LA	188	17.25	1	13.5	1	32.75
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
MSRC "Kvichak"	MSRC 800-OIL-SPIL	Ingleside, TX	Marco Skimmer	1	3,588	24	Ingleside, TX	412	2	1	29.5	1	33.5
			Personnel	4									
			30' Fast Response Boat	1									
SBS w/ Queensboro	MSRC 800-OIL-SPIL	Toledo, OH	Offshore Skimmer	1	905	400	Port Fourchon, LA	188	18.8	1	13.5	1	34.25
			20" Boom	50'									
			Personnel	4									
			* Push Boat	1									
MSRC "Lightning"	MSRC 800-OIL-SPIL	Tampa, FL	LORI Brush Skimmer	1	5,000	50	Tampa, FL	526	2	1	37.5	1	41.5
			Personnel	4									
			47' Fast Response Boat	1									
										DERATED RECOVERY RATE (BBLS/DAY)	240,903		
										SKIMMING VESSEL STORAGE CAPACITY (BARRELS)	11,668		

* - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.

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

Walker Ridge 508
Sample Aerial Surveillance Activation List

Aerial Surveillance System	Supplier & Phone	Warehouse	Aerial Surveillance Package	Quantity	Staging Area	Distance to Site from Staging (nautical miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Total ETA
Twin Commander Air Speed - 288 MPH	Airborne Support 985-851-6391	Houma, LA	Surveillance Aircraft	1	Houma, LA	216	1	0.25	0.75	2.00
			Spotter Personnel	2						
			Crew - Pilots	1						
Eurocopter EC-135 Helicopter Air Speed - 141 knots	PHI 985-475-5400	Houma, LA	Surveillance Aircraft	1	Houma, LA	216	1	0.25	0.75	2.00
			Spotter Personnel	2						
			Crew - Pilots	1						
Sikorsky S-76 Helicopter Air Speed - 141 knots	PHI 985-475-5400	Houma, LA	Surveillance Aircraft	1	Houma, LA	216	1	0.25	0.75	2.00
			Spotter Personnel	2						
			Crew - Pilots	1						

Table 9.D.6 Aerial Surveillance Activation List

Walker Ridge 508
Sample Offshore Aerial Dispersant Activation List

Aerial Dispersant System	Supplier & Phone	Warehouse	Aerial Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours): Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Twin Commander Air Speed - 288 MPH	CGA/Airborne Support 985-851-6391	Houma, LA	Aero Commander	1	Houma, LA	216	2	0.4	0.75	0.2	3.35
			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	216	2	0.5	1.11	0.3	3.95
			Dispersant - Gallons	2000							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	216	1.11	0.5	1.11	0.3	3.05
			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	216	2	0.5	1.44	0.3	4.25
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	216	1.44	0.5	1.44	0.3	3.70
			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	216	2	0.5	1.44	0.3	4.25
			Dispersant - Gallons	1200							
			Spotter Aircraft	1							
			Spotter Personnel	2	Houma, LA 2nd Flight	216	1.44	0.5	1.44	0.3	3.70
			Crew - Pilots	2							
BE-90 King Air Aircraft Air Speed - 213 MPH	MSRC 800-OIL-SPIL	Stennis, MS	BE-90 Dispersant Aircraft	1	Stennis INTL., MS 1st Flight	282	4.00	0.20	1.32	0.20	5.75
			Dispersant - Gallons	250							
			Spotter Aircraft	1							
			Spotter Personnel	2	Stennis INTL., MS 2nd Flight	282	1.32	0.20	1.32	0.20	3.05
			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	282	12.00	0.20	1.32	0.20	13.75
			Dispersant - Gallons	250							
			Spotter Aircraft	1							
			Spotter Personnel	2	Stennis INTL., MS 2nd Flight	282	1.32	0.20	1.32	0.20	3.05
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC 800-OIL-SPIL	Stennis, MS	C130-A Dispersant Aircraft	1	Stennis INTL., MS 1st Flight	282	4.00	0.3	0.82	0.5	5.70
			Dispersant - Gallons	3250							
			Spotter Aircraft	1							
			Spotter Personnel	2	Stennis INTL., MS 2nd Flight	282	0.82	0.3	0.82	0.5	2.50
			Crew - Pilots	2							
C130-A Aircraft Air Speed - 342 MPH	MSRC 800-OIL-SPIL	Mesa, AZ	C130-A Dispersant Aircraft	1	Ellington Field, TX 1st Flight	345	8	0.3	1.01	0.5	9.85
			Dispersant - Gallons	3250							
			Spotter Aircraft	1							
			Spotter Personnel	2	Stennis INTL., MS 2nd Flight	282	0.82	0.3	0.82	0.5	2.50
			Crew - Pilots	2							
ADDS PACK Air Speed - 330 MPH	Clean Carribean 985-851-6391	Pt. Everglades, FL	C-130 Aircraft (contractor)	1	Clearwater, FL 1st Flight	544	24-48	1	1.65	0.5	27.15 to 51.15
			ADDS PACK	1							
			Dispersant - Gallons	5000							
			Spotter Aircraft	1	Stennis INTL, MS 2nd Flight	150	0.45	0.3	0.45	0.5	1.71
			Spotter Personnel	2							
			Crew - Pilots	2							
ADDS PACK Air Speed - 330 MPH	Oil Spill Response +44 (0) 1224-72-6859	South Hampton, UK	L-382 Hercules Aircraft	1	Stennis INTL, MS 1st Flight	282	6-24	2-4	0.85	0.5	9.4 to 29.4
			ADDS PACK	1							
			Dispersant - Gallons	5000							
			Spotter Aircraft	1	Stennis INTL, MS 2nd Flight	150	0.45	0.3	0.45	0.5	1.71
			Spotter Personnel	2							
			Crew - Pilots	2							
ADDS PACK Air Speed - 330 MPH	Oil Spill Response +44 (0) 1224-72-6859	Singapore, SG	L-382 Hercules Aircraft	1	Stennis INTL, MS 1st Flight	282	6-24	2-4	0.85	0.5	9.4 to 29.4
			ADDS PACK	1							
			Dispersant - Gallons	5000							
			Spotter Aircraft	1	Stennis INTL, MS 2nd Flight	150	0.45	0.3	0.45	0.5	1.71
			Spotter Personnel	2							
			Crew - Pilots	2							

Table 9.D.7 Offshore Aerial Dispersant Activation List

Walker Ridge 508
Sample Offshore Boat Spray Dispersant Activation List

Boat Spray Dispersant System	Supplier & Phone	Warehouse	Boat Spray Dispersant Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Monitor Induction Dispersant Spray System	AMPOL 800-482-6765	Port Fourchon, LA	Dispersant Spray System	1	Port Fourchon, LA	188	4	0.5	13.5	1	19
			Dispersant (Gallons)	500							
			Personnel	4							
			* 110' Utility Boat	1							
			* Crew Boat	1							
USCG SMART Team	USCG	Mobile, AL	Personnel	4	Port Fourchon, LA	188	4.25	1	13.5	0.5	19.25
			* Crew Boat	1							
Fire Monitor Induction Dispersant Spray System	AMPOL 800-482-6765	Cameron, LA	Dispersant Spray System	1	Port Fourchon, LA	188	5	0.5	13.5	1	20
			Dispersant (Gallons)	500							
			Personnel	4							
			* 110' Utility Boat	1							
			* Crew Boat	1							

** - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.*

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

Walker Ridge 508
Sample Subsea Dispersant Package Activation List

Containment System	Supplier & Phone	Warehouse	Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Days)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
"Top Hat" Unit	RP / MWCC	Port Fourchon, LA	Anchor Handling Tug Supply Vessel	1	Port Fourchon, LA	188	13*	1	13.5	3	12
			ROV's	2							
			Multi-Purpose Supply Vessel	1							
			Drill Ship (Processing Vessel)	1							
			"Top Hat"	1							
			Containment Chamber	1							
			Shuttle Barge	1							
Site Assessment and Surveillance	RP	Port Fourchon, LA	Multi-Service Vessel	1	Port Fourchon, LA	188	0	1.5	13.5	0.5	15.5
			ROV's	2							
Subsea Dispersant Application	RP / MWCC	Port Fourchon, LA	Multi-Service Vessel	1	Port Fourchon, LA	188	1.5	1.5	13.5	2	18.5
			ROV's	2							
			Coil Tubing Unit	1							
		Houston, TX	Dispersant	200,000 gal							
			Manifold	1							
			System	1							
Capping Stack	RP / MWCC	Port Fourchon, LA	Anchor Handling Tug Supply Vessel	1	Port Fourchon, LA	188	2	1.5	13.5	3	20
			ROV's	1							
		Houston, TX	Hydraulic System	1							
			Capping Stack	1							

** - Response time may vary depending on Drill Ship's operations and location at the time of deployment.*

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

Walker Ridge 508
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Port Fourchon, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	4	1	13.5	1	**19.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Port Fourchon, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	4	1	13.5	1	**19.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Port Fourchon, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	4	1	13.5	1	**19.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	CGA 888-CGA-2007	Harvey, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	4	1	13.5	1	**19.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	CGA 888-CGA-2007	Harvey, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	4	1	13.5	1	**19.5**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Lake Charles, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	6.25	1	13.5	1	**21.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Lake Charles, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	6.25	1	13.5	1	**21.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Lake Charles, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	6.25	1	13.5	1	**21.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Lake Charles, LA	Fire Boom (ft)	500	Port Fourchon, LA	188	6.25	1	13.5	1	**21.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							

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

Walker Ridge 508
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							

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

Walker Ridge 508
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							

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

Walker Ridge 508
Sample In-Situ Burn Equipment Activation List

Skimming System	Supplier & Phone	Warehouse	Skimming Package	Quantity	Staging Area	Distance to Site from Staging (Miles)	Response Times (Hours)				
							Staging ETA	Loadout Time	ETA to Site	Deployment Time	Total ETA
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
Fire Team (In-Situ Burn Fire System)	MSRC 800-OIL-SPIL	Houston, TX	Fire Boom (ft)	500	Port Fourchon, LA	188	8.25	1	13.5	1	**23.75**
			Guide Boom/Tow Line (ft)	400							
			* Offshore Vessel (0.5 kt capability)	2							
			Personnel	6							
			Ignition Device	10							
						TOTAL FIRE BOOM AVAILABLE (FEET)		21,000			

*** - These components are additional operational requirements that must be procured by OSROs in addition to the system identified.***

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

Walker Ridge 508
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
Lawson Environmental Service 985-876-0420	Houma, LA	Containment Boom - 18" to 24"	50,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	9,500'					
		Response Boats - 14' to 20'	38					
		Response Boats - 21' to 36'	21					
		Portable Skimmers	6					
		Shallow Water Skimmers	2					
ES&H Environmental 877-437-2634	Golden Meadow, LA	Containment Boom - 18" to 24"		Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"						
		Response Boats - 14' to 20'						
		Response Boats - 21' to 36'						
		Portable Skimmers						
		Shallow Water Skimmers						
		Bird Scare Cannons						
		Response Personnel						
ES&H Environmental 877-437-2634	Houma, LA	Containment Boom - 18" to 24"	45,600'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	15,000'					
		Response Boats - 14' to 20'	38					
		Response Boats - 21' to 36'	13					
		Portable Skimmers	35					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	200					
		Response Personnel	11					
Oilmop 985-798-1005	Larose, LA	Containment Boom - 18" to 24"	2500'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Shallow Water Skimmers	1					
ES&H Environmental 877-437-2634	Port Fourchon, LA	Containment Boom - 18" to 24"	1000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	200'					
		Response Boats - 14' to 20'	3					
		Portable Skimmers	3					
		Response Personnel	2					
ES&H Environmental 877-437-2634	Morgan City, LA	Containment Boom - 18" to 24"	2,000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	1,200'					
		Response Boats - 14' to 20'	7					
		Response Boats - 21' to 36'	8					
		Portable Skimmers	6					
		Response Personnel	6					
AMPOL 800-482-6765	Harvey, LA	Containment Boom - 18" to 24"	28,600'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	2,400'					
		Response Boats - 14' to 20'	1					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	2					
		Shallow Water Skimmers	1					
		Response Personnel	18					
CGA	Harvey, LA	Wildlife Rehab Trailer	1	Port	4	1	1	6
		Wildlife Husbandry Trailer	1					
		Support Trailer	1					
		Contract Truck (Third Party)	3					
USES Environmental 888-279-9930	Harvey, LA	Containment Boom - 18" to 24"	300'	Port Fourchon, LA	4	1	1	6
USES Environmental 888-279-9930	Marrero, LA	Containment Boom - 18" to 24"	600'	Port Fourchon, LA	4	1	1	6
USES Environmental 888-279-9930	Hahnville, LA	Containment Boom - 18" to 24"	500'	Port Fourchon, LA	4	1	1	6
Oilmop 800-637-5471	Morgan City, LA	Containment Boom - 18" to 24"	1000'	Port Fourchon, LA	4	1	1	6
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	1					
		Portable Skimmers	1					
		Response Personnel	8					
USES Environmental 888-279-9930	Amelia, LA	Containment Boom - 18" to 24"	1000'	Port Fourchon, LA	4	1	1	6
		Personnel (Responder/Mechanic)	4					
USES Environmental 888-279-9930	Belle Chasse, LA	Containment Boom - 18" to 24"	600'	Port Fourchon, LA	4.25	1	1	6.25
ES&H Environmental 877-437-2634	Lafayette, LA	Containment Boom - 18" to 24"		Port Fourchon, LA	4.25	1	1	6.25
		Containment Boom - 6" to 10"						
		Response Boats - 14' to 20'						
		Response Boats - 21' to 36'						
		Portable Skimmers						
		Shallow Water Skimmers						
		Bird Scare Cannons						
		Response Personnel						

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

Walker Ridge 508
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	Belle Chasse, LA	Containment Boom - 18" to 24"		Port Fourchon, LA	4.25	1	1	6.25
		Containment Boom - 6" to 10"						
		Response Boats - 14' to 20'						
		Response Boats - 21' to 36'						
		Portable Skimmers						
		Shallow Water Skimmers						
		Bird Scare Cannons						
		Response Personnel						
Oilmop 800-645-6671	Belle Chasse, LA	Containment Boom - 18" to 24"	21,000'	Port Fourchon, LA	4.25	1	1	6.25
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	5					
		Portable Skimmers	23					
		Shallow Water Skimmers	1					
		Bird Scare Cannons	20					
		Response Personnel	18					
USES Environmental 888-279-9930	Lafitte, LA	Containment Boom - 18" to 24"	1000'	Port Fourchon, LA	4.5	1	1	6.5
		Response Boats - 14' to 20'	2					
USES Environmental 888-279-9930	Meraux, LA	Containment Boom - 18" to 24"	6000'	Port Fourchon, LA	4.25	1	1	6.25
		Containment Boom - 6" to 10"	1000'					
		Response Boats - 14' to 20'	13					
		Response Boats - 21' to 36'	4					
		Portable Skimmers	3					
		Response Personnel	44					
USES Environmental 888-279-9930	Geismar, LA	Containment Boom - 18" to 24"	1000'	Port Fourchon, LA	4.5	1	1	6.5
		Response Boats - 14' to 20'	3					
		Portable Skimmers	1					
		Response Personnel	9 to 18					
AMPOL 800-482-6765	New Iberia, LA	Containment Boom - 6" to 10"	750'	Port Fourchon, LA	4.75	1	1	6.75
		Containment Boom - 18" to 24"	4,3950'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	10					
		Portable Skimmers	27					
		Shallow Water Skimmers	2					
		Bird Scare Cannons	7					
		Response Personnel	70					
Oilmop 800-637-5471	Port Allen, LA	Containment Boom - 18" to 24"	2500'	Port Fourchon, LA	4.75	1	1	6.75
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	3					
		Response Personnel	18					
Oilmop 800-637-5471	New Iberia, LA	Containment Boom - 18" to 24"	3,500'	Port Fourchon, LA	4.75	1	1	6.75
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	6					
		Response Personnel	8					
Clean Harbors 1.800.645.8265	New Iberia, LA	Containment Boom - 18" to 24"	33,800'	Port Fourchon, LA	4.75	1	1	6.75
		Containment Boom - 6" to 10"	500'					
		Response Boats - 21' to 36'	4					
		Portable Skimmers	22					
		Shallow Water Skimmers	1					
		Response Personnel	10					
Wildlife of Texas 281-731-8826	Baton Rouge, LA	Wildlife Specialist - Personnel	6 to 20	Port Fourchon,	5	1	1	7
Clean Harbors 1.800.645.8265	Baton Rouge, LA	Containment Boom - 18" to 24"	14,000'	Port Fourchon, LA	5	1	1	7
		Response Boats - 14' to 20'	1					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	3					
		Response Personnel	10					
USES Environmental 888-279-9930	Biloxi, MS	Containment Boom - 18" to 24"	2,000'	Port Fourchon, LA	5.25	1	1	7.25
		Response Boats - 14' to 20'	1					
		Portable Skimmers	2					
USES Environmental 985-534-2744	Venice, LA	Containment Boom - 18" to 24"	10,000'	Port Fourchon, LA	5.75	1	1	7.75
		Response Boats - 14' to 20'	8					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	2					
		Shallow Water Skimmers	1					
MSRC 800-OIL-SPIL	Lake Charles, LA	Wildlife Trailer	1	Port Fourchon, LA	6.25	1	1	8.25
		Contract Truck (Third Party)	1					
		Personnel (Responder/Mechanic)	1					

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

Walker Ridge 508
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
Miller Env. Services 800-929-7227	Sulphur, LA	Containment Boom - 18" to 24"	24,000'	Port Fourchon, LA	6.25	1	1	8.25
		Containment Boom - 6" to 10"	600'					
		Response Boats - 14' to 20'	7					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	6					
		Shallow Water Skimmers	1					
		Response Personnel	49					
Clean Harbors 1.800.645.8265	Lake Charles, LA	Containment Boom - 18" to 24"	3000'	Port Fourchon, LA	6.25	1	1	8.25
		Response Boats - 21' to 36'	4					
		Portable Skimmers	1					
		Response Personnel	18					
ES&H Environmental 877-437-2634	Lake Charles, LA	Containment Boom - 18" to 24"		Port Fourchon, LA	6.25	1	1	8.25
		Containment Boom - 6" to 10"						
		Response Boats - 14' to 20'						
		Response Boats - 21' to 36'						
		Portable Skimmers						
		Shallow Water Skimmers						
		Bird Scare Cannons						
		Response Personnel						
USES Environmental 888-279-9930	Mobile, AL	Containment Boom - 18" to 24"	5,000'	Port Fourchon, LA	6.25	1	1	8.25
		Containment Boom - 6" to 10"	800'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
SWS Environmental 1-877-742-4215	Pensacola, FL	Containment Boom - 18" to 24"	2,500'	Port Fourchon, LA	7	1	1	9
		Response Boats - 14' to 20'	3					
		Shallow Water Skimmers	2					
		Response Personnel	20					
Miller Env. Services 800-929-7227	Beaumont, TX	Containment Boom - 18" to 24"	14,000'	Port Fourchon, LA	7	1	1	9
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	1					
		Response Personnel	47					
Clean Harbors 1.800.645.8265	Port Arthur, TX	Containment Boom - 18" to 24"	3,000'	Port Fourchon, LA	7.25	1	1	9.25
		Response Boats - 14' to 20'	7					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	3					
		Response Personnel	10					
Oilmop 800-637-5471	Port Arthur, TX	Containment Boom - 18" to 24"	4000'	Port Fourchon, LA	7.25	1	1	9.25
		Response Boats - 14' to 20'	6					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	5					
		Shallow Water Skimmers	1					
		Response Personnel	8					
Wildlife of Texas 281-731-8826	Houston, TX	Wildlife Specialist - Personnel	6 to 20	Port Fourchon,	8.25	1	1	10.25
SWS Environmental 1-877-742-4215	Houston, TX	Containment Boom - 18" to 24"	10,000'	Port Fourchon, LA	8.25	1	1	10.25
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	1					
		Response Personnel	20					
USES Environmental 888-279-9930	Houston, TX	Containment Boom - 18" to 24"	5,000'	Port Fourchon, LA	8.25	1	1	10.25
		Containment Boom - 6" to 10"	500'					
		Response Boats - 14' to 20'	4					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	1					
Anderson Pollution Control 936-441-2225	Houston, TX	Containment Boom - 18" to 24"	28,600'	Port Fourchon, LA	8.25	1	1	10.25
		Containment Boom - 6" to 10"	400'					
		Response Boats - 14' to 20'	3					
		Response Boats - 21' to 36'	5					
		Portable Skimmers	11					
Oilmop 800-637-5471	Houston, TX	Containment Boom - 18" to 24"	4000'	Port Fourchon, LA	8.25	1	1	10.25
		Response Boats - 14' to 20'	4					
		Response Boats - 21' to 36'	2					
		Portable Skimmers	1					
Phoenix Pollution Control & Environmental Services 281-838-3400	Baytown, TX	Containment Boom - 18" to 24"	17,000'	Port Fourchon, LA	8	1	1	10
		Containment Boom - 6" to 10"	1,150'					
		Response Boats - 14' to 20'	9					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	24					
		Shallow Water Skimmers	2					
Miller Env. Services 800-929-7227	Houston, TX	Containment Boom - 18" to 24"	14,000'	Port Fourchon,	8.25	1	1	10.25
T&T Marine 409-744-1222 281-488-5757	Houston/ Galveston, TX	Containment Boom - 18" to 24"	50,000'	Port Fourchon, LA	8.75	1	1	10.75
		Containment Boom - 6" to 10"	1,000'					
		Response Boats - 14' to 20'	12					
		Portable Skimmers	17					

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

Walker Ridge 508
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
Clean Harbors 1.800.645.8265	Houston, TX	Containment Boom - 18" to 24"	4000'	Port Fourchon, LA	8.25	1	1	**10.25**
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	5					
		Portable Skimmers	1					
		Shallow Water Skimmers	1					
		Response Personnel	18					
SWS Environmental 1-877-742-4215	Panama City, FL	Containment Boom - 18" to 24"	12,000'	Port Fourchon, LA	9	1	1	**11**
		Response Boats - 14' to 20'	2					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	3					
		Bird Scare Cannons	7					
		Response Personnel	20					
Miller Env. Services 800-929-7227	Corpus Christi, TX	Containment Boom - 18" to 24"	50,000'	Port Fourchon, LA	11.5	1	1	**13.5**
		Containment Boom - 6" to 10"	2,000'					
		Response Boats - 14' to 20'	10					
		Response Boats - 21' to 36'	3					
		Portable Skimmers	6					
		Shallow Water Skimmers	2					
		Response Personnel	142					
SWS Environmental 1-877-742-4215	St. Petersburg, FL	Containment Boom - 18" to 24"	13,000'	Port Fourchon, LA	13.75	1	1	**15.75**
		Response Boats - 14' to 20'	1					
		Response Boats - 21' to 36'	1					
		Portable Skimmers	1					
		Response Personnel	20					
SWS Environmental 1-877-742-4215	Tampa, FL	Containment Boom - 18" to 24"	1,700'	Port Fourchon, LA	13.25	1	1	**15.25**
		Response Boats - 21' to 36'	1					
		Portable Skimmers	2					
		Response Personnel	20					
TRI-STATE 302-737-9543	Newark, DE	Wildlife Specialist - Personnel	6 to 12	Port Fourchon,	21.5	1	1	**23.5**

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

SECTION 10: ENVIRONMENTAL MONITORING

A. Monitoring Systems

A deepwater metocean mooring system will be utilized to provide real-time environmental information for the production system and support operations. Measurements will be recorded internally (both within sensors and control system) on the mooring and transmitted in real-time. Compliance with NTL 2009-G02 will be achieved with a pair of Acoustic Doppler Current Profiler (ADCP) meters transmitting in real-time through a surface link. Metocean conditions such as sea states, wind speed, ocean currents, sea and air temperatures and barometric pressure will be obtained with a surface buoy. A near-bottom mounted current meter will obtain near sea floor current measurements.

