Prepared by:

U.S. Department of Transportation

Maritime Administration

Final Environmental Impact Statement

Sea Port Oil Terminal Deepwater Port Project

July 2022

Docket No. MARAD-2019-0011

Volume I

FINAL ENVIRONMENTAL IMPACT STATEMENT
FOR
SPOT TERMINAL LLC
DEEPWATER PORT LICENSE APPLICATION

Location: Federal waters within the Outer Continental Shelf, Galveston Area, South Addition Protraction Area (Gulf of Mexico) approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas.

Docket Number: MARAD-2019-0011

Prepared By: The U.S. Coast Guard (USCG) and Maritime Administration (MARAD) with technical support from its third-party environmental contractor, Environmental Resources Management.

Cooperating Agencies: U.S. Environmental Protection Agency; U.S. Department of the Interior's Bureau of Ocean Energy Management, Bureau of Safety and Environmental Enforcement, and U.S. Fish and Wildlife Service; U.S. Department of Commerce's National Oceanic and Atmospheric Administration, National Marine Fisheries Service (NMFS); U.S. Department of Agriculture's Natural Resources Conservation Service; U.S. Army Corps of Engineers; and U.S. Department of Transportation Pipeline and Hazardous Materials Safety Administration.

Contact Information: Contact MARAD via email at SPOT_EIS@dot.gov and the USCG at DeepwaterPorts@uscg.mil.

Abstract: SPOT Terminal Services LLC, a wholly owned subsidiary of Enterprise Products Operating LLC, seeks a Federal license under the Deepwater Port Act of 1974 (DWPA), as amended, to own, construct, operate, and eventually decommission a deepwater port for the export of crude oil. The proposed deepwater port would be located in Federal waters within the Outer Continental Shelf, Galveston Area, South Addition Protraction Area (Gulf of Mexico), approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas, in water depths of approximately 115 feet (35 meters). The onshore components would consist of modifications to the existing Enterprise Crude Houston (ECHO) Terminal, located on the southeast side of Houston, to support the delivery of crude oil to the proposed Oyster Creek Terminal; one 50.1-mile pipeline from the existing ECHO Terminal to the proposed Oyster Creek Terminal; one pipeline interconnection; a new Oyster Creek Terminal, including seven aboveground storage tanks; two collocated 12.2-mile crude oil pipelines from the Oyster Creek Terminal to the shore crossing where the onshore pipelines meet the offshore pipelines supplying the SPOT DWP; and ancillary facilities for the onshore pipelines. The offshore components would consist of two collocated 46.9-mile offshore pipelines for crude oil delivery from the Oyster Creek Terminal to the platform; one fixed offshore platform; two SPM buoys to concurrently moor two VLCCs or other crude oil carriers; four pipeline end manifolds (PLEM)—two per SPM buoy—to provide the interconnection with the pipelines; four 0.66-nautical mile pipelines (two per PLEM) to deliver crude oil from the platform to the PLEMs; four 0.66-nautical mile vapor recovery pipelines (two per PLEM) to connect the VLCC or other crude oil carrier to the three vapor combustion units on the platform; three service vessel moorings, located in the southwest corner of Galveston Area lease block 463; and an anchorage area in Galveston Area lease block A-59.

Date of Publication: July 29, 2022

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ACRONYMS AND ABBREVIATIONS

Acronym	Definition
°C	degrees Celsius
°F	degrees Fahrenheit
μPa	microPascal
ACT	Antiquities Code of Texas
Agreement	Paris Climate Agreement
AHT	anchor handling tug
AIS	Automated Identification System
APE	area of potential effect
API	American Petroleum Institute
Applicant	SPOT Terminal Services LLC
AQS	Air Quality System
ARPA	Archeological Resources Protection Act
ASME	American Society of Mechanical Engineers
ATBA	areas to be avoided
ATWS	additional temporary workspace
BA	Biological Assessment
BACT	best available control technology
bbl	barrels
BCC	birds of conservation concern
B.C.E	before common era
BCR	bird conservation region
BGEPA	Bald and Golden Eagle Protection Act
BMOP	Blue Marlin Offshore Port
BMP	best management practice
BOEM	Bureau of Ocean Energy Management
bpd	barrels per day
bph	barrels per hour
BSE	bays, estuaries, and sounds
BSEE	Bureau of Safety and Environmental Enforcement
CAA	Clean Air Act
CBCMB	Columbia Bottomlands Conservation Mitigation Bank
CEQ	Council on Environmental Quality
CFR	Code of Federal Regulations
CGMTA	U.S. Coast Guard and Maritime Transportation Act of 2012
CH_4	methane
CNW	commercially navigable waterway
CO	carbon monoxide
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
COLREGS	International Regulations for Preventing Collisions at Sea 1972
COSIM	Chemical/Oil Spill Impact Module
Cr	chromium
CR	County Road
CWA	Clean Water Act
CZMA	Coastal Zone Management Act
dB	decibel
dBA	A-weighted decibel
DO	dissolved oxygen
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DWH	Deepwater Horizon
DWP	deepwater port
DWPA	Deepwater Port Act
DWPSP	Deepwater Port Security Plan
ECHO	Enterprise Crude Houston
ECHO to Oyster Creek Pipeline	36-inch-diameter pipeline from the existing ECHO Terminal to the proposed Oyster Creek Terminal
EEM	estuarine emergent
EEZ	Exclusive Economic Zone
EFH	Essential Fish Habitat
EI	Environmental Inspector
EIA	Energy Information Administration
EIS	environmental impact statement
EMS	emergency medical services
EOP MP	ECHO to Oyster Creek Pipeline milepost
EPO	Enterprise Products Operating LLC
ERM	Environmental Resources Management
ESA	Endangered Species Act
ESS	estuarine scrub shrub

Acronym	Definition
FAA	Federal Aviation Administration
FAD	fish aggregating device
FCU	functional capacity unit
Fed. Reg.	Federal Register
FERC	Federal Energy Regulatory Commission
FGBNMS	Flower Garden Banks National Marine Sanctuary
FHWG	Fisheries Hydroacoustic Working Group
FM	Farm to Market Road
FMP	fishery management plan
ft^3	cubic feet
FY	fiscal year
g	gravity
g/m^2	grams per square meter
GCEDD	Gulf Coast Economic Development District
GCPMB	Gulf Coastal Plains Mitigation Bank
GDP	gross domestic product
GEMS	Gulf Ecological Management Sites
GHG	greenhouse gas
GIS	geographic information system
GIWW	Gulf Intracoastal Waterway
GLO	Texas General Land Office
GMGMC	Gulf of Mexico Fishery Management Council
GoM	Gulf of Mexico
gpd	gallons per day
gpm	gallons per minute
GWP	global warming potential
H_2S	hydrogen sulfide
HAP	hazardous air pollutant
HAZID	hazard identification
HCA	high consequence area
HDD	horizontal directional drill
HGB	Houston-Galveston-Brazoria
HIPPS	high integrity pipeline protection system
HIOS	High Island Operating System
HMS	highly migratory species
hp	horsepower
HPA	high population area

Acronym	Definition
Hz	hertz
IBA	Important Bird Area
IEA	International Energy Agency
IMO	International Maritime Organization
IPCC	Intergovernmental Panel on Climate Change
ISD	Independent School District
ISPS	International Ship and Port Facility Security
kHz	kilohertz
km	kilometer
kW/m^2	kilowatts per square meter
LACT	lease automatic custody transfer
LBRMB	Lower Brazos River Mitigation Bank
L_{dn}	day-night sound level
L_{eq}	equivalent sound level
LFL	lower flammability limit
LiDAR	light detection and ranging
L_{max}	maximum sound level
LNG	liquefied natural gas
LOC	loss of containment
LOOP	Louisiana Offshore Oil Port
LOS	Level of Service
LPG	liquefied petroleum gas
MACT	Maximum Achievable Control Technology
MAG	magnetometer
MARAD	U.S. Maritime Administration
MARPOL	International Convention for the Prevention of Pollution from Ships
MBTA	Migratory Bird Treaty Act
MERA	Modeling and Effects Review
MERP	Modeled Emission Rate for Precursor
mg/L	milligrams per liter
MLLW	mean lower low water
MLV	mainline valve
mm	millimeter
mmbbl/d	million barrels per day
MMPA	Marine Mammal Protection Act
MMS	Minerals Management Service
MP	milepost
MPA	Marine Protection Area

Acronym	Definition
MPRSA	Marine Protection Research and Sanctuaries Act
MSA	Magnuson-Stevens Fishery Conservation and Management Act
N_2O	nitrous oxide
NAA	no anchor area
NAAQS	National Ambient Air Quality Standards
NAGPRA	Native American Graves Protection and Repatriation Act
NDC	Nationally determined contribution
NEPA	National Environmental Policy Act
NFPA	National Fire Protection Association
NHPA	National Historic Preservation Act
Ni	nickel
NLCD	National Land Cover Database
NMFS	National Marine Fisheries Service
NO_2	nitrogen dioxide
NOA	Notice of Application
NOI	Notice of Intent
NOx	nitrogen oxides
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
NRHP	National Register of Historic Places
NRI	Nationwide Rivers Inventory
NSA	noise sensitive area
NSR	New Source Review
NTL	Notices to Lessees and Operators
NWR	National Wildlife Refuge
OCP	Operator Cleanup Program
OCS	Outer Continental Shelf
OPA90	Oil Pollution Act of 1990
OPAREA	operating areas
OPSMAN	Port Operations Manual
OSP MP	Oyster Creek to Shore Pipeline milepost
Oyster Creek to Shore Pipelines	two 36-inch-diameter crude oil pipelines from the Oyster Creek Terminal to the shore crossing
Pa	Pascal
PAH	polycyclic aromatic hydrocarbon
Pb	lead
PBF	physical and biological features

Acronym	Definition
PCB	polychlorinated biphenyl
PEM	palustrine emergent
PFO	palustrine forested
pga	peak ground acceleration
PHMSA	Pipeline and Hazardous Materials Administration
PLEM	pipeline end manifold
PM_{10}	particulate matter with aerodynamic diameter of less than 10 micrometers
$PM_{2.5}$	particulate matter with aerodynamic diameter of less than 2.5 micrometers
ppb	parts per billion
ppb-hours	parts per billion per hours
PRA	permit review area
PRM	permittee-responsible mitigation
Project	Sea Port Oil Terminal Deepwater Port Project
Proposed Action	the proposed SPOT Project
PSD	Prevention of Significant Deterioration
PSS	palustrine scrub-shrub
PSV	pressure safety valve
PTS	permanent threshold shift
RHA	Rivers and Harbors Act
RMC	resource management code
RMS	root mean square
ROD	Record of Decision
ROI	Region of Influence
RP	return period
RRC	Railroad Commission of Texas
RTHL	Register of Texas Historic Landmarks
RV	recreational vehicle
SAL	State Antiquities Landmark
SCC	stress corrosion cracking
SDRDB	Submitted Driller's Report Database
SEAMAP	Southeast Area Monitoring and Assessment Program
Secretary	Secretary of Transportation
SEL	sound exposure level
SEL_{cum}	cumulative sound exposure level

Acronym	Definition
SH	State Highway
SHPO	State Historic Preservation Office
SIL	Significant Impact Level
SIP	State Implementation Plan
SLA	Submerged Lands Act
SO_2	sulfur dioxide
SPL	sound pressure level
SPM	single point mooring
SPOT	Sea Port Oil Terminal
SPOT DWP	SPOT deepwater port
SQuiRTs	Screening Quick Reference Tables
SSURGO	Soil Survey Geographic database
SVOC	semi-volatile organic compound
SWPPP	Stormwater Pollution Prevention Plan
TAN	total acid number
TCEQ	Texas Commission on Environmental Quality
TCMP	Texas Coastal Management Program
TCP	traditional cultural property
TDS	total dissolved solids
TDWT	total deadweight tonnage
TEMPSC	totally enclosed motor-propelled survival craft
Texas GulfLink	Texas GulfLink Project
Texas Gulf Terminals	Texas Gulf Terminals, Inc.
THC	Texas Historical Commission
THPO	Tribal Historic Preservation Office
TIA	traffic impact analysis
TMDL	total maximum daily load
TOC	total organic carbon
TPWD	Texas Parks and Wildlife Department
TRV	toxicity reference values
TSS	total suspended solids
TTS	temporary threshold shift
TxDOT	Texas Department of Transportation
UDP	Unanticipated Discoveries Plan
UME	Unusual mortality event
U.S.	United States
USA	unusually sensitive area
USACE	U.S. Army Corps of Engineers

Acronym	Definition
U.S.C.	United States Code
USCG	United States Coast Guard
USDA	U.S. Department of Agriculture
USDOI	U.S. Department of the Interior
USEPA	U.S. Environmental Protection Agency
USFWS	U.S. Fish and Wildlife Service
USGS	U.S. Geological Survey
UTOS	U-T Operating System
VHF	very high frequency
VLCC	very large crude carrier
VOC	volatile organic compound
WCD	worst-case discharge
WCI	worst credible impact
WCS	Western Canadian Select
WTI	West Texas Intermediate

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EXECUTIVE SUMMARY

ES1. INTRODUCTION

SPOT Terminal Services LLC (hereinafter referred to as the Applicant), a wholly owned subsidiary of Enterprise Products Operating LLC (EPO), a Texas limited liability company, is proposing the Sea Port Oil Terminal (SPOT) Project (hereafter referred to as the SPOT Project, SPOT deepwater port [SPOT DWP], or the Project). On January 31, 2019, the Applicant submitted an application to the Maritime Administration (MARAD) and United States Coast Guard (USCG) seeking a Federal license under the Deepwater Port Act of 1974 (DWPA), as amended, to own, construct, operate, and eventually decommission a deepwater port (DWP) for the transportation of crude oil for export to the global market in United States (U.S.) Federal waters between 27.2 and 30.8 nautical miles off the coast of Brazoria County, Texas. The SPOT DWP would allow for up to two very large crude carriers (VLCCs) or other crude oil carriers to moor at single point mooring (SPM) buoys. EPO proposes to use its affiliates' existing assets and access to varying grades of crude oil supplies from multiple sources along the northern Texas Gulf Coast. Oil would be transported from the proposed Oyster Creek Terminal through the Oyster Creek to Shore Pipelines and the subsea pipelines, and delivered to the offshore platform. Upon filing the Notice of Application (NOA) in the Federal Register (Fed. Reg.) on March 4, 2019, MARAD assigned the proposed SPOT Project Docket No. MARAD-2019-0011.

Together, MARAD and the USCG are the lead Federal agencies responsible for processing the application for the proposed SPOT Project. In accordance with Section 5(f) of the DWPA (33 United States Code [U.S.C.] § 1504(f)), this Environmental Impact Statement (EIS) has been prepared in cooperation with additional Federal agencies and departments to comply with the requirements of the National Environmental Policy Act (NEPA) of 1969. Such compliance fulfills the NEPA responsibilities of these agencies and departments related to the licensing and review of the proposed Project and the requirements of NEPA; the DWPA; USCG Commandant 5090.1; Department of Homeland Security Management Directive 23-01, Environmental Planning Program; the U.S. Department of Transportation (DOT) Order 5610.1C, "Procedures for Considering Environmental Impacts;" and Maritime Administrative Order 600-1, "Procedures for Considering Environmental Impacts." The U.S. Environmental Protection Agency (USEPA) and U.S. Army Corps of Engineers (USACE) have formally agreed to be cooperating agencies for the purpose of this EIS and they may incorporate the EIS in their permitting processes. Additionally, the following agencies are cooperating agencies for the purpose of this EIS: the U.S. Department of Energy, the U.S. Department of the Interior, the Bureau of Ocean Energy Management, the Bureau of Safety and Environmental Enforcement, the U.S. Fish and Wildlife Service, the National Oceanic and Atmospheric Administration Fisheries Service (the National Marine Fisheries Service), and the DOT Pipeline and Hazardous Materials Safety Administration (PHMSA). These agencies have provided review and comment on the Project as part of the NEPA process.

The DWPA of 1974, as amended, defines a licensing system for ownership, construction, operation, and eventual decommissioning of DWPs in waters beyond state jurisdiction. Originally, the DWPA promoted the construction and operation of DWPs as a safe and effective means of importing oil into the United

States and transporting oil from the Outer Continental Shelf (OCS), while minimizing tanker traffic and associated risks close to shore. The DWPA currently defines a DWP as "any fixed or floating manmade structure other than a vessel, or any group of such structures, that are located beyond State seaward boundaries and that are used or intended for use as a port or terminal for the transportation, storage, or further handling of oil or natural gas for transportation to or from any State, except as otherwise provided in Section 1522 of this title, and for other uses not inconsistent with the purposes of this chapter, including transportation of oil or natural gas from the United States outer continental shelf." State seaward boundaries refer to the areas of the Gulf of Mexico (GoM) over which coastal states have jurisdiction. The State of Texas boundary is approximately 9 nautical miles offshore. As such, under the DWPA, the Federal government regulates the location, ownership, construction, and operation of DWPs outside of 9 nautical miles from the Texas coast. To adjust to changing markets and regulate the export of product, the U.S. Coast Guard and Maritime Transportation Act of 2012, amended Section 3(9)(A) of the DWPA to insert the words "or from" before the words "any State" in the definition of a DWP (33 U.S.C. § 1502(9)(A)). This change granted MARAD the authority to license the construction of DWPs for the export of oil and natural gas from domestic sources within the United States to foreign global markets.

Under the DWPA, all DWPs must be licensed by the Secretary of Transportation (Secretary). The Secretary has delegated authority to MARAD and the USCG to process applications submitted by private parties to construct, own, and operate DWPs (62 Fed. Reg. 48 [March 12, 1997], 11382). The USCG retains this responsibility under the Department of Homeland Security. On June 18, 2003, the Secretary delegated authority to MARAD to issue, transfer, amend, or reinstate a license for the construction and operation of a DWP. The responsibility for preparing the SPOT Project Record of Decision and for issuing or denying the DWP license has also been delegated to MARAD. Hereafter, "Secretary" refers to the Maritime Administrator as the delegated representative of the Secretary. On April 30, 2013, MARAD issued a *Notice of Policy Clarification Concerning the Designation of Adjacent Coastal States for Deepwater Port License Applications*, advising the public that nautical miles shall be used when determining adjacent coastal state status. Pursuant to the criteria provided in the DWPA, Texas is the only adjacent coastal state for the proposed SPOT Project, as it would be directly connected by pipeline to the SPOT DWP. No other state would be directly connected to the SPOT DWP or within 15 nautical miles of the proposed Project. Other states may apply for adjacent coastal state status in accordance with 33 U.S.C. § 1508(a)(1).

On March 4, 2019, MARAD issued a NOA for the Project in the Fed. Reg., summarizing the Applicant's DWP application (84 Fed Reg. 42, (March 4, 2019), 7413-15). Under procedures set forth in the DWPA, MARAD and the USCG have 240 days from the date of the NOA to hold one or more public license hearings in the adjacent coastal state(s) for a project.

On March 7, 2019, MARAD issued a Notice of Intent (NOI), which also included a notice of public meeting and request for comments on the Project (84 Fed. Reg. 45 (March 7, 2019), 8401-04). In this notice, MARAD and the USCG stated their intent to prepare an EIS as part of the environmental review for the SPOT Project and hold one public scoping meeting on March 20, 2019, in the adjacent coastal State of Texas, and requested to receive comments by Monday, April 8, 2019.

On February 7, 2020, MARAD issued a Notice of Availability for the Draft EIS, which also included a notice of public comment meeting and request for comments on the Project (85 Fed. Reg. 26 [February 7, 2020], 7381–7383). In this notice, MARAD and the USCG made the Draft EIS available for public review and comment. The agencies also announced their intent to hold one public comment meeting on February 26, 2020, in the adjacent coastal State of Texas, and requested to receive comments by March 23, 2020. Subsequently, MARAD and the USCG issued a Notice of Extension in the Fed. Reg. (85 Fed. Reg. 85 [May 1, 2020], 25507–25508) on May 1, 2020, announcing an extension of the public comment period through May 31, 2020, due to the COVID-19 pandemic.

On October 8, 2021, MARAD issued a Notice of Availability for the Draft General Conformity Determination (86 Fed. Reg. 193 [October 8, 2021], 56349-56350). The notice announced the opening of a 30-day comment period and provided directions for submitting comments on the Draft General Conformity Determination.

On October 29, 2021, MARAD and the USCG issued a Notice of Availability for the Supplemental Draft EIS, which also announced a virtual public meeting and requested comments on the Project (86 Fed. Reg. 207 [October 29, 2021], 60093–60095). In this notice, MARAD and the USCG made the Supplemental Draft EIS available for public review and comment. Due to the ongoing COVID-19 pandemic, the agencies also announced their intent to hold one virtual public meeting on November 16, 2021, and requested to receive comments by December 13, 2021.

The Applicant filed a permit application required under Section 10 of the Rivers and Harbors Act and Section 404 of the Clean Water Act with the USACE on March 15, 2019. The USACE published a Public Notice for the permit application on February 11, 2020, under reference number SWG-2018-00751. The Applicant filed a draft National Pollutant Discharge Elimination System permit with the USEPA on January 31, 2019, and subsequent revisions to the application in both March and April 2020. The Applicant also submitted draft permit applications required under the Clean Air Act to the USEPA on January 31, 2019, and submitted a revised Title V permit application in March 2020. The Applicant has coordinated with these various agencies regarding requests for additional information and other permitting requirements. These permitting activities are outside the authority of MARAD and the USCG and occur on separate, but concurrent paths to the NEPA evaluation.

ES2. DESCRIPTION OF THE PROPOSED ACTION

The proposed Project would have both onshore and offshore components. The proposed SPOT DWP would be located in Federal waters of the GoM, in Galveston Area OCS lease blocks 463 and A-59, approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas, in water depths of approximately 115 feet. The onshore components would include the existing Enterprise Crude Houston (ECHO) Terminal, new Oyster Creek Terminal, and onshore pipelines from the existing terminal to the mean high-water line at the shore crossing. The offshore components would include the SPOT DWP and connected facilities, including the subsea pipelines, to the mean high-water line on shore.

The onshore components of the Project would consist of:

- Modifications to the existing ECHO Terminal, located on the southeast side of Houston, Texas, just east of Pearland, Texas, including four electric motor-driven mainline crude oil pumps, four electric motor-driven booster crude oil pumps, and one measurement skid to support delivery of crude oil to the proposed Oyster Creek Terminal;

- One 50.1-mile, 36-inch-diameter pipeline from the existing ECHO Terminal to the proposed Oyster Creek Terminal (hereafter referred to as the ECHO to Oyster Creek Pipeline);
- One pipeline interconnection from the existing Rancho II 36-inch-diameter pipeline to the ECHO to Oyster Creek Pipeline, at the existing Rancho II Junction facility;
- A new Oyster Creek Terminal, including six electric motor-driven mainline crude oil pumps with the capacity to push crude oil to the offshore pipelines at a rate of up to 85,000 barrels per hour (2 million barrels per day), four electric motor-driven booster crude oil pumps, seven aboveground storage tanks (each with a capacity of 685,000 barrels (bbl) [600,000 bbl of working storage]) for a total onshore storage capacity of approximately 4.8 million bbl (4.2 million bbl working storage) of crude oil, metering equipment, two permanent and one portable vapor combustion units, and a firewater system;
- Two collocated 12.2-mile, 36-inch-diameter crude oil pipelines from the proposed Oyster Creek Terminal to the shore crossing where the onshore pipelines meet the offshore pipelines supplying the SPOT DWP (hereafter referred to as Oyster Creek to Shore Pipelines); and
- Ancillary facilities for the onshore pipelines, including ten mainline valves (MLVs), of which six would be along the ECHO to Oyster Creek Pipeline and four along the Oyster Creek to Shore Pipelines, pig launchers for the ECHO to Oyster Creek Pipeline, and pig launchers and receivers for the Oyster Creek to Shore Pipelines.

The offshore components of the Project would consist of:

- Two collocated, bi-directional, 46.9-mile, 36-inch-diameter crude oil offshore pipelines for crude oil delivery from the proposed Oyster Creek Terminal to the platform;
- One fixed offshore platform with eight piles, four decks, and three vapor combustion units;
- Two SPM buoys to concurrently moor two VLCCs or other crude oil carriers with capacities between 120,000 and 320,000 deadweight tonnage for loading up to 365 days per year, including floating crude oil and vapor recovery hoses;
- Four pipeline end manifolds (PLEMs)—two per SPM buoy—to provide the interconnection with the pipelines;
- Four 0.66-nautical mile, 30-inch-diameter pipelines (two per PLEM) to deliver crude oil from the platform to the PLEMs;
- Four 0.66-nautical mile, 16-inch-diameter vapor recovery pipelines (two per PLEM) to connect the VLCC or other crude oil carrier to the three vapor combustion units on the platform;
- Three service vessel moorings, located in the southwest corner of Galveston Area lease block 463; and
- An anchorage area in Galveston Area lease block A-59, which would not contain any infrastructure.

Detailed descriptions of the Proposed Action are provided in Section 2.2, Detailed Description of the Proposed Action.

ES3. PUBLIC INVOLVEMENT

Agency and public participation in the NEPA process promotes open communication between the public and the government and enhances decision-making. All persons and organizations having a potential interest in the Secretary's decision whether to grant the license are encouraged to participate in the decision-making process.

MARAD and the USCG initiated the public scoping process on March 7, 2019, with the publication of a NOI to prepare an EIS in the Fed. Reg. The NOI included information on the public meeting and informational open house; requested public comments on the scope of the EIS; and provided information on how the public could submit comments by mail, hand delivery, facsimile, or electronic means. MARAD and the USCG set April 8, 2019, as the closing date for receipt of materials in response to the request for comments on the proposed Project. The NOI also announced the establishment of a public docket, accessible through the Federal Docket Management System website: http://www.regulations.gov under docket number MARAD–2019–0011.

MARAD and the USCG delivered an Interested Party Letter, a copy of the NOI published in the Fed. Reg., and a description of the proposed Project to potentially interested parties on March 7, 2019. They also delivered letters to Federal, state, and local agency representatives, and other potentially interested parties on March 4, 2019. Public comments and agency correspondence submitted as part of the scoping process were considered during the development of the EIS. Seven comments were received via the public docket during the scoping period, and comments were also received from a number of Federal, state, and local agencies and tribes, including the Bureau of Safety and Environmental Enforcement, U.S. Department of Agriculture Natural Resources Conservation Service, USEPA, U.S. Fish and Wildlife Service, Railroad Commission of Texas, Texas Commission on Environmental Quality, Texas Department of Transportation, Texas Historical Commission, Texas General Land Office, Texas Parks and Wildlife Department (TPWD), Port Freeport, American Indians of Texas of Spanish Colonial Missions, Choctaw Nation of Oklahoma, Coushatta Tribe of Louisiana, and Quapaw Nation. The comments are addressed in this EIS.

MARAD and the USCG issued a Notice of Availability in the Fed. Reg. on February 7, 2020 (85 Fed. Reg. 26 [February 7, 2020], 7381–7383) announcing the availability of the Draft EIS for public review (Appendix A, Public Notices). The Notice of Availability included information on the public meeting and informational open house; requested public comments on the Draft EIS; and provided information on how the public could submit comments by mail, hand delivery, facsimile, or electronic means. The comment period ended on March 23, 2020. Subsequently, MARAD and the USCG issued a Notice of Extension in the Fed. Reg. (85 Fed. Reg. 85 [May 1, 2020], 25507–25508) on May 1, 2020, announcing an extension of the public comment period through May 31, 2020, due to the COVID-19 pandemic limiting the capability of the public to provide feedback on the Draft EIS. MARAD and the USCG delivered an Interested Party Letter and a copy of the Notice of Availability to potentially interested parties, including Federal, state and local agency representatives, tribal representatives, landowners, and other stakeholders on January 31, 2020. Public comments submitted as part of the public comment process, both the initial ending March 23, 2020, and the secondary ending May 31, 2020, were considered during the development of the Supplemental Draft EIS and are included, as relevant, in Appendix C1.

A total of 3 submissions from Federal agencies, 2 submissions from state agencies, 1 submission from a local government, 2 submissions from a Tribe, 25 submissions from non-governmental organizations, 1 submission from a business, and 37,325 submissions from individuals were received on the Federal docket under docket number MARAD-2019-0011 for the Draft EIS.

MARAD and the USCG issued a Notice of Availability in the Federal Register on October 8, 2021 (86 Fed. Reg. 193, 56349-56350) announcing the availability of the Draft General Conformity Determination. The notice was published in the Federal Register, and newspaper ads ran twice during the comment period in each of the following papers in English, Spanish, or Vietnamese, as appropriate: *The Facts, Alvin Sun, The Houston Chronicle, Pearland Journal, The Daily News Galveston County, The Vietnam Post, La Prensa de Houston, La Voz de Houston, Vietnam Daily News, and La Informacion*. A total of one submission from a non-governmental organization, 25 individual submissions with unique content, and 1,844 individual form letter submissions, for a total of 1,870 submissions were received on the Federal docket under docket number MARAD-2019-0011 and were considered in the Final General Conformity Determination (Appendix C2 and V).

MARAD and the USCG issued a Notice of Availability in the Federal Register on October 29, 2021 (86 Fed. Reg. 207, 60093–60095) announcing the availability of the Supplemental Draft EIS for public review (Appendix A, Public Notices). The Notice of Availability included information on the public meeting; requested public comments on the Supplemental Draft EIS; and provided information on how the public could submit comments. The notice was published in the Federal Register, and newspaper ads ran twice during the comment period in each of the following papers in English, Spanish, or Vietnamese, as appropriate: *The Facts, Alvin Sun, The Houston Chronicle, Pearland Journal, The Daily News Galveston County, The Vietnam Post, La Prensa de Houston, La Voz de Houston, Vietnam Daily News, and La Informacion*. The Supplemental Draft EIS was made available on the Project website at www.SPOTNEPAProcess.com beginning October 29, 2021 and digital copies of the documents were made available at the Freeport and Lake Jackson Public Libraries on December 7, 2021. A total of one submission from a Federal agency, one submission from a state agency, 11 submissions from non-governmental organizations, 473 individual submissions with unique content (including oral comments at the public meeting), and 46,784 individual form letter submissions were received on the Supplemental Draft EIS via Federal docket number MARAD 2019 0011, for a total of 47,270 submissions.

ES4. ALTERNATIVES CONSIDERED

NEPA requires any Federal agency proposing a major action to consider alternatives to the Proposed Action. To warrant detailed evaluation by MARAD and the USCG, an alternative must be reasonable and meet the purpose and need of the Proposed Action. The Council on Environmental Quality defines reasonable as, "practical or feasible from the technical and economic standpoint and using common sense." Specific criteria are used to determine the reasonability/feasibility of alternatives and are described in Sections 2.3, No Action Alternative, through 2.10, Decommissioning Alternatives. Evaluation of the alternatives assists in broadening the scope of options that might be available to reduce or avoid impacts associated with the action as proposed by the Applicant. The NEPA analysis is one of the nine factors the Secretary must consider in making a final determination (33 U.S.C. § 1503c).

MARAD and the USCG evaluated a number of alternatives related to various components of the SPOT Project. Those that would not meet the purpose and need of the Proposed Action are discussed in Chapter 2, Description of the Proposed Action and Alternatives, but are not evaluated further in this EIS. Alternatives that could meet the purpose and need of the Proposed Action are presented in Chapter 2, Description of the Proposed Action and Alternatives, and are evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

The No Action Alternative refers to the continuation of existing conditions without implementation of the Proposed Action. Under the No Action Alternative, the infrastructure proposed by the Applicant would not be built or brought online, and the potential beneficial or adverse environmental impacts identified in this EIS would not occur. Furthermore, the purpose of the Proposed Action to transport and export excess and available domestic crude oil supplies to the global market with reduced use of ship-to-ship transfers would not be satisfied under the No Action Alternative. Similarly, if the Secretary were to deny the Applicant's DWPA license application, it is likely that exports of oil that are already occurring due to international global demand and domestic excess production would continue to use shoreside terminals in combination with offshore ship-to-ship transfers. As current excess production exceeds the capacity of existing shoreside terminals, a denial of a DWP license could result in expansion or establishment of onshore oil terminals in other locations along the Gulf Coast. Other license applications concerning proposals to export crude oil might be submitted to the Secretary, or other means might be used to export oil, such as expansion or establishment of onshore oil terminals that would require construction of onshore export facilities, including storage tanks, and pumping facilities. Chapter 1, Introduction, of this EIS includes a description of the Project's purpose and need, which provides additional information regarding the Applicant's proposal to fully load VLCCs or other crude oil carriers offshore.

The Proposed Action is an export project and, as such, any alternatives considered must have the ability to export crude oil. Furthermore, surplus crude oil sources from excess production capability, at the time of this EIS, are primarily located in the Permian Basin in west Texas and the Eagle Ford Basin in south Texas. Thus, the system alternatives evaluated focus on new, existing, and proposed infrastructure capable of delivering and storing crude oil from these basins, ideally located along the Gulf Coast. This EIS evaluated the expansion of proposed or existing offshore crude oil loading terminals in the GoM, as well as the construction of new or expansion of existing onshore crude oil terminals on the Gulf Coast. Offshore, one existing and four proposed projects in the GoM were identified for evaluation as expansion system alternatives, including the Louisiana Offshore Oil Port, Bluewater Texas Terminal, LLC, Texas GulfLink Holdings, and Blue Marlin Offshore Port, LLC. The Proposed Action's export volume would require a substantial expansion of any of these projects to meet the capabilities of the Proposed Action discussed in Section 2.2, Detailed Description of the Proposed Action. As such, these projects would need to meet regulatory and development requirements for the area in which they are operating or proposed and would, therefore, include evaluation for environmental impacts, associated permitting timelines, and mitigation costs. These projects would result in environmental impacts similar to or greater than the Proposed Action and are therefore not considered further in this EIS. One proposed onshore terminal along the GoM was identified for evaluation that would be capable of fully loading VLCCs—the Axis Harbor Island Marine Terminal. Axis Island Marine Terminal would not be able to meet the capacity and also would not be capable of fully loading VLCCs. In addition, existing terminals along the Gulf Coast are not capable of fully loading VLCCs and would require a substantial amount of dredging. Therefore, construction of new or expansion of existing onshore crude terminals as a system alternative would not meet the purpose and need of the Proposed Action and is not considered further in this EIS.

Onshore, five major alternative pipeline routes and one minor alternative pipeline route were identified from the existing ECHO Terminal in Harris County to the shoreline of the GoM in Brazoria County (ECHO to Oyster Creek Pipeline), including the Proposed Action. A comment received during the Draft General Conformity comment period proposed an alternative route from Oyster Creek, Texas to a shoreline crossing that would extend through Freeport, Texas. However, this alternative would substantially increase impacts on environmental justice communities, and was not considered further in this EIS. The five major alternative routes that were considered included two from the ECHO Terminal to the area near Sandy Point, Texas south of Highway 6, and three from that point to the shoreline. The minor alternative route was evaluated for the southernmost portion of the collocated Oyster Creek to Shore Pipelines. The alternatives take into account existing linear rights-of-way with which the Proposed Action could be collocated to minimize effects and are all considered in Chapter 3, Environmental Analysis of the Proposed Action.

The SPOT Project would require approximately 100 acres for storage and pumping facilities to receive, transport, store, and deliver the crude oil volumes. Because of the industrial nature of the area surrounding the existing ECHO Terminal in Harris County, available land greater than or equal to 100 acres was not available. Thus, expansion of the ECHO Terminal is not viable and a new onshore storage and pumping facility would be necessary to support the SPOT Project. Sites were identified that would provide at least 100 acres of land for development, minimize pipeline lengths and workspaces, and include location of a mainline pumping unit within 16 miles[1] of the shoreline, which is the maximum distance required to transfer oil to the SPOT DWP without adding additional pumping unit(s) along the collocated Oyster Creek to Shore Pipelines. Four alternative onshore terminal sites for the proposed Oyster Creek Terminal were identified that meet the criteria, and all are evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

Offshore, MARAD and the USCG identified six lease blocks and three offshore pipeline routes that meet the applicable USCG siting guidelines (33 Code of Federal Regulations § 148.720) for a DWP. MARAD and the USCG also considered other Project needs and evident obstacles (e.g., shipwrecks) and carried forward all of these alternatives for further evaluation in Chapter 3, Environmental Analysis of the Proposed Action.

Three offshore DWP design alternatives are also considered in this EIS in regard to the SPOT DWP itself and VLCC or other crude oil carrier mooring: a fixed platform with berth, a fixed platform with SPM buoy, and an SPM buoy without fixed platform. The fixed platform with berth would require a greater amount of infrastructure and would, therefore, result in greater impacts than a fixed platform with SPM buoy, which is the Proposed Action. Based on the design limitations, the SPM buoy without fixed platform is not considered further in this EIS, as it would not be capable of meeting the purpose and need of the Proposed Action. The other two alternatives are further evaluated in Chapter 3, Environmental Analysis of the Proposed Action.

[1] Unless otherwise specified, the term "mile" refers to statute miles throughout this EIS.

Three alternatives for the volatile organic compound recovery and removal system are considered in this EIS: vapor combustor alternative (Proposed Action), adsorption and absorption alternative, and adsorption with vapor combustion alternative. The vapor combustor alternative would provide the highest rate of volatile organic compound destruction/recovery, allow for the greatest flexibility, and require the smallest footprint of the alternatives considered. The vapor combustor can also be enclosed, minimizing visual and noise impacts from an open flare. The adsorption with absorption alternative would require more space than the other alternative methods and substantial power generation. The adsorption with vapor combustion alternative would also require a large footprint and substantial power generation. All three are evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

MARAD and the USCG also identified alternative construction methods for the SPOT Project to determine whether offshore environmental impacts could be reduced or mitigated by the use of alternative methods. This included a review of pipeline construction at the shoreline and platform foundation/pile driving alternatives. Two shoreline construction alternatives were identified for crossing the shoreline and beach at Surfside in Brazoria County: the open-cut alternative and the horizontal directional drill (HDD) alternative, which is the Proposed Action. The HDD method would avoid impacts on beach access, onshore and nearshore habitats, and nearshore water quality; it would also install the pipeline at a greater depth then the open-cut alternative and would thus provide greater pipeline protection. Therefore, only the HDD method is further considered in Chapter 3, Environmental Analysis of the Proposed Action. The pile driving methods evaluated include suction piles, drilled piles, jetted piles, mat foundations, and conventional impact or vibratory hammer. Based on site conditions, suction piles, drilled piles, jetted piles, and mat foundations would not be viable for the Project. Therefore, only conventional impact or vibratory hammer methods are further evaluated in Chapter 3, Environmental Analysis of the Proposed Action.

Four alternatives for the removal of the SPOT DWP facilities and offshore pipelines were evaluated, based on a request from the Bureau of Ocean Energy Management, including the partial removal and full removal of the subsea pipelines. The alternatives considered include removal of all Project components except the subsea pipelines, which would be abandoned in place; removal of all Project components except the portion of the subsea pipelines that would be located in state waters; removal of all Project components except the portion of the subsea pipelines that would be located in Federal waters; and removal of all Project components except for the subsea pipelines, which would be abandoned in place from the shore crossing to the platform. All four alternatives are evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

ES5. EXISTING CONDITIONS

This section defines the key resources and receptors evaluated in this EIS and summarizes existing conditions for those resources and their components.

ES5.1. WATER RESOURCES

Water resources include the physical and chemical characteristics of any waterbodies or wetlands within, or in the vicinity of, the SPOT Project. Onshore water resources include groundwater, surface water, and wetlands. Offshore water resources include the coastal and marine waters from Mean Lower Low Water (i.e., the lowest of the two low tides per day) to the Exclusive Economic Zone within the GoM. GoM offshore environments, which include coastal and marine waters, are primarily influenced by temperature, salinity, dissolved oxygen, turbidity, nutrients, pH, and toxic contaminants. Coastal waters are nearshore waters and are dominated by tides, nearshore circulation, freshwater discharge from rivers, and local precipitation. This area of mixing between freshwater and marine waters forms estuarine habitats such as marshes, mangroves, and coastal wetlands along the Gulf Coast. Marine waters are waters that generally lie seaward of coastal waters, are influenced largely by tides and currents, have salinity levels similar to the open ocean, and include the deepwater environment of the GoM.

ES5.1.1. GROUNDWATER

The onshore proposed Project would be within the area of the Gulf Coast aquifer, which provides groundwater support for approximately one-third of the Texas population. The aquifer is used primarily for municipal, industrial, and irrigation purposes. Water quality is variable relative to depth and location throughout the Gulf Coast aquifer. The primary source of recharge for the Gulf Coast aquifer system is precipitation, and the largest recharge areas occur in southwestern Mississippi and parts of Louisiana. In coastal areas, the mixing of seawater within recharge zones results in increased salinity and higher total dissolved solid concentrations. No known wellhead protection areas would be crossed by the Project.

ES5.1.2. SURFACE WATER

The onshore Project components would cross 129 waterbodies (128 crossings associated with pipeline facilities and workspace and 1 crossing associated with an access road), including 48 perennial waterbodies, 21 intermittent waterbodies, 50 ephemeral waterbodies, and 10 ponds. The onshore Project components would cross 13 Section 10 waters in the USACE Galveston District. The proposed Oyster Creek Terminal would be located within the 500-year flood zone, portions of the onshore pipelines would cross both 100-year flood zones and 500-year flood zones, and the shoreline MLV would be located in the -100-year flood zone. The remaining sections of onshore pipelines and the modifications to the existing ECHO Terminal would not be located in a flood hazard zone.

ES5.1.3. WETLANDS

A total of about 100.5 acres of wetlands would be affected by the Project, including about 39.9 acres of palustrine emergent wetlands, 2.8 acres of palustrine scrub-shrub wetlands, 6.7 acres of palustrine forested wetlands, 45.1 acres of estuarine emergent wetlands, and 6.0 acres of estuarine scrub-shrub wetlands.

ES5.1.4. PHYSICAL OCEANOGRAPHY

The proposed Project would be located on the continental shelf of the GoM. Bathymetry surveys conducted for the Project identified slopes of approximately 12 feet per mile from the HDD exit point (approximately 5,000 feet from shore) to the first curve of the offshore pipeline route. Further from shore, the seafloor slopes at a rate of approximately 2 feet per mile, becoming more gradual until the pipeline reaches the SPOT DWP site. Water depths within the proposed SPOT DWP survey area range from

110 to 117 feet, with the proposed terminal site being located in water 115 feet deep. The seafloor at the proposed SPOT DWP site is largely featureless with some pockmarks and trawl scars.

ES5.1.5. Coastal and Marine Environments

The offshore pipelines and SPOT DWP would be located within coastal waters in the GoM. The Brazos River and Oyster Creek are larger waterbodies that supply freshwater inputs into the GoM near the Project area. Runoff from several rivers into the GoM has caused an excess of nutrients, primarily nitrogen and phosphorus, resulting in hypoxia. Once outside the influence of coastal anthropogenic processes and surface water runoff, water quality in the marine environment of the OCS typically improves. In the central GoM, hydrocarbon seeps are widespread and contribute hydrocarbons to the surface sediments and water column. Analysis of water quality samples found that metal and nutrient concentrations were predominately below the reporting limits, with only one total phosphorus concentration detected above the reporting limit.

ES5.2. Habitats

Habitats are composed of the natural environment in which organisms live. Both upland and aquatic areas contain habitats and, for the purposes of this EIS, MARAD and the USCG have defined the various habitats as vegetation, oyster reefs, marine protected areas (MPAs), and Gulf Ecological Management Sites (GEMS). The upland and aquatic habitats in the vicinity of the proposed Project provide food, shelter, and reproductive areas for wildlife and aquatic species.

ES5.2.1. Vegetation

The proposed Project is located within the Western Gulf Coast Plain ecoregion. The dominant vegetation community type identified within the Project footprint is Coastal Prairie, which accounts for more than half of the onshore pipeline route. About 84 percent of the Oyster Creek Terminal site is composed of Columbia Bottomlands; Grasslands and Gulf Coast; and Coastal Prairie. Project workspace would intersect several TPWD coastal communities as well as established Priority Protection Habitats. One Federally and state-listed endangered plant, the Texas prairie dawn-flower (*Hymenoxys texana*), was identified as having the potential to occur in the vicinity of the onshore pipelines and Oyster Creek Terminal. Six species of noxious and invasive weeds have been observed within the survey corridor for the onshore pipeline. Five species of seagrass are found along the Texas coast, along with floating *Sargassum* algal beds in open water areas offshore. The closest seagrass beds are located in Christmas Bay, more than 35 nautical miles from the SPOT DWP location and approximately 4.3 nautical miles from the offshore HDD exit pit. *Sargassum* lives about 1 year and begins growing in the western GoM in March before moving eastward while expanding. It is generally most prominent in the GoM in summer months.

ES5.2.2. Oyster Reefs

Oyster reefs occur in subtidal and intertidal zones of coastal waters in the GoM. Oyster reefs are considered Essential Fish Habitat and are afforded additional protection compared to other wetlands. Oyster reefs are also designated as coastal natural resource areas by the Texas General Land Office. The Applicant conducted field surveys to identify oyster reefs along the onshore pipeline route.

Approximately 0.5 acre of oyster reefs would occur within the construction workspace of the SPOT Project.

ES5.2.3. MARINE PROTECTED AREAS

Portions of the offshore pipelines and the SPOT DWP would be located within three MPAs: Reef Fish Stressed Area, Reef Fish Longline and Buoy Gear Restricted Area, and Texas Shrimp Closure. The closest MPA sanctuary to the proposed Project is the Flower Garden Banks National Marine Sanctuary. On January 19, 2021, National Oceanic and Atmospheric Administration announced the final rule to expand the sanctuary and the SPOT DWP would be about 40 nautical miles northwest of Stetson Bank—the closest part of the sanctuary to the Project.

ES5.2.4. GULF ECOLOGICAL MANAGEMENT SITES

The GEMS Program is "an initiative of the Gulf of Mexico Foundation, the USEPA Gulf of Mexico Program and the five Gulf of Mexico states" (TPWD 2014c). The purpose of the program is to further conservation efforts in the GoM; therefore, each Gulf state has designated ecologically important marine areas as GEMS. In Texas, three GEMS are located in relatively close proximity to the SPOT DWP: Christmas Bay Coastal Preserve, Freeport Liberty Ship Reef Complex, and Flower Garden Banks National Marine Sanctuary.

ES5.3. WILDLIFE AND AQUATIC RESOURCES

Wildlife and aquatic resources potentially affected by the Project include onshore wildlife and migratory birds, freshwater fisheries, marine mammals, benthic resources, and plankton. Inland wildlife, birds, and freshwater fish rely on upland, wetland, and stream habitats for food, shelter, and reproduction. Migratory birds may also rely on coastal habitats and estuarine wetlands, while marine species rely on coastal, nearshore, and offshore habitats of the GoM.

ES5.3.1. WILDLIFE

The Project facilities would cross habitats that support a variety of wildlife species and would affect about 1,134 acres of land. The greatest wildlife diversity and density are found in natural habitats such as grasslands, scrub-shrub habitats, and extensive contiguous forests. The Project would avoid crossing state or Federally managed lands or other sensitive areas. However, at its closest points, workspace for the Oyster Creek to Shore Pipelines would be about 515 feet from the west side and 420 feet from the south side of the Brazoria National Wildlife Refuge. The closest important bird area is the Columbia Bottomlands Important Bird Area, which is located about 2 miles southwest of the Oyster Creek to Shore Pipelines workspace. All native migratory game and non-game birds are protected under the Migratory Bird Treaty Act. Both the onshore and offshore Project components are located within the Central Flyway, one of four major migratory routes for birds in North America.

ES5.3.2. FRESHWATER FISHERIES

The proposed Project is located in the Western Gulf Coast Plain Ecoregion and the Texas Gulf Coast Prairies and Marshes region. Forty-nine families and 268 species of fishes are known to inhabit the freshwaters of Texas. Construction of the proposed onshore pipelines would include 129 waterbody crossings. Some of the freshwater wetlands proposed to be crossed are intermittently dry and not likely to support permanent freshwater fish populations.

ES5.3.3. Benthic Resources

Benthic resources in the northern GoM include level-bottom soft sediment (i.e., mud, sand), hard bottom (e.g., gravel, rock), and artificial reefs. The Project would predominantly cross mud and sand on the continental shelf. In the northern GoM a diverse assemblage of macrofaunas is present, with polychaete annelid worms being most common, and amphipod crustaceans and bivalve mollusks also present in large numbers. Macrofauna are found in highest densities in the nearshore/inshore environment while the outer-shelf margin has the lowest densities.

ES5.3.4. Plankton

The majority of fishes in the GoM have pelagic larval stages. The length of time spent in the egg and larval stages varies from 10 to 100 days, depending on the species. Ichthyoplankton is abundant in the northern GoM and peak seasons for ichthyoplankton concentrations on the shelf are spring and summer. Larval densities are lowest during the winter. The Applicant indicated that net data collected between 1982 and 2016 for 82 Southeast Area Monitoring and Assessment Program stations within the established block showed an overall fish larvae density of 0.22 per cubic meter, whereas the density of fish eggs averaged 2.97 per cubic meter. A total of 156 taxonomic groups were represented in the larvae samples collected from the 82 stations. Gobiidae (gobies) were the most abundant larval taxa.

ES5.3.5. Marine Mammals (Non-Endangered)

Nineteen species of non-endangered marine mammals or cetaceans have the potential to occur in the area of the GoM where the SPOT Project has been proposed. The marine habitat and several of these species may have been affected by the Deepwater Horizon oil spill due to the duration and volume of oil released into the GoM. The most affected areas during that incident were shoreline habitats and estuaries within the bays of the GoM. These ecosystems provide shelter and food sources, especially for nearshore species such as the bottlenose dolphin.

ES5.4. Estuarine and Marine Fisheries

The GoM has a relatively high biodiversity, partly due to the diversity of habitats ranging from coastal marshes to the deep sea. The northern GoM has one of the most productive fisheries in the world, with approximately 25 percent of the U.S commercial fish landings and 40 percent of the recreational harvest. This highly productive fishery area has 1,443 finfish species representing 223 families. The Gulf of Mexico Fishery Management Council and National Marine Fisheries Service manage fishery resources in Federal waters of the GoM (from 9 to 200 miles off the coast of Texas). The proposed Project area is located in commercially fished areas of the GoM.

ES5.5. Threatened and Endangered Species

MARAD and the USCG have developed a Biological Assessment for the Project to be used for interagency coordination required under NEPA and consultation required under the Endangered Species Act (see Appendix E1, Biological Assessment and Essential Fish Habitat Assessment). Based on a review of publicly available information, agency correspondence, and field surveys, 28 Federally listed threatened or endangered species, 1 species that is a candidate for listing under the ESA, and 1 area of designated critical habitat may occur within the Project area and/or on the VLCC or other crude oil carrier transit routes. MARAD and the USCG concluded that the Project would have no effect on eight of the Federally listed threatened or endangered species or critical habitat and the Project would be not likely to adversely affect the remaining 20 Federally listed species, and would be not likely to jeopardize the continued existence of the one candidate species. On April 23, 2020, the U.S. Fish and Wildlife Service provided concurrence on the findings of effect for 10 species; however, the listing status of Eastern Black Rail changed from proposed to threatened after submittal of the Biological Assessment in January 2020 and consultation is ongoing for this species (see Appendix E2). Based on information obtained from the TPWD's Rare, Threatened, and Endangered Species of Texas database, 34 state-listed threatened or endangered species in Brazoria and Harris counties have the potential to occur within the Project area and are managed by the TPWD. Of these, 19 state-listed species are also Federally listed as threatened or endangered and are discussed in detail in the Biological Assessment (Appendix E1). An additional four state-listed species use habitats that would not be affected by the proposed Project.

ES5.6. Geologic and Soil Resources

The analysis of soil and geologic resources includes the characteristics of the soil, sediment, and bedrock; geologic hazards such as seismic events and hurricanes; mineral resources; and paleontological materials such as the fossils of plants, animals, and other organisms.

ES5.6.1. Regional and Local Geology

The onshore Project area would be located within the West Gulf Coastal Plain region, with gently rolling topography that includes features such as circular knolls, shallow depressions, and surface expressions of faulting and past stream activity. The onshore Project area would be located within an area of documented salt deposits. The offshore Project area would be located within the GoM basin, which slopes gently to the south or southeast, and has sandy silty clay, silty clay, silty sand, and sand sediments.

ES5.6.2. Soil and Sediment Character

The onshore Project components would cross 23 major soil types (see Appendix T, Soil Maps). This includes 10 soil types that meet the definitions of prime farmland and farmland of statewide importance, or would meet these definitions if drained, accounting for more than 77 percent of the disturbed area. The Project would also cross 13 soil types that qualify as hydric (poorly drained, often water-saturated), including 2 types that could be prime farmland if properly drained. Based on geotechnical investigation, shallow sediments crossed by the offshore Project components consist of sandy sediments near the coastline that grade into silty clays and clays farther offshore.

ES5.6.3. Geologic Hazards

Geologic hazards are naturally occurring or induced conditions that can result in damage to land and structures, or cause injury to people. Potential geologic hazards in the onshore Project area include seismic activity related to earthquakes, movement along existing faults, ground settlement due to subsidence, flooding and storm surges, and shoreline erosion. The potential offshore geologic hazards include seismicity related to earthquakes and seafloor subsidence.

ES5.6.4. Mineral and Paleontological Resources

Mineral resources include ores and active mines, industrial materials (e.g., sand and gravel), and fossil fuels such as coal, oil, and gas. One sand pit, one salt dome mine, and 25 active oil and gas wells are located within 0.25 mile of the onshore Project area. Paleontological resources include the preserved fossilized remnants and indirect traces or imprints of plants and animals. In the Project area, deposits from four geologic eras dating as far back as 65 million years ago could contain a wide variety of paleontological resources. No potentially significant vertebrate fossils are present within the proposed Project area.

ES5.6.5. Offshore Geophysical Investigation

The Applicant conducted an offshore geophysical investigation along the proposed subsea pipeline route, at the proposed platform and SPM buoy sites, and at the proposed anchorage area. The geophysical survey noted the presence of pockmarks in addition to trawl scars and depressions along the proposed offshore pipeline route and at the SPOT DWP site, and cut-and-fill channel complexes in the anchorage area.

ES5.7. Cultural Resources

The affected environment for cultural resources is the area of potential effect (APE), as defined by the National Historic Preservation Act, and includes the seabed that would be affected by any bottom-disturbing activities during construction, operation, or decommissioning (offshore direct APE); terrestrial areas that would be affected by any ground-disturbing activities during construction, operation, or decommissioning (onshore direct APE); and the viewshed from which onshore, aboveground Project components would be visible (onshore indirect APE).

ES5.8. Land Use, Recreation, Visual Resources, and Ocean Use

This EIS evaluated land use, recreation resources (including onshore recreation resources, recreational fishing and boating, artificial reefs and scuba diving, and cruise ships), onshore and offshore visual resources, and ocean uses (including offshore oil and gas activity, non-energy mineral resources, and military uses) affected by the Project.

ES5.8.1. Land Use

Land uses within the onshore Project footprint predominantly include agricultural areas (hay/pasture and cultivated crops) and developed areas associated with residential, commercial, and industrial uses, as well as some more rural, undeveloped areas.

ES5.8.2. Recreation

Recreation resources in the area include onshore parks, beaches, and recreation areas, and offshore recreation activities such as recreational boating and fishing, scuba diving, and marine cruising. The existing ECHO Terminal is adjacent to the Pasadena Municipal Golf Course, while the proposed onshore pipelines would be located directly adjacent to three established parks and would cross one public beach. Recreational fishing occurs in both inland waterways and in the GoM near the Project area, and is an important economic activity in Texas. Offshore recreational boating and fishing activities occur in the vicinity of the proposed offshore pipelines and SPOT DWP. Scuba diving is a popular activity at artificial reefs offshore Texas. The closest artificial reefs to the Project would be a converted platform reef 10.6 miles east-northeast of the SPOT DWP.

ES5.8.3. VISUAL RESOURCES

Onshore, the baseline visual character includes some high-intensity suburban and industrial development near the existing ECHO Terminal and the northern portions of the Oyster Creek to Shore Pipelines; however, most of the onshore pipeline routes pass through lower-intensity suburban, agricultural, and rural residential areas on flat coastal plains, interspersed with more heavily vegetated areas near waterbodies and occasional oil and gas infrastructure such as MLV sites. The visual character at the landing site for the offshore pipeline is a developed beachfront environment, with residences and rental properties, within sight of the GoM. Industrial development is common in this region of Texas, and oil and gas infrastructure and other energy infrastructure are visible or close by in much of the existing viewshed for all proposed Project components. Offshore, the baseline visual character of the Project area is beach shoreline and open ocean. Infrastructure including oil and gas platforms, drilling rigs, and aids to navigation (such as navigation buoys) are widely scattered offshore, and offshore oil and gas infrastructure is a common sight in the regional landscape.

ES5.8.4. OCEAN USE

Ocean uses include offshore oil and gas activity, non-energy marine minerals activity, marine shipping and commercial ports, and military use. Approximately 17 percent of total U.S. crude oil production comes from the GoM, with the largest share of that production occurring in the central and western portions of the GoM. Offshore oil and gas activity is thus common in the GoM region, although no active lease blocks with ongoing production are located in the immediate vicinity of the SPOT DWP. No substantial sediment resources were identified in the Project area, and the nearest active marine minerals lease areas are located offshore Louisiana. Military uses within the GoM include military vessel and aircraft transit between onshore bases and offshore areas, aircraft carrier operations, rocket and missile research and testing, air-to-air gunnery, sonar buoy operations, and pilot training.

ES5.9. TRANSPORTATION

Onshore transportation resources evaluated in the EIS include the well-developed road network that links the Freeport area and other smaller towns to the greater Houston region. Offshore transportation resources include commercial shipping, fishing, passenger and recreational vessels, and offshore oil and gas activity. The EIS also briefly evaluates air traffic.