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 2012-BSEE-G01	"Marine Trash and Debris Awareness and Elimination"
NTL 2012-Joint-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2012-Joint-G02	"Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

C. Flower Garden Banks National Marine Sanctuary

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

SECTION 11: LEASE STIPULATIONS

Leases OCS-G 18730 and 17001 are not part of a Biological Sensitive Area, known Chemosynthetic Area, or Shipping Fairway. See Section 6 of this plan for site specific archeological information.

OCS-G 18730, Walker Ridge Block 507
OCS-G 17001, Walker Ridge Block 508
OCS-G 18731, Walker Ridge Block 509
OCS-G 21861, Walker Ridge Block 551
OCS-G 18737, Walker Ridge Block 552
OCS-G 17004, Walker Ridge Block 553
OCS-G 21862, Walker Ridge Block 596
OCS-G 26409, Walker Ridge Block 597

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 Oil Spill Response Plan. Section 18 of this plan discusses impacts and mitigation measures.

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 2012-BSEE-G01	"Marine Trash and Debris Awareness and Elimination"
NTL 2012-Joint-G01	"Vessel Strike Avoidance and Injured/Dead Protected Species Reporting"
NTL 2012-Joint-G02	"Implementation of Seismic Survey Mitigation Measures & Protected Species Observer Program"

SECTION 13: RELATED FACILITIES AND OPERATIONS INFORMATION

The initial production system will consist of a single drill center with subsea wells tied back to a single manifold, connected to a Floating Production Storage and Offloading (FPSO) host by dual flow lines with steel lazy wave risers. Oil export will be with shuttle tankers and gas export via a gas export pipeline.

Topsides will be installed on an FPSO with full offshore processing capabilities including required heat exchangers, separation equipment, gas dehydration equipment, power generation equipment, compression equipment, pumps, flare, water treatment equipment, bulk oil treating equipment, and hull storage. The system will be designed in accordance with Shell standards.

Product	Peak Processing Throughput
Oil (BPD)	60,000 BPD
Produced Water (BPD)	30,000 BPD
Total Fluids (BPD)	90,000 BPD
Gas (MMscfd)	15 MMcfd

The hull configuration for the Floating Production Facility will be a ship shaped FPSO based on a converted double hull tanker. The hull, topsides, marine systems, and station keeping systems will all be classed by the American Bureau of Shipping (ABS). The FPSO will be registered with the Bahamas Maritime Authority (BMA).

The FPSO will be designed to remain connected during winter storms and sudden hurricanes and to disconnect from its moorings and depart the field, under its own propulsion, for named storms and hurricanes.

The FPSO will be a converted Suezmax-size tank ship which will have been built outside the US and will be transported to the US GOM under its own power. The buoy section of the disconnectable turret, along with moorings, will be pre-installed in the US GOM prior to the arrival of the FPSO.

The FPSO marine systems will include the following:

- <u>A fully functional marine propulsion and navigation system to be used when the FPSO is disconnected.</u>
- <u>Oil export system for offloading produced oil to a shuttle tanker. This system shall consist of a reel mounted floating double carcass oil export hose and a tandem mooring hawser.</u>

The topsides process facilities are similar to existing deepwater facilities in the Gulf of Mexico except they are designed to consider the dynamic motions of the FPSO and include a swivel to allow for vessel weathervaning. The topsides modules will be installed on the FPSO and will provide full offshore processing capabilities including heat exchangers, separation equipment, gas dehydration equipment, power generation equipment, compression equipment, pumps, flare, water treatment equipment, bulk oil treating equipment, and hull storage.

A Distributed Control System (DCS) will be utilized for Process Safety Controls. The Emergency Support System (ESS) and Fire and Gas Detection will be TUV Certified SIL-3.

The major utility services provided by the FPSO are cooling water, electrical power and process heating. Cooling water will be lifted from the sea, filtered and pumped to the main users. Dual fuelled turbine driven generating sets will provide power to all consumers of electricity. Emergency power generation will be provided by a diesel engine driven generator set servicing all safety systems and control functions. Process heat will be provided through a closed loop heat medium system. Process gas will be the primary fuel for the FPSO. Chemical injection systems will be provided. These will inhibit formation of hydrates, corrosion products, foaming, emulsions and scale.

Subsea

Phase 1 of the Stones development will include a single manifold to support the production wells. The manifold will be configured to allow the well to flow under natural flow to the surface facilities in addition to being configured to align the production wells to the artificial lift system (after it is installed).

The Stones artificial lift system is designed to boost the process fluids from the sea floor to the FPSO in single phase. The pumps will be driven by variable frequency drives located on the topsides facility, and will have a dedicated controller located topsides as well. Stones' modular mud-line boosting system consists of three pumps configured in a single pumping station with 3x50% pump units. Each pump module on the pumping station will be retrievable.

The subsea control modules will use an electro hydraulic multiplexed pod with high speed fiber optic communication between topside and subsea. Controls and instrumentation for the booster pumps system will comply with NTL 2011-N11, and will be available for alert, interlock, and shutdown function for certain conditions (e.g. seal failure, loss of communications, high and low pressure). Testing for controls and instrumentation will be performed per regulatory requirements.

Seafloor multiphase meters will be provided to allow for well testing. In addition it is expected that there will be sufficient pressure and temperature gauges located in the wells, trees and manifolds to provide for virtual metering of the well streams.

The flow line system transports fluids from the producing wells via the production manifold and artificial lift system. A dual flow line system is selected. The flow lines will be initiated with a PLET and terminated with a Steel Lazy Wave riser that connects the flow line to the host. Wells, manifold and flow lines will be connected via jumpers with vertical connectors The Stones flow lines will be 8" nominal.

Pipeline	Route	Diameter	Length	Product	Shut-in time in the event of a leak
Gas Export Line	FPSO WR 551 to WR Gathering System in WR 457	8.625"	98717'	Gas	45 seconds
WR 508 FPSO Flowline #1	WR 508 to WR 551 FPSO	8.625"	19586'	Crude oil	45 seconds
Flowline Jumper 85501A	Manifold To WR508 PLET	8.625"	100'	Crude oil	45 seconds
WR 508 FPSO Flowline #2	WR 508 to WR 551 FPSO	8.625"	18973'	Crude oil	45 seconds
Flowline Jumper 85501B	Manifold To WR508 PLET	8.625"	50'	Crude oil	45 seconds
Subsea Manifold	WR 508	8.625"	50'	Crude oil	45 seconds
Well Jumpers (x8)	WR508	8.625"	45' to 100'	Crude oil	45 seconds

Control, power, chemical injection and communication functions for all subsea equipment, including wells, multiphase pumps, trees and associated support structures, shall be provided through electrical-hydraulic umbilicals. The umbilicals will terminate at UTAs on the seafloor.

Product Transport

The oil export will be via dedicated double hull shuttle tanker. The shuttle tanker will be Jones Act and OPA 90 compliant. The shuttle tanker will be a "Veteran" class, or equivalent, tankship, with a nominal crude storage capacity of 330,000 barrels oil, converted for shuttle service. The tanker will be equipped with a conventional diesel engine with a single Controllable Pitch Propeller (CPP) and a bow thruster for enhanced maneuverability. The shuttle tanker will be moored in tandem behind the FPSO using a mooring hawser. The mooring hawser will be retrieved back to the FPSO when not in use. The oil will be offloaded from the FPSO using the cargo pumps via an export hose to a bow loading system located on the shuttle tanker. The export hose will be stored on a reel located on the stern of the FPSO when not in use. The offloading operation is estimated to take approximately 14 hours not including approach, mooring or disconnect time. Offloading of oil will be performed approximately every 5 days when producing at full capacity. Shuttle tanker deliveries will be to terminals of choice within the GoM. See table 13.1 below for list of potential refiners for the product.

A secondary (back up) system for offloading produced oil will be provided capable of offloading oil to a tanker equipped with a conventional OCIMF midship manifold in a tandem mooring configuration. This back-up system may be used with a non-dedicated Jones Act tanker when the dedicated shuttle tanker is not available.

An ESD (Emergency Shutdown) system shall be incorporated into the design of the systems located on the FPSO and shuttle tanker to manage the offloading operation.

A field support vessel, with sufficient bollard pull to serve as a pullback tug, will be deployed at Stones and used during offloading operations, primarily as a redundancy measure to cater for the unplanned non availability of the shuttle tanker's main propulsion system.

Gas export shall be via pipeline, with the selected export route via Enbridge's Walker Ridge Gathering System. The Stones lateral pipeline is configured to operate in both export and import modes to allow the Stones JV to backflow gas for fuel late in life. The gas export pipeline shall consist of a Steel Lazy Wave Riser connecting to a pipeline to the planned hub in block WR 457.

Potential USCG Refiners			
	Company Name	**Location**	**State**
1	Marathon	Garyville	LA
2	Chevron	Pascagoula	MS
3	Valero Energy Corp.	Port Arthur	TX
4	ConocoPhillips	Sweeny	TX
5	ExxonMobil	Baytown	TX
6	ConocoPhillips	Lake Charles	LA
7	Motiva Enterprises LLC	Port Arthur	TX
8	Total SA	Port Arthur	TX
9	Valero Energy Corp.	St. Charles (Norco)	LA
10	CITGO	Lake Charles	LA
11	ExxonMobil	Beaumont	TX
12	Valero Energy Corp.	Texas City	TX
13	ExxonMobil/PDVSA	Chalmette	LA
14	ExxonMobil	Baton Rouge	LA
15	Valero Energy Corp.	Corpus Christi	TX
16	CITGO	Corpus Christi	TX
17	Hunt Refining Co.	Tuscaloosa	AL
18	BP	Texas City	TX
19	LyondellBasell	Houston	TX
20	Flint Hills Resources	Corpus Christi	TX

SECTION 14: SUPPORT VESSELS AND AIRCRAFT

A. General

Support Equipment – FPSO Production Operations

Type	Maximum Fuel Tank Storage Capacity (Bbls)	Maximum Number In Area at Any Time	Trip Frequency or Duration
Supply Boat	9750	1	Once per week
Offshore Support Vessel	7500	1	Once every two weeks
Helicopter	22	1	Four times per week.

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	7500	4 weekly	Port Fourchon to FPSO location

Support Equipment – FPSO Installation

Vessel Type	Maximum Fuel Tank Storage Capacity (Barrels)	Maximum Number in Area at Any Time	Trip Frequency or Duration
Anchor Handling Tug	6000	3	21 days
Support Vessel	7500	1	45 days
Crane Vessel (Balder)	48960	1	21 days
Tow Tug	7150	2	14 days
Heavy Lift Transport	17000	1	5 days
Pile installation vessel (NI class)	23600	1	14 days
Helicopter	22	1	Five times per week

Installation and Support Equipment – Subsea

Type	Maximum Fuel Tank Storage Capacity (Gals)	Maximum No. In Area at Any Time	Trip Frequency or Duration
Flowline/Riser/Manifold Installation Vessel	26228	1	2 Trips – 55 Days total
Flowline LCV	10378	1	3 Trips – 72 Days Total
Flowline Cargo Tug	10378	2	30 Days
Flowline Supply	10378	2	41 Days
Flowline Heading Tugs	10378	2	19 Days
Umbilical Installation Vessel	9500	1	21 Days
Umbilical Support	10378	1	21 Days
Tree Installation	8945	1	2 Trips – 14 Days Total
Jumper Metrology Vessel	8945	1	1 Trip – 14 Days Total
Jumper Installation Vessel	8945	1	2 Trips – 28 Days Total

B. Drilling Fluids Transportation

Florida is not an affected state for operations proposed in this plan.

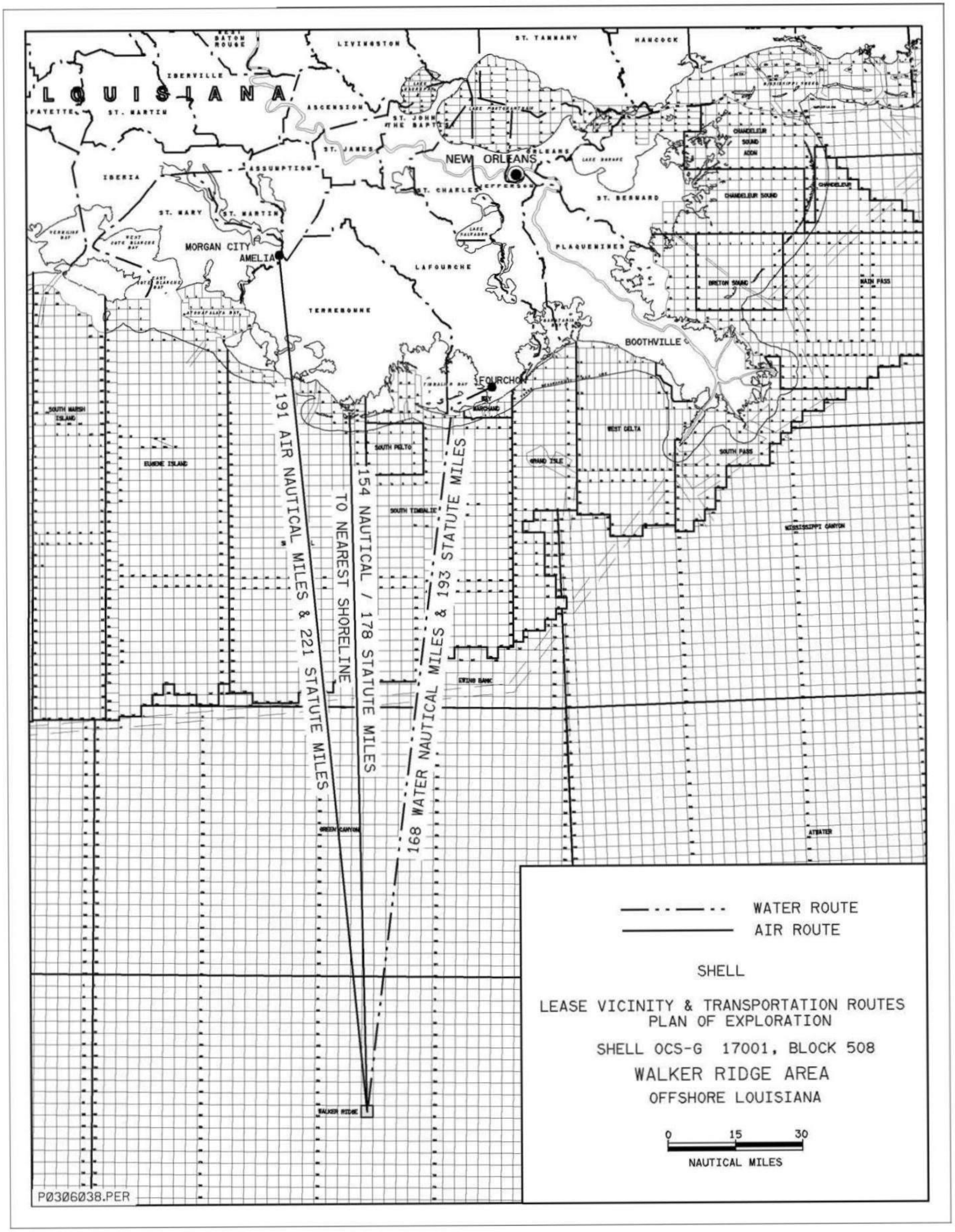
C. Solid and Liquid Wastes Transportation

See Section 7, Table 7B.

D. Vicinity Map

See Attachment 14A.

Attachment 14A
Vicinity Map



SECTION 15: ONSHORE SUPPORT FACILITIES

A. General

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

The onshore support bases for water and air transportation will be the existing terminals in Amelia 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 Amelia, LA is located at 4008 Lake Palourde Road, Amelia, LA 70340. However, there is the possibility that other shore bases may be utilized in other states. If operations affect Mississippi, the shorebase in Pascagoula will be utilized. If operations affect Alabama, then Mobile shorebase will be utilized. If operations affect Texas, then Galveston will be used. These are all existing shore bases.

B. Support Base Construction or Expansion

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

C. Support Base Construction or Expansion Timetable

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

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

SECTION 17: COASTAL ZONE MANAGEMENT ACT

LOUISIANA
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

Development Operations Coordination Document
Type of Plan

OCS-G 18730, Walker Ridge Block 507
OCS-G 17001, Walker Ridge Block 508
OCS-G 18731, Walker Ridge Block 509
OCS-G 21861, Walker Ridge Block 551
OCS-G 18737, Walker Ridge Block 552
OCS-G 17004, Walker Ridge Block 553
OCS-G 21862, Walker Ridge Block 596
OCS-G 26409, Walker Ridge Block 597

Offshore Louisiana
Lease Number, Area & Block

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 A Bellone

Sylvia A. Bellone
Certifying Official

04/26/2013
Date

TEXAS
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

Development Operations Coordination Document
Type of Plan

OCS-G 18730, Walker Ridge Block 507
OCS-G 17001, Walker Ridge Block 508
OCS-G 18731, Walker Ridge Block 509
OCS-G 21861, Walker Ridge Block 551
OCS-G 18737, Walker Ridge Block 552
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OCS-G 21862, Walker Ridge Block 596
OCS-G 26409, Walker Ridge Block 597

Offshore Louisiana
Lease Number, Area & Block

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

SHELL OFFSHORE INC.
Operator

Sylvia A Bellone

Sylvia A. Bellone
Certifying Official

04/26/2013
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 Offshore Inc. (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:

(a) CONSISTENCY CERTIFICATION
A Coastal Zone Consistency Certification for activities that affect the State of Texas is provided in Section 17 of the DOCD.

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 plan. 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 DOCD.
- Oil Spill Information is provided in Section 9 of the DOCD. All operations are covered by Shell's Regional Oil Spill Response Plan. The Plan is available upon request.

The 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 Waste Water to Coastal Waters

No discharges from the proposed activities will occur in coastal waters. The proposed activities are >100 miles 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 miles 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 miles 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

ALABAMA
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

Development Operations Coordination Document
Type of Plan

OCS-G 18730, Walker Ridge Block 507
OCS-G 17001, Walker Ridge Block 508
OCS-G 18731, Walker Ridge Block 509
OCS-G 21861, Walker Ridge Block 551
OCS-G 18737, Walker Ridge Block 552
OCS-G 17004, Walker Ridge Block 553
OCS-G 21862, Walker Ridge Block 596
OCS-G 26409, Walker Ridge Block 597

Offshore Louisiana
Lease Number, Area & Block

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

SHELL OFFSHORE INC.
Operator

Sylvia A Bellone

Sylvia A. Bellone
Certifying Official

4/26/2013

Date

Coastal Zone Management Consistency Information
For the State of Alabama

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

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

A. CONSISTENCY CERTIFICATION

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

B. OTHER INFORMATION

(1) Shell Offshore, Inc shall utilize a shore base in Fourchon, Louisiana for water support and PHI's Amelia terminal for air traffic for the proposed activities.

(2) 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 above-mentioned DOCD.
- Oil Spill Information is provided in Section 9 of the above-mentioned DOCD.
- All operations are covered by Shell Offshore Inc.'s Regional Oil Spill Response Plan, which has been approved by BSEE. The Plan is available upon request.

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

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

COASTAL RESOURCE USE POLICIES

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

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

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

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

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

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

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

NATURAL RESOURCE PROTECTION POLICIES

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

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

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

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

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

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

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

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

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

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

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

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

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

MISSISSIPPI
COASTAL ZONE MANAGEMENT
CONSISTENCY CERTIFICATION

Development Operations Coordination Document
Type of Plan

OCS-G 18730, Walker Ridge Block 507
OCS-G 17001, Walker Ridge Block 508
OCS-G 18731, Walker Ridge Block 509
OCS-G 21861, Walker Ridge Block 551
OCS-G 18737, Walker Ridge Block 552
OCS-G 17004, Walker Ridge Block 553
OCS-G 21862, Walker Ridge Block 596
OCS-G 26409, Walker Ridge Block 597

Offshore Louisiana
Lease Number, Area & Block

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

SHELL OFFSHORE INC.
Operator

Sylvia A Bellone

Sylvia A. Bellone
Certifying Official

4/26/2013

Date

Coastal Zone Management Consistency Information
For the State of Mississippi

Goal 1. To provide for reasonable industrial expansion in the Coastal Area and to insure the efficient utilization of waterfront industrial sites so that suitable sites are conserved for the water dependent industry.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 2. To favor the preservation of the coastal wetlands and ecosystems, except where a specific alternation of specific coastal wetlands would serve a higher public interest in compliance with the public purposes of the public trust in which the coastal wetlands are held.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 3. To protect, propagate, and conserve the State's seafood and aquatic life in connection with the revitalization, and conserve the State's seafood and aquatic life in connection with the revitalization of the seafloor industry of the State of Mississippi.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 4. To conserve the air and waters of the State, and to protect, maintain and improve the quality thereof for public use, for the prorogation of wildlife, fish and aquatic life, and for domestic, agricultural, industrial, recreational and other legitimate beneficial uses.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 5. To put the benefit use to the fullest extent of which they are capable to water resources of the State, and to prevent the waste, unreasonable use, or unreasonable method of use of water.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 6. To preserve the State's historical and archaeological resources, to prevent their destruction, and to enhance these resources whenever possible.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 7. To encourage the preservation of natural scenic qualities in the coastal area.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

Goal 8. To assist local government in the provision of public facilities services in a manner consistent with the coastal program.

The proposed activities are located in OCS Federal Waters, Gulf of Mexico, approximately 178 miles from the nearest Louisiana shoreline. Shell will utilize existing facilities in Fourchon, Louisiana; therefore, there should not be any adverse impacts to the Mississippi coastal areas.

SECTION 18: ENVIRONMENTAL IMPACT ANALYSIS

INITIAL DEVELOPMENT OPERATIONS COORDINATION DOCUMENT
Walker Ridge Block 507 (OCS-G 18730)
Walker Ridge Block 508 (OCS-G 17001)
Walker Ridge Block 551 (OCS-G 21861)
Walker Ridge Block 552 (OCS-G 18737)
Offshore Louisiana

April 2013

Prepared for:

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Introduction

Project Summary

Shell Offshore Inc. (Shell) is submitting an Initial Development Operations Coordination Document (DOCD) for Walker Ridge (WR) Blocks 507, 508, 551, and 552 that includes the installation and operation of a floating production, storage, and offloading (FPSO) vessel in WR 551 and the installation of subsea infrastructure to tie back nine wells in WR 508 to the new FPSO in WR 551. The drilling and completion of the Stones production wells is covered under a separate, previously filed Supplemental Exploration Plan for WR Blocks 507 and 508.

The lease area is 178 miles (286 km) from the nearest shoreline, 193 miles (311 km) from the onshore support base at Port Fourchon, Louisiana, and 221 miles (356 km) from the helicopter base at Amelia, Louisiana. All miles in this Environmental Impact Analysis (EIA) are statute miles. Water depths in the project area range from approximately 9,548 to 9,558 ft (2,910 to 2,913 m).

Under this Initial DOCD, Shell plans to install subsea equipment necessary to produce the wells in WR 508 including anchors, umbilicals, flowlines, manifolds, pipeline end terminations (PLETs), umbilical termination assemblies (UTAs), flying leads, and a seafloor artificial lift pump system. This DOCD will also cover installation and operation of the FPSO. Subsea and FPSO installation activities are anticipated to be completed by the third quarter of 2015 with "First oil" production from the Stones Unit anticipated during the first quarter of 2016.