ES5.9.1. ROAD NETWORK AND TRAFFIC

The south-central portion of Brazoria County is characterized by a mix of traffic associated with residential, industrial, construction, shipping, and recreational/tourism activities. Some local petrochemical and industrial complexes experience large daily inflows and outflows of vehicles during work-shift turnarounds and construction projects. Port Freeport experiences large increases in road traffic when vessels are being loaded and unloaded and commodities transported out of the area. Recreational and tourist traffic patterns vary seasonally, with most activity taking place on weekends and during special events, especially in summer months. The southern portion of the Houston metropolitan area experiences heavy morning and evening peak-hour traffic, with the heaviest morning flows directed northward (inbound toward central Houston) and the heaviest evening flows directed southward (outbound).

ES5.9.2. Marine Navigation and Vessel Traffic

Cargo vessels, container ships, barges, and tankers carrying crude oil or other liquid commodities form much of the vessel traffic in the heavily travelled GoM. Commercial fishing, as well as recreational and passenger vessels, also contribute substantial volumes of marine traffic. The most concentrated vessel activity occurs in Federally designated shipping safety fairways. The Project's lease blocks have no existing safety or security zones, and are not within designated lightering areas, navigation safety fairways, or anchorages.

ES5.9.3. Air Traffic

The Project would not involve fixed-wing aircraft travel; therefore, the EIS evaluation of air traffic focuses primarily on helicopter traffic. In the Project area, helicopters provide transportation between the GoM coast and offshore oil platforms for crews, supplies, and emergencies. Numerous heliports exist in Brazoria County and nearby in Galveston County, including those at airports, hospitals, and private businesses.

ES5.10. Air Quality

Air quality is defined as a measurement of pollutants in ambient air. Air pollution comes from many different sources, including stationary sources, mobile sources, and naturally occurring sources. The USEPA classifies and regulates six criteria air pollutants, including ozone, carbon monoxide, nitrogen dioxide, sulfur dioxide, particulate matter, and lead. Greenhouse gases such as carbon dioxide, methane, and nitrous oxide are also regulated air pollutants. In addition, state agencies have state-specific standards that regulate a variety of air pollutants that can harm public health and the environment. Based on the greenhouse gas emissions associated with construction and operation of the Project, the social cost of carbon was evaluated according to methods in the Interagency Working Group on Social Cost of Greenhouse Gases Technical Support document (IWG 2021), and for construction emissions for the year with the greatest emissions (2025) the social cost of carbon ranges from $540,855 to $2,640,643 depending on the discount rate chosen. The social costs of annual operational emissions associated with the Project range from $3,303,112 to $16,085,184 in year 2025, the first proposed year of Project operation to $6,220,987 to $22,512,752 in 2050 depending on the discount rate chosen.

ES5.10.1. Regional Climate

The onshore Project area has a warm, humid climate with hot summers. The entire GoM and its coastal areas are subject to tropical storms and hurricanes, which are most likely to occur between late May and early November. Along the coast, heavy rains and wind-driven storm surges may cause local or widespread flooding.

ES5.10.2. ONSHORE AIR QUALITY

The Houston-Galveston-Brazoria (HGB) area, within which the Project's onshore components would be located, is designated as serious nonattainment for the 2008 Eight-Hour Ozone National Ambient Air Quality Standards (NAAQS) and marginal nonattainment for the 2015 Eight-Hour Ozone NAAQS. Marginal is the lowest level of ozone nonattainment severity, and serious is the middle level of severity, below severe and extreme. The HGB area is designated as attainment or unclassifiable for the NAAQS for other criteria pollutants. Both the 2008 NAAQS and the 2015 NAAQS are currently in effect for the HGB area, as the 2008 NAAQS have not yet been revoked by the USEPA.

ES5.10.3. OFFSHORE AIR QUALITY

The USEPA and the Texas Commission on Environmental Quality have not assigned an air quality attainment status (i.e., attainment or nonattainment) for locations beyond the seaward state territorial boundary, which extends 9 nautical miles from the shoreline. Therefore, the NAAQS attainment status of the nearest adjacent onshore location should be considered for the offshore locations. Brazoria County, which is the nearest onshore location to the proposed SPOT DWP, is designated as serious nonattainment for the 2008 Eight-Hour Ozone NAAQS and marginal nonattainment for the 2015 Eight-Hour Ozone NAAQS. Marginal is the lowest level of ozone nonattainment severity, and serious is the middle level of severity below severe and extreme. Brazoria County is designated as attainment or unclassifiable for the other NAAQS.

ES5.11. NOISE

The terms "noise" and "sound" are often used interchangeably. Sound is energy created by vibrations, resulting in sound waves, and is a normal and desirable part of life. Noise is a class of sounds that are considered unwanted, and in some situations, noise can adversely affect the health and well-being of individuals, both human and animal. Consequently, noise is defined as audible acoustic energy that adversely affects, or can affect, the physiological and psychological well-being of people.

The standard unit of sound measurement is the decibel (dB). The dB scale is a measure used to quantify sound power or sound pressure. A sound power level describes the acoustical energy of a sound and is independent of the medium in which the sound is traveling. Because sound consists of variations in pressure, the unit for measuring sound is referenced to a unit of pressure, the Pascal (Pa). A dB is defined as the ratio between the measured sound pressure level in microPascals (μPa) and a reference pressure. In air, the sound reference level is dB re 20 μPa, which relates to the amplitude of a sound wave's loudness with a pressure of 20 μPa. In water, the reference level is dB re 1 μPa.

For onshore activities, the EIS evaluates existing and Project-related airborne noise. For offshore activities, the EIS evaluates airborne and underwater noise.

ES5.12. SOCIOECONOMICS

Socioeconomic resources include population and demographics, housing, employment and income, public services, land- and marine-based tourism and recreation, commercial fisheries, marine commerce and shipping, and offshore mineral resources. The socioeconomic study area consists of Brazoria and Harris counties, Texas, which houses the Project's proposed onshore pipelines, proposed new terminal, and existing terminal, and which would experience the Project's direct and indirect economic impacts. The EIS evaluates cities and towns that would contain or be adjacent to Project facilities, as well the cities of Freeport and Lake Jackson, which are adjacent to Port Freeport, the Applicant's proposed shore base for Project activities.

ES5.12.1. POPULATION AND DEMOGRAPHICS

Harris County has the largest population among Texas counties, and contains Houston, the most populous city in Texas. The largest municipalities in Brazoria County are Pearland, adjacent to Houston's southern boundary, and Lake Jackson near the Gulf Coast. The municipalities within Harris and Brazoria counties grew at varying rates from 2010 to 2017. Regional projections anticipate that Harris and Brazoria counties will grow through 2040, with Harris County adding more than 72,000 new residents per year and Brazoria County adding nearly 9,000 new residents per year.

ES5.12.2. HOUSING

The EIS evaluates housing resources within an approximately 35-mile radius of the proposed Project facilities. Vacancy rates in Harris and Brazoria counties are similar to the statewide rates. In 2017, there were more than 13,000 vacant housing units in Brazoria County and more than 47,000 vacant housing units in Harris County (excluding the City of Houston). In 2016, there were 49 hotels or motels in Brazoria County, as well approximately 745 in Harris County, the large majority of which are in the City of Houston itself.

ES5.12.3. EMPLOYMENT AND INCOME

Employment data evaluated in the EIS includes the number of jobs by industry, unemployment, and tax revenues. Manufacturing and construction sectors are prominent employers in the Project area, together providing 29 percent of the jobs in Harris and Brazoria counties. The oil and gas industry cluster (petroleum products manufacturing, chemical manufacturing, pipeline transportation, oil/gas extraction, support activities for mining, and heavy/civil engineering construction) provided 13 percent of jobs and at least half the region's total gross economic output of both southern and northern Brazoria County. Other major sectors of Brazoria County's economy include government, healthcare and social assistance, and retail trade. Unemployment in Harris County was higher than the state as a whole. Brazoria County had lower unemployment and a higher median income than Harris County or the state. Major revenue sources for Texas include the general sales tax; taxes on certain products and services such as motor fuels, motor vehicles, utilities, hotel, insurance, and franchises; licenses and fees; and Federal contributions. The largest revenue sources for Texas counties and municipalities are property and sales taxes.

ES5.12.4. PUBLIC SERVICES

Public services evaluated in the EIS include hospitals; police, fire, and emergency medical service (EMS) providers; and schools. Brazoria County has four general hospitals with 291 total beds. Harris County has 50 general hospitals with 12,288 total beds, 82 percent of which are in Houston. Brazoria County has 37 fire departments and Harris County has 64 fire departments, most consisting of more than one fire station. Twelve licensed EMS providers serve municipalities and communities in Brazoria County, in addition to seven private ambulance companies that are also state-licensed EMS providers. Police protection in the socioeconomic study area includes municipal police departments and county sheriff's departments. The Sheriff's Offices patrol unincorporated areas, as well as provide backup support throughout the counties. Most communities in the EIS study area have police staffing levels close to or exceeding the nationwide per capita average. The Project would pass through four of Brazoria County's eight independent school districts, all of which have available capacity for additional students.

ES5.12.5. RECREATION AND TOURISM

Recreation and tourism are minor economic drivers (compared to other industries) in Brazoria County and southern Harris County, generating jobs and encompassing a variety of onshore and offshore activities. Popular onshore recreation and tourism activities in Brazoria County include hunting, fishing, boating, wildlife viewing, and birdwatching. Offshore recreation activities in the vicinity of the proposed offshore pipelines and SPOT DWP include boating and fishing, scuba diving at artificial reefs, and cruise ship operations. Although offshore recreation is not a major economic activity in Brazoria County and southern Harris County, recreational fishing is an important economic activity in Texas, generating 1.2 million recreational fishing trips in the GoM in 2016, along with expenditures that supported an estimated 16,000 jobs and generated $2 billion in sales.

ES5.12.6. COMMERCIAL FISHERIES

In 2016, the GoM accounted for 18 percent of the weight and 16 percent of the value of the U.S. commercial fishery landings. On average, Texas contributes approximately 6 percent of the landings and 26 percent of the revenue in the GoM. Ports within the Galveston Bay Complex ranked third among Texas ports in landings and second in value. Fishing vessels composed 70 percent of the marine traffic within the lease block where the proposed SPOT DWP would be located.

ES5.12.7. MARINE COMMERCE AND SHIPPING

Texas Gulf Coast ports handled more than 496 million tons of foreign and domestic cargo in 2016, more than 20 percent of all U.S. port tonnage. The Port of Houston ranked 2nd among U.S. ports in terms of annual tonnage, while Port Freeport ranked 34th. Within the study area, Port Freeport and the Port of Houston are focal points for the transportation and warehousing sectors of the county economy.
Port Freeport is the only port on the U.S. Gulf Coast currently able to receive large "post-Panamax" container ships now beginning to visit GoM ports due to the 2016 expansion of the Panama Canal. The Houston Ship Channel is the busiest waterway in the United States, and is also the home of the largest petrochemical complex in the nation.

ES5.12.8. OFFSHORE MINERAL RESOURCES

Mineral extraction, including offshore sand and gravel mining and particularly the oil and gas industries, is an important component of the study area's economy. Several large oil and gas and petrochemical companies (including Dow Chemical, Phillips 66, and Freeport LNG, among others) are present in southern Brazoria County. These companies rely on their coastal location and harbor access for transportation of products or supplies, but are not necessarily focused on offshore exploration or extraction in the region. Oil and gas are key industries in the regional economy as a whole. The oil and gas industry along the Gulf Coast originated due to the availability of oil in the GoM. Energy industry jobs account for approximately 20 percent of the region's wages and 30 percent of the regional GDP, along with 57 percent of the total freight handled by the ports in the region.

ES5.13. ENVIRONMENTAL JUSTICE

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations." Minority and Hispanic populations compose a majority of the populations in Texas (57.1 percent), as well as in Brazoria and Harris counties (50.9 and 69.4 percent, respectively). Low-income populations compose 16 percent of the state's population. Of the 80 U.S. Census block groups within 1 mile of proposed Project facilities, 61 had potential environmental justice communities, based on minority and/or low-income population characteristics.

ES6. PROPOSED PROJECT IMPACTS

ES6.1. ACTIVITIES GENERATING IMPACTS

Project construction and operation would involve numerous activities that would potentially generate impacts on one or more of the resources described in Section ES5, Existing Conditions. The EIS identifies the potential impact-causing activities for each resource. Examples of these activities include (but are not limited to):

- Ground and ocean floor disturbance;
- Surface or groundwater use;
- Soil compaction and erosion;
- Onshore land clearing, earth-moving, trenching, and pipeline installation and burial;
- Offshore pipeline installation via jet sled;
- Movement and anchoring of construction vessels, VLCCs, and other crude oil carriers;
- Offshore pile driving and Project component installation;
- Sedimentation and turbidity in waterbodies;
- Installation of impervious surfaces;
- Light and noise associated with Project operation; and
- Accidental spills of hazardous materials.

ES6.2. SUMMARY OF CONSTRUCTION AND OPERATION IMPACTS

Potential impacts on environmental resources may be direct or indirect, adverse or beneficial, long-term or short-term; and negligible, minor, moderate, or major. Section 3.2.1, Descriptions of Impact, defines these terms.

In evaluating the potential social and environmental impacts from the construction, operation, and decommissioning of the proposed Project, MARAD and the USCG have considered mitigation measures recommended by cooperating agencies or subject matter experts and best management practices (BMPs) proposed by the Applicant to comply with Federal, state, and local requirements for permits and authorizations, and to reduce potentially adverse effects if a license is issued for the proposed Project. In addition, recommendations from various agencies, including MARAD and the USCG, have factored in the impact analyses for each resource. A complete list of mitigation measures, BMPs, and agency recommendations is included in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures.

Table ES-1 summarizes impacts of Project construction and operation, with implementation of mitigation measures and BMPs. Decommissioning impacts are discussed following Table ES-1. Table ES-1 considers the use of Applicant-proposed BMPs and agency-recommended mitigation measures to which the Applicant has agreed. Table ES-1 does not summarize impacts from unplanned or unexpected events, such as oil spills during operation; rather it focuses on the anticipated direct and indirect impacts from the proposed Project. Impacts from oil spills would be minor to major, depending on the volume, location, and timing of the spill, and are further discussed throughout Chapter 3.

Table ES-1: Summary of Impacts from Proposed SPOT Project Activities

Resource	Project Area	Phase [a]	Direct or Indirect [b]	Adverse or Beneficial [c]	Duration [d]	Magnitude [e, f]	Notes
Water Resources							
Groundwater	Onshore	C, O	D, I	A	S, L	Neg to Min	
		C	D	A	S, L	Min to Mod	Minor to moderate impact for encountering contaminated groundwater
		O	D, I	A	S, L	Mod to Maj	Moderate to major impacts could result from an oil spill
Surface Water	Onshore	C, O	D	A	S	Min	
		C	D	A	S	Mod	Moderate impact for open-cut waterbody crossings
		O	D	A	S, L	Min to Maj	Minor to major impact on surface waters could result from an oil spill
Wetlands	Onshore	C, O	D	A	S, L	Min to Mod	Clearing and maintaining ROW through wetlands; and temporary impacts of forested wetlands
		C	D	A	S	Min to Maj	Minor to major impact on wetlands if there were an inadvertent release of drilling fluid in wetlands during HDD installation
		O	D	A	S, L	Min to Maj	Minor to major impact could occur if an oil spill occurred in or reached wetlands
Physical Oceanography	Offshore	C	D	A	S	Neg	
		O	D	Unknown	L	Min	Adverse/beneficial cannot be determined
Coastal and Marine Environments	Offshore	C	D	A	S	Min	
		O	D	A	S, L	Neg to Min	
		O	D	A	S, L	Min to Maj	Minor to major impacts could affect coastal and marine environments if an oil spill occurred
Habitats							
Vegetation	Onshore	C, O	D	A	S	Min	Herbaceous, scrub-shrub
		C, O	D	A	L	Mod	Moderate impacts in forested areas due to tree clearing
	Offshore	C	None	None	None	None	
		O	D	A	S, L	Min to Maj	Minor to major impacts could occur if an oil spill reached seagrass beds, *Sargassum* mats, or Priority Protection habitats
Oyster Reefs	Offshore	C	None	None	None	None	
		O	D	A	S, L	Mod to Maj	Moderate to major impacts could occur if an oil spill reached oyster reefs

Resource	Project Area	Phase [a]	Direct or Indirect [b]	Adverse or Beneficial [c]	Duration [d]	Magnitude [e, f]	Notes
Marine Protected Areas	Offshore	C	None	None	None	None	
		O	D	A	S, L	Min to Maj	Minor to major impacts could occur if an oil spill affected Marine Protected Areas
Gulf Ecological Management Sites	Offshore	C	None	None	None	None	
		O	D	A	S, L	Min to Maj	Minor to major impacts could occur if an oil spill affected Gulf Ecological Management Sites
Wildlife and Aquatic Resources							
Wildlife	Onshore	C, O	D, I	A	S, L	Neg to Min	Onshore pipelines
		O	D, I	A	L	Min to Mod	Minor to moderate impacts on migratory birds, depending on frequency of vegetation management during the nesting season
		C, O	D, I	A	L	Min to Mod	Terminal facilities; moderate impacts on birds due to lighting and noise at terminal facilities
	Offshore	C, O	D	A	S, L	Neg to Mod	Moderate impact on migratory birds from artificial lighting at the platform during operations
	Onshore and Offshore	O	D, I	A	S, L	Min to Maj	Minor to major impacts to wildlife if an oil spill occurred
Freshwater Fisheries	Onshore	C	D	A	S	Min	
		O	None	None	None	None	
		O	D, I	A	S, L	Min to Maj	Minor to major impacts could occur if an oil spill reached areas with freshwater fish present
Benthic Resources	Offshore	C	D, I	A	S, L	Min	
		O	D	A	L	Min	
		O	D, I	A	L	Min to Maj	Minor to major impacts if an offshore oil spill occurred
Plankton	Offshore	C	D	A	S	Neg to Min	
		O	D	A	S, L	Min	
		O	D	A	S	Min to Mod	Minor to moderate impacts on plankton if an oil spill occurred
Marine Mammals (non-Endangered)	Offshore	C	D, I	A	S	Neg to Min	General construction, marine debris, noise from jet sledding/vessel traffic
		C	D	A	L	Min to Mod	Dolphins in nearshore waters would be impacted by noise from anchor handling
		C	D, I	A	S, L	Min to Maj	Artificial lighting, noise from pile-driving, vessel strikes

Resource	**Project Area**	**Phase** [a]	**Direct or Indirect** [b]	**Adverse or Beneficial** [c]	**Duration** [d]	**Magnitude** [e, f]	**Notes**
		O	D, I	A	S, L	Neg to Min	Noise from VLCC or other crude oil carrier transits and helicopter flights; entanglement; impacts from vessel strikes could be lethal; artificial lighting; marine debris
		O	D, I	A	S, L	Min to Maj	Minor to major impacts if an oil spill occurred
Estuarine and Marine Fisheries	Offshore	C	D, I	A	S	Neg	Habitat conversion, water quality, marine debris
		C	D	A	S	Min to Mod	Jet sledding, hydrostatic testing, noise, lighting
		O	D	A, B	S, L	Neg	Habitat conversion, commercial shrimp fisheries, marine debris
		O	D, I	A	S, L	Min to Mod	Water intake and discharge (including ballast water); noise; lighting; vessel strikes could be lethal for individual animals.
		O	D	A	S, L	Mod to Maj	Moderate to major if an oil spill occurred.
Threatened and Endangered Species							
Federally-Listed	Onshore	C, O	D, I	A	S, L	Min	Birds, nesting sea turtles
	Offshore	C, O	D	A	L	Min	Vessel noise, marine debris on marine mammals, sea turtles, fish
		C	D	A	S, L	Min to Maj	Pile driving impacts on marine mammals, sea turtles, fish
		C, O	D	A	L	Min to Maj	Vessel strikes on marine mammals and sea turtles
		C	None	None	None	None	Corals
		O	D, I	A	S, L	Min to Maj	Oil spills could affect marine mammals, sea turtles, fish, corals, and critical habitat
State-Listed	Onshore	C, O	D, I	A	S, L	Min	
		O	D, I	A	S, L	Min to Maj	Minor to major impacts if an oil spill occurred
Geologic and Soil Resources							
Regional and Local Geology	Onshore	C, O	D	A	S	Neg to Min	
	Offshore	C	D	A	S	Min to Mod	Sediment disturbance and erosion
		O	D	A	L	Neg	
Soil and Sediment Character	Onshore	C, O	D	A	L	Min to Mod	Compaction, erosion, HDD activities
	(Soil)	C, O	D	A	S	Neg	Encountering contaminated sites
		O	D	A	S, L	Min to Maj	Soil contamination if an oil spill occurred
	Offshore	C	D	A	S	Mod	Alteration of sediment composition and structure
	(Sediment)	O	D	A	L	Neg	
		O	D	A	S, L	Min to Maj	Sediment contamination if an oil spill occurred

Resource	Project Area	Phase [a]	Direct or Indirect [b]	Adverse or Beneficial [c]	Duration [d]	Magnitude [e, f]	Notes
Geologic Hazards	Onshore	C	D	A	L	Min	Compaction only. The Project would not impact other geologic hazards; however, seismicity, subsidence, shoreline erosion, flooding, and storm surge could affect onshore and offshore Project components.
Mineral and Paleontological Resources	All	C, O	D, I	A	L	Neg	
Offshore Geophysical Investigation (seafloor features)	Offshore	C	D	A	S	Min to Mod	Seafloor features
		O	None	None	None	None	
Cultural Resources							
Onshore Direct and Indirect APE	Onshore	C, O	D, I	A	L	Neg to Min	
Offshore Direct APE	Offshore	C, O	None	None	None	None	The Applicant would avoid all identified side scan sonar and MAG targets by developing construction, operation, and decommissioning phase avoidance buffers around each target/anomaly in accordance with BOEM's recommendations; therefore, the Project would have no impact on known offshore cultural resources.
Land Use, Recreation, Visual Resources, and Ocean Use							
Land Use	Onshore	C	D	A	S	Min	Construction of Oyster Creek Terminal
		C	D	A	S	Mod	Construction of onshore pipelines
		O	D	A	L	Min	Operation of Oyster Creek Terminal
		O	D	A	L	Min	Operation of onshore pipelines

Resource	Project Area	Phase [a]	Direct or Indirect [b]	Adverse or Beneficial [c]	Duration [d]	Magnitude [e, f]	Notes
Recreation	Onshore	C	D, I	A	S	Min	Use of parks, wildlife refuge, beaches
		O	I	A	L	Neg	Use of parks, wildlife refuge, beaches
	Onshore and offshore	C	D, I	A	S	Neg	Recreational boating and fishing. Inland waters and offshore.
		C	D, I	A	S	Min	Subsistence fishing. Inland waters and offshore. Not a recreational activity, but discussed in this section because it closely aligns with the impacts on recreational fishing.
	Offshore	C	D, I	A	S	Neg	Boating, recreational fishing, subsistence fishing, scuba diving, and cruise ships.
		O	D, I	A	S, L	Neg	Boating, recreational fishing, subsistence fishing, scuba diving, and cruise ships.
Visual Resources	Onshore	C	D	A	S	Neg to Mod	Facility contrasts with immediately adjacent lands
		O	D	A	L	Neg to Mod	Visual contrast within 2-mile radius
	Offshore	C	D	A	S	Neg	
		O	D	A	L	Neg	
Ocean Use	Offshore	C	D, I	A	S	Neg	
		O	D	A	L	Neg to Min	
Transportation							
Road Network and Traffic	Onshore	C	D	A	S	Neg	Pipeline installation
		C	D	A	S	Min to Mod	Construction of Oyster Creek Terminal, ECHO Terminal
		O	D	A	L	Neg	
Marine Navigation and Vessel Traffic	Offshore	C	D	A	S	Neg	Overall project construction vessel activity
		C	D	A	S	Mod	Pipeline construction across safety fairways
		O	D	A	L	Min	Marine traffic volume in safety fairways
		O	D	A	L	Neg	VLCC and other crude oil carrier and supply vessel traffic
		O	D	B	L	Mod	Elimination of lightering traffic
Air Traffic	All	C	None	None	None	None	No aircraft activity for with Project construction
		O	D	A	L	Neg	
Air Quality							
Onshore Air Quality	Onshore	C	D, I	A	S	Min	
		O	D, I	A	L	Min	
Offshore Air Quality	Offshore	C	D, I	A	S	Min	
		O	D, I	A	L	Min	

Resource	**Project Area**	**Phase** [a]	**Direct or Indirect** [b]	**Adverse or Beneficial** [c]	**Duration** [d]	**Magnitude** [e, f]	**Notes**
Greenhouse Gases	All	C	D	A	S	Neg	
		O	D	A	L	Min	
Noise							
Onshore Noise	Onshore	C	D	A	S	Min	
		O	D	A	L	Min	
Offshore Noise	Offshore	C	D	A	S	Neg	Airborne noise
		C	D	A	S, L	Min to Maj	Underwater noise from construction activities
		O	D	A	L	Min	Airborne noise
		O	D	A	S, L	Min	Underwater noise from vessel traffic
Socioeconomics							
Population and Demographics	All	C	D	Neither	S	Neg	
		O	D	Neither	L	Neg	
Housing	All	C	D	B	S	Min	Reflects increased short-term lodging occupancy
		C	I	A	S	Neg to Min	Reflects competition for housing development resources
		O	D	B	L	Neg	Reflects decreased residential vacancy rates
Employment and Income	All	C	D, I	B	S	Min	Reflects increased jobs and spending; impacts could be moderate if Applicant coordinates with local government/organization on hiring goal
		O	D, I	B	L	Min	Reflects increased jobs and tax revenue
Public Services	All	C	I	A	S	Min	
		O	D, I	A	L	Neg	
Recreation and Tourism	Onshore	C	D	A	S	Neg to Min	Minor for HDD installation at the shoreline
		O	D	A	S	Neg	
	Offshore	C	D, I	A	S	Min	
		O	I	A	L	Neg to Min	
Commercial Fisheries	All	C	D	A	S	Mod	Impact on commercial fishing industry, for-hire and charter boating
		C	I	A	S	Min	Impacts on shore-based establishments supported by commercial fishing.
		O	D, I	A	L	Min	
Marine Commerce and Shipping	All	C	D	B	S	Min	Reflects economic activity at Port Freeport
		C	D	A	S	Min	Vessel avoidance of construction across fairways
		O	D	B	L	Min	Contracts for support vessels
		O	I	B	L	Mod to Maj	Re-use of lightering terminals for other/additional purposes
Offshore Mineral Resources	All	C	I	A	S	Neg	

Resource	**Project Area**	**Phase [a]**	**Direct or Indirect [b]**	**Adverse or Beneficial [c]**	**Duration [d]**	**Magnitude [e, f]**	**Notes**
		O	I	B	L	Min	Reflects economic activity related to mineral extraction or oil exploration
Environmental Justice	All	C	NA[g]	NA[g]	NA[g]	NA[g]	No disproportionately high or adverse impacts on environmental justice communities.[h] Moderate impacts on residential neighborhoods in southern Harris County during pipeline installation would be transient, lasting only a few days at each location. Moderate visual impacts on residents with views of Oyster Creek Terminal site would be limited by distance, topography, and vegetation. Increased road congestion, as well as noise at certain public parks, would be short-term and negligible to moderate. Minor impacts on subsistence fishing and moderate impacts on commercial fishing would have short-term impacts on environmental justice communities.
		O	NA[g]	NA[g]	NA[g]	NA[g]	No disproportionately high or adverse impacts on environmental justice communities.[h] Moderate visual impacts on residents with views of Oyster Creek Terminal site would be limited by distance, topography, and vegetation. All other impacts related to environmental justice communities would be negligible or minor.

BOEM = Bureau of Ocean Energy Management; HDD = horizontal directional drill; MAG = magnetometer; VLCC = very large crude carrier

[a] C = Construction; O = Operation

[b] D = Direct; I = Indirect

[c] A = Adverse; B = Beneficial

[d] S = Short-term; L = Long-term

[e] Neg = Negligible; Min = Minor; Mod = Moderate; Maj = Major

[f] Accidental spills of hazardous materials could have direct or indirect, adverse, short-term or long-term, and minor to major impacts for these resources, depending on location, size, and duration of the spill. Impacts from accidental spills of hazardous materials and planned or unplanned maintenance are not included in this table, but are described in detail for each resource in Chapter 3.

[g] NA = not applicable (if impacts on environmental justice communities are not disproportionate, these qualifiers are not used).

[h] None of the impacts described in Section 3.15, Environmental Justice would be major or long-term impacts.

ES6.3. SUMMARY OF DECOMMISSIONING IMPACTS

The Applicant would comply with the environmental regulations applicable at the time of decommissioning to minimize impacts on the natural and social environment, and would implement its spill response plans in the event of an accidental spill during decommissioning. The type and severity of impacts that would affect the natural or social environment would need to be reevaluated at the time of decommissioning to account for changes between the time the EIS is published and the time the Project is decommissioned.

Compared to operational impacts summarized in Table ES-1 (and throughout Chapter 3, Environmental Analysis of the Proposed Action), Project decommissioning would generally have beneficial impacts, due to the removal of Project components and restoration of affected areas, in accordance with regulatory requirements and Project plans and commitments. See Section 3.16, Decommissioning, of the EIS for a detailed discussion of the impacts of decommissioning on specific resources.

ES7. SAFETY

The proposed Project would increase vessel traffic in the Freeport Harbor safety fairway and the Galveston Entrance safety fairway, and near the Freeport Harbor Anchorage Area, as defined in 33 Code of Federal Regulations § 166.200(d); however, the location of the proposed SPOT DWP, approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas, would move vessel traffic away from more congested safety fairways and navigation areas near and approaching Galveston and Houston. At the same time, the proposed Project would reduce the need for tanker trips to and from Galveston and Houston for ship-to-ship transfers. As a result, the offshore location of the proposed SPOT DWP would provide a safety benefit of reducing the likelihood and consequences of collisions or allisions associated with VLCCs and other tankers.

While safety concerns might have direct or indirect, adverse or beneficial, long-term, minor impacts on the decision-making processes of potential future proposals within the hazard area, there would be no direct, adverse, short-term or long-term, impact on activities outside the safety zone, area to be avoided (ATBA; see Section 2.2.8.5, Anchorage Areas, Safety Zones, and Limited Access Areas for the SPOT Deepwater Port), or vessels associated with the proposed Project. The safety zone would exclude non-Project vessels and the general public from the highest hazard zones surrounding the proposed SPOT DWP. To further enhance navigation safety, the Applicant would request an ATBA (a request that the USCG would pass along to the International Maritime Organization, as appropriate, on behalf of the U.S. Department of State). The sizes, locations, and designation of proposed safety zones and ATBAs have not been fully evaluated by the USCG. Further discussion and determinations of the Project's proposed navigational safety measures would be conducted prior to licensing, and would require a regulatory amendment in addition to the official notification to the International Maritime Organization.

This EIS does not serve as the USCG's final safety screening for the proposed Project or its alternatives. Should a license be issued, the Applicant would be required to submit a Final Port Operations Manual for review and approval by the USCG. This manual would contain detailed plans and procedures to address routine operations and emergencies at the proposed Project location. The USCG's review would ensure that appropriate safety and security plans are included in the operations manual to minimize risk to proposed Project personnel, and the general public.

The DOT is mandated to prescribe minimum safety standards to protect against risks posed by pipeline facilities under 49 U.S.C. § 601. PHMSA administers the national regulatory program to ensure the safe transportation of natural gas and other hazardous materials by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards that set the level of safety to be attained and allow the pipeline operator to use various technologies to achieve safety. PHMSA's safety mission is to ensure that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the Federal, state, and local level.

ES8. CUMULATIVE IMPACTS

Cumulative impacts are the collective result of the incremental impacts of an action that, when added to the impacts of other past, present, and reasonably foreseeable future actions, would affect the same resources, regardless of what agency or person undertakes those actions. Cumulative impacts can result from individually minor but collectively substantial actions taking place over a period of time. The EIS identifies 44 such cumulative projects, including:

- 11 onshore major industrial projects;
- 2 major onshore infrastructure projects;
- 1 onshore warehousing and distribution project;
- 1 utility project;
- 6 Federal, state, and municipal activities;
- 2 transportation projects;
- 5 commercial and residential developments;
- 3 pipeline projects;
- 8 major offshore industrial projects; and
- 5 waterway transportation projects.

Additionally, the EIS evaluated upstream and downstream emissions associated with the Project. Based on consultations with U.S. DOT economists, it is expected that the Project will have minimal impacts on downstream consumption and marginal impacts on upstream production. Based on these analyses, although the GHG emissions associated with the upstream production and downstream end use of the crude oil to be exported by the Project at maximum capacity represent a significant amount of GHG emissions (see Table ES.8-1), the majority of these emissions likely already occur as part of the U.S. crude oil supply chain, and the Project itself is likely to have very little effect on the amount of GHG emissions associated with the overall U.S. crude oil supply chain. Finally, the social cost of carbon was evaluated according to methods in the Interagency Working Group on Social Cost of Greenhouse Gases Technical Support document (IWG 2021) for upstream and downstream GHG emissions. The social costs of the production of the maximum amount of crude oil that could be exported by the Project range from $222,427,840 to $1,085,971,217 in year 2025, the first proposed year of Project operation to

$418,687,698 to $1,517,742,906 in 2050, depending on the discount rate chosen. The social costs of the end use of the maximum amount of crude oil that could be exported by the Project range from $3,738,152,203 to $18,250,978,401 in year 2025, the first proposed year of Project operation to $7,036,521,793 to $25,507,391,501 in 2050, depending on the discount rate chosen.

Table ES.8-1: Estimated Total Greenhouse Gas Emissions from the Project, including Crude Oil Production, Export, and End Use of Crude Oil That Could be Exported by the Project

Activity Category	Emission Estimates CO_2e (tons per year)
2023 through 2025 Total Project Construction CO_2 Emissions [a]	83,284
Total of Annual Project Operational CO_2e Emissions [b, c]	213,017
Total of Upstream Exploration, Production, and Transportation CO_2e Emissions [d]	13,083,991
Total of Downstream Refining and Combustion CO_2e Emissions [e]	219,891,306

[a] Source: SPOT 2021d

[b] Source: SPOT 2021e

[c] Source: SPOT 2019a, Application, Volume IIa, Section 11

[d] Source: (USEPA 2022b). Greenhouse Gas Inventory Data Explorer, Petroleum Systems. See Appendix BB for calculation details.

[e] Source: (USEPA 2022c). Greenhouse Gas Emissions Typical Passenger Vehicle. See Appendix BB for calculation details.

The potential impact of the proposed Project, when combined with the impacts from the other projects considered, would not result in a major cumulative contribution to impacts on resources within the cumulative impact areas (see Chapter 5, Cumulative Impacts). Therefore, with the implementation of the mitigation measures, BMPs, and agency recommendations described throughout the EIS (and included in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures), the impacts of the proposed Project when combined with those of other projects would not result in major cumulative impacts.

1. INTRODUCTION

1.1. OVERVIEW

SPOT Terminal Services LLC (hereafter referred to as the Applicant), a wholly owned subsidiary of Enterprise Products Operating LLC (EPO), a Texas limited liability company, is proposing the Sea Port Oil Terminal (SPOT) Project (hereafter referred to as the SPOT Project, SPOT deepwater port [SPOT DWP], or the Project). On January 31, 2019, the Applicant submitted an application to the United States Coast Guard (USCG) and Maritime Administration (MARAD) seeking a Federal license under the Deepwater Port Act of 1974 (DWPA), as amended, to own, construct, operate, and eventually decommission a deepwater port (DWP) for the transportation of crude oil for export to the global market in United States (U.S.) Federal waters between 27.2 and 30.8 nautical miles off the coast of Brazoria County, Texas. The SPOT DWP would allow for up to two very large crude carriers (VLCCs) or other crude oil carriers to moor at single point mooring (SPM) buoys. EPO proposes to use its affiliates' existing assets and access to varying grades of crude oil supplies from multiple sources along the northern Texas Gulf Coast. Oil would be transported from the proposed Oyster Creek Terminal through the Oyster Creek to Shore Pipelines and the subsea pipelines, and delivered to the offshore platform. Upon filing the Notice of Application (NOA) in the Federal Register (Fed. Reg.) on March 4, 2019, MARAD assigned the proposed SPOT Project Docket No. MARAD-2019-0011.

Together, MARAD and the USCG are the lead Federal agencies responsible for processing the application for the proposed SPOT Project. In accordance with Section 5(f) of the DWPA (33 United States Code [U.S.C.] § 1504(f)), this Environmental Impact Statement (EIS) has been prepared in cooperation with additional Federal agencies and departments to comply with the requirements of the National Environmental Policy Act (NEPA) of 1969.[1] Such compliance fulfills the NEPA responsibilities of these agencies and departments related to the licensing and review of the proposed Project and the requirements of NEPA; the DWPA; USCG Commandant Instruction 5090.1; Department of Homeland Security Management Directive 23-01, Environmental Planning Program; the U.S. Department of Transportation (DOT) Order 5610.1C, "Procedures for Considering Environmental Impacts;" and Maritime Administrative Order 600-1, "Procedures for Considering Environmental Impacts." The U.S. Environmental Protection Agency (USEPA) and U.S. Army Corps of Engineers (USACE) have formally agreed to be cooperating agencies for the purpose of this EIS, and they may incorporate the EIS in their permitting processes. Additionally, the following agencies are cooperating agencies for the purpose of this EIS: the U.S. Department of Energy, the U.S. Department of the Interior (USDOI), the Bureau of Ocean Energy Management, the Bureau of Safety and Environmental Enforcement, the U.S. Fish and Wildlife Service (USFWS), the National Oceanic and Atmospheric Administration Fisheries Service (also known as the National Marine Fisheries Service or NMFS), and the DOT Pipeline and Hazardous Materials Safety Administration. These agencies have provided review and comment on the Project as part of the NEPA process.

[1] The Council on Environmental Quality (CEQ) updated its implementing NEPA regulations on July 15, 2020. Pursuant to 40 Code of Federal Regulations (CFR) § 1506.13, the new regulations went into effect on September 14, 2020. The environmental review for the SPOT Project began prior to September 14, 2020. As such, this EIS was prepared under the previous CEQ regulations. Any citations to CEQ regulations in this EIS refer to the regulations in effect prior to September 14, 2020.

The DWPA of 1974, as amended, currently defines a licensing system for ownership, construction, operation, and eventual decommissioning of DWPs in waters beyond state jurisdiction. Originally, the DWPA promoted the construction and operation of DWPs as a safe and effective means of importing oil into the United States and transporting oil from the Outer Continental Shelf (OCS), while minimizing tanker traffic and associated risks close to shore. The DWPA currently defines a DWP as "any fixed or floating manmade structure other than a vessel, or any group of such structures, that are located beyond State seaward boundaries and that are used or intended for use as a port or terminal for the transportation, storage, or further handling of oil or natural gas for transportation to or from any State, except as otherwise provided in Section 1522 of this title, and for other uses not inconsistent with the purposes of this chapter, including transportation of oil or natural gas from the United States outer continental shelf." State seaward boundaries refer to the areas of the Gulf of Mexico (GoM) over which coastal states have jurisdiction. The State of Texas boundary is approximately 9 nautical miles offshore. As such, under the DWPA, the Federal government regulates the location, ownership, construction, and operation of DWPs outside of 9 nautical miles from the Texas coast. To adjust to changing markets and regulate the export of product, the U.S. Coast Guard and Maritime Transportation Act of 2012 (CGMTA) amended Section 3(9)(A) of the DWPA to insert the words "or from" before the words "any State" in the definition of a DWP (33 U.S.C. § 1502(9)(A)). This change granted MARAD the authority to license the construction of DWPs for the export of oil and natural gas from domestic sources within the United States to foreign global markets.

Under the DWPA, all DWPs must be licensed by the Secretary of Transportation (Secretary). The Secretary has delegated authority to MARAD and the USCG to process applications submitted by private parties to construct, own, and operate DWPs (62 Fed. Reg. 48 [March 12, 1997]). The USCG retains this responsibility under the Department of Homeland Security. On June 18, 2003, the Secretary delegated authority to MARAD to issue, transfer, amend, or reinstate a license for the construction and operation of a DWP. The responsibility for preparing the SPOT Project Record of Decision (ROD) and for issuing or denying the DWP license has also been delegated to MARAD. Hereafter, "Secretary" refers to the Maritime Administrator as the delegated representative of the Secretary. On April 30, 2013, MARAD issued a *Notice of Policy Clarification Concerning the Designation of Adjacent Coastal States for Deepwater Port License Applications*, advising the public that nautical miles[2] shall be used when determining adjacent coastal state status. Pursuant to the criteria provided in the Act, Texas is the only adjacent coastal state for the proposed SPOT Project, as it would be directly connected by pipeline to the SPOT DWP. No other state would be directly connected to the SPOT DWP or within 15 nautical miles of the proposed Project. Other states may apply for adjacent coastal state status in accordance with 33 U.S.C. § 1508(a)(1).

On March 4, 2019, MARAD issued a NOA for the Project in the Fed. Reg., summarizing the Applicant's DWP application (Appendix A, Public Notices) (84 Fed. Reg. 42, [March 4, 2019], 7413). Under procedures set forth in the DWPA, MARAD and the USCG have 240 days from the date of the NOA to hold one or more public license hearings in the adjacent coastal state(s) for a project.

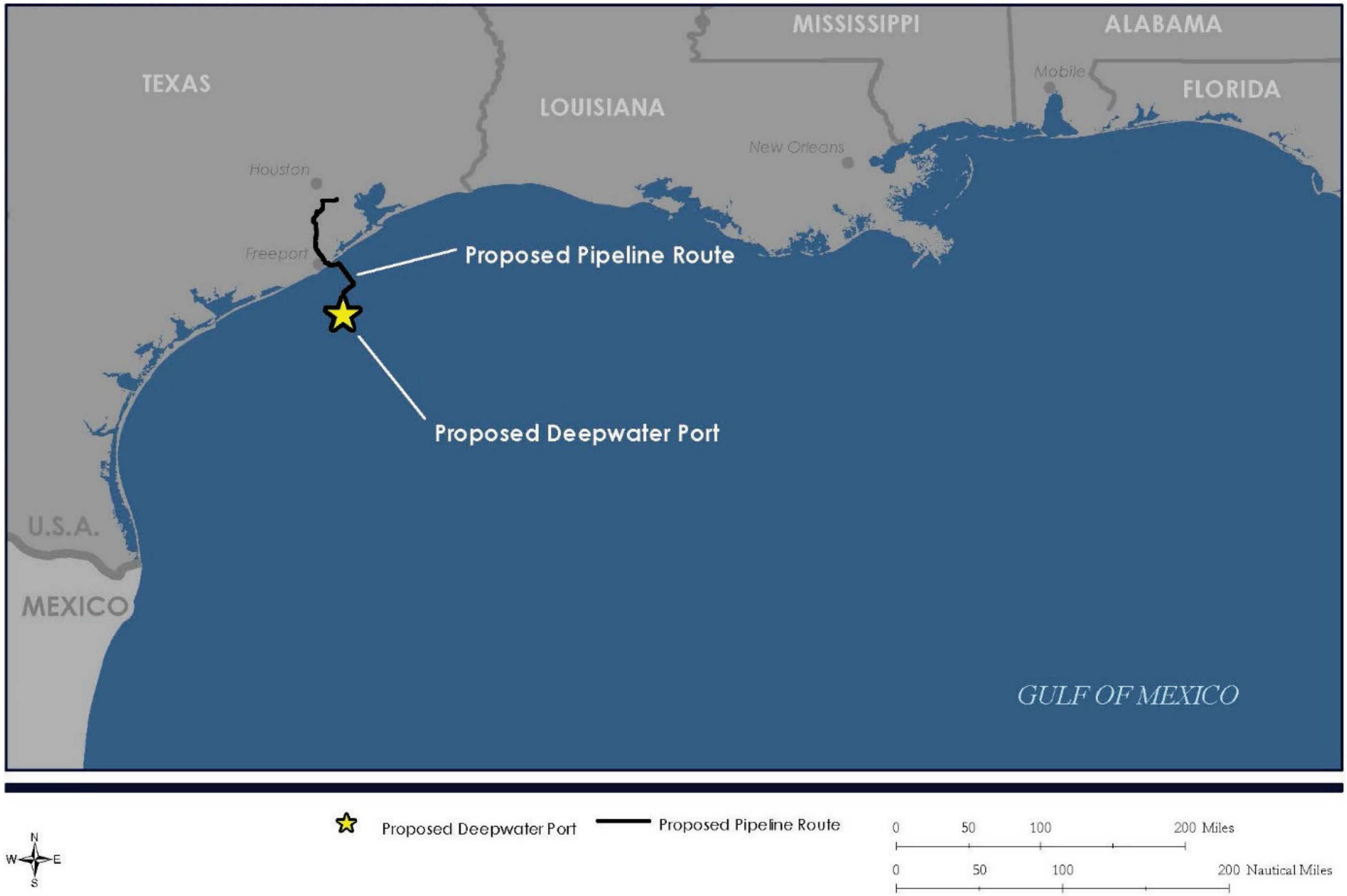
[2] The nautical mile is based on the circumference of the earth and is equal to one minute of latitude. One nautical mile equals 1.508 statute (land-measured) miles.

On March 7, 2019, MARAD issued a Notice of Intent (NOI), which also included a notice of public meeting and request for comments on the Project (Appendix A, Public Notices) (84 Fed. Reg. 45 [March 7, 2019], 8401). In this notice, MARAD and the USCG stated their intent to prepare an EIS as part of the environmental review for the SPOT Project and to hold one public scoping meeting on March 20, 2019, in the adjacent coastal State of Texas, and requested to receive comments by Monday, April 8, 2019.

To comply with other Federal requirements, as outlined in Table 1.6-1, the Applicant provided applications to USACE and the USEPA. The Applicant filed a permit application required under Section 10 of the Rivers and Harbors Act (RHA) and Section 404 of the Clean Water Act (CWA) with USACE on March 15, 2019. The Applicant filed a draft National Pollutant Discharge Elimination System (NPDES) permit with the USEPA on January 31, 2019, but has not yet filed the final application. The Applicant also submitted draft permit applications required under the Clean Air Act (CAA) to the USEPA on January 31, 2019. Section 1.6, Permits, Approvals, and Regulatory Requirements, of this EIS discusses additional permits.

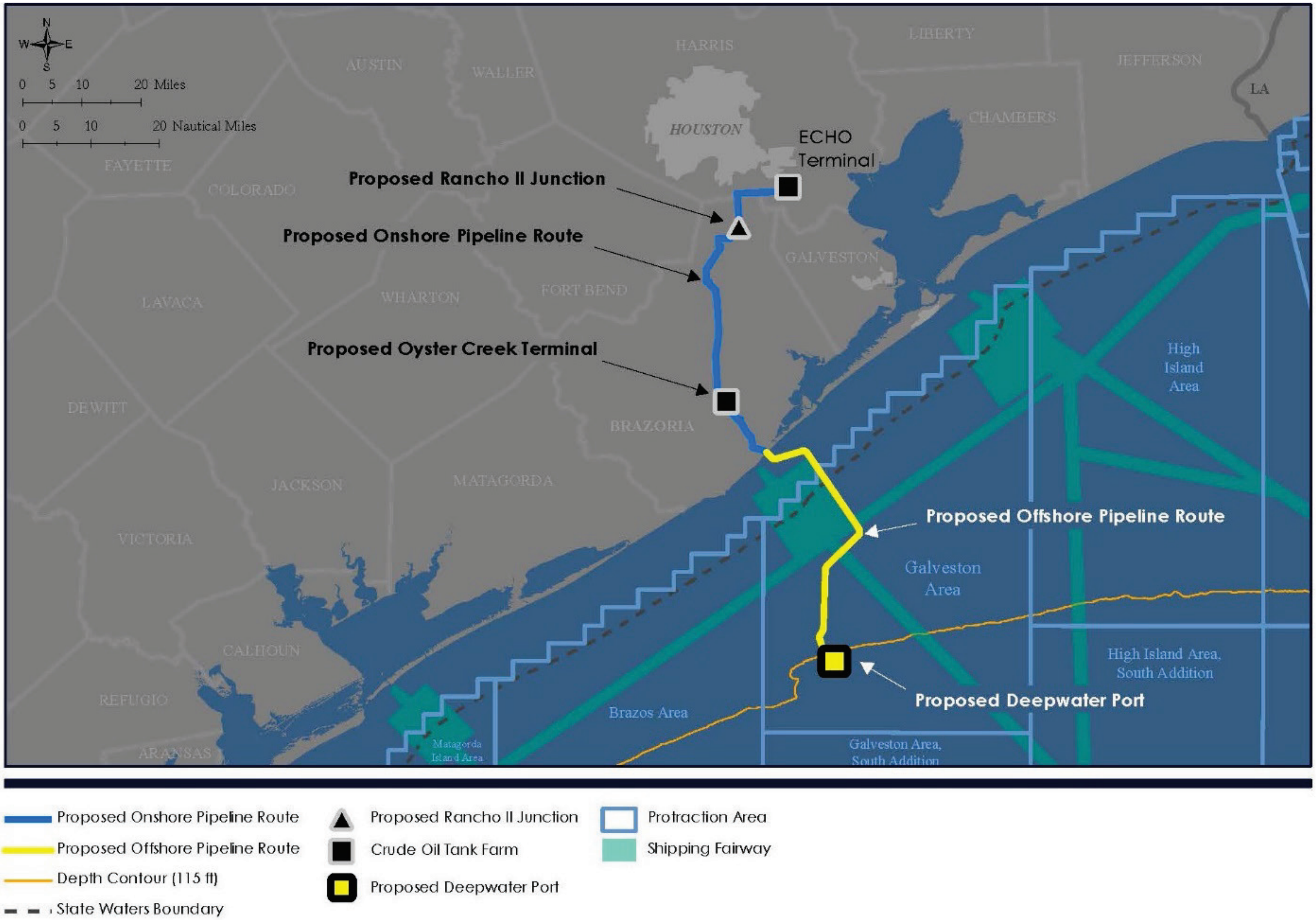
The proposed Project would have both onshore and offshore components. The proposed SPOT DWP would be located in Federal waters of the GoM, in Galveston Area OCS lease blocks 463 and A-59, approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas, in water depths of up to 115 feet. Figure 1.1-1 shows the general location of the proposed Project and Figure 1.1-2 shows the locations of specific Project components. The onshore components of the Project would consist of:

- Modifications to the existing Enterprise Crude Houston (ECHO) Terminal, located on the southeast side of Houston, Texas just east of Pearland, Texas, including four electric motor-driven mainline crude oil pumps, four electric motor-driven booster crude oil pumps, and one measurement skid to support delivery of crude oil to the proposed Oyster Creek Terminal;
- One 50.1-mile, 36-inch-diameter pipeline from the existing ECHO Terminal to the proposed Oyster Creek Terminal (hereafter referred to as the ECHO to Oyster Creek Pipeline);
- One pipeline interconnection from the existing Rancho II 36-inch-diameter pipeline to the ECHO to Oyster Creek Pipeline, at the existing Rancho II Junction facility;
- A new Oyster Creek Terminal, including six electric motor-driven mainline crude oil pumps with the capacity to push crude oil to the offshore pipelines at a rate of up to 85,000 barrels per hour (bph), four electric motor-driven booster crude oil pumps, seven aboveground storage tanks (each with a capacity of 685,000 barrels (bbl) [600,000 bbl of working storage]) for a total onshore storage capacity of approximately 4.8 million bbl (4.2 million bbl working storage) of crude oil, metering equipment, two permanent and one portable vapor combustion units, and a firewater system;
- Two collocated 12.2-mile, 36-inch-diameter crude oil pipelines from the proposed Oyster Creek Terminal to the shore crossing where the onshore pipelines meet the offshore pipelines supplying the SPOT DWP (hereafter referred to as Oyster Creek to Shore Pipelines); and
- Ancillary facilities for the onshore pipelines, including ten mainline valves, of which six would be along the ECHO to Oyster Creek Pipeline and four along the Oyster Creek to Shore Pipelines, pig launchers for the ECHO to Oyster Creek Pipeline, and pig launchers and receivers for the Oyster Creek to Shore Pipelines.



Source: SPOT 2019a, Application, Volume IIa, Section 1

Figure 1.1-1: Project Location Map



Source: SPOT 2019a, Application, Volume IIa, Section 1

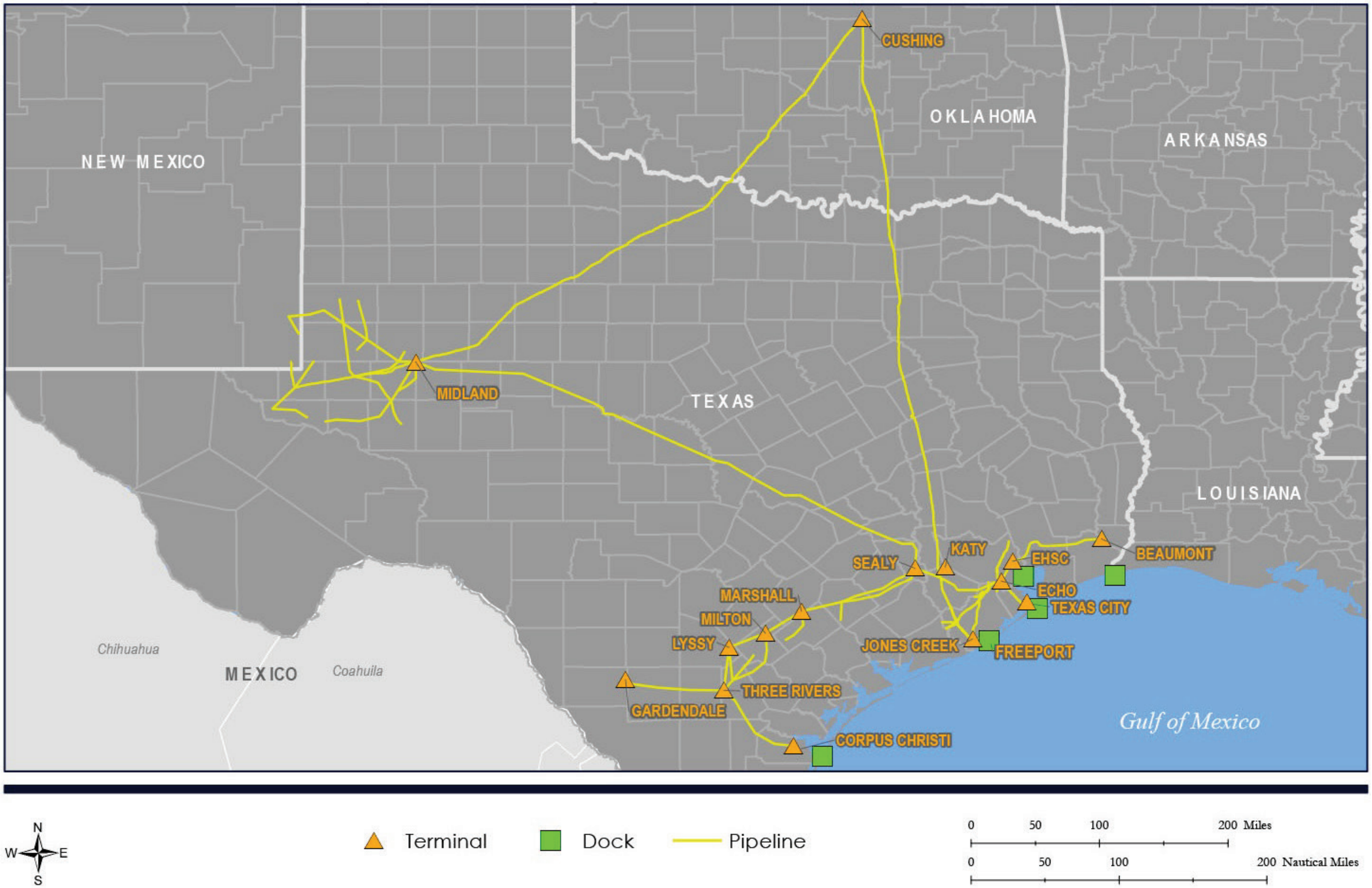
Figure 1.1-2: Project Components

The offshore components of the Project would consist of:

- Two collocated, 36-inch-diameter crude oil offshore pipelines for crude oil delivery;
- One fixed offshore platform with eight piles, four decks, and three vapor combustion units;
- Two SPM buoys to moor the VLCCs or other crude oil carriers for loading;
- Four pipeline end manifolds (PLEMs)—two per SPM buoy—to provide the interconnection with pipelines;
- Four 30-inch-diameter pipelines (two per PLEM) to deliver crude oil from the platform to the PLEMs;
- Four 16-inch-diameter vapor recovery pipelines (two per PLEM) to connect the VLCC or other crude oil carrier to the three vapor combustion units on the platform;
- Three service vessel moorings, located in the southwest corner of Galveston Area lease block 463 and;
- An anchorage area in Galveston Area lease block A-59, which would not contain any infrastructure.

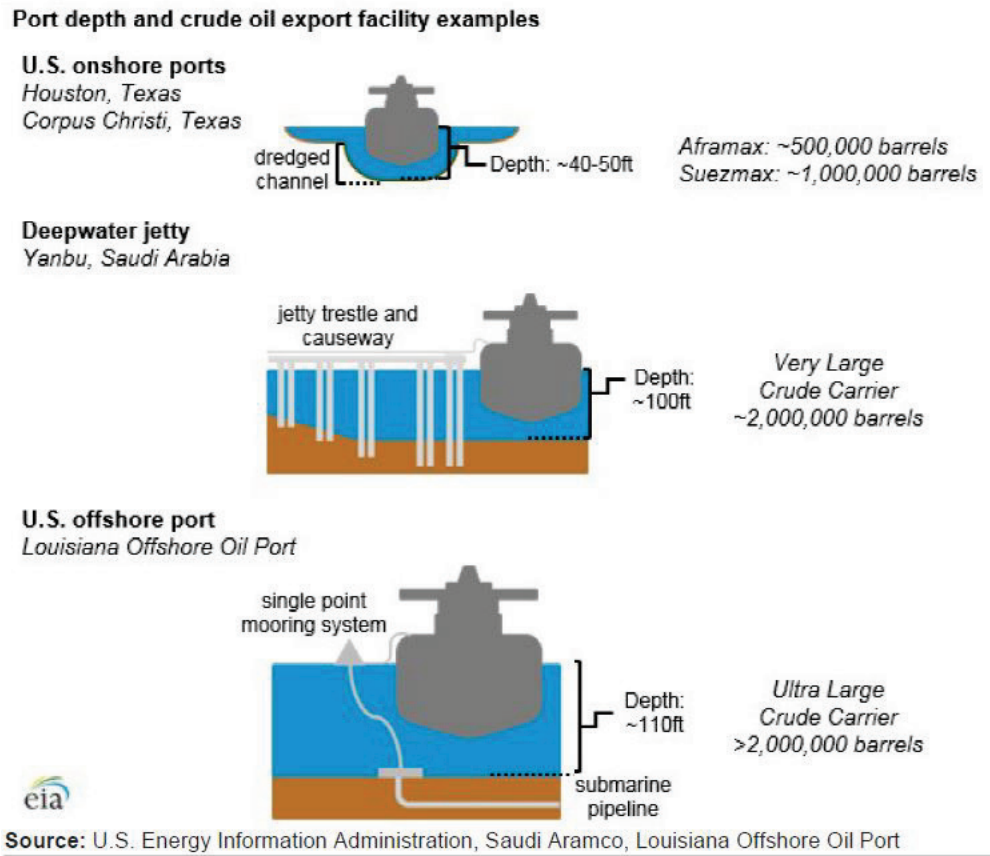
Onshore and offshore pipelines would deliver mostly domestically produced crude oil to the SPOT DWP for loading and export via VLCCs or other crude oil carriers. EPO proposes to use its affiliates' existing assets and access to crude oil supplies from multiple sources along the northern Texas Gulf Coast (Figure 1.1-3). Crude oil, ranging from ultralight to heavy grade, would be stored at the modified ECHO Terminal, and would then be transported to the proposed Oyster Creek Terminal via the proposed ECHO to Oyster Creek Pipeline. At the proposed Oyster Creek Terminal, oil would be stored in seven storage tanks, and then transported via the two proposed Oyster Creek to Shore Pipelines to the two interconnected, collocated offshore pipelines. The offshore pipelines would deliver crude oil to the SPOT DWP. Various grades of crude oil, at flow rates of up to 85,000 bph, would be loaded to VLCCs or other crude oil carriers moored at the two SPM buoys. The maximum frequency of loading VLCCs or other crude oil carriers would be 2 million barrels per day (bpd), 365 days per year. VLCCs have a maximum capacity of 330,693 U.S. tons and a maximum draft of approximately 71 feet. Other crude oil carriers that could call on the SPOT DWP include the Suezmax and the Aframax. The Suezmax has a maximum capacity of 242,508 U.S. tons and a draft of 66 feet. The Aframax has a maximum capacity of 132,277 U.S. tons and a draft of 49 feet. Figure 1.1-4 illustrates the relative ship sizes and channel depths.

Detailed descriptions of the Proposed Action are provided in Section 2.2, Detailed Description of the Proposed Action.



Source: SPOT 2019a, Application, Volume IIa, Section 1

Figure 1.1-3: Enterprise Products Operating LLC Asset Map



Source: EIA 2018b

Figure 1.1-4: Relative Ship Sizes and Channel Depths

1.2. Deepwater Port Regulatory Criteria

The DWPA of 1974, as amended, was enacted to promote and regulate the construction and operation of DWPs as a safe and effective means of importing and exporting oil or natural gas. The DWPA requires the Secretary to approve or deny a DWP license application. In reaching this decision, the Secretary must carry out the Congressional intent expressed in the DWPA, which is to:

- Authorize and regulate the location, ownership, construction and operation of DWPs located beyond State seaward boundaries;
- Provide for the protection of the marine and coastal environment to prevent or minimize any adverse impact that might occur as a consequence of the development of such ports;
- Protect the interests of the United States and those of adjacent coastal states in the location, construction, and operation of DWPs;
- Protect the rights and responsibilities of the States and communities to regulate growth, determine land use, and otherwise protect the environment in accordance with law;

- Promote the construction and operation of DWPs as a safe and effective means of importing oil and natural gas into the United States and transporting oil and natural gas from the OCS while minimizing tanker traffic and the risks attendant thereto; and
- Promote oil and natural gas production on the OCS by affording an economic and safe means of transportation of OCS oil and natural gas to the United States mainland (33 U.S.C. § 1501(a)(1)–(6)).

The Congressional intent is codified in nine requirements set forth in 33 U.S.C. § 1503(c), as follows:

1. **Financial Responsibility**: The Secretary has determined that the Applicant is financially responsible and will meet the requirements of the DWPA.
2. **Compliance with Relevant Laws, Regulations, and License Conditions**: The Secretary has determined that the Applicant can and will comply with applicable laws, regulations, and license conditions.
3. **National Interest**: The Secretary has determined that the construction and operation of the DWP will be in the national interest and consistent with national security and other national policy goals and objectives, including energy sufficiency and environmental quality.[3]
4. **International Navigation**: The Secretary has determined that the DWP will not unreasonably interfere with international navigation or other reasonable uses of the high seas, as defined by treaty, convention, or customary international law.
5. **Impact on the Marine Environment**: The Secretary has determined that the Applicant has demonstrated that the DWP will be constructed and operated using best available technology, so as to prevent or minimize adverse impact on the marine environment.
6. **National Environmental Laws**: The Secretary has not been informed, within 45 days of the last public hearing on a proposed license for a designated application area, by the Administrator of the Environmental Protection Agency that the DWP will not conform with all applicable provisions of the CAA, as amended (42 U.S.C. § 7401 et seq.); the Federal Water Pollution Control Act, as amended (33 U.S.C. § 1251 et seq.); or the Marine Protection, Research and Sanctuaries Act, as amended (16 U.S.C. § 1431 et seq., 1447 et seq.; 33 U.S.C. § 1401 et seq., § 2801 et seq.).
7. **Consultation with the Secretaries of the Army, State, and Defense**: The Secretary has consulted with the Secretaries of the Army, State, and Defense to determine their views on the adequacy of the application, and its effect on programs within their respective jurisdictions.
8. **Approval of the Governor of the Adjacent Coastal State**: The Governor of the adjacent coastal state approves, or is presumed to approve, issuance of the license.
9. **Consistency with Coastal Zone Management Program**: The adjacent coastal state to which the DWP is to be directly connected by pipeline has developed, or is making, at the time the application is submitted, reasonable progress toward developing, an approved coastal zone management program pursuant to the Coastal Zone Management Act (CZMA) of 1972 (16 U.S.C. § 1451 et seq.).

[3] A determination of whether construction and operation of the proposed DWP will be in the national interest will be made by the Maritime Administrator in developing the Record of Decision.

On December 20, 2012, with the enactment of the 2012 CGMTA (Public Law 112–213, Section 312 [Dec. 20, 2012]), Congress amended Section 3(9)(A) (33 U.S.C. § 1502(9)(A)) of the DWPA to include export facilities. Accordingly, MARAD, with the concurrence of the USCG, intends to use the existing DWP regulations for the review, evaluation, and processing of any DWP license application involving the export of oil or natural gas from domestic sources within the United States, as provided in 33 Code of Federal Regulations (CFR) Parts 148, 149, and 150 (80 Fed. Reg. 88 [May 7, 2015], 26321).

1.3. Purpose and Need

In addition to regulating the location, ownership, construction, and operation of deepwater ports, the purpose of the DWPA also includes promoting DWPs "as a safe and effective means of…transporting oil or natural gas from the outer continental shelf while minimizing tanker traffic and the risks attendant thereto." The Applicant proposes to construct, own, operate, and eventually decommission the proposed SPOT DWP in order to be able to fully load VLCCs without the need for ship-to-ship transfers and to enable the export of domestically produced ultralight, to light, to heavy grade crude oil to foreign global markets. In addition to the SPOT DWP itself, this proposed Project would include both existing and proposed onshore oil storage infrastructure and proposed onshore and offshore pipelines.

To reduce the need for ship-to-ship transfers offshore, the Applicant has proposed to fully load VLCCs at the proposed SPOT DWP. Fully loaded VLCCs have drafts of approximately 71 feet, which would preclude the use of onshore loading facilities, as the typical depths of deep-draft shipping channels in the United States are approximately 45 feet (EIA 2018b). By comparison, SPOT has stated that it would not be able to partially load VLCCs at existing ports, and that an average of 2.7 Aframax vessels or 1.6 Suezmax vessels would be required to carry the same amount of crude oil as a single VLCC (SPOT 2019yy). As a result, use of VLCCs to export the same volume of crude oil as proposed for the SPOT Project would require approximately 1,870 trips per year by Aframax and Suezmax vessels (counting trips to and from the VLCC anchored offshore). By comparison, construction and operation of the Project would avoid these trips (see Section 5.3.6, Transportation, and Appendix Y, Lightering).

The Project would allow for the export of crude oil from excess production capability from the United States to meet global market demands at competitive prices. The technological advancement of exploration methods has resulted in companies targeting various stacked, tight oil formations with large reservoirs of light oil and natural gas, in addition to conventional oil formations (EIA 2020a). The U.S. Energy Information Administration (EIA) acknowledged that reduced economic activity associated with the COVID-19 pandemic caused short-term changes in energy supply and demand patterns. Although some analysts believe that oil demand has already peaked or will peak around the time that the proposed project would be built (Randall and Warren 2020; Takahashi 2021a; Crowley 2020; Solsvik 2021; Wilson 2020; Douglas 2020; Takahashi 2020), the EIA states that U.S. crude oil production is expected to return to pre-pandemic levels by 2025, reaching 13.2 million bpd by 2025 and remaining at that level or above through 2048 (EIA 2021). The EIA acknowledges that the continuing pandemic and the Omicron variant introduces additional uncertainty into the oil market, but expects increased demand to rise by 3.5 million bpd in 2022 (EIA 2021b). Additionally, the U.S. Government Accountability Office reported that the repeal of the U.S. crude oil export ban resulted in greater incentive for domestic producers to increase crude oil production (GAO 2020), and the EIA (2021c) reports that the expansion of crude oil infrastructure since 2015 has allowed more oil from the Permian Basin and Eagle Ford Basin to be exported. As much as 4 million bpd could be exported from the Permian Basin by 2022 (Radhakrishnan et al. 2019). However, future changes in national climate policy, oil export policy, or global climate policies, could reduce the volume of crude oil exports (Donaghy et al. 2020).

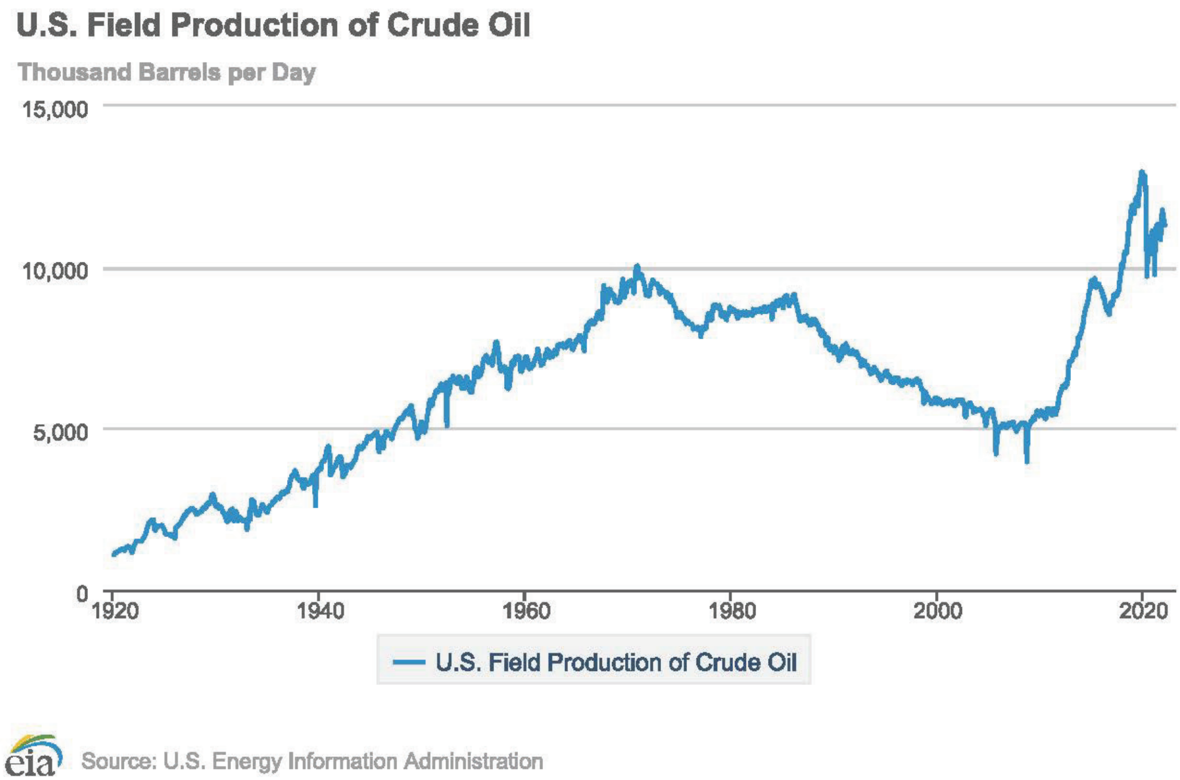
While a portion of the crude oil produced by the United States is refined domestically for domestic use, the existing refineries in the United States are not anticipated to be able to handle the amount of crude oil projected to be produced in the United States through 2050. This, in conjunction with lifting the ban on crude oil exports in December 2015,[4] has resulted in a more active crude oil export market (IPAA 2015, EIA 2017, EIA 2019a).

Refineries are designed to process specific suites or ranges of crude oil to make specific end products for market. Refineries in the United States have been modified over time to accommodate different unrefined products and make different end products to meet market supply and demand. Refineries along the U.S. Gulf Coast are mostly configured to process heavy crude oil into multiple end-user products (IPAA 2015; EIA 2019a). While refineries on the East Coast of the United States are able to refine light crude oil, these facilities typically import light crude oil from other countries for financial reasons (EIA 2019c). Therefore, the refineries in the United States cannot currently accommodate the additional large volumes of crude oil that are being produced in the United States at this time.

In 2021, U.S. production of crude oil ranged monthly from an average of about 9.8 to 11.8 million bpd (Figure 1.3-1) with roughly 75 percent coming from the Gulf Coast as shown on Figure 1.3-2 (EIA 2022a). The United States currently exports domestically produced crude oil, with exported volumes steadily increasing since 2014 (Figure 1.3-3). In 2021, weekly U.S. exports of crude oil ranged from about 1.8 to 4.1 million bpd (EIA 2022b). From 2014 to the present, imports of crude oil to the U.S. have been roughly double or more of the volume of U.S. crude oil exports (Figure 1.3-3) (EIA 2022b).

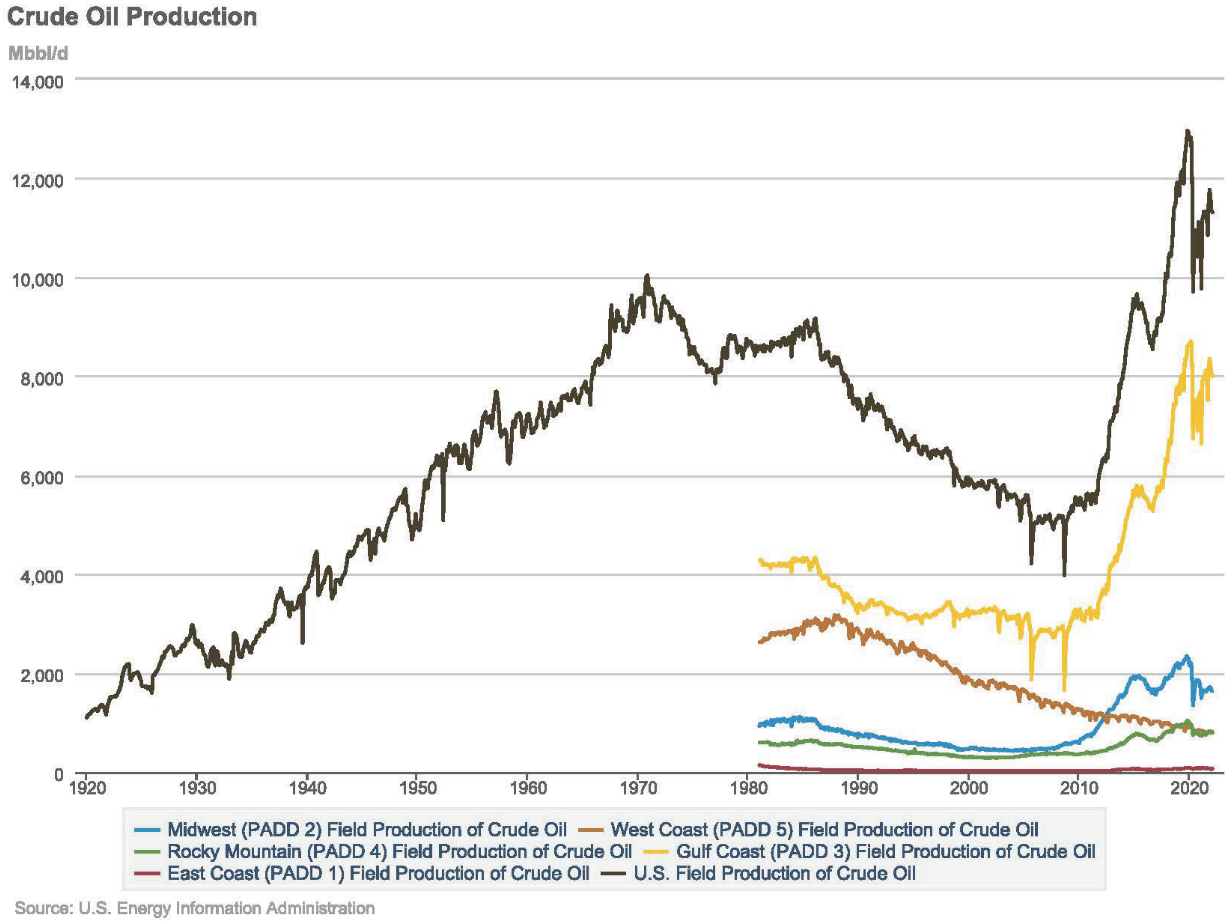
The proposed Project has a maximum export capacity of 730 million barrels per year (i.e., 2 million bpd for 365 days per year). Using the EIA production and export report data from 2021, the proposed Project, if licensed, could export crude oil representing about 18 percent of annual U.S. crude oil production and about 67 percent of annual U.S. crude oil exports. However, it is highly unlikely that the proposed Project would operate at maximum capacity due to downtime for planned and unplanned maintenance, severe weather shutdowns, and market conditions, among other factors.

[4] Consolidated Appropriations Act of 2016 (HR 2029), signed December 18, 2015.



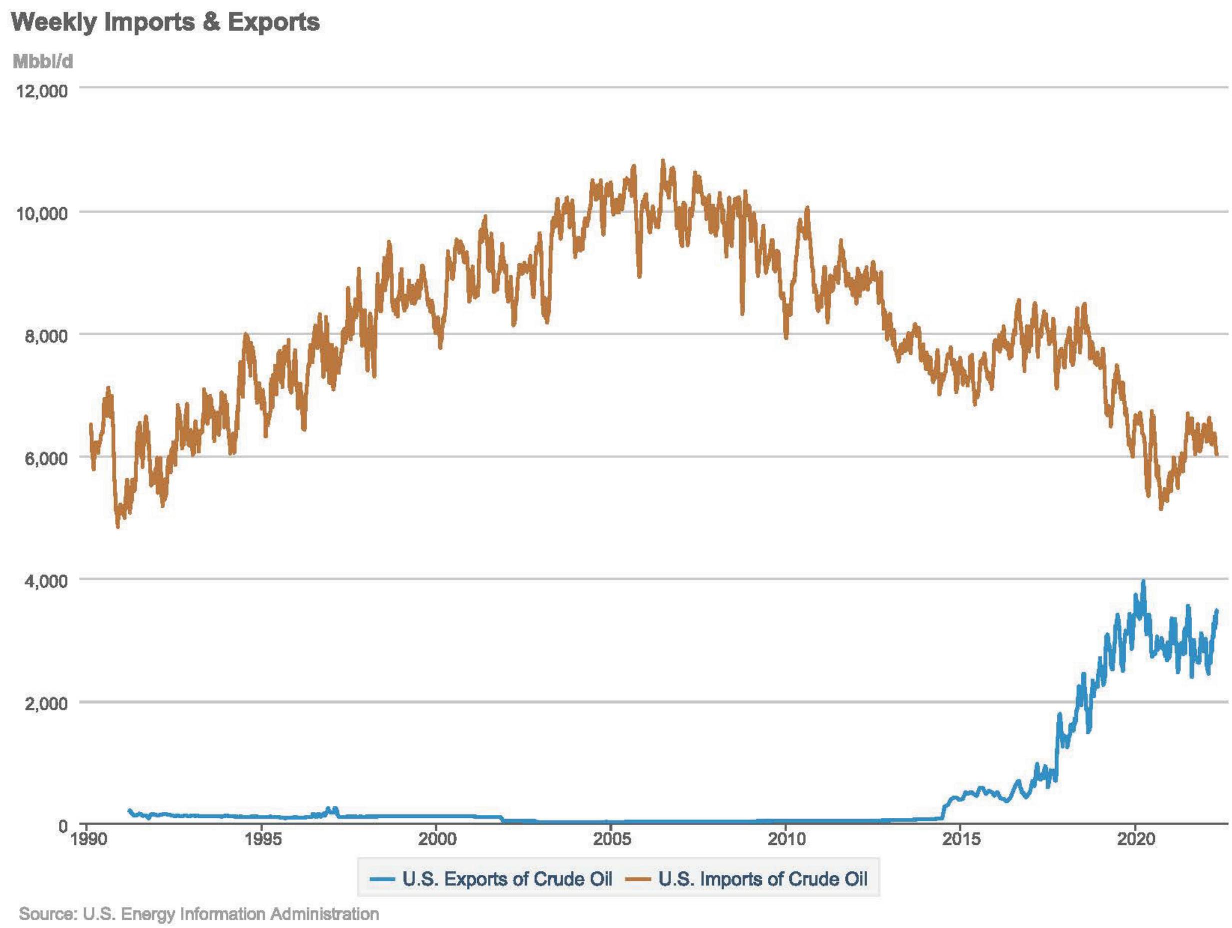
Source: EIA 2022a

Figure 1.3-1: U.S. Crude Oil Production



Source: EIA 2022a

Figure 1.3-2: U.S. Crude Oil Production by Region



Source: EIA 2022b

Figure 1.3-3: Weekly U.S. Crude Oil Imports and Exports

The proposed Project would meet the Applicant's objective to provide a safe, efficient, and reliable facility to allow full capacity loading of a maximum of 365 VLCCs and other crude oil carriers per year. VLCCs are over 1,000 feet long with beams of approximately 200 feet. In addition, the draft of a fully loaded VLCC is approximately 71 feet. Because of their large size, VLCCs require ports with waterways of sufficient width and depth for safe navigation (EIA 2018b). All onshore U.S. ports along the Gulf Coast that actively trade petroleum are located in inland harbors and are connected to the open ocean through shipping channels or navigable rivers (EIA 2018b). Although these channels and rivers are regularly dredged to maintain depth and enable safe navigation for most ships, they are not deep enough for deep-draft vessels, such as fully loaded VLCCs (EIA 2018b). In addition, the length of the VLCCs limits their ability to navigate in tight channels due to their large turning radii. Currently, nearly all VLCCs are partially loaded onshore, completely loaded via ship-to-ship transfer offshore, or loaded using a combination of both. Ship-to-ship transfer is a process in which VLCCs are loaded via multiple product transfers by smaller crude oil carriers that are loaded at onshore facilities and travel to designated lightering areas[5] in the GoM where water depths are not a constraint. The proposed Project would be

[5] Lightering areas or zones are designated locations at sea where ship-to-ship transfer of oil cargo is carried out from one tanker to another larger tanker.

designed to allow for a safer, more reliable method of direct, single loading of VLCCs and other crude oil carriers at the proposed SPOT DWP while minimizing environmental impacts. By constructing the SPOT Project, a portion of ship-to-ship transfers currently occurring in the GoM would be displaced from existing dock facilities, including EPO facilities in the Houston-Galveston-Brazoria (HGB) area, to the SPOT DWP. This would allow for other uses of these facilities, and reduce costs and risks associated with ship-to-ship transfers.

1.4. Scope and Organization of the Draft Environmental Impact Statement

The purpose of this EIS is to provide an environmental analysis sufficient to support the Secretary's licensing decision; facilitate a determination of whether the Applicant has demonstrated that the proposed Project would be located, constructed, operated, and eventually decommissioned using the best available technology necessary to prevent or minimize adverse impacts on the environment; and encourage and facilitate involvement by the public and interested agencies in the environmental review process. Together, MARAD and the USCG are the lead Federal agencies responsible for processing the application and compiling the EIS; however, the EIS also supports the decision-making processes of Federal cooperating agencies with responsibilities to evaluate permit applications for the SPOT Project.

The affected environmental resource areas evaluated in this EIS include water resources; habitats; wildlife and aquatic resources; estuarine and marine fisheries; threatened and endangered species; geologic and soil resources; cultural resources; land use, recreation and visual resources;; transportation; air quality; noise; socioeconomics; environmental justice; and public safety. This EIS includes a Description of the Proposed Action and Alternatives (Chapter 2); the Environmental Analysis of the Proposed Action, including existing conditions and probable environmental consequences that may result from construction, operation, and decommissioning of the proposed Project (Chapter 3); a description of public safety and security (Chapter 4); an analysis of Cumulative Impacts (Chapter 5); an overview of Coastal Zone Consistency (Chapter 6); a summary of Irreversible and Irretrievable Commitment of Resources (Chapter 7); and an analysis of the Relationship between Short-Term and Long-Term Productivity (Chapter 8). Chapter 3 discusses the onshore and offshore impacts on each resource that would be affected by the proposed Project separately to allow for more focused agency reviews at the Federal and state levels. Chapter 3 also evaluates the environmental consequences of the alternatives considered, in comparison with the Proposed Action. This EIS has analyzed impacts for the anticipated life of the Project.

Where applicable, this EIS considers safety, but does not function as the final safety evaluation. All aspects of SPOT DWP safety would be addressed in the Port Operations Manual (OPSMAN), which would require USCG approval prior to initiation of SPOT DWP operations as a condition of the license, if the Project is approved. A formal Prevention, Monitoring, and Mitigation Program would be contained within the OPSMAN, which would address construction of the SPOT DWP and would be finalized for USCG approval prior to commencement of construction (33 CFR § 150.15). The OPSMAN would be finalized for USCG approval prior to commissioning of the Project. The SPOT DWP would operate in accordance with the conditions of the license, the DWP regulations (33 CFR Subchapter NN), and the OPSMAN. After commencement of operations, the SPOT DWP operator(s) would be required to continuously assess operational performance and conditions under which routine and emergency actions are conducted, and incorporate lessons learned into the OPSMAN to enhance safety of personnel, infrastructure and the environment, and operations and safety.

To comply with the license, regulations, and the OPSMAN, the SPOT DWP operator would conduct an annual self-assessment in accordance with 33 CFR Part 150 Subpart B (Inspections) to evaluate the quality and effectiveness of current policy and procedures for operations and maintenance. The SPOT DWP operator would then submit a report to the USCG Captain of the Port and Officer in Charge, Marine Inspection. The USCG would review the report and conduct an on-site inspection to verify the conditions outlined in the report. If modifications to SPOT DWP operations are deemed necessary, the SPOT DWP operator would incorporate revisions into the OPSMAN.

One key safety factor that must be addressed in the OPSMAN is DWP safety and security. A Port Security Plan is required for each DWP and is an integral part of the OPSMAN (33 CFR § 150.15(x)). Security procedures comparable to 33 CFR Part 106 (Offshore Facilities), but specific to the SPOT DWP itself, must be developed and implemented.

Financial responsibility is being evaluated within MARAD as a separate task, concurrent with this NEPA review, and will be considered along with the Final EIS as part of the final licensing decision.

MARAD's authority under the DWPA is limited to approval or denial of DWP license applications, as discussed in Section 1.2, Deepwater Port Regulatory Criteria. In developing this Final EIS, MARAD and the USCG adhered to the procedural requirements of NEPA; the Council on Environmental Quality (CEQ) regulations for implementing NEPA (40 CFR Parts 1500–1508); Department of Homeland Security Management Directive 23-01, Environmental Planning Program; USCG procedures for implementing NEPA (Commandant Instruction 5090.1, National Environmental Policy Act Implementing Procedures and Policy for Considering Environmental Impacts); the USCG's final rule for DWPs (33 CFR Subchapter NN); and the DOT and MARAD procedures for considering environmental impacts (DOT Order 5610.1C and Maritime Administrative Order 600-1). The EIS includes an environmental analysis of the impacts from Project construction, operation, and decommissioning activities, and includes an analysis of upstream greenhouse gas (GHG) emissions associated with the production of the crude oil to be transported by the Project and the subsequent downstream effects from refining and end use of the export of crude oil.

Changes made to this EIS following publication of the Supplemental Draft EIS on October 29, 2021, are identified by a vertical bar in the left margin of the document.

1.5. Public and Agency Review and Comment

Agency and public participation in the NEPA process promotes open communication between the public and the government and enhances decision-making. All persons and organizations having a potential interest in the Secretary's decision whether to approve or deny the license are encouraged to participate in the decision-making process.

The public scoping process was initiated on March 7, 2019, with the publication of a NOI to prepare an EIS in the Fed. Reg. (Appendix A, Public Notices) (84 Fed. Reg. 45 [March 7, 2019], 8401). The NOI included information on the public meeting and informational open house; requested public comments on the scope of the EIS; and provided information on how the public could submit comments by mail, hand delivery, facsimile, or electronic means. MARAD set April 8, 2019, as the closing date for receipt of materials in response to the request for comments on the proposed Project. The NOI also announced the establishment of a public docket, accessible through the Federal Docket Management System website at http://www.regulations.gov under docket number MARAD–2019–0011.

The USCG delivered an Interested Party Letter, a copy of the NOI published in the Fed. Reg., and a description of the proposed Project to potentially interested parties on March 7, 2019 (Appendix B, Initial Notification Letters). It also delivered letters to Federal, state, and local agency representatives, and other potentially interested parties on March 4, 2019 (Appendix B, Initial Notification Letters). Public comments and agency correspondence submitted as part of the scoping process were considered during the development of the EIS. Public comments on the Draft EIS were considered in the Supplemental Draft EIS (and included as Appendix C1). See Appendix D for agency correspondence.

As an additional mechanism to facilitate public participation in the scoping process, MARAD and the USCG held an informational open house followed by a public scoping meeting at the Courtyard Marriott Lake Jackson, 159 State Highway 288, Lake Jackson, Texas, on March 20, 2019. The scoping meeting was attended by 53 recorded individuals. Three individuals provided oral comments at the scoping meeting. No written comments were submitted. Seven comments were received via the public docket during the scoping period, and comments were also received from a number of agencies. The comments fell into the following general topics and are addressed in this EIS:

- Concern regarding the number of DWPs under consideration in the GoM;
- Request for a programmatic EIS for currently proposed DWPs in the GoM;
- Upstream oil and gas activities;
- Alternative onshore pipeline route and consideration of master-planned communities in Manvel, Texas;
- Permit authorizations;
- Concern regarding environmental impacts of the SPOT DWP in Galveston Bay, including three decommissioning alternatives for the subsea pipelines;
- Impacts on listed and other protected species due to vessel strikes, underwater noise, spills, invasive species, climate change, GHGs, and air quality;
- Resources of cultural importance to Indian tribes;
- Impacts from hurricanes on southern Brazoria County due to the location of the Project; and
- Scoping period timeline and process.

MARAD and the USCG issued a Notice of Availability in the Fed. Reg. on February 7, 2020 (85 Fed. Reg. 26 [February 7, 2020], 7381) announcing the availability of the Draft EIS for public review (Appendix A, Public Notices). The Notice of Availability included information on the public meeting and informational open house; requested public comments on the Draft EIS; and provided information on how the public could submit comments by mail, hand delivery, facsimile, or electronic means. The comment period ended on March 23, 2020. Subsequently, MARAD and the USCG issued a Notice of Extension in the Fed. Reg. (85 Fed. Reg. 85 [May 1, 2020], 25507) on May 1, 2020, announcing an extension of the public comment period through May 31, 2020, due to the COVID-19 pandemic limiting the capability of the public to provide feedback on the Draft EIS.

The USCG delivered an Interested Party Letter notifying potentially interested parties of the availability of the Draft EIS on January 31, 2020 (Appendix B, Notification Letters). This mailing included Federal, state, and local agency representatives, and other potentially interested parties. Public comments submitted as part of the public comment process, both the initial comment period ending March 23, 2020, and the secondary comment period ending May 31, 2020, were considered during the development of the Supplemental Draft EIS and are included, as relevant, in Appendix C1.

To facilitate public participation in the EIS process, MARAD and the USCG held a public meeting in Lake Jackson, Texas on February 26, 2020. The public meeting was preceded by an informational open house. The public meeting was attended by 42 recorded individuals; 10 speakers provided a total of 15 oral comments at the meeting and 1 written comment was received. A total of 3 submissions from Federal agencies, 2 submissions from state agencies, 1 submission from a local government, 2 submissions from a Tribe, 25 submissions from non-governmental organizations, 1 submission from a business, and 37,325 submissions from individuals were received on the Federal docket under docket number MARAD-2019-0011. The USCG's and MARAD's methodology for processing agency and public comments, considering the comments, and addressing the comments is discussed in detail in Appendix C1. Appendix C1 also contains summary information and detailed responses to substantive comments on the Draft EIS.

Based on comments received during the Draft EIS comment period, the USCG verified the list of directly affected landowners based on the most current county records, and included landowners that abut the alignments of the proposed ECHO to Oyster Creek Pipeline or the proposed Oyster Creek to Shore Pipelines. The expanded list of landowners received the public notice for the General Conformity Determination (see Section 3.12.7, General Conformity) and received the Notice of Availability, including the notice for public hearing, for the Supplemental Draft EIS.

MARAD and the USCG issued a Notice of Availability in the Federal Register on October 8, 2021 (86 Fed. Reg. 193 [October 8, 2021], 56349) announcing the availability of the Draft General Conformity Determination. The Notice of Availability was published in the Federal Register, and newspaper ads ran twice during the comment period in each of the following papers in English, Spanish, or Vietnamese, as appropriate: *The Facts, Alvin Sun, The Houston Chronicle, Pearland Journal, The Daily News Galveston County, The Vietnam Post, La Prensa de Houston, La Voz de Houston, Vietnam Daily News,* and *La Informacion*. MARAD and USCG received comments on the Draft General Conformity Determination on the Federal docket under docket number MARAD-2019-0011, including 1 submission from a non-governmental organization, 25 individual submissions with unique content, and 1,847 individual form letter submissions for a total of 1,873 submissions. The USCG's and MARAD's methodology for processing agency and public comments, considering the comments, and addressing the comments is discussed in detail in Appendix C2. Appendix C2 contains summary information and detailed responses to substantive comments on the Draft General Conformity Determination. Substantive comments on the Draft General Conformity Determination are also included as an attachment to the Final General Conformity Determination in Appendix V.

MARAD and the USCG issued a Notice of Availability in the Fed. Reg. on October 29, 2021 (86 Fed. Reg. 207 [October 29, 2021], 60093) announcing the availability of the Supplemental Draft EIS for public review (Appendix A, Public Notices). MARAD and USCG provided outreach, translation of select Project documents, and interpretation services for certain populations with limited English proficiency. The full analysis and explanation is provided in Appendix AA. The Notice of Availability of the Supplemental Draft EIS was published in the Federal Register, and newspaper ads ran twice during the comment period in each of the following papers in English, Spanish, or Vietnamese, as appropriate: *The Facts, Alvin Sun, The Houston Chronicle, Pearland Journal, The Daily News Galveston County, The Vietnam Post, La Prensa de Houston, La Voz de Houston, Vietnam Daily News,* and *La Informacion*. The Supplemental Draft EIS was made available on the Project website at www.SPOTNEPAProcess.com beginning October 29, 2021. Digital copies of the documents were made available at the Freeport and Lake Jackson Public Libraries on December 7, 2021. Additionally, library computers have internet access, and thus access to files on the Project website.

MARAD and the USCG held a virtual public meeting on November 16, 2021, via Zoom, with simultaneous translation in Spanish and Vietnamese via dial-in lines. In-person public meetings were not held due to concerns related to the ongoing COVID-19 pandemic. The purpose of the meeting was to provide citizens an opportunity to make formal oral comments concerning the Supplemental Draft EIS. The public had the opportunity to enter comments and concerns into the official record by speaking during the meeting or by submitting written comments on the website or directly to the public docket. The meeting was attended by 62 individuals, with 59 attending via Zoom, 1 via the Spanish dial-in line, and 2 via the Vietnamese dial-in line; 20 speakers provided oral comments in English and 1 speaker provided oral comments in Vietnamese. A total of 1 submission from a Federal agency, 1 submission from a state agency, 11 submissions from non-governmental organizations, 473 individual submissions with unique content (including oral comments at the public meeting), and 48,498 individual form letter submissions were received on the Supplemental Draft EIS via Federal docket number MARAD 2019 0011, for a total of 48,984 submissions. The USCG's and MARAD's methodology for processing agency and public comments, considering the comments, and addressing the comments is discussed in detail in Appendix C2. Appendix C3 contains summary information and detailed responses to substantive comments on the Supplemental Draft EIS.

For the Final EIS, USCG and MARAD are providing outreach, translation of select Project documents, and interpretation services for populations with limited English proficiency consistent with what was provided for the Supplemental Draft EIS and as described in Appendix AA.

1.6. Permits, Approvals, and Regulatory Requirements

As the lead agencies for processing applications filed under the DWPA and to comply with NEPA, MARAD and the USCG are responsible for evaluating whether the Applicant can comply with the provisions of numerous Federal and state environmental laws and consulting with other agencies concerning specific environmental resources. Agency consultations and correspondence can be found in Appendix D, Agency Correspondence. The ROD and License will include a condition that the Applicant comply with all applicable Federal, state, and local regulations.

Examples of Federal laws requiring consultation include Section 7 of the Endangered Species Act (ESA), the Magnuson-Stevens Fishery Conservation and Management Act (MSA), and Section 106 of the National Historic Preservation Act (NHPA). Described below are the various legal requirements and consultation obligations. Chapter 3, Environmental Analysis of Proposed Action; Chapter 4, Safety; and Chapter 6, Coastal Zone Consistency of this EIS also discuss those requirements. Any enforceable conditions imposed as part of an approved license would be consistent with the appropriate and applicable regulations.

As a condition of any license, the Applicant would be required to obtain authorizations related to and comply with all applicable and appropriate permits, guidelines, and approvals as provided in the CZMA, the CWA, the CAA, the ESA, and the Marine Mammal Protection Act (MMPA) for any impacts on coastal resources, wastewater discharges, regulated air emissions to the environment, or protected species, respectively. The Applicant must also provide the licensing agency with the information necessary to evaluate potential compliance with the applicable regulations and guidelines.

Letters were sent from the USCG to other Federal agency representatives and other potentially interested parties on February 6, 2019 requesting comments on the SPOT DWP application (Appendix B, Initial Notification Letters). The comment topics are discussed in Section 1.5, Public and Agency Review and Comment. Agency comments and correspondence submitted were considered in the development of the EIS.

MARAD and the USCG formally requested the USEPA, USACE, and NMFS be cooperating agencies in the NEPA process for the Project, per each agency's policy. The USEPA agreed to be a cooperating agency in a letter dated March 25, 2019, the USACE agreed to be a cooperating agency in a letter dated April 15, 2019, and NMFS agreed to be a cooperating agency in a letter dated August 28, 2020. All consultation correspondence to date is located in Appendix D, Agency Correspondence, of this EIS.

Table 1.6-1 lists major Federal and state permits, approvals, and consultation requirements needed to construct and operate the SPOT Project. The Federal cooperating agencies responsible for those permits advise MARAD and the USCG on NEPA sufficiency with respect to their individual jurisdictions.

Table 1.6-1: Major Permits, Approvals, and Consultations for Deepwater Ports

Agency	Role	Permit/Approval
U.S. Department of Homeland Security, U.S. Coast Guard	• Serves as co-lead agency with MARAD for processing license application • Conducts NEPA review and prepares a single NEPA document for the Project • Supports MARAD in developing ROD • Approves and oversees post-licensing design, construction, and operations approval • Certifies that navigational aids for the DWP meet the applicable requirements	• Approves Port Operations Manual • Approves PATONs
U.S. Department of Transportation, Maritime Administration	• Serves as co-lead agency with the USCG for processing license application • Consults with the USCG during the NEPA review and in preparation of the NEPA document • Determines the Applicant's financial and U.S. citizenship requirements have been met	• Issues an ROD documenting the Secretary of Transportation's decision on DWP license • Issues DWP license
U.S. Department of Transportation, Pipeline and Hazardous Materials Safety Administration	• Serves as Federal cooperating agency • Establishes and enforces DWP pipeline safety regulations for crude oil pipeline construction and operation	• None
U.S. Department of the Interior, Bureau of Offshore Energy Management	• Serves as Federal cooperating agency • Advises MARAD and the USCG concerning the potential impacts of DWPA terminals on OCS lease blocks • Reviews Pipeline Right-of-Way Application	• None
U.S. Department of the Interior, Bureau of Safety and Environmental Enforcement	• Serves as Federal cooperating agency • Makes Oil Pollution Act of 1990 liability adjustment, as necessary • Reviews Pipeline Right-of-Way Application	• Issues Pipeline Right-of-Way authorization for offshore pipelines
U.S. Department of the Interior, U.S. Fish and Wildlife Service, Region 2	• Serves as Federal cooperating agency • Consults with MARAD and the USCG regarding species listed as threatened or endangered and designated critical habitat under Section 7 of the ESA • Advises MARAD and the USCG on impacts on wildlife protected under the Fish and Wildlife Coordination Act, Migratory Bird Treaty Act, and Coastal Barrier Resources Act	• Issues concurrence with or Biological Opinion on MARAD and USCG effect determinations for threatened and endangered species and designated critical habitat • Issues Letter of Authorization or Incidental Harassment Authorization for take of listed species, if necessary • Issues Depredation Permit under the Migratory Bird Treaty Act, if necessary

Agency	Role	Permit/Approval
U.S. Environmental Protection Agency, Region 6	• Serves as Federal cooperating agency • Advises MARAD and the USCG on analysis of impacts regulated under the CWA, CAA, and MPRSA	• Provides input to USACE for Sections 401 and 404 of the CWA • Issues CWA NPDES Permit to Discharge Process Wastewater, including hydrostatic test water for the DWP • Issues CWA NPDES MSGP for Stormwater Discharges Associated with Industrial Activity for Onshore Facilities • Issues CGP for Stormwater Discharges from Construction Activities for Onshore Facilities • Issues CAA Title V Permit for the DWP • Issues CAA PSD Air Permit for the DWP
U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Marine Fisheries Service, Southeast Region	• Serves as Federal cooperating agency pursuant to 40 CFR § 1501.6 because the scope of the proposed action and alternatives involve activities having potential to affect marine resources under their jurisdiction by law and special expertise • Serves as the consulting agency in accordance with 50 CFR § 402 for Federal agencies proposing action that may affect marine resources listed as threatened or endangered	• Incidental Take Authorization pursuant to MMPA and 50 CFR § 216 • Consultation pursuant to Section 7 of the ESA • EFH consultation pursuant to the MSA and 50 CFR § 600
U.S. Army Corps of Engineers, Galveston District	• Serves as Federal cooperating agency • Advises MARAD and the USCG on analysis of impacts regulated under Section 404 of the CWA and Sections 10 and 14 of the RHA	• Issues CWA Section 404 permit for the discharge of dredged or fill material into the waters of the United States • Issues the RHA Section 10 permit to prevent obstructions to navigation in navigable waters of the United States, including infrastructure located on the seabed to the seaward limit of the OCS • Reviews and authorizes the Project under Section 408 for public works projects • Issues Real Estate Outgrant or approval
U.S. Department of Defense	• Consults with MARAD and the USCG on administrative completeness of application and effects on Department of Defense programs	• None
U.S. Department of State, Bureau of Oceans and International Environmental and Scientific Affairs	• Consults with MARAD and the USCG on administrative completeness of application and effects on Department of State programs	• None
Advisory Council on Historic Preservation	• Advises MARAD and the USCG on analysis of impacts under Section 106 of the NHPA	• None

Agency	Role	Permit/Approval
Office of the Governor, Texas	• Reviews application and NEPA document • Consults with MARAD regarding license issuance	• Provides consent to MARAD to issue DWP license
Texas General Land Office	• Advises MARAD and the USCG on analysis of impacts regulated under the CZMA and Oil Spill Prevention and Response Act • Manages state-owned submerged land	• Issues CZMA consistency determination in coordination with Section 404 permit authorization from USACE • Issues Miscellaneous Easements for Project facilities that would cross state-owned submerged land • Oil Spill Prevention and Response program issues a facility certificate, based on approval of Applicant's discharge prevention and response plan
Texas Historical Commission, State Historic Preservation Office	• Consults with MARAD and the USCG regarding cultural resources listed or eligible for listing under Section 106 of the NHPA	• Issues Texas Antiquities Permit for cultural resource field surveys • Issues concurrence with direct and indirect APE for the Project • Issues concurrence with Section 106 determination of effect • Approves Unanticipated Discoveries Plan
Railroad Commission of Texas	• Advises MARAD and the USCG on analysis of impacts regulated under the CWA	• Issues CWA Section 401 Water Quality Certification in coordination with USACE Section 404 permit authorization • Issues CWA Section 401 certification for NPDES permits • Issues CZMA consistency determination for NPDES permits • Issues Hydrostatic Test Discharge Permit • Issues Permit to Operate Product Pipeline (Form T-4) as a common carrier under Texas Administrative Code, Title 16, Part 1, Chapter 3, Rule 3.70
Texas Commission on Environmental Quality, Air Quality Division	• Advises MARAD and the USCG on analysis of impacts regulated under the CAA • Coordinates with the USEPA with regards to permit issuance	• Issues Non-Rule Standard Permit Air Permit for Oil and Gas Handling and Production Facilities for the Oyster Creek Terminal • Issues Air PBR 106 for the ECHO Terminal and onshore pipeline mainline valves • Coordinates with USEPA for any required revisions to the State Implementation Plan
Texas Parks and Wildlife Department	• Advises MARAD and the USCG on analysis of impacts on state-listed threatened and endangered species • Consults with Applicant regarding crossings of state waters	• Issues Sand and Gravel General Permits for relevant waterbody crossings
Texas Department of Transportation	• Consults with the Applicant regarding a request for utility installation	• Issues Utility Installation Permit

Agency	Role	Permit/Approval
Village of Surfside, Coastal Management Program	• Coordinates with Texas General Land Office and the Applicant regarding dune protection under the Texas Coastal Management Plan	• Issues Dune Protection Permit

Sources: SPOT 2019a, Application, Volume IIa, Appendix C; SPOT 2020c, Response to IR #289.

APE = Area of Potential Effect; CAA = Clean Air Act; CFR = Code of Federal Regulations; CGP = Construction General Permit; CWA = Clean Water Act; CZMA = Coastal Zone Management Act; DWP = deepwater port; DWPA = Deepwater Port Act; ECHO = Enterprise Crude Houston; EFH= essential fish habitat; ESA = Endangered Species Act; MARAD = Maritime Administration; MPRSA = Marine Protection Research and Sanctuaries Act; MSGP = Multi-Sector General Permit; NEPA = National Environmental Policy Act; NHPA = National Historic Preservation Act; MMPA = Marine Mammal Protection Act; MSA = Magnuson-Stevens Fishery Conservation and Management Act; NPDES = National Pollutant Discharge Elimination System; OCS = Outer Continental Shelf; PATON = permanent aids to navigation; PBR = Permit by Rule; Project = SPOT DWP Project; PSD = Prevention of Significant Deterioration; RHA = Rivers and Harbors Act; USACE = United States Army Corps of Engineers; USCG = United States Coast Guard; USEPA = United States Environmental Protection Agency

1.6.1. Endangered Species Act

Section 7 of the ESA states that any project authorized, funded, or conducted by any Federal agency should not “jeopardize the continued existence of any endangered species or threatened species or result in the destruction or adverse modification of habitat of such species which is determined…to be critical.” MARAD and the USCG are required to consult with the USFWS and NMFS to determine whether any Federally listed or proposed endangered or threatened species or their designated critical habitats occur near and may be affected by the proposed Project. If it is determined that these species or habitats might be affected by the proposed Project, MARAD and the USCG must request to initiate consultation with the USFWS and/or NMFS. The nature and extent of effects and recommended measures that would avoid or reduce potential effects on the species and their designated critical habitat are discussed in a Biological Assessment (BA, see Appendix E1, Biological Assessment and Essential Fish Habitat Assessment) to determine whether the effects would likely jeopardize any listed species or result in the destruction or adverse modification of designated critical habitat. After review of the relevant information, NMFS and/or the USFWS would issue a concurrence letter through informal consultation or a Biological Opinion through formal consultation on the potential for jeopardy. NMFS and/or the USFWS may also issue an incidental take statement through formal consultation as an exception to the takings prohibitions in Section 7 of the ESA, if necessary. The BA can be found in Appendix E1, Biological Assessment and Essential Fish Habitat Assessment, of this EIS. Agency consultations under Section 7 of the ESA were initiated on May 1, 2019. Correspondence with the USFWS, Region 2 and NMFS, Southeast Region, with respect to the ESA, is presented in Appendix D, Agency Correspondence.

1.6.2. Magnuson-Stevens Fishery Conservation and Management Act

The MSA, amended by the Sustainable Fisheries Act of 1996, establishes procedures designed to identify, conserve, and enhance essential fish habitat (EFH) for those species regulated under a Federal Fishery Management Plan. The MSA requires Federal agencies to consult with NMFS on all actions or proposed actions authorized, funded, or undertaken by the agency that might adversely affect EFH. NMFS recommends consolidated EFH consultations with interagency coordination procedures required by other statutes, such as NEPA or the ESA (50 CFR § 600.920(e)(1)), to reduce duplication and improve efficiency. The mandatory content of an EFH Assessment is detailed in 50 CFR § 600.920(e)(3). The BA that accompanies this EIS (Appendix E1, Biological Assessment and Essential Fish Habitat Assessment) describes EFH and potential Project-related impacts and serves as the EFH Assessment for the proposed Project. Agency consultation under the MSA was initiated on May 1, 2019. Agency consultations and correspondence to date can be found in Appendix D, Agency Correspondence.

1.6.3. Marine Mammal Protection Act

Section 101(a) of the MMPA (16 U.S.C. § 1361) prohibits persons or vessels subject to the jurisdiction of the United States from taking any marine mammal in waters or on lands under the jurisdiction of the United States or on the high seas (16 U.S.C. § 1372(a) (l), (a)(2)). Sections 101(a)(5)(A) and (D) of the MMPA provide exceptions to the prohibition on take, which give NMFS (and USFWS) the authority to authorize the incidental but not intentional take[6] of small numbers of marine mammals, provided certain findings are made and statutory and regulatory procedures are met. The incidental take of a marine mammal falls under three categories: mortality, serious injury, or harassment[7]. Incidental Take Authorizations (ITAs) may be issued as either (1) regulations and the associated Letter of Authorization or (2) an Incidental Harassment Authorization. Letters of Authorization may be issued for up to a maximum period of 5 years and Incidental Harassment Authorization s may be issued for a maximum period of 1 year. Detailed information about the MMPA and 50 CFR Part 216 is available at https://www.fisheries.noaa.gov/topic/laws-policies#marine-mammal-protection-act.

NMFS promulgated regulations to implement the provisions of the MMPA governing the taking and importing of marine mammals (see 50 CFR Part 216) and published application instructions that prescribe the procedures necessary to apply for ITAs. U.S. citizens seeking to obtain authorization for the incidental take of marine mammals under NMFS jurisdiction[8] must comply with these regulations and application instructions in addition to the provisions of the MMPA. Information on the NMFS application process is available at https://www.fisheries.noaa.gov/permit/incidental-take-authorizations-under-marine-mammal-protection-act.

Once NMFS determines an application is adequate and complete, NMFS has a corresponding duty to determine whether and how to authorize take of marine mammals incidental to the activities described in the application. To authorize the incidental take of marine mammals, NMFS evaluates the best available scientific information to determine whether the take would have a negligible impact on the affected marine mammal species or stocks and an immitigable impact on their availability for taking for subsistence uses. NMFS must also prescribe the “means of effecting the least practicable adverse impact” on the affected species or stocks and their habitat, and on the availability of those species or stocks for subsistence uses, as well as monitoring and reporting requirements.

As a result of the Proposed Action, NMFS may receive an application pursuant to MMPA section 101(a)(5)(A) or (D) from the Applicant for authorization to take marine mammals incidental to construction activities associated with the SPOT Project. Since NMFS’ action will involve consideration whether to authorize take of marine mammals incidental to a subset of the activities analyzed in this EIS, these components of the Proposed Action are the subject of the NMFS action. The purpose of NMFS’ action—which will be a direct outcome of the request for authorization to take marine mammals incidental to construction activities—is to evaluate the Applicant’s application pursuant to MMPA section 101(a)(5)(A) or (D) and 50 CFR Part 216 and issue an ITA, if appropriate. The need for NMFS’ action is to consider the impacts of the Applicant’s activities on marine mammals and ultimately allow the Applicant to conduct its activities in compliance with the MMPA if section 101(a)(5)(A) or (D) is satisfied. Finally, NMFS' consideration whether to issue an ITA under the MMPA is a major Federal action triggering NMFS independent responsibility to comply with NEPA. When serving as a cooperating

[6] The term “take” means to harass, hunt, capture, kill, or attempt to harass, hunt, capture, or kill any marine mammal (16 U.S.C. § 1362(13)).
[7] Except with respect to certain activities not pertinent here, the MMPA defines “harassment” as any act of pursuit, torment, or annoyance which (1) has the potential to injure a marine mammal or marine mammal stock in the wild (Level A harassment); or (2) has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering (Level B harassment).
[8] NMFS has jurisdiction over most marine species, (e.g., marine mammals and pinnipeds).

agency, NMFS may satisfy this independent NEPA obligation by preparing a separate NEPA document or, if appropriate, by adopting the NEPA document prepared by the lead agency for issuance of an ITA. Therefore, NMFS, in accordance with 40 CFR §§ 1506.3 and 1505.2, may adopt the Final EIS, if appropriate, and issue a separate ROD associated with its decision to grant or deny the request for an ITA for the SPOT Project pursuant to MMPA section 101(a)(5)(A) or (D).

1.6.4. National Historic Preservation Act

Section 106 of the NHPA requires MARAD and the USCG to consider the effects of its undertakings on properties listed or eligible for listing on the National Register of Historic Places, including prehistoric or historic sites, districts, buildings, structures, objects, or properties of traditional religious or cultural importance, and to allow the Advisory Council on Historic Preservation to comment on the undertaking. An undertaking is defined under 36 CFR § 800.16(y) as "a project, activity, or program funded in whole or in part under the direct or indirect jurisdiction of a Federal agency, including those carried out by or on behalf of a Federal agency; those carried out with Federal financial assistance; and those requiring a Federal permit, license or approval." As a Federal undertaking, issuance of the SPOT Project DWPA license would require a NHPA Section 106 review. The NHPA Section 106 review involves four sequential phases:

- Initiation of the Section 106 process
- Identification of historic properties
- Assessment of adverse effects on historic properties
- Resolution of adverse effects, including development of mitigation strategies

As part of the second phase (identification of historic properties), the lead Federal agency is required to determine and document the area of potential effect (APE) for the undertaking in consultation with the appropriate State Historic Preservation Office (SHPO) or Tribal Historic Preservation Office. The APE is defined under 36 CFR § 800.16(d) as "the geographic area or areas within which an undertaking may directly or indirectly cause alterations in the character or use of historic properties, if any such properties exist. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking." Consultation with the SHPO would take place to confirm the APEs for the Project and if a potential adverse impact on historic properties as a result of the proposed Project is identified. MARAD and the USCG mailed an initial consultation letter to the Texas SHPO on May 1, 2019. MARAD and the USCG also mailed an initial request for information letter to 27 Federally recognized tribes and 2 state-recognized tribes on May 1, 2019. Section 3.9, Cultural Resources, of this EIS discusses the Section 106 review. All consultation and correspondence is located in Appendix D, Agency Correspondence, of this EIS.

1.6.5. Marine Protection, Research, and Sanctuaries Act

Under Section 101 of the Marine Protection Research and Sanctuaries Act (MPRSA), 33 U.S.C. § 1401 et seq., no person may transport material from the United States for the purpose of dumping it in marine waters in the absence of a permit issued by the USEPA pursuant to Section 102 of the Act. "Dumping" does not include "construction of any fixed structure or artificial island nor the intentional placement of any device in ocean waters, on or in the submerged land beneath such waters, for a purpose other than disposal, when such construction or such placement is otherwise regulated by Federal or state law." Under Section 103 of the MPRSA, the USACE is the Federal agency that decides whether to issue a permit authorizing the ocean disposal of dredged materials. USACE relies on the USEPA's ocean dumping criteria when evaluating permit requests for (and implementing Federal projects involving) the transportation of dredged material for the purpose of dumping it into ocean waters. MPRSA permits and Federal projects involving ocean dumping of dredged material are subject to USEPA review and concurrence.

Dumping would not occur from the construction or operation of the proposed Project; therefore, a permit under the MPRSA would not be required.

1.6.6. Coastal Zone Management Act

The CZMA calls for the "effective management, beneficial use, protection, and development" of the nation's coastal zone and promotes active state involvement in achieving those goals. To reach those goals, the CZMA requires participating states to develop management programs that demonstrate how these states would meet their obligations and responsibilities in managing their coastal areas. The agency responsible for administering the CZMA for the proposed Project is the Texas General Land Office (GLO). The Applicant must prepare a consistency certification, finding that its proposed activities would be fully consistent with the enforceable policies and goals of the Texas Coastal Management Program (TCMP), and submit it for review by the GLO.

To assist with regulating the TCMP, Brazoria County and the Village of Surfside have adopted a Beach Access and Dune Protection Program and permit process for projects that alter sand dunes in Brazoria County. The Applicant would cross the dunes using the horizontal directional drilling construction method.