Installation Activities

FPSO installation activities will include installation of the mooring buoy, associated mooring anchors, production risers, and flowlines. Installation of the subsea equipment will be accomplished with a non-anchored pipeline lay barge supported by tug boats, supply vessels, and helicopters as detailed in **Section 14** of this **DOCD**. Installation of the FPSO will be handled by a pile installation vessel, crane vessel, and associated transport vessels and tugs as detailed in **Section 14** of this **DOCD**.

Production Operations

The FPSO will have a double hull design with segregated cargo and ballast tanks designed to store approximately 800,000 barrels (bbl) of crude oil.

Topside processing facilities on the FPSO will be similar to existing deepwater facilities in the Gulf of Mexico with the additional consideration of the dynamic motion of the FPSO.

Processed oil will be transported by dedicated shuttle tanker to ports of opportunity along the Gulf coast approximately once every 5 days when producing at peak capacity. Oil export will be via a "Veteran" class, or equivalent, double-hulled tankship converted for dedicated shuttle service as described in **Section 13** of the **DOCD**. During offloading, the shuttle tanker will be moored in a tandem configuration approximately 490 ft (150 m) from the stern of the FPSO using a tandem mooring hawser as described in **Section 2E** of the **DOCD**. The mooring hawser will be retrieved back to the FPSO when not in use.

Decommissioning Activities

The Minerals Management Service (MMS) (2001) described decommissioning of an FPSO as the removal of the FPSO vessel from the field and removal or abandonment in place of all subsea equipment and production site structures. Decommissioning activities are anticipated to be essentially the same as the installation activities, but conducted in the opposite order and over a shorter duration (MMS, 2001). Decommissioning activities will be conducted in accordance with 30 CFR 250 Subpart Q.

Purpose of the EIA

This EIA was prepared pursuant to the requirements of the Outer Continental Shelf Lands Act (OCSLA), 43 U.S.C. §§ 1331-1356, as well as regulations including 30 CFR 550.242(s) and 550.261. The EIA is a project- and site-specific analysis of Shell's planned activities under this DOCD. Shell understands that the Bureau of Ocean Energy Management (BOEM) will review this EIA and prepare a Site-Specific Environmental Assessment (SEA) for the project. This EIA complies with guidance provided in existing Notices to Lessees and Operators (NTLs) issued by the former MMS and the Bureau of Ocean Energy Management, Regulation and Enforcement (BOEMRE), including NTL 2008-G04. Throughout this EIA, when existing guidance and general agency activities are referred to, "BOEM" is meant to subsume the former agencies and to represent the continuous regulatory entity now called BOEM. The former agency names (MMS and BOEMRE) are used when referring to particular historical documents published under those names. In addition, until NTLs are reissued under BOEM and/or Bureau of Safety and Environmental Enforcement (BSEE), the EIA will refer to the former BOEMRE as BOEM when addressing NTLs issued by BOEMRE or MMS.

The EIA presents data, analyses, and conclusions to support 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). It also identifies some of the mitigation measures Shell will implement in connection with the planned activities.

The EIA is a project-specific analysis that focuses on the impacts of a specific plan. This EIA addresses the impact-producing factors (IPFs), resources, and impacts associated with the activities proposed in this DOCD. The EIA also analyzes the potential environmental impacts of the revised blowout scenario and worst case discharge (WCD) information.

The MMS and BOEM have performed numerous environmental evaluations of oil and gas activities on the Gulf of Mexico Outer Continental Shelf (OCS). Potential impacts were analyzed at a broader level in the Programmatic Environmental Impact Statement (EIS) for the OCS Oil and Gas Leasing Program (MMS, 2007a; BOEM, 2012a) and in multi-lease-sale EISs for the Western and Central Gulf of Mexico Planning Areas (MMS, 2007b; BOEM, 2012b). Impacts specifically related to the use of an FPSO on the OCS were analyzed at a broader level in the Proposed Use of Floating Production, Storage, and Offloading Systems on the Gulf of Mexico OCS; Western and Central Planning Areas: Final Environmental Impact Statement (MMS, 2001) and specifically in the SEA for an FPSO Facility: Cascade-Chinook Project (MMS, 2008a).

These studies generated critical data and advanced the large body of existing knowledge on the Gulf of Mexico OCS. They analyze potential impacts on the natural environment, the socioeconomic effects of exploration and development activities, and other regional resources. Numerous technical studies address the likely trajectory of spilled oil, the effects of underwater noise on threatened and endangered species, and other IPFs. The studies inform agency decision-making on lease offerings, mitigation measures and lease stipulations, operational requirements, and permit restrictions. This substantial body of work which, in part, forms the basis for the evaluation presented here, will allow the BOEM and other regulatory agencies to evaluate Shell's Initial DOCD and ensure that oil and gas development and production activities are performed in an environmentally sound manner, with minimal impacts on the environment. Shell has incorporated these comprehensive environmental analyses by reference and built on them with project- and site-specific analyses, where applicable.

OCS Regulatory Framework

The regulatory framework for OCS activities in the Gulf of Mexico was summarized by MMS (2010) and post-Macondo regulatory changes were summarized by BOEM (2012b). 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, the BOEM and BSEE are charged with the responsibility of 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 Parts 250, 251, 252, 254, 256, 270, and 282. The BOEM offshore regulations are in 30 CFR Parts 550, 551, 552, 556, 559, 560, 570, 580, 581, 582, and 585.

In implementing its responsibilities under the OCSLA and NEPA, the BOEM consults numerous federal departments and agencies that have authority to govern 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 establish consultation and coordination processes with federal, state, and local agencies (e.g., the ESA, MMPA, Coastal Zone Management Act of 1972, and the Magnuson-Stevens Fishery Conservation and Management Act).

NTLs are formal documents issued by the BOEM and BSEE that provide clarification, description, or interpretation of a regulation or standard. **Table 1** lists and summarizes the NTLs applicable to this EIA.

Oil Spill Prevention and Contingency Planning

Shell submitted an update to the Gulf of Mexico Regional Oil Spill Response Plan (OSRP) to the BSEE as a fundamental component of the planned drilling program that certifies Shell's capability to respond to the maximum extent practicable to a WCD (see **DOCD Section 9**). The OSRP demonstrates Shell's capabilities 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 upon 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 and 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 information required by NTL 2008-G04, which provides guidance regarding information required by 30 CFR Part 550 for DOCDs. The main impact-related discussions are in **Section A** (Impact-Producing Factors) and **Section C** (Impact Analysis).

Table 1. Notices to Lessees and Operators (NTLs) that are applicable to this Environmental Impact Analysis (EIA).

NTL	Title	Summary
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 worst case discharge (WCD) scenarios to ensure capability to respond to oil discharges is both efficient and effective.
2012-JOINT-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.
2012-BSEE-G01	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.
2011-JOINT-G01	Revisions to the List of OCS Blocks Requiring Archaeological Resource Surveys and Reports	Provides new information on which Outer Continental Shelf (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 FR 63346). Informs operators that the 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.
2010-N06	Information Requirements for Exploration Plans, Development and Production Plans, and Development Operations Coordination Documents on the OCS	Rescinds the limitations set forth in NTL 2008-G04 regarding a blowout scenario and worst case discharge (WCD) scenario, and provides guidance regarding the information required in blowout scenario and WCD scenario descriptions.
2009-G40	Deepwater Benthic Communities	Guidance for avoiding and protecting high-density deepwater benthic communities (including chemosynthetic and deepwater coral communities) from damage caused by OCS oil and gas activities in water depths greater than 984 ft (300 m). Prescribes separation distances of 2,000 ft (610 m) from each mud and cuttings discharge location and 250 ft (76 m) from all other seafloor disturbances.
2009-G39	Biologically Sensitive Underwater Features and Areas	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.
2008-G04	Information Requirements for Exploration Plans and Development Operations Coordination Documents	Guidance on the information requirements for OCS plans, including EIA requirements and information regarding compliance with the provisions of the Endangered Species Act and 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.

A. Impact-Producing Factors

Table 2 is a matrix of IPFs and potentially affected environmental resources adapted from Form BOEM-142. 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 activity are listed below and briefly discussed in the following subsections:

- Installation and removal of subsea equipment and FPSO mooring system;
- FPSO presence (including noise and lights);
- Air pollutant emissions;
- Effluent discharges;
- Water intake;
- Onshore waste disposal;
- Marine debris;
- Vessel and helicopter traffic; and
- Accidents.

A.1 Installation and Removal of Subsea Equipment and FPSO Mooring System

Installation and removal of the subsea equipment and FPSO mooring system are anticipated to be essentially the same, but conducted in the opposite order with decommissioning activities occurring over a shorter duration (MMS, 2001).

The production system will consist of a single drill center with nine subsea wells tied back to a single manifold and connected to an FPSO host by dual flow lines with a steel lazy wave riser (SLWR) system. Physical disturbance of the seafloor will be limited to the proximal area where the subsea equipment is placed on the substrate. The following subsea equipment will be installed on the seafloor and is shown in **DOCD Attachment 1B**:

- Umbilicals;
- Flowlines;
- (1) Manifold;
- (2) Pipeline end terminations (PLETs);
- (2) Umbilical termination assemblies (UTAs);
- Flying leads;
- Seafloor artificial lift pump system;
- FPSO buoy;
- Production risers; and
- Single point mooring system.

The manifold will be installed on the seafloor in WR 508, approximately 2.3 miles (3.7 km) from the FPSO location in the northeast corner of WR 551. Nine subsea wells, connected to the manifold via a jumper, will have surface locations within 100 ft (30.5 m) of the manifold. A dual flow line system will be installed to transport fluids from the producing wells via the production manifold and artificial lift system. The 8" nominal flow lines will be initiated with a PLET and terminated with a SLWR that connects the flow line to the host approximately 2.3 miles (3.7 km) away. Jumpers with vertical connectors will connect the wells, manifold, and flow lines.

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

Environmental Resources	Impact-producing Factors										
	Installation and Removal of Subsea Equipment & FPSO Mooring System	FPSO Presence, Noise, and Lights	Air Pollutant Emissions	Effluent Discharges	Water Intake	Onshore Waste Disposal	Marine Debris	Vessel and Helicopter Traffic	Accidents		
									Small Oil Spill	Large Oil Spill	
										Surface Release	Blowout
Physical/Chemical Environment											
Air quality	--	--	**X**(9)	--	--	--	--	--	**X**(6)	**X**(6)	**X**(6)
Water quality	**X**	--	--	**X**	--	--	--	--	**X**(6)	**X**(6)	**X**(6)
Seafloor Habitats and Biota											
Soft bottom benthic communities	**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**(8,9)	**X**(6,8)	**X**(6,8)	**X**(6,8)
Florida manatee (endangered)	--	--	--	--	--	--	--	**X**(8,9)	--	**X**(6,8)	**X**(6,8)
Endangered mysticete whales	--	--	--	--	--	--	--	--	--	--	--
Non-endangered marine mammals (protected)	**X**	**X**	--	--	--	--	--	**X**(9)	**X**(6)	**X**(6)	**X**(6)
Sea turtles (endangered/threatened)	**X**(8)	**X**(8)	--	--	--	--	--	**X**(8,9)	**X**(6,8)	**X**(6,8)	**X**(6,8)
Piping Plover (threatened)	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Whooping Crane (endangered)	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Gulf sturgeon (threatened)	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Beach mice (endangered)	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Coastal and Marine Birds											
Marine and pelagic birds	--	**X**	--	--	--	--	--	**X**(8,9)	**X**(6)	**X**(6)	**X**(6)
Shorebirds and coastal nesting birds	--	--	--	--	--	--	--	**X**(8,9)	--	**X**(6)	**X**(6)
Fisheries Resources											
Pelagic communities and ichthyoplankton	--	**X**	--	**X**	**X**	--	--	--	**X**(6)	**X**(6)	**X**(6)
Essential Fish Habitat	**X**	**X**	--	**X**	**X**	--	--	--	**X**(6)	**X**(6)	**X**(6)
Archaeological Resources											
Shipwreck sites	--(7)	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Prehistoric archaeological sites	--(7)	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Coastal Habitats and Protected Areas											
Beaches	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Wetlands and seagrass beds	--	--	--	--	--	--	--	**X**(8,9)	--	**X**(6)	**X**(6)
Coastal wildlife refuges and wilderness areas	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Socioeconomic and Other Resources											
Recreational and commercial fishing	--	**X**	--	--	--	--	--	--	**X**(6)	**X**(6)	**X**(6)
Public health and safety	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)	**X**(5)
Employment and infrastructure	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)	**X**(6)
Recreation and tourism	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)	**X**(6)
Land use	--	--	--	--	--	--	--	--	--	**X**(6)	**X**(6)
Other marine uses	--	**X**	--	--	--	--	--	--	--	**X**(6)	**X**(6)

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-mi zone of the Flower Garden Banks, or the 3-mi zone of Stetson Bank;*

   (b) *1,000-m, 1-mi, or 3-mi 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.*

   Not applicable. The lease is not within the given ranges (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 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 because no features indicative of high-density chemosynthetic communities or coral communities are located within 500 ft (152 m) of the proposed subsea equipment installations. A non-anchored pipeline lay barge supported by tug boats, supply vessels, and helicopters will be used to install subsea equipment; the FPSO will maintain position by a permanently installed single point mooring system. Therefore, seafloor disturbances due to anchoring will not occur.

(5) *Exploration or production activities where H_2S concentrations greater than 500 ppm might be encountered.*

   DOCD Section 4 contains Shell's request for classification as an area absent of H_2S.

(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. The lease area is not on the list of archaeology survey blocks (BOEM, 2012c). The geohazards and archaeological assessments indicate multiple sonar contacts in the lease area, but none are interpreted to be historically significant. The lease is beyond the 197-ft (60-m) depth contour, therefore prehistoric archaeological sites are not likely. A non-anchored pipeline lay barge supported by tug boats, supply vessels, and helicopters will be used to install subsea equipment; the FPSO will maintain position by a permanently installed single point mooring system. Therefore, seafloor disturbances due to anchoring will not occur.

(8) *All activities that you determine might have an adverse effect on endangered or threatened marine mammals or sea turtles or their critical habitats.*

   IPFs that may affect marine mammals, sea turtles, or their critical habitats include FPSO presence and emissions; shuttle tanker, 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.*

   Production activities involving transportation of produced fluids using a shuttle tanker could affect the resources marked (X) in the matrix, and impacts are analyzed in **Section C**.

Installation of the subsea equipment and flowlines will be conducted by a non-anchored pipelay barge supported by tug boats, supply vessels, and helicopters as detailed in **Section 14** of the **DOCD**.

The installation of bottom-founded components is anticipated to disturb approximately 20 ac (8 ha) of the seafloor. Based on approximate footprints of the manifold, PLETs, UTAs, flying leads, and pump system on the seafloor, placement of these structures on the seafloor will directly disturb a small area estimated to be approximately 0.07 ac (0.03 ha). The MMS (2007b) estimated an area of seafloor disturbance between 1.2 ac (0.5 ha) and 2.5 ac (1.0 ha) per kilometer of pipeline or flowline installation. Due to the water depth in the lease area, it is anticipated that the pipelines and flowlines will not be buried by trenching, but instead will be placed on the seafloor, decreasing the area of impact. Thus, using the lower range value of 1.2 ac (0.5 ha) per kilometer of flowline or umbilical installed, the total area disturbed by installation of the flowlines and umbilicals is 19.6 ac (7.9 ha).

The FPSO will maintain position via a synthetic single-point mooring (SPM) system connected to the seabed via nine synthetic rope mooring lines in a taught leg configuration as detailed in **Section 2E** of the **DOCD**. The mooring lines will be terminated at suction anchor piles and will consist of chain and polyester rope segments. The anchors will be installed in three groups of three approximately 10,000 ft (3 km) radial distance from the FPSO in blocks WR 507, WR 551, and WR 552. Installation of the SPM system is anticipated to disturb approximately 5 ac per anchor (MMS 2008a) of the seabed for a total of 45 ac (18 ha).

By summing the estimated impact area of the subsea equipment with the impact area of the SPM system, the total footprint and seafloor disturbance from these permanent structures is estimated to be approximately 65 ac (26 ha).

Installation and removal activities will also produce machinery noise in the project area. Noise from structure installation and removal could be intermittent, sudden, and at times high in intensity (MMS, 2008a). The use of suction piles in place of driven piles for the SPM anchor system decreases the potential for acoustic impacts. Explosive removal techniques are not anticipated to be necessary to remove an FPSO or the associated bottom-founded equipment. There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources of sound.

A.2 FPSO Presence, Noise, and Lights

The production system for the Stones Unit will consist of a ship-shaped FPSO based on a converted double hull tanker with a nominal capacity of 800,000 bbl of export oil. The FPSO will be a converted Suezmax-size tank ship built outside the United States and registered with the Bahamas Maritime Authority (BMA). The FPSO will be transported to the U.S. Gulf of Mexico under its own power utilizing a fully functional marine propulsion and navigation system to be used when the FPSO is disconnected.

The FPSO will be moored on site utilizing a permanently fixed SPM system with a disconnectable internal turret as detailed in **Section 2E** of the **DOCD**. The risers and mooring system will be connected to the underside of the turret. The turret will allow for full 360° rotational weathervaning and full disconnect of the FPSO from its moorings, risers, and umbilicals in order to depart the field, under its own propulsion, during emergencies or named storms and hurricanes. The use of a disconnectable SPM system with the riser and mooring lines attached to the detachable buoy makes the riser system similar to other deepwater production systems and thus adds no more risks to the environment than those systems currently employed in the Gulf of Mexico for other deepwater operations (MMS 2008a). The physical presence of a processing facility and associated risers and mooring system in the ocean can attract pelagic fishes and other marine life, as discussed in **Section C.5.1**.

The amplitude, frequency, and duration of noise transmitted into the air and water column from FPSOs should be comparable to that of other deepwater development systems of similar size (MMS, 2001). Sound and vibration transmission from an FPSO are anticipated to be similar to a semisubmersible, in which sound and vibration are transmitted to the water either through the air or the risers (MMS, 2000). Machinery noise generated during the operation of fixed structures can be continuous or transient, and variable in intensity ranging from 20 to 40 dB above background levels within a frequency spectrum of 30 to 300 hertz (Hz) at a distance of 98 ft (30 m) (BOEM 2012b).

The FPSO and shuttle tanker (when on site) will maintain exterior lighting for navigational and aviation safety in accordance with federal regulations.

A.3 Air Pollutant Emissions

Air pollutant emissions occur mainly from combustion of diesel fuel. 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).

Estimates of air pollutant emissions are provided in **DOCD Section 8**. Offshore air pollutant emissions will vary between the installation and operations phases of the project as detailed in the Air Quality Emissions Report (see **DOCD Section 8**).

During the installation phase, air pollutant emissions will result from subsea installations in WR 508, SPM installation activities in WR 507, 551, and 552 and operations of the construction vessels and helicopters. A non-anchored pipeline lay barge, a pile installation vessel, a crane vessel, and associated transport vessels, supply vessels, tugs, and helicopters will be onsite during the installation of the subsea equipment and FPSO as detailed in **Section 14** of the **DOCD**.

During the operations phase, air pollutant emissions will result from production operations on the FPSO, the shuttle tanker, and a field support vessel in WR 551. Full offshore processing capabilities will be installed on the FPSO including, but not limited to, heat exchangers, separation equipment, gas dehydration equipment, power generation equipment, compression equipment, pumps, flare, water treatment equipment, bulk oil treating equipment, and hull storage. FPSO fuel sources are similar to other deepwater development technologies (e.g., tension leg platforms [TLPs], single point anchor reservoirs [SPARS]) and other offshore production systems (MMS, 2001). Diversion of any of the gas production stream to the flare system may occur in an emergency event such as equipment failure or the need to relieve system pressure.

The Air Quality Emissions Report (see **DOCD Section 8**) prepared in accordance with BOEM requirements shows that the projected emissions from emission sources associated with the proposed activities meet the BOEM exemption criteria and are therefore exempt from further air quality review pursuant to 30 CFR 550.303(d).

A.4 Effluent Discharges

Effluent discharges from the FPSO are summarized in **Table 3** and in **DOCD Section 7**. Shuttle tanker and support vessel discharges are expected to be in accordance with USCG regulations, and therefore are not expected to cause significant impacts on water quality. Discharges from the FPSO will be in compliance with and monitored as required by the NPDES) general permit for oil and gas activities in the western Gulf of Mexico (GMG 290000).

Table 3. Effluent wastes discharged from the floating production, storage, and offloading vessel.

Type of Waste	Composition	Discharge Method
Domestic waste (kitchen water, shower water)	Grey water	Ground to <25-mm mesh size and discharged overboard
Sanitary waste (toilet water)	Treated sanitary waste	Treated in the marine sanitation device prior to discharge to meet NPDES limits
Deck drainage	Wash and rainwater	Retained in Hazardous and Non hazardous drain tanks for 25 min for gravity separation and drained overboard.
Well treatment fluids, well completion fluids, workover fluids	Well treatment fluids, well completion fluids, workover fluids	Discharged overboard after treating
Desalinization unit discharge	Rejected water from watermaker unit	Discharged overboard below waterline
Miscellaneous Discharge	Uncontaminated Bilge Water	Discharged overboard below waterline
Miscellaneous Discharge	Uncontamined/Untreated seawater during turret connect and reconnect processes	Discharged at waterline in turret/hull annulus
Blowout preventer fluid	Water based	Discharged at seafloor
Ballast water	Uncontaminated seawater	Discharged overboard
Fire water (jockey pump)	Uncontaminated seawater	Discharged overboard
Cooling water	Uncontaminated seawater	Discharged overboard
Produced water	Produced water	Discharged overboard after treating

MARPOL = International Convention for the Prevention of Pollution from Ships; NPDES = National Pollutant Discharge Elimination Systems; ppm = parts per million.

Produced water and process effluents, including well treatment fluids, completion fluids, and workover fluids, may be discharged overboard via a downpipe below the water surface, after treatment that complies with NPDES permit limitations for these fluids. Other effluent discharges expected to be in accordance with the NPDES permit may include non-contact cooling water, treated sanitary and domestic wastes, deck drainage, desalination unit brine, uncontaminated fire water, and ballast water.

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 FPSO (**DOCD Table 7a**). High volumes of ballast water will also be on-loaded into segregated ballast tanks on the FPSO and subsequently discharged to maintain stability during production and offloading operations (MMS, 2001).

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 NPDES General Permit No. GMG 290000 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 2 million gallons per day (MGD), of which at least 25% is used for cooling purposes. The FPSO will be a converted double-hull tanker constructed prior to July 17, 2006, and as such, the cooling water intake structure portions of NPDES Permit GMG290000 do not apply to the FPSO. USEPA acknowledged that modifying existing facilities with known technologies to reduce impingement or entrainment would require unacceptable changes in the existing vessel structure, potentially decreasing the seaworthiness and potentially interfering with the structural components of the hull (USEPA, 2011a).

Two existing intake structures, or sea chests, are located in the engine room, one on the port side and one on the starboard side. The openings are located at a minimum of 37.7 ft (11.5 m) below the water line in FPSO mode. The cooling water intake velocity is 3.72 feet per second (ft/s) (1.1 m/s) across the screen resulting in an intake rate of 5.97 MGD. At 1.67 ft (0.5 m) from the intake screen, the intake velocity decreases to 0.5 ft/s (0.2 m/s); at 2.75 ft (0.8 m), the intake velocity decreases to 0.25 ft/s (0.1 m/s). This small zone of influence reduces potential for entrainment and/or impingement. The existing sea chests will not be modified to further reduce intake velocity due to restrictions in space availability.

Additionally, two new sea chests will be added to the FPSO for topsides non-contact cooling water intake. These two new sea chests will be designed to minimize intake velocities to reduce environmental impacts from the cooling water intake. There will also be two new sea chests for fire water intake, which will have infrequent, short duration periods of use for fire water usage (e.g., testing of firewater system).