Chapter 6, Coastal Zone Consistency, of this EIS provides details regarding coastal zone consistency, including the GLO's conditional concurrence with the consistency certification (Appendix G, Federal Consistency Decision).

1.6.7. Clean Water Act

The Federal CWA, as amended, establishes the basic structure for regulating discharges of pollutants into the waters of the United States. The objective of the CWA is to restore and maintain the chemical, physical, and biological integrity of the nation's waters (33 U.S.C. § 1251 et seq.) and the act gives the USEPA the authority to implement pollution control programs such as setting wastewater standards for industry. The CWA also sets water quality standard requirements for all contaminants in surface waters and makes it unlawful for any person to discharge any pollutant from a point source[9] into navigable waters, unless a permit is obtained under its provisions. Three sections of the CWA are applicable to the proposed Project:

- Section 401 requires Federal agencies to obtain certification from the state, territory, or Indian tribes before issuing permits that would result in increased pollutant loads to a waterbody. Section 401 certification is issued only if such increased loads would not cause or contribute to exceedances of

[9] A specific source from which pollutants are discharged

water quality standards. Section 401 water quality criteria are developed by state agencies for receiving waters based on their beneficial uses.

- Section 402 requires that developers obtain an NPDES permit for point source discharges into a surface waterbody.
- Section 404 regulates the placement of dredge or fill materials into waters of the United States.

For the proposed Project, surface water quality standards for state waters are administered by the Railroad Commission of Texas. The proposed Project would require an application to the Railroad Commission of Texas for a Section 401 Water Quality Certification.

The primary mechanism in the CWA regulating the discharge of pollutants is the NPDES program, which is administered by the USEPA. Under the NPDES program, a permit is required from USEPA or an authorized state for the discharge of any pollutant from a point source into the waters of the United States (Section 402; 33 U.S.C. § 1342). An NPDES permit for certain stormwater discharges is also required. In the case of discharges to the territorial sea or beyond, permits are also subject to the ocean discharge criteria developed under Section 403 of the CWA (33 U.S.C. § 1343). Permits for discharges into the territorial sea or state waters may be issued by states following approval of their permit program by USEPA; in the absence of an approved state permit program, and for discharges beyond the territorial sea, USEPA is the permit-issuing authority. The USEPA regulates and permits discharges to Texas and Federal waters through the NPDES program under the CWA. The proposed Project would require applications/NOIs to the USEPA for a NPDES Permit to Discharge Process Wastewater, including hydrostatic test water, from the SPOT DWP, NPDES Multi-Sector General Permit for Stormwater Discharges Associated with Industrial Activity for the Oyster Creek Terminal and mainline valves, and a General Construction Permit for Stormwater Discharges from Construction Activities for the Oyster Creek Terminal and Oyster Creek to Shore Pipelines.

The Section 404 Permit Program is administered by the USACE, but is subject to review by the USEPA and other resource agencies, such as the USFWS, NMFS, and applicable state agencies. The proposed Project would require permits under Sections 401, 402, and 404 of the CWA. All agency correspondence is located in Appendix D, Agency Correspondence, of this EIS.

1.6.8. Rivers and Harbors Act

Section 10 of the RHA prohibits the unauthorized obstruction or alteration of any navigable water of the United States. A Section 10 authorization is given for all structures and work located within U.S. waters, including infrastructure located on the seabed to the seaward limit of the OCS, through Section 4(f) of the Outer Continental Shelf Lands Act of 1953, as amended (43 U.S.C. § 1333(e)). The USACE has responsibility for Section 10 of the RHA. Section 408 (33 U.S.C. § 408) falls under Section 14 of the RHA. Section 14 of the RHA, approved March 3, 1899, provides that the Secretary of the Army, on the recommendation of the Chief of Engineers, may grant permission for the temporary occupation or use of any sea wall, bulkhead, jetty, dike, levee, wharf, pier, or other work built by the United States. This permission is granted by an appropriate real estate instrument in accordance with existing real estate regulations upon a determination that the alteration proposed would not be injurious to the public interest nor impair the usefulness of the civil works project.

The proposed Project would require permits under both Section 10 and Section 14 of the RHA. All agency correspondence is located in Appendix D, Agency Correspondence, of this EIS.

1.6.9. Clean Air Act

The CAA requires the USEPA to set limits on how much of each of several pollutants can be present in the ambient air anywhere in the United States. These limits are known as the National Ambient Air Quality Standards (NAAQS). The law allows individual states to develop their own ambient air quality standards, as long as they are commensurate with or more stringent than the NAAQS. Criteria (i.e., primary) air pollutants have NAAQS established by the CAA and include ozone, sulfur dioxide (SO_2), particulate matter, lead, nitrogen oxides (NO_x), and carbon monoxide (CO). The CAA includes specific limits, timelines, and procedures to reduce these criteria pollutants. The CAA also regulates what are called "hazardous air pollutants" (e.g., mercury compounds, lead compounds, benzene). SO_2 and NO_x, which contribute to acid rain, are regulated by the CAA under a comprehensive permit program for electric generating facilities. Further, the CAA protects stratospheric ozone by restricting the use of chlorofluorocarbons and limits ambient ground-level ozone by regulating the emissions of volatile organic compounds and NO_x.

Under the CAA, states have to develop state implementation plans (SIPs) that explain how each state will meet the NAAQS established under the CAA. A SIP is a collection of the regulations a state will use to improve areas that are not meeting the NAAQS and maintain those areas in compliance with the NAAQS. The USEPA must approve each SIP, and, if a SIP is not acceptable, the USEPA can assume enforcement of the CAA in that state. The SPOT Project would need to comply with the Texas SIP and, specifically, regional conditions for the HGB area for the onshore portions of the SPOT Project (TCEQ 2019b). The offshore area proposed for the SPOT DWP has not been designated as "nonattainment," "attainment," or "unclassifiable" in accordance with 40 CFR Part 81. The USEPA has reviewed and extended the applicable Texas state law to support the treatment of the offshore area as an attainment/unclassifiable area.

The CAA also regulates GHG emissions. There are multiple different GHGs, but the most common are carbon dioxide, methane, and nitrous oxide. Carbon dioxide equivalents are used to calculate total GHG emissions by estimating the global warming potential of each individual GHG emitted based on its global warming potential as compared to carbon dioxide. Major sources of GHG are required to implement best available control technology to control GHG emissions. In addition, certain GHG emitters are required to report annual GHG emissions under the GHG Reporting Rule (40 CFR Part 98).

1.6.9.1. New Source Review/Prevention of Significant Deterioration

One of the key programs designed to achieve compliance with the NAAQS is the New Source Review (NSR) program, a preconstruction review process for new and modified stationary sources. The NSR program has two component parts: the Prevention of Significant Deterioration (PSD) program for attainment or "clean" areas, which requires new or modified sources to install state-of-the-art pollution controls to ensure that the ambient air quality will not degrade; and the nonattainment area NSR program, which is designed to ensure that any new industrial growth in an area not meeting the NAAQS will comply with stringent emission limitations. The nonattainment NSR program requires the most protective pollution controls and emission offsets of new growth, with the goal of improving air quality overall to meet the NAAQS. The NSR program requires companies to obtain a permit for new construction or major modifications that substantially increase a facility's emissions of a criteria pollutant.

The proposed Project consists of two distinct but interrelated components: the onshore component and the offshore component. The Texas Commission on Environmental Quality (TCEQ) is the air permitting authority for air emissions from the onshore components of the SPOT Project. The Applicant has applied for separate NSR air permit authorizations under the Permit by Rule and Non-Rule Standard Permit programs. The USEPA Region 6 is the air permitting authority for the air emissions from the offshore components of the SPOT Project, and the Applicant has applied for an NSR PSD Permit-to-Construct. All consultation and correspondence is located in Appendix D, Agency Correspondence, of this EIS.

1.6.9.2. Title V Permits

State environmental agencies issue air permits to large stationary sources of pollution, including all sources subject to NSR permitting. The permitting process provides an operating permit for sources after they have completed construction or modifications to document all emission limits, monitoring, recordkeeping, and reporting requirements for ongoing operation of the new or modified facility. The information contained in this permit and all required records are available to the permitted facility, other agencies, and the public. These permits are known as “Title V” permits because they are required by Title V of the 1990 CAA. The Title V permit is meant to contain all the requirements for the permitted source and includes semi-annual and annual certification of compliance with the permit, all of which is public information.

The proposed Project would require a Title V Operating Permit from the USEPA Region 6 for the offshore components of the Project. All agency correspondence is located in Appendix D, Agency Correspondence, of this EIS.

1.6.9.3. New Source Performance Standards

Section 111 of the CAA requires the USEPA to establish criteria pollutant emission standards for stationary sources of air pollution. New Source Performance Standards establish emission controls, testing, recordkeeping, and reporting standards for various different types of emission sources, which are codified in 40 CFR Part 60. General provisions for facilities subject to New Source Performance Standards are codified in 40 CFR Part 62.

1.6.9.4. National Emission Standards for Hazardous Air Pollutants

Section 112 of the CAA requires the USEPA to regulate emissions of hazardous air pollutants (HAPs) using technology-based standards. These standards are known as National Emission Standards for Hazardous Air Pollutants codified in 40 CFR Parts 61 and 63 and are commonly referred to as Maximum Achievable Control Technology (MACT). During the pre-construction permitting process, developing a MACT standard could be required through a case-by-case MACT analysis for a particular new major HAP source category that may not be specifically regulated or exempt from a standard issued pursuant to Sections 112(d), 112(h), or 112(j) of the CAA. Stationary sources of HAP emissions which are covered by the National Emission Standards for Hazardous Air Pollutants are classified in two categories: major sources and area sources.

1.6.9.5. General Conformity

Section 176(c)(1) of the CAA established requirements to ensure that Federal actions or actions approved by Federal agencies do not adversely affect a state's ability to achieve and maintain attainment with the NAAQS for projects located in an area not in attainment with the NAAQS for one or more criteria pollutants. The proposed Project would have construction and operational emissions within the HGB ozone nonattainment area, thus requiring an evaluation of potential Project emissions with respect to General Conformity (TCEQ 2019a). Section 3.12.6, Air Quality, General Conformity, discusses potential Project emissions and General Conformity.

1.6.10. Migratory Bird Treaty Act

Migratory birds are protected under the Federal Migratory Bird Treaty Act (MBTA) of 1918 (16 U.S.C. § 703 et seq.), which was enacted as a prohibition on the killing of migratory birds. The MBTA prohibits activities that:

> pursue, hunt, take, capture, kill, attempt to take, capture or kill, possess, offer for sale, sell, offer to purchase, purchase, deliver for shipment, ship, cause to be shipped, deliver for transportation, transport, cause to be transported, carry, or cause to be carried by any means whatever, receive for shipment, transportation or carriage, or export, at any time, or in any manner, any migratory bird, included in the terms of this Convention...for the protection of migratory birds...or any part, nest, or egg of any such bird.

Migratory bird species protected by the MBTA occur throughout the general Project vicinity and are ubiquitous worldwide. On December 22, 2017, the Principal Deputy Solicitor of the Department of the Interior issued a legal opinion, M-37050, "The Migratory Bird Treaty Act Does Not Prohibit Incidental Take," concluding that the MBTA's prohibitions on pursuing, hunting, taking, capturing, killing, or attempting to do the same apply only to actions that are directed at migratory birds, their nests, or their eggs. On March 2, 2021, the Department of the Interior issued Memorandum M-37065, permanently revoking and withdrawing the 2017 Solicitor Opinion M-37050, which stated the MBTA does not prohibit incidental take. On January 7, 2021, the USFWS published a final rule that formalized the legal opinion, M-37050 (86 Fed. Reg. 4 [January 7, 2021], 1134); however, the USFWS revoked the January 7, 2021 rule and issued a final rule to return the implementation of MBTA to prohibit take and apply enforcement consistent with implementation practice that existed prior to 2017. The final rule was published in the Federal Register on October 4, 2021 (86 Fed. Reg. 189 [October 4, 2021], 54642) and became effective on December 3, 2021. As such, at the time of publication of this EIS, the MBTA's prohibition on pursuing, hunting, taking, capturing, killing, or attempting to do the same applies to all "direct and affirmative purposeful actions that reduce migratory birds, their eggs, or their nests, by killing or capturing, to human control." Under this guidance, the incidental take of migratory birds or nests from clearing activities associated with the Project would violate the MBTA. Additionally, Executive Order 13186 (66 Fed. Reg. 11 [January 17, 2001], 3853) directs Federal agencies to identify where unintentional take is likely to have a measurable negative effect to migratory bird populations and to avoid or minimize adverse impacts on migratory birds through enhanced collaboration with the USFWS. While the MBTA does not explicitly contain specific compliance measures to address potential impacts on migratory birds, under Memorandum M-37065 and in concert with Executive Order 13186, the USFWS will continue to encourage developers to evaluate existing avian resources and take reasonable measures to prevent avian impacts.

Section 3.5.3, Wildlife and Aquatic Resources, Wildlife, of this EIS describes migratory birds and potential Project-related impacts.

1.6.11. Bald and Golden Eagle Protection Act

The Bald and Golden Eagle Protection Act makes it unlawful to take, possess, sell, purchase, barter, offer to sell, purchase or barter, transport, export or import, at any time or any manner, any bald or golden eagle, alive or dead, or any part, nest, or egg thereof without a permit. “Take” includes pursue, shoot, shoot at, poison, wound, kill, capture, trap, collect, molest or disturb (16 U.S.C. § 668c; 50 CFR § 22.3). Since delisting of the Bald Eagle under the ESA in 2007, Bald Eagles are now protected only by the Bald and Golden Eagle Protection Act and the MBTA. Section 3.7.2, Threatened and Endangered Species, State Listed Threatened and Endangered Species, in this EIS describes Bald Eagles and potential Project-related impacts. Golden Eagles are not known to be present in the Project area.

1.6.12. Oil Pollution Act

The Oil Pollution Act of 1990 (OPA90) streamlined and strengthened the Federal government’s ability to prevent and respond to catastrophic oil spills. A trust fund financed by a tax on oil is available to clean up spills when the responsible party is incapable or unwilling to do so. OPA90 requires oil storage facilities and vessels to submit to the Federal government plans detailing how they would respond to large discharges. The USEPA has published regulations for aboveground storage facilities, and the USCG has published regulations for oil tankers. OPA90 also requires the development of Area Contingency Plans to prepare and plan for oil spill response on a regional scale. The Applicant’s Onshore Construction Spill Response Plan is included in Appendix F, Applicant’s Onshore Construction Spill Response Plan. Additional information regarding oil spill risks and response can be found in the Oil Spill Trajectory and Fate Modeling Report (SPOT 2019w); the Spill Risk Analysis (SPOT 2019a, Application, Volume IIa, Appendix M); Appendix H, Spill Risk Analysis; and Appendix I, Summary of Hypothetical Oil Spill Response Actions.

1.6.13. Archeological Resources Protection Act

The Archeological Resources Protection Act (ARPA) established requirements to protect archaeological resources and sites on public lands and Indian lands, and to foster increased cooperation and exchange of information between governmental authorities, the professional archaeological community, and private individuals. ARPA (16 U.S.C. § 470aa to mm) established civil and criminal penalties for the destruction or alteration of cultural resources. The USDOI has issued regulations under the ARPA, available at 43 CFR Part 7, establishing definitions, standards, and procedures to be followed by all Federal land managers in providing protection for archaeological resources located on public lands and Indian lands of the United States. In addition, the National Park Service has issued regulations under the ARPA for the curation of Federally owned and administered collections; these regulations are available at 36 CFR Part 79. Section 3.9, Cultural Resources, of this EIS describes cultural resources and potential Project-related impacts.

1.6.14. Native American Graves Protection and Repatriation Act

The Native American Graves Protection and Repatriation Act of 1990 (NAGPRA) and the regulations (43 CFR Part 10) that allow for its implementation address the rights of lineal descendants, Indian tribes, and Native Hawaiian organizations (parties with standing) to Indian human remains, funerary objects, sacred objects, and objects of cultural patrimony (cultural items). The statute requires Federal agencies and museums to provide information about Indian cultural items to parties with standing and, upon presentation of a valid claim, ensure the item(s) undergo disposition or repatriation. NAGPRA requires that the National Park Service and Bureau of Reclamation complete a number of reports and submit them to tribes and the USDOI through the National NAGPRA Program. Section 3.9, Cultural Resources, of this EIS describes cultural resources and potential Project-related impacts.

1.6.15. State-Owned Submerged Land, Texas Natural Resources Code, Antiquities Code of Texas

The Submerged Lands Act of 1953 (SLA) and the regulations (43 U.S.C. § 1301 et seq.) grants coastal states title to natural resources located within their coastal submerged lands out to 3 nautical miles from their coastlines (9 nautical miles for Texas). The SLA Boundary (also known as the State Seaward Boundary or Federal-State Boundary) defines the seaward limit of a state's submerged lands and the landward boundary of Federally managed OCS lands. The SLA defines "natural resources" as oil, gas, and all other minerals, and fish, shrimp, oysters, clams, crabs, lobsters, sponges, kelp, and other marine animal and plant life," yet expressly excludes "water power, or the use of water for the production of power." It addresses the rights and claims by the states to the lands and resources beneath navigable waters within their historic boundaries and provides for their development by the states. The SLA preserves the control of the seabed and resources of the OCS beyond state boundaries to the Federal government and authorizes leasing by the Secretary of the Interior in accordance with certain specified terms and conditions.

Under Texas Natural Resources Code § 51.291, the GLO is responsible for managing state-owned submerged land. Portions of the Project on state-owned submerged land would require a Miscellaneous Easement authorized by the GLO Commissioner. Written authorization from the GLO would also be required if any portions of a permittee-responsible mitigation project were to be located on state-owned submerged land.

The principal Texas legislation governing cultural resources is the Antiquities Code of Texas (ACT) (Texas Natural Resource Code, Title 9, Chapter 191). The ACT requires state agencies and political subdivisions of the state—including cities, counties, river authorities, municipal utility districts, and school districts—to notify the Texas Historical Commission (THC), which is the Texas SHPO, of ground-disturbing activity on public land and work affecting state-owned historic buildings.

The ACT also establishes the designation of State Antiquities Landmarks (SALs), which may be applied to state-owned historic buildings and any archeological sites on non-Federal public lands (9 Tex. Nat. Res. Code § 191.091). Under the ACT, all cultural resources on non-Federal public lands in Texas are eligible to be designated as SALs. Historic buildings and other aboveground historic resources must be listed in the National Register of Historic Places (NRHP) before they can be designated as SALs, but archeological sites do not need to be listed on the NRHP to be considered SALs.

The requirements of the ACT apply to all public lands within Texas, including waters that are “in, on, or under any of the land in the state of Texas, including the tidelands, submerged land, and the bed of the sea” (9 Tex. Nat. Res. Code § 191.002).

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2. DESCRIPTION OF THE PROPOSED ACTION AND ALTERNATIVES

2.1. INTRODUCTION

The following sections present a detailed description of the design, construction, operation, and eventual decommissioning of the proposed Project (Section 2.2, Detailed Description of the Proposed Action). This chapter also includes sections that analyze reasonable alternatives to the Proposed Action (or proposed Project), including the No Action Alternative, system alternatives, site alternatives, and design alternatives as required by NEPA (Sections 2.3 through 2.9).

NEPA requires any Federal agency proposing a major action to consider reasonable alternatives to the Proposed Action. The NEPA environmental analysis is one of the nine factors the Secretary must consider in making a final determination (33 U.S.C. § 1503c). To warrant detailed evaluation by MARAD and the USCG, an alternative must be reasonable and meet the purpose and need of the Proposed Action. The CEQ defines reasonable as, “practical or feasible from the technical and economic standpoint and using common sense” (CEQ 1981). Specific criteria are used to determine the reasonability/feasibility of alternatives and are described in Section 2.3 through 2.10. As described in Section 2.11, under the DWPA, the Secretary is not required to identify a preferred alternative within the EIS and defers identification of the agency’s preferred alternative until a decision is made to approve or deny a DWP license.

2.2. DETAILED DESCRIPTION OF THE PROPOSED ACTION

The proposed SPOT DWP would be located in Federal waters of the GoM, in Galveston Area OCS lease blocks 463 and A-59, approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas, in water depths of approximately 115 feet. Onshore components of the proposed Project would be located in both Brazoria and Harris counties, Texas. The general location of the proposed Project is depicted on Figure 1.1-1 in Chapter 1, Introduction. The onshore components of the Project would consist of:

- Modifications to the existing ECHO Terminal, including four electric motor-driven mainline crude oil pumps, four electric motor-driven booster crude oil pumps, and one measurement skid to support delivery of crude oil to the proposed Oyster Creek Terminal;
- The 50.1-mile, 36-inch-diameter ECHO to Oyster Creek Pipeline;
- One pipeline interconnection from the existing Rancho II 36-inch-diameter pipeline to the ECHO to Oyster Creek Pipeline (Rancho II Junction);
- A new Oyster Creek Terminal, including six electric motor-driven mainline crude oil pumps with the capacity to push crude oil to the offshore pipelines at a rate of up to 85,000 bph (2 million bpd), four electric motor-driven booster crude oil pumps, seven aboveground storage tanks (each with a capacity of 685,000 bbl [600,000 bbl of working storage]) for a total onshore storage capacity of approximately 4.8 million bbl (4.2 million bbl working storage) of crude oil, metering equipment, two permanent and one portable vapor combustion units, and a firewater system;
- Two collocated 12.2-mile, 36-inch-diameter Oyster Creek to Shore Pipelines; and

- Ancillary facilities for the onshore pipelines, including ten mainline valves (MLVs), of which six would be along the ECHO to Oyster Creek Pipeline and four along the Oyster Creek to Shore Pipelines, pig launchers for the ECHO to Oyster Creek Pipeline, and pig launchers and receivers for the Oyster Creek to Shore Pipelines.

The State of Texas is the only coastal state that would be directly connected by pipeline to the SPOT DWP or located within 15 miles[1] of it. Accordingly, Texas is the only adjacent coastal state for the SPOT DWP, pursuant to Section 1502 of the DWPA (33 U.S.C. § 1502 (1)).

The offshore components would consist of:

- Two collocated, bi-directional, 46.9-mile, 36-inch-diameter crude oil offshore pipelines for crude oil delivery from the proposed Oyster Creek Terminal to the platform;
- One fixed offshore platform with eight piles, four decks, and three vapor combustion units;
- Two SPM buoys to concurrently moor two VLCCs or other crude oil carriers with capacities between 120,000 and 320,000 deadweight tonnage for loading up to 365 days per year, including floating crude oil and vapor recovery hoses (SPOT 2019a, Application, Vol IIa, Section 1; EIA 2014; Maritime Connector 2019);
- Four PLEMs—two per SPM buoy—to provide the interconnection between the SPOT DWP and the SPM buoys;
- Four 0.66-nautical mile, 30-inch-diameter pipelines (two per PLEM) to deliver crude oil from the platform to the PLEMs; and
- Four 0.66-nautical mile, 16-inch-diameter vapor recovery pipelines (two per PLEM) to connect the VLCC or other crude oil carrier to the three vapor combustion units on the platform.

The SPOT Project would be capable of exporting a number of products, including ultralight crude, such as processed condensate; light crude, such as the West Texas Intermediate; and heavy grade crude oil, such as Western Canadian Select.

2.2.1. Onshore Storage/Supply Components

The onshore storage and supply components would include modifications to the existing ECHO Terminal, including the addition of a pump and meter station, the new Oyster Creek Terminal, and onshore pipelines and ancillary facilities.

2.2.1.1. ECHO Terminal

The existing ECHO Terminal is located approximately 4 miles northeast of Pearland, Texas in Harris County near the intersection of Interstate 45 and State Highway (SH) 8 (also known as Beltway 8 and the Sam Houston Tollway). New equipment would be installed within the existing operating fence line of the facility, and would provide connection to crude oil supplies from multiple sources along the northern Texas Gulf Coast. Modifications at the ECHO Terminal would include:

[1] Unless otherwise specified, the term "mile" refers to statute miles throughout this EIS.

- Four 10,000-horsepower (hp), electric motor-driven, centrifugal pumps in series;
- Four 2,500-hp, electric motor-driven, vertical booster pumps; and
- One measurement skid.

The vertical booster pumps would operate in two parallel sets of two—one set would connect to the electronic delivery system manifold and its related storage tanks, and the other set would connect to the legacy manifold and related storage tanks. Both booster pump trains would move crude oil from their respective manifolds and related storage tanks through the measurement skid prior to delivery to the mainline pumps. The measurement skid would hold helical turbine metering equipment, which would meter the crude oil exiting the ECHO Terminal destined for the Oyster Creek Terminal. The mainline centrifugal pumps would operate in series to pump crude oil at or up to 1,480 pounds per square inch. Backup energy sources are not proposed for the centrifugal or booster pumps; therefore, if the ECHO Terminal lost power, the pumps would not operate until power is restored. Figure 2.2-1 provides an aerial image of the existing ECHO Terminal, including the area where the new equipment would be installed.

2.2.1.2. ECHO to Oyster Creek Pipeline

To connect the existing ECHO Terminal with the proposed Oyster Creek Terminal, the Applicant would construct one 36-inch-diameter pipeline (ECHO to Oyster Creek Pipeline). The ECHO to Oyster Creek Pipeline would be 50.1 miles long and would cross both Harris and Brazoria counties, Texas. The route would run from the existing ECHO Terminal parallel to an existing pipeline right-of-way through Harris County, and west to Brazoria County for 19.9 miles. It would then turn southwest and parallel a levee and railroad for 1.7 miles, followed by a pipeline right-of-way for 4.7 miles. The pipeline would then run generally south, following property lines, for 7.1 miles, then parallel an electric transmission right-of-way for 16.1 miles to the Oyster Creek Terminal. Table 2.2-1 outlines the areas of collocation for the ECHO to Oyster Creek Pipeline.

Table 2.2-1: Collocation of the ECHO to Oyster Creek Pipeline with Other Rights-of-Way

Collocated Facility Name	Milepost Start	Milepost End	Approximate Distance Between Right-of-Way Centerlines (feet)
Enterprise Rancho Pipeline (36-inch)	0.0	19.9	15
Enterprise Seaway Pipeline (36-inch)	21.6	26.3	25
CenterPoint Energy Transmission Line	33.4	49.5	65

Source: SPOT 2019l, 2019y

It is unknown at the time of this EIS how much of the existing maintained rights-of-way would overlap with the ECHO to Oyster Creek Pipeline right-of-way, as agreements have not yet been finalized. However, MARAD and the USCG have reviewed the available data and determined that a portion of the proposed right-of-way would likely overlap with the existing rights-of-way from Milepost (MP) 0.0 to MP 19.9 and from MP 21.6 to MP 26.3, due to the proximity of the centerline of the existing right-of-way and the fact that the ECHO to Oyster Creek Pipeline would be collocated with an Enterprise utility. From MP 33.4 to MP 49.5, MARAD and the USCG have determined there would be minimal to no overlap with the existing right-of-way of the CenterPoint Energy transmission line due to the distance between the centerlines of the rights-of-way.

Source: SPOT 2019ll and GIS spatial files received from SPOT

Figure 2.2-1: Aerial View of the Existing ECHO Terminal and Proposed Modifications

In addition, a connection from the existing 36-inch Rancho II Pipeline to the ECHO to Oyster Creek Pipeline would be constructed at the MLV 2 site. This would include a measurement skid, and is collectively referred to in this EIS as the pipeline interconnection from the existing Rancho II 36-inch-diameter pipeline to the ECHO to Oyster Creek Pipeline. Appendix J, USGS Topographic Map Route Series, illustrates the pipeline route.

A new pig[2] launcher would be constructed at the beginning MP of the ECHO to Oyster Creek Pipeline within the operating fence line of the ECHO Terminal, and a new pig receiver would be constructed at the ending MP of the pipeline within the fence line of the Oyster Creek Terminal. The purpose of pig launchers and receivers is to allow for inspection or cleaning using a smart pig, maintenance pig, or sphere without shutting down the pipeline.

The ECHO to Oyster Creek Pipeline would also include the construction of six MLVs, which would be installed approximately 10 miles apart. Each MLV site would be approximately 0.1 acre in size, fenced for security purposes, and have the option to be operated either locally or remotely via electric motor operators.

The permanent easement for the ECHO to Oyster Creek Pipeline would be 30 feet wide, and the construction workspace would generally be 100 feet wide. Additional temporary workspace (ATWS) would be needed in certain locations (e.g., horizontal directional drill [HDD] entry and exit sites, feature crossings, point of intersect). The pipeline would be installed with a minimum of 3 feet of cover per 49 CFR § 192.327.

2.2.1.3. Oyster Creek Terminal

The proposed Oyster Creek Terminal would be located approximately 2.5 miles northeast of Lake Jackson, Texas and 4 miles southeast of Angleton, Texas in Brazoria County, on Farm to Market Road 523. The site would be approximately 140.1 acres, and most of the acreage would be permanently affected through the installation of facilities and impervious surfaces. The portion of the site that would be allowed to remain in an herbaceous state would be regularly maintained. The 140.1-acre site would be secured by an 8-foot-tall security fence and have perimeter video surveillance. The facilities at the Oyster Creek Terminal would include:

- Seven crude oil storage tanks;
- Four 900-hp, electric motor-driven, vertical booster pumps (two for each of the Oyster Creek to Shore Pipelines);
- Six 9,000-hp, electric motor-driven, centrifugal pumps (three for each of the Oyster Creek to Shore Pipelines, working in series);
- Four measurement skids;
- Two permanent and one portable vapor combustion units;
- A firewater system and pond;

[2] A pig is an internal tool that can be used to clean and dry a pipeline and/or to inspect it for damage or corrosion.

- An electrical substation and utilities; and
- Office, warehouse, and support buildings.

Seven aboveground storage tanks would be installed at the Oyster Creek Terminal, each with a total storage capacity of 685,000 bbl (working storage capacity of 600,000 bbl each). In total, the storage capacity at the Oyster Creek Terminal would be approximately 4.8 million bbl (4.2 million bbl of working storage). The tanks would be constructed of steel, and would have interior steel floating roofs and exterior geodesic aluminum roofs—specifications considered to be the best available control technology for minimizing air emissions for crude oil storage. The site would include secondary containment for the storage tanks. One berm would be constructed around all seven storage tanks, and would be capable of holding up to 110 percent of the 685,000-barrel capacity of one storage tank (i.e., 753,500 bbl), in accordance with USEPA regulations (40 CFR Part 112). Berms would also be installed around each individual tank, and would be capable of holding 10 percent of each storage tank (i.e., 68,500 bbl).

The four measurement skids would hold helical turbine metering equipment, and would be installed within the fence line of the Oyster Creek Terminal. One measurement skid would be installed where the ECHO to Oyster Creek Pipeline would enter the site, two measurement skids would be installed where the Oyster Creek to Shore Pipelines would exit the site, and one measurement skid would be installed for a potential future third-party pipeline connection. No current plans exist for future connections; however, the Applicant has proposed to allot space for an additional pipeline in the event it may be needed. Any such future connection would be subject to its own, distinct NEPA and permitting process.

The vertical booster pumps and the centrifugal pumps would work in parallel to move the crude oil. Two sets of two vertical booster pumps would move oil from the storage tanks through the measurement skids. Two sets of three centrifugal pumps each would be installed downstream of the booster pumps and would move crude oil from the measurement skids to the Oyster Creek to Shore Pipelines. The pumps would have a maximum flow rate of 42,500 bph, but would be capable of varying speeds to adjust flow rates. Backup energy sources are not proposed for the centrifugal or booster pumps; therefore, if the Oyster Creek Terminal lost power, the pumps would not operate until power is restored.

Vapors are generated in the space between the internal floating roof of the storage tank, which is an emissions control device, and the level of the oil below the floating roof when the storage tank has been emptied and is being filled after undergoing maintenance or a change in product. To prevent these vapors from being uncontrollably emitted (i.e., while oil is not in contact with the floating roof), two permanent and one back-up vapor combustors would be installed. The vapor combustors would be capable of eliminating more than 99 percent of volatile organic compounds (VOCs) that would otherwise be emitted during tank filling, maintenance, or inspection activities. The flame for the unit would be enclosed; however, the base of the exhaust stack would include louvers to allow control of airflow. Each vapor combustor would include a 12.5-foot-diameter, 70-foot-tall combustion stack, a vapor safety unit, a vapor blower unit, isolation and control valves, detonation arrestors, and associated piping. One horizontal knockout vessel would be installed at the Oyster Creek Terminal to service both combustors, which would be used to separate liquids from the vapor before the vapor is sent through the combustion units.

For fire control purposes, a firewater pond would be constructed within the Oyster Creek Terminal site and would be capable of holding 25,200,000 gallons of water, which is equivalent to the volume of water required to hydrostatically test a single storage tank. The water from the firewater pond would be used to control a fire. In addition, a foam system would be installed to control fires at storage tank seals. The northwest corner of the firewater pond and the foam system would be located approximately 2,500 feet from the farthest point on the site at which firefighting equipment would be needed (i.e., the farthest edge of the northern-most storage tank). The firewater pond would be sloped to drain to a stormwater outfall, should an excessive rain event occur.

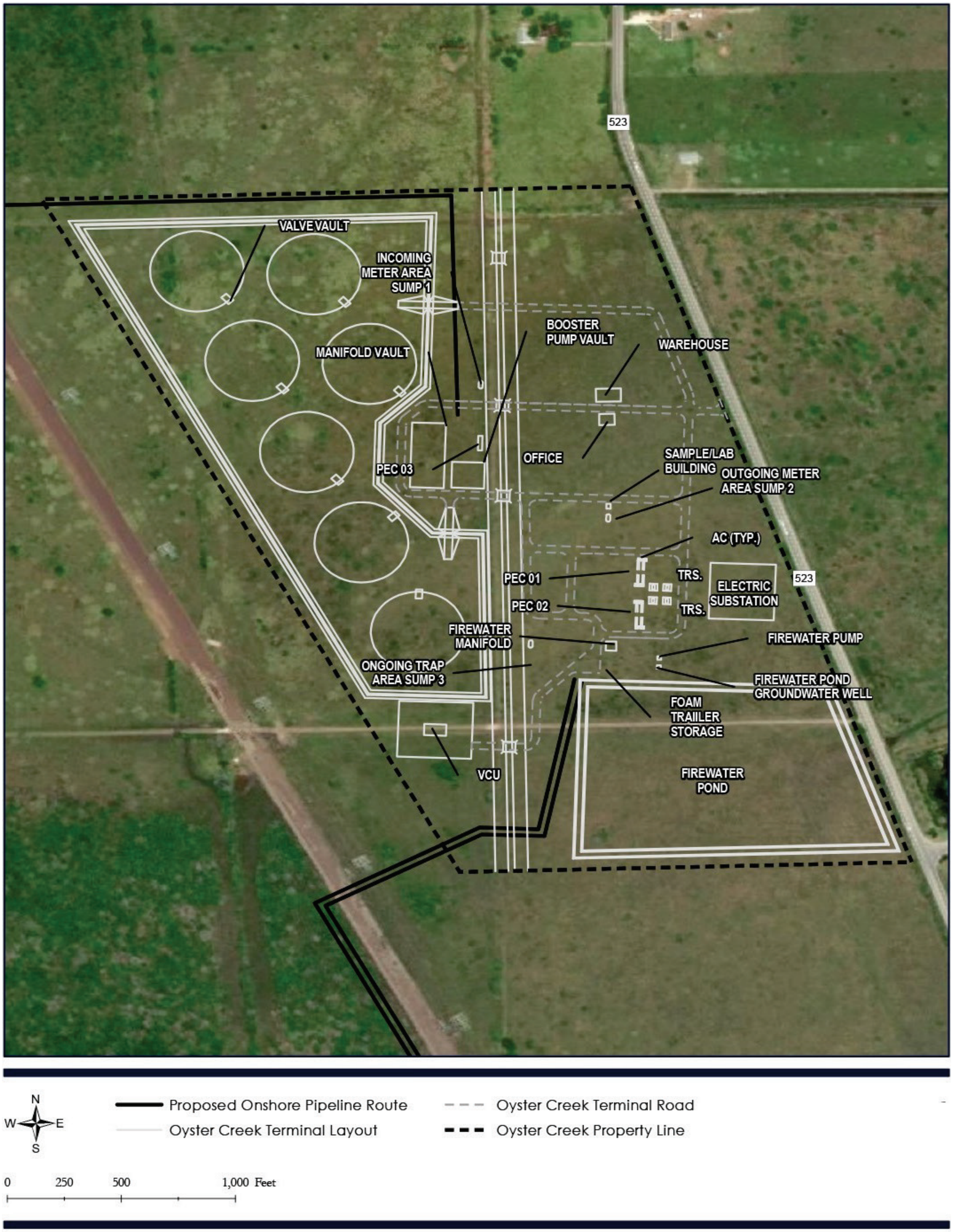
Additional facilities would be installed to support the operation of the Oyster Creek Terminal and would include an electrical substation, electrical service, and office and warehouse buildings, as well as an on-site sewage system. The substation would provide electrical service to the facilities on the entire site and would be powered by the existing electrical transmission system located adjacent to the Oyster Creek Terminal site along Farm to Market Road 523. Lighting at the Oyster Creek Terminal is anticipated to include flood lights mounted on approximately 25-foot-tall poles, other outdoor lighting rated for the correct classification per National Fire Protection Association and American Petroleum Institute (API) standards, supplemental floodlights as needed for particular operational activities, and emergency lighting. All outdoor lighting at the Oyster Creek Terminal would have globes and refractors, as well as outer globes and guards. Lighting to be placed near heavily trafficked areas would also have external reflectors to minimize the glare from the lights.

Figure 2.2-2 provides an aerial image of the boundary of the proposed Oyster Creek Terminal, including the locations for new equipment.

2.2.1.4. Oyster Creek to Shore Pipelines

Two collocated 36-inch-diameter pipelines would be constructed from the Oyster Creek Terminal to the shoreline (Oyster Creek to Shore Pipelines) in Brazoria County, Texas. These pipelines would be approximately 12.2 miles long, and would run generally south-southeast from the Oyster Creek Terminal to the shoreline, where they would become the subsea pipelines from the shoreline to the SPOT DWP. The route of the Oyster Creek to Shore Pipelines would run south-southeast from the proposed Oyster Creek Terminal parallel to an existing CenterPoint Energy electrical transmission line right-of-way for 2.2 miles, then follow an existing south-southwest pipeline right-of-way for 2.0 miles. The route would continue south-southeast paralleling another existing pipeline right-of-way for 1.0 mile, then mostly parallel other existing pipeline rights-of-way for 4.5 miles. The last portion of the route would continue south-southeast through greenfield areas to the MLV site at the shore crossing. Appendix J, USGS Topographic Map Route Series, illustrates the pipeline route. Table 2.2-2 outlines the areas of collocation for the Oyster Creek to Shore Pipelines.

Since the publication of the Draft EIS, the Applicant has changed the proposed location of the shoreline MLV from the south side to the north side of Bluewater Highway (approximately 80 meters [262 feet] farther inland) to minimize visual impacts along the beach during construction (SPOT 2019uu). This change is reflected in the alignment mapping included in Appendix Z and throughout this EIS, where appropriate.



Source: SPOT 2019a, Application, Volume IIb, Section 1

Figure 2.2-2: Oyster Creek Terminal Plot Plan

Table 2.2-2: Collocation of the Oyster Creek to Shore Pipelines with Other Rights-of-Way

Collocated Facility Name	Milepost Start	Milepost End	Approximate Distance Between Right-of-Way Centerlines (feet)
CenterPoint Energy Transmission Line	0.3	2.2	140
Gulf South Pipeline (18-inch)	2.2	4.2	190
Enterprise Pipeline (6-inch)	4.4	4.8	10
Freeport LNG Pipeline (42-inch)	4.8	7.6	35
American Midstream Pipeline (12-inch)	8.4	9.9	35
Sunoco Pipeline (8-inch)	10.6	11.0	25

Source: SPOT 2019l, 2019y

It is unknown at the time of this EIS how much of the existing maintained rights-of-way would overlap with the Oyster Creek to Shore Pipelines right-of-way, as agreements have not yet been finalized. However, MARAD and the USCG have reviewed the available data and determined that a portion of the proposed right-of-way would likely overlap with the existing rights-of-way from MP 4.4 to MP 4.8, MP 4.8 to MP 7.6, MP 8.4 to MP 9.9, and MP 10.6 to MP 11.0, due to the proximity of the centerline of the existing right-of-way. From MP 0.3 to MP 2.2 and MP 2.2 to MP 4.2, MARAD and the USCG have determined there would be minimal to no overlap with the existing rights-of-way of these utilities due to the distance between the centerlines of the rights-of-way.

The Oyster Creek to Shore Pipelines would also include the construction of four MLVs. One MLV (one for each pipeline) would be constructed at MP 5.4. In its original application and as presented in the Draft EIS, the Applicant indicated the second MLV would be constructed at MP 12.2. Since the publication of the Draft EIS, the Applicant has proposed to move the MLV from the south side of Bluewater Highway at MP 12.2 to the north side of Bluewater Highway at MP 12.1 (Appendix Z). Each MLV site would be approximately 0.1 acre, fenced for security purposes, and have the option to be operated either locally or remotely via electric motor operators. The Oyster Creek to Shore Pipelines would have pigging capability; the pig launchers/receivers would be located within the Oyster Creek Terminal, allowing continuous pigging from the Oyster Creek Terminal to the SPOT DWP platform and back.

The permanent easement for the Oyster Creek to Shore Pipelines would be 30 feet wide, and the construction right-of-way would generally be 150 feet wide to accommodate both 36-inch pipelines. ATWS would be needed in certain locations (e.g., HDD entry and exit sites, feature crossings, point of intersect). The pipelines would be installed with a minimum of 3 feet of cover per 49 CFR § 192.327.

2.2.2. Offshore/Marine Components

The offshore portion of the SPOT Project would originate at the shoreline crossing in Surfside, Brazoria County, Texas, where the onshore Oyster Creek to Shore Pipelines would tie into the subsea pipelines to deliver crude oil to the SPOT DWP. All portions of the SPOT Project would be located on the OCS in the Bureau of Ocean Energy Management (BOEM)-defined Galveston Area lease blocks. Figure 1.1-1 shows the general location of the proposed Project. A more detailed description of the offshore Project components is provided in the sections below. A summary of Galveston Area lease blocks where the SPOT Project facilities would be located is provided in Table 2.2-3.

Table 2.2-3: Lease Block Information for the SPOT Project

Project Facility	OCS Galveston Area Lease Blocks
Subsea crude oil export pipelines	280, 304, 303, 314, 330, 329, 347, 348, 360, 359, 382, 392, 421, 426, 463
SPOT DWP platform	463
SPOT anchorage area	A-59

Source: BOEM 2019d

DWP = deepwater port; OCS = Outer Continental Shelf; SPOT = Sea Port Oil Terminal

The offshore components of the SPOT Project would consist of:

- The subsea crude oil export pipelines;
- The offshore platform, including the crude oil loading pipelines and vapor recovery pipelines, PLEMs, and the vapor combustion units;
- SPM buoys and interconnections;
- Service vessel moorings; and
- Anchorage area.

2.2.2.1. Subsea Crude Oil Export Pipelines from Onshore to the Deepwater Port Platform

The Applicant would construct two collocated 36-inch-diameter pipelines to deliver crude oil from the Oyster Creek to Shore Pipelines to the SPOT DWP. The pipelines would be approximately 40.8 nautical miles long. They would leave the shoreline perpendicularly towards the southeast, then turn to run northeast and then southeast around the Freeport Harbor Anchorage Area. After skirting the anchorage area, the pipelines would run southeast where they would cross the state water boundary and the Aransas Pass to Calcasieu Pass shipping fairway[3], then turn 90 degrees southwest to perpendicularly cross the Freeport Shipping Fairway. The subsea pipelines would then turn south through five lease blocks to the proposed SPOT DWP in Galveston Area lease block 463. Figure 2.2-3 shows the pipeline route and the lease blocks the pipelines would cross.

The subsea crude oil pipelines would conform to the definitions of American Society of Mechanical Engineers (ASME) 600#, and would be concrete coated to approximately 5 inches for on-bottom stability. The pipelines would also be coated with 15 to 16 mils[4] fusion-bonded epoxy for corrosion protection. The pipelines would be installed a minimum of 3 feet below the ocean floor; however, in areas where the pipelines would cross a shipping fairway, the pipelines would be installed a minimum of 10 feet below the underwater natural bottom elevation (49 CFR § 192.327, 49 CFR § 192.612). Where the subsea pipelines would cross existing pipelines, concrete mattresses would be added for separation and protection, and bracelet anodes for cathodic protection would be installed.

The subsea pipelines would have pigging capability; the pig launchers/receivers would be located within the Oyster Creek Terminal, allowing continuous pigging from the Oyster Creek Terminal to the SPOT DWP platform and back. The subsea crude oil pipelines would be installed from the shore crossing to just

[3] A shipping fairway is a lane or corridor in which no artificial island or fixed structure, whether temporary or permanent, is permitted, so as to provide unobstructed approaches for vessels using U.S. ports (33 CFR §166.100 and 33 CFR §166.105).
[4] 1 mil equals 0.001 inch.

over 1.0 mile (5,500 feet) offshore using the HDD method. From the HDD exit site, the pipelines would be installed using a lay barge and trenched with a sled. The Applicant selected the HDD method for installing the subsea pipelines from the shore crossing running offshore to avoid impacts on the beach area at the shoreline, as well as nearshore waters and habitats that experience high levels of commercial and recreational use. Detailed descriptions of construction methods are provided in Section 2.2.6, Offshore Construction and Installation.

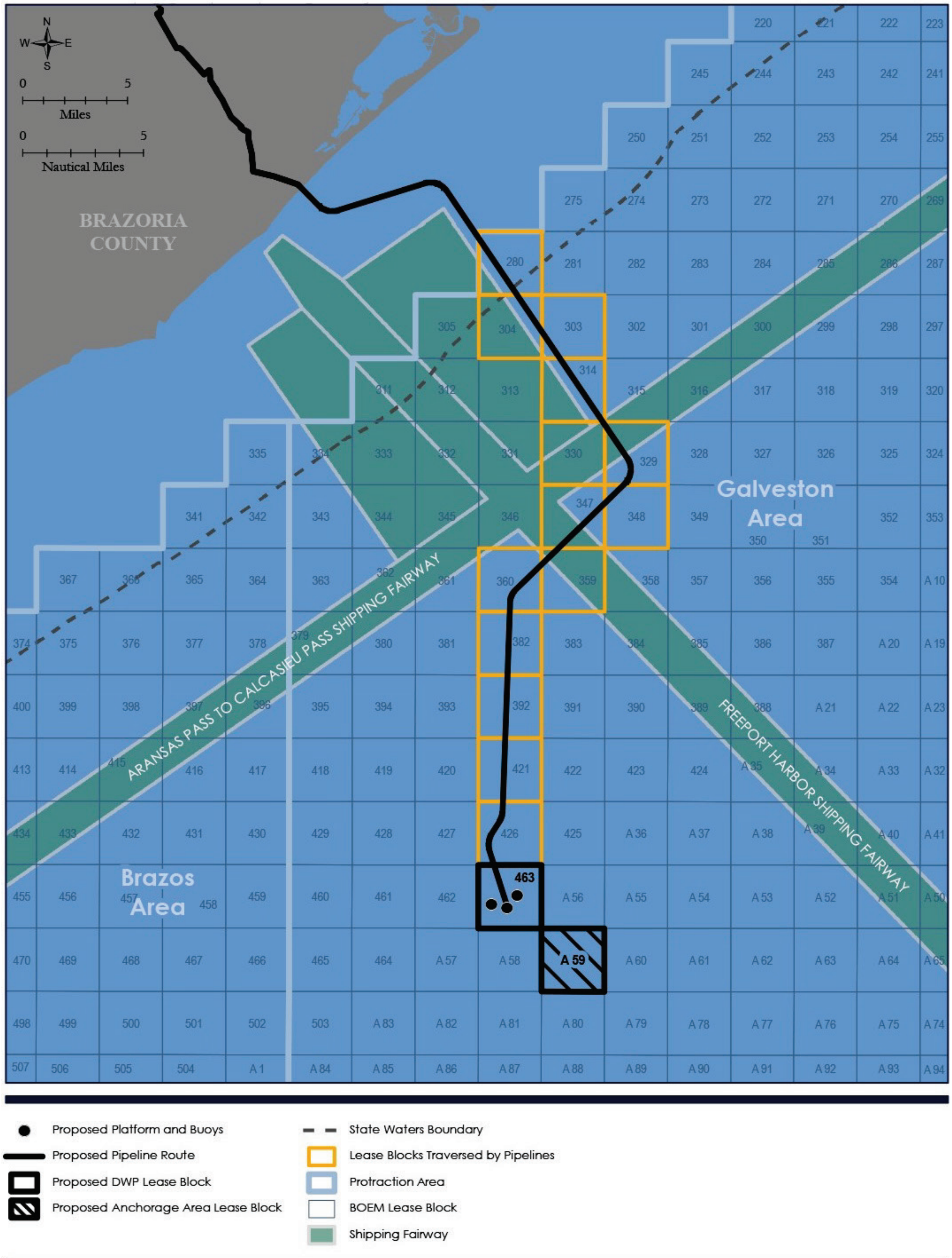
The collocated subsea pipelines would be bi-directional, allowing the Applicant to transport different crude oil grades to and from the platform simultaneously. The Applicant would change crude oil grades in the pipelines by displacing one product from one pipeline through the second pipeline back to the Oyster Creek Terminal. This would allow the platform to load two different crude oil grades to two VLCCs or other crude oil carriers concurrently, or load the vessels with the same product back to back.

2.2.2.2. SPOT Deepwater Port Platform

The subsea crude oil pipelines would run from shore to the SPOT DWP in Galveston Area lease block 463 where the SPOT DWP would be located in approximately 115 feet of water. The SPOT DWP would be a manned jacket-designed platform able to accommodate 20 platform-based personnel and up to 36 people total for short visits. The platform would be supported by a jacket (i.e., the tubular structure supporting the decks) equipped with eight piles and four decks, including:

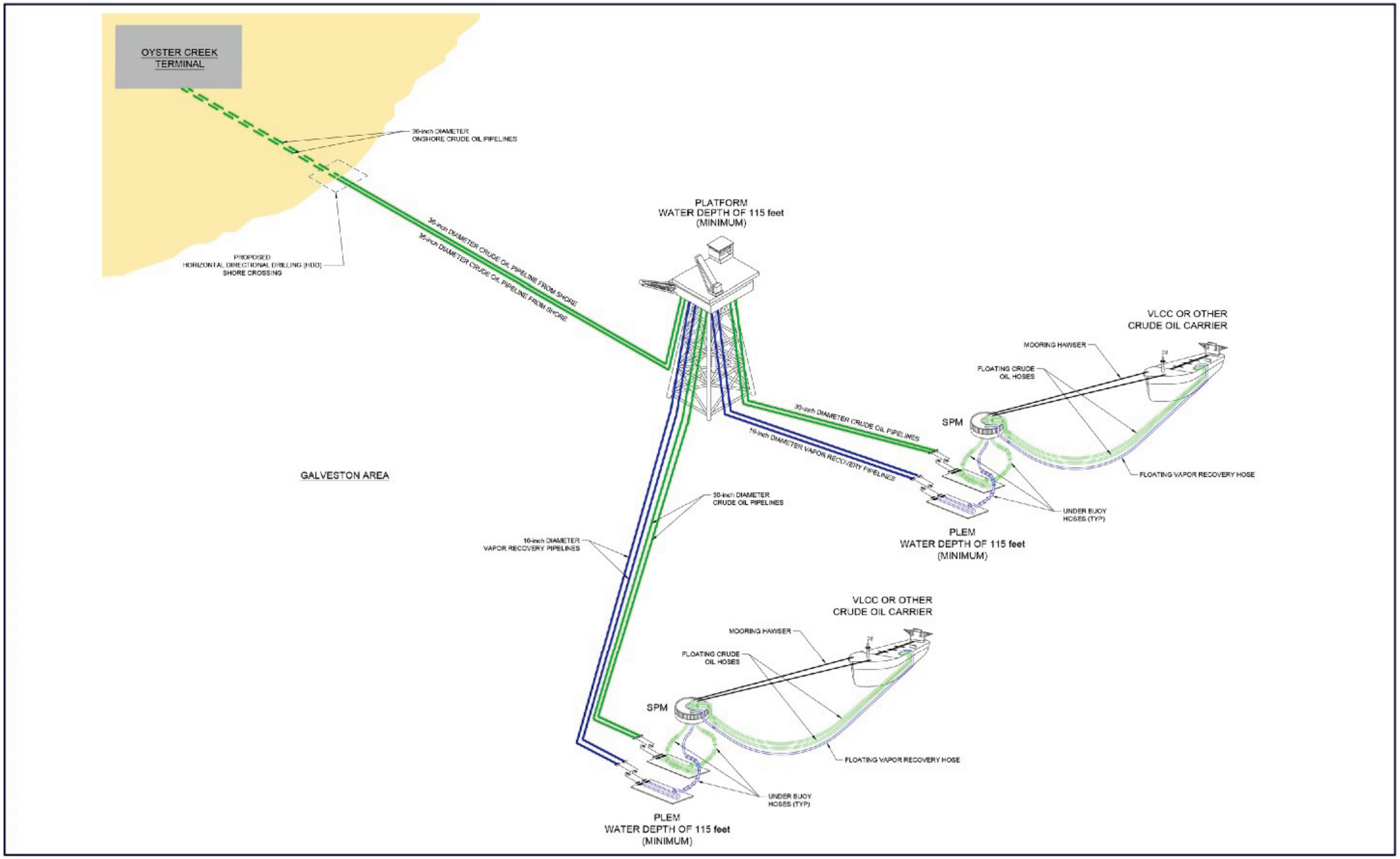
- A laydown deck with a crane laydown area;
- A main deck with a lease automatic custody transfer (LACT) unit, prover loop, living quarters, electrical and instrument building, and other ancillary equipment;
- A cellar deck with departing pig launchers/receivers, generators, and vapor combustion units; and
- A sump deck with shut-down valves and open drain sump.

Figure 2.2-4 illustrates the layout of the SPOT DWP. The topside decks would hold equipment for the crude oil loading process, as well as vapor recovery and destruction during the loading process. Figure 2.2-5 details the block flow diagram for the process the crude oil would follow once arriving at the SPOT DWP.



Source: SPOT 2019a, Application, Volume IIa, Section 1

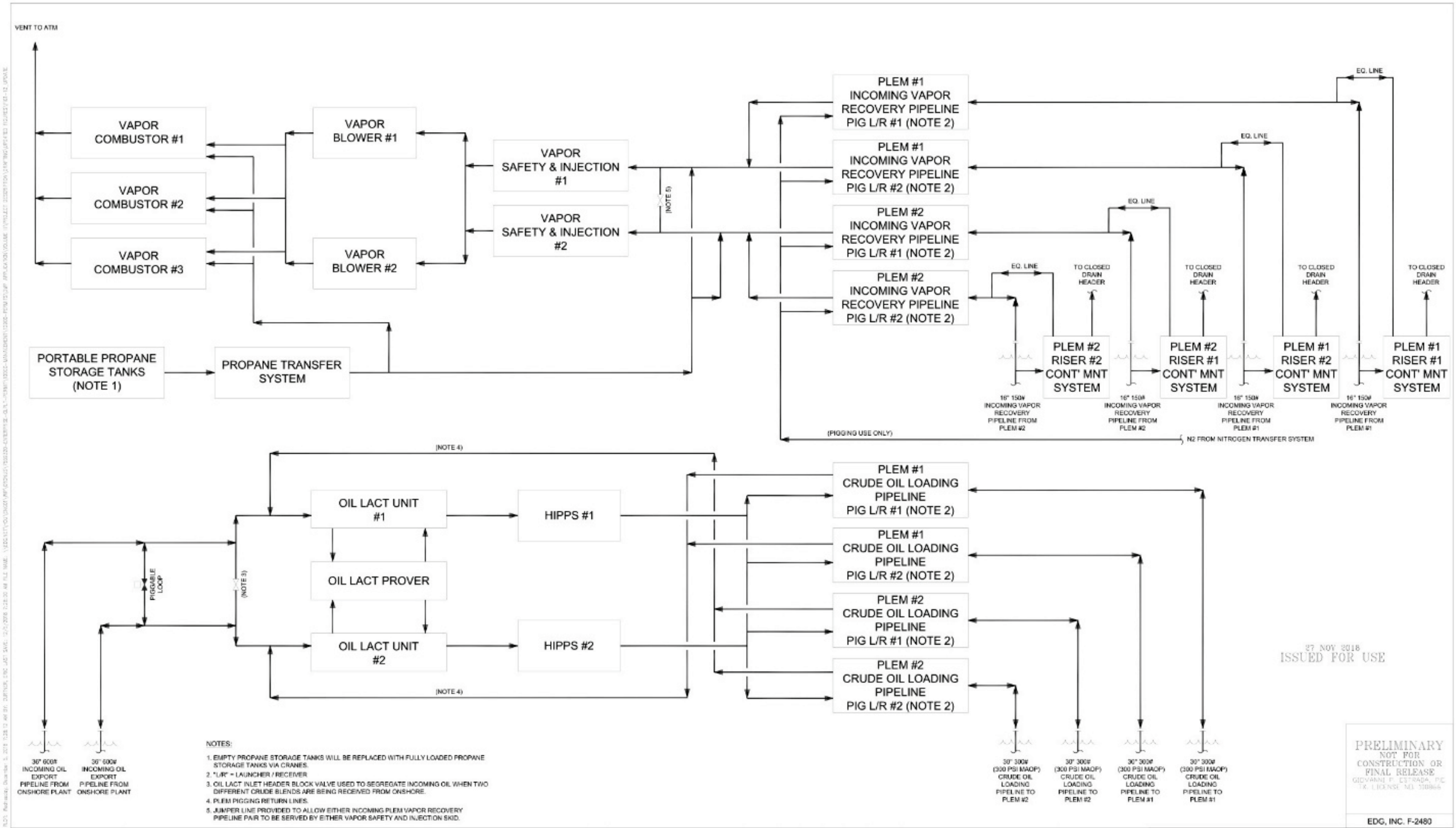
Figure 2.2-3: Lease Blocks Crossed by the SPOT DWP Offshore Pipelines



Source: SPOT 2019a, Application, Volume IIa, Section 1

PLEM = pipeline end manifold; SPM = single point mooring; VLCC = very large crude carrier

Figure 2.2-4: Proposed Deepwater Port Schematic



Source: SPOT 2019a, Application, Volume IIa, Section 1

HIPPS = high integrity pipeline protection system; L = left; LACT = lease automatic custody transfer; PLEM = pipeline end manifold; R = right

Figure 2.2-5: SPOT DWP Platform Block Flow Diagram

The crude oil would arrive at the SPOT DWP from the subsea pipelines and enter the LACT unit, which would measure the crude oil being transferred to the VLCCs or other crude oil carriers. The oil LACT prover would test performance and calibrate the liquid meters on the oil LACT unit before being transferred through the high integrity pipeline protection system (HIPPS). The HIPPS is a pressure safety valve (PSV) that would be required somewhere between the subsea crude oil pipelines and the loading hoses. The Applicant would install the HIPPS following the LACT units in the system. The oil would then move through the four 30-inch-diameter crude oil loading pipelines to the two PLEMs installed on the seafloor. Two pipelines would run to each PLEM. In addition, pig launchers and receivers would be installed in various locations for cleaning and inspecting the four 30-inch-diameter crude oil loading pipelines and four 16-inch incoming vapor recovery pipelines. The four vapor recovery pipelines would run from the two PLEMs into the vapor combustion system to bring the vapor coming from the VLLCs or other crude oil carriers back to the platform for destruction. The vapor combustion system would consist of two vapor safety and injection skids, two vapor blowers with 100 percent redundant back-ups, and three propane-fueled vapor combustors.

Specific equipment that would be located on the topsides of the offshore platform is summarized in Table 2.2-4. The item numbers in Table 2.2-4 correlate to figures in Appendix K, Facility Layout 3-D Illustrations. The systems are discussed in detail below and include:

- Process safety and control
- Metering
- Pig launchers and receivers
- Vapor combustion system
- Pipeline maintenance
- Life support and life-saving;
- Safety
- Utilities
- Buildings and structures

Table 2.2-4: Equipment List and Location for the SPOT Project

Item #	Equipment	Number of Units	System
Main Deck			
1	Pedestal cranes with diesel storage tank	2 cranes 1 storage tank	Utilities
2	Nitrogen system – storage tanks, vaporizers, and transfer pumps	1	Utilities
3	Combustor exhaust stacks	3	Vapor Combustion System
4	Propane system – storage tanks, vaporizers, and transfer pumps	1	Utilities
5	Oil LACT unit	1	Metering
6	Oil LACT prover	1	Metering
7	Utility and potable water system – storage tanks, pumps, pressure tank, and water maker package	1	Utilities

Item #	Equipment	Number of Units	System
8	Utility and instrument air system – compressors, coolers, separators, filters, dryers, and receivers	1	Utilities
9	Chemical injection system – storage tanks and pumps	1	Utilities
10	Emergency generator package	1	Life Support / Life Saving
11	Totally enclosed motor propelled survival craft	1	Life Support / Life Saving
12	Living quarters	1	Buildings and Structures
13	Electrical and instrument building with laboratory	1	Buildings and Structures
14	Maintenance building	1	Buildings and Structures
15	Communications tower	1	Life Support / Life Saving
16	Vapor safety and injection skids (i.e., dock safety skid)	2	Vapor Combustion System
17	Helideck [a]	1	Life Support / Life Saving
19	Vapor blower skids	2	Vapor Combustion System
21	Vent boom	1	Utilities
44	Navigational aids – rotating beacon [b]	1	Safety
45	Navigational aids – radar beacon [b]	1	Safety
46	Safety shower / eyewash station	1	Safety
Cellar Deck			
18	Diesel generator packages	2	Utilities
20	Vapor combustors	3	Vapor Combustion System
22	HIPPS	2	Process Safety and Control
23	Crude oil loading pipeline pig launchers / receivers	4	Pig Launchers / Receivers
24	Incoming vapor recovery pipeline pig launchers / receivers	4	Pig Launchers / Receiver
25	Topsides hydraulic power unit	1	Utilities
26	Diesel tanks	2	Utilities
27	Diesel transfer pumps and diesel storage pumps	2 transfer pumps 2 storage pumps	Utilities
28	Sewage treatment unit	1	Utilities
29	Diesel firewater pumps	2	Life Support / Life Saving
30	Firewater jockey pumps	2	Life Support / Life Saving
31	Closed drain / vent scrubber	1	Utilities
32	Closed drain / vent scrubber pumps	2	Utilities
33	Aqueous film-forming foam tank system	1	Life Support / Life Saving
37	30-inch crude oil loading pipeline shutdown valves	4	Process Safety and Control
38	Incoming 16-inch vapor recovery pipeline shutdown valves	4	Process Safety and Control
39	Deluge valve skid	1	Life Support / Life Saving
40	Navigational aids – marine lanterns [b]	4	Safety
42	Navigational aids – foghorn and fog detector [b, c]	1	Safety
47	Incoming oil export pipeline pig launchers / receivers [d]	2	Pig Launchers / Receivers
Sump Deck			
34	Open drain sump	1	Utilities
35	Open drain collection system pumps	2	Utilities
36	Incoming 36-inch oil export pipeline shutdown valves	4	Process Safety and Control

Item #	Equipment	Number of Units	System
48	Incoming vapor recovery pipeline collection system pumps	4	Pipeline Maintenance
Jacket			
41	Navigational aids – marine lanterns [b, c]	4	Safety
43	Navigational aid – foghorn and fog detector [b, c]	1	Safety

Source: SPOT 2019a, Application, Volume IIa, Section 1

LACT = lease automatic custody transfer; HIPPS = high integrity pipeline protection system

[a] Helideck is located above the main deck.

[b] Not included in Appendix K, Facility Layout 3-D Illustrations

[c] This equipment would be temporary.

[d] For future use

Process Safety and Control

The process safety and control features of the SPOT Project would include the shutdown valves, the HIPPS, the fire and gas detection system, the emergency shutdown and safety control system, and the process control system. The purposes of these systems would be to protect the offshore platform from overpressure, detect fire and gas, perform emergency and safety shutdowns of the equipment, and perform platform process control.

In the event of an emergency, the emergency shutdown controller would provide signals to the shutdown valves. The shutdown valves would close and would isolate the rest of the platform from crude oil. The Applicant would install four 36-inch shutdown valves for the incoming crude oil pipelines on the sump deck, in accordance with 30 CFR § 250.1004(4). Placing the shutdown valves on the lowest deck above the water line would maximize the distance between the facility and personnel and incoming crude oil. These emergency shutdown valves are listed as Item #36 in Table 2.2-4 and displayed in Appendix K, Facility Layout 3-D Illustrations. The Applicant would install four 30-inch shutdown valves for the crude oil loading pipelines. These valves would be installed on the cellar deck and would isolate the crude oil departing the SPOT DWP and running to the PLEMs and then the VLCCs or other crude oil carriers. These shutdown valves are listed as Item #37 in Table 2.2-4 and displayed in Appendix K, Facility Layout 3-D Illustrations. The Applicant would also install four 16-inch vapor recovery pipeline shutdown valves on the cellar deck. These valves would be designed to isolate the incoming vapor from the vessels to the platform during loading. These vapor recovery shutdown valves are listed as Item #38 in Table 2.2-4 and displayed in Appendix K, Facility Layout 3-D Illustrations.

The purpose of the HIPPS would be to detect high-pressure conditions and close isolation valves so as to protect downstream facilities. The HIPPS would operate independently from the rest of the SPOT DWP process shutdown system, and would operate autonomously only if the crude oil loading pipeline shutdown valves do not activate in time to prevent overpressure. However, it could be operated for other events, such as loss of motive power[5] of an instrument signal. The HIPPS would be designed to automatically shut off and isolate the source of high pressure before the allowable (i.e., design) pressure is reached so that an uncontrolled loss of containment would be prevented. The time between a detection of high pressure by the HIPPS and closure of the valve would depend on the volume and pressure profile.

[5] Energy used to power a mechanical device.

For typical systems, the time between occurrence and detection is within 10 seconds. Upon detection, the system would initiate facility shutdown, and the valves would close in 30 to 60 seconds. The SPOT DWP would have two 48-inch HIPPS valves on the main deck. One valve would be installed on each set of two 30-inch crude oil loading pipelines that would run from the platform to the PLEMs. The HIPPS would include the following features:

- Three pressure transmitters—two of the three transmitters would need to agree that an overpressure event is occurring;
- Two closure valves in series, for redundancy; and
- A high integrity logic solver independent of the platform's process safety system.

The HIPPS is listed as Item #22 in Table 2.2-4 and displayed in Appendix K, Facility Layout 3-D Illustrations.

The safety control and process control systems would operate independently using separate instrumentation. The safety control system would manage the safety systems (e.g., high-pressure shutdowns, emergency shutdowns, fire and gas detection system). The process control system would control the process and utility operations on the DWP. Both systems would be installed in the control room in the electrical and instrument building, listed as Item #13 in Table 2.2-4 and displayed in Appendix K, Facility Layout 3-D Illustrations.

Metering

The metering features on the SPOT DWP would include the oil LACT unit and the oil LACT prover. The LACT unit would measure the crude oil being transferred to the VLCCs or other crude oil carriers, while the oil LACT prover would test the accuracy of the LACT unit. This equipment would be installed on the main deck. The LACT unit is listed as Item #5 and the LACT prover as Item #6 in Table 2.2-4 and both are displayed in Appendix K, Facility Layout 3-D Illustrations.

Pig Launchers and Receivers

The pig is inserted into the line at the launcher, moved through the line by the pressure of the product in the pipeline itself, and then retrieved at the receiver. The Applicant would install four pig launchers/receivers on the crude oil loading pipelines, which would allow for pigging from the platform to the PLEMs. The Applicant would also install four pig launchers/receivers on the incoming vapor recovery pipelines to allow for pigging between the platform and the PLEMs. The crude oil loading launchers/receivers are listed as Item #23 and the vapor recovery launchers/receivers are listed as Item #24 in Table 2.2-4 and are displayed in Appendix K, Facility Layout 3-D Illustrations.

The materials (primarily nitrogen) pushed through the system during pigging operations would be collected by a closed drain and vent system. In addition, any hydrocarbons liquids collected through the open drain system on the platform would be transferred to the closed drain system. Hydrocarbon liquids would be transferred by the closed drain pumps to a temporary storage tank for transport to shore by barge, transfer back into the production pipe, or transferred directly to the boat landing for transport to shore by barge. Vapors from the closed drain vent scrubber would pass through a detonation arrestor and be released via the vent boom to the air. These systems are discussed in more detail below.

In addition, the Applicant would install two pig launchers/receivers to service two 36-inch incoming oil export pipelines in the future. These launchers/receivers would service any future line between the Oyster Creek Terminal and the platform. The launchers/receivers for future service are listed as Item #47 in Table 2.2-4 and are displayed in Appendix K, Facility Layout 3-D Illustrations.

Vapor Combustion System

The Applicant would install a vapor combustion system on the DWP platform to manage the VOC vapors displaced during loading of the VLCCs or other crude oil carriers. Three vapor combustion units would be installed. The complete system would include three exhaust stacks, two vapor safety and injection skids, two blowers, and three vapor combustors.

The purpose of the vapor combustion system would be to destroy 95 percent or more of the VOCs emitted during the loading process. The vapors would be transferred from the vapor discharge header into the 24-inch floating hoses, then through the PLEMs into the two 16-inch vapor recovery pipelines running to the platform. To achieve a 95-percent destruction of vapors, the vapor combustors would use high combustion temperatures by enriching the VOC vapors to a minimum of 164 British thermal units per standard cubic foot. Propane would be used to enrich the vapors, which would be stored on the platform. The enrichment process would be monitored by oxygen sensors to determine the correct propane-to-VOC vapor ratio. Once the vapors are enriched, the mixture would be transferred into the vapor scrubbers to remove any liquids, then enter the vapor blowers to be transferred to the vapor combustors for burning. The vapor combustors would reach temperatures at or above 1,200 degrees Fahrenheit. The flame from the vapor combustion units would be enclosed; therefore, no flame would be visible from passing vessels and radiant heat effects would be minimized. The exhaust gas from burning would then flow up the exhaust stacks into the air. Any liquids removed by the vapor scrubber would flow to the closed drain vent scrubber. The Applicant would install detonation arrestors at the inlet of the vapor combustor skid to prevent flames from entering back into the system.

Propane would be used to enrich the VOC vapors only if needed to reach the 164 British thermal units per standard cubic foot, which would optimize destruction of the vapors. Approximately 1,428 gallons of propane would be required during the loading of each VLCC or other crude oil carrier, approximately 303 gallons would be needed to purge the vapor recovery lines after each loading effort, and 324 gallons would be needed each day as pilot gas for the combustors. Assuming an average of one VLCC or other crude oil carrier loaded per day, daily propane use would total approximately 2,055 gallons, and approximately 695 additional gallons of propane would be needed on a monthly basis for oxygen dilution of the system. The SPOT DWP would receive bi-weekly shipments of propane by vessel, and the entire system would require approximately 29,466 gallons between shipments. The platform would be capable of storing 32,772 gallons of propane; as such, the DWP would be able to load 15 VLCCs or other crude oil carriers between bi-weekly propane shipments. The vapor safety and injection skids are listed as Item #16, the vapor combustors are listed as Item #20, the vapor blowers are listed as Item #19, and the exhaust stacks are listed as Item #3 in Table 2.2-4. All components are displayed in Appendix K, Facility Layout 3-D Illustrations.

Pipeline Maintenance

The Applicant would install four collection system pumps for the incoming vapor recovery pipelines to remove liquids from the vapor recovery pipelines prior to sending the vapors through the vapor combustion system. This equipment is listed as Item #48 in Table 2.2-4 and displayed in Appendix K, Facility Layout 3-D Illustrations.

Life Support and Life Saving

The life-support and life-saving equipment for the SPOT DWP would include the emergency generator and power system, the communications tower, the totally enclosed motor-propelled survival craft (TEMPSC), the firewater system, the helideck, and miscellaneous life saving devices.

The Applicant would install the emergency generator on the main deck, which would provide power to the emergency power system to maintain life-support systems, lighting, communication, the safety control system, and navigational aids. The generator would automatically start upon receipt of an emergency signal. The generator is listed as Item #10 in Table 2.2-4. The communications (i.e., radio) tower would support antennas for telecommunications. The tower would allow for communications with the VLCCs or other crude oil carriers and the tugs supporting the vessels. The communications tower is listed as Item #15 in Table 2.2-4. The Applicant would install one TEMPSC to evacuate personnel from the platform in the event of an emergency. The survival craft would be capable of evacuating up to 36 personnel. The crew size on any given day would be a maximum of 16 individuals (two shifts), including those crew members based on the VLCCs or other crude oil carriers, and visitors would be allowed only up to the maximum number of people the survival craft could accommodate, which would allow for all personnel onboard the platform to evacuate. The Applicant would ensure the number of people onboard at any given time does not exceed the number of seats available in the survival craft. This equipment is listed as Item #11 in Table 2.2-4. The Applicant would install a helideck above the main deck on the offshore platform, which would accommodate two Bell 407 helicopters (one parked and one landing), or one Sikorsky S-76. The helideck would be designed to meet API RP 2L, International Civil Aviation Organization, and other industry standards. The helideck is listed at Item #17 in Table 2.2-4. Additional life saving devices, such as life vests, life buoys, and life rafts would be located in various locations on the offshore platform for easy access in the event of an emergency. Enough life vests and life rafts would be available to accommodate all personnel onboard the platform.

The firewater system on the SPOT DWP would include both water and foam firefighting capabilities. Two jockey water pumps would be installed to pull water from below the water line and supply seawater to the water maker package and the utility water storage tank. This water would be used for life support purposes and would also maintain pressure in the fire protection piping system (i.e., sprinkler system). In the event a pressure drop in the system is detected (i.e., a sprinkler is activated), the fire pump automatic controller would initiate the diesel firewater pumps. The two diesel firewater pumps would pull water from below the water line and would supply seawater to the firewater main, the deluge valve skid, and the sprinkler system. In addition to automatically starting when a pressure drop is detected in the sprinkler system, the diesel pumps would automatically start if hose reels or other firefighting equipment connections are opened, resulting in a pressure drop. The Applicant would also include additional firefighting equipment on the platform, including firehoses, self-contained breathing apparatus, and miscellaneous hand tools. The jockey water pumps are listed as Item #30, the diesel firewater pumps are listed as Item #29, and the deluge valve skid is listed as Item #39 in Table 2.2-4. In addition to firewater, the SPOT DWP would store aqueous film-forming foam for fire suppression. Foam would smother the fire, preventing contact with oxygen and thereby eliminating one of the elements required for continued combustion. The aqueous film-forming foam tank is listed as Item #33 in Table 2.2-4. All life-support and life-saving components are displayed in Appendix K, Facility Layout 3-D Illustrations. Information regarding the volumes of water to be withdrawn and discharged for testing of this system can be found in Section 2.2.8.2, Offshore Facilities.

Safety

The Applicant would include a safety shower and eyewash station for use by personnel onboard. The station would be located next to the chemical injection system on the main deck of the platform and is listed as Item #46 in Table 2.2-4. All safety components are displayed in Appendix K, Facility Layout 3-D Illustrations.

Both temporary and permanent navigational aids would be installed on the DWP and at the four corners of both Galveston Area lease blocks for the Project (463 and A-59). Permanent navigational aids would include foghorns and beacons, and be used to provide warnings to vessel traffic near the DWP and the SPM buoys. Temporary navigational aids would be used during construction only and would include a marine lantern and foghorn system installed on top of the jacket for times when the decks are not already in place (i.e., once the jacket is installed, it would take between 2 and 4 days for the topsides to be placed on the jacket). Section 2.2.8.2, Offshore Facilities, contains additional information on permanent navigational aids.

Utilities

The utility systems on the SPOT DWP would include the diesel generators and power distribution, pedestal cranes, utility and instrument air system, utility and potable water system, chemical injection system, nitrogen system, propane system, closed drain and vent system, hydraulic power unit system, diesel transfer system, sewage treatment system, and open drain system.

Two diesel generators would be installed to provide continuous power for life support and safety systems, as well as to power the remainder of the equipment on the platform. They would also provide power to the main power bus to support lighting; heating, ventilation, and air conditioning; and other services. The Applicant anticipates that, pending final design, the laydown deck would have a total of 17 lights, the main deck would have a total of 59 lights, the cellar deck would have a total of 60 lights, the sump deck would have a total of 38 lights, and the stair towers and crane platforms would have a total of 42 lights. The diesel generators are listed as Item #18 in Table 2.2-4. The Applicant would install two pedestal cranes to move personnel, equipment, and other materials to, from, and between locations on the platform. Each crane would have an adjustable height boom that could extend to a maximum height of 282 feet above the water line and rotate around a turret. In the resting position, the cranes would be approximately 186 feet above the water line. The cranes would be supported by one diesel engine each, which would be independent from the main power system to allow use for life support and emergency evacuation in the event of a power loss. The cranes are listed as Item #1 in Table 2.2-4. The utility and air instrument system would provide compressed air to the platform for operating instrumentation and equipment (e.g., pneumatic tools), and would include compressors, coolers, separators, filters, dryers, receivers, and two vertical pressure vessels to store the compressed air. The air system is listed as Item #8 in Table 2.2-4.

The utility and potable water system would be used to provide treated water and utility water to the platform, and would include storage tanks, pumps, a pressure tank, and a reverse osmosis unit. The reverse osmosis unit would treat seawater provided through the pumps to make it safe for drinking, and send the potable water to the potable water storage tank. The storage tank could also receive potable water from a supply boat. From the potable water tank, water would be pumped through a filter and ultraviolet light sterilizer, then sent to the potable water header where it would be distributed to various locations on the platform. The potable water would supply the safety shower and eyewash station. The potable water system would be capable of generating 13,044 gallons per day (gpd) of potable and utility water; therefore, water could be treated as needed based on consumption. In addition, the pumps would supply seawater to the utility water storage tank for use on the platform, such as washing down the decks. The water system is listed as Item #7 in Table 2.2-4. Information regarding the volumes of seawater to be withdrawn for this system can be found in Section 2.2.8.2, Offshore Facilities.

The Applicant would install a chemical injection system to transport necessary chemicals, such as biocides, throughout the platform systems. The Applicant would use biocides for the open drain, vent scrubber, and pump caissons to keep them clear of biological growth, which could affect the function of these systems. The various materials that would be stored on the SPOT DWP platform are listed in Table 2.2-5. The chemical injection system is listed as Item #9 in Table 2.2-4. The Applicant would also install a nitrogen system to provide the gas to move the pigs through the vapor recovery pipelines, as well as for other utility applications. The nitrogen system would include storage tanks, vaporizers, and transfer pumps. Nitrogen would be delivered to the platform and placed in the storage tanks. When needed, the nitrogen would be transferred from the tanks through the transfer pumps into the vaporizer, then into the header for use. The nitrogen system is listed as Item #2 in Table 2.2-4. As described earlier in this section, propane would be used to fuel the vapor combustion system during loading of VLCCs or other crude oil carriers. The propane system would include storage tanks, vaporizers, and transfer pumps. As with the nitrogen, the propane would be delivered to the platform, then stored in tanks. The transfer skid would vaporize the propane upon transfer from the tanks and send it to the safety and injection system for transfer to the vapor recovery pipelines and combustors. Propane would be used to enrich the VOC vapors, purge the vapor recovery lines and to fuel the vapor combustors, as well as to perform suction stream oxygen dilution of the system on a monthly basis. The propane system is listed as Item #4 in Table 2.2-4.

The closed drain and vent system would discharge vented vapors from the vent scrubber during pigging operations and from relief valve releases on the platform, and would include a vent boom, a closed drain/vent scrubber, and two closed drain pumps. The closed drain system would be used for fluids that could contain hydrocarbons. Fluids from the closed drains, vapor scrubbers, liquid pressure relief valves, and vent sources, as well as hydrocarbons collected from the open drain system, would be collected in the closed drain/vent scrubber. The liquids would be transferred by the closed drain pumps to a temporary storage tank for transport to shore by barge, transfer back into the production pipe, or transferred directly to the boat landing for transport to shore by barge. Vapors from the closed drain vent scrubber would pass through a detonation arrestor and be released via the vent boom to the air. The vent boom is listed as

Item #21, the closed drain/vent scrubber is listed as Item #31, and the closed drain pumps are listed as Item #32 in Table 2.2-4.

The Applicant would install a topside hydraulic power unit system to power the controls for the large actuating valves on the platform. The system would filter and pressurize hydraulic fluid, then transfer the fluid to the valves. The hydraulic power unit system is listed as Item #25 in Table 2.2-4. The Applicant would also install a diesel transfer system to provide fuel to necessary equipment throughout the platform. The diesel transfer system would include a crane pedestal tank, two diesel tanks, two diesel transfer pumps, and two diesel storage pumps. Supply barges would transport the diesel from shore to the platform, then pump the diesel into the crane pedestal tank. The diesel transfer pump would then pump the diesel to individual user tanks through a filter coalescer. End uses of diesel on the platform would include the diesel firewater pumps, generators, and the emergency generator. The diesel storage tanks are listed as Item #26 in Table 2.2-4 and the diesel transfer pumps are listed as Item #27.

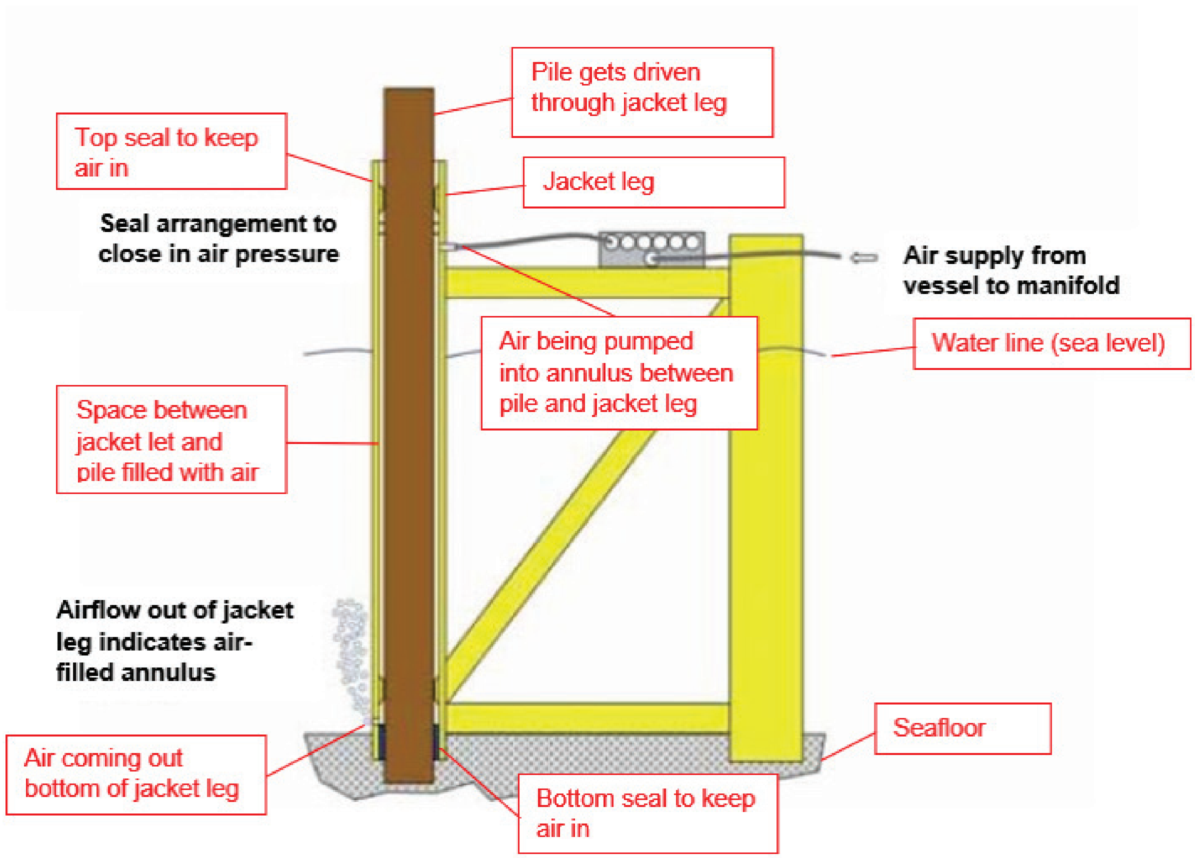
The platform would contain a sewage treatment system to treat the brown water and black water produced onboard for discharge overboard. Brown water would come from bathtubs, showers, sinks, washing machines, and other domestic sources. Black water is classified as sanitary sewage. To treat the water, a jockey water pump would transfer seawater to the system. Both brown and black water would enter the system, then be aerated, allowed to settle, and disinfected in accordance with regulatory requirements and the NPDES permit for discharge overboard. The system would be designed to limit suspended solids to less than 150 milligrams per liter and fecal coliform counts to less than 100 most probable number (i.e., the most probable number in 100 milliliters of water). The discharge would occur via a discharge pipe near the deck leg. The sewage treatment system is listed as Item #28 in Table 2.2-4. Information on volumes that would be discharged can be found in Section 2.2.8.2, Offshore Facilities. In total, 2,406 gpd of brown and blackwater would be generated and 1,980 gpd would be used for waste treatment processing. The system would be designed to meet USCG and International Maritime Organization (IMO) Marine Environment Protection Committee 159 (55) certified Type II standards.

An open drain system would also be installed on the platform to capture rainwater or other precipitation and separate the rainwater from any potential hydrocarbons. The open drain system would include an open drain sump and two open drain collection system pumps. The deck drains on the platform would flow into the open drain sump where hydrocarbons would then be separated from rainwater. The hydrocarbons would be transferred to the closed drain/vent scrubber system described above. The separated rainwater would be discharged overboard while the collected hydrocarbons would be disposed of by removal to shore by barge or transfer back into the production pipe. The open drain sump is listed as Item #34 in Table 2.2-4 and the open drain sump pumps are listed as Item #35. All utility systems are displayed in Appendix K, Facility Layout 3-D Illustrations.

Buildings and Structures

Three buildings would be erected on the platform, including living quarters, an electrical and instrument building, and a maintenance building. The living quarters would be constructed to house up to 20 operations and maintenance personnel, and would contain sleeping quarters, laundry facilities, offices, and a galley. The control room, manned at all times, would also be located within the living quarters—this control room would control all process and safety systems on the platform. The living quarters would also be located as far from the production equipment as possible, and would serve as the closest mustering station to the TEMPSC and helideck for emergency evacuation. The Applicant would install the electrical and instrument equipment, including motor starters, motor control centers, and panels, in the electrical and instrument building. In addition, the power and control systems and a laboratory for sample testing from the LACT would be housed within the electrical and instrument building. The maintenance building would contain tools and work benches for use by operations and maintenance personnel, and would serve as a workshop for maintenance projects. The living quarters are listed as Item #12 in Table 2.2-4, the electrical and instrument building is listed as Item #13, and the maintenance building is listed as Item #14. All buildings and structures are displayed in Appendix K, Facility Layout 3-D Illustrations.

The SPOT DWP would be a manned jacket-designed platform. The jacket is the structure that supports the decks and all equipment, and would be supported with eight steel piles, 72 inches in diameter. The jacket structure would be anchored by driving piles within the jacket structure legs. The jacket itself would be installed first and would serve as the confined system through which compressed air would be introduced between the piles and the jacket legs to minimize underwater noise impacts during construction (Figure 2.2-6). The eight piles would be driven into the ocean floor to a stipulated design depth of 380 feet using a pile hammer/driver mounted on a derrick barge. The piles would be driven at an angle (i.e., battered piles) of 8:1, or eight vertical units to one horizontal unit. The piles are installed at an angle, per industry standards, to allow for greater ability to carry lateral loads, such as the four decks. Each pile would consist of four sections, resulting in a total length of 514 feet per pile.



Source: SPOT 2021g

Figure 2.2-6: Confined Bubble Curtain System for 72-inch Platform Piles

Fuels, Chemicals, and Lubricants to be Stored on the SPOT Deepwater Port

The SPOT DWP would require a number of fuels, chemicals, and lubricants for operation. Specifically, these materials would be required for the propane system, the diesel system, the nitrogen system, the carbon dioxide (CO_2) snuffing system, the biocide injection system, the utility and instrument air system, the potable and utility water system, lube oil and coolant storage, and the sewage system. A summary of the materials to be stored on the platform is included in Table 2.2-5. Each of these systems is described in detail above.

Propane would be delivered on a bi-weekly basis. Diesel, nitrogen, and biocide would be delivered on a weekly basis. The nitrogen system would primarily be used for pigging the vapor recovery pipelines between the platform and the PLEMs. The Applicant anticipates conducting pigging of the vapor recovery pipelines after loading every VLCC or other crude oil carrier. The CO_2 snuffing system would be part of the vapor combustion system to prevent vapor ignition from the vent boom. The CO_2 would be stored in cylinders and used only when needed. The Applicant anticipates requiring CO_2 once per year for 5 minutes. The utility and instrument air system would take air from the atmosphere, compress it, and filter it for utility air, and would also dry the air for instrument air. As such, no deliveries would be made for this system. The potable and utility water system would mostly use seawater to generate potable and utility water for consumption by personnel as drinking water and for use on the platform.

Table 2.2-5: Summary of Materials to be Stored on the SPOT Deepwater Port Platform

Material	Purpose	Storage Capacity	Storage Vessel / Container	Average Consumption	Delivery Frequency
Nitrogen	Vapor recovery pipeline pigging	21,000 gallons	Transportable IMO/ UN tanks	100,000 scf/ pigging operation	Weekly
Instrument Air	Control instrumentation	NA	NA (produced at facility)	168 scfm	NA
Utility Air	Control air tools	NA	NA (produced at facility)	365 scfm	NA
Propane	Enrichment fuel for marine vapor combustion unit	32,772 gallons	Transportable IMO/ UN tanks	78,079 scfd	Bi-weekly
Diesel Fuel	Fuel for power generation	70,980 gallons	One crane pedestal storage tank, two diesel storage tanks, and refill via supply boat	3,960 gpd	Weekly
Lube Oil	Lubrication for various equipment	385 gallons	55-gallon drums	NA	As needed
Engine Coolant	Cool lube oil and equipment	330 gallons	55-gallon drums	NA	As needed
Potable Water	Drinking water	1,175 gallons	Fiberglass tank	2,406 gpd	NA
Utility Water	Deck wash down and sewage treatment water supply	1,175 gallons	Fiberglass tank	3,420 gpd	NA
Biocide	Bacteria control	1,100 gallons	Transportable IBC tanks	39.3 gpd	Weekly
AFFF	Firefighting foam	5,565 gallons	Transportable DOT containers	NA	As needed
Hydraulic Oil	Hydraulic Power Unit	150 gallons	Pressurized accumulator	NA	As needed
Refrigerant	HVAC	450 pounds	Transportable DOT cylinders	NA	As needed

Source: SPOT 2019a, Application, Volume IIa, Section 1.

AFFF = aqueous film-forming foam; DOT = United States Department of Transportation; gpd = gallons per day; HVAC = heating, ventilation, and air conditioning; IBC = intermediate bulk containers; IMO/UN = International Maritime Organization / United Nations; NA = not applicable; scf = standard cubic feet; scfd = standard cubic feet per day; scfm = standard cubic feet per minute; SPOT = Sea Port Oil Terminal

Lube oil and engine coolant would be stored on the platform for use as needed; however, the Applicant anticipates the need for both materials would be infrequent. Lube oil would be used for maintenance of the diesel engines and smaller pumps onboard. Engine coolant would be used for maintenance of the diesel engines. Both lube oil and engine coolant would be stored in 55-gallon drums on the main deck for use, and would be replaced as needed. Hydraulic fluid would be used to support maintenance activities on the platform. Refrigerant would be used for periodic recharging of the heating, ventilation, and air conditioning systems in the living quarters, the control room, and the maintenance building. Both hydraulic fluid and refrigerant are not expected to be frequently used and would be replaced as needed.

The sewage treatment system would treat black and brown water for discharge overboard. The system would require 1,980 gpd of utility water for waste treatment processing. The total discharge overboard would be 4,386 gpd.

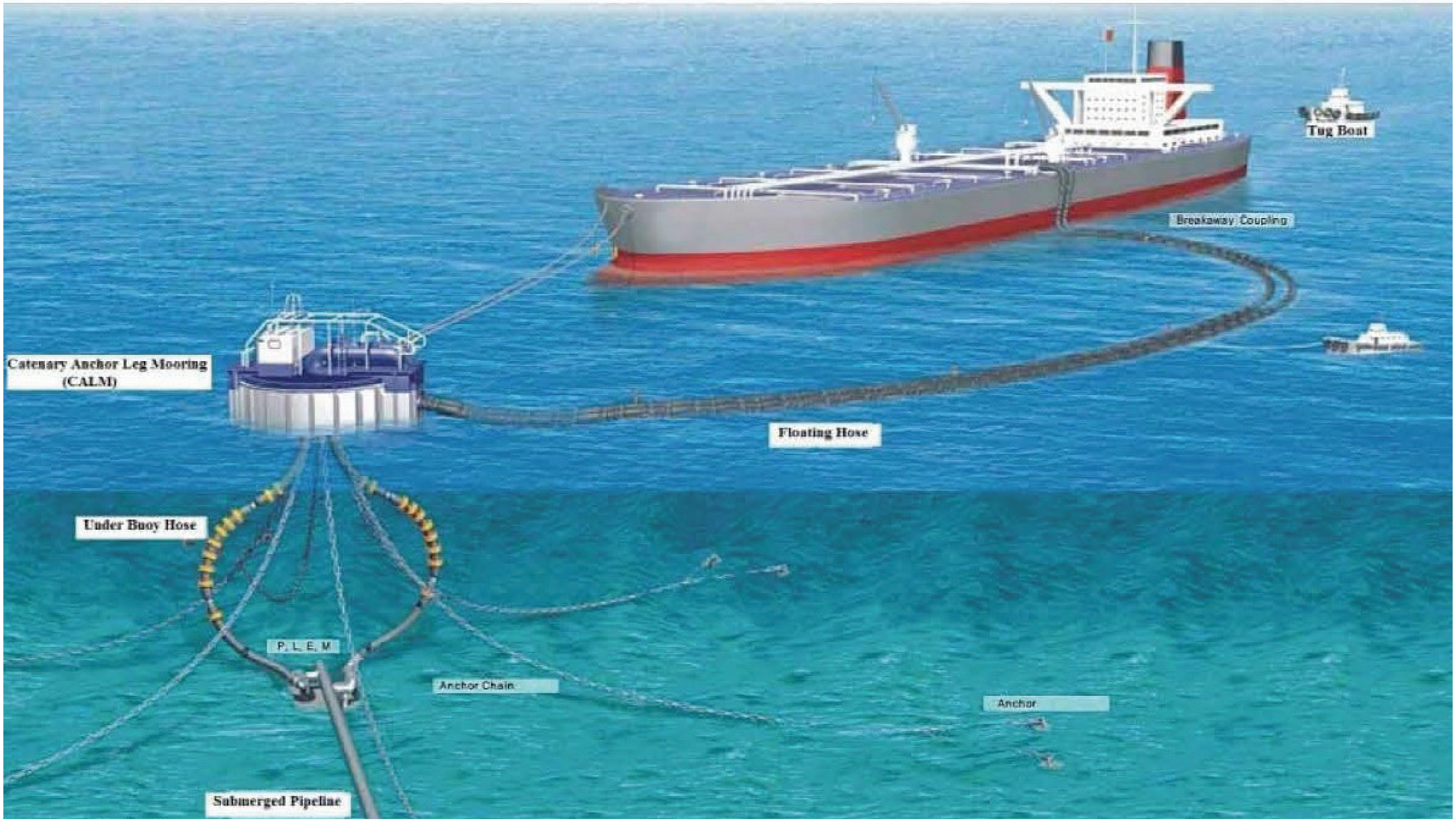
2.2.2.3. Pipeline End Manifolds and Interconnection Pipelines

The platform would connect to the SPM buoys by a series of pipelines running through four PLEMs. Underneath each SPM buoy, two PLEMs would be installed on the ocean floor. One PLEM would be for the crude oil loading pipelines and the other for the vapor recovery pipelines. The crude oil loading PLEMs would allow for transfer of crude oil from the platform, through the crude oil loading pipeline, and into the crude oil floating hose to the VLCC or other crude oil carrier for loading. The vapor recovery PLEMs would facilitate the transfer of vapors created during the loading process from the VLCCs or other crude oil carriers through the vapor recovery floating hoses, into the vapor recovery pipelines, and back to the platform. The Applicant would use 30-inch steel foundation piles to install the PLEMs on the ocean floor. Each PLEM would have pigging capabilities and valves for maintenance purposes.

Each PLEM would be connected to the platform via two 30-inch crude oil loading pipelines approximately 0.66 nautical mile in length. In addition, each PLEM would have two 16-inch vapor recovery pipelines of the same length as the crude oil pipelines running between the PLEMs and the platform.

2.2.2.4. Single Point Mooring Buoys and Interconnection Hoses

The Applicant has designed the Project with two SPM buoys to moor VLCCs or other crude oil carriers concurrently. The SPMs are floating buoys, which would be anchored in the same lease block as the platform 0.66 nautical mile away, and would be connected with the PLEMs and, thus, the platform, by floating crude oil and vapor recovery hoses. Both SPMs would be anchored in approximately 115 feet of water, using six fluke anchors per SPM connected by anchor chain. Fluke anchors are anchors with triangular projections that help the anchor become buried in the ocean floor and keep the buoys in place. The fluke anchors would be installed in a circular manner around the SPM buoys, each separated by 60 degrees, and connected by the anchor chain. The fluke anchors would be designed for calculated loading conditions and site-specific geotechnical conditions. This configuration would allow the SPM buoys to move as needed based on wind, waves, current, and VLCC or other crude oil carrier conditions, within defined limits. The anchor system for each SPM buoy would disturb 0.182 acre of seafloor, and a total of 0.364 acre of seafloor for both SPM buoys. Figure 2.2-7 shows an example of an SPM with moored vessel.



Source: Mirji 2018

Figure 2.2-7: SPM Buoy Mooring Schematic

The SPM buoys for the SPOT Project would each include a fluid transfer system, a buoy hall and turntable assembly, a mooring hawser assembly and anchor system, and ancillary equipment. The fluid transfer system would include piping at the PLEMs and associated valves, the underbuoy crude oil and vapor recovery pipelines, a fluid swivel which would allow the moored vessel to move with the currents (i.e., weathervane), buoy piping, and the floating crude oil and vapor recovery hoses. The fluid transfer system would conduct the transfer of crude oil from the PLEM to the floating crude oil hose for loading on the VLCC or other crude oil carrier. The buoy hall and turntable assembly would allow the VLCC or other crude oil carrier to remain stable at its desired position relative to the buoy. The mooring hawser would be a thick nylon or polyester rope and would moor the vessel to the SPM buoy. The anchor system would connect the SPM buoy to the ocean floor, as described above. Ancillary equipment on the SPM buoys would include telemetry and wireless controls for communication to the platform, hydraulic controls for valve actuation, navigation lights, a foghorn, a radar reflector, lifting aids, and maintenance equipment. The control system would be solar-powered using solar panels and a storage battery designed to store enough energy for several days without sun. If the power level drops too low, an alarm would be sent to the platform.

The SPM buoys would each connect to a PLEM via two 24-inch underbuoy crude oil hoses and one 24-inch underbuoy vapor recovery hose. Once crude oil reaches the SPM buoy, it would be loaded on the VLCC or other crude oil carrier via two 24-inch crude oil floating hoses. Each floating crude oil hose would include approximately 200 feet of 16-inch tail hose that would be lifted and would hang over the edge of the railing of the vessel being loaded. The tail hose would use a butterfly valve on the end and a blind flange to close off the hose after loading prior to returning the tail hose to the water surface. The floating crude oil hoses would be designed as a double carcass system, which is a two-layer hose. If the outer carcass or layer failed or was damaged, the inner carcass would prevent the release of product within the hose. Each SPM buoy would also include one 24-inch vapor recovery hose approximately 1,000 feet in length connected to the moored VLCC or other crude oil carrier. Similar to the floating crude oil hoses, each vapor recovery hose would include approximately 200 feet of 16-inch tail hose. This floating hose would connect with the underbuoy vapor recovery hose leading back to the PLEM. During normal sea states, the floating hoses would typically float parallel to each other and avoid entanglement. During high/turbulent sea states, the floating hoses could become entangled with each other or with marine debris. Prior to each loading of a VLCC or other crude oil carrier, the Applicant would untangle the hoses; as up to 365 loadings are anticipated per year, frequent handling or untangling of hoses would occur to minimize potential hose damage from long-term entanglement.

2.2.2.5. Service Vessel Moorings

A number of service vessels would be required to assist with operation of the SPOT DWP, such as tugboats, supply vessels, and crew boats. The Applicant would provide three mooring points for these vessels in the southwest corner of Galveston Area lease block 463. These service mooring points would be anchored to the ocean floor using two concrete blocks of 20,000 pounds each, joined together with a bridle. An anchor chain would attach to the bridle and connect to the mooring buoy. The total disturbance of all three service vessel moorings would be 0.0016 acre. The Applicant proposes to designate a self-enforced precautionary area of a specified distance around each service vessel mooring point to allow the vessels to turn or move with the ocean currents as necessary. This would meet guidelines established by the World Association for Waterborne Transport Infrastructure, also known as PIANC. Each mooring point would have a secondary precautionary area of a prescribed distance to minimize risk of collision, which would meet Unified Facilities Criteria established by the U.S. Department of Defense (UFC 4-150-06) and would be administered by the Applicant. A discussion regarding the types of service vessels that would be used during operation of the SPOT DWP can be found in Section 2.2.4, Service Vessels and Helicopters.

2.2.2.6. Anchorage Area and Navigation

The Applicant is proposing Galveston Area lease block A-59 as the anchorage area for the DWP. The anchorage area would allow VLCCs or other crude oil carriers to stage near the SPOT DWP if the vessels are not able to navigate directly to the SPM buoys or if they must disconnect from the SPM buoys for safety reasons. Section 2.2.8.5, Anchorage Areas, Safety Zones, and Limited Access Areas for the SPOT Deepwater Port, contains additional information regarding the anchorage area.

2.2.3. Very Large Crude Carriers and Other Crude Oil Carriers

The SPOT DWP would be able to accommodate two VLCCs or other crude oil carriers at a time, and the Applicant anticipates loading up to 365 vessels per year. Vessels from the existing worldwide fleet are anticipated to call on the SPOT DWP. VLCCs are the largest vessels the SPOT DWP has been designed to accommodate; however, it is anticipated that other smaller vessels, such as Suezmax and Aframax crude oil carriers, would call on the SPOT DWP. The vessels calling on the SPOT DWP would not be under the control of EPO. Characteristics of these vessels are provided in Table 2.2-6. Each vessel would enter the U.S. Exclusive Economic Zone[6] from international waters and transit to a shipping fairway, then exit the shipping fairway to approach the SPOT DWP at a location east-northeast of the DWP. Upon nearing the DWP, the SPOT Pilot and Mooring Master would be transferred from the platform to the approaching vessel, and tugboats would assist the vessels with mooring to the SPM buoys via two mooring hawsers.

Table 2.2-6: Characteristics of Typical Crude Oil Carriers Which May Call on the SPOT Deepwater Port

Characteristic	VLCC	Suezmax	Aframax
Length overall [a]	1,092 feet	900 feet	820 feet
Beam [a]	197 feet	164 feet	105 feet
Draft (maximum load) [a]	71 feet	66 feet	49 feet
Deadweight tonnage (maximum load) [b]	325,000 metric tonnes	200,000 metric tonnes	120,000 metric tonnes
Estimated maximum capacity [b]	2,000,000 barrels	1,000,000 barrels	750,000 barrels

Source: [a] SPOT 2019a, Application, Volume IIa, Section 1; [b] Oil Tanks 2020

VLCC = very large crude carrier

2.2.4. Service Vessels and Helicopters

Service vessels and helicopters would be required for the SPOT Project, and would support the maneuvering and loading of the VLCCs or other crude oil carriers, provide emergency response support,

[6] An area of coastal water and seabed within a certain distance of a country's coastline, to which a country claims exclusive rights for fishing, drilling, and other economic activities.

and provide personnel and supplies. The service vessels and helicopters anticipated to be used for the SPOT Project include:

- Twice-weekly crew boat or supply runs from the Freeport, Texas area;
- Two mooring tugboats to assist with mooring operations—one to manage the mooring process and one to manage the floating crude oil and vapor recovery hoses—that would be based at the SPOT DWP;
- One maintenance vessel for inspection, servicing, and maintenance of the SPOT DWP that would be based at an onshore facility near Freeport, Texas and would transit to the SPOT DWP as required for maintenance;
- One emergency response vessel for escorting and emergency response to the VLCCs or other crude oil carriers that would be based at the SPOT DWP; and
- Helicopter support approximately once per week, contracted out of Freeport, Texas.

If additional supplies or personnel are required, the Applicant would contract the necessary vessels or helicopters on an as-needed basis from Freeport, Texas.

In addition to the vessels noted above, during construction, the Applicant would use two additional tugboats for a total of four tugboats, a crew boat, a dive support vessel, a reaming barge, a jack-up barge, and a push boat. The tugboats, maintenance supply vessel, crew boat, and dive support vessel would be used for 14 months, and the reaming barge, jack-up barge, and push boat would be used for 2 months.

2.2.5. Onshore Construction and Installation

Construction of the proposed Project would begin in the second quarter of 2023 if a license is issued and all license conditions are met. Onshore construction is expected to begin in the second quarter of 2023 and be completed in the fourth quarter of 2024. The Applicant anticipates commissioning of the Project would occur in the third and fourth quarters of 2025 and the first exports of crude oil would commence in December 2025.

The onshore Project components would have short-term impacts during construction and long-term impacts during operation. The land requirements for the onshore components are listed in Table 2.2-7.

Table 2.2-7: Land Requirements for the Onshore Components of the SPOT Project

Project Component	Construction Right-of-Way Width (feet)	Total Construction Impact Area (acres) [a]	Total Permanent Impact Area (acres) [b]
ECHO Terminal	NA	3.2	3.2
ECHO to Oyster Creek Pipeline	100 feet	745.0	145.1
Oyster Creek Terminal	NA	140.1	140.1
Oyster Creek to Shore Pipelines	150 feet	237.7	72.6
Access Roads	NA	8.0	5.9
Total	NA	1,134.0	366.9

Source: SPOT 2019a, Application, Volume IIb, Section 1; SPOT 2019bbb

ECHO = Enterprise Crude Houston; NA = not applicable; SPOT = Sea Port Oil Terminal

[a] Construction impacts include ATWSs and MLVs

[b] Permanent impacts include MLVs

2.2.5.1. ECHO Terminal and Oyster Creek Terminal

The modifications to the ECHO Terminal would take approximately 9.5 months, and construction of the Oyster Creek Terminal would take approximately 20 months. An additional 2 and 2.5 months, respectively, of cleanup and restoration would be required for these onshore components.

Modifications at the ECHO Terminal and construction of the Oyster Creek Terminal would occur through the following sequence: clearing and grading; foundation construction; equipment and storage tank installation; hydrostatic testing; and restoration.

Clearing and Grading

Prior to construction, the Applicant would clear aboveground facility footprints and required ATWS of any large obstacles such as trees, brush, and logs. Timber and other suitable vegetative debris may be chipped and utilized as mulch for erosion control or disposed of per landowner requirements or in accordance with applicable local regulations. Once large obstacles are removed from the construction workspace, the Applicant would grade the sites to create a level working surface to allow the safe passage of construction equipment. Sensitive resources, such as wetlands and waterbodies, would be visibly marked. The Applicant would install temporary erosion controls immediately following initial ground disturbance activities and maintain or reinstall as needed until permanent erosion controls could be installed or restoration is complete.

Foundation Construction

Concrete ring foundations would be installed for the crude oil storage tanks at the proposed Oyster Creek Terminal. Each ring would be the size of the storage tank and would be placed 6 to 8 feet below the ground surface. An impermeable membrane, including a network of open plumbing, would be installed within each concrete ring, and then sand would be placed inside the ring. This design would allow for a leak detection system to manually detect crude oil vapors in the open plumbing.

For on-grade buildings and other facilities, such as piping vaults and pumps, the construction contractor would set the forms, install rebar, and pour and cure the concrete foundations per applicable industry standards. Concrete required for the proposed Project would be brought in from existing concrete plants.

Equipment and Storage Tank Installation

The Applicant would ship necessary equipment to the terminal sites, offload the equipment with cranes or other equipment, and store the equipment on site within ATWS until it is ready to be installed. To install the equipment, the construction contractor would place the necessary components on each foundation, level, grout where necessary, and secure.

Crude oil storage tanks would be constructed on site on the concrete ring foundations. Once the tank is constructed, each geodesic aluminum roof would be assembled next to its respective storage tank and installed on top of each storage tank.

Non-screwed piping would be welded, except where connected to flanged components. The Applicant would employ welders and use welding procedures in accordance with API and ASME standards. Welds in large-diameter piping systems would be examined using radiography, ultrasound, or other approved methods to ensure compliance with all applicable codes. Once installed, the construction contractor would clean and paint all aboveground piping. Paint inspection and cleanup procedures would occur in accordance with Federal and state regulatory requirements and industry standards.

Hydrostatic Testing

Following terminal facility construction, all high-pressure service components for both the Oyster Creek and ECHO Terminals (e.g., valves, pumps, firewater system) would be hydrostatically tested in accordance with Pipeline and Hazardous Materials Administration (PHMSA) requirements (49 CFR Part 195) and Enterprise Standard 4507. Any leaks would be repaired and retested. The Applicant would obtain the approximately 26,848,297 gallons of hydrostatic test water required for the Oyster Creek Terminal storage tanks and piping from the firewater pond constructed on site or from municipal sources. Modifications at the ECHO Terminal would require 521,857 gallons, and would be obtained from its existing firewater ponds or from municipal sources. The Applicant does not anticipate treatment of the hydrostatic test water, and no chemicals or desiccant would be used to dry the pipe. Hydrostatic test water would not be discharged into the surrounding surface waters or over land; rather the water would be returned or sent to the firewater pond at the Oyster Creek Terminal.

Restoration

Following construction, most of the area disturbed within the existing ECHO Terminal and for the new Oyster Creek Terminal would be paved roads or graveled. In areas intended to be maintained in an herbaceous state, the Applicant would revegetate the area using a seed mix recommended by the U.S. Department of Agriculture Natural Resources Conservation Service, and would maintain the area by periodically managing vegetation on an as-needed basis. Herbicides would be used as needed.

2.2.5.2. ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines

The ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines, collectively, would take approximately 7 months to construct. An additional 2 months of cleanup and restoration would be required for the onshore pipelines. The ECHO to Oyster Creek Pipeline would consist of one construction spread while the Oyster Creek to Shore Pipelines would make up a second construction spread.

The Applicant would employ conventional cross-country pipeline construction techniques to install the onshore crude oil pipelines. Work would be conducted as one continuous operation, to minimize the amount of time a tract of land is disturbed, as shown on Figure 2.2-8. The stages of typical pipeline construction procedures include:

- Clearing and grading
- Trenching
- Pipe stringing and bending
- Pipe assembly, welding, x-ray, and repair
- Lowering-in, padding, and backfilling
- Hydrostatic testing
- Cleanup and Restoration

Clearing and Grading

Workspace areas would be cleared and vegetation removed. Timber and vegetation debris would be chipped for use as erosion control mulch or disposed of in accordance with applicable local regulations and landowner requirements. The workspace would be graded, as necessary, to provide a level work surface to allow safe passage of equipment. Temporary erosion controls would be properly installed immediately after initial ground disturbance, and would be maintained until replaced by permanent erosion controls or until restoration is complete.

In wetland or agricultural areas, or where requested by the landowner, topsoil would be segregated across the full width of the construction workspace. Topsoil and vegetation debris would be stripped to a depth of 12 inches over the trench and spoil storage areas. Typically, the soil composition in the Project area is such that topsoil and subsoil piles can be separated without the use of barriers. The Applicant would separate the topsoil and subsoil piles without using physical barriers, and would place silt fence on the downslope sides of the piles to minimize erosion from precipitation. Erosion from wind is not anticipated for a majority of the soil types in the Project area, based on the composition of the soils. Section 3.8, Geologic and Soil Resources, contains additional information on wind erosion potential of various soil types.

Trenching

Trenches would be excavated using a track-mounted excavator or similar equipment to a depth sufficient to allow a minimum of 3 feet of cover (unless otherwise specified) between the top of the pipe and the final land surface after backfilling. The bottom of the trench would be excavated to at least 12 inches wider than the outside diameter of the pipe. Excavated subsoil would be stockpiled separately from topsoil, where required, on the spoil side of the trench away from construction traffic.

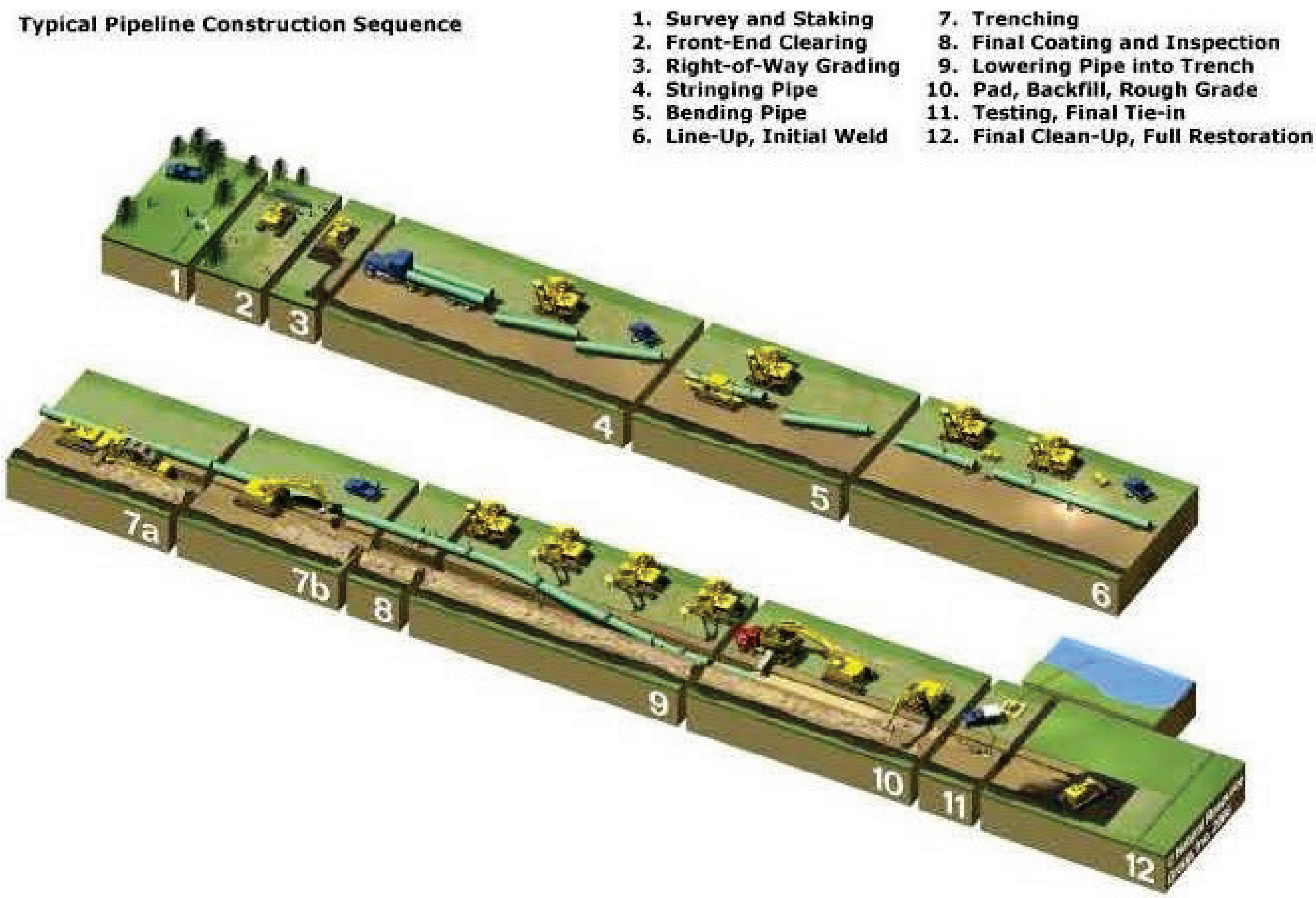


Figure 2.2-8: Typical Pipeline Construction Sequence

Pipe Stringing and Bending

Once the trench is excavated, the next process is stringing the pipe along the trench. Stringing involves initially hauling the pipe, generally in 40-foot lengths (referred to as joints), from existing pipe yards onto the right-of-way via a stringing truck. The pipe would be off-loaded and placed along the excavated trench end-to-end (or "strung") to allow for welding into continuous lengths known as strings. Individual joints would be strung along the right-of-way parallel to the centerline so they are easily accessible to construction personnel. At wetland and stream crossings, the amount of pipe required to cross the feature would be stockpiled in temporary work areas close to the water or wetland feature. In most locations, the ATWS required for staging the pipe would be located at least 50 feet from the edge of wetland or waterbody features; however, the Applicant may be unable to accomplish this in certain locations.