A.6 Onshore Waste Disposal

Wastes generated during development activities are tabulated in **DOCD Section 7**. Non-hazardous trash and debris and non-recyclable waste will be transported to Republic/BFI landfill, Sorrento, Louisiana or the parish landfill, Avondale, Louisiana. Recyclable trash and debris will be recycled at Omega Waste Management in Patterson, Louisiana, or at ARC of New Iberia, Louisiana. Hazardous waste such as paints, solvents, and unused chemicals will be disposed of at Safety Kleen Systems, Inc. in Denton, Texas. Used oil and glycol will be sent to Omega Waste Management in Patterson, Louisiana, or ARC of New Iberia, Louisiana, for recycling. Universal waste items will be sent to Lamp Environmental in Hammond, Louisiana. At the onshore facilities, wastes will be recycled or disposed of according to applicable regulations.

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 similar materials (e.g., trash and debris) into the marine environment, and 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, posting informational placards, manifesting trash sent to shore, and using special precautions such as covering outside trash bins to prevent accidental loss of solid waste. Shell complies with NTL 2012-BSEE-G01, which 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. Shell's compliance with applicable laws, regulations, and NTL 2012-BSEE-G01 will avoid significant impacts on the environment.

A.8 Vessel and Helicopter Traffic

Shell will use existing shore-based facilities at Port Fourchon and Amelia, Louisiana, for onshore support for water and air transportation, respectively. No terminal expansion or construction is planned at either location.

Processed oil will be transported to existing ports of opportunity along the Gulf coast in Texas, Louisiana, Mississippi, and Alabama approximately once every 5 days by a dedicated shuttle tanker when producing at peak capacity. A "Veteran" class, or equivalent, double hulled tankship will be converted for dedicated shuttle service as described in **Section 13** of the **DOCD**. The shuttle tanker will be compliant with the Jones Act and Oil Pollution Act of 1990 and equipped with a conventional low-sulfur fuel oil engine with a single controllable pitch propeller (CPP) and a bow thruster for enhanced maneuverability. The tanker will be equipped with a bow loading system and have a nominal crude oil storage capacity of 330,000 bbl.

A non-anchored pipeline lay barge, a pile installation vessel, a crane vessel, and associated transport vessels, supply vessels, tugs, and helicopters will be onsite during the installation of the subsea equipment and the FPSO as detailed in **Section 14** of this **DOCD**. During the operations phase, Shell will utilize a field support vessel that will be on site during export operations. The support vessel will also be used to make supply runs to the shorebase. The supply base at Port Fourchon is located on Bayou Lafourche, approximately 3 miles (5 km) from the Gulf of Mexico. Supply and installation 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 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, 2012a).

A.9 Accidents

A.9.1 Types of Accidents Evaluated

A range of potential accidents were analyzed in this EIA to encompass the most likely type of accident, FPSO-unique accidents, and the worst case discharge (WCD).

The following subsections summarize assumptions about the sizes and fates of these spills as well as Shell's spill response plans. A large oil spill from an FPSO is expected to be a rare event. The probability of such an event will be minimized by safety measures incorporated into the design of the FPSO, including a secondary offloading system and an emergency shutdown system as described in **Section 2E** of the **DOCD**. A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in **DOCD Section 2j**. Impacts are analyzed in **Section C**.

Previous lease sale EISs (BOEM, 2012b) analyze other types of accidents including chemical spills, pipeline failures, vessel collisions, and loss of well control. These accidents are discussed briefly in **Section A.9.4**.

A.9.2 Small Oil Spills

Spill Size. According to the analysis in BOEM (2012b), the most likely type of small spill (<1,000 [bbl]) on the OCS would occur from a mishap on a production facility resulting in a minor crude or refined (diesel or hydraulic) oil spill. Most spills <1,000 bbl are expected to be diesel fuel (BOEM, 2012b), but the most likely type of small spill unique to FPSO operations is a crude oil spill resulting from a ruptured fuel transfer hose during transfer operations from the FPSO to the shuttle tanker (MMS, 2001). The risk of spills during offloading is similar to that of lightering operations in the Gulf of Mexico (MMS, 2001).

Historically, most diesel spills have been <1 bbl, and this size is predicted to be the most common in ongoing and future OCS activities in the Western and Central Gulf of Mexico Planning Areas (BOEM, 2012b). The median size for spills <1 bbl is <0.024 bbl, and the median size for spills of 1 to 10 bbl is 3 bbl (BOEM, 2012b). For this analysis, a small diesel fuel spill of 3 bbl is assumed. Operational experience suggests that the most likely cause of such a spill would be or a cargo piping leak on deck, resulting in less than 3 bbl.

MMS (2001) analyzed the frequency and risk of oil spills unique to FPSO operations and determined that 1.8% of the volume of potential FPSO-unique spills was likely to be from the transfer of crude oil from the FPSO to the shuttle tanker. Crude oil spills during transfer operations resulted entirely in small spills <1,000 bbl with half releasing less than 10 bbl of crude oil. Therefore, the median size of small oil spills related to FPSO operations is less than 10 bbl. The likelihood of a small crude oil spill during offloading operations was determined to be low and similar to that for lightering operations in the Gulf of Mexico.

Spill Fate. The fate of a small oil spill in the lease area would depend on meteorological and oceanographic conditions at the time as well as the effectiveness of spill response activities. A small oil spill is likely to persist on the sea surface for at least 3 days. However, 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.

The water-soluble fractions of diesel are dominated by two- and three-ringed polycyclic aromatic hydrocarbons (PAHs), which are moderately volatile (National Research Council [NRC], 2003). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel's 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, 2003) and would not be 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 2 (ADIOS2) model. 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 over 90% of a small diesel spill would be evaporated or naturally dispersed within 24 hours. The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac (0.5 to 5 ha) depending on sea state and weather conditions.

The ADIOS2 results, coupled with spill trajectory information discussed below for a large spill, indicate that a small fuel spill would not affect coastal or shoreline resources. The lease area is 178 miles (286 km) from the nearest shoreline (Louisiana). Modeling results discussed below indicate that a surface spill in the lease area would have a 1% probability of contacting the nearest Louisiana shorelines within 30 days after a spill. 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, 2012b). Because of the distance of these potential spills on the OCS and their lack of persistence, it is unlikely that a spill would make landfall prior to dissipation (BOEM, 2012b).

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

A.9.3 Large Oil Spills

Surface Release of Crude Oil

A large surface release of oil (≥1,000 bbl) may occur on the FPSO at the production site. The FPSO EIS (MMS, 2001) assessed the frequencies of all accidental releases unique to FPSO operations and shuttle tanker-related failures and found the risk to be low. The frequency of FPSO-unique oil releases is 0.037 per billion barrels produced and the frequency of shuttle tanker-related failures is 1.2 per billion barrels transported (MMS, 2001). MMS (2001) determined that the risk of shuttle tanker transport spills is comparable to and slightly less than that of oil transport by offshore pipeline, and that process releases are the single largest FPSO-unique risk for release on the FPSO.

Spill Size. The most probable discharge of oil from the FPSO would result from a process release such as a rupture of production equipment, including separators and piping. The combined volume in the production equipment and process piping is approximately 3,500 bbl, therefore, this is considered the estimated maximum discharge resulting from a process release.

Subsea Blowout

A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in **DOCD Section 2j**. Blowouts are rare events and most do not result in oil spills (BOEM, 2012a).

Spill Size. Shell has calculated a production blowout as the WCD for this DOCD using the requirements prescribed by NTL 2010-N06. The WCD is 68,291 bbl for the first day with a 30-day average of 37,318 barrels per day (BPD). The detailed analysis of this calculation can be found in **DOCD Section 2j**. The WCD scenario for this DOCD, in terms of both initial and sustained rates, has a low probability of being realized. Some of the factors that are likely to reduce rates and volumes, which 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.

Shell has a robust system in place to prevent blowouts. Included in **DOCD Sections 2j** and **9b** is Shell's response to NTL 2010-N06, 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 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.

The results for Launch Area 48 (the launch area nearest to the lease area) are presented in **Table 4**. The model predicts no shoreline contacts within 3 or 10 days. After 30 days, 8 counties and parishes from Texas to Louisiana may be contacted. Plaquemines and Cameron Parish, Louisiana, as well as Galveston County, Texas, have the greatest probability of shoreline contact, with a 2% chance within 30 days.

Table 4. Conditional probabilities of a spill in the lease area contacting shoreline segments (From: Ji et al., 2004). Values are conditional probabilities that a hypothetical spill in the lease area (represented by OSRA Launch Area 48) could contact shoreline segments within 3, 10, or 30 days.

Shoreline Segment	County or Parish and State	Conditional Probability of Contact[a] (%)		
		3 Days	10 Days	30 Days
C08	Matagorda, TX	--	--	1
C09	Brazoria, TX	--	--	1
C10	Galveston, TX	--	--	2
C12	Jefferson, TX	--	--	1
C13	Cameron, LA	--	--	2
C14	Vermilion, LA	--	--	1
C17	Terrebonne, LA	--	--	1
C20	Plaquemines, LA	--	--	2

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

The OSRA model 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 by 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 but has generally been used by BOEM to evaluate contact probabilities for spills greater than 1,000 bbl.

Weathering

Following an oil spill, several physical, chemical, and biological processes, collectively called weathering, interact to change the physical and chemical properties of the oil, and thereby influence its harmful 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, 2003).

Weathering decreases the concentration of oil and produces changes in its chemical composition, physical properties, and toxicity. The more toxic, light aromatic and aliphatic hydrocarbons are lost rapidly by evaporation and dissolution from the slick 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. Photooxidation 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 at the time an Application for Permit to Drill (APD) is submitted and will include equipment and services available to Shell through MWCC's development of near-term capability and other industry sources. Shell is a member of Clean Caribbean & Americas, 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.

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

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

Open-water *in situ* burning may also be used as a response strategy, depending on the circumstances of the release. If appropriate conditions exist and approval from the Unified Command is received, one or multiple *in situ* burning task forces could be deployed offshore.

See **DOCD Section 9b** for a detailed description of spill response measures.

A.9.4 Other Accidents Not Analyzed in Detail

The lease sale EIS (BOEM, 2012b) discusses four other types of accidents: chemical spills, pipeline failures, vessel collisions, and loss of well control. These accidents are discussed briefly below. Other FPSO-unique accidents are discussed in the FPSO EIS (MMS, 2001) and are incorporated by reference. Hydrogen sulfide (H_2S) is not expected at this site at levels above established regulatory thresholds, and no other site-specific issues have been identified for this DOCD. The analysis in the lease sale EIS for these topics is incorporated by reference.

Chemical Spill. Chemicals are used in production operations to protect and maintain subsea and processing equipment. The following chemicals are likely to be used on the FPSO: ethylene glycol (blowout prevention control fluid, used in closed cooling loops for crane and main engines and brake coolers), solvents (used in painting operations), hydraulic fluids (used in cranes and other hydraulic equipment), lubricating oil and grease (used in reciprocating and electrical equipment), and sodium hypochlorite (dilute, used as laundry bleach and disinfectant).

A study of environmental risks of chemical products used in OCS activities determined that only two chemicals could potentially affect the marine environment in the concentrations typically used: zinc bromide and ammonium chloride (Boehm et al., 2001). The project addressed by this DOCD does not anticipate the use of ammonium chloride, but zinc bromide will be used during well completion. The potential for impact from zinc bromide is minimized because it will not be in continuous use and it precipitates rapidly in marine waters (BOEM, 2012b). Most other chemicals are either nontoxic or used in small quantities (BOEM, 2012b). No significant impacts are expected from chemical spills.

Vessel Collisions. As summarized in MMS (2007b) and BOEM (2012b), vessel collisions occasionally occur during routine operations. Most collision mishaps are the result of service vessels colliding with platforms or vessel collisions with pipeline risers. About 10% of these collisions have caused spills of diesel fuel or chemicals (BOEM, 2012b). Shell will comply with USCG and BOEM-mandated safety requirements to minimize the potential for vessel collisions.

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 minor to serious well control incidents, while blowouts, discussed in **Section A.9.3**, are considered to be a more serious subset of loss of well control incidents with greater risk of oil spill or human injury (MMS, 2007b). Not all loss of well control events result in blowouts (BOEM, 2012b). In addition to the potential release of gas, condensate, oil, sand, or water, the loss of well control can also resuspend and disperse bottom sediments (BOEM, 2012b). BOEM (2012b) 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 DOCD is Shell's response to NTL 2010-N06, 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 also comply with NTL 2010-N10 and the Final Drilling Safety Rule, which specify additional safety measures for OCS activities. See **DOCD Sections 2j** and **9b** for further information.

H_2S Release. **DOCD Section 4** contains Shell's request for classification as an area absent of H_2S.

B. Affected Environment

The lease area is in the north-central Gulf of Mexico, 178 miles (286 km) from the nearest shoreline, 193 miles (311 km) from the onshore support base at Port Fourchon, Louisiana, and 221 miles (356 km) from the helicopter base at Amelia, Louisiana.

WR 508 straddles the Sigsbee Escarpment and abyssal plain in an area of seafloor furrows. The well development area is in WR 508 and is positioned between seafloor furrows where the soils are relatively soft. The FPSO will be positioned south of the Sigsbee Escarpment and water depths in the project area range from 9,548 to 9,558 ft (2,910 to 2,913 m) (Geoscience Earth & Marine Services, Inc. [GEMS], 2006; Fugro GeoConsulting, Inc. [FGCI], 2010). Anchors for the FPSO will be located in an area of seafloor furrows oriented in a northeast-southwest direction. The furrows are the result of water currents from the Sigsbee Escarpment causing the softer sediment to erode thus exposing the older and harder sediments. The side-scan sonar survey confirmed the presence of piston cores, drilling splays, anchor chain scars, and previously drilled wells in the lease area, but none are within 500 ft (152 m) of the proposed bottom-founded equipment locations. Shell has established avoidance zones of at least 50 ft (15 m) around sonar targets identified within the anchor radius. No archaeologically significant sonar contacts were identified.

A detailed description of the regional affected environment is provided in recent EISs (MMS, 2007b; BOEM, 2012b,d) and the Cascade-Chinook SEA (MMS, 2008a). These regional descriptions include 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 below, and brief descriptions of each potentially affected resource are presented in **Section C**, including site-specific and/or new information if available.

The local environment in the lease area is not known to be unique with respect to physical/chemical, biological, or socioeconomic conditions. Baseline environmental conditions in the lease area are expected to be consistent with the regional description of continental slope locations evaluated in recent lease sale EISs (MMS, 2007b; BOEM, 2012b,d) and the Cascade-Chinook SEA (MMS, 2008a).

C. Impact Analysis

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

Impacts have been analyzed extensively in multi-lease-sale EISs for the Western and Central Gulf of Mexico Planning Areas (MMS, 2007b; BOEM, 2012b), the final EIS for the Proposed Use of Floating, Production, Storage, and Offloading Systems on the Gulf of Mexico Outer Continental Shelf Western and Central Planning Areas (MMS, 2001), and the SEA for an FPSO Facility for Petrobras America Inc.'s Cascade-Chinook Project (MMS, 2008a). 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 shorebased 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 (MMS, 2007b).

In general, ambient air quality on coastal counties along the Gulf of Mexico is relatively good (BOEM, 2012a). As of December 14, 2012, Louisiana, Mississippi, Alabama, and Florida coastal counties and parishes are in attainment of the National Ambient Air Quality Standards (NAAQS) for all criteria pollutants (USEPA, 2012). One coastal metropolitan area in Texas (Houston-Galveston-Brazoria) is a nonattainment area for 8-hour ozone.

Winds in the region are driven by the clockwise circulation around the Bermuda High (MMS, 2007b; MMS, 2008a). 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 potentially affecting air quality are air pollutant emissions and two types of accidents: a small oil spill and a large oil spill.

Impacts of Air Pollutant Emissions

Air pollutant emissions are the only routine IPF likely to affect air quality. Offshore air pollutant emissions will occur during installation, production, and decommissioning activities resulting from the operation of the installation and decommissioning vessels, FPSO, shuttle tanker, and standby vessel as well as helicopters as described in **Section A.3**. These emissions occur mainly from combustion of diesel 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 in the lease sale EISs (MMS, 2007b; BOEM, 2012b,d), emissions of air pollutants from routine activities in the Gulf of Mexico Central Planning 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.

The Air Quality Emissions Report (see **DOCD Section 8**) prepared in accordance with BOEM requirements shows that the projected emissions from emission sources associated with the proposed activities meet the BOEM exemption criteria. This DOCD is therefore 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 National Park Service and the USFWS if emissions from proposed projects may affect the Breton Class I area. The lease area is approximately 228 miles (367 km) from the Breton Wilderness Area. Shell does not anticipate impact on the Class I area but will comply with emissions requirements as directed by the BOEM.

Impacts of a Small Oil Spill

Potential impacts of a small spill on air quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d) and the FPSO EIS (MMS, 2001). The probability of a small spill would be minimized by Shell's preventative measures during routine operations, including fuel transfer and offloading to the shuttle tanker. Safety measures incorporated into the design of the FPSO, including a secondary offloading system and an emergency shutdown system as described in **Section 2E** of the **DOCD** will further minimize the potential of a small spill.

In the unlikely event of a spill, implementation of Shell's OSRP and presence of the field support vessel will mitigate and reduce the impacts. **DOCD 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 from a small spill would not be significant.

A small oil spill would likely affect air quality near the spill site by introducing VOCs through evaporation. The ADIOS2 model (see **Section A.9.2**) indicates that more than 90% of a small diesel spill would be evaporated or dispersed within 24 hours. The area of the sea surface with diesel fuel on it 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 not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill

Potential impacts of a large oil spill resulting from a subsea blowout or a surface release from the FPSO on air quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d), the FPSO EIS (MMS, 2001), and the SEA for the Petrobras Cascade-Chinook development (MMS, 2008a).

A large oil spill would likely affect air quality by introducing VOCs through evaporation from the slick. 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 included *in situ* burning of the floating oil. Burning would generate a plume of black smoke and result in emissions of NO_x, SO_x, CO, and PM, as well as greenhouse gases.

Due to the lease area location (178 miles [286 km] from the nearest shoreline), 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 OSRA modeling predictions (**Table 4**), Cameron, and Plaquemines Parish, Louisiana, as well as Galveston County, Texas, are the coastal areas most likely to be affected.

A large oil spill from an FPSO is expected to be rare with localized impacts of short duration (MMS, 2001). A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on air quality are expected.

C.1.2 Water Quality

Deepwater areas in the Gulf of Mexico are relatively homogeneous with respect to temperature, salinity, and oxygen (MMS, 2007b). Potential impacts to water quality will occur during installation, production, and decommissioning activities. IPFs potentially affecting water quality are installation and removal of subsea equipment and FPSO mooring system, effluent discharges, and two types of accidents: a small oil spill and a large oil spill.

Impacts of Subsea Equipment and FPSO Mooring System Installation and Removal

Installation of the subsea equipment and mooring anchors will disturb approximately 65 ac (26 ha) of the seafloor producing temporary, localized increases in turbidity near the seafloor in the immediate vicinity of the activities as described in **Section A.1**. The elevated turbidity will return to background levels once the disturbance ceases (MMS, 2008a). No persistent impacts on water quality in the lease area are expected (BOEM, 2012b,d) therefore no significant impacts on water quality are expected.

Removal of the subsea equipment and mooring anchors are likely to result in similar disturbances to the seafloor and impacts on water quality as installation activities, unless the bottom-founded structures are left in place, thus reducing or eliminating the impacts. Therefore, physical disturbance to the seafloor during decommissioning will have no significant impact on water quality.

Impacts of Effluent Discharges

Effluent discharges will occur during installation, production, and decommissioning activities resulting from the operation of the installation and decommissioning vessels, FPSO, shuttle tanker, and standby vessel as described in **Section A.4**. Potential effluent discharges include treated sanitary and domestic wastes, produced water, deck drainage, desalination unit brine, uncontaminated fire water, non-contact cooling water, and ballast water.

<u>Sanitary and Domestic Wastes.</u> The FPSO, shuttle tanker, and construction and support vessels will discharge treated sanitary and domestic wastes. These will have a slight effect on water quality in the immediate vicinity of the discharges. The FPSO discharges are subject to NPDES permit requirements, while shuttle tanker and construction and support vessel discharges are subject to USCG regulations and are therefore not expected to cause significant impacts on water quality.

<u>Produced Water</u>. Produced water is water that originates from or passes through the hydrocarbon-bearing geological strata and is brought to the surface with oil and gas during production (USEPA, 1993). Produced water contains a variety of chemicals that have been dissolved from the geologic formations in which the produced water resided for millions of years (Veil et al., 2005). MMS (2001) provides a review of the metals and organic chemicals associated with produced water discharges. Potential constituents in produced water, including salts, petroleum hydrocarbons, some metals, and naturally occurring radioactive material, may degrade water quality in the immediate vicinity of the discharge point. Most produced waters from offshore sources have salinities (total dissolved solid concentrations) greater than that of seawater (Neff, 1987; Veil et al., 2005).

Upon discharge, produced water is diluted rapidly, typically by 30- to 100-fold within tens of meters (International Association of Oil & Gas Producers [OGP], 2005). At distances of 1,640 to 3,280 ft (500 to 1,000 m) from the discharge point, the dilution factor is 1,000 to 100,000 or more (OGP, 2005). Some constituents will precipitate, and others such as trace metals and aromatic hydrocarbons, will be scavenged onto particulate matter. According to BOEM (2012b), the discharge of produced water may result in increased concentrations of some metals, hydrocarbons, and dissolved solids within an area of about 328 ft (100 m) adjacent to the point of discharge. Compliance with NPDES permit requirements would result in only short-term localized impacts to receiving waters (MMS, 2007b).

Deck Drainage. Deck drainage includes effluents resulting from rain, deck washings, and runoff from curbs, gutters, and drains, including drip pans in work areas. All rainwater that falls on the FPSO will be collected and processed to meet NPDES permit requirements. Rainwater that falls outside of the FPSO process modules will be collected in an open drain system while the FPSO process modules have containment systems to collect rainwater. Rainwater that falls on the shuttle tanker and installation and support vessels will meet USCG regulations for deck drainage. Negligible impact on water quality is anticipated.

Other Discharges. Other discharges from the FPSO and the subsea facility (in WR 508) are expected to be in accordance with the NPDES permit, while discharges from the shuttle tanker and installation and support vessels are subject to USCG regulations. Discharges such as desalination unit brine; uncontaminated cooling water; fire water; well workover, treatment, and completion fluids; subsea facility control fluids; and ballast water are expected to be diluted rapidly and have little or no impact on water quality.

Impacts of a Small Oil Spill

Potential impacts of a small spill on water quality are expected to be consistent with those analyzed and discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d) and the FPSO EIS (MMS, 2001). The probability of a small spill would be minimized by Shell's preventative measures during routine operations, including fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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.

A small oil spill in offshore waters would increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. However, it is estimated that more than 90% of a small diesel spill would be evaporated or dispersed within 24 hours (see **Section A.9.2**). The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac (0.5 to 5 ha) depending on sea state and weather conditions.

The water-soluble fractions of diesel are dominated by two- and three-ringed PAHs, which are moderately volatile (NRC, 2003). The constituents of these oils are light to intermediate in molecular weight and can be readily degraded by aerobic microbial oxidation. Diesel's density is such that it will not sink and pool on the seafloor. Diesel dispersed in the water column can adhere to suspended sediments, but this generally occurs only in coastal areas with high-suspended solid loads (NRC, 2003) and would not be 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).