Pipe would be delivered to the work area in straight sections. Some bending of the pipe would be required to enable the pipeline to follow the natural grade and direction changes of the right-of-way. Selected joints would be field-bent by track-mounted hydraulic bending machines, as necessary, prior to stringing. For larger angles (i.e., changes in direction), prefabricated pipe would be installed.

Pipe Assembly, Welding, X-Ray, and Repair

Following stringing and bending, the individual pipe joints would be aligned and welded together using multiple passes for a full penetration weld. Welding would be conducted according to applicable American Welding Society, ASME, and API standards.

Every completed weld would be visually examined and non-destructively tested to determine its quality using radiographic or other approved methods according to API standards. Any welds displaying unacceptable defects would be repaired or removed. After the weld is approved, the joint would be epoxy coated. The coating on the entire pipe section would be inspected and any damaged areas repaired. The Applicant would install six deep, vertical, impressed current cathodic protection anode beds for the onshore pipelines to control corrosion of the pipe. Each bed would consist of anodes installed at least 130 feet deep, and the workspace required for each would be wholly contained within the permanent right-of-way. The Applicant anticipates these anode beds would be installed at approximately MP 7.1, MP 20.9, MP 26.4, MP 32.2, and MP 47.0 of the ECHO to Oyster Creek Pipeline, and at MP 5.36 of the Oyster Creek to Shore Pipelines (SPOT 2019xx).

Lowering-In, Padding, and Backfilling

Before the pipeline is lowered-in, the trench would be inspected to ensure that it is free of rocks and other debris that could damage the pipe or protective coating. The trench would also be inspected to ensure that the pipe and trench configurations are compatible.

After lowering the pipe into the trench, the trench would be backfilled with previously excavated materials. If the previously excavated material is not suitable backfill (i.e., contains large rocks or other materials that could damage the pipe coating), screen fill (i.e., padding) would be placed around the pipe prior to backfilling. Screened materials would be generated from excavated material and processed with a track-mounted padding machine or a bucket screen on an excavator.

Hydrostatic Testing

After burial, the pipelines would be hydrostatically tested to ensure the system is capable of withstanding the operating pressure for which it was designed. Hydrostatic testing would be conducted in accordance with PHMSA requirements (49 CFR Part 195). Hydrostatic test water would be obtained from the proposed Oyster Creek Terminal firewater pond or via municipal water sources. Test water would be cascaded down the onshore pipeline for reuse and then returned or sent to the firewater pond at the Oyster Creek Terminal. The Applicant does not anticipate any treatment of hydrostatic test water prior to or during testing, or after discharge into the firewater pond.

Cleanup and Restoration

Following successful completion of hydrostatic testing, workspaces, including the right-of-way and ATWSs, would be returned to preconstruction contours, and debris would be removed and disposed of in accordance with local ordinances. Permanent erosion and sediment control measures, including slope breakers, trench breakers, and vegetation, would be installed. Soils that supported vegetation prior to construction would be revegetated using seed mixes, application rates, and timing windows recommended by local soil conservation authorities or as requested by the landowner. Fences, gates, driveways, and roads disturbed during construction would be restored to original or better condition.

Specialized Construction Procedures

Construction through areas containing sensitive resources (e.g., wetlands, waterbodies) or in areas with construction constraints would require construction techniques that differ from the standard measures described above. The Applicant's specialized construction techniques would include:

- HDD
- Bore
- Open-cut stream construction
- Wetland construction
- Agricultural construction
- Residential construction

Horizontal Directional Drill

The HDD method involves establishing land-based staging areas along both sides of the proposed crossing in order to avoid trenching in sensitive areas. The process commences with the boring of a pilot hole beneath the waterbody or other feature to be avoided, then enlarging the hole with one or more passes of a reamer until the hole is the necessary diameter to facilitate the pull-back (installation) of the pipeline. Once the remaining passes are completed, a prefabricated pipe segment is pulled through the hole to complete the crossing.

Throughout the drilling process, a slurry of non-toxic, bentonite clay, and water would be pressurized and pumped through the drilling head to lubricate the drill bit, remove drill cuttings, and hold the hole open. This slurry, referred to as drilling mud or drilling fluid, has the potential to be inadvertently released to the surface through fractures, fissures, or during the drilling of the pilot hole when the pressurized drilling mud is seeking the path of least resistance. The path of least resistance is typically the path back along the drilled pilot hole. However, if the drill path becomes temporarily blocked or large fractures or fissures that lead to the surface are crossed, an inadvertent release could occur at the fracture or fissure location. The drilling construction contractor would monitor the pipeline route and the circulation of drilling mud throughout the HDD operation for indications of an inadvertent drilling mud release and would immediately implement corrective actions if a release is observed or suspected. The corrective actions that the Applicant would implement are outlined in SPOT's HDD Contingency Plan (Appendix L). Depending on the exact soil conditions at each HDD location, an additive to the bentonite mixture may be needed. For example, if the soil at a particular site contains reactive clay, sand, or cobble, a polymer additive may be needed.

The Applicant proposes to use the HDD construction method at 28 locations onshore, including 13 roads or unspecified landowner parcels, 1 road with an adjacent waterbody, and 14 wetland or waterbody features. Some temporary workspaces would be used in between the HDD entry and exit points for travel lanes to minimize construction equipment move-arounds. HDD crossings are detailed in Table 2.2-8. In addition, the Applicant is proposing to install approximately 5,500 feet of the subsea pipelines from the shoreline running offshore via the HDD method.

Table 2.2-8: HDD Crossings for the ECHO to Oyster Creek Pipeline and the Oyster Creek to Shore Pipelines of the SPOT Project

HDD Number	Approximate Start Milepost [a]	Approximate End Milepost [a]	Approximate Length (feet)	Feature Crossed
ECHO to Oyster Creek Pipeline				
HDD #1	0.1	0.5	2,000	Galveston Road
HDD #2 [b]	0.7	1.1	1,980	Retention Pond
HDD #3	1.2	1.5	1,820	Interstate 45
HDD #4	1.9	2.1	1,325	HCFCD waterway A119
HDD #5 [b]	2.1	2.4	1,500	Sageglen Drive
HDD #6	2.7	2.9	1,250	Hughes Road
HDD #7	3.3	4.0	3,850	HCFCD waterway A120
HDD #8	4.5	4.8	1,700	Blackhawk Boulevard
HDD #9	5.6	5.9	1,600	Pearland Parkway
HDD #10	7.4	7.9	2,850	Mykawa Road / BNSF Railroad
HDD #11	9.4	9.6	1,075	HCFCD waterway A100
HDD #12	12.5	13.1	2,950	Property Tract BO-0030
HDD #13 [b]	13.3	13.5	1,400	Mary's Creek
HDD #14	25.0	25.6	2,800	Property Tract BO-0112
HDD #15	27.8	28.2	2,200	Property Tract BO-0129
HDD #16	32.3	32.6	1,800	Property Tract BO-0142
HDD #17	43.0	43.6	3,100	BNSF Railroad / Highway 171
HDD #18	48.1	48.9	4,000	Bastrop Bayou
Oyster Creek to Shore Pipeline – Line 1 (West Pipeline)				
HDD #1	1.8	2.1	1,600	Phair Cemetery Road / Waterbody SF003
HDD #2	8.0	8.4	1,900	Oyster Creek #1

HDD Number	Approximate Start Milepost [a]	Approximate End Milepost [a]	Approximate Length (feet)	Feature Crossed
HDD #3	9.9	10.4	2,600	Oyster Creek #2
HDD #4	10.5	10.9	2,120	Oyster Creek #3
HDD #5 [c]	11.0	12.1	5,700	Gulf Intracoastal Waterway / Swan Lake
Oyster Creek to Shore Pipeline – Line 2 (East Pipeline)				
HDD #1	1.8	2.1	1,400	Phair Cemetery Road / Waterbody SF003
HDD #2	8.0	8.4	2,000	Oyster Creek #1
HDD #3	9.9	10.4	2,500	Oyster Creek #2
HDD #4	10.5	10.9	2,000	Oyster Creek #3
HDD #5 [b]	11.0	12.1	5,820	Gulf Intracoastal Waterway / Swan Lake

ECHO = Enterprise Crude Houston; HCFCD=Harris County Flood Control District; HDD = horizontal directional drill; SPOT = Sea Port Oil Terminal

[a] MPs rounded to tenths of a mile, based on information provided in the Applicant's application.

[b] The Applicant would use temporary bridges at these locations to allow equipment to cross the retention pond, drainage canal, and Mary's Creek.

[c] Crossing would require Section 408 authorization by the USACE under 33 U.S.C. § 408, as noted in Table 1.6-1 of this EIS.

Bore

The bore method is a trenchless installation procedure whereby an area is excavated on either side of the feature being crossed and a horizontal tunnel is installed beneath a surface feature (e.g., road, minor waterbody). Similar to HDD, a fluid mixture of water and bentonite clay would be used throughout the boring process to lubricate the bit, transport cuttings to the surface, and maintain the integrity of the hole during installation. Inadvertent releases could occur if natural fractures or weak ground are encountered during the drilling process. The correction actions the Applicant identified in Appendix L, HDD Contingency Plan, would also be applicable to the bore construction method.

The Applicant proposes to use the bore construction method at 65 locations, including roads, driveways, levees, railroads, pipelines, and canals—8 of these locations are for the Oyster Creek to Shore Pipelines, where one bore would be completed for each of the two collocated pipelines. These crossings are detailed in Table 2.2-9.

Table 2.2-9: Bore Crossings for the ECHO to Oyster Creek Pipeline and the Oyster Creek to Shore Pipelines of the SPOT Project

Bore Number	Approximate Start Milepost [a]	Approximate Length (feet)	Feature Crossed
ECHO to Oyster Creek Pipeline			
Bore #1	1.1	220	Scarsdale Boulevard
Bore #2	2.4	220	Canal
Bore #3	2.5	140	Sagedown Lane
Bore #4	3.0	100	Sagemont Church Driveway
Bore #5	3.2	80	Sagemont Church Driveway
Bore #6	4.9	160	Hall Road

Bore Number	Approximate Start Milepost [a]	Approximate Length (feet)	Feature Crossed
Bore #7	5.4	460	Nature View Circle
Bore #8	5.6	100	Driveway
Bore #9	6.0	120	Studio Movie Grill Entry
Bore #10	6.2	460	Multiple Driveways
Bore #11	7.0	280	Telephone Road
Bore #12	8.8	200	Driveway
Bore #13	10.2	120	Brookside Drive
Bore #14	10.9	100	Sharon Drive
Bore #15	11.1	100	Summer Rain Drive
Bore #16	11.2	60	Canal
Bore #17	11.7	180	Driveway / Canal
Bore #18	12.2	200	W. Broadway Street
Bore #19	13.1	400	Magnolia Street
Bore #20	14.1	260	Bailey Road
Bore #21	15.1	220	Canal
Bore #22	15.2	160	McKeever Road
Bore #23	15.3	120	Country Club Drive
Bore #24	16.0	160	Oilfield Road
Bore #25	16.2	220	Scopel Road
Bore #26	16.6	140	Easley Farm Road
Bore #27	17.2	140	Belcher Road
Bore #28	17.2	100	Texas County Road
Bore #29	17.5	240	Canal
Bore #30	17.9	180	Masters Road
Bore #31	20.9	460	Morris Avenue
Bore #32	21.6	380	Railroad / Canal
Bore #33	21.9	160	Allelua Trail
Bore #34	26.6	500	Airline Road No 2 E
Bore #35	27.3	100	Sandy Point Loop
Bore #36	29.0	120	Schovajsa Road
Bore #37	29.5	240	Multiple Canals
Bore #38	31.4	220	Highway 1462
Bore #39	33.6	260	Canal
Bore #40	33.9	200	Field Road
Bore #41	34.7	160	Canal
Bore #42	35.4	180	Canal
Bore #43	38.4	200	Highway 45
Bore #44	41.6	280	Canal
Bore #45	41.8	200	Highway 523
Bore #46	42.0	140	Canal
Bore #47	42.2	360	E. Mulberry Street
Bore #48	42.5	180	E. County Road 341

Bore Number	Approximate Start Milepost [a]	Approximate Length (feet)	Feature Crossed
Bore #49	42.9	180	Levee
Bore #50	44.1	240	Cedar Road
Bore #51	44.9	160	E. Kiber Street
Bore #52	45.8	180	Fort Road
Bore #53	46.0	140	Kings Drive
Bore #54	46.1	120	Canal
Bore #55	46.8	420	Downing Road
Bore #56	47.1	500	Coale Road
Bore #57	49.3	240	Ditch
Oyster Creek to Shore Pipeline – Line 1 (West Pipeline)			
Bore #1	1.1	140	Dixie Brown Road
Bore #2	1.1	120	Canal
Bore #3	1.2	240	Levee
Bore #4	3.0	280	Stratton Ridge Road
Bore #5	4.0	220	Highway 523
Bore #6	4.3	280	Pipeline Corridor
Bore #7	7.5	240	Highway 792
Bore #8	12.2	180	Crossing
Oyster Creek to Shore Pipeline – Line 2 (East Pipeline)			
Bore #1	1.1	140	Dixie Brown Road
Bore #2	1.1	120	Canal
Bore #3	1.2	240	Levee
Bore #4	3.0	280	Stratton Ridge Road
Bore #5	4.0	220	Highway 523
Bore #6	4.3	280	Pipeline Corridor
Bore #7	7.5	240	Highway 792
Bore #8	12.2	180	Crossing

Source: SPOT 2019a, Application, Volume IIb, Section 1

ECHO = Enterprise Crude Houston; SPOT = Sea Port Oil Terminal

[a] MPs rounded to tenths of a mile, based on information provided in the Applicant's application. End MPs not provided due to short lengths of bores.

Open-Cut Stream Construction

All streams not crossed using a trenchless design (i.e., HDD or bore) would be crossed using the open-cut construction method. The Applicant anticipates using the open-cut crossing method at perennial, intermittent, and non-flowing stream crossings. A trench would be excavated across the streambed and banks using backhoes, dozers, mechanical ditchers, and/or draglines. For most open-cut crossings, equipment would be staged and operated outside the water's edge when water is present, unless approved to operate in the streambed. Trench spoil would be placed in upland areas where possible. Where storage in wetlands or waterbodies would be required, alternating spoil piles would be used to allow sheet flow. Following excavation, prefabricated pipe strings would be lowered into the trench, fitted with buoyancy control, and covered with backfill. Backfilling would start at the center of the stream and work back towards the water edge. Following backfilling, the streambed would be stabilized using standard restoration methods and temporary vehicle crossings would be removed. For waterbodies that are greater than 100 feet wide, the Applicant would install the pipeline with a minimum of 48 inches of cover, rather than the typical 36 inches.

Wetland Construction

Where construction would occur in wetlands, vegetation would be cut to ground level. Stump removal would be limited to areas directly over the trench. Silt fences would be installed at the edges of the right-of-way to minimize the potential for sediment runoff. If water is present in the trench, trench plugs would be left in the trench before its entrance into the wetland. The hydrologic integrity of the wetland would be maintained by installing trench breakers where the trench enters and exits the wetland. Where possible, ATWS would be located at least 50 feet from the edge of wetlands.

In areas where groundwater is near the surface, trench excavation may intersect the water table. If groundwater enters the trench or if a substantial rain event occurs, dewatering of the trench may be necessary. The Applicant would use filter bags, silt fencing, or hay bale structures to minimize the potential for erosion or sedimentation, and trench water would be released into well-vegetated upland areas where it would be reabsorbed, in accordance with the Applicant's Onshore Construction Best Management Practices (Construction BMPs) (Appendix M, BMP #1 in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures).

Standard pipeline construction, similar to construction methods described for uplands, would be used for unsaturated wetlands. Topsoil segregation would occur in the same manner as described for agricultural lands. In saturated wetlands with standing water or unstable soils, timber mats or crushed stone on geotextile fabric would be installed at work surfaces adjacent to the trench. Topsoil would be segregated across the full width of the construction workspace to a maximum of 12 inches, unless otherwise specified by the landowner. In areas where topsoil is less than 12 inches deep, the actual depth of the topsoil would be segregated. Topsoil segregation would not be possible in saturated wetlands. Pipe stringing and fabrication may occur within the wetland or in adjacent ATWS. Trenchless construction techniques, such as HDD and bore, would also be used to cross under certain wetlands.

Agricultural Construction

Where the ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines would cross actively cultivated and rotated cropland, the Applicant would segregate topsoil from subsoil. As in wetland areas, a maximum of 12 inches of topsoil would be segregated. In areas where the topsoil is less than 12 inches deep, only the actual depth of the topsoil would be segregated. The Applicant would store topsoil and subsoil in separate piles to avoid mixing.

Residential Construction

The ECHO to Oyster Creek Pipeline and the Oyster Creek to Shore Pipelines would all cross residential areas along some portion of the routes. Within these areas, the Applicant would implement BMPs from its Construction BMPs (Appendix M, BMP #1 in Appendix N). These practices would be implemented in areas where construction workspace would be located within 50 feet of a residential property. Specific practices may include:

- Reducing the construction right-of-way to maximize the distance between construction activities and the residential property;
- Excavating the trench only once the pipe has been welded and is ready to lay in the trench;
- Immediately backfilling the excavated trench once the pipe is installed;
- Notifying the homeowner 1 week prior to commencing construction activities;
- Installing and maintaining construction safety fencing along the workspaces;
- Maintaining access to residential properties at all times; and
- Restoring completely any landscaping, lawn, fencing, or other amenities that may have been affected during construction.

The Applicant would install the pipeline with a minimum of 48 inches of cover in areas where the pipeline would be within 50 feet of two residences near MP 12.3; all other residences are greater than 50 feet from the pipeline. Where this minimum depth of cover is infeasible, the Applicant would place warning tape and additional pipeline markers to indicate the presence of the pipeline.

2.2.6. Offshore Construction and Installation

Construction of the proposed Project would begin in the second quarter of 2023 if a license is issued and all license conditions are met. Construction of the offshore components of the proposed Project is expected to begin in the second quarter of 2024 and be completed in the fourth quarter of 2025. The Applicant anticipates commissioning of the Project would occur in the third and fourth quarters of 2025 and the first shipments of oil for export would occur in December 2025. Most of the offshore components of the SPOT Project would be fabricated onshore prior to installing offshore, which would minimize potential delays that offshore construction projects often encounter. The Applicant anticipates fabrication of the platform and SPM buoy equipment would take 14 to 16 months; fabrication of the jacket and piles would take 6 to 8 months; and deck fabrication and outfitting would take 14 to 16 months. Construction of the platform offshore, including transport of the equipment offshore, would take approximately 4 weeks, once all the components are fabricated. Construction of the subsea pipelines, including the SPMs, PLEMs, interconnecting pipelines, and floating hoses, would take between 18 and 20 months. Once construction is complete, final commissioning and startup for the offshore components of the Project would take approximately 6 weeks.

The offshore Project components would have short-term impacts during construction and long-term impacts during operation. The seafloor requirements for the offshore components are listed in Table 2.2-10.

Table 2.2-10: Seafloor Requirements for the Offshore Components of the SPOT Project

Project Component	Total Construction Impact Area (acres)	Total Permanent Impact Area (acres)
Subsea Pipelines	1,212	0
DWP Platform, PLEMs, SPM Buoys, and Service Vessel Moorings	1 [a]	1 [a]
Total	1,213	1

Sources: SPOT 2019a, Application, Volume IIa, Section 4; SPOT 2020a

DWP = deepwater port; PLEM = pipeline end manifold; SPM = single-point mooring; SPOT = Sea Port Oil Terminal

[a] Of the 1 acre of impact for the DWP platform, PLEMs, SPM buoys, and service vessel moorings, approximately 0.366 acre of temporary and permanent impact would result from the SPM buoys and service vessel moorings alone.

2.2.6.1. Fabrication of Offshore Components

Certain components of the SPOT Project would be prefabricated at various vendor facilities or an onshore fabrication yard within the Gulf Coast region. Using prefabricated components would minimize the construction timeframe for the offshore portion of the Project. The platform, jacket, jacket risers, piles, and PLEMs would be fabricated and assembled at a regional fabrication yard. The subsea tie-in spools would be fabricated and tested at the pipeline installation contractor's facilities. Most of the large equipment, such as the generators, cranes, LACT unit, LACT prover, and utilities, would be fabricated and assembled at the various vendor facilities and shipped to the SPOT DWP ready to install. The living quarters would be fabricated at the vendor facility and shipped separately for assembly and installation on the platform.

The manufacturer and location of fabrication is currently unknown for the SPM buoys, interconnection pipelines, and floating hoses.

2.2.6.2. Subsea Crude Oil Export Pipelines

HDD technique would be used to install the two collocated subsea pipelines between the shore crossing and offshore segments. The HDD entry hole would be located onshore, and the exit pit would be excavated offshore near the 28-foot water depth contour, or about 5,500 feet from the shoreline. Spoil materials would be sidecast within the temporary workspace on either side of the pipelines and on the shore side of the trench. The HDD exit hole would be allowed to backfill naturally from currents and wave action following completion of the HDD.

A pipeline installation barge would install a start-up anchor approximately 200 feet from the planned HDD exit hole at about the 30-foot water depth contour and begin assembling the HDD pipe string. The barge would move forward once each pipe joint is welded together on the installation barge. The completed 7,500-foot-long pipe string would be laid on the ocean floor and an anchor would be installed on the deep end to hold the pipe in place. The process would be repeated for the second collocated pipeline.

The HDD drilling rig would operate from the shore side, and a reaming support barge would operate offshore. The pipe installation barge and a support barge would assist in pullback operations once reaming is complete. After pullback of the two 36-inch-diameter pipe segments is complete, the ends would be secured with anchors. Each pipeline segment would also be filled with seawater and hydrostatically tested. The Applicant anticipates using a corrosion inhibitor with propylene glycol and polyoxyalkylenes. Section 3.3, Water Resources, provides a more detailed discussion of the use of corrosion inhibitors.

A total of 86.9 nautical miles of pipeline, including the four crude oil loading pipelines and four vapor recovery pipelines, would be installed using conventional open-cut trenching methods. The remaining sections of the two collocated 36-inch-diameter subsea pipelines would be installed using an anchored pipeline installation barge (pipelay barge). This method uses cargo barges and tugboats to transport pipe joints to the installation barge where pipe joints would be welded, inspected, and field joint coatings would be applied. Work would begin near the HDD exit hole, where anchor-handling tugs would position and hold the pipeline installation barge along the right-of-way using two stem anchors, a minimum of two bow anchors, and four breast anchors. As pipe segments are completed, the pipelay barge would move forward until the entire pipeline is laid on the ocean floor. The same process would be repeated for the second collocated pipeline.

The pipelay barge would also install the four 30-inch-diameter crude oil loading pipelines between the platform and PLEM target box locations. A dead-man anchor would be set in line with the pipeline route, and the pipelay barge would assemble and lay the pipe, moving away from the startup anchor in the same manner as described above. Once the design length of pipeline is welded, a flanged laydown head would be installed, and the pipe would be lowered to the designated location on the sea floor. The four 16-inch vapor recovery pipelines would be installed in the same manner between the platform and PLEMs.

Upon completion of pipeline installation on the sea floor, a trenching vessel using a jet sled would be positioned at the HDD exit point and use high-pressure water jets to break up the consolidated bottom materials alongside and underneath the pipeline. High-pressure compressed air would remove the slurry beneath the pipe as the barge moves ahead. The hardness of the substrate would determine the rate of travel. The same process would be followed for the two 36-inch, four 30-inch, and four 16-inch-diameter pipelines. The pipelines would be buried to a minimum depth of 3 feet below natural bottom elevation, except at shipping fairway crossings, which would require a burial depth of 10 feet below natural seabed elevation. Multiple passes of the jet sled may be required to achieve this depth.

The subsea pipelines would cross seven existing pipelines and two existing cables—the pipelines are currently identified as abandoned and the cables are identified as active. Where the subsea pipelines would cross existing pipelines and cables, high-pressure water jets and compressed air-lift operation would be used to remove any cover above the existing utilities. The same jetting airlift operation would be used to lower the existing utilities to a depth that would allow 18 inches of separation between the existing utilities and the new pipelines, as well as 3 feet of cover over the new pipelines. Concrete mats would be placed on top of the existing pipelines or on either side of existing cables to maintain the 18-inch separation. Concrete mats or sandbags would be placed over the new pipelines in areas where 3 feet cover could not be achieved due to existing pipeline elevations.

2.2.6.3. Platform Components, Pipeline End Manifolds, and Single Point Mooring Buoys

The platform would be supported by eight jacketed steel piles, each 72 inches in outside diameter with wall thicknesses between 1.25 and 2.75 inches, fabricated in accordance with API Specification 2B, Specification for the Fabrication of Structural Steel Pipe. Table 2.2-11 outlines the piles that would be used for the SPOT Project. The jacket would be fabricated off-site and brought to the SPOT DWP site via cargo barge. Piles would be shipped with the jacket; jacket and pile installation would occur prior to deck installation. The jacket would be lifted and set in position, then verified by an on-site surveyor. The 72-inch-diameter piles would then be driven to a stipulated design depth of 380 feet below bottom elevation using a pile hammer/driver operating from a dynamically positioned derrick barge. Platform piles would require 1,278 strikes per hour and operations would occur 24 hours per day. The hammer would operate for 2 hours every 6 hours. There would then be a 12-hour welding and cool-down period. This cycle would be repeated eight times over the course of 10 days and would result in a maximum of 10,224 strikes per pile. The jacket would be leveled, and the piles would be welded to the top of the jacket. Each deck would be lifted from the cargo barge to the derrick barge, set on top of the jacket legs, and then welded in place. The living quarters would then be lifted and set in place.

Table 2.2-11: Piles Summary for the SPOT Deepwater Port

Project Component	Number of Piles	Pile Diameter (inches)	Maximum Hammer Strikes (per pile)	Depth (feet)	Driving Hours (per pile)
Platform	8	72	10,224	380	8
PLEM	16	30	1,500	60	8

PLEM = pipeline end manifold

Tie-in spools would be fabricated at onshore facilities and transported to the installation location by a supply vessel. A dive support vessel would lower the tie-in spools to the ocean floor, and the flanged ends would be connected between the pipelines, the risers, and the PLEMs. Flanged connections with swivel and misalignment ball flanges would be used for installation, as required to facilitate the connection of the subsea pipelines to the fixed orientation of the jacket risers.

The PLEMs would be transported on a material transport barge and would be lowered to the ocean floor with support from a dynamic positioned diving support vessel. The two PLEMs would be secured in place with four 30-inch outside diameter driven steel piles each, with wall thicknesses from 0.75 to 1.0 inch and fabricated in accordance with API Specification 5L, Specification for Line Pipe. The impact hammer would operate 24 hours a day, with one pile driven continuously approximately every 8 hours over 5.3 days. Piles for the PLEMs would require approximately 1,500 strikes every 40 minutes from a dynamically positioned derrick barge.

The SPM system would use fluke anchors and anchor chain to secure the buoys in position. The six anchors would be equally spaced on a 1,043-foot-radius circle with 1,080 feet of anchor chain between the anchor and the chain stopper on the buoy. An installation vessel would first install each fluke anchor and lay out the chain. A large anchor-handling tug would set the anchors by pulling each anchor in the direction of the buoy's proposed location, then laying the chain out on the ocean floor. After the fluke anchors and anchor chains are laid out and inspected, the SPM buoy would be towed into the designated location and the anchor chains would be installed in accordance with the buoy designer's recommended installation sequence and procedures. Following inspection, the underbuoy pipelines would be installed following the Oil Companies International Marine Forum guidelines. Two underbuoy crude oil pipelines and two underbuoy vapor recovery pipelines would be installed for each PLEM. Upon completion of installation, the SPM buoy system would be fully inspected.

The Applicant would install a telemetry system on each SPM buoy to monitor conditions which may be of significance to VLCCs or other crude oil carriers and operation at the offshore platform. The system would be installed and tested in accordance with all relevant industry standards.

The floating crude oil and vapor recovery hoses would be connected to the SPM buoy swivel and hose sections flanged together until the hose tail is reached. The floating hoses would float on the surface of the water and would move with the current. One end of each mooring hawser for mooring the VLCCs or other crude oil carriers would be connected to each SPM buoy and the other ends would be used to moor the vessels.

2.2.7. Startup and Commissioning

Following completion of construction, the Applicant would undertake a number of activities for startup and commissioning of the Project, including dewatering, purging and packing, and purging and filling.

The Applicant would first remove the hydrostatic test water from all components of the Project. Following water removal, pigs, propelled by air, would be used to clean and dry the system. Nitrogen would then be pushed through the system to remove the air. Once the air is removed from the system, the nitrogen would be replaced by crude oil.

During startup and commissioning, a number of issues could arise, such as loss of communications, valve misalignment, weather delays, and accidental release of crude oil during purging and filling. If communications are lost at any time during startup and commissioning, or if severe weather occurs, the Applicant would stop work until communications can be restored or the weather improves. During startup and commissioning activities, the Applicant would conduct work in accordance with SPOT-approved operating and lock-out tag-out procedures. Specifically, the Applicant would use DOT-qualified operators to conduct valve alignment. During purging and filling, when there is potential for an inadvertent release of crude oil, the Applicant would use a nitrogen vent containment system. This system would capture any liquids when nitrogen is being replaced by crude oil within the system through the use of frac tanks and vents with socks. If a failure in the nitrogen vent containment system is detected, the Applicant would stop work until the system can be repaired.

2.2.8. Operation

Crude oil would be transferred from the ECHO Terminal through the ECHO to Oyster Creek Pipeline for storage. As VLCCs or other crude oil carriers moor at the SPOT DWP, the crude oil would then be transferred from the storage tanks at the Oyster Creek Terminal through the Oyster Creek to Shore Pipelines, into the subsea pipelines, and to the offshore platform. The crude oil would be metered at the offshore platform, then be transferred through the 30-inch-diameter pipelines to the PLEMs, through the underbuoy pipelines to the SPM buoys, then through the floating crude oil hoses to the VLCCs or other crude oil carriers for loading. The Applicant anticipates the DWP would be called on by 365 VLCCs or other crude oil carriers per year. The loading time would be approximately 24 hours from VLCC or other crude oil carrier mooring to disconnection and transit back into the GoM; however, other crude oil carriers may not take as long to load as a VLCC due to their smaller capacities.

2.2.8.1. Onshore Facilities

The existing ECHO Terminal and proposed Oyster Creek Terminal would both be operated and maintained in accordance with PHMSA regulations provided in 49 CFR Part 195. The Applicant would control operations from a remote location at EPO's secure controls center in Houston, Texas, which currently operates all of EPO's assets. Both terminals would be manned during daytime hours for regular maintenance and operational tasks, as directed by the EPO control center.

The ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines would be operated in accordance with industry standards and PHMSA regulations in 49 CFR Part 195. The onshore pipelines would be monitored by the EPO control center 24 hours per day, 7 days per week for pipeline flowrates, pressures, and operating conditions. A change in operating conditions, or in the event of an emergency, immediate communication would be made with the control center for response. The Applicant would also monitor the pipelines via aerial patrol, in accordance with 49 CFR Part 195. The Applicant would conduct maintenance pigging of the onshore pipelines on a monthly basis and would conduct inspections using smart pigs once every 5 years. The Applicant would include the maintenance requirements and frequency of inspection for internal and external corrosion, among other factors, in its USCG-approved OPSMAN.

Routine vegetation management would occur over the full width of the 30-foot and 50-foot-wide permanent rights-of-way of the onshore pipelines on an annual basis (PHMSA 2019c). A smaller corridor centered on the pipeline may be cleared as necessary to maintain an herbaceous cover to facilitate corrosion and leak surveys. At waterbody crossings, the Applicant would allow a 25-foot-wide riparian buffer to naturally revegetate across the full width of the right-of-way and would clear a small corridor centered on the pipeline only as necessary to conduct corrosion and leak surveys. In wetlands, the Applicant would conduct routine vegetation management in the same manner as in uplands; however, the Applicant would avoid vegetation management of inundated or excessively saturated wetlands. The Applicant would clear trees throughout the permanent rights-of-way.

In accordance with 33 CFR Part 154, Subpart F, the Applicant would develop an operational spill response plan within its Prevention, Monitoring, and Maintenance Plan for operations. This plan would also be developed in accordance with OPA90 and PHMSA's implementing regulations in 49 CFR Part 194, the National Oil and Hazardous Substances Pollution Contingency Plan, applicable Area Contingency Plans, the USEPA Region 6 Regional Integrated Contingency Plan, and the One Gulf Plan. Each of these laws, regulations, and plans include specific requirements and guidelines for operational spill response plan development, which are publicly available. The Applicant's plan would be developed to assist personnel with quickly, safely, and effectively responding to a crude oil spill either onshore or offshore, and would be prepared during construction of the proposed Project. In the event of an oil spill, the operational spill response plan would be implemented and the decision regarding what types of spill response actions to use would be determined based on the location, size, and nature of the oil spill, as well as the type of crude oil released. Potential spill response actions are included in Appendix I, Summary of Hypothetical Oil Spill Response Actions. Potential impacts from oil spills are addressed in Chapter 3, Environmental Analysis of the Proposed Action.

2.2.8.2. *Offshore Facilities*

The SPOT DWP would be operated in accordance with the USCG-approved OPSMAN. Up to 12 personnel would operate the DWP over a 14-day rotational shift, at which point a second crew of the same size would relieve the first crew. The platform would be manned at all times. The Applicant anticipates 10 individuals would staff a day shift, and 2 individuals would staff a night shift. Table 2.2-12 describes the SPOT DWP staff.

Table 2.2-12: SPOT DWP Personnel

Title	Number of Persons per Rotational Shift [a]	Location of Personnel	Role / Responsibilities
Port Superintendent	1	SPOT DWP Platform	Overall managing authority for the SPOT DWP.
Mooring Master [b]	1	VLCC or other crude oil carrier	Advise the VLCC or other crude oil carrier Master on operational and ship control matters and requirements specific to the SPOT DWP, including navigational aids, water depth, current characteristics, mooring equipment and procedures, emergency towing procedures, and vessel control procedures. Maintain communications with the Vessel Traffic Controller (not a SPOT employee) and the Assistant Mooring Master until mooring operations are complete.
Assistant Mooring Mater [b]	1	VLCC or other crude oil carrier	Stationed on the VLCC or other crude oil carrier during mooring operations to report position approach data to Mooring Mater and advise ship personnel in handling of mooring equipment specific to the SPOT DWP.
Deck Watch [b]	2	VLCC or other crude oil carrier	Stand periodic watch of VLCC or other crude oil carrier manifold and bow while moored at SPOT DWP.
Board Operator	2	SPOT DWP Platform	Monitor operations of the platform from control room.
Outside Operator	2	SPOT DWP Platform	Monitor operations of the platform and serve as crane operator.
Electrical and Instrumentation Technician	2	SPOT DWP Platform	Maintain, troubleshoot, and repair control, electrical, measurement, and heating, ventilation, and air conditioning equipment.
Mechanical Technician	2	SPOT DWP Platform	Maintain, troubleshoot, and repair generators, pumps, valves, and blowers. Serve as crane operators.
Maintenance Technician	1	SPOT DWP Platform	Assist the Electrical and Instrumentation Technician and Mechanical Technician.
Vessel Traffic Controller	1	SPOT DWP Platform	Control traffic at the SPM buoys and Anchorage Area.
Marine Terminal Security Officer	1	SPOT DWP Platform	Responsible for security operations for the SPOT DWP.

Source: SPOT 2019a, Application, Volume IIa, Section 1; SPOT 2019pp

DWP = deepwater port; SPOT = Sea Port Oil Terminal; VLCC = very large crude carrier

[a] Each rotational shift would be 14 days, at which time a crew of the same size would replace the working crew.

[b] Would be assigned to each loading.

As described above, the Applicant would develop an operational spill response plan in accordance with OPA90 and PHMSA's implementing regulations in 49 CFR Part 194, the National Oil and Hazardous Substances Pollution Contingency Plan, applicable Area Contingency Plans, the USEPA Region 6 Regional Integrated Contingency Plan, and the One Gulf Plan. The plan would be developed to assist personnel with quickly, safely, and effectively responding to a crude oil spill either onshore or offshore, and would be prepared during construction of the proposed Project. This operational spill response plan would be developed in consideration of a worst-case discharge, as discussed in Appendix H, Spill Risk Analysis.

Subsea Crude Oil Export Pipelines

The subsea pipelines would be operated in accordance with industry standards, PHMSA regulations in 49 CFR Part 192 and 49 CFR Part 195, and Bureau of Safety and Environmental Enforcement requirements in 30 CFR Part 250, Subpart J. Both collocated pipelines would be monitored by the EPO control center 24 hours per day, 7 days per week for pipeline flowrates, pressures, and operating conditions. In the event of a change in operating conditions, or in the event of an emergency, immediate communication would be made with the control center for response. The subsea pipelines would be bi-directional to allow for the export of different types of crude oil based on customer demand. The Applicant would conduct maintenance pigging of the subsea pipelines on a monthly basis and would conduct inspections using smart pigs once every 5 years.

Platform, Vapor Recovery Units, Single Point Mooring Buoys, and Interconnections

The platform operations team, consisting of the team members listed in Table 2.2-12, would manage the daily operation, maintenance, and repairs of equipment on the SPOT DWP platform and living quarters, as well as scheduled activities. The platform operations team would be supported by the onshore base located in Freeport, Texas. The onshore base would be manned Monday through Friday during regular business hours, and would be responsible for coordinating logistics and warehousing support for the platform operations team.

Activities for the platform operations team would include operating, monitoring, testing, and maintaining process and operational equipment, including the vapor combustors, HIPPS, pigging equipment, and safety equipment. The team would also communicate with the VLCCs or other crude oil carriers to coordinate pre-arrival checklists, mooring and connecting to the SPM buoys, and crude oil loading operations. The team would monitor crude oil loading, communicate with the onshore pump station during loading, and would have the ability to cease loading activities and shut down the onshore pumps if necessary.

The SPOT DWP would be operated in accordance with the USCG-approved OPSMAN. Detailed procedures would be described in this document, including, but not restricted to:

- Daily work permits for hot work, safe work, maintenance, and other activities;
- Simultaneous Operations requirements for work occurring during other operations, such as crude oil loading;

- Health, safety, and environment procedures (e.g., stop work authority, behavior-based safety training, job safety analysis, incident reporting, noise exposure and awareness, hazardous materials handling, crane safety, platform orientation);
- Energy isolation/lockout-tagout;
- Helicopter and marine communications guidelines;
- Personnel transfer to and from the platform;
- Mustering and evacuation;
- Personnel onboard accounting;
- Medical treatment, first aid supplies, supplemental support capability (e.g., defibrillator), and evacuation of injured or sick personnel;
- Platform security and onboarding of new personnel;
- Platform beacons and alarms with required actions;
- Daytime and nighttime operations, with roles and responsibilities;
- Moving materials/equipment/consumables to and from transport vessels and around the facility;
- Bunkering of diesel fuel;
- Work at heights or over water;
- Rigging and equipment inspection for safe operation;
- Chemical handling and safety systems (e.g., eyewash stations, self-contained breathing apparatus, safety shower);
- Incipient firefighting guidelines and available fire safety systems (deluge system, hose reels, extinguishers);
- Regulatory documentation and reporting requirements; and
- Daily platform operations and maintenance reporting requirements.

The SPM buoys would be unmanned at nearly all times. The Applicant's personnel and/or subcontractor personnel would board the SPM buoys periodically from the boat landing area to conduct maintenance, flush the floating hoses, and make necessary repairs.

Routine maintenance activities that would be conducted during operations include:

- Maintenance of generators and firewater pumps;
- Pigging of the vapor recovery pipelines—the Applicant estimates 208 times annually;
- Pigging of the crude oil pipelines—the Applicant estimates 208 times annually;
- Monitoring, testing, and any required maintenance for the vapor combustors, HIPPS, all pigging components, and all safety devices; and
- Testing of the sewage treatment system.

Water Use and Discharge

Operation of the SPOT DWP would require the withdrawal of water from the GoM, as well as discharge or water and waste streams back into the GoM. Water would be withdrawn from the GoM to support the jockey water pump, the firewater pump, the potable water system, the sewage treatment system, and the utility water hoses. The firewater pumps would be tested for both withdrawal and discharge activities for 30 minutes each week and 12 hours per quarter. The jockey water pumps would supply water for the sewage treatment system and the potable water system. The jockey water pumps and firewater pumps would withdraw seawater from 50 feet below the water surface according to industry standards. The water intakes would include mesh screens, or strainers, to minimize impacts on aquatic species due to entrainment. Additional information can be found in Section 3.5, Wildlife and Aquatic Resources. A summary of the withdrawal rates from the SPOT DWP is detailed in Table 2.2-13.

Table 2.2-13: Summary of Seawater Withdrawal Requirements for the SPOT DWP

Equipment	Location	Maximum Rate	Estimated Rate Over Time	Treatment	Water Depth of Withdrawal
Jockey Water Pumps (two total)	Risers below pumps at northwest and southwest legs	20 gpm each	28,800 gpd 21,024,000 gpy	Biocide	-50 feet
Firewater Pumps (two total)	Risers below pumps at northeast and southeast legs	4,000 gpm each	17,760,000 gpy each 1,480,000 g/m each	Biocide, run only 30 minutes per week for testing or fire emergency plus 12 hours per quarter	-50 feet
Estimated Total Annual Withdrawal Rate			56,544,000 gpy		

Source: SPOT 2019a, Application, Volume IIa, Section 1; SPOT 2019oo

DWP =deepwater port; g/m = gallons per month; gpd = gallons per day; gpm = gallons per minute; gpy = gallons per year; m^3/hr = cubic meters per hour; SPOT = Sea Port Oil Terminal

In addition, the VLCCs or other crude oil carriers would discharge ballast water and would withdraw cooling water for equipment that would run during the loading process (e.g., generators). VLCCs or other crude oil carriers would exchange up to 1.6 million gallons of ballast water per hour for the duration of the 24-hour loading period, totaling approximately 38 million gallons per ship while moored at the SPOT DWP. VLCCs and other crude oil carriers would also require cooling water exchange while moored at the SPOT DWP. At a surface water temperature of 72 °F, one VLCC or other crude oil carrier moored for a single loading event would require 400,000 to 530,000 gallons of cooling water per hour.

Sources of discharge would be from the sanitary sewer system, the potable water system, the firewater system, excess water from the jockey water pump, the open drain sump, and utility water. Water and waste streams from these systems would be discharged through pipelines extending down the platform from the necessary deck to approximately 15 feet below the water surface. These wastewater streams would be treated to comply with the SPOT DWP's NPDES permit, which would be issued by the USEPA. A summary of discharges is included in Table 2.2-14. The locations of the various discharges on the SPOT DWP are illustrated in Appendix K, Facility Layout 3-D Illustrations, as Items #D1 through D7 and #S1 through #S4.

The open drain system, as described in Section 2.2.2.2, SPOT Deepwater Port Platform, would capture rainwater, process the rainwater to remove hydrocarbons from the decks which may mingle with the rainwater, and return oil via a collection system back for processing. Oil-free, or clean, rainwater would be discharged overboard at a maximum estimated rate of 175,560 gpd.

Table 2.2-14: Summary of Discharges from the SPOT DWP Platform

Equipment	Location	Maximum Rate	Estimated Rate Over Time	Treatment	Water Depth of Discharge
Main deck open drainage	Deck drainage	175,560 gpd	64,079,400 gpy	Capture and separate oil/grease in sump for transfer to closed drain system	-15 feet
Jockey Water Pumps (two total)	Overboard discharge lines from cellar deck northwest and southwest legs	14,400 gpd each	21,024,000 gpy	Biocide, then discharge overboard	-15 feet
Water Maker	Overboard discharge line from cellar deck south end	7,218 gpd	2,634,570 gpy	Hyperfilter reject water, discharge overboard	-15 feet
Sewage Treatment System	Overboard discharge line from cellar deck south end	4,386 gpd	1,600,890 gpy	Filter, break up solids, capture solids, chlorinate, then discharge overboard	-15 feet
Open Drain Sump	Overboard disposal line from cellar deck near northwest leg	1,464 gpm	64,079,400 gpy	Flotation separation of any captured grease/oils, pump oils back into hydrocarbon process, discharge water overboard	-15 feet
Firewater Pumps (two total)	Risers below pumps at northwest and southeast legs	2,000 gpm each	35,520,000 gpy 2,960,000 g/m	Biocide, run 30 minutes per week for testing plus 12 hours per quarter	-15 feet
Utility Water	From jockey water pump supply header to deck users and into sump	1,440 gpd	525,600 gpy	Filter and biocide	-15 feet
Estimated Total Annual Discharge Rate			189,463,860 gpy		

Source: SPOT 2019a, Application, Volume IIa, Section 1; SPOT 2019oo

DWP =deepwater port; g/m = gallons per month; gpd = gallons per day; gpm = gallons per minute; gpy = gallons per year; SPOT = Sea Port Oil Terminal

2.2.8.3. Communications and Navigational Aids

The SPOT Project would establish a communication system capable of maintaining communication between the onshore facilities, the SPOT DWP platform, appropriate agencies, such as the USCG, service vessels, helicopters, and VLCCs or other crude oil carriers. The system would include satellite communications, which would require a small aperture terminal at the platform, a broadband satellite connection, and a teleport onshore, which would link up ground-based and satellite communications. Communication between the platform and vessels approaching the DWP would be conducted using marine very high frequency (VHF) radio, and would established when the vessel is 20 nautical miles from the safety zone on the International Calling Frequency. At that point, the Vessel Traffic Controller would assign a working frequency with that particular vessel. The safety zone is described in Section 2.2.8.5, Anchorage Areas, Safety Zones, and Limited Access Areas for the SPOT Deepwater Port. Communication with the onshore facilities or vessels outside marine VHF range would be conducted using telephone or internet. In addition, the SPOT DWP would include a radar system to detect aircraft or marine vessels in the vicinity of the DWP. The antenna for the radar system would be installed on top of the living quarters, and the signal processor and computer would be housed in the communications room. A dedicated radar monitor would be located in the dispatcher room.

A number of audio and visual navigational aids would be installed by the Applicant to provide warnings to vessel traffic in the vicinity of the SPOT DWP and SPM buoys. Navigational aids for the SPOT Project would adhere to 33 CFR Part 149, Subpart E, Aids to Navigation. The Applicant would install four lighted yellow navigation buoys at the four corners of Galveston Area lease block 463, which would flash in unison at night. These buoys would be solar-powered and have battery backup and Global Positioning System-linked lanterns. Within Galveston Area lease block 463, the SPOT DWP platform and the SPM buoys would display the name of the DWP and the name or number of the structure as prescribed in 33 CFR § 149.570. The DWP would include marine lanterns at each of the four corners on the cellar deck at approximately 68 feet above the water surface. These lanterns would be white and flash in unison between sunset and sunrise. In addition to marine lanterns, the platform would have a radar beacon and a sound signal, which would both warn vessels during times of low visibility. The platform would also display a rotating beacon from the top of the communications tower on the main deck at approximately 150 feet above the water surface. This rotating beacon would distinguish the platform from other offshore structures nearby. Each SPM buoy would include navigation obstruction lights. The floating hoses would have yellow flashing lights, which would be visible for at least 2 miles on a clear, dark night. The floating hoses would have ten lights evenly spaced every 90 feet. The end of the tail hose section would have two red flashing lights at the end of each hose string that would also be visible for 2 miles. Any additional objects on the water surface or breaking the water surface would be marked with reflective tape.

While VLCCs or other crude oil carriers are moored to the SPOT SPM buoys, each vessel would display a rotating beacon in accordance with the IMO's 1972 Convention on the International Regulations for Preventing Collisions at Sea, Part D. Once the vessels are disconnected from the SPM buoys, the vessels would display standard lights required for a vessel in transit.

Navigational aids for the offshore facilities would be reviewed and approved by the USCG and would be powered by an independent system. The system would have battery backup, allowing for 4 days of operation without direct power.

2.2.8.4. Very Large Crude Carriers and Other Crude Oil Carriers

VLCCs and other crude oil carriers from the worldwide fleet, such as Suezmax and Aframax vessels, would call on the SPOT DWP. Up to 365 vessels are anticipated to moor at the SPOT DWP for crude oil loading per year. The vessels would navigate to the assigned SPM buoy, then moor to the buoy using two mooring hawsers. It is anticipated two tugboats would assist each vessel in mooring: one tugboat would be responsible for mooring and the other tugboat would be responsible for managing the floating crude oil and vapor recovery hoses during the mooring process. Tugboat personnel would secure the VLCC's or other crude oil carrier's messenger line to a pick-up line, which would allow the mooring hawser chafe chains to be winched onboard the vessel and secured to the shipboard mooring fittings. Mooring would be conducted only within the criteria listed in Table 2.2-15 to provide for safe operation and prevent incidents.

Table 2.2-15: Weather Criteria for Mooring of Vessels at the SPOT DWP

Criteria	Operational Limit
Wind Speed	< 28 knots
Wave Height	< 9.9 feet
Wave Period	< 8.7 seconds
Current Speed	< 1.51 feet per second
Visibility	at Mooring/Loading Master's discretion

Source: SPOT 2019a, Application, Volume IIa, Section 1

Once the VLCC or other crude oil carrier is moored at the SPM buoy, the floating crude oil hoses and vapor recovery hoses would be connected to the vessel. The vessel would have a working platform from which to conduct connecting activities, which would have a grated floor and sit on a drip tray with a 50-barrel capacity, per Oil Companies International Marine Forum guidelines. The drip tray would have drain plugs and outlets with valves to drain to a cargo tank or slop tank onboard the vessel, if necessary. The floating hoses would be connected and disconnected on the working platform. The floating crude oil hose would have a manual butterfly valve and a blank flange at the end. Prior to connection or disconnection, the piping between these two valves would be drained. As such, connection and disconnection would not result in any substantial spill of product, but rather a small release of residual oil, which would be collected by the drip pan under the working platform. Any remaining oil on the working platform or floating hose would be cleaned by the vessel crew prior to releasing the floating hose back to the water surface.

2.2.8.5. Anchorage Areas, Safety Zones, and Limited Access Areas for the SPOT Deepwater Port

The Applicant proposes to include an anchorage area in Galveston Area lease block A-59 adjacent to the southeast corner of Galveston Area lease block 463, which would contain the SPOT DWP and SPM buoys. The anchorage area would be 3 square miles and would not contain any Project infrastructure. White lighted buoys would be placed at the northeast, southeast, and southwest corners of the anchorage area. The northwest corner would be marked with a lighted yellow buoy, as described in Section 2.2.8.2, Offshore Facilities, as it is the southeast corner of the lease block containing the SPOT DWP.

Limited access areas, such as safety zones, areas to be avoided (ATBAs), and no-anchor areas (NAAs) are established with varying degrees of vessel restrictions and notification requirements. Pursuant to the regulations of the DWPA, the USCG is authorized to establish mandatory safety zones around the DWP. The safety zone around the SPOT DWP platform would have a radius of 500 meters (1,640 feet) extending out from the centroid of the platform. Based on current regulatory practice, the safety zone for each SPM buoy would likely extend 500 meters (1,640 feet) from the buoy itself (see Figure 2.2-9). In addition to the safety zone, an ATBA could be established at the request of the USCG (on behalf of the U.S. Department of State) to the IMO. Other DWPs have requested that the ATBA be a single, contiguous area; in the case of SPOT, the ATBA could be an area that extends up to 500 meters (1,640 feet) beyond the safety zones for the platform and SPM buoys, as depicted on Figure 2.2-9. As part of the request for ATBA establishment, the USCG would also request that the ATBA be designated an NAA. As shown on Figure 2.2-9, the USCG would also establish safety zones for the support vessel mooring areas. Based on the size of typical oil tanker and DWP support vessels, and the Applicant's proposed mooring design, the safety zone for each support vessel mooring would likely extend 250 meters (820 feet) from the mooring buoy.

The design and layout of the SPOT DWP, including its proposed safety zone and placement of the SPM buoys meets the requirements of 33 CFR § 150.910 and 33 CFR § 148.5. Per 33 CFR § 148.5, new DWP safety zones are limited to 500 meters around the facility. In addition to the protections established by this safety zone, additional operational risk mitigation measures were identified as part of the Risk Analysis for the SPOT DWP. These mitigations include, but are not limited to:

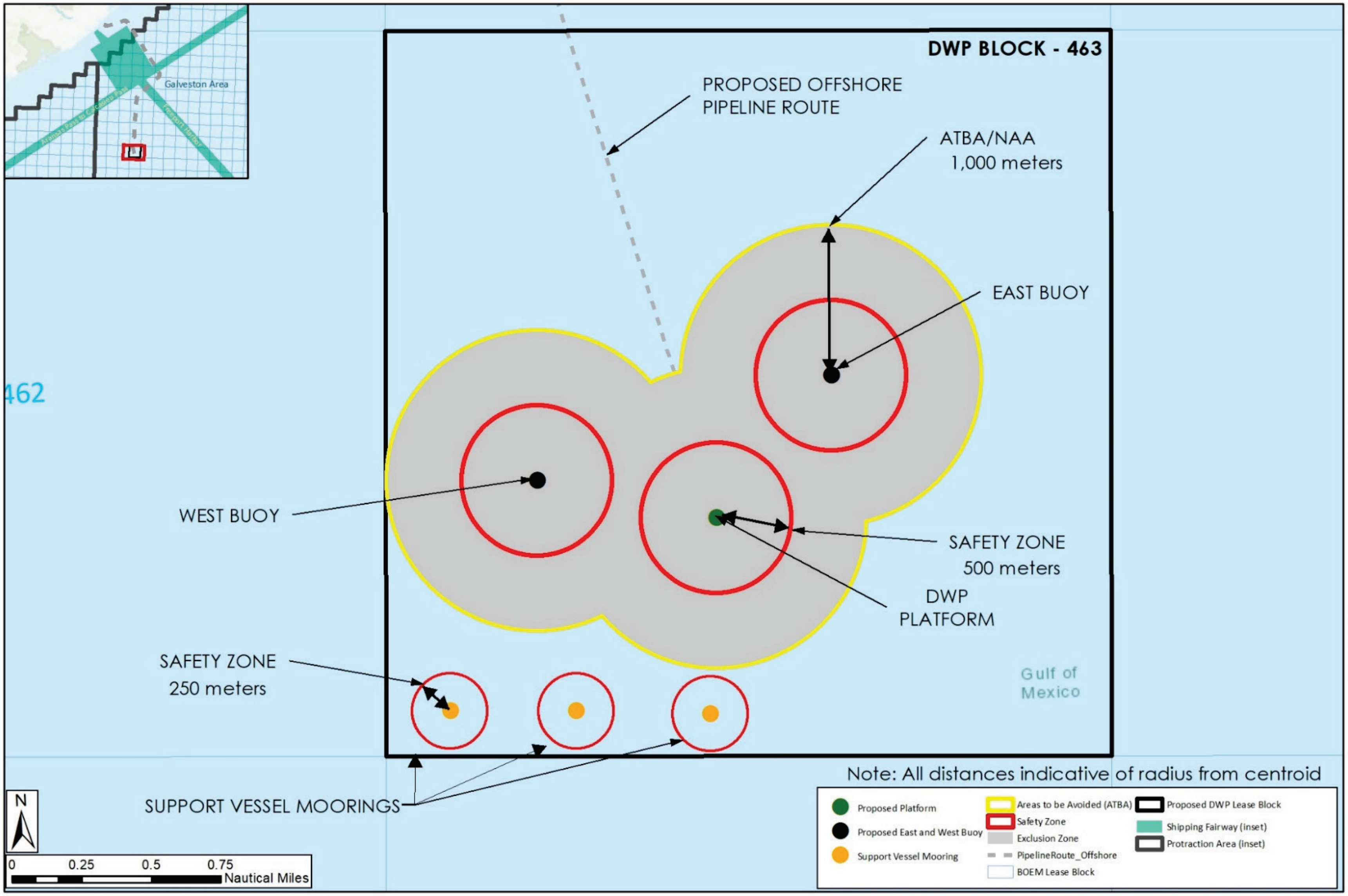
- Vessel traffic controls;
- Operational weather restrictions;
- Collision/allusion avoidance systems;
- Weather forecasting and monitoring technologies; and
- Platform impact protections.

The safe and secure operation of any DWP is a result of the layered implementation of numerous risk mitigation measures. The mitigation measures identified during the risk assessments are incorporated into the OPSMAN. In accordance with 33 CFR Part 150, the proposed DWP cannot operate without prior USCG approval of the OPSMAN. As discussed in Section 4.5.7 Port Security, the OPSMAN must provide detailed specifications and procedures for all aspects of DWP operation to include prevention and mitigation strategies for both accidental and intentional spill release scenarios. Furthermore, the final sizes, locations, and designation of proposed safety zones require both a regulatory amendment and official notification to the IMO in accordance with 33 CFR § 150.915.

In accordance with 33 CFR § 148.105(x), the Applicant submitted a draft Operations Manual as part of their DWP license application and the USCG is satisfied that it meets the regulatory requirements of 33 CFR Subchapter NN. The USCG issues final approval of a DWP Operations Manual only after supporting federal and state agencies provide substantive input in ensuring the OPSMAN addresses the requirements for safe operation in accordance with (1) all Federal regulatory requirements; and (2) the conditions of the DWP license issued by MARAD.

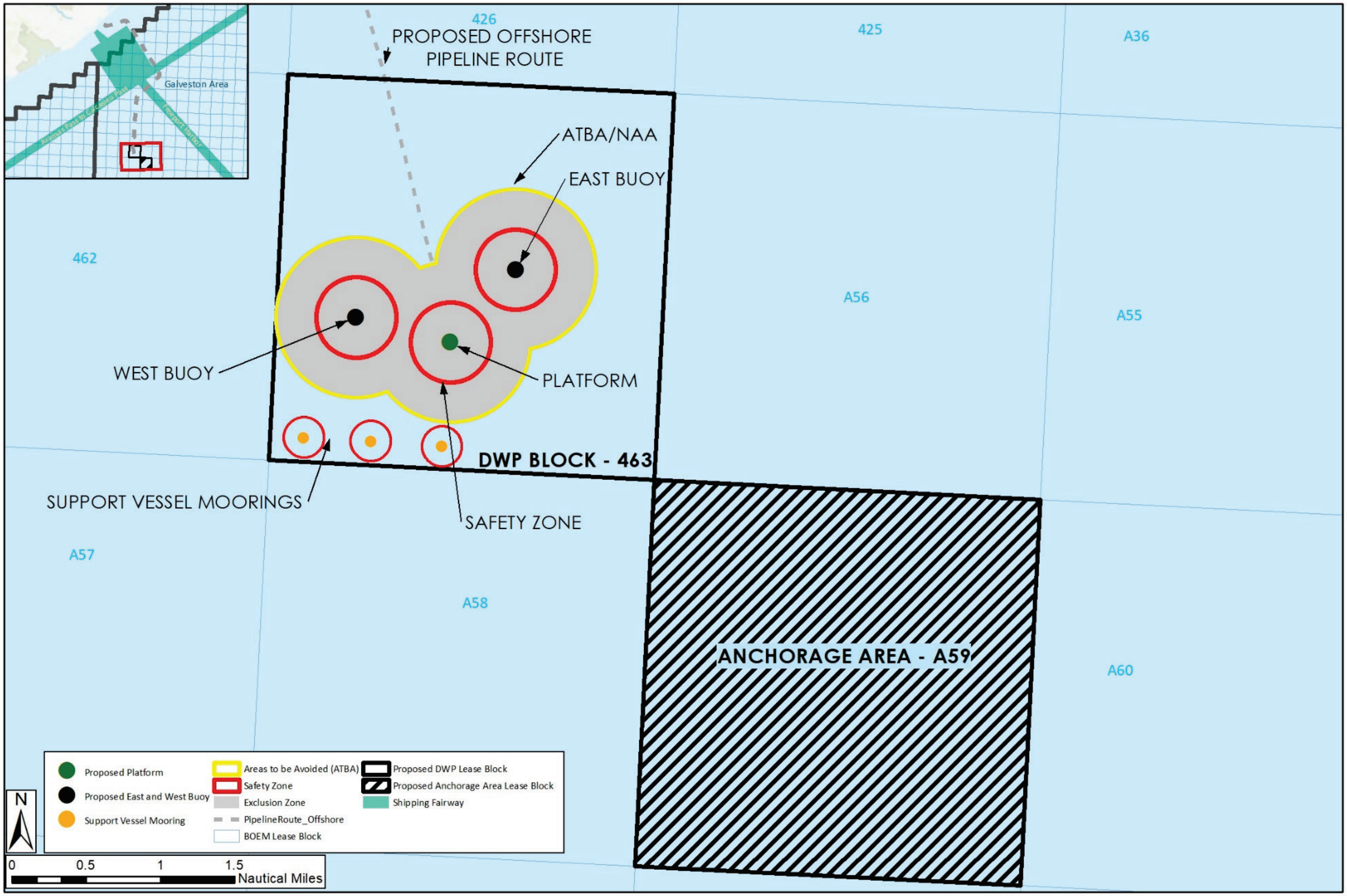
The safety zone would only be open to entry for VLCCs or other crude oil carriers prepared for connection for loading of crude oil, and the necessary service vessels supporting that process. As described above, the VLCCs or other crude oil carriers would establish communications with the SPOT DWP when the vessel is 20 nautical miles from the safety zone. Activities within the safety zone would be regulated by the USCG (33 CFR § 150.905(b)); however, it would be the Applicant's responsibility to ensure the safety and security of the SPOT DWP, personnel, vessels, and the environment. The USCG, as well as other state and local law enforcement and emergency response organizations, would provide assistance in the event of a credible security threat to the SPOT DWP. Figure 2.2-10 illustrates the configuration of the anchorage area in relation to the DWP and other facilities, as well as the safety zones and ATBA/NAA.

The actual size of the ATBAs/NAAs that would be requested of the IMO would be determined through the advice and consent of the USCG. The ATBAs/NAAs would appear on publicly available nautical charts. The intent of the NAAs would be to prevent damage to the SPOT DWP and mooring system or damage to the proposed SPOT DWP's equipment from entanglement. The intent of the ATBAs is to discourage vessel traffic, and to help prevent other vessels not associated with the SPOT Project from interfering with the SPOT DWP's operations, including the maneuvering of the VLCCs or other crude oil carriers and service vessels. The Applicant's ATBA/NAA designation would likely apply to bottom trawling and other seafloor-disturbing activities associated with oil and gas or other mineral extraction, and fishing or mineral exploration vessels and associated equipment for the mutual protection of the SPOT DWP and non-Project vessels and equipment.



ATBA = area to be avoided; DWP = deepwater port

Figure 2.2-9: Safety Zones and Limited Access Areas for the SPOT Deepwater Port



ATBA = area to be avoided; DWP = deepwater port

Figure 2.2-10: Anchorage Area

2.2.9. Decommissioning

Decommissioning of the SPOT Project would be performed when necessary or at the end of the useful life of the Project. The anticipated life of the Project is 30 years. This EIS has analyzed impacts for the anticipated life of the Project. If the SPOT DWP were to remain active beyond 30 years, another NEPA review could be required. The onshore terminals and pipelines would likely be repurposed or maintained for continued use, and decommissioning of the onshore facilities may not occur for some period of time longer than the 30-year lifespan of the proposed SPOT DWP. At the time of abandonment or removal, the Applicant would decommission the onshore facilities in accordance with applicable rules and regulations in place at that time.

Vessels and barges would be mobilized to remove offshore components of the SPOT Project, which would be transported for disposal or recycling, or relocated to a Rigs-to-Reefs location. The Applicant would prepare a decommissioning plan prior to conducting decommissioning activities. The main activities that would compose decommissioning of the SPOT Project include:

- Removing navigational buoys and ancillary equipment;
- Disconnecting the floating crude oil loading and vapor recovery pipelines;
- Removing SPM buoys and ancillary equipment, including the underbuoy crude oil and vapor recovery lines;
- Removing the PLEMs and crude oil and vapor recovery lines connecting to the platform and connecting to the subsea pipelines;
- Abandoning the subsea crude oil pipelines in place; and
- Removing the platform.

The Applicant would remove all lighted buoys, their chains, and their anchor blocks for transport onshore for disposal. The floating crude oil and vapor recovery hoses and underbuoy crude oil and vapor recovery lines would be flushed with seawater from the open end to the PLEMs. The floating hoses would be disconnected from the SPM buoys, capped by divers, and transported to shore for disposal. The underbuoy lines and SPM buoy anchor chains would be disconnected from the buoys and the fluke anchors. Fluke anchors would also be removed if they are less than 15 feet below the natural bottom elevation. If the fluke anchors are more than 15 feet below the natural bottom elevation, they would be left in place. The buoys, chains, and anchors would be transported to shore for disposal. The crude oil loading and vapor recovery pipelines between the platform and the PLEMs would be flushed from the platform to the PLEMs and back again using the pigging system. Any crude oil would be pushed into the subsea pipelines to shore. Following removal of the crude oil, flushing water and chemicals would be run through the lines. The discharge water would be separated until no hydrocarbons are identified in the flushing water. All free liquids on the platform, including the discharge water, would be drained from piping and vessels into an industry-approved transport container for transport to shore. The tie-in spools at either end of the lines would be removed and transported to shore for disposal. The pipeline ends would be capped, lowered to 3 feet below the natural bottom elevation, and covered with concrete mattresses. The PLEMs would be removed and transported to shore for disposal. The anchor piles would be cut approximately 15 feet below the natural bottom elevation and the upper pile sections removed for disposal.

To fully decommission the platform, any piping not cleaned via pigging the crude oil pipelines/hoses would be cleaned of hazardous chemicals, diesel, or other materials. Equipment onboard the platform, such as the cranes, would be tied down. Other components of the platform, such as the living quarters, main components of the main deck, and the helideck would be removed with a derrick barge and transported to shore for disposal. Deck legs would be cut at the top of the jacket and each of the decks would be lifted onto a cargo barge for transport to shore and disposal. Jacket piles would be cut from the inside approximately 15 feet below the natural bottom elevation via abrasive cutters, explosives, or water cutters. The piles would be removed and transported to shore for disposal. The jacket would be lifted by a derrick barge and transported to a Rigs-to-Reef location.

The subsea crude oil pipelines from the platform to state-owned submerged lands boundary (9 nautical miles from shore) would be abandoned in place. First, crude oil would be pushed from the platform to the Oyster Creek Terminal using the pigging system, then the lines would be flushed with seawater in a loop until no hydrocarbons are identified in the flushing water. The tie-in spools at the platform end of the pipelines would be removed and transported to shore for disposal. The pipeline ends would then be capped and the lines lowered to 3 feet below the natural bottom elevation, then covered with concrete mattresses.

The portions of subsea pipelines located on state-owned submerged lands and installed via jet trenching, would be removed from the seafloor. After the pipeline is cleaned, a section of pipe near the HDD exit pit would be uncovered, cut, and a 40-foot pipe section would be removed. A plug would be installed in the end of the HDD segment and a concrete mattress would be installed to cover the pipe end. Cross bars would also be installed in the end of the offshore pipe segment. A vessel would then move to Galveston Area Block 463 and locate the pipe end, remove concrete mattresses, remove the blind flange, install a pig launcher, and run a pig with air from the launcher to the north end of the pipe segment near the HDD exit pit. The pipe would then be ready to be pulled through the stringer, onto the pipelay barge, and up the pipelay ramp to the bow of the barge. The pipelay barge would remove the field joint and cut the pipe into 40-foot pieces, backing up to the next segment until about 64,800 feet of pipe is removed. The segments of pipe that remain would be completely filled with seawater, the laydown head would be trenched to a minimum of 3 feet below natural bottom, and a concrete mattress would be placed over the trenched laydown head end. The process would be repeated for both subsea pipelines. All recovered pipe joints would be transported to an onshore facility for disposal.

Where subsea pipelines would be installed on state-owned submerged lands via HDD construction methods, the Applicant would comply with requirements of the GLO's Miscellaneous Easement, which may allow for pipeline segments installed via the HDD method to be abandoned in place, provided they are sufficiently buried to industry standards and pose no threat to human health and safety or to the environment.

The service vessel moorings would be some of the last offshore components to be removed during decommissioning, because they would remain in use during the decommissioning process for vessels performing certain activities. The mooring buoys would each be lifted onto the deck of a vessel and the anchor line disconnected. The anchor blocks would then be removed using a crane and transported to shore for disposal. If necessary, jetting may be used to loosen the anchor blocks from the seafloor.

Following decommissioning of all offshore components, a trawl survey would be conducted to confirm no debris is left behind and the Applicant would submit final reports to appropriate regulatory agencies.

2.2.10. Best Management Practices

The Applicant has committed to implementing BMPs to the extent practicable to minimize environmental and social impacts due to the construction, operation, and decommissioning of the proposed Project (Appendix N, List of Applicant's Best Management Practices and Recommendations and Agency Recommended Mitigation Measures). BMPs are discussed by resource in Chapter 3, Environmental Analysis of the Proposed Action, and are based on Federal and state guidance documents and regulations, as well as standard practices associated with the industry and the proposed Project area. The impact conclusions made in Chapter 3 take these BMPs into account with regard to mitigation and minimization of potential impacts.

Federal and state agencies may provide similar or additional measures as the environmental review for the proposed Project progresses. These measures will be addressed in the Final EIS.

2.3. No Action Alternative

The No Action Alternative refers to the continuation of existing conditions without implementation of the Proposed Action. Inclusion of the No Action Alternative is prescribed by the CEQ's NEPA-implementing regulations (40 CFR § 1502.14) and serves as a benchmark against which Federal actions can be evaluated. Under the No Action Alternative, the infrastructure proposed by the Applicant would not be built or brought online, and the potential beneficial or adverse environmental impacts identified in this EIS would not occur. Furthermore, the purpose of the Proposed Action to transport and export excess and available domestic crude oil supplies to the global market with reduced use of ship-to-ship transfers would not be satisfied under the No Action Alternative. Similarly, if the Secretary were to deny the Applicant's DWPA license application, it is likely that exports of oil that are already occurring due to international global demand and domestic excess production would continue to use shoreside terminals in combination with offshore ship-to-ship transfers. As current excess production exceeds the capacity of existing shoreside terminals, a denial of a DWP license could result in expansion or establishment of onshore oil terminals in other locations along the Gulf Coast. Other license applications concerning proposals to export crude oil might be submitted to the Secretary, or other means might be used to export oil, such as expansion or establishment of onshore oil terminals that would require construction of onshore export facilities, including storage tanks, and pumping facilities. The environmental impacts of expanding or building new shoreside facilities would likely have greater temporary construction impacts to coastal and onshore resources and substantially less offshore construction impacts than the proposed Project, but similar offshore operational impacts as lightering would likely still be required. Section 5.3.6, Potential Cumulative Impacts by Resource Area, Transportation, includes a summary of ship-to-ship transfer vessel trips that would be avoided if the currently proposed DWPs, including the SPOT Project, become operational.

Furthermore, under the No Action Alternative the inability to fully load VLCCs and other crude oil carriers at onshore U.S. ports along the Gulf Coast would continue. Because all onshore U.S. ports along the Gulf Coast are located in inland harbors, these channels and rivers must be regularly dredged to maintain depth and enable safe navigation for most ships, as they are not deep enough for deep-draft vessels, such as fully loaded VLCCs (EIA 2018b). Currently, most VLCCs are partially loaded onshore, completely loaded via ship-to-ship transfers offshore, or loaded using a combination of both. Thus, under the No Action Alternative the purpose of the Proposed Action to fully load VLCCs offshore and minimize the need for ship-to-ship transfers when exporting domestic crude oil would not be satisfied. Section 1.3, Purpose and Need, includes a description of the Project's purpose and need, which provides additional information regarding the Applicant's proposal to fully load VLCCs offshore.

Section 1.3, Purpose and Need, also includes a description of the Project's purpose and need in regard to oil production in the United States. The EIA acknowledged that reduced economic activity associated with COVID-19 caused short-term changes in energy supply and demand patterns. The EIA states that U.S. crude oil production is expected to return to pre-pandemic levels by 2025, reaching 13.2 million bpd by 2025 and remaining at or above that level through 2048 (EIA 2021). While a portion of the crude oil produced by the United States is refined domestically for domestic use, the existing refineries in the United States are not anticipated to be able to handle the amount of crude oil projected to be produced in the United States through 2050. This, in conjunction with lifting the ban on crude oil exports in December 2015, has resulted in a more active crude oil export market (IPAA 2015; EIA 2017; EIA 2019a). The global market demand for oil is also anticipated to result in the need for projects similar to the Proposed Action. These projects would need to meet regulatory and development requirements for the area in which they are proposed and would, therefore, include evaluation for environmental impacts, associated permitting timelines, and mitigation costs. Other facilities that could meet the purpose and need of the Proposed Action would likely result in similar, greater, or lesser impacts than the Proposed Action, and are therefore not considered further in this EIS.

2.4. System Alternatives

Under the analysis of system alternatives, MARAD and the USCG evaluated the ability of other existing, planned, or proposed[7] (new or expanded) facilities to meet the objectives of the proposed SPOT Project (Proposed Action). This EIS reviews system alternatives throughout the United States, but focuses on the Gulf Coast region, to evaluate the ability of other existing, planned, or proposed facilities to meet the stated purpose and need of the Proposed Action. Moreover, system alternatives were evaluated to determine if they would have a substantial environmental advantage over the Proposed Action and would be technically feasible.

The status of system alternatives (e.g., planned, proposed, or approved) is current as of the development of this EIS, and is subject to change over time. By definition, implementation of a system alternative would make construction of the Proposed Action facilities unnecessary. A system alternative could include infrastructure additions or other modifications to existing or proposed facilities to adjust capacity

[7] Proposed projects are projects for which the USCG/MARAD have deemed the application complete and issued a Notice of Application or the proponent has submitted a formal application to another Federal agency; planned projects are projects that have been announced, but have not formally filed an application with a jurisdictional agency; approved or existing projects are projects that have received Federal authorization.

to provide receipt, transport, or export capabilities consistent with that of the Proposed Action. Such modifications may result in environmental impacts that are less than, comparable to, or greater than those associated with construction and operation of the Proposed Action. A reasonable range of system alternatives to the Proposed Action includes those alternatives that would make use of other existing or proposed systems, with or without modifications, to meet the stated purpose and objectives of the Proposed Action.

The Applicant proposes to export crude oil grades ranging from ultralight, to light, to heavy from existing and proposed onshore oil infrastructure on the Texas Gulf Coast. The primary objectives of the Proposed Action are to access crude oil supplies from excess production capability from multiple crude oil basins, and to fully load up to 365 VLCCs and other crude oil carriers offshore annually for export and delivery to global markets.

As part of the review of system alternatives, MARAD and the USCG conducted a detailed review of projects and facilities over which either agency has or would have jurisdiction (i.e., DWPs).[8] The CEQ requires that a reasonable range of alternatives be analyzed, even those alternatives, if deemed reasonable, that are outside the capability of the Applicant or jurisdiction of the agency. Therefore, MARAD and the USCG also considered other projects and systems with publicly available information that each believes are relevant to the NEPA review of the Proposed Action. This analysis was predicated on the assumption that each planned, proposed, or approved existing project has an equal chance of being constructed or modified and would, therefore, be available as a potential system alternative. However, assuming each project would be authorized, market demand will ultimately influence which and how many of these facilities are constructed and operated.

The Proposed Action is an export project and, as such, any alternatives considered must have the ability to export crude oil. Furthermore, crude oil sources from excess production capability, at the time of this EIS, are primarily located in the Permian Basin in west Texas and the Eagle Ford Basin in south Texas. Thus, this analysis focuses on new, existing, and proposed infrastructure capable of delivering and storing crude oil from these basins, ideally located along the Gulf Coast. Proximity to these basins was then refined to the Texas Gulf Coast, noting that the northern Texas Gulf Coast provides the most existing infrastructure (i.e., crude oil terminals and crude oil transmission pipelines) in this region (see Figure 2.4-1).

2.4.1. Expansion of Proposed or Existing Offshore Crude Oil Loading Terminals in the Gulf of Mexico

One existing and three proposed projects in the GoM were identified for evaluation as expansion system alternatives. The location of these system alternatives in relation to the proposed SPOT Project is depicted in Figure 2.4-1 and discussed below.

The Louisiana Offshore Oil Port (LOOP) is a joint venture of Marathon Pipe Line LLC, Shell Oil Company, and Valero Terminaling and Distribution Company. It is currently the only operating facility in the United States that is able to transport crude oil, import and export oil, and fully load VLCCs. It is

[8] This includes the amended 2012 CGMTA in Section 3(9)(A) of the DWPA, which granted MARAD the authority to license the construction of DWPs for the export of oil and natural gas from domestic sources within the United States to foreign global markets.

located approximately 18 nautical miles off the coast of Louisiana and is generally 210 nautical miles from the Texas Gulf Coast south of Beaumont, Texas. It includes an onshore storage facility, underground storage caverns, and approximately 53 miles of onshore and offshore pipeline to transport crude oil to the DWP. LOOP is designed with a fixed offshore platform and three SPM loading buoys. In 2019, LOOP scheduled the loading of six VLCCs within 1 month or less (Eaton 2019). As such, LOOP can load at least at least 72 VLCCs per year. Based on global market demand and the purpose and need of the Proposed Action to load up to 365 VLCCs or other crude oil carriers per year, it is unlikely LOOP could meet the demand of the Proposed Action without substantial facility additions and modifications, such as adding pipelines, SPM buoys, and crude oil loading hoses to load additional vessels. Furthermore, if existing subsea pipelines connected to LOOP do not have capacity for additional oil, new pipeline(s) would need to be built, either onshore or offshore or both ranging from approximately 20 miles (from the closest existing petroleum product terminal in Louisiana to LOOP) to approximately 250 miles (from the closest existing petroleum product terminal in Texas to LOOP). The general location of these facilities is depicted in Figure 2.4-1. As such, installation of new onshore and/or subsea pipelines alone could result in similar or greater adverse environmental impacts as compared to the Proposed Action.

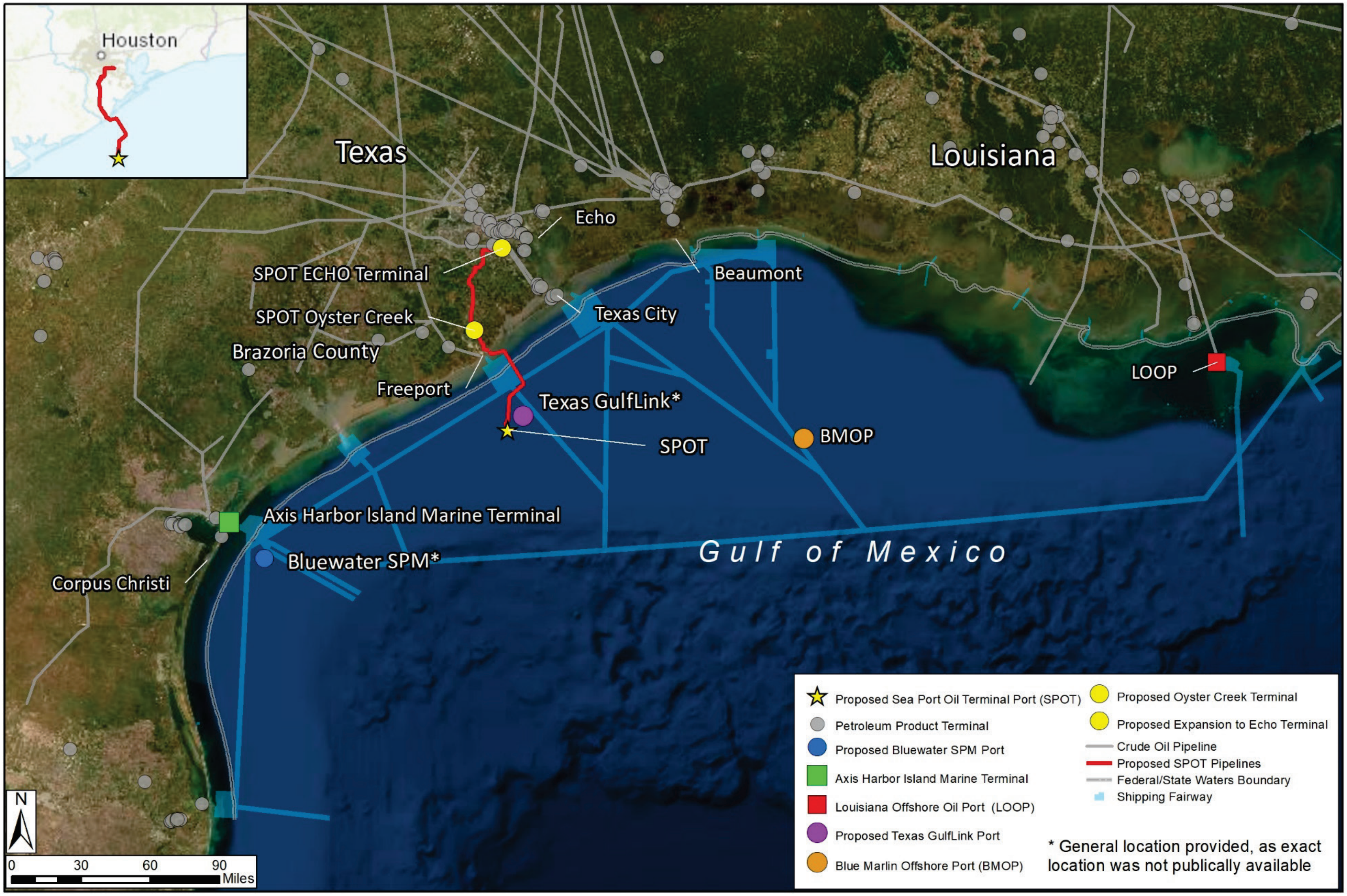


Figure 2.4-1: System Alternatives Considered in this EIS

Bluewater Texas Terminal LLC is proposing the Bluewater SPM Project that is under review by MARAD and the USCG (DWP application filed May 30, 2019 under docket number MARAD-2019-0094) for a crude oil export DWP in the GoM approximately 15 nautical miles off the coast of San Patricio County, Texas. It includes a booster station and 29.4 miles of onshore and inshore pipeline and 27.1 miles of offshore pipeline to transport crude oil to the proposed DWP. As proposed, the project would load up to 192 VLCCs per year from two SPM loading buoys (i.e., an offshore platform is not proposed). The proposed export volume for the Bluewater SPM Project would not meet the volume that would be exported by the Proposed Action without substantial design modifications and facility additions such as a platform, SPM buoys, and crude oil loading hoses to load additional vessels.

Texas GulfLink Holdings, a subsidiary of Sentinel Midstream LLC, is proposing the Texas GulfLink Project (Texas GulfLink) that is under review by MARAD and the USCG (DWP application filed May 30, 2019 under docket number MARAD-2019-0093) for a crude oil export DWP in the GoM approximately 26.6 nautical miles off the coast of Brazoria County, Texas (and approximately 7 nautical miles east of the SPOT Project). Texas GulfLink includes a new storage terminal, and 21.9 miles of onshore and inshore pipeline and 32.6 miles of offshore pipeline to transport crude oil to the proposed DWP. As proposed, the Texas GulfLink would load up to 180 VLCCs per year via a DWP with a fixed offshore platform and two SPM loading buoys. Although Texas GulfLink is located in a similar area as the Proposed Action, Texas GulfLink's proposed export volume would not meet the volume that would be exported by the Proposed Action without substantial design modifications and facility additions, such as SPM buoys and crude oil loading hoses to load additional vessels.

Blue Marlin Offshore Port, LLC, which is a subsidiary of Energy Transfer Partners, is proposing the Blue Marlin Offshore Port (BMOP) project (DWP application filed September 30, 2020, under docket number MARAD-2020-0127) for a crude oil export DWP in the GoM approximately 86 nautical miles off the coast of Cameron Parish, Louisiana. It includes about 37 miles of new onshore pipeline, a new pump station, conversion of two existing stations onshore in Cameron Parish, Louisiana, conversion of about 4 miles of existing onshore pipeline, conversion of about 99 miles of existing offshore pipeline, conversion of several existing platforms to make up the DWP, and two new catenary anchor leg mooring buoys for loading VLCCs. As proposed, the project would load up to 365 VLCCs or other crude oil carriers per year via a DWP with a fixed offshore platform and two catenary anchor leg mooring loading buoys. The BMOP project's proposed export volume would not meet the volume that would be exported by the Proposed Action without substantial design modifications and facility additions, such as loading buoys, and onshore and offshore pipelines to connect the existing ECHO Terminal with the BMOP project.

As discussed in Chapter 1, Introduction, the EIA has stated that U.S. crude oil production is expected to return to pre-pandemic levels by 2025, reaching 13.2 million bpd by 2025 and remaining at or above that level through 2048 (EIA 2021). Based on the purpose and need of the Proposed Action to load 365 VLCCs (2 million bpd each) or other crude oil carriers per year and the known export volumes of the one existing and three proposed projects in the GoM, substantial expansion would be required of any existing or new offshore crude oil loading terminal similar to the proposed and existing facilities discussed in Section 2.2, Detailed Description of the Proposed Action. As such, these projects would need to meet regulatory and development requirements for the area in which they are operating or proposed and would, therefore, include evaluation for environmental impacts, associated permitting timelines, and mitigation costs. These projects would result in similar or greater impacts than the Proposed Action and are therefore are not considered further in this EIS.

2.4.2. Construction of New or Expansion of Existing Onshore Crude Oil Terminals on the Gulf Coast

One proposed onshore terminal along the GoM was identified for evaluation that would be capable of fully loading VLCCs. The general locations of this proposed project in relation to the proposed SPOT Project is depicted in Figure 2.4-1.

Axis Midstream Holdings LLC is proposing to build a series of facilities including two ship berths to store, transport, and load crude oil into ships for export at a terminal on Harbor Island long the Texas Gulf Coast near Corpus Christi (Axis Harbor Island Marine Terminal). Ship berths would be about 730 feet by 1,164 feet in size and would accommodate two Suezmax-sized vessels (Parker 2019). Suezmax-sized vessels are smaller in capacity (200,000 maximum deadweight tons) compared to VLCCs (320,000 maximum deadweight tons) (Maritime Connector 2019). As such, two Suezmax vessels would be required to carry the same amount of crude oil as a single VLCC (EIA 2018b). The proposed Axis Harbor Island Marine Terminal would be under the jurisdiction of the USACE, Railroad Commission of Texas, and TCEQ, along with other Federal and state agencies. According to the July 7, 2020, USACE public notice, the project would include: a tank farm, a staging facility adjacent to the Gulf Intracoastal Waterway west of Aransas Pass, two 36-inch crude oil pipelines, and two 42-inch crude oil pipelines (USACE 2020). Dredge material from the proposed berths would need to be placed on site for shoreline restoration and/or in one of the identified and placement areas approval from the USACE and Railroad Commission of Texas. This project would also require maintenance dredging. Compared to the Proposed Action, which does not propose any dredging activities, the amount of dredging required is substantial and would result in additional environmental impacts. Additionally, the proposed Axis Harbor Island Marine Terminal would not meet the purpose and need of the Proposed Project to fully load VLCCs; thus, it would also not meet the volume demand of the Proposed Action without substantial project design modifications, such as more channel dredging and berth redesigns.

Although only one new onshore crude terminal along the Gulf Coast was assessed in this EIS, any existing or proposed terminals would not be capable of fully loading VLCCs without substantial dredging activities, as onshore U.S. terminals that actively trade petroleum are located in inland harbors (EIA 2018a; EIA 2018b; Spector 2018). These channels and rivers along the Gulf Coast are typically between 40 and 50 feet deep in the center of the channel; thus, channels would need to be dredged to at least 75 feet to accommodate fully loaded VLCCs (EIA 2018b). For this reason, construction of new or expansion of existing onshore crude terminals as a system alternative would not meet the purpose and need of the Proposed Action and is not considered further in this EIS.

2.5. Alternative Onshore Pipeline Routes

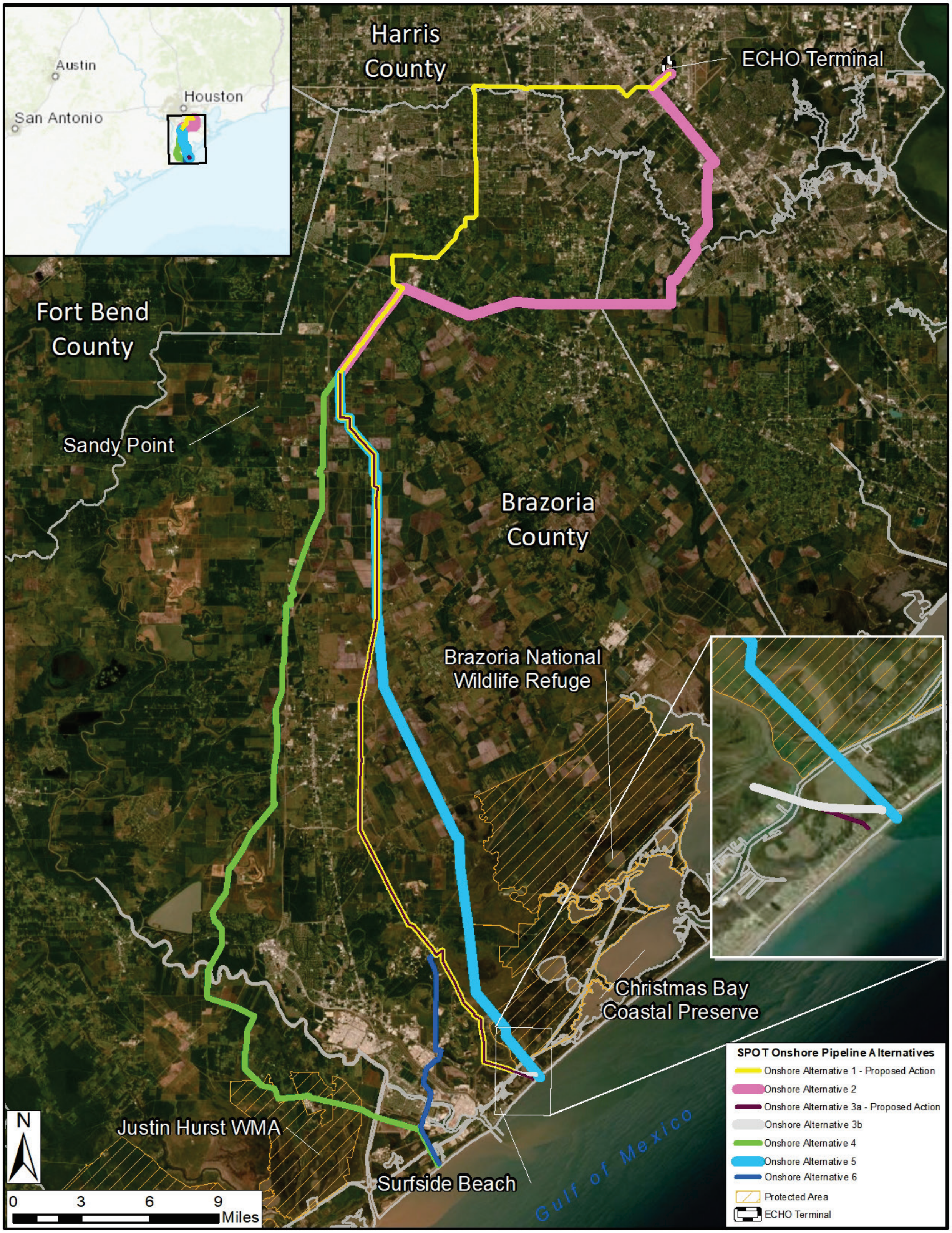
Alternative routes were identified from the existing ECHO Terminal in Harris County to the shoreline of the GoM in Brazoria County. Existing linear rights-of-way with which the Proposed Action could be collocated to minimize effects were reviewed between the existing ECHO Terminal and the shoreline of the GoM. The locations of route alternatives evaluated are depicted on Figure 2.5-1 and discussed below.

Southern Harris County, where the existing ECHO Terminal is located, and Brazoria County north of SH 6 are densely populated with residential and industrial/commercial areas. As a result, this area was reviewed independently from the pipeline route between the area near Sandy Point south of SH 6 and the shoreline. Within Harris County and northern Brazoria County, existing linear rights-of-way were identified with which the proposed onshore pipeline route could be collocated to minimize impacts. Two alternatives were identified for this portion of the pipeline route:

- Onshore Pipeline Alternative 1 from the ECHO Terminal to Sandy Point; and
- Onshore Pipeline Alternative 2 from the ECHO Terminal to Sandy Point

From the terminus of Onshore Pipeline Alternatives 1 and 2, areas within Brazoria County were identified for route alternatives northeast of the city of Sandy Point to the shoreline of the GoM. This included the area west of Christmas Bay Coastal Preserve to avoid impacts on the sensitive estuary, which is one of the most ecologically productive areas in this region of Texas (TPWD 1992). Within this area, existing linear rights-of-way were considered with which the proposed onshore pipeline route could be collocated to minimize impacts. Three major alternatives were identified for this portion of the pipeline route:

- Onshore Pipeline Alternative 3 from Sandy Point to Shore;
- Onshore Pipeline Alternative 4 from Sandy Point to Shore; and
- Onshore Pipeline Alternative 5 from Sandy Point to Shore.



WMA = Wildlife Management Area

Figure 2.5-1: Alternative Onshore Pipeline Routes

2.5.1. Onshore Pipeline Alternative 1 from ECHO Terminal to Sandy Point, Texas (Proposed Action)

Onshore Pipeline Alternative 1 originates at the ECHO Terminal and extends 26.2 miles to a location southwest of the City of Sandy Point. The EPO Rancho II Pipeline right-of-way was identified as a route with which the Project could be collocated (94 percent) through heavily populated and developed areas. Onshore Pipeline Alternative 1 is the Proposed Action for the SPOT Project and is evaluated further in Section 3.17, Evaluation of Alternatives.

2.5.2. Onshore Pipeline Alternative 2 from ECHO Terminal to Sandy Point, Texas

Onshore Pipeline Alternative 2 originates at the ECHO Terminal and extends 29.2 miles to a location southwest of the City of Sandy Point. Approximately 80 percent, or 23.3 miles, of the route are collocated with other linear infrastructure. Onshore Pipeline Alternative 2 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.5.3. Onshore Pipeline Alternative 3 from Sandy Point, Texas to Shore (Proposed Action)

Onshore Pipeline Alternative 3 originates at the terminus of Onshore Pipeline Alternatives 1 or 2 from ECHO Terminal to Sandy Point, Texas and extends approximately 36 miles south to a shore location north of Surfside Beach.

Alternative 3 comprises two minor route alternatives: 3a and 3b. Alternative 3a is the Proposed Action for the SPOT Project and extends to a shore crossing location just north of Surfside Beach and south of the crossing for Alternative 3b. Alternative 3b extends from the Oyster Creek to Shore Pipeline HDD #5 exit pit approximately 1,400 feet northwest of Marlin Avenue in Surfside, Texas, to the shoreline of the GoM north of the crossing of Alternative 3a. Alternative 3b was proposed by a representative of the Village of Surfside to avoid the proposed shore crossing location for the two offshore pipelines.

Approximately 67 percent, or 24.2 miles, of Alternative 3a is collocated with other linear infrastructure. Approximately 69 percent, or 24.3 miles, of Alternative 3b is collocated with other linear infrastructure. Both Onshore Pipeline Alternative 3a and Alternative 3b are evaluated further in Section 3.17, Evaluation of Alternatives.

2.5.4. Onshore Pipeline Alternative 4 from Sandy Point, Texas to Shore

Onshore Pipeline Alternative 4 originates at the terminus of Onshore Pipeline Alternatives 1 or 2 from ECHO Terminal to Sandy Point, Texas and extends 44.7 miles east-southeast to a shore location south of Surfside Beach. Approximately 37 percent, or 16.5 miles, of the route are collocated with other linear infrastructure. This alternative also crosses 2.7 miles of the Justin Hurst Wildlife Management Area, which is public land focused on the development of habitat for migratory and indigenous wildlife. It offers a wide range of recreational uses such as hunting, fishing, hiking, biking, and wildlife viewing. It is also immediately adjacent to, but does not cross, USFWS-designated critical habitat for the Piping Plover

(*Charadrius melodus*), which is listed as a threatened avian species that occupies wintering habitat along the shores of Texas. Onshore Pipeline Alternative 4 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.5.5. Onshore Pipeline Alternative 5 from Sandy Point, Texas to Shore

Onshore Pipeline Alternative 5 originates at the terminus of Onshore Pipeline Alternatives 1 or 2 from ECHO Terminal to Sandy Point, Texas and extends 33.6 miles south to a shore location north of Surfside Beach. Approximately 18 percent, or 5.9 miles, of the route are collocated with other linear infrastructure. This alternative crosses 3.4 miles of the Brazoria National Wildlife Refuge. Brazoria National Wildlife Refuge contains both salt and freshwater marshes along with coastal prairies, and has wintering habitat for migratory waterfowl and songbirds. It is a popular area for recreational bird watching, hunting, and fishing. Onshore Pipeline Alternative 5 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.5.6. Onshore Pipeline Alternative 6 from Oyster Creek, Texas to Shore

Alternative 6 is an alternative provided by a member of the public during the SDEIS comment period. Alternative 6 extends from Oyster Creek, Texas at about milepost 6.5 of the Oyster Creek to Shore Pipelines to a shore location south of Surfside Beach. During the Draft General Conformity comment period, MARAD and USCG received a comment with a pipeline route alternative that would avoid "high-value residential impacts and high-value wetlands" and would route the pipelines through Freeport, Texas. Environmental justice communities extend the entire length of Alternative 6, which would substantially increase the impacts to environmental justice communities as compared to the proposed action. Furthermore, as described in Table 2.5.6-1, Alternative 6 does not provide other meaningful environmental benefits. Therefore, Alternative 6 is not considered further in this Final EIS.

Table 2.5.6-1: Comparison of Onshore Pipeline Alternatives

Parameter [a]	Alternative 3a (Proposed Action)	Alternative 3b	Alternative 4	Alternative 5	Alternative 6
Total length	35.9	36.0	44.7	33.6	39.8
Collocation [b] with other pipelines and electrical lines (miles/percent [%])	24.2/67%	24.7/69%	16.5/37%	5.9/18%	14.9/37%
Federal, State, and Locally Owned Property					
Brazoria National Wildlife Refuge	0.0	0.0	0.0	3.4	0.0
Justin Hurst Wildlife Management Area	0.0	0.0	2.7	0.0	0.0
Land Cover and Land Use					
Cultivated crops	9.3	9.3	10.1	10.4	9.3
Forest [c]	0.7	0.7	0.7	0.2	0.9
Developed [d]	1.3	1.3	0.7	0.2	5.5
Hay/pasture	9.5	9.5	12.1	6.4	9.5

Parameter [a]	Alternative 3a (Proposed Action)	Alternative 3b	Alternative 4	Alternative 5	Alternative 6
Herbaceous	2.8	2.8	1.0	1.2	3.6
Open water [e]	0.7	0.9	0.5	0.7	0.6
Scrub/shrub	1.6	1.6	1.3	0.6	1.4
Prime farmland soils	25.1	25.1	36.0	19.8	26.0
National Wetlands Inventory Wetlands					
Estuarine and marine deepwater wetlands	0.4	0.4	0.2	0.4	0.3
Estuarine and marine wetlands	2.3	2.5	0.4	1.7	0
Freshwater emergent wetlands	0.5	0.4	4.7	4.2	2.6
Freshwater forested/shrub wetlands	0.3	0.3	2.8	0.2	0.3
Riverine wetlands	0.2	0.2	0.3	0.2	0.3
Waterbodies [f]					
Stream/river (number of crossings)	33	33	23	227	37
Other Resources					
Floodplain (100-year)	19.9	19.9	25.5	19.7	18.3
Other Infrastructure					
Pipelines (number of crossings)	98	98	106	75	83
Electrical transmission lines (number of crossings)	6	6	10	3	13
Roads (number of crossings)	26	26	17	8	39

Sources: FEMA 2020; HIFLD 2019; NRCS 2019; RRC 2019b; TPWD 2014a; TXDOT 2018; USFWS 2019f; USFWS 2018a; USGS 2019b; USGS 2016; USGS 2010

[a] All parameters are measured in miles unless otherwise noted.

[b] Collocation includes linear infrastructure within 200 feet of the route based on centerline to centerline measurement (SPOT 2019y).

[c] Forest land includes evergreen, deciduous, and mixed forest land cover.

[d] Developed includes low, medium, and high intensity land cover, as well as developed, open space (e.g., parks).

[e] Open water includes ponds and lakes.

[f] Waterbodies were identified by review of high-resolution mapping for water features that are 30 feet wide with visible water. Features that are 30 feet wide with extensive tree cover are assumed to have water and are also included in the total count.

2.6. Alternative Onshore Terminal Sites and Designs

The existing ECHO Terminal was evaluated to determine if an expansion at this facility could provide the necessary space for storage and pumping facilities to receive, transport, store, and deliver the crude oil volumes proposed for the SPOT Project. The Applicant determined that approximately 100 acres would be required to house the storage and pumping facilities, as well as a firewater pond, needed for the SPOT Project. There was no available land greater to or equal than 100 acres adjacent to the ECHO Terminal; therefore, expansion of the ECHO Terminal is not viable. A new onshore storage and pumping facility would be necessary to support the SPOT Project.

The following factors narrowed the area for site identification:

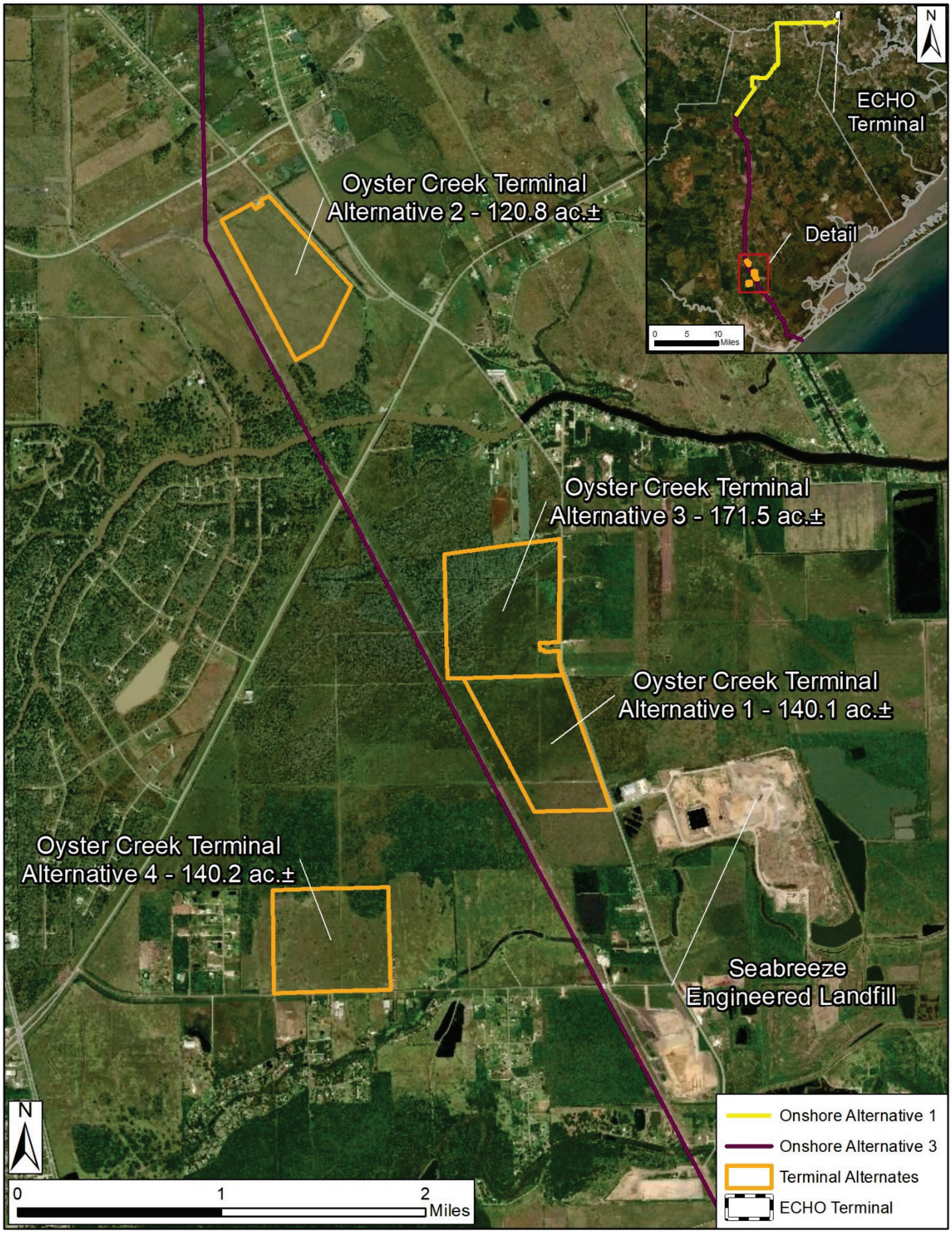
- Available parcels with at least 100 acres for development;
- Location relative to the onshore pipeline route(s) that would minimize pipeline lengths and workspaces; and
- Location of a mainline pumping unit within 16 miles of the shoreline, which is the maximum distance required to transfer oil to the SPOT DWP without adding additional pumping unit(s) along the collocated Oyster Creek to Shore Pipelines.

2.6.1. Onshore Sites Considered

Based on the criteria above, alternative onshore terminal sites were evaluated in Brazoria County. Four sites were identified:

- Oyster Creek Terminal Alternative 1
- Oyster Creek Terminal Alternative 2
- Oyster Creek Terminal Alternative 3
- Oyster Creek Terminal Alternative 4

The locations of onshore terminal sites alternatives are depicted on Figure 2.6-1 and discussed below.



ac = acres

Figure 2.6-1: Alternative Onshore Storage Terminal Sites

2.6.1.1. Oyster Creek Terminal Alternative 1 (Proposed Action)

Oyster Creek Terminal Alternative 1 is 140.1 acres. It is 37.1 miles from the existing ECHO Terminal and less than 0.1 mile from Onshore Pipeline Alternative 3 from Sandy Point, Texas to shore. The entire 140.1-acre site is within the 100-year floodplain (FEMA 2020). Oyster Creek Terminal Alternative 1 is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.6.1.2. Oyster Creek Terminal Alternative 2

Oyster Creek Terminal Alternative 2 is 120.8 acres. It is 35.5 miles from the existing ECHO Terminal and less than 0.1 mile from Onshore Pipeline Alternative 3 from Sandy Point, Texas to shore. A total of 118 acres of the 120.8-acre site is within the 100-year floodplain (FEMA 2020). Oyster Creek Terminal Alternative 2 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.6.1.3. Oyster Creek Terminal Alternative 3

Oyster Creek Terminal Alternative 3 is 171.5 acres. It is 36.5 miles from the existing ECHO Terminal and less than 0.1 mile from Onshore Pipeline Alternative 3 from Sandy Point, Texas to shore. The entire 171.5-acre site is within the 100-year floodplain (FEMA 2020). Oyster Creek Terminal Alternative 3 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.6.1.4. Oyster Creek Terminal Alternative 4

Oyster Creek Terminal Alternative 4 is 140.3 acres. It is 38.1 miles from the existing ECHO Terminal and 0.6 mile from Onshore Pipeline Alternative 3 from Sandy Point, Texas to shore. The entire 140.3-acre site is within the 100-year floodplain. Oyster Creek Terminal Alternative 4 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.6.2. Alternative Onshore Crude Oil Storage Terminal Design

Two different crude oil pump unit designs were evaluated for both the proposed expansion of the existing ECHO Terminal and the proposed Oyster Creek Terminal.

2.6.2.1. Electric-Driven Pump Alternative Design (Proposed Action)

The Electric-Driven Pump Alternative Design uses electricity as the primary power source and includes the use of induction motors, which do not produce air emissions. The Electric-Driven Pump Alternative Design can provide the power necessary to operate the proposed driver centrifugal pumps at the onshore facilities. The Electric-Driven Pump Alternative Design is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.6.2.2. Combustion-Driven Pump Alternative Design

The Combustion-Driven Pump Alternative Design includes an internal combustion engine that consumes fossil fuels (e.g., diesel, natural gas), which results in air emissions. The Combustion-Driven Pump Alternative Design can provide the power necessary to operate the driver centrifugal pumps. This alternative would require the installation of additional pipeline(s) or facilities for fuel delivery by truck to operate the equipment. The Combustion-Driven Pump Alternative Design is evaluated further in Section 3.17, Evaluation of Alternatives.

2.7. Alternative Deepwater Port, Anchorage, and Offshore Pipeline Locations

In identifying a potential site for a DWP, applicable USCG siting criteria (33 CFR § 148.720) must be considered. These regulations require an evaluation of how well the proposed and alternative sites meet the following criteria:

- Optimize location to prevent or minimize detrimental environmental effects;
- Minimize the space needed for safe and efficient operation, potential for interference from existing offshore structures and activities, and danger posed to safe navigation by surrounding water depths and currents;
- Locate offshore components in areas with stable seafloor characteristics;
- Locate onshore components where stable foundations can be developed;
- Minimize the danger to the DWP, its components, and VLCCs or other crude oil carriers calling at the DWP from storms, earthquakes, or other natural hazards;
- Take advantage of areas already allocated for similar use, without overusing such areas, and maximize the permitted use of existing work areas, facilities, and access routes while minimizing the environmental impact from the temporary use of work areas, facilities, and access routes;
- Maximize the distance between the DWP and its components and critical habitats, including commercial and sport fisheries, threatened and endangered species habitats, wetlands, floodplains, coastal resources, marine management areas, and EFH;
- Minimize the displacement of existing and potential mining, oil, or gas production or transportation uses;
- Avoid permanent interference with natural processes or features that are important to natural currents and wave patterns; and
- Avoid extensive dredging or removal of natural obstacles (such as reefs) in areas where sediments contain high levels of heavy metals, biocides, oil or other pollutants or hazardous materials and in areas designated as wetlands or other protected coastal resources.

Considering these criteria and safeguards in place for existing pipelines, detailed in Section 4.8, no one alternative offshore pipeline route is expected to have a greater risk of pipeline damage due to dropped or dragged anchors than any other.

MARAD and the USCG identified six lease blocks and three offshore pipeline routes. The identification process considered several factors, including:

- Lease blocks a minimum of 2.0 square miles in size, as the lease blocks smaller than this are closer to shore in shallower water;
- Lease blocks adjacent to another block that is not more than 1.0 mile from the SPOT DWP to accommodate VLCC or other crude oil carrier anchorage;
- Water depths of at least 75 feet to accommodate the draft of a fully loaded VLCC in calm seas;
- An associated offshore pipeline route for each alternative, as the location of the DWP is dependent on location and proximity to the offshore pipeline route;
- Ability to connect the offshore pipeline routes to Onshore Pipeline Alternative 3 from Sandy Point—or to other reasonably available onshore pipelines, as defined in Section 2.5, Alternative Onshore Pipeline Routes—at an unoccupied or undeveloped parcel of land (minimum of 150 feet wide by 250 feet long) for workspace associated with the Applicant-proposed HDD construction method; and
- Ability to terminate the offshore pipeline routes at the applicable Alternative DWP Site.

Three alternative DWP locations (six total lease blocks) with associated offshore pipeline routes were identified as shown on Figure 2.7-1 and are as follows:

- Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1—Lease Blocks 463, A-59, Offshore Pipeline Alternative 1;
- Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2—Lease Blocks A-54, A-61, and Offshore Pipeline Alternative 2; and
- Deepwater Port, Anchorage, and Offshore Pipeline Alternative 3—Lease Blocks A-44 and A-45, and Offshore Pipeline Alternative 3.

2.7.1. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 (Proposed Action)

Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 includes Galveston Area lease blocks 463 and A-59, and a 46.9-mile offshore pipeline route. The depth of these lease blocks reaches up to 129 feet, which meets the depth criteria to fully load VLCCs for export.

The associated 46.9-mile offshore pipeline route originates at the shoreline (at the terminus of Onshore Pipeline Alternative 3) and extends southeast around the Freeport Harbor Shipping Fairway anchorage area, crossing the Aransas Pass to Calcasieu Pass safety fairway before turning west across the Freeport Harbor Shipping Fairway then extending southwest to Galveston Area lease block 463. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.7.2. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2

Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2 includes Galveston Area lease blocks A-54 and A-61, and a 47.7-mile offshore pipeline route. The depth of these lease blocks reaches up to 128 feet, which meets the depth criteria to fully load VLCCs for export.

The associated 47.7-mile offshore pipeline route originates at the shoreline (at the terminus of Onshore Pipeline Alternative 3) and extends southeast around the Freeport Harbor Shipping Fairway anchorage area, crossing the Aransas Pass to Calcasieu Pass safety fairway before turning west across the Freeport Harbor Shipping Fairway then extending south-southwest to Galveston Area lease block A-54. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2 is evaluated further in Section 3.17, Evaluation of Alternatives.