A small oil spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill

Surface Release of Crude Oil. Potential impacts of large oil spill from the FPSO on water quality are expected to be consistent with those analyzed and discussed in the FPSO final EIS (MMS, 2001), the SEA for Cascade-Chinook Fields (MMS, 2008a), and recent EISs (MMS, 2007b; BOEM, 2012b,d). 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 surface slick or sheen would move continuously in the general direction of prevailing wind and surface currents (MMS, 2001). The effects of weathering on two crude types, Mississippi Canyon (MC) 807 and Viosca Knoll (VK) 990, was analyzed by MMS (2001); the API of MC 807 crude oil is most similar to the crude oil expected from this development. The Open-Ocean Oil-Weathering Model predicts that 45% to 65% of MC 807 crude oil would disperse within 30 days (MMS, 2001). The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures.

A surface slick immediately begins to weather through a variety of physical, chemical, and biological processes that act to disperse the oil slick. 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, 2003). Spills from FPSOs and shuttle tankers will temporarily degrade water quality in the water column under and adjacent to the drifting oil slick through dispersion and dissolution of hydrocarbons into the water column (MMS, 2001). Dispersion by currents and microbial degradation removes the oil from the water column or dilutes the constituents to background levels.

Due to the lease area location (178 miles [286 km] from the nearest shoreline), 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 OSRA modeling predictions (**Table 4**), nearshore waters and embayments of Cameron and Plaquemines Parishes in Louisiana, as well as Galveston County in Texas are the coastal areas most likely to be affected.

A surface release of crude oil from the FPSO is a rare event expected to produce relatively short adverse impacts to the ambient water quality (MMS, 2001). In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on water quality are expected.

Subsea Blowout. Potential impacts from a subsea blowout that results in a large oil spill on water quality are expected to be consistent with those analyzed and discussed in previous EISs (MMS, 2007b, 2008b; BOEMRE, 2011; BOEM, 2012b). 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 and the effectiveness of spill response measures. Most of the 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; Joint Analysis Group, 2010a,b,c). A report by Kujawinski et al. (2011) indicates that chemical components of subsea dispersants used during the Macondo spill persisted for up to two months and were detectable up to 186 miles (300 km) from the wellsite at a water depth of 3,280 to 3,937 ft (1,000 to 1,200 m). While dispersants were detectable in 353 of the 4,114 total water samples, concentrations in the samples were significantly below the chronic screening level for dispersant (BOEM, 2012d).

Once oil enters the ocean, a variety of physical, chemical, and biological processes act to disperse the oil slick. 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, 2003). 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. Dispersion by currents and microbial degradation removes the oil from the water column or dilutes the constituents to background levels.

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

Due to the lease area location (178 miles [286 km] from the nearest shoreline), 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 OSRA modeling predictions (**Table 4**), nearshore waters and embayments of Cameron Parish and Plaquemines Parish, Louisiana, and Galveston County, Texas, are the most likely coastal areas to be affected.

A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on water quality are expected.

C.2 Seafloor Habitats and Biota

Water depth in the project area ranges from 9,548 to 9,558 ft (2,910 to 2,913 m). See **DOCD Section 6a** for further information.

According to the BOEM (2012b), existing information for the deepwater Gulf of Mexico indicates that the seafloor is composed primarily of soft sediments; hard bottom communities are rare. WR 507, 508, 551, and 552 are within deepwater Grid 11 where remotely operated vehicle coverage of the seafloor is considered adequate to characterize the area (BOEM, 2011).

C.2.1 Soft Bottom Benthic Communities

Data from the Northern Gulf of Mexico Continental Slope Habitats and Benthic Ecology study (Wei, 2006; Rowe and Kennicutt, 2009) can be used to describe typical benthic communities in the area. **Table 5** summarizes data from two nearby stations in similar water depths. Sediments at these two stations were predominantly clay (55% [NB-5]; 58% [B-3]) and silt (41% [NB-5]; 39% [B-3]).

Table 5. Benthic community data from stations near the lease area and in similar water depths 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)
NB-5	31 mi NE	2,110	117,263	706	1,600
B-3	63 mi ENE	2,649	155,817	814	362

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

Meiofauna (animals passing through a 0.5-mm sieve but retained on a 0.062-mm sieve) densities in water depths representative of the lease area typically range from about 100,000 to 180,000 individuals/m^2 (Rowe and Kennicutt, 2009). Nematodes, nauplii, and harpacticoid copepods were the three dominant groups in the meiofauna, accounting for about 90% of total abundance.

The benthic macroinfauna is characterized by small mean individual sizes and low densities, both of which are a reflection of the meager primary production in Gulf of Mexico surface waters (Wei, 2006). Densities decrease exponentially with water depth. Based on an equation presented by Wei (2006), macroinfaunal densities in the water depth of the wellsites are expected to be about 800 individuals/m^2, similar to the values in **Table 5**.

Polychaetes are typically the most abundant macroinfaunal group on the northern Gulf of Mexico continental slope, followed by amphipods, tanaids, bivalves, and isopods. Wei (2006) recognized four depth-dependent faunal zones (1 through 4), two of which are divided horizontally. The lease area is in Zone 3W, which consists of stations on the most complex bathymetric features in the northern Gulf of Mexico, including the Alaminos Canyon, basins and non-basins sites and the Sigsbee Escarpment. These stations range in depth from 6,150 to 9,870 ft (1,875 to 3,008 m). The five most abundant species in Zone 3W were the polychaetes *Levinsenia uncinata, Paraonella monilaris,* and *Tachytrypane* sp. and two bivalve *Heterodonta* spp.

Megafaunal density from nearby stations NB-5 and B-3 was 1,600 and 362 individuals/ha, respectively (**Table 5**). Densities of 1,300 to 1,900 individuals/ha were reported from other stations in a similar depth range. Common megafauna included motile groups such as decapods, ophiuroids, holothurians, and demersal fishes, as well as sessile groups such as sponges and anemones.

Bacteria are the foundation of deep-sea chemosynthetic communities (Ross et al., 2012) and are an important component in terms of biomass and cycling of organic carbon (Cruz-Kaegi, 1998). Bacterial biomass at the depth range of the lease area typically is about 1 to 2 grams of carbon per square meter (g C m^{-2}) in the top 6 inches (15 cm) of sediments (Rowe and Kennicutt, 2009).

IPFs potentially affecting benthic communities are installation and removal of subsea equipment and FPSO mooring system and a large oil spill resulting from a well blowout at the seafloor. A small fuel spill and a large spill from the FPSO would not affect benthic communities because the oil (crude or diesel) would float and dissipate on the sea surface.

Impacts of Subsea Equipment and FPSO Mooring System Installation and Removal

Installation of the subsea equipment and FPSO mooring system will disturb the seafloor in the immediate vicinity of the activities. The estimated area of seafloor potentially impacted from installation activities is approximately 65 ac (26 ha) (see **Section A.1**).

The areal extent of these impacts from installation activities will be small compared to the lease area itself. Soft bottom communities are ubiquitous along the northern Gulf of Mexico continental slope (Gallaway et al., 2003; Rowe and Kennicutt, 2009). Recolonization and immigration by organisms from neighboring soft-bottom substrate to the impacted areas would be expected to occur within a relatively short period of time (MMS, 2007b; BOEM, 2012b,d). Physical disturbance to the seafloor during this project will have no significant impact on soft bottom benthic communities on a regional basis.

Removal of the subsea equipment and mooring anchors are likely to result in similar disturbances to the seafloor as installation activities unless the bottom-founded structures are left in place, thus reducing or eliminating the impacts. Therefore, physical disturbance to the seafloor during decommissioning will have no significant impact on soft bottom benthic communities.

Impacts of a Large Oil Spill

Potential impacts of a large oil spill resulting from a subsea blowout on the benthic community are expected to be consistent with those analyzed and discussed in the recent EISs (MMS, 2007b; BOEM, 2012b,d). Likely impacts from a subsea blowout 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. The MMS (2007b) estimates that a severe subsurface blowout could resuspend and disperse sediments within a 984-ft (300-m) radius. While 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 resuspended for more than 30 days and dispersed over a much wider area. Previous studies characterized surface sediments in the vicinity of the site as about 50% clay and 45% silt (Rowe and Kennicutt, 2009).

Previous analyses (MMS, 2007a, 2008b) 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, during the Macondo spill, subsurface plumes were reported at a water depth of about 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 (Joint Analysis Group, 2010c). Chemical components of subsea dispersants used during the Macondo spill persisted for up to two months and were detected up to 186 miles (300 km) from the wellsite at a water depth 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 contact the seafloor and affect benthic communities beyond the 984-ft (300-m) radius estimated by MMS (2007a, 2008b), depending on its extent, trajectory, and persistence. This contact could result in smothering and/or toxicity to benthic organisms. The affected area would be recolonized by benthic organisms over a period of months to years (NRC, 2003).

A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on soft bottom communities are expected.

C.2.2 High-Density Deepwater Benthic Communities

As defined by 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, Inc., 2007). These communities occur almost exclusively on authigenic carbonates created by chemosynthetic communities, and on shipwrecks. The nearest known chemosynthetic community site is located approximately 83 miles (133 km) north of the lease area in Green Canyon 287 (Brooks et al., 2009).

The chemosynthetic community assessments by Geoscience Earth and Marine Services, Inc. (GEMS) (2006), Fugro Geoconsulting, Inc. (FGCI) (2010), and C & C Technologies, Inc. (2012) did not identify features that could support high-density deepwater benthic communities within 500 ft (152 m) of the proposed equipment locations.

The only IPF potentially affecting high-density deepwater benthic communities is a large oil spill from a well blowout at the seafloor. A small fuel spill and a large oil spill from the FPSO would not affect benthic communities because the oil would float and dissipate on the sea surface.

Impacts of a Large Oil Spill

Previous analyses (MMS, 2007a, 2008b) concluded that oil spills resulting from a subsea blowout 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, during the Macondo spill, subsurface plumes were reported at a water depth of about 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 (Joint Analysis Group, 2010c). Chemical components of subsea dispersants used during the Macondo spill persisted for up to two months and were detectable up to 186 miles (300 km) from the wellsite at a water depth 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 MMS (2007a, 2008b), depending on its extent, trajectory, and persistence. Oil plumes that contact sensitive benthic communities before degrading could potentially impact the resource (BOEM, 2012b). Potential impacts on sensitive resources would be an integral part of the decision and approval process for the use of dispersants. The chemosynthetic community assessment by GEMS (2006), FGCI (2010), and C & C Technologies, Inc. (2012) did not identify features that could support high-density deepwater benthic communities within 500 ft (152 m) of the proposed equipment locations. Potential impacts of oil on high-density deepwater benthic communities are discussed in MMS (2007b) and BOEM (2012b).

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 or deepwater corals. As discussed by MMS (2007b), 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, 2012d).

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 about 50 by 130 ft (15 by 40 m) was covered by a brown flocculent material (BOEMRE, 2010) with signs of stress, including varying degrees of tissue loss and excess mucous production (White et al., 2012). Researchers concluded, based on hopanoid petroleum biomarker analysis of the flocculent material, that it contained oil from the Macondo spill. The injured and dead corals were in an area where 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). The study location is about 75 miles (120 km) northeast of the activities discussed in this EIA. There would not likely be cumulative impacts to those corals even in the unlikely event of a large spill associated with the activities discussed in this EIA.

A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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 blocks are 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 Ewing Bank 945 in Ship Shoal South, located 108 miles (174 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 the distance from the lease area.

C.2.4 Pinnacle Trend Area Live Bottoms

The lease area is not covered by the Live Bottom (Pinnacle Trend) Stipulation. As defined by NTL 2009-G39, the nearest pinnacle trend blocks are located about 238 miles (384 km) northeast of the lease area, along the shelf edge south of Alabama.

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.

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 100 m (328 ft) 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 by NTL 2009-G39, is Destin Dome 573, approximately 274 miles (440 km) northeast of the project area.

There are no IPFs associated with either routine operations or accidents that could cause impacts to eastern Gulf live bottom areas due to the distance from the lease area.

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

This section discusses species listed as endangered or threatened under the ESA. In addition, it includes all marine mammal species in the region, which are protected under the MMPA.

Endangered or threatened species that may occur in the project area and/or along the northern Gulf Coast are listed in **Table 6**. 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. The NMFS has jurisdiction over ESA-listed cetaceans and fishes in the Gulf of Mexico. The USFWS has jurisdiction over ESA-listed birds and the Florida manatee. These two agencies share federal jurisdiction over sea turtles, with NMFS having lead responsibility at sea and USFWS on nesting beaches.

Table 6. Federally listed endangered and threatened species 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
Florida manatee	*Trichechus manatus latirostris*	E	--	X	Florida (Peninsular)
Blue whale	*Balaenoptera musculus*	E	X[a]	--	None
Fin whale	*Balaenoptera physalus*	E	X[a]	--	None
Humpback whale	*Megaptera novaeangliae*	E	X[a]	--	None
North Atlantic right whale	*Eubalaena glacialis*	E	X[a]	--	None
Sei whale	*Balaenoptera borealis*	E	X[a]	--	None
Sea Turtles					
Loggerhead turtle	*Caretta caretta*	T, E[b]	X	X	None
Green turtle	*Chelonia mydas*	T, E[c]	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					
Gulf sturgeon	*Acipenser oxyrinchus desotoi*	T	--	X	Coastal Louisiana, Mississippi, Alabama, and Florida (Panhandle)
Terrestrial Mammals					
Beach mouse (Alabama, Choctawhatchee, Perdido Key, St. Andrew)	*Peromyscus polionotus*	E	--	X	Alabama and Florida (Panhandle) beaches

E = Endangered; T = Threatened.

a 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.

b The loggerhead turtle is composed of nine distinct population segments (DPS) that are considered "species." The only DPS that may occur in the project area (Northwest Atlantic DPS) is listed as threatened (76 FR 58868; September 22, 2011).

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

The sperm whale and five species of sea turtles are the only endangered or threatened species likely to occur at or near the lease area. No critical habitat has been designated for these species in the Gulf of Mexico.

Five endangered mysticete whales (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) also have been reported from the Gulf of Mexico but are considered rare or extralimital there (Würsig et al., 2000). No critical habitat has been designated for these species in the Gulf of Mexico.

Coastal endangered or threatened species include the Florida 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 6** and discussed in individual sections.

Two other coastal species (Bald Eagle and Brown Pelican) discussed by MMS (2007b) and BOEM 2012b are no longer federally listed as endangered or threatened; these species are discussed in **Section C.4.2**, **Shorebirds and Coastal Nesting Birds**.

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*), elkhorn coral (*Acropora palmata*), staghorn coral (*Acropora cervicornis*), and Florida salt marsh vole (*Microtus pennsylvanicus dukecampbelli*) are remote from the lease area and highly unlikely to be affected.

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 a recent lease sale EIS (MMS, 2007b). 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., 2012). No critical habitat for the sperm whale has been designated in the Gulf of Mexico.

The distribution of sperm whales in the Gulf of Mexico is correlated with mesoscale physical features such as eddies associated with the Loop Current (Jochens et al., 2008). Sperm whale populations in the north-central Gulf of Mexico are present there throughout the year (Davis et al., 2000). Results of a multi-year tracking study show female sperm whales typically concentrated along the upper continental slope between the 656- and 3,280-ft (200- and 1,000-m) depth contours (Jochens et al., 2008). Male sperm whales were more variable in their movements and were documented in water depths greater than 9,843 ft (3,000 m). Generally, groups of sperm whales sighted in the Gulf of Mexico during the MMS-funded Sperm Whale Seismic Study (SWSS) consisted of mixed-sex groups comprising adult females and immatures, and groups of bachelor males. Typical group size for mixed groups was 10 individuals (Jochens et al., 2008). SWSS results show 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 potentially affecting sperm whales include installation and removal of subsea equipment and FPSO mooring system, FPSO and shuttle tanker presence, noise, and lights; 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 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 (MMS, 2001). Compliance with NTL 2012-BSEE-G01 will minimize the potential for marine debris-related impacts on sperm whales.

Impacts of Subsea Equipment and FPSO Mooring System Installation and Removal

Machinery noise from installation vessels has the potential to disturb sperm whales. Sperm whales appear to have good low-frequency hearing, but the available data do not indicate a consistent response to anthropogenic noise (Jochens et al., 2008). Noise from structure installation could be intermittent, sudden, and at times high-intensity (MMS, 2008a). The region as a whole has a large number of similar sources. Due to the short duration, timing, and geographic location of installation activities, this project would represent a small temporary contribution to the overall noise regime.

Noise from removal operations of the subsea equipment and mooring anchors are likely to result in similar disturbances to the sperm whales as installation activities, unless the bottom-founded structures are left in place, thus reducing or eliminating the impacts. Explosive removal techniques are not required to decommission an FPSO. Due to the short duration, timing, and geographic extent of decommissioning and decommissioning activities, this project would represent a small temporary contribution to the overall noise regime.

Although noise from installation and removal activities was considered as a potential factor affecting sperm whales, the FPSO EIS (MMS, 2001) did not identify noise from installation activities as an IPF for sperm whales. Therefore, no significant impacts are expected.

Impacts of FPSO and Shuttle Tanker Presence, Noise, and Lights

Machinery noise from routine activities has the potential to disturb sperm whales. Sperm whales appear to have good low-frequency hearing, but the available data do not indicate a consistent response to anthropogenic noise (Jochens et al., 2008). Noise from vessels is typically in the lower frequency ranges (e.g., 10 to 200 Hz) (MMS, 2001). The region as a whole has a large number of similar sources. Due to the short duration of installation activities, timing, and geographic location of installation activities, this project would represent a small temporary contribution to the overall noise regime.

Although offshore, lighting and presence of the FPSO, shuttle tanker, and OCS vessels were considered potential factors affecting sperm whales, NMFS's 2007 Biological Opinion, recent lease sale EISs (MMS, 2007b; BOEM, 2012b,d), and the FPSO EIS (MMS, 2001) did not identify these as IPFs for sperm whales. Therefore, no significant impacts are expected.

Impacts of Vessel and Helicopter Traffic

Increased traffic from installation vessels, the shuttle tanker, and support vessel have the potential to disturb sperm whales. There is also a risk of vessel strikes, which are identified as a threat in the recovery plan for this species (NMFS, 2010a). The expected increase in OCS service vessel and shuttle tanker traffic associated with normal operations of the FPSO coupled with the extended periods of time sperm whales spend at the surface may increase the likelihood of collisions between these vessels and sperm whales (MMS, 2001). Data concerning the frequency of vessel strikes are presented in the lease sale EIS (MMS, 2007b). To reduce the potential for vessel strikes, the BOEM has issued NTL 2012-JOINT-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 (NMFS, 2007). With implementation of the mitigation measures in NTL 2012-JOINT-G01, NMFS concluded that the likelihood of collisions between vessels and sperm whales would be reduced to insignificant levels. NMFS concluded that the observed avoidance of passing vessels by sperm whales is an advantageous response to avoid a potential threat and is not expected to result in any significant effect on migration, breathing, nursing, breeding, feeding, or sheltering to individuals, or have any consequences at the level of the population. With implementation of the vessel strike avoidance measures requirement to maintain a distance of 295 ft (90 m) from sperm whales, 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 800 ft (245 m). A reaction to the initial pass of the aircraft was observed during three (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 probably of no long-term biological significance.

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 specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2012a,b). Although whales may respond to helicopters (Smultea et al., 2008), NMFS (2007) and BOEM (2012a) concluded that this altitude would minimize the potential for disturbing sperm whales. Therefore, no significant impacts are expected.

Impacts of a Small Oil Spill

Potential spill impacts on marine mammals including sperm whales are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d), the FPSO EIS (MMS, 2001), and the Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico (NMFS, 2007). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990). For this DOCD there are no unique site-specific issues with respect to spill impacts on these animals.

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

A small oil spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac

(0.5 to 5 ha), depending on sea state and weather conditions. Sperm whales can easily avoid such small spills and the concentrations of hydrocarbon vapors over the spill are unlikely to get very high, thus small spills are unlikely to pose a serious risk to sperm whales (MMS, 2001).

Direct physical and physiological effects of exposure to diesel fuel or crude oil 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 would be expected.

Impacts of a Large Oil Spill

Potential impacts from a large oil spill resulting from a subsea blowout or a surface release from the FPSO on marine mammals including sperm whales are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d), the FPSO EIS (MMS, 2001), and by the NMFS (2007). Oil impacts on marine mammals are discussed by Geraci and St. Aubin (1990). MMS (2001) determined that the risk to sperm whales from large spills from FPSO operations is low due to the expected low frequency of large surface spills from the FPSO and the relatively low abundance of sperm whales in deep offshore shelf edge and slope waters. For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

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. 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 areas near the Macondo spill in 2010.

Studies have shown that the cetacean epidermis functions as an effective barrier to noxious substances found in petroleum (Geraci and St. Aubin, 1985). Unlike other mammals, penetration of such substances in cetacean skin is impeded by tight intercellular bridges, the vitality of the superficial cells, the thickness of the epidermis, and the lack of sweat glands and hair follicles. In addition, cetacean skin is free from hair or fur, which in other marine mammals not found in the Gulf of Mexico (e.g., pinnipeds and otters) tend to collect oil and/or tar.

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 2012-JOINT-G01 to reduce the potential for striking or disturbing these animals.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on sperm whales are expected.

C.3.2 Florida Manatee (Endangered)

Most of the Gulf of Mexico manatee population is located in peninsular Florida (USFWS, 2001). Manatees regularly migrate farther west of Florida in the warmer months (Wilson, 2003) 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 a recent lease sale EIS (MMS, 2007b) and in the recovery plan for this species (USFWS, 2001).

IPFs potentially affecting manatees are vessel and helicopter traffic and a large oil spill resulting from a subsea blowout or a surface release from the FPSO. A small fuel spill in the lease area would be unlikely to affect manatees, as the lease area is approximately 178 miles (286 km) from the nearest shoreline (Louisiana). As explained in **Section A.9.2**, a small fuel spill would not be expected to make landfall or reach coastal waters prior to breaking up. Compliance with NTL 2012-BSEE-G01 will minimize the potential for marine debris-related impacts on manatees. Consistent with the analysis in BOEM (2012a), impacts of routine project-related activities on the manatee would be negligible.

Impacts of Vessel and Helicopter Traffic

Increased traffic from construction vessels, the shuttle tanker, and support vessel have 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). To reduce the potential for vessel strikes, the BOEM has issued NTL 2012-JOINT-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 2012-JOINT-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 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 OSRA results summarized in **Table 4** predict that some Texas and Louisiana shorelines could be contacted by a large oil spill resulting from a subsea blowout within 10 to 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.

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 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 (or contaminated vegetation, in the case of manatees); 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, 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 resulting from a subsea blowout or a surface release from the FPSO 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 2012-JOINT-G01 to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on manatees are expected.

C.3.3 Endangered Mysticete Whales

Five endangered mysticete whales (blue whale, fin whale, humpback whale, North Atlantic right whale, and sei whale) also have been reported from the Gulf of Mexico but are considered rare or extralimital there (Würsig et al., 2000). No critical habitat has been designated for these species in the Gulf of Mexico.

Due to the rare occurrence of these whales in the Gulf of Mexico, it is unlikely that any endangered mysticete would come into contact with any project activities, either routine operations or accidents.

Mysticete whales were not included as affected species in the Biological Opinion for the Five-Year Oil and Gas Leasing Program in the Central and Western Planning Areas of the Gulf of Mexico (NMFS, 2007). Potential impacts analyzed in recent lease sale EISs (MMS, 2007b; BOEM, 2012a,b,d) are incorporated by reference. If any of these whales were present in the area, potential impacts would be the same as those discussed below in **Section C.3.4**.

C.3.4 Non-Endangered Marine Mammals (Protected)

In addition to the seven endangered species that have been cited previously, 22 additional species of marine mammals may be found in the Gulf of Mexico, including 2 species of mysticete whales, the dwarf and pygmy sperm whales, 4 species of beaked whales, and 14 species of delphinids (see **DOCD Section 6h**). All marine mammals are protected species under the MMPA. The most common non-endangered cetaceans in the deepwater environment are odontocetes such as the pantropical spotted dolphin, spinner dolphin, and

Clymene dolphin. A brief summary is presented below, and additional information on these groups is presented in a recent lease sale EIS (MMS, 2007b).

Mysticete whales. Two species of non-endangered mysticete whales are known from the Gulf of Mexico: the Bryde's whale (*Balaenoptera edeni*) and minke whale (*Balaenoptera acutorostrata*). The Bryde's whale (*Balaenoptera edeni*) has been sighted most frequently along the 328-ft (100-m) isobath (Davis and Fargion, 1996; Davis et al., 2000). 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. The minke whale is considered rare in the Gulf of Mexico, with the only confirmed records coming from strandings (Würsig et al., 2000). 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., 2012). 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*), Cuvier's beaked whale (*Ziphius cavirostris*), Sowerby's beaked whale (*Mesoplodon bidens*), and Gervais' beaked whale (*Mesoplodon europaeus*). Stranding records in the Gulf of Mexico suggest that Gervais' beaked whale is the most common and Sowerby's beaked whale is extralimital. Due to the difficulties of at-sea identification, beaked whales in the Gulf of Mexico are identified either as Cuvier's beaked whales or are grouped into an undifferentiated complex (*Mesoplodon* spp. and *Ziphius* spp.). In the northern Gulf of Mexico, they are broadly distributed in waters greater than 3,281 ft (1,000 m) over lower slope and abyssal landscapes (Davis et al., 2000). Any of these species could occur in the lease area (Waring et al., 2012).

Delphinids. Fourteen species of delphinids are known from the Gulf of Mexico, including 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 are the pantropical spotted dolphin, spinner dolphin, and Clymene dolphin. However, any of these species could occur in the lease area (Waring et al., 2012).

Bottlenose dolphin populations in the northern Gulf of Mexico are separated into 37 geographically distinct population units, or stocks, for management purposes by the NMFS (Waring et al., 2012). NMFS (2013) has proposed to classify the Gulf of Mexico Northern Coastal Stock, Western Coastal Stock, and all 32 of the Bay, Sound, and Estuarine Stocks as strategic stocks based primarily on the occurrence of an "unusual mortality event" of unprecedented size and duration that has affected these stock areas. This unusual mortality event began in February 2010 and is ongoing. 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.

IPFs potentially affecting non-endangered marine mammals include subsea equipment and FPSO mooring system installation, FPSO and shuttle tanker presence, noise, and lights; vessel and helicopter traffic, decommissioning; 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 2012-BSEE-G01 will minimize the potential for marine debris-related impacts on marine mammals.

Impacts of Subsea Equipment Installation and Removal Activities

Machinery noise from installation vessels has the potential to disturb marine mammals. Noise from structure installation could be intermittent, sudden, and at times high-intensity (MMS, 2008a). Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. The region as a whole has a large number of similar sources. Due to the short duration, timing, and geographic location of installation activities, this project would represent a small temporary contribution to the overall noise regime.

Noise from removal operations of the subsea equipment and mooring anchors are likely to result in similar disturbances to marine mammals as installation activities, unless the bottom-founded structures are left in place, thus reducing or eliminating the impacts. Explosive removal techniques are not required to decommission an FPSO. Due to the short duration, timing, and geographic extent of decommissioning and decommissioning activities, this project would represent a small temporary contribution to the overall noise regime.

Although noise from installation and decommissioning activities was considered as a potential factor affecting non-endangered marine mammals, the FPSO EIS (MMS, 2001) did not identify noise from installation activities as an IPF affecting marine mammals. Therefore, no significant impacts are expected.

Impacts of FPSO and Shuttle Tanker Presence, Noise, and Lights

Machinery noise from routine activities has the potential to disturb marine mammals. Noise from vessels is typically in the lower frequency ranges (e.g., 10 to 200 Hz) (MMS, 2001). There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources. Due to the geographic location of installation activities, this project would represent a small contribution to the overall noise regime.

Although offshore, lighting and presence of the FPSO, shuttle tanker, and OCS vessels were considered potential factors affecting sperm whales, NMFS's 2007 Biological Opinion, recent lease sale EISs (MMS, 2007b; BOEM, 2012a,b,d), and the FPSO EIS (MMS, 2001) did not identify these as IPFs for marine mammals in recent lease sale EISs (MMS, 2007b; BOEM, 2012a,b,d). Therefore, no significant impacts are expected.

Impacts of Vessel and Helicopter Traffic

Increased traffic from installation vessels, the shuttle tanker, and support vessel have the potential to disturb marine mammals, and there is also a risk of vessel strikes. The expected increase in OCS service vessel and shuttle tanker traffic associated with normal operations of the FPSO may increase the likelihood of collisions between these vessels and marine mammals (MMS, 2001). Data concerning the frequency of vessel strikes are presented in the lease sale EIS (MMS, 2007b). To reduce the potential for vessel strikes, the BOEM and BSEE have issued NTL 2012-JOINT-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for marine mammals and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. Vessel 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 specify that helicopters maintain an altitude of 1,000 ft (305 m) within 300 ft (91 m) of marine mammals (BOEM, 2012a,b,d). This altitude will minimize the potential for disturbing marine mammals, and no significant impacts are expected (BOEM, 2012a,b,d).

Impacts of a Small Oil Spill

Potential spill impacts on marine mammals are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d), the FPSO EIS (MMS, 2001), and oil impacts on marine mammals in general are discussed by Geraci and St. Aubin (1990). MMS (2001) estimated that crude oil spills from FPSOs in the OCS will occur at a frequency of about 0.5/year, with most involving less than 1,000 bbl of oil. For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

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

A small spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. Marine mammals can easily avoid such small spills and the concentrations of hydrocarbon vapors over the spill are unlikely to get very high, thus small spills are unlikely to pose a serious risk to marine mammals (MMS, 2001).

Direct physical and physiological effects of exposure to crude oil or diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMC, 2011). However, due to the limited areal extent and short duration of water quality impacts from a small 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 that result from a subsea blowout or a surface release from the FPSO on marine mammals are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d), the FPSO EIS (MMS, 2001), and by Geraci and St. Aubin (1990). MMS (2001) determined that the risk to marine mammals from large spills from FPSO operations is low due to the expected low frequency of large surface spills from the FPSO and the relatively low abundance of marine mammals in deep offshore shelf edge and slope waters. For this DOCD, 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 (or contaminated vegetation, in the case of manatees); 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, changing prey availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMC, 2011).

In the event of a large spill resulting from a subsea blowout or a surface release from the FPSO, the level of vessel and aircraft activity associated with spill response could disturb marine mammals and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL 2012-JOINT-G01 to reduce the potential for striking or disturbing these animals, and therefore no significant impacts are expected.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill is also an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on marine mammals are expected.

C.3.5 Sea Turtles (Endangered/Threatened)

As listed in **DOCD Section 6h**, five species of endangered or threatened sea turtles may be found near the lease area. Endangered species are the leatherback (*Dermochelys coriacea*), Kemp's ridley (*Lepidochelys kempii*), and hawksbill (*Eretmochelys imbricata*) turtles. The distinct population segment (DPS) of loggerhead turtle (*Caretta caretta*) that occurs in the Gulf of Mexico is listed as threatened, although other DPSs are endangered. The green turtle (*Chelonia mydas*) is listed as threatened, except for the Florida breeding population, which is listed as endangered. Species descriptions are presented in a recent lease sale EIS (MMS, 2007b).

Leatherbacks and loggerheads are the most likely species 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. 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, 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 and, to a lesser extent, from Texas through Alabama (MMS, 2007b). The nearest significant nesting area of loggerhead turtles is found in Louisiana, on beaches within the Breton NWR.
- Green and leatherback turtles – Green and leatherback turtles infrequently nest on Florida Panhandle beaches (Florida Fish and Wildlife Conservation Commission, 2013).
- Kemp's ridley turtles – The main nesting site of Kemp's ridley turtles is Rancho Nuevo beach, Tamaulipas, Mexico (NMFS et al., 2011). Approximately 200 Kemp's ridley turtles nested on Texas beaches in 2009 (Sea Turtle Restoration Project, 2011). 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, 2010).
- Hawksbill turtles – Hawksbill turtles typically do not nest anywhere near the project area.

IPFs potentially affecting sea turtles include installation of subsea equipment and FPSO mooring system; FPSO and shuttle tanker presence, noise, and lights; vessel and helicopter traffic; decommissioning; and two types of accidents – a small oil 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 2012-BSEE-G01 will minimize the potential for marine debris-related impacts on sea turtles.

Impacts of Subsea Equipment Installation and Removal Activities

Machinery noise from installation vessels has the potential to disturb sea turtles. Noise from structure installation could be intermittent, sudden, and at times high-intensity (MMS, 2008a). Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. There are other OCS facilities and activities near the lease area, and the region as a whole has a large number of similar sources.

Noise from removal operations of the subsea equipment and mooring anchors are likely to result in similar disturbances to sea turtles as installation activities, unless the bottom-founded structures are left in place, thus reducing or eliminating the impacts. Explosive removal techniques are not required to decommission an FPSO.

Due to the short duration, timing, and geographic location of installation and removal activities, this project would represent a small temporary contribution to the overall noise regime. Therefore, no significant impacts are expected.

Impacts of FPSO and Shuttle Tanker Presence, Noise, and Lights

Machinery noise from routine activities has the potential to disturb sea turtles. Potential impacts may include behavioral disruption and temporary or permanent displacement from the area near the sound source. Certain sea turtles, especially loggerheads, may be attracted to offshore structures (Lohoefener et al., 1990) and, thus, may be more susceptible to impacts from sounds produced during routine operations. Helicopters and service vessels may also affect sea turtles due to machinery noise and/or visual disturbances. The most likely impacts would be short-term behavioral changes such as diving and evasive swimming, disruption of activities, or departure from the area. Due to the limited scope, timing, and geographic extent 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 Vessel and Helicopter Traffic

Increased traffic from construction vessels, the shuttle tanker, and support vessel have the potential to disturb sea turtles, and there is also a risk of vessel strikes. The expected increase in OCS service vessel and shuttle tanker traffic associated with normal operations of the FPSO may increase the likelihood of collisions between these vessels and sea turtles (MMS, 2001). Data show that vessel traffic 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, the BOEM and BSEE have issued NTL 2012-JOINT-G01, which recommends protected species identification training and that vessel operators and crews maintain a vigilant watch for sea turtles and slow down or stop their vessel to avoid striking protected species, and requires operators to report sightings of any injured or dead protected species. When sea turtles are sighted, vessel operators and crews are required to attempt to maintain a distance of 150 ft (45 m) or greater whenever possible. Compliance with this NTL will minimize the likelihood of vessel strikes as well as reduce the chance for disturbing sea turtles (NMFS, 2007). Therefore, no significant impacts are expected.

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

Impacts of a Small Oil Spill

Potential spill impacts on sea turtles are discussed in recent EISs (MMS, 2007b; BOEM, 2012b, d), the FPSO EIS (MMS, 2001), and by the NMFS (2007) 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. For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a small spill will be minimized by Shell's preventative measures during fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for impacts on sea turtles. **DOCD 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 oil spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

Direct physical and physiological effects of exposure to diesel fuel could include skin irritation, inflammation, or necrosis; chemical burns of skin, eyes, and mucous membranes; inhalation of toxic fumes; ingestion of oil directly or via contaminated prey; and stress from the activities and noise of response vessels and aircraft (MMS, 2007b, 2008a; NMFS, 2010b; BOEM, 2012b,d). However, due to the limited areal extent and short duration of water quality impacts from a small spill, no significant impacts would be expected.

A small oil spill in the lease area would be unlikely to affect sea turtle nesting beaches because the lease area is 178 miles (286 km) from the nearest shoreline (Louisiana). As explained in **Section A.9.2**, a small oil 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, dispersants, and beach cleanup activities). 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, changing food availability and foraging distribution and/or patterns, changing reproductive behavior/productivity, and changing movement patterns or migration (MMS, 2007b; NMFS, 2010c). In the unlikely event of a spill, implementation of Shell's OSRP is expected to mitigate and reduce the potential for these types of impacts on sea turtles. **DOCD Section 9b** provides detail on spill response measures.

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

The OSRA results summarized in **Table 4** predict that some shorelines that support sea turtle nesting could be contacted within 30 days. The nearest nesting area of loggerhead turtles is found on beaches within the Breton NWR. This area (Plaquemines Parish) has a contact probability of 2% after 30 days.

Spilled oil reaching sea turtle nesting beaches could have effects on 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 are subject to the same types of oil spill exposure hazards as adults. Hatchlings that contact oil residues while crossing a beach can exhibit a range of effects, from acute toxicity to impaired movement and normal bodily functions (NMFS, 2007).

In the event of a large spill, the level of vessel and aircraft activity associated with spill response could disturb sea turtles and potentially result in vessel strikes, entanglement, or other injury or stress. Response vessels would operate in accordance with NTL 2012-JOINT-G01 to reduce the potential for striking or disturbing these animals.

NOAA's Office of Response and Restoration prepared guidelines in 2007 to minimize impacts on nesting activities and existing nests due to beach cleanup activities (Shigenaka et al., 2010). Oil spill cleanup activities on the beach (e.g., raking, shoveling, use of mechanical equipment) may adversely affect sea turtle nesting activity or existing beach nests. Human activity on nesting beaches can result in negative impacts to nesting turtles, incubating egg clutches, and hatchlings. Response workers and vehicles may crush eggs and compact beach sand, making it difficult or impossible for hatchlings to emerge or for females to use for nesting (Shigenaka et al., 2010). Increased human presence on the beach may disturb nesting females (e.g., artificial lighting). Nighttime human activity can prevent sea turtles from coming ashore, and may cause females to stop nesting and return to the ocean. Nighttime driving can disturb nesting females, disorient emerging hatchlings, and crush hatchlings attempting to reach the ocean. Beach driving may also contribute to erosion, which may affect nests. Driving may create deep tracks that are an impediment to emerging hatchlings. Locating and marking turtle nests with a 10-ft (3-m) buffer zone to aid in avoidance and minimizing impacts is recommended during beach cleanup activities; mechanical equipment and hand tools should not be used within the buffer area (USFWS, n.d.).

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 surface release of crude oil from the FPSO resulting in a large oil spill is a rare event.

A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP would mitigate and reduce direct and indirect impacts to turtles from oil exposure and response activities and materials. **DOCD Section 9b** provides detail on spill response measures. Adherence to the requirements of NTL 2012-JOINT-G01 and general guidance regarding beach cleanup activities (Shigenaka et al., 2010; USFWS, n.d.) is expected to help to minimize potential impacts to sea turtles at sea as well as nesting females and existing nests on shore.

C.3.6 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, 2010a). A species description is presented in a recent lease sale EIS (MMS, 2007b).

A large oil spill is the only IPF potentially affecting Piping Plovers. There are no IPFs associated with routine project activities that could affect these birds. 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.9.2**).

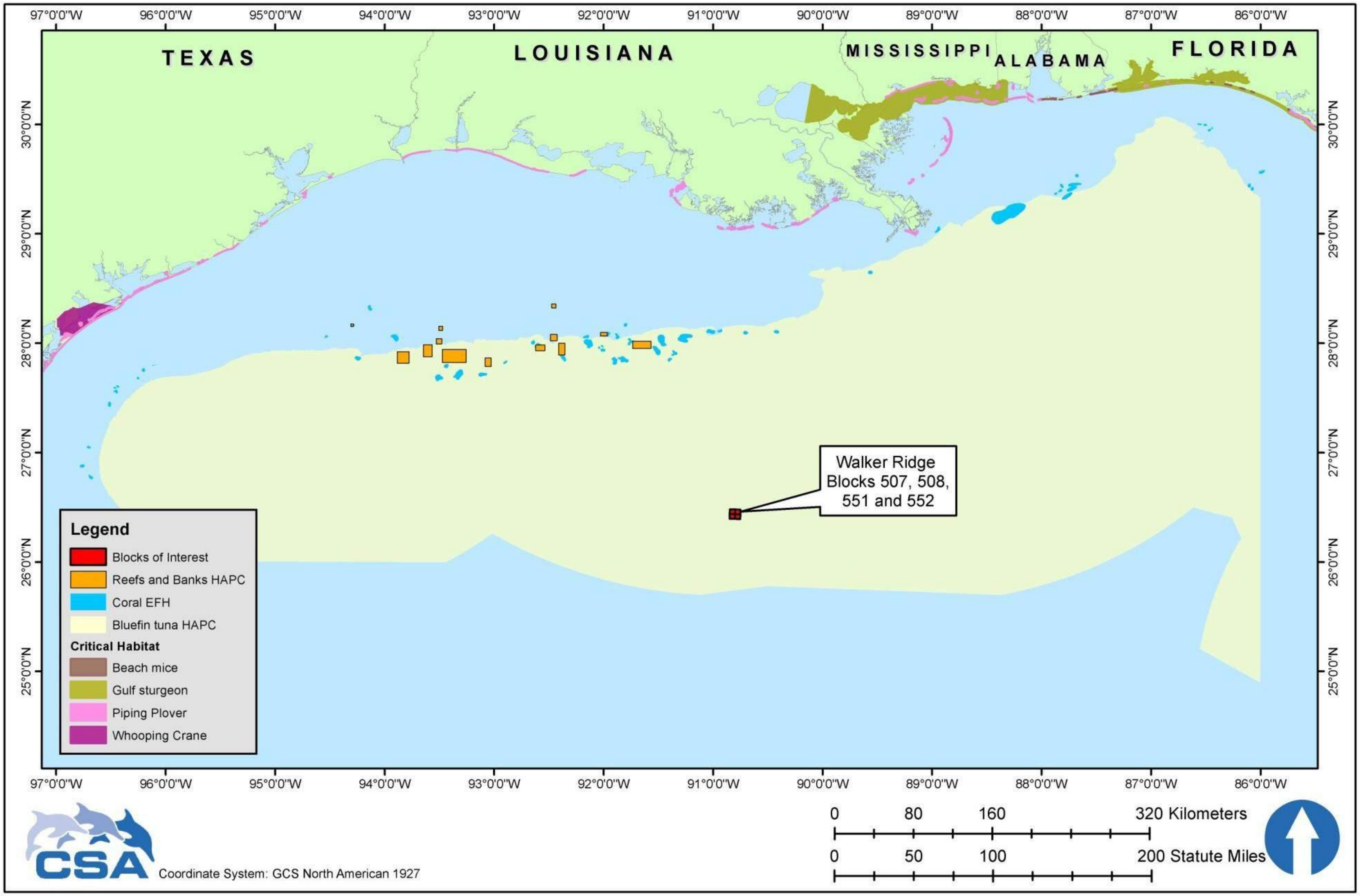

Figure 2. Location of selected environmental features in relation to the lease area.

Impacts of a Large Oil Spill

The lease area is 178 miles (286 km) from the nearest shoreline inhabited by Piping Plovers. The OSRA results summarized in **Table 4** predict that Texas and Louisiana shorelines designated as critical habitat for the wintering Piping Plover could be contacted by a spill within 30 days. A surface release from the FPSO has a 2% chance of reaching Piping Plover critical habitat within 30 days in Cameron and Plaquemines Parishes in Louisiana. Plaquemines Parish, Louisiana, includes Piping Plover critical habitat.

Plovers could become externally oiled while foraging on oiled shores or be exposed internally through ingestion of oiled intertidal sediments and prey (MMS, 2007b). 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 plovers are most common along the coastal Gulf or if spills contacted critical habitat. Impacts could also occur from vehicular traffic on beaches and other activities associated with spill cleanup. Shell has extensive resources available to protect and rehabilitate wildlife in the event of a spill reaching the shoreline, as detailed in the OSRP.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Piping Plovers are expected.

C.3.7 Whooping Crane (Endangered)

The Whooping Crane (*Grus americana*) is an omnivorous wading bird and an endangered species. There are three wild populations in North America (National Wildlife Federation, 2012). One population winters along the Texas coast at Aransas NWR and summers at Wood Buffalo National Park in Canada. This population represents the majority of the world's population of free-ranging Whooping Cranes and reached a record population of 278 at Aransas/Wood Buffalo National Park in August 2011 (Whooping Crane Eastern Partnership, 2012). A non-migrating population has been re-introduced in central Florida, and another re-introduced population summers in Wisconsin and migrates to the southeastern U.S. for the winter. 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 on 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 in recent lease sale EISs (MMS, 2007b; BOEM, 2012b,d).

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

Impacts of a Large Oil Spill

A large oil spill has a low probability of affecting Whooping Cranes because the lease area is approximately 372 miles (598 km) from its critical habitat (Aransas NWR, Texas) and the likelihood of contact with the habitat is extremely low (BOEM, 2012b).

In the event of oil exposure, Whooping Cranes could become externally oiled while foraging in oiled areas or internally exposed to oil through ingestion of contaminated shellfish, frogs, and fishes. It is possible that some death of Whooping Cranes could occur. 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 surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Whooping Cranes are expected.

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). An anadromous fish that migrates from the sea upstream into coastal rivers to spawn in freshwater, it historically ranged from the Mississippi River to Charlotte Harbor, Florida (Wakeford, 2001). Today, this range has contracted to encompass major rivers and inner shelf waters from the Mississippi River to the Suwannee River, Florida. Populations have been depleted or even extirpated throughout this 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). Critical habitat in the Gulf extends from Lake Borgne, Louisiana (St. Bernard Parish), to Suwannee Sound, Florida (Levy County) (NMFS, 2010d) (**Figure 2**). A species description is presented in a recent lease sale EIS (MMS, 2007b) and in the recovery plan for this species (USFWS and Gulf States Marine Fisheries Commission, 1995).

A large oil spill is the only IPF potentially affecting 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.9.2**).

Impacts of a Large Oil Spill

Potential spill impacts on Gulf sturgeon are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d) and by the NMFS (2007) 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. For this DOCD, there are no unique site-specific issues with respect to this species.

The lease area is about 244 miles (393 km) from the nearest Gulf sturgeon critical habitat. OSRA modeling (**Table 4**) predicts that a spill in the lease area will not contact the coastal areas inhabited by Gulf sturgeon within 30 days.

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, subadult and adult Gulf sturgeon would be most vulnerable to a 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).

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. Shell has extensive resources available to protect coastal and estuarine wildlife and habitats in the event of a spill reaching the shoreline, as detailed in the OSRP. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on Gulf sturgeon are expected.

C.3.9 Beach Mice (Endangered)

Four subspecies of endangered beach mouse (*Peromyscus polionotus*) occur on the barrier islands of Alabama and the Florida Panhandle. They are the Alabama, Choctawhatchee, Perdido Key, and St. Andrew beach mouse. Critical habitat has been designated for all four subspecies; **Figure 2** shows the critical habitat combined for all four subspecies. Species descriptions are provided in a recent lease sale EIS (MMS, 2007b).

A large oil spill is the only IPF potentially affecting subspecies of beach mouse. There are no IPFs associated with routine project activities that could affect these animals due to the distance from shore and the lack of onshore support activities near their habitat.

Impacts of a Large Oil Spill

Potential spill impacts on beach mice are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d). For this DOCD, there are no unique site-specific issues with respect to these species.

The lease area is about 308 miles (496 km) from the nearest beach mouse critical habitat. OSRA modeling predicts that a spill in the lease area would not contact beach mouse critical habitat within 30 days. 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 contaminated food. Indirect impacts could include reduction of food supply, destruction of habitat, and fouling of nests. Impacts could also occur from vehicular traffic and other activities associated with spill cleanup.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on beach mice are expected.

C.4 Coastal and Marine Birds

C.4.1 Marine and Pelagic Birds

A variety of seabirds may occur in the pelagic environment of the project areas (Clapp et al., 1982a,b, 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 along the coast. In addition, other birds 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 due to the distance from shore. 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) 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 in the Gulf (Sooty Tern, Least Tern, Sandwich Tern, Magnificent Frigatebird); winter residents (gannets, gulls, jaegers); and permanent resident species (Laughing Gull, Royal Tern, Bridled Tern) (Hess and Ribic, 2000).

Common seabird species include Wilson's Storm-Petrel (*Oceanites oceanicus*), Magnificent Frigatebird (*Fregata magnificens*), Northern Gannet (*Morus bassanus*), Masked Booby (*Sula dactylatra*), Brown Booby (*Sula leucogaster*), Cory's Shearwater (*Calonectris diomedea*), Greater Shearwater (*Puffinus gravis*), and Audubon Shearwater (*Puffinus lherminieri*). Seabirds are distributed Gulf-wide and are not specifically associated with the lease area.

Relationships with hydrographic features were found for several seabird species, possibly due to effects of hydrography on nutrient levels and productivity of surface waters where birds forage. GulfCet II did not estimate bird densities; however, Powers (1987) indicates that seabird densities over the open ocean typically are <10 birds/km^2.

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

IPFs potentially affecting marine and pelagic birds include FPSO and shuttle tanker presence, noise, and lights; vessel and helicopter traffic; and two types of accidents – a small oil spill and a large oil spill. Effluent discharges 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 (MMS, 2001). Compliance with NTL 2012-BSEE-G01 will minimize the potential for marine debris-related impacts on birds.

Impacts of FPSO and Shuttle Tanker Presence, Noise, and Lights

Birds that frequent platforms may be exposed to contaminants including air pollutants and routine discharges, but significant impacts are unlikely due to rapid dispersion of effluents and air pollutants. 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. In other cases, navigation may be disrupted by noise (Russell, 2005). On the other hand, offshore structures are suitable stopover habitats for most trans-Gulf migrant species, and most of the migrants that stop over on platforms probably benefit from their stay, particularly in spring (Russell, 2005).

A study in the North Sea indicated that platform lighting causes circling behavior in various birds, especially on cloudy nights; apparently the birds' geomagnetic compass is upset by the red part of the spectrum from the lights currently in use (Poot et al., 2008). The numbers varied greatly, from none at all to some tens of thousands of birds per night per platform, with an apparent effect radius of up to 3 miles (5 km). The OSPAR workshop (OSPAR Commission, 2012) noted that this circling increases the risk of collisions leading to traumas and deaths and may interrupt their migration. A study in the Gulf of Mexico also noted the phenomenon, but did not recommend mitigation (Russell, 2005). Factors to consider in evaluating this impact in the Gulf of Mexico would include the lower incidence of cloudy and foggy days in the Gulf of Mexico versus the North Sea. Impacts on populations of seabirds and trans-Gulf migrant birds may be adverse but are not expected to be significant (BOEM, 2012b).

Impacts of Vessel and Helicopter Traffic

Traffic from construction vessels, the shuttle tanker, support vessel, 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, and the impact would not be significant.

Impacts of a Small Oil Spill

Potential spill impacts on marine birds are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d). For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

The probability of a small oil spill will be minimized by Shell's preventative measures during routine operations including fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts on marine and pelagic birds. **DOCD 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 oil spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

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 toxic fumes. Due to 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 would be expected.

Impacts of a Large Oil Spill

Potential spill impacts on marine and pelagic birds are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d) and the FPSO EIS (MMS, 2001). For this DOCD, there are no unique site-specific issues with respect to spill impacts on these animals.

Pelagic seabirds could be exposed to oil from a surface spill or a subsea blowout at the project area. Hess and Ribic (2000) reported that terns, storm-petrels, shearwaters, and jaegers were the most frequently sighted seabirds in the deepwater Gulf of Mexico (>656 ft [>200 m]). 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.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on marine and pelagic birds are expected.

C.4.2 Shorebirds and Coastal Nesting Birds

Threatened and endangered bird species (Piping Plover and Whooping Crane) were discussed in **Section C.3**. 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 breed on beaches, flats, dunes, bars, barrier islands, and similar 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 in recent lease sale EISs (MMS, 2007b; BOEM, 2012b,d).

The Brown Pelican (*Pelecanus occidentalis*) was delisted from federal endangered status in 2009 (USFWS, 2010c). However, this species remains endangered on the Louisiana list of Endangered Species (State of Louisiana Department of Wildlife and Fisheries, 2013), is listed as a species of greatest conservation need by the State of Mississippi (Mississippi Department of Wildlife, Fisheries and Parks, 2005), and is a species of special concern by the State of Florida (Florida Fish and Wildlife Conservation Commission, 2013). 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, 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).

IPFs potentially affecting shorebirds and coastal nesting birds include vessel and helicopter traffic and a large oil spill. Compliance with NTL 2012-BSEE-G01 will minimize the potential for marine debris-related impacts on shorebirds.

Impacts of Vessel and Helicopter Traffic

The shuttle tanker and installation and support vessels and helicopters will transit coastal areas near Port Fourchon and Amelia, Louisiana, where shorebirds and coastal nesting birds may be found. The shuttle tanker will transit coastal areas near the offloading ports of opportunity along the Gulf of Mexico coast. These activities could periodically disturb individuals or groups of birds within sensitive coastal habitats (e.g., wetlands that may support feeding, resting, or breeding birds).

Vessel traffic may disturb some foraging and resting birds. Flushing distances vary among species and individuals (Rodgers and Schwikert, 2002). The disturbances will be limited to flushing birds away from vessel pathways; known distances are from 65 to 160 ft (20 to 49 m) for personal watercraft and 75 to 190 ft (23 to 58 m) for outboard-powered boats (Rodgers and Schwikert, 2002). Flushing distances may be similar or less for the support vessels to be used for Shell's project, and some species such as gulls are attracted to boats. Support vessels will not approach nesting or breeding areas on the shoreline, so nesting birds, eggs, and chicks will not be disturbed. Vessel operators will use designated navigation channels and comply with posted speed and wake restrictions while transiting sensitive inland waterways. Due to the limited scope and geographic extent of the proposed activities, any short-term impacts are not expected to be biologically significant to coastal bird populations.

Aircraft traffic can cause some disturbance to birds onshore and offshore. Responses are highly dependent on the type of aircraft, the bird species, the activities that animals were previously engaged in, and previous exposures to overflights (Efroymson et al., 2000). Helicopters seem to cause the most intense responses over other human disturbances for some species (Bélanger and Bédard, 1989). However, Federal Aviation Administration Advisory Circular No. 91-36D recommends that pilots maintain a minimum altitude of 2,000 ft (610 m) when flying over noise-sensitive areas such as wildlife refuges, parks, and areas with wilderness characteristics. This is greater than the distance (slant range) at which aircraft overflights have been reported to cause behavioral effects on most species of birds studied (Efroymson et al., 2000). With these guidelines in effect, it is likely that individual birds would experience, at most, only short-term behavioral disruption.

Impacts of Large Oil Spill

The OSRA results summarized in **Table 4** predict that shorelines of Texas and Louisiana that include habitat for shorebirds and coastal nesting birds could be affected within 30 days from a large oil spill.

The Macondo spill provides additional information regarding impacts on species of coastal and shorebirds that may be affected in the event a large oil spill reached coastal habitats. Although the Macondo spill had direct and indirect impacts to coastal and marine birds, it is premature to conclude impacts over a long period (BOEM, 2012b). Impacts to birds from the Macondo spill are being studied as part of the Natural Resource Damage Assessment, but results have not yet been released. Antonio et al. (2011) modeled bird mortality from the Macondo spill showing cumulative carcass numbers and mortality rate increasing exponentially from the start of the Macondo spill until the mortality rate began to decline after the 97th day of the spill. Note that the collected animals are a small subset of the total number of impacted birds; therefore, they represent an underestimate of the overall impact of the Macondo spill (BOEM, 2012b).

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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, 1993). Pelagic eggs and larvae become part of the planktonic community for various lengths of time (10 to 100 days, depending on the species) (MMS, 2007b). A study by Ross et al. (2012) on mid-water fauna to characterize vertical distribution of mesopelagic fishes in selected deepwater areas in the Gulf of Mexico substantiated high species richness, but general domination by relatively few families and species.

IPFs potentially affecting pelagic communities and ichthyoplankton include FPSO and shuttle tanker presence, noise, and lights; effluent discharges; water intakes; and two types of accidents – a small fuel spill and a large oil spill.

Impacts of FPSO and Shuttle Tanker Presence, Noise, and Lights

The FPSO, as a floating structure in the deepwater environment, will act as a fish-attracting device (FAD). Additionally, the FPSO-associated structures and equipment, such as the attendant mooring lines, risers, and subsea equipment, will also act as a FAD (MMS, 2001). 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 et al., 1990; Higashi, 1994; Relini et al., 1994). This FAD effect could possibly enhance the feeding of epipelagic predators by attracting and concentrating smaller fish species. Because the FPSO is a single, temporary structure, impacts on fish populations, whether beneficial or adverse, are considered minor.

Impacts of Effluent Discharges

Effluent discharges will occur during installation, production, and decommissioning activities resulting from the operation of the installation and decommissioning vessels, FPSO, shuttle tanker, and field support vessel as described in **Section A.4**. Potential effluent discharges include treated sanitary and domestic wastes, produced water, deck drainage, and other discharges.

Sanitary and Domestic Wastes. Treated sanitary and domestic wastes may have a slight 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 will be diluted rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Produced Water. Produced water and process effluents, including well treatment fluids, completion fluids, and workover fluids, will be discharged overboard via a downpipe below the water surface, after treatment that complies with the 29 mg/L NPDES permit requirements for oil and grease. Potential constituents such as salts, petroleum hydrocarbons, some metals, and naturally occurring radioactive material in produced water may degrade water quality in the immediate vicinity of the discharge point.

Upon discharge, produced water is diluted rapidly, typically by 30- to 100-fold within tens of meters (OGP, 2005). At distances of 1,640 to 3,280 ft (500 to 1,000 m) from the discharge point, the dilution factor is 1,000 to 100,000 or more (OGP, 2005). Some constituents will precipitate and others such as trace metals and aromatic hydrocarbons will be scavenged onto particulate matter. According to BOEM (2012b), the discharge of produced water may result in increased concentrations of some metals, hydrocarbons, and dissolved solids within an area of about 328 ft (100 m) adjacent to the point of discharge. Compliance with NPDES permit requirements would result in only short-term localized impacts to receiving waters (MMS 2007b).

Deck Drainage. Deck drainage may have a slight effect on the pelagic environment in the immediate vicinity of these discharges. Deck drainage from contaminated 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 will be diluted rapidly to undetectable levels within tens to hundreds of meters from the source. Minimal impacts on water quality, plankton, and nekton are anticipated.

Other Discharges. Other discharges in accordance with the NPDES permit, such as desalination unit brine; uncontaminated cooling water; fire water, well workover, treatment, and completion fluids; subsea facility control fluids; and ballast water are expected to be diluted rapidly and have little or no impact on water column biota.

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 FPSO (**DOCD Table 7a**). The FPSO will have a total of six water intake structures or sea chests: two new sea chests for topsides cooling intake, two new sea chests for fire water intake, and two existing sea chests in the engine room. The two existing sea chests, located in the engine room of the converted double-hull vessel, will not be modified because of space constraints. The openings for the existing engine room sea chests are located at a minimum of 37.7 ft (11.5 m) below the water line in FPSO mode. The cooling water intake velocity is 3.72 ft/s (1.1 m/s) across the screen, resulting in an intake rate of 5.97 MGD. At 1.67 ft (0.5 m) from the intake screen, the intake velocity decreases to 0.5 ft/s (0.2 m/s); at 2.75 ft (0.8 m) the intake velocity decreases to 0.25 ft/s (0.1 m/s). The intake volumes for cooling water usage through the existing sea-chests are expected to be similar in nature to water intakes for current offshore oil and gas production facilities. As discussed previously, NPDES Permit No. GMG290000 did not specify cooling water intake structure requirements for facilities constructed prior to July 17, 2006. USEPA acknowledged that modifying these existing facilities with known technologies to reduce impingement or entrainment would require unacceptable changes in the existing vessel structure, potentially decreasing the seaworthiness and potentially interfering with the structural components of the hull.

The two new sea chests for cooling water intake will be designed to minimize intake velocities to reduce environmental impacts from the cooling water intake. The intake velocity of the new sea chests is anticipated to be low, which should allow most strong-swimming juvenile fishes and smaller adults to escape entrainment into the sea chests, or risk the potential of impingement on the strainer assemblies. USEPA acknowledges that reductions in velocities through the intake screen is protective for both impingement and entrainment (USEPA, 2011b). There will also be two new sea chests for fire water intake, which will have infrequent and short duration periods for fire water usage. It is expected that the seawater intake would have negligible-to-minor impacts on adult or juvenile fishes.

The FPSO will be located in the deepwater environment. Based on Gulf of Mexico data from SEAMAP, larval fish densities decrease with water depth, and are lower in the deepwater environment than in shallower water. Entrainment losses are estimated to be minimal for the few species that reproduce in deepwater regions (water depths >200 m) of the Gulf of Mexico (LGL Ecological Research Associates, Inc., 2009). High flow intakes associated with activation of firewater pumps are infrequent and of short duration and the larger fish species that inhabit the deepwater environment have little potential for impingement due to their breakaway speed from a challenging intake velocity. The operational features of the FPSO combined with the characteristics of the geographic area suggest that minimal impact from intake impingement and entrainment is expected.

Impacts of a Small Oil Spill

Potential spill impacts on fisheries resources are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d) and the FPSO EIS (MMS, 2001). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

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

A small oil (crude or refined) spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with diesel fuel on it would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

A small fuel spill could have localized impacts on phytoplankton, zooplankton, ichthyoplankton, and nekton. Due to the limited areal extent and short duration of water quality impacts, a small fuel spill would be unlikely to produce detectable impacts on pelagic communities.

Impacts of a Large Oil Spill

Potential spill impacts on pelagic communities and ichthyoplankton are discussed in recent lease sale EISs (BOEM, 2012a,b,d) and the FPSO EIS (MMS, 2001). For this DOCD, there are no unique site-specific issues.

A large oil spill resulting from a subsea blowout or a surface release from the FPSO could 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.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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, stone crab, 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 on the Texas-Louisiana OCS, the nearest of which is located 102 miles (164 km) north-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 at or near the lease area include the following (NMFS, 2009):

- Atlantic bigeye tuna (adults)
- Atlantic bluefin tuna (spawning, eggs, larvae, adults)
- Atlantic skipjack tuna (spawning, adults)
- Atlantic yellowfin tuna (all)
- Albacore tuna (adults)
- Atlantic swordfish (larvae, juveniles, adults)
- Blue marlin (juveniles, adults)
- White marlin (juveniles, adults)
- Longbill spearfish (juveniles, adults)
- Oceanic whitetip shark (all)
- Longfin mako shark (all)
- Common thresher shark (all)

Research indicates the central and western Gulf of Mexico may be important spawning habitat for Atlantic bluefin tuna, and NMFS (2009) 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 15,000 mi^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 United States and Canadian coasts, followed by migration to the Gulf of Mexico to spawn in April, May, and June (NMFS, 2009).

Other HAPCs have been identified in the Gulf of Mexico by the GMFMC (2005). These include the Florida Middle Grounds, Madison-Swanson Marine Reserve, Tortugas North and South Ecological Reserves, Pulley Ridge, and several individual reefs and banks of the northwestern Gulf of Mexico (**Figure 2**). The nearest of these is Jakkula Bank, located 114 miles (183 km) north-northwest of the lease area.

Routine IPFs potentially affecting EFH and fisheries resources include installation of subsea equipment; FPSO and shuttle tanker presence, noise, and lights; effluent discharges; water intakes; and decommissioning. In addition, two types of accidents – a small fuel spill and a large oil spill – may potentially affect EFH and fisheries resources.

Impacts of Subsea Equipment and FPSO Mooring System Installation and Removal

Installation of subsea equipment including FPSO mooring anchors may produce localized impacts to fishery resources resulting from increased turbidity and displacement. These impacts are likely to be temporary and are considered negligible (MMS, 2001). Therefore, no significant impacts are expected.

Removal of subsea equipment including FPSO mooring anchors may produce localized impacts to fishery resources resulting from increased turbidity and displacement similar to installation activities. These impacts are likely to be temporary and are considered negligible (MMS, 2001). Removing the bottom-founded structures removes the beneficial effect of the FAD, thus if the bottom-founded structures are left in place, negative impacts would be reduced or eliminated. Therefore, no significant impacts are expected.

Impacts of FPSO and Shuttle Tanker Presence, Noise, and Lights

The FPSO, attendant mooring lines, risers, and subsea equipment will act as a FAD (MMS, 2001). In oceanic waters, vertically migrating mesopelagic fishes and epipelagic fishes may be attracted to or repelled by an FPSO structure. Mooring anchors and the bottom-founded equipment will also serve as FADs, which would benefit species preferring bottom relief such as snappers and groupers (MMS, 2001). 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 et al., 1990; Higashi, 1994; Relini et al., 1994). This FAD effect would possibly enhance feeding of epipelagic predators by attracting and concentrating smaller fish species. Any impacts on EFH for highly migratory pelagic fishes are considered minor.

Impacts of Effluent Discharges

Effluent discharges affecting EFH by diminishing ambient water quality include produced water and process effluents, treated sanitary and domestic wastes, deck drainage, and miscellaneous discharges such as desalination unit brine; uncontaminated cooling water; fire water; well workover, treatment, and completion fluids; subsea facility control fluids; and ballast water. All effluent discharges will be treated in compliance with NPDES permit limitations for these fluids. 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 may cause entrainment and impingement of plankton, including fish eggs and larvae (ichthyoplankton). The FPSO is to be located within designated EFH for highly migratory pelagic fishes, which occur as transients in the lease area. Due to the location of the lease area and the geographic extent of FPSO production activities, any short-term impacts on EFH for highly migratory pelagic fishes are not expected to be biologically significant becasue their reproductive output is dispersed over wide oceanic areas resulting in low egg and larval densities at any specific site (LGL Ecological Research Associates, Inc., 2009).

The intake volumes for cooling water usage through the existing sea chest are expected to be similar in nature to water intakes for current offshore oil and gas production facilities . and the new seawater intakes are anticipated to be designed for low intake velocities across the intake.

The FPSO will be located in the deepwater environment. Based on Gulf of Mexico data from SEAMAP, larval fish densities decrease with water depth, and are lower in the deepwater environment than in shallower waters. Entrainment losses are estimated to be minimal for the few species that reproduce in deepwater regions (depths >200 m) in the Gulf of Mexico (LGL Ecological Research Associates, Inc., 2009). High flow intakes associated with activation of firewater pumps are infrequent and of short duration and the larger fish species that inhabit the deepwater environment have little potential for impingement due to their breakaway speed from a challenging intake velocity. The operational features of the FPSO combined with the geographical area characteristics suggest that minimal impact from intake impingement and entrainment is expected.

Impacts of a Small Oil Spill

Potential spill impacts on EFH are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d) and the FPSO EIS (MMS, 2001). For this DOCD, there are no unique site-specific issues with respect to spill impacts.

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

A small crude or refined oil spill in offshore waters would produce a slick on the water surface and increase the concentrations of petroleum hydrocarbons and their degradation products. The extent and persistence of impacts would depend on the meteorological and oceanographic conditions at the time and the effectiveness of spill response measures. **Section A.9.2** discusses the likely fate of a small fuel spill and indicates that over 90% would be evaporated or dispersed naturally within 24 hours. The area of the sea surface with oil on it would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions.

A small 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 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 114,793 mi^2 (297,312 km^2) of the Gulf of Mexico. Therefore, no significant spill impacts on EFH for highly migratory pelagic fishes are expected.

A small spill would not affect EFH for corals and coral reefs; the nearest coral EFH is Ewing Bank, located 102 miles (164 km) north-northwest of the lease area. A small spill would float and dissipate on the sea surface and would not contact these 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 in recent EISs (MMS, 2007b; BOEM, 2012a,b,d) and the FPSO EIS (MMS, 2001). For this DOCD, there are no unique site-specific issues with respect to EFH.

A large oil spill resulting from a subsea blowout or a surface release from the FPSO 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, 2009), some impact on EFH would be unavoidable.

A large spill could affect the EFH for many managed species including shrimps, stone crab, spiny lobster, corals and coral reefs, reef fishes, coastal migratory pelagic fishes, red drum, and highly migratory pelagic fishes. 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 contaminated and result in persistent degradation of the seafloor habitat for managed demersal fish and invertebrates.

The lease area is within the HAPC for spawning Atlantic bluefin tuna (NMFS, 2009). 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 and their offspring. 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, 2009).

The nearest feature designated as EFH for corals is located 102 miles (164 km) north-northwest of the lease area. An accidental spill would be unlikely to reach or affect this feature.

Near-bottom currents in the region are expected to flow along the isobaths (Nowlin et al., 2001) and typically would not carry a plume up onto the continental shelf edge.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on EFH are expected.

C.6 Archaeological Resources

C.6.1 Shipwreck Sites

WR 507, 508, 551, and 552 are not on the list of archaeological survey blocks (BOEM, 2012c). Archaeological surveys conducted by Fugro (2011) and C& C Technologies, Inc. (2011) revealed unidentified side-scan sonar targets, several anchor chain scars, piston cores, and previously drilled wells within the survey area, but none were within 500 ft (152 m) of the proposed locations for the bottom-founded equipment. None of the sonar contacts within the 12,000 ft anchor radius were deemed historically significant (C & C Technologies, Inc., 2011).

The archaeological surveys revealed 29 unidentified sonar contacts. Shell has established avoidance zones around the sonar targets within the anchor radius and no anchors will cross or lie in the avoidance zones.

Because there are no historic shipwreck sites in the lease area (see **DOCD Section 6**), there are no routine IPFs that are likely to affect these resources. A small oil spill would not affect shipwrecks in adjoining blocks because the oil would float and dissipate on the sea surface. The impact of a large oil spill from a subsea blowout or a surface release from the FPSO contacting shipwrecks in other areas is considered below a level of concern.

Impacts of a Large Oil Spill

There are no known historic shipwrecks in the lease area and a large oil spill resulting from a blowout or a surface release from the FPSO would not result in any impact on archaeological resources in adjoining blocks. A spill entering shallow coastal waters could conceivably contaminate an undiscovered or known historic shipwreck site. The OSRA modeling summarized in **Table 4** predicts that Texas and Louisiana shorelines could be contacted by a spill within 30 days.

Previous analyses (MMS, 2007a, 2008b) concluded that oil spills would be unlikely to affect archaeological sites 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, during the Macondo spill, subsurface plumes were reported at a water depth of about 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 (Joint Analysis Group, 2010c). 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 MMS (2007a, 2008b), depending on its extent, trajectory, and persistence.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on historic shipwrecks are expected. Also as noted by MMS (2007b), should an oil spill contact a coastal historic site, such as a fort or a lighthouse, the major impact would be a temporary, reversible visual impact from oil contact and contamination of the site and its environment. However, more recent studies suggest that the impacts could be longer term and not easily reversible (BOEM, 2012b,d).

C.6.2 Prehistoric Archaeological Sites

With water depths ranging from approximately 9,548 to 9,558 ft (2,910 to 2,913 m), the lease area well beyond the 197-ft (60-m) depth contour used by the 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 resulting from a subsea blowout or a surface release from the FPSO that would reach coastal waters within the 197-ft (60-m) depth contour.

Impacts of a Large Oil Spill

Because prehistoric archaeological sites are not found in the lease area, they would not be affected by the physical effects of a subsea blowout. The MMS (2007b) 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 (MMS, 2007b). The OSRA modeling summarized in **Table 4** predicts that Texas and Louisiana shorelines could be contacted by a spill within 30 days. 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 and site features).

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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 recent EISs (MMS, 2007b; BOEM, 2012a,b,d). Sensitive coastal habitats are also tabulated in the OSRP. Coastal habitats inshore of the project area include barrier beaches and dunes, wetlands, and submerged seagrass beds. Generally, most of the northern Gulf is fringed by barrier beaches, with wetlands and/or submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries.

Due to the distance from shore, there are no IPFs associated with routine activities occurring in the lease area that are likely to affect beaches and dunes, wetlands, seagrass beds, coastal wildlife refuges, wilderness areas, or any other managed or protected coastal area. The support bases at Port Fourchon and Amelia are not located in a wildlife refuge or a wilderness area. Potential impacts of vessel traffic are briefly addressed below.

A small fuel spill in the lease area would be unlikely to affect coastal habitats because it would not be expected to make landfall or reach coastal waters prior to breaking up (see explanation in **Section A.9.2**).

Impacts of Vessel Traffic

For OCS activities in general, increased vessel traffic including construction vessels, shuttle tanker, 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. Vessel traffic as detailed in **DOCD Section 14** may have a minor incremental impact on coastal habitats or protected areas. Impacts will be minimized by following the speed and wake restrictions in harbors and channels.

Impacts of a Large Oil Spill

Potential spill impacts on coastal habitats are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d) and the FPSO EIS (MMS, 2001). Coastal habitats inshore of the project area include barrier beaches and dunes, wetlands, and submerged seagrass beds. For this DOCD, there are no unique site-specific issues with respect to coastal habitats.

The OSRA results summarized in **Table 4** predict that shorelines of Texas and Louisiana could be affected within 30 days. A surface release from the FPSO has a 2% chance of reaching coastal habitats in Galveston, Texas, and Cameron and Plaquemine Parish, Louisiana. After 30 days, eight counties or parishes may be contacted from Matagorda, Texas, to Plaquemines, Louisiana.

The shorelines within the geographic range predicted by the OSRA modeling include extensive barrier beaches and wetlands, with submerged seagrass beds occurring in sheltered areas behind the barrier islands and in estuaries. NWRs and other protected areas along the coast are discussed in the lease sale EISs (MMS, 2007b; BOEM, 2012b) and Shell's OSRP. Coastal wildlife refuges, wilderness areas, and state and national parks within the geographic range of the potential shoreline contacts after 30 days include the following:

- Aransas NWR
- Mad Island NWR
- Big Boggy NWR
- San Bernard NWR
- Peach Point Wildlife Management Area (WMA)
- Brazoria NWR
- Christmas Bay State Park
- Christmas Bay Coastal Preserve
- Galveston Island State Park
- Apffel Park
- Seawolf Park
- Old Fort Travis Park
- Atkinson Island WMA
- Ft. Anahuac Park
- Anahuac NWR
- McFaddin NWR
- Candy Abshier WMA

- Atkinson Island WMA
- Sea Rim State Park
- J.D. Murphree WMA
- Texas Point NWR
- Sabine NWR
- Cameron Prairie NWR
- LaCassine NWR
- Little Pecan Island Preserve
- Peveto Woods Sanctuary
- Lower Neches WMA
- Rockefeller State Wildlife Refuge and Game Preserve
- Paul J. Rainey WMA
- Atchafalaya Delta WMA
- Mandalay NWR
- Isles Dernieres Barrier Islands Refuge
- Pointe Au Chien WMA
- Salvador WMA
- Jean Lafitte National Historical Park
- Delta NWR
- Pass a Loutre WMA
- Breton NWR
- St. Bernard State Park

The OSRA results in **Table 4** include only shoreline segments with contact probabilities greater than 0.5% within 30 days; other coastal areas could be affected at lower contact probabilities within 30 days, or from a spill persisting for more than 30 days. Additional NWRs and managed wildlife areas occur along the Gulf Coast. These areas include habitats such as barrier beach and dune systems, wetlands, and submerged seagrass beds that support diverse wildlife, including endangered or threatened species.

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 (MMS, 2007b). Oil that makes it to beaches may be either liquid weathered oil, an oil-and-water mousse, or tarballs (MMS, 2007b). 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.

Coastal wetlands are highly sensitive to oiling and can be significantly impacted because of the inherent toxicity of hydrocarbon and non-hydrocarbon components of the spilled substances (Mendelssohn, 2012). The MMS (2007b) predicted that for every 50 bbl of oil contacting wetlands, approximately 6.7 ac (2.7 ha) of wetland vegetation will experience dieback. Thirty percent of these damaged wetlands are assumed to recover within 4 years, and 85% within 10 years. About 15% of the contacted wetlands are expected to be converted permanently to open-water habitat. The critical concentration of oil is that concentration above which impacts to wetlands will be long-term and recovery will take longer than two growing seasons, and which causes plant mortality and some permanent wetland loss. Critical concentrations of various oils are expected to vary broadly for wetland types and wetland plant species. Louisiana wetlands are assumed to be more sensitive to oil contact than elsewhere in the Gulf because of high cumulative stress (MMS, 2007b). In addition to the direct impacts of oil, cleanup activities in marshes may accelerate rates of erosion and retard recovery rates (MMS, 2007b).

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on coastal habitats are expected.

C.8 Socioeconomic and Other Resources

C.8.1 Recreational and Commercial Fishing

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, Inc., 2002). Pelagic longlining has occurred historically in the project area, primarily during spring and summer.

It is unlikely that any commercial fishing activity other than longlining occurs at or near 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 about 820 to 1,804 ft (250 to 550 m). Tilefishes (primarily *Lophalotilus chamaeleonticeps*) are caught by bottom longlining in water depths from about 540 to 1,476 ft (165 to 450 m) (Continental Shelf Associates, Inc., 2002). The proposed project is in 9,548 to 9,558 ft (2,910 to 2,913 m) of water. 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, Inc., 1997, 2002). In deeper water, the main attraction to recreational fishers would be petroleum platforms in offshore waters of Texas and Louisiana. The proposed project is 178 miles (286 km) from the nearest shoreline. Due to the distance from shore, it is unlikely that any recreational fishing activity is occurring in the project area.

The only routine IPF potentially affecting fisheries is FPSO and shuttle tanker presence (including noise and lights). Two types of potential accidents are also addressed below – a small fuel spill and a large oil spill. 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 FPSO and Shuttle Tanker Presence

There is a slight possibility of pelagic longlines becoming entangled in the FPSO and shuttle tanker, mooring lines, and bottom structures. 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, Inc., 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.

Impacts of a Small Oil Spill

The probability of a small oil spill will be minimized by Shell's preventative measures during routine operations including fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **DOCD 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.

Pelagic longlining activities in the lease area, if any, could be interrupted in the event of a small fuel spill. The area of the sea surface with oil on it would range from 1.2 to 12 ac (0.5 to 5 ha), depending on sea state and weather conditions. Fishing activities could be interrupted due to the activities of response vessels operating in the lease area. A small spill would not affect coastal water quality because the spill would not be expected to make landfall or reach coastal waters prior to breaking up (see **Section A.9.2**).

Impacts of a Large Oil Spill

Potential spill impacts on fishing activities are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d). For this DOCD, there are no unique site-specific issues with respect to this activity.

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

Impacts of a Small Fuel Spill

The probability of a small spill will be minimized by Shell's preventative measures during routine operations including fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **DOCD Section 9b** provides detail on spill response measures.

A small oil spill would not have impacts on public health and safety because it would likely affect only a small area of the open ocean 178 miles (286 km) from the nearest shoreline and nearly all of the oil would evaporate or disperse naturally within 24 hours. Response crews would be equipped with appropriate safety equipment to avoid injury and health effects. A small spill would not be expected to make landfall or reach coastal waters prior to breaking up (**see Section A.9.2**).

Impacts of a Large Oil Spill

In the event of a large spill resulting from a blowout or a surface release from the FPSO, 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 FPSO and shuttle tanker maintain a Shipboard Oil Pollution Emergency Plan as required under MARPOL 73/78.

Depending on the spill rate and duration, the physical/chemical characteristics of the oil, the meteorological and oceanographic conditions at the time, and the effectiveness of spill response measures, the public could be exposed to oil on the water and along the shoreline, through skin contact or inhalation of VOCs. Crude oil is a highly flammable material, and any smoke or vapors from a crude oil fire can cause irritation. Exposure to large quantities of crude oil may pose a health hazard.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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 development and production operations with support from existing shorebased 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, existing offshore and coastal infrastructure (including major sources of supplies, services, energy, and water), and minority and lower income groups. Impacts of a small oil spill and a large oil spill are addressed below.

Impacts of a Small Oil Spill

The probability of a small spill will be minimized by Shell's preventative measures during routine operations including fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **DOCD Section** and **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 oil 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.

Impacts of a Large Oil Spill

Potential socioeconomic impacts of an oil spill are discussed in recent EISs (MMS, 2007b; BOEM, 2012b,d). For this DOCD, there are no unique site-specific issues with respect to employment and coastal infrastructure. A large spill could cause several types of economic impacts: extensive fishery closures could put fishermen out of work; temporary employment could increase as part of the response effort; adverse publicity could reduce employment in coastal recreation and tourism industries; and OCS drilling activities, including service and support operations that are an important part of local economies, could be suspended.

The lease area is 178 miles (286 km) from the nearest shoreline. Based on the OSRA modeling predictions (**Table 4**), Texas and Louisiana coastal areas are the most likely to be contacted by a spill.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. Therefore, no significant spill impacts on employment and infrastructure are expected.

C.8.4 Recreation and Tourism

There are no known recreational uses of 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 2012-BSEE-G01 will minimize the chance of trash or debris being lost overboard from the FPSO and subsequently washing up on beaches.

Impacts of a Small Oil Spill

The probability of a small spill will be minimized by Shell's preventative measures during routine operations including fuel transfer and offloading to the shuttle tanker. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the potential for impacts. **DOCD 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 oil spill in the lease area would be unlikely to affect recreation and tourism. There are no known recreational or tourism activities occurring in the lease area, and as explained in **Section A.9.2**, a small oil spill would not be expected to make landfall or reach coastal waters prior to breaking up.

Impacts of a Large Oil Spill

Potential impacts of an oil spill on recreation and tourism are discussed in recent EISs (MMS, 2007b; BOEM, 2012a,b,d). For this DOCD, there are no unique site-specific issues with respect to these impacts.

Impacts on recreation and tourism would vary depending on the duration of the spill and its fate including the effectiveness of response measures. A large spill that reached coastal waters and shorelines could adversely affect recreation and tourism by contaminating beaches and wetlands, resulting in negative publicity that encourages people to stay away. Based on OSRA modeling as summarized in **Table 4**, areas most likely to be contacted by a spill are Plaquemines and Cameron Parish, Louisiana, and Galveston County, Texas. The shorelines along Galveston, Texas, include popular beaches and recreational sites along the coast.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts.

DOCD Section 9b provides detail on spill response measures. 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 in recent lease sale EISs (MMS, 2007b; BOEM, 2012b,d). 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 accident 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, 2012b). 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.

A surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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 lightering area. WR 507, 508, 551, and 552 are not in a designated Military Warning Area. Shell will comply with BOEM requirements and lease stipulations to avoid impacts on uses of the area by military vessels and aircraft.

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 oil spill would not have impacts on other marine uses, as the spill and response activities would be mainly within the lease area and the duration would be brief.

Impacts of a Large Oil Spill

An accidental spill would be unlikely to significantly affect shipping or other marine uses. The blocks are not located within any USCG-designated fairway or shipping lane. 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 surface release of crude oil from the FPSO resulting in a large oil spill is a rare event. A blowout resulting in a large oil spill also is an extremely rare event, and the probability of such an event will be minimized by Shell's well control and blowout prevention measures as detailed in **DOCD Section 2j**. In the unlikely event of a spill, implementation of Shell's OSRP will mitigate and reduce the impacts. **DOCD Section 9b** provides detail on spill response measures. 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, MMS prepared a multisale EIS in which it analyzed the environmental impact of activities that might occur in the multi-lease-sale area. The MMS also recently analyzed the cumulative impacts of OCS development activities similar to those planned in this DOCD in several documents. The level and types of activities planned in Shell's DOCD are within the range of activities described and evaluated in the Final EIS for Gulf of Mexico OCS Oil and Gas Lease Sales 2007-2012: Western Planning Area Sales 204, 207, 210, 215, and 218, and Central Planning Area Sales 205, 206, 208, 213, 216, and 222 (MMS, 2007b), as updated by a 2012 Final Supplemental EIS for Gulf of Mexico OCS Oil and Gas Lease Sales 2012-2017: Western Planning Area Lease Sales 229, 233, 246, and 248 and Central Planning Area Lease Sales 227, 231, 235, 241 and 247 (BOEM, 2012b). Activities unique to FPSO installation, routine operations, and decommissioning activities were evaluated in the Final EIS for the Proposed Use of Floating, Production, Storage, and Offloading Systems on the Gulf of Mexico OCS: Western and Central Planning Areas (MMS, 2001). 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 (MMS, 2001, 2007b; BOEM, 2012b).

Description of Activities Reasonably Expected to Occur in the Vicinity of Project Area. Other exploration and development activities may occur in the vicinity of lease blocks WR 507, 508, 551, and 552. Shell does not anticipate other projects in the vicinity of the project area beyond the types of projects analyzed in the Multisale and Supplemental EIS (MMS, 2001, 2007b, 2008a; BOEM, 2012b).

Cumulative Impacts of Activities in the DOCD. The MMS (2007b) multi-lease-sale EIS and BOEM (2012b) Final EIS included a lengthy discussion of cumulative impacts, which analyzed the environmental and socioeconomic impacts from the incremental impact of the 11 proposed lease sales, in addition to all activities (including non-OCS activities) projected to occur from past, proposed, and future lease sales during the 40-year period of 2007 to 2046 (see MMS, 2007b; BOEM, 2012b). 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 level and type of activity proposed in Shell's DOCD are within the range of activities described and evaluated in the recent multi-lease-sale EISs. This EIA incorporates and builds on these analyses by examining the potential impacts on physical, biological, and socioeconomic resources from the work planned in this DOCD, in conjunction with the other reasonably foreseeable activities expected to occur in the Gulf of Mexico. Thus, for all impacts, the incremental contribution of Shell's proposed actions to the cumulative impacts analysis in these prior analyses is not significant.

C.9.1 Cumulative Impacts to Physical/Chemical Resources

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

Air Quality. Emissions from pollutants into the atmosphere from activities are not projected to have significant effects on onshore air quality because of the prevailing atmospheric conditions, emission rates and heights, and resulting pollutant concentrations. As the BOEM found in the multi-lease-sale 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 national ambient air quality standard (MMS, 2007b; BOEM, 2012b,d). In addition, the cumulative contribution to visibility impairment is also very small (MMS, 2007b; BOEM, 2012b,d). As mentioned in previous sections, projected emissions meet the BOEM exemption criteria and would not contribute to cumulative impacts on air quality.

Climate Change. Carbon dioxide (CO_2) and CH_4 emissions from the project would constitute a small incremental contribution to greenhouse gas emissions from all OCS activities. According to a recent OCS lease sale EIS (BOEM, 2012b), estimated CO_2 emissions from OCS oil and gas sources are 0.4% of the U.S. total and all OCS activities are about 0.005% of the total global CO_2 emissions. Greenhouse gas emissions may contribute to climate change, with important effects on temperature, rainfall, frequency of severe weather, ocean acidification, and sea level rise (Intergovernmental Panel on Climate Change, 2007). In the Gulf of Mexico, sea level rise is an important issue due to the ongoing losses in coastal wetlands, particularly in coastal Louisiana. Greenhouse gas emissions from the DOCD represent a negligible contribution to the total greenhouse gas emissions from reasonably foreseeable activities in the Gulf of Mexico area and would not significantly alter any of the climate change impacts evaluated in the previous EISs. Globally, Shell is working to reduce greenhouse gas emissions by increasing the efficiency of its operations, establishing a substantial capability in CO_2 capture and storage, and continuing to research and develop technologies that increase efficiency and reduce emissions in hydrocarbon production. In 2010, Shell met a voluntary target set in 1998 for direct greenhouse gas emissions from its facilities to be at least 5% lower than the comparable 1990 level (Shell, 2011).

Water Quality. Shell's project will result in some minor water quality impacts due to the NPDES-permitted discharge of produced water, treated sanitary and domestic wastes, non-contact cooling water, deck drainage, desalination unit brine, uncontaminated fire water, and ballast water. These effects are expected to be minor (localized to the area within a few hundred meters of the FPSO), and temporary (lasting only hours longer than the disturbance or discharge). Any cumulative effects to water quality are expected to be negligible.

Archaeological Resources. WR 507, 508, 551, and 552 are not on the list of archaeology survey blocks (BOEM, 2012c). Archaeological assessments by Fugro GeoServices, Inc. (FGSI, 2011) and C & C Technologies, Inc. (2012) identified multiple sonar targets in the project area considered to be debris and indicated that one of the sonar contacts in the lease area could not be reliable identified. Shell has established avoidance zones of at least 50 ft (15 m) around sonar targets identified within the anchor radius. Also, the lease area is well beyond the 197-ft (60-m) depth contour used by the BOEMRE 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 Supplemental and Final EISs (BOEM, 2012b,d) has been incorporated into the EIA, where applicable.

C.9.2 Cumulative Impacts to Biological Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on biological resources will be correspondingly limited.

Seafloor Habitats and Biota. Effects on seafloor habitats and biota from the installation of subsea equipment are expected to be minor and limited to a small area. 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 multi-lease-sale EISs, the incremental contributions of activities similar to Shell's proposed activities to the cumulative impacts are not significant (MMS, 2007b; BOEM, 2012b,d).

Threatened, Endangered, and Protected Species. Threatened and endangered species reasonably likely to occur in the lease area include the sperm whale and five species of sea turtles. Potential impact sources include FPSO and shuttle tanker presence including noise and lights; marine debris; and 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 2012-BSEE-G01 and 2012-JOINT-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 2012-BSEE-G01 will minimize the likelihood of debris-related impacts on birds. 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 and geographic extent of the proposed 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 installation and production activity would be negligible.

Coastal Habitats. Due to the distance of the FPSO 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 at Port Fourchon and Amelia are not in wildlife refuge or wilderness areas. Installation and support operations, including installation vessels, the shuttle tanker, 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 Supplemental and Final EISs (BOEM, 2012b,d) has been incorporated into the EIA, where applicable.

C.9.3 Cumulative Impacts to Socioeconomic Resources

The work planned in this DOCD is limited in geographic scope and duration, and the impacts on socioeconomic resources will be correspondingly limited.

The multi-lease-sale 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 (MMS, 2007b; BOEM, 2012b,d). The 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.

New Information. New information included in the most recent Supplemental and Final EISs (BOEM, 2012b,d) has been incorporated into the EIA, where applicable.

D. Environmental Hazards

D.1 Geologic Hazards

The shallow hazards assessment included in this DOCD, based on the shallow hazards reports by Gardline Surveys (2004), GEMS (2006), FGCI (2010), and C & C Technologies, Inc. (2012), concludes that the project area is free of any major geological hazards and is suitable for the proposed activities. There is no evidence of seafloor or near-surface hydrocarbon-charged sediments associated with surface faulting, acoustic void zones associated with surface faulting, mounds, knolls, gas seeps, oil seeps, or hard bottom within this area. Currently, there are no pipelines or communications cables in the vicinity of the proposed project area based on results of a high-resolution geophysical survey consisting of frequency-enhanced three-dimensional seismic, enhanced surface renderings, autonomous underwater vehicle surveys, and side-scan sonar. The abandoned Stones #4 well was drilled at the drill center in 2012 and will be avoided when placing new subsea infrastructure at the drill center. No other subsea infrastructure exists within 500 ft (152 m) of planned activities.

See **DOCD Section 6a** for supporting geological and geophysical information.

D.2 Severe Weather

Under most circumstances, weather is not expected to have any effect on the proposed activities. The FPSO and single-point mooring will be designed for a 10,000-year winter storm or a 10,000-year sudden hurricane extreme surface conditions as well as 10,000-year Loop Current and near bottom current conditions, thus the FPSO will remain moored onsite during winter storms, loop events, and sudden hurricanes. 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 FPSO for safety reasons until the storm or weather event passes. In the event of a named storm or hurricane, the FPSO would disconnect from its moorings and depart the field under its own propulsion following the procedures in Shell's Hurricane Evacuation Plan.

D.3 Currents and Waves

A deepwater metocean mooring system will be utilized to provide real time environmental information for the production system and support operations. Measurements will be recorded internally (both within sensors and in the control system) on the mooring and transmitted in real time. Compliance with NTL 2009-G02 will be achieved with a pair of Acoustic Doppler Current Profiler (ADCP) meters transmitting in real-time through a surface link. Metocean conditions such as sea states, wind speed, ocean currents, sea and air temperatures, and barometric pressure will be obtained with a surface buoy. A near bottom mounted current meter will obtain near sea floor current measurements. Under most circumstances, physical oceanographic conditions are not expected to have any effect on the proposed activities. Strong currents (e.g., caused by Loop Current eddies and intrusions) and large waves were considered in the design criteria for the FPSO. High waves during a severe storm could disrupt support activities (vessel and helicopter traffic) and make it necessary to suspend some activities on the FPSO for safety reasons until the storm or weather event passes.

E. Alternatives

No formal alternatives were evaluated in this EIA. However, various technical and operational options, including the location of the FPSO and the design specifics of the FPSO and mooring system, were considered by Shell in developing the proposed action. There are no other reasonable alternatives to accomplish the goals of this project.

F. Mitigation Measures

The proposed action includes numerous mitigation measures required by laws, regulations, and BOEM lease stipulations and NTLs. The project will comply with applicable federal, state, and local requirements concerning air pollutant emissions, discharges to water, and solid waste disposal. Project activities will be conducted under Shell's OSRP and will include the measures described in **DOCD Section 2f**.

G. Consultation

No persons or agencies were consulted regarding potential impacts associated with the proposed activities during the preparation of this EIA.

H. Preparers

The EIA was prepared at the direction of 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 2 – Production data table

Section 5 – Reservoir development

B. Bibliography

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- GEMS prepared a Wellsite Descriptions, Proposed Wellsites C & D, Walker Ridge 508 (Report Number 0306-1151) dated May 2006 for Shell.
- Fugro GeoConsulting, Inc. wrote an Integrated Geophysical and Geotechnical Field Development Planning Study (Report Number 27.2009-2328) dated May 2010 for Shell.
- Fugro prepared an AUV Archaeological Assessment Stones Development Area Blocks 420, 464, 508 and 552 Walker Ridge Area (Report Number 2411-1019) dated July 2011 for Shell.
- C&C Technologies prepared an Archeological Assessment Survey for Stones Development Prospect (Report 110394) on Blocks 507, 508, 551, and 552 and vicinity in Walker Ridge Area dated August 2011 for Shell.
- C&C Technologies (C&C) prepared a Hazard Assessment Site Clearance and Drill Center, Blocks 507, 508, 550, 551, and 552 and Vicinity Walker Ridge, Volumes 1-3 (Number 110394) dated November 2011 for Shell.
- C&C Technologies prepared an Archaeological, Engineering & Hazard Assessment Proposed 8" Gas Export Pipeline, Flowline and Umbilical Routes (Report 110394) Dated December 2011 for Shell.
- C&C Technologies prepared a Geotechnical Laboratory Testing Data Report, Stones Export Line Survey (Report No. 110394) dated February 3, 2012 for Shell Offshore Gas Pipeline.
- CSA International, Inc. Environmental Impact Analysis, April 2013
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