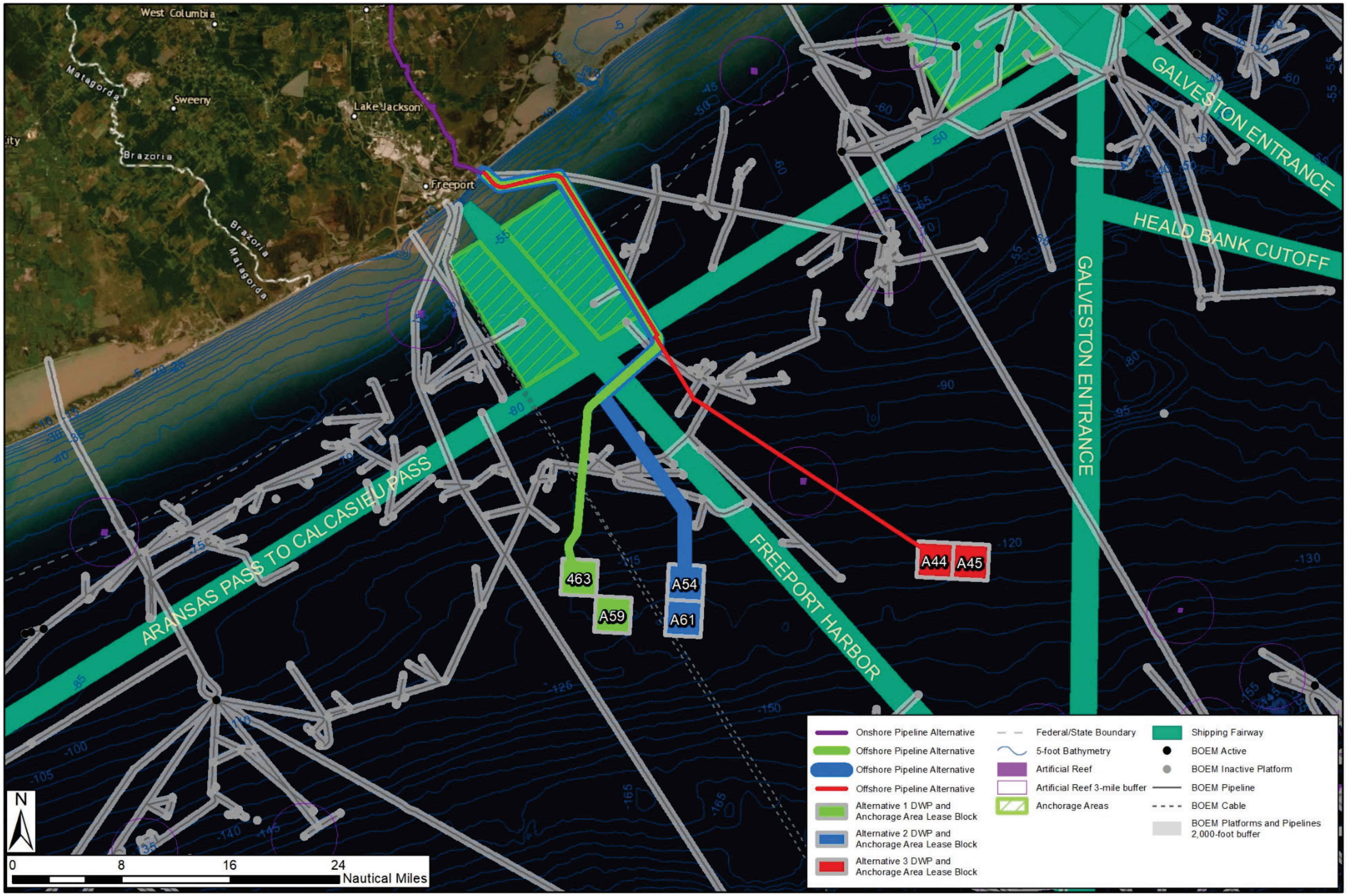


Figure 2.7-1: Alternative Deepwater Port Sites and Offshore Pipeline Routes

2.7.3. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 3

Deepwater Port, Anchorage, and Offshore Pipeline Alternative 3 includes Galveston Area lease blocks A-44 and A-45, and a 53.8-mile offshore pipeline route. The depth of these lease blocks reaches up to 123 feet, which meets the depth criteria to fully load VLCCs for export.

The associated 53.8-mile offshore pipeline route originates at the shoreline (at the terminus of Onshore Pipeline Alternative 3) and extends southeast around the Freeport Harbor Shipping Fairway anchorage area, crossing the Aransas Pass to Calcasieu Pass safety fairway before extending slightly east to Galveston Area lease block A-44. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 3 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.8. Alternative Deepwater Port and Component Designs

Alternative DWP designs were identified based on suitability for use in the GoM, as well as economic and operational feasibility.

2.8.1. Offshore Deepwater Port Design Alternatives

Offshore DWP design alternatives were identified in regard to the DWP itself and VLCC or other crude oil carrier mooring. Three DWP designs were identified based on several factors, including the footprint of the infrastructure required, the maximum loading rate, the range of conditions during which VLCCs or other crude oil carriers could moor and load, safety equipment, and operational considerations, such as custody transfer and maintenance.

2.8.1.1. Offshore Deepwater Port Design Alternative 1—Fixed Platform with SPM Buoy (Proposed Action)

Offshore Deepwater Port Design Alternative 1 includes a fixed support platform with anchored SPM buoy(s) that integrate mooring capabilities and crude oil transfer systems directly from a pipeline. A VLCC or other crude oil carrier moors to the SPM buoy with mooring hawser lines and is connected to the DWP via the PLEMs with floating crude oil loading hoses. Support tugboats transport the mooring hawser from the SPM buoy to the VLCC or other crude oil carrier and then tow the floating hoses to the vessel to connect with the shipboard manifold system. Fixed platforms require infrastructure be installed using piles driven into the seafloor with connected jacket structures.

Because this design includes a large infrastructure footprint, it can provide the following systems:

- VOC processing and vapor recovery to reduce air emissions;
- Use of a PSV or HIPPS to detect high-pressure conditions and close isolation valves to protect lower-rated downstream infrastructure—these are typically installed between the incoming offshore pipeline and loading hoses;
- Custody transfer meters near the VLCC or other crude oil carrier for accurate volume transfer documentation;

- Pig launcher and receivers to conduct pigging operations (i.e., monitor pipeline integrity) between the onshore and offshore pipelines, which also ensures no mixing of different crude oil grades occurs between loadings;
- Leak detection systems to provide the locations and severity of leaks;
- Manned loading operations near the VLCC or other crude oil carrier loading area, allowing for continuous visual monitoring and quick response to adverse events;
- Allows for a wider range of acceptable mooring and loading conditions, as the VLCCs and other crude oil carriers have the flexibility to weathervane (i.e., swing) as necessary based on the conditions of the ocean; and
- Flexibility to install additional SPM buoy(s) with less impact than berth(s) to allow multiple and simultaneous VLCC or other crude oil carrier loadings.

Offshore Deepwater Port Design Alternative 1 is the Proposed Action and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.8.1.2. Offshore Deepwater Port Design Alternative 2—Fixed Platform with Berth

Offshore Deepwater Port Design Alternative 2 includes a fixed support platform with mooring and berthing dolphins, crude oil loading arms at a marine berth, and interconnecting bridges between the support platform and marine berth. The mooring has a fixed orientation (i.e., vessels cannot weathervane with real-time sea states), which could limit VLCC or other crude oil carrier mooring/berthing and subsequent loading operations during less than optimal sea conditions. Loading arms attached to the fixed platform transfer crude oil to the moored VLCC or other crude oil carrier. Fixed platforms with berths require the largest amount of infrastructure of the alternatives considered, and are installed using piles driven into the seafloor with connected jacket structures.

Because this design includes a large infrastructure footprint, it can provide the following systems:

- VOC processing and vapor recovery to reduce air emissions;
- Use of a PSV or HIPPS to detect high-pressure conditions and close isolation valves to protect lower-rated downstream infrastructure—these are typically installed between the incoming offshore pipeline and loading hoses;
- Custody transfer meters near the VLCC or other crude oil carrier for accurate volume transfer documentation;
- Pig launcher and receivers to conduct pigging operations (i.e., monitor pipeline integrity) between the onshore and offshore pipelines, which also ensures no mixing of different crude oil grades occurs between loadings;
- Leak detection systems to provide the locations and severity of leaks; and
- Manned loading operations near the VLCC or other crude oil carrier loading area, allowing for continuous visual monitoring and quick response to adverse events.

Offshore Deepwater Port Design Alternative 2 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.8.1.3. Offshore Deepwater Port Design Alternative 3—SPM Buoy without Fixed Platform

Offshore Deepwater Port Design Alternative 3 includes SPM buoys with no fixed platform. The SPM buoys connect directly to the offshore pipeline and to moored VLCCs or other crude oil carriers. This design reduces the amount of infrastructure, but is limited in its flow rate capabilities and the following:

- Inability to support the crude oil loading flow rate the other alternatives are capable of;
- Lack of above-water safety or metering equipment, such as PSVs, HIPPS, or custody transfer meters at the SPOT DWP, as these facilities would need to be installed onshore or subsea, which is not typical in the GoM;
- Unknown feasibility of providing a vapor recovery and process to remove VOCs, as these facilities would need to be installed onshore or subsea, which is not typical in the GoM; and
- Absence of personnel stationed offshore, which would not allow for visual leak detection and immediate response in the event of an emergency or adverse conditions.

Based on the design limitations, Offshore Deepwater Port Design Alternative 3 is not considered further in this EIS.

2.8.2. Alternative Volatile Organic Compound Control Technologies

A critical design criterion for the SPOT DWP is the ability to include a VOC recovery and removal system. Three alternatives were identified based on current industry standards and ability to support the volume of crude oil proposed to be loaded at the SPOT DWP, including removal of 90 percent or more of the VOCs from the recovered vapors.

2.8.2.1. Vapor Combustor Alternative (Proposed Action)

The Vapor Combustor Alternative includes a vapor combustor unit fueled by propane that uses high combustion temperatures to achieve VOC removal via destruction. The recovered vapors are enriched to a minimum 164 British thermal units per standard cubic feet to ensure sufficient combustion for destruction of VOCs before being routed to the combustor, where temperatures reach over 1,200 degrees Fahrenheit. The combustor is able to destroy 95 percent or more of the VOCs. This technology provides the highest rate of VOC destruction/recovery and allows for the greatest flexibility in VOC composition. However, fuel is required to enrich the vapors, which requires shipment and storage at the DWP. The Vapor Combustor Alternative is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.8.2.2. Adsorption with Absorption Alternative

The Adsorption with Absorption Alternative uses a combination of adsorption (i.e., holding VOC molecules on a solid surface) and absorption (i.e., dissolution of VOC molecules into a liquid) technologies to achieve VOC removal from the recovered vapors. In this process, recovered vapors pass through one or more adsorber beds to recover the VOC before the air is released into the atmosphere. The adsorber beds use activated carbon that must be regenerated every 10 to 15 minutes during vapor recovery operations, which requires spare beds to be shipped to and stored at the DWP. Adsorber beds are taken offline as they become saturated and are regenerated through a two-stage vacuum pump system. The discharge gases from the two-stage vacuum pump system then run through a single absorber column where the VOCs are absorbed into a circulating liquid hydrocarbon stream, known as lean oil. The lean oil stream, along with the recovered VOCs, are collected at the base of the absorber column and then pumped back into the crude oil loading flow. The Adsorption with Absorption Alternative is capable of removing 90 percent or more of VOCs from recovered vapors and is evaluated further in Section 3.17, Evaluation of Alternatives.

2.8.2.3. Adsorption with Vapor Combustion Alternative

The Adsorption with Vapor Combustion Alternative is similar to the adsorption with absorption alternative, except the VOC stream from the regeneration process would be sent to a vapor combustion unit rather than an absorption system. The Adsorption with Vapor Combustion Alternative is capable of removing 90 percent or more of VOCs from recovered vapors and is evaluated further in Section 3.17, Evaluation of Alternatives.

2.9. ALTERNATIVE CONSTRUCTION METHODS

MARAD and the USCG identified construction method alternatives for the SPOT Project to determine whether offshore environmental impacts could be reduced or mitigated. This included a review of pipeline construction at the shoreline and platform foundation/pile driving alternatives. A description of each of these alternative methods is presented below.

2.9.1. Alternative Shoreline Pipeline Construction Methods

Two shoreline construction alternatives were identified for crossing the shoreline and beach at Surfside in Brazoria County.

2.9.1.1. Horizontal Directional Drill Alternative (Proposed Action)

The Horizontal Directional Drill Alternative would be used to install the two collocated subsea pipelines between the shore crossing and offshore segments of the subsea pipelines. This construction method would result in the pipelines being installed approximately 60 to 70 feet below the ground surface at the beach crossing. The HDD entry hole would be located onshore and the exit pit would be excavated offshore near the 28-foot water depth contour, or about 5,500 feet from the shoreline. Spoil materials would be sidecast within the temporary workspace on either side of the pipelines and on the shore side of the trench.

A pipeline installation barge would install a start-up anchor approximately 200 feet from the planned HDD exit hole at about the 30-foot water depth contour and begin assembling the HDD pipe string. The barge would move forward once each pipe joint is welded together on the installation barge. The completed 7,500-foot-long pipe string would be laid on the ocean floor and an anchor would be installed on the deep end to hold the pipe in place. The process would be repeated for the second collocated pipeline.

The HDD drilling rig would operate from the shore side and a reaming support barge would operate offshore. The pipe installation barge and a support barge would assist in pullback operations once reaming is complete. After pullback of the two 36-inch-diameter pipeline segments is complete, the ends would be secured with anchors. Each pipeline segment would also be filled with seawater and hydrostatically tested.

The Horizontal Directional Drill Alternative is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.9.1.2. Open-Cut Trenching and Jet Sled Alternative

This alternative includes several construction methods based on the location of the pipe and the land type (i.e., upland, beach, nearshore, offshore). Standard open-cut upland construction techniques would be used from the tie-in at the MLV across Bluewater Highway and the beach at Surfside. Special construction methods would be used from the beach into shallow waters of the GoM, and for offshore installation in water depths of about 10 to 25 feet.

For the upland, onshore segment, the pipeline would be installed at a depth sufficient to provide a minimum of 3 feet of cover measured from top of pipe to grade. This would require a construction right-of-way measuring up to 150 feet wide. Construction methods for onshore clearing, grading, and backfilling would be similar to those described in Section 2.2.5, Onshore Construction and Installation. Following installation of the pipeline, the disturbed area would be restored to preconstruction conditions.

For the beach crossing segment, the pipeline would be installed at a depth sufficient to provide a minimum of 15 feet of cover (measured from top of pipe to grade) to ensure protection of the pipeline from activities in the beach area. For both the beach and nearshore crossings, the open-cut construction method would include a dredge barge for construction nearshore and in shallow waters. A dredge barge would excavate at least a 100-foot-wide flotation canal for the barge to transit to the shoreline for trenching activities. Prior to excavation, sheet piles would be installed both along the shoreline and the trench line to maintain the integrity of the trench walls during construction. The dredge would excavate a trench from the shoreline to nearshore waters at a water depth of approximately 10 feet. A lay barge would be used to assemble and lay the pipe. A winch would be used to pull the pipeline segment from the lay barge into the trench across the beach. The sheet piles would be removed and the trench would be backfilled with native and/or clean compatible material. Disturbed areas of the beach would be restored to preconstruction conditions.

For the offshore segment, the pipeline would be installed at a depth sufficient to provide 3 feet of cover measured from top of pipe to grade. A dredge barge would be utilized to excavate the trench. A pipe lay barge would be used to assemble and lay the pipeline segment out to a depth of approximately 25 feet, the typical minimum depth required for use of the jet sled. The jet sled would be used to trench the remainder of the offshore pipeline to the tie-in with offshore pipeline as discussed in Section 2.2.6, Offshore Construction and Installation. Following installation of the pipeline, the trench would be backfilled with native materials and the seafloor restored to ambient contours.

The Open-Cut Trenching and Jet Sled Alternative is evaluated further in Section 3.17, Evaluation of Alternatives.

2.9.2. Alternative Offshore Construction Foundation/Pile Driving Methods

Four foundation/pile driving methods were identified for the Proposed Action. These alternatives and the rationale for consideration are discussed below.

2.9.2.1. Driven Pile Alternative (Proposed Action)

The driven pile method consists of a high-grade steel pile that is open-ended and driven into the seafloor by either conventional impact hammers or vibratory hammers. This method is generally used in conditions consisting of non-cohesive sediments, such as sand or silt, or in stratified soil conditions. It can also be effective in most other soil conditions. Decommissioning of driven piles typically involves cutting the pile about 15 feet below the seafloor and leaving the remainder of the pile in place. The Driven Pile Alternative is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.9.2.2. Suction Pile Alternative

The suction pile method includes a cylinder steel pile that is capped on one end and open at the other end. The suction pile would be embedded in the sediments by pumping out water and creating a negative pressure inside the caisson skirt. Suction piles are best used in clay and fine sediment conditions with few sediment layers, and have proven highly reliable. These piles are also typically used in areas where the water depth is greater than the length of the pile. Suction piles are recoverable during decommissioning. The Suction Pile Alternative is evaluated further in Section 3.17, Evaluation of Alternatives.

2.9.2.3. Jetted Pile Alternative

The jetted pile method consists of a steel pile that is installed with a pressurized jet of water (or compressed air) at the end of the steel pile that allows the pile to penetrate the seafloor. The jet of water or air decreases the soil-bearing capacity in the vicinity of the pile and allows for less soil resistance and friction on the outer surface of the pile, which drives the pile into the seafloor. This method is used in very dense soils and can be used in conjunction with, or separate from, pile-driving methods for pile installation. The Jetted Pile Alternative is evaluated further in Section 3.17, Evaluation of Alternatives.

2.9.2.4. Grouted Drill Pile Alternative

The grouted drill pile method includes a steel pile and is similar to a driven pile, but is installed differently. If the sediment condition consists of cemented soil layers and/or rock material, grouted drill piles may be required, as these materials limit the amount of penetration with driving hammers. A hole for the pile would be drilled into the seafloor to achieve the penetration of the grouted pile anchor. Grout would then be pumped in between the soil/cemented wall and the pile. Grouted pile anchors are not easily recovered during decommissioning and the general practice is similar to driven piles, where they are cut 15 feet below the seafloor. The Grouted Drill Pile Alternative is evaluated further in Section 3.17, Evaluation of Alternatives.

2.10. DECOMMISSIONING ALTERNATIVES

Four alternatives for the removal of the proposed SPOT DWP facilities and offshore pipelines were identified, including a specific request from BOEM regarding the partial removal and full removal of subsea pipelines. Under current regulations, abandoning subsea pipelines in place, while normal practice, is not a default action, but rather an active decision. As such, this alternatives analysis is presented to inform the agencies that would have jurisdiction over the decommissioning of the SPOT Project, as well as the public.

2.10.1. Decommissioning Alternative 1 (Proposed Action)

Decommissioning Alternative 1 includes removal of the SPOT DWP, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. The crude oil export pipelines from shore to the SPOT DWP, crude oil loading pipelines, and the vapor recovery pipelines would be abandoned in place.

The lighted buoys, their chains, and their anchor blocks would be removed for transport onshore for reuse or disposal. The floating crude oil and vapor recovery hoses and underbuoy crude oil and vapor recovery hoses would be flushed with seawater from the open end to the PLEMs. The floating hoses would be disconnected from the SPM buoys, capped by divers, and transported to shore for disposal. The underbuoy lines and SPM buoy anchor chains would be disconnected from the buoys and the anchor piles. The anchor piles would be cut approximately 15 feet below the ocean floor and the upper pile sections removed. The buoys, chains, and piles would be transported to shore for disposal. The crude oil loading and vapor recovery pipelines between the platform and the PLEMs would be flushed from the platform to the PLEMs and back again using the pigging system. Any crude oil would be pushed into the subsea pipelines to shore. Following removal of the crude oil, flushing water and chemicals would be run through the lines. The discharge water would be separated until no hydrocarbons are identified in the flushing water. The tie-in spools at either end of the lines would be removed and transported to shore for disposal. The pipeline ends would be capped, lowered to 3 feet below the ocean floor, and covered with concrete mattresses. The PLEMs would be removed and transported to shore for disposal. The anchor piles would be cut approximately 15 feet below the ocean floor and the upper pile sections removed for disposal.

To fully decommission the platform, any piping not cleaned via pigging the crude oil pipelines/hoses would be cleaned of hazardous chemicals, diesel, or other materials using other methods. Equipment onboard the platform, such as the cranes, would be tied down. Other components of the platform, such as the living quarters, main components of the main deck, and the helideck would be removed with a derrick barge and transported to shore for disposal. Deck legs would be cut at the top of the jacket and each of the decks would be lifted onto a cargo barge for transport to shore and disposal. Jacket piles would be cut from the inside approximately 15 feet below the ocean floor via abrasive cutters, explosives, or water cutters. The piles would be removed and transported to shore for disposal. The jacket would be lifted by a derrick barge and transported to a Rigs-to-Reef location.

The offshore pipelines would be flushed of hydrocarbons, filled with seawater, and left capped at both ends and abandoned in place in accordance with regulatory requirements.

Decommissioning Alternative 1 is the Proposed Action for the SPOT Project and is evaluated further in Chapter 3, Environmental Analysis of the Proposed Action.

2.10.2. Decommissioning Alternative 2

Decommissioning Alternative 2 includes removal of the SPOT DWP platform, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. It also includes the partial removal of the two crude oil export pipelines state waters only, as requested by BOEM. The pipelines in Federal waters including the two crude oil export segments, crude oil loading pipelines, and the vapor recovery pipelines would be abandoned in place.

The SPOT DWP platform and associated facilities would be removed as discussed in Decommissioning Alternative 1.

The crude oil export pipelines in offshore Federal would be flushed of hydrocarbons via the pigging system, filled with seawater, and left capped with plumber's plugs at both ends, then abandoned in place in accordance with regulatory requirements. Dewatering of the two crude oil export pipeline segments would occur from Galveston Area lease block 463. A pipelay barge would pull and cut the joints onboard before placement on cargo barges for transportation to an onshore facility for disposal.

The HDD pipe segments beneath the beach at the shore crossing would not be removed. They would remain in place after being filled with seawater with the offshore end plugged, trenched, and covered with concrete in accordance with 30 CFR Part 250, Subpart J.

Decommissioning Alternative 2 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.10.3. Decommissioning Alternative 3

Decommissioning Alternative 3 includes removal of the SPOT DWP platform, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. It also includes the partial removal of the two crude oil export pipelines, crude oil loading pipelines, and the vapor recovery pipelines from Federal waters only to the SPOT DWP, as requested by BOEM. The pipelines in state waters would be abandoned in place.

The SPOT DWP platform and associated facilities would be removed as discussed in Decommissioning Alternative 1.

The crude oil export pipelines in offshore state waters would be flushed of hydrocarbons via the pigging system, filled with seawater, and left capped with plumber's plugs at both ends, then abandoned in place in accordance with regulatory requirements. Dewatering of the two crude oil export pipeline segments would occur from Galveston Area lease block 463. A pipelay barge would back under the two pipeline segments as the pipelines are pulled onboard, and the joints would be cut and placed on cargo barges for transportation to an onshore facility for disposal.

For the removal of the crude oil loading pipelines and vapor recovery pipelines in Federal waters, a vessel would remove the concrete mattresses, remove the blind flange, and install a pig receiver to flush the lines prior to removal. A pipelay barge would pull and cut the joints onboard before placement on cargo barges for transportation to an onshore facility for disposal.

Decommissioning Alternative 3 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.10.4. Decommissioning Alternative 4

Decommissioning Alternative 4 includes removal of the SPOT DWP platform, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. It also includes the full removal of the two offshore crude oil export pipelines, crude oil loading pipelines, and the vapor recovery pipelines from state and Federal waters to the SPOT DWP, as requested by BOEM.

The SPOT DWP platform and associated facilities would be removed as discussed in Decommissioning Alternative 1.

For the removal of the crude oil loading pipelines in Federal and state waters and the vapor recovery pipelines in Federal waters, a vessel would remove the concrete mattresses, remove the blind flange, and install a pig receiver to flush the lines prior to removal. A pipelay barge would pull and cut the joints onboard before placement on cargo barges for transportation to an onshore facility for disposal.

The HDD pipe segment under the beach at the shore crossing would not be removed and would remain in place after being filled with seawater and the offshore end plugged, then trenched and covered with concrete in accordance with 30 CFR Part 250, Subpart J.

Decommissioning Alternative 4 is evaluated further in Section 3.17, Evaluation of Alternatives.

2.11. Identification of the Agencies' Preferred Alternative

CEQ regulations stipulate that this EIS "identify the agency's proposed Project or alternatives, if one or more exists…unless another law prohibits the expression of such preference" (40 CFR § 1502.14[e]). Under the DWPA, MARAD has the decision-making authority to approve, approve with conditions, or deny a license application for a DWP. Because MARAD is the decision-making authority, identifying its preferred alternative could be interpreted as inappropriate prior to the Secretary's assembling, reviewing, and analyzing all of the relevant information pertaining to the license application, as required under the DWPA. As such, the Secretary will defer identification of the agency's preferred alternative until a decision is made to approve or deny a DWP license. If the license is approved, the Secretary will indicate the agency's preferred alternative in its ROD issued under the DWPA.

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3. ENVIRONMENTAL ANALYSIS OF THE PROPOSED ACTION

3.1. INTRODUCTION

This chapter of the EIS is divided between existing conditions and environmental consequences, or impacts, for each of the resource types assessed in this EIS. The proposed Project would have both onshore and offshore components. The affected environment for the proposed onshore components includes areas surrounding the existing ECHO Terminal, proposed onshore pipelines and ancillary facilities, and the proposed Oyster Creek Terminal. The affected environment for the proposed offshore components includes those areas surrounding the subsea pipelines, the SPOT DWP, and the anchorage area. This chapter also provides a detailed evaluation of alternatives to the proposed Project, as selected through the evaluation in Chapter 2, Description of the Proposed Action and Alternatives.

3.2. EVALUATION CRITERIA FOR ASSESSING ENVIRONMENTAL CONSEQUENCES

The purpose of this EIS is to provide an environmental analysis sufficient to support the Secretary's licensing decision; to facilitate a determination of whether the Applicant has demonstrated that the proposed Project would be located, constructed, operated, and decommissioned using the best available technology necessary to prevent or minimize adverse impacts on the environment; and to encourage and facilitate involvement by the public and interested agencies in the environmental review process. Together, the USCG and MARAD are the lead Federal agencies responsible for processing the application and compiling the EIS; however, the EIS will also support the decision-making processes for Federal cooperating agencies with responsibilities to evaluate permit applications for the SPOT Project. The evaluation criteria established to assess the impacts of the proposed Project on the natural and social environment are discussed below.

3.2.1. Descriptions of Impact

Potential impacts on environmental resources may be direct or indirect; adverse or beneficial; long-term or short-term; and negligible, minor, moderate, or major. As used in this assessment, these characteristics are defined below.

3.2.1.1. Direct or Indirect

Direct impacts are those that would occur as a result of, and at the same time and place as the SPOT Project. Direct impacts can be identified and assessed with more certainty than indirect impacts, as they would overlap with the SPOT Project both spatially and temporally. Direct impacts can be short-term or long-term. Indirect impacts are those that would be caused by the SPOT Project, but would be separated by time and/or place. Indirect impacts are more difficult to identify and assess, as they would occur in the near and distant future and involve dynamic variables.

3.2.1.2. Adverse or Beneficial

An adverse impact would cause unfavorable or undesirable outcomes for the natural or social environment. A beneficial impact would cause positive or desirable outcomes for the natural or social environment. A single act could result in adverse impacts on one resource and beneficial impacts on another resource. For example, sediment disturbance could expose benthic invertebrates to predation (the consumption of one animal by another animal), which would adversely affect the benthic community. This would, however, result in a beneficial impact on fish by increasing prey availability (USCG and MARAD 2006a, 2006b, 2006c). A single act could also result in adverse and beneficial impacts on the same resource, either at different times, or simultaneously. For example, increased housing demand associated with construction or operation of a project could increase housing prices and rents, which would be an adverse impact on current residents who cannot afford those increased prices, but would be a beneficial impact on homeowners seeking to sell or rent their properties. In such cases, the adverse and beneficial impacts are considered separately, and are typically not combined or averaged.

3.2.1.3. Long-Term or Short-Term

These characteristics are determined on a case-by-case basis and do not refer to a specific period. In general, long-term impacts are those that would occur either continually or periodically throughout the life of the SPOT Project (e.g., operational air emissions, stormwater discharge), or would last for years after an impact-producing activity occurred (e.g., removal of wildlife habitat). Short-term impacts are those that would occur only during a specific phase of the proposed Project, such as noise during construction or certain installation activities. Construction of proposed Project components would occur over a 2-year period; however, certain impacts from construction of the Project may be of shorter duration. These impacts are considered short-term in this EIS because the impacts would end at the time, or shortly after, construction activities ceased. The duration of most short-term impacts would be a few hours to a few days.

3.2.1.4. Negligible, Minor, Moderate, or Major

These relative terms are used to characterize the magnitude of an impact. Negligible impacts are generally those that might be perceptible, but in certain cases may be undetectable. A minor impact is slight, but detectable. Moderate impacts are more perceptible, can often be quantified, and may approach the thresholds for major impacts. Major impacts, based on their context and intensity (or severity), have the potential to meet the thresholds for significance set forth in CEQ regulations (40 CFR § 1508.27). Major impacts warrant additional attention in a NEPA analysis and a review of potential mitigation measures that would fulfill the policies set forth in NEPA, which include avoiding, minimizing, or mitigating major impacts. Table 3.2-1 details the evaluation criteria used to determine the magnitude of impact for each resource type analyzed in this EIS.

3.2.2. Evaluation Criteria

The evaluation criteria summarized in Table 3.2-1 provide a framework for establishing context and intensity (i.e., severity). These evaluation criteria were developed by environmental professionals in relevant fields in coordination and consultation with stakeholder agencies, and were adopted by the USCG and MARAD. Although some evaluation criteria have been designated based on legal or regulatory limits or requirements, others are based on best standard practice, professional judgment, and BMPs. The evaluation criteria include both quantitative and qualitative analyses, as appropriate for each resource, and indicate the potential severity of impact if the criteria were to be violated.

Table 3.2-1: Evaluation Criteria for Determining Environmental Consequences by Resource Area

Resource	Evaluation Criteria [a]
Water Resources	• Violate a Federal, state, local, or Federally recognized international water quality criterion or waste discharge requirement (major) • Cause irreparable harm to human health, aquatic life, or beneficial uses of aquatic ecosystems (major) • Degrade groundwater quantity or quality (major) • Degrade marine, coastal, or terrestrial (lakes, rivers, wetlands, tidal environments) water quality (minor to major, depending on extent) • Increase contaminant levels in the water column, sediment, or biota to levels shown to have the potential to harm marine organisms, even if the levels do not exceed the formal water quality criteria (moderate)
Biological Resources, Including Threatened and Endangered Species Habitat and Essential Fish Habitat	• Violate a legal standard for protection of a species or its critical habitat (major) • Degrade the commercial, recreational, ecological, or scientific viability or significance of a biological resource or its critical habitat (minor to major, depending on extent) • Measurably change the population size (density) or change the distribution of an important species in the region (minor to major, depending on extent) • Introduce new, invasive, or disruptive species in the proposed Project area (minor to major, depending on extent) • Directly affect nesting migratory birds protected under the Migratory Bird Treaty Act (major) • Reduce quality and/or quantity of essential fish habitat as defined by the Magnuson-Stevens Fishery Conservation and Management Act, causing adverse effects, such as direct or indirect physical, chemical, or biological alterations of the waters or substrate, and loss of or injury to benthic organisms, prey species, their habitat, and other ecosystem components (major)
Geologic and Soil Resources	• Degrade unique geological features (major) • Increase erosion potential (minor to moderate, depending on extent) • Prevent recovery of mineral resources due to site(s) of facilities (minor to moderate) • Increase the potential for geologic hazards to occur, such as seismic events (minor to major, depending on extent) • Alter the lithology, stratigraphy, or geological structures that control or contribute to groundwater quality, the distribution of aquifers and confining beds, and groundwater availability (minor to major, depending on extent) • Alter soil or sediment composition, structure, or function (minor to moderate, depending on extent) • Degrade or prevent the study or recovery of paleontological resources (minor to major, depending on extent)
Cultural Resources	• Directly or indirectly affect submerged cultural resources (minor to major, depending on extent) • Cause irretrievable or irreversible damage to a prehistoric or historic property that is listed or eligible for listing on the National Register of Historic Places (major) • Alter or impair a viewshed (the area from a specific point), scenic quality, or aesthetic value related to a historic property not consistent with applicable laws or regulations (minor to major depending on extent of alteration) • Adversely affect a prehistoric or historic property that is listed or eligible for listing on the National Register of Historic Places (minor to major, depending on extent)

Resource	Evaluation Criteria [a]
	• Violate cultural resource standards by affecting resources that are of value to Indian culture and heritage (major) • Disturb human remains, including those interred outside of formal cemeteries (major)
Ocean and Land Use	• Alter the functional use of an area already in use (minor to major, depending on current use) • Conflict with applicable planning and zoning (minor to major, depending on conflict) • Conflict with the Texas Coastal Zone Management Plan (minor to major, depending on conflict) • Cause permanent loss or impairment of agricultural soils, or affect prime farmland (moderate) • Affect existing residences or business (moderate to major, depending on extent)
Recreation	• Interfere with access to coastal recreational shorelines or waterways (minor to moderate, depending on extent) • Cause the loss or displacement of an important recreational resource, such as recreational fishing sites and other water-dependent recreational activities (minor to major, depending on extent) • Degrade recreational value, as established in applicable public agency management plans or policies (minor to moderate, depending on extent)
Visual Resources	• Alter or impair a viewshed, scenic quality, or aesthetic value not consistent with applicable laws or regulations (minor to major, depending on extent) • Create a new source of substantial light or glare that would, over the long term, adversely affect nighttime views, especially from shoreline areas, adjacent water areas, and other locations where dark skies are an expected or protected value (minor to major, depending on extent)
Transportation	• Interfere with access to transportation routes, over the long term (minor to major, depending on extent) • Cause permanent decreases in the Level of Service of key transportation arteries (minor to major, depending on extent and severity of change in Level of Service) • Cause a substantial increase in maritime traffic (minor to major, depending on extent) • Cause a substantial increase in the risk of collisions or other incidents (e.g., grounding, air traffic accidents) (minor to major, depending on risk)
Air Quality	• Cause or contribute to a violation of National Ambient Air Quality Standards (major) • Cause or contribute to a violation of a Class I or Class II increment (the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant) (major) • Cause an adverse impact on air quality-related values in a Class I area (moderate to major, depending on extent) • Expose sensitive receptors to substantially increased pollutant concentrations (minor to major, depending on extent) • Increase emissions of criteria pollutants beyond limits allowed under Clean Air Act regulations (major) • Substantially increase the emissions of greenhouse gases (minor to moderate, depending on extent) • Create objectionable odors, resulting in adverse effects to a substantial number of people (minor to moderate, depending on extent)

Resource	Evaluation Criteria [a]
Noise	• Cause a substantial change in existing ambient noise levels on land (which would affect humans and wildlife) or underwater (which would affect marine wildlife) (minor to moderate, depending on extent) • Exceed U.S. Environmental Protection Agency recommended thresholds for noise levels at noise sensitive receptors (minor to moderate, depending on extent) • Violate state or local noise ordinances, limits, or standards, or applicable land use compatibility guidelines (minor to moderate, depending on extent)
Socioeconomics	Cause substantial change (minor to major, depending on extent) in: • Population or demographics • Housing demand or affordability • The local or regional economy, including employment levels and income • Availability or quality of public services (e.g., schools, emergency services, medical services) • Local and regional economic contributions of recreation and tourism • Local and regional economic contributions of marine commerce and shipping
Environmental Justice	• Cause adverse and disproportionate environmental, economic, social, or health impacts on minority or low-income populations (minor to major, depending on extent) • Cause adverse and disproportionate environmental health or safety risks to children (minor to major, depending on extent)
Safety and Security	• Cause adverse risks to public safety from operation of both onshore and offshore Project components (moderate to major, depending on extent) • Violate Federal safety regulations (major) • Disregard standard or best practices for safety and security of the facilities (minor to major, depending on standard/practice and extent)

[a] Impact characteristics (i.e., minor, moderate, or major) are indicated for each evaluation criteria to provide a framework for determining context and intensity.

In evaluating potential impacts on these resources from the proposed Project, the USCG and MARAD have considered mitigation measures recommended by cooperating agencies or subject matter experts and BMPs proposed by the Applicant to comply with Federal, state, and local requirements for permits and authorizations, and to reduce potentially adverse environmental effects if a license is issued for the proposed Project. In addition, recommendations from various agencies, including the USCG and MARAD, have factored in the impact analyses for each resource. A complete list of the Applicant's BMPs and agency recommendations is included in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures. The BMPs in Appendix M and N will be included in the ROD and License or OPSMAN if the proposed Project is approved.

3.3. WATER RESOURCES

3.3.1. Definition of the Resource

In this document, water resources are defined as the physical and chemical characteristics of any waterbodies or wetlands within, or in the vicinity of, the SPOT Project. Onshore water resources include groundwater, surface water, and wetlands. Offshore water resources include the coastal and marine waters from Mean Lower Low Water (MLLW; i.e., the lowest of the two low tides per day) to the Exclusive Economic Zone (EEZ) within the GoM. They are defined by physical and chemical characteristics of the marine environment that support biological resources. Biological resources are discussed in Section 3.4, Habitats, through Section 3.7, Threatened and Endangered Species.

GoM offshore environments, which include coastal and marine waters, are primarily influenced by temperature, salinity, dissolved oxygen (DO), turbidity, nutrients, pH, and toxic contaminants. Coastal waters are nearshore waters and are dominated by tides, nearshore circulation, freshwater discharge from rivers, and local precipitation. This area of mixing between freshwater and marine waters forms estuarine habitats such as marshes, mangroves, and coastal wetlands along the Gulf Coast. Marine waters are waters that generally lie seaward of coastal waters and are influenced largely by tides and currents, have salinity levels similar to the open ocean, and include the deepwater environment of the GoM.

The SPOT Project components and workspaces would intersect with or contain onshore water resources (onshore pipelines, ECHO Terminal, and Oyster Creek Terminal), as well as coastal water resources (offshore pipelines) and marine water resources (offshore pipelines and SPOT DWP).

3.3.2. Existing Threats

Threats to onshore water resources and the GoM include human encroachment (from increased populations), climate change, intensification of the dead zone, hazardous spills, introduction of non-native species, and human use (Love et al. 2013).

The population of Texas has grown over 20 percent since 2000, and nearly 40 percent of the population lives near the coast (Love et al. 2013). The Gulf Coast Region is defined as 141 counties in 5 states that have a minimum of 15 percent of the county land area within either a coastal watershed or a United States Geological Survey (USGS) coastal cataloging unit (NOAA 2011c; Love et al. 2013). These increasing populations stress the coastal ecosystem by altering coastal habitats and increasing the risk of damage to those habitats. Texas coasts have lost an increasing number of wetlands due to hydrologic changes from shoreline protection and development (Love et al. 2013).

Climate change has and continues to increase temperatures, alter ocean acidity, raise sea levels, and increase numbers and intensity of storms in the GoM. Increased temperatures can alter habitat, modify species' use of existing habitats, change precipitation patterns, and increase storm intensity (USEPA 2016a; USEPA 2016b; NASA 2019; Love et al. 2013). Increase of the ocean's acidity reduces available carbon that organisms use to build shells, which can alter food webs offshore (USEPA 2016a; NASA 2019; Love et al. 2013). Increasing ocean acidification also affects the ability of larvae from some marine organisms (e.g., sea urchins and oysters) to develop properly, and causes some fish larvae to lose their sense of smell, making them more vulnerable to predation. These effects may alter the number of larvae able to mature and reproduce (USEPA 2016e). Researchers predict that climate change will result in a reduction of the number of hurricanes in the GoM, but an increase in the intensity of storms that do occur. Model predictions also indicate that there will be increased rainfall associated with hurricanes in the GoM (Bruyère 2019; NASA 2019). One example is Hurricane Harvey, which produced record rainfall that was as much as 40 percent higher than rainfall from past storms (Waldman 2017). Current models show that sea level in the GoM could rise as much as 3 feet by 2100, which would contribute to loss of wetland habitats, alteration of coastal landscapes, increased coastal erosion, and an increase in saltwater intrusion into freshwater sources (USEPA 2016b; NASA 2019; Love et al. 2013).

The "dead zone" is an area of little to no oxygen that forms in the GoM during spring and summer months when excess nutrients from the Mississippi River (e.g., agricultural runoff, stormwater runoff, atmospheric deposition from burning fossil fuels) drain into the GoM and cause an overgrowth of algae. When the algae dies and sinks, it results in oxygen levels near the bottom that are too low to support most marine life. The dead zone can extend as far as 80 miles off the coast of Texas (Love et al. 2013).

With increased human presence and industry in and around the GoM, hazardous spills are likely to continue to occur. The Texas Groundwater Protection Committee (2019) reports that the leaks from petroleum storage tanks in heavily populated areas like Houston are the most common source of groundwater contamination. Currently, the largest sources of releases of toxic substances in the GoM are from the oil and gas, and chemical industries (Love et al. 2013). Spills cause damage to ecosystems, harm human health, and disrupt local economies (Love et al. 2013).

In addition, onshore and offshore vehicle and vessel traffic can result in impacts on noise levels, the amount of light visible during various times, and air quality. Increases in vessel traffic can also, in turn, increase the potential for spills in surface waters. Groundwater, surface waters, and wetlands can also be affected by fuel, particle, and salt-laden runoff from streets, highways, and storage facilities (Trumbull and Bae 2000).

Existing threats to water resources also include the introduction of non-native species to waterbodies when boats or trailers are not properly cleaned between uses (TPWD 2019l). Non-native species have been introduced to the GoM through various methods, such as ballast water, escapes from aquaculture facilities, and the aquarium trade (Love et al. 2013). These species upset the ecological balance and outcompete native species, altering the ecosystem and negatively affecting local economies (Love et al. 2013).

3.3.3. Groundwater

3.3.3.1. Existing Conditions

The onshore proposed Project would be within the area of the Gulf Coast aquifer, which is the major aquifer that underlies all or portions of the 54 counties within 5 states along the Gulf Coast and inland along the coastal plain. The Jasper, Evangeline, and Chicot aquifers make up the Gulf Coast aquifer and are composed of discontinuous sand, silt, clay, and gravel beds ranging from 700 feet to 1,300 feet in total thickness. The minimum depth of the Gulf Coast aquifer near the onshore SPOT Project area is approximately 700 feet (TWDB 2017); however, the surficial geology of the Texas Gulf Coast provides a direct hydrologic connection between surface water and the underlying Gulf Coast aquifer. This surficial layer allows groundwater utilization at depths less than 700 feet (TWDB 2006). The Gulf Coast aquifer provides groundwater support for approximately one third of the Texas population. The aquifer is used primarily for municipal, industrial, and irrigation purposes. Land subsidence in Texas has become common in recent years due to high utilization of groundwater in Harris, Galveston, Fort Bend, Jasper, and Wharton counties (TWDB 2017).

Within the State of Texas, the Gulf Coast aquifer runs parallel to the Texas coastline from the Louisiana/Texas state line to the United States/Mexico border and consists of six permeability zones (TWDB 2017). Water quality is variable relative to depth and location throughout the Gulf Coast aquifer.

Groundwater quality is based on the concentration of total dissolved solids (TDS), which is directly related to the level of groundwater flow. The primary source of recharge for the Gulf Coast aquifer system is precipitation and the largest recharge areas occur in southwestern Mississippi and parts of Louisiana (Scanlon. et al. 2011; Williamson and Grubb 2001). In areas where aquifers are recharged, TDS concentrations are low. In coastal areas, the mixing of seawater within recharge zones results in increased salinity and higher TDS concentrations. The best water quality is in the northeastern portion of the aquifer, which contains less than 0.067 ounces per gallon (500 milligrams per liter [mg/L]) TDS, with gradual water quality decline southward, reaching a maximum TDS concentration of about 1.3 ounces per gallon (10,000 mg/L).

Sole Source Aquifers

The USEPA designates sole source and principal aquifers pursuant to Section 1424(e) of the Safe Drinking Water Act. USEPA-designated sole source and principal source aquifers are aquifers designated as those that supply 50 percent or more of the drinking water for an area and for which there are no other reasonably available alternative sources if the aquifer becomes contaminated. Under the Safe Drinking Water Act, the USEPA may review any Federally funded projects in order to prevent possible aquifer contamination.

The closest sole source aquifer to the proposed Project is the Edwards aquifer, located more than 154 miles west-northwest from the onshore SPOT Project area. The Project would not impact any sole source aquifers.

Water Supply Wells and Springs

Texas Water Development Board and TCEQ databases indicate 25 public and private water supply wells within 150 feet of the onshore pipeline and terminal construction workspace (TCEQ 2018a; TWDB 2019). Table 3.3.3-1 provides details for the water wells within 150 feet of the Project workspace. No springs were identified in the Project workspace.

Table 3.3.3-1: Water Wells within 150 feet of the SPOT Project Workspace

Well ID [a]	Well Type	Approximate Well Depth (feet)	Distance from Centerline (feet)	Direction to Onshore Pipeline	Nearest Milepost	County	Private or Public
ECHO to Oyster Creek Pipeline							
TWDB ID: 6531208	Industrial	381	258.9	Southeast	0.1	Harris	Private
SDR ID: 220408	Industrial	376	113.5	Northwest	0.2	Harris	Private
PWS ID: 1010013	Public Water Supply	1,200	133.9	South	1.7	Harris	Public
TWDB ID: 6531209	Public Water Supply	1,201	149.3	South	1.7	Harris	Public
SDR ID: 37338	Domestic	296	91.9	East	10.3	Brazoria	Private
TWDB ID: 6530538	Public Water Supply	315	112.2	East	11.2	Brazoria	Public
TWDB ID: 6530537	Public Water Supply	513	110.6	East	11.2	Brazoria	Public
PWS ID: 0200390	Public Water Supply	513	131.9	East	11.2	Brazoria	Unknown

Well ID [a]	Well Type	Approximate Well Depth (feet)	Distance from Centerline (feet)	Direction to Onshore Pipeline	Nearest Milepost	County	Private or Public
TWDB ID: 6530706	Unused	194	46.3	Southeast	16.8	Brazoria	Unknown
TWDB ID: 6530705	Plugged/ Destroyed	618	51.2	Southeast	16.8	Brazoria	Unknown
TWDB ID: 6530701	Unused	195	84.9	Northwest	16.8	Brazoria	Unknown
SDR ID: 278775	Domestic	440	118.4	West	22.2	Brazoria	Private
SDR ID: 484670	Rig Supply	329	135.8	Southeast	23.5	Brazoria	Private
SDR ID: 457953	Public Water Supply	1,133	124.7	East	23.5	Brazoria	Public
SDR ID: 164206	Domestic	406	117.8	West	25.8	Brazoria	Private
SDR ID: 44551	Domestic	465	118.8	West	27.0	Brazoria	Private
SDR ID: 66856	Domestic	148	64.3	West	39.1	Brazoria	Private
SDR ID: 66855	Domestic	210	56.1	West	39.2	Brazoria	Private
SDR ID: 171328	Domestic	180	76.1	West	45.9	Brazoria	Private
SDR ID: 13136	Domestic	285	66.6	West	46.0	Brazoria	Private
Oyster Creek Terminal							
SDR ID:180169	Domestic	278	NA	East	NA	Brazoria	Private
Oyster Creek to Shore Pipelines							
PWS ID: 0200528	Inactive	145	3.3	West	3.0	Brazoria	Unknown
TWDB ID: 6562404	Industrial	145	12.8	Northeast	3.0	Brazoria	Private
SDR ID: 216009	Industrial	223	42.7	Northeast	3.3	Brazoria	Private
ID: 33313	Domestic	215	61.7	East	6.6	Brazoria	Private

Source: SPOT 2019n

Note: NA = not applicable; PWS = public water supply; SDR = submitted driller reports; TWDB = Texas Water Development Board

[a] Review distance of 150 feet based on Federal Energy Regulatory Commission requirements outlined in its *Guidance Manual for Environmental Report Preparation* (FERC 2017a).

Wellhead Protection Areas

Under the Safe Drinking Water Act, each state is required to develop and implement a Wellhead Protection Program to identify the recharge areas associated with public supply wells and to prevent contamination of drinking water supplies. An amendment to the Safe Drinking Water Act requires development of a broader-based Source Water Assessment Program, which includes using a watershed approach to assess potential contamination of both groundwater and surface water. The USEPA approved the Texas wellhead protection program on March 16, 1990. No known wellhead protection areas would be crossed by the Project.

Contaminated Groundwater

The onshore pipeline and terminal components would be located in developed areas with the potential presence of contaminated soils or groundwater from unrelated point and non-point sources. The Applicant reviewed environmental databases to identify potential sources of groundwater contamination within 0.25 mile of the Project. Seven sites were identified along the ECHO to Oyster Creek Pipeline. The results are summarized in Table 3.3.3-2.

Table 3.3.3-2: Potential Sources of Contaminated Groundwater within 0.25 Mile of the SPOT Project Workspace

Site Name	Distance from Workspace (feet)	Direction from Workspace	Nearest Milepost	Site in Relation to the Workspace	Type of Contamination
Kroger Fueling Facility	1,214	North	2.84	Up-gradient	Petroleum release from a LPST occurred in 2002. The LPST case received final closure in 2015.
Beamer Shell Gas Station	334	North	3.29	Up-gradient	Petroleum release from a LPST that contaminated groundwater. The LPST case opened in 2002 and, as of August 2019, the site is undergoing remediation.
Stop N Go Retail Gas Station	332	North	3.49	Up-gradient	Diesel fuel leak from a dispenser occurred in 2007. The release was not referred to the LPST Remediation Program.
Bell Bottom Foundation Company	950	South	7.00	Down-gradient	Petroleum release from a LPST was detected in 2008, and the LPST case received final closure in 2009.
O.F. Ewing Lease, Manvel Field	845	Northwest	16.3	Up-gradient	Elevated arsenic, barium, and chloride were detected in groundwater, which was measured to range from 2 to 16 feet below ground surface. Shallow groundwater flow is towards the southwest. As of October 2019, the site is classified as 'active' and groundwater monitoring reports are annually submitted to the RRC.
Quick Stop Retail Gas Station	1,226	East	21.6	Down-gradient	Petroleum release from a LPST. Monitoring and remediation activities began in 1996 and continued until 2005, when the LPST case received final closure.
F0901	475	East	39.6	Down-gradient	Former mercury meter measuring station that was remediated. The RRC issued final site closure in 2010.

Source: TCEQ 2019c; SPOT 2019gg

LPST = leaking petroleum storage tank; RRC = Railroad Commission of Texas

3.3.3.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on groundwater resources. The study area within which potential impacts were assessed includes the SPOT Project workspace and areas down-gradient within 5 to 8 miles of the Project components to account for any impacts on aquifers and the potential movement of groundwater.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on groundwater have been evaluated based on their potential to:

- Violate a Federal, state, local, or Federally recognized international water quality criterion or waste discharge requirement;
- Degrade groundwater quantity or quality; and/or

- Cause irreparable harm to human health or aquatic life.

The remainder of this section describes the effects of Project construction and operation on groundwater and water wells from soil compaction, ground disturbance, installation of impervious surfaces, and accidental spills of hazardous materials. This section also discusses the potential for the Project to encounter previously contaminated groundwater.

Pipeline Construction

Project construction would not substantially affect groundwater resources because the majority of construction would include shallow, temporary excavation for the pipeline trench. Surficial aquifers and aquifer recharge areas could sustain indirect effects from changes in overland sheet flow due to clearing and grading of the workspace. Heavy construction equipment, including equipment used for clearing and grading the right-of-way, could cause compaction and could reduce the ability of soils to absorb water in some areas, thus affecting the ability and/or speed in which water enters the aquifer. The addition of impervious surfaces at the terminal facilities could also affect recharge areas within the boundaries of the facilities.

Trenches for onshore pipeline installation would be excavated using a track-mounted excavator or similar equipment to a depth sufficient to allow a minimum of 3 feet of cover (unless otherwise specified) between the top of the pipe and the final land surface after backfilling. Following construction, the Applicant would restore the ground surface contours as closely as possible to preconstruction conditions and would revegetate the right-of-way to ensure restoration of preconstruction overland flow and recharge patterns in accordance with the Applicant's Construction BMPs (Appendix M; BMP #1 in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures). Additionally, in agricultural, residential, and wetland areas, the Applicant would decompact subsoil via plow or other deep tillage methods before replacing topsoil (BMP #1), which would allow water to percolate through the soils.

In areas where groundwater is near the surface, trench excavation may intersect the water table. If groundwater enters the trench to the extent trench dewatering is required, dewatering of the trench would result in a temporary fluctuation or drawdown of the groundwater in that area. When trench dewatering is necessary, filter bags, silt fencing, or hay bale structures would be used to minimize the potential for erosion or sedimentation, and trench water would be released into well-vegetated upland areas where it would be reabsorbed, in accordance with the Applicant's Construction BMPs (Appendix M; BMP #1 in Appendix N). The discharged groundwater would filter back through the soil to enter the groundwater system again. In addition, the Applicant would require contractors to use drip pans for all heavy equipment stored overnight in the Project workspace (BMP #32 in Appendix N). Therefore, impacts on groundwater from construction of the onshore pipelines would be indirect, adverse, short-term, and minor.

Aboveground Facilities

The Applicant anticipates using two existing laydown yards during onshore construction. Use of these yards would not result in impacts on groundwater resources, as they would continue to be used for their current purpose, and no groundwater resources are present within or near these yards. No contractor yards have been identified by the Applicant at this time. Any construction activities associated with new pipe or contractor yards would be limited to clearing and grading. These activities could result in soil compaction over the course of the construction period; however, the likely size of any pipe or contractor yard would be small and compaction would have very little effect on groundwater resources in the area. However, because new pipe and contractor yards have not been identified as of the publication of this EIS, the effects on groundwater at these locations cannot be evaluated.

Construction of the new Oyster Creek Terminal and modifications to the existing ECHO Terminal would involve the conversion of vegetation cover to impervious surface. This conversion would result in a long-term impact on the recharge area of the Gulf Coast aquifer. However, as noted in Section 3.3.3.1, Water Resources, Groundwater: Existing Conditions, the largest recharge area for the aquifer is located in Mississippi and Louisiana, northeast of the Project. Therefore, groundwater impacts from construction and modification of the terminals would be direct, highly localized, adverse, long-term, and negligible.

Water Use and Quality

Construction of the onshore pipelines could affect well yields and water quality of wells near the workspace. To protect water wells within 150 feet of the construction workspace, the Applicant would establish temporary boundaries, including barricades and/or fencing around each wellhead to prevent construction vehicles from entering well areas (BMP #2 in Appendix N). Erosion control devices would be placed around wellheads to prevent erosion from reaching the area (BMP #2). The Applicant would also require that any refueling occur at least 200 feet from water wells (see Appendix F, Applicant's Onshore Construction Spill Response Plan; BMP #3 in Appendix N).

For water wells within the permanent easement, the Applicant would consult with the landowners prior to construction to determine acceptable mitigation measures, which may include:

- Closing and capping the well by a licensed water well contractor (BMP #2);
- Installing a new water well outside the permanent easement (BMP #2); and/or
- Providing the landowner with an alternate water source (BMP #2).

With implementation of these measures, impacts on water wells within 150 feet of the construction workspace would be direct, adverse, short-term, and minor.

Accidental Spills of Hazardous Materials

Contamination caused by spills of hazardous materials during construction could infiltrate the ground and reach unconfined aquifers and shallow groundwater areas. The greatest risk to groundwater resources due to accidental spills during construction would be associated with refueling or storage of fuel, oil, or other fluids. If not adequately cleaned up, contaminated soil could continue to leach and add pollutants to groundwater long after a spill occurred. By restricting the location of refueling and storage areas, and by cleaning up any inadvertent releases, the potential effects associated with spills or leaks of hazardous liquids would be avoided or minimized.

To minimize groundwater impacts, the Applicant would implement its Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), which includes:

- Secondary containment for the storage of hazardous materials (BMP #3);

- Secondary containment capable of containing 110 percent of the volume of hazardous materials (BMP #3);
- Daily inspections of tanks for leaks (BMP #3); and
- Restricting refueling and transferring of liquids to pre-designated locations away from sensitive areas (BMP #3).

The Construction Spill Response Plan also specifies actions to contain and clean up a spill if one were to occur, including:

- Using adsorbent pads for minor leak cleanup (BMP #3);
- Stopping or diverting flow to temporary containment areas (BMP #3);
- Immediately constructing temporary containment structures, if necessary (BMP #3); and
- Collecting, storing, and properly disposing of contaminated materials (BMP #3).

During construction, the Applicant's Environmental Inspectors (EIs) would ensure compliance with the Construction Spill Response Plan. With implementation of these measures, impacts on groundwater due to an inadvertent release of hazardous materials during construction would be direct, adverse, short-term, and minor. During operation, an oil spill on land could lead to contamination of groundwater. Generally, a land-based oil spill is easier to contain than one that occurs offshore, and remediation activities can be conducted to reduce or eliminate contaminants in soil and prevent ongoing contamination to groundwater. Drinking water transported through a pipeline from Freeport to Surfside Beach is unlikely to be affected if an oil spill occurred because the water is contained within a pipe along the Bluewater Highway, thus protecting it from contamination. However, an oil spill that reached a water supply well could contaminate water at the well over time if not properly cleaned up.

Research indicates that biodegradation of oil in the anaerobic zone of soils is very slow and can be a source of groundwater contamination when water percolates through the contaminated soils (Duffy et al. 1980). To minimize the impacts of an oil spill, the pipelines would be constructed with shutdown valves to allow sections of the pipeline to be isolated. Shutdown valves would limit the continuous flow of oil once a leak is detected. Storage tanks at the Oyster Creek Terminal would be contained within a concrete ring lined with an impermeable membrane. A leak detection system would be installed within the concrete ring for each storage tank. The seven new storage tanks would be installed within a secondary containment berm designed per National Fire Protection Association (NFPA) requirements, and would be capable of containing 110 percent of the capacity of one storage tank. Berms would also be installed around each individual tank, and would be capable of holding 10 percent of each storage tank (i.e., 68,500 bbl).

The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3). Oil would flow from the opening under operating pressure until the line is depressurized and the leaking segment is isolated. The Applicant provided hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions). These include:

- Booming-containment
- Skimming
- Physical herding

- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

Table 3.3.3-3: SPOT Project Isolatable Sections for Project Components

Isolatable Section	Volume (cubic feet)	Oil Barrels (bbl)
ECHO Terminal to MLV 1	263,493	46,930
MLV 1 to MLV 2	307,160	54,708
MLV 2 to MLV 3	333,658	59,427
MLV 3 to MLV 4	294,470	52,447
MLV 4 to MLV 5	210,869	37,557
MLV 5 to MLV 6	342,242	60,956
MLV 6 to Oyster Creek Terminal	117,937	21,005
Oyster Creek Terminal Incoming Metering and Manifold	125,832	22,412
Oyster Creek Terminal Storage Tanks	3,366,000 [a]	599,510
Oyster Creek Terminal Export Metering and Pumps	2,400,000	427,458
Oyster Creek Terminal to MLV 7	197,060	35,098
MLV 7 to Shore Crossing [b]	251,945	44,873
Subsea Pipeline [b]	1,775,392	316,211
SPOT Platform Oil Metering	320,000	56,994
Subsea Flowline and Oil PLEM	10,000	1,781
Buoy	10,000	1,781
Very Large Crude Carrier	11,269,000	2,007,095

Source: SPOT 2019w, Metric Conversions 2018

MLV = mainline valve; PLEM = pipeline end manifold; SPOT = Sea Port Oil Terminal

[a] Total capacity of one storage tank assuming the operating level is 50 percent of the tank's capacity.

[b] Relocating MLV 7 to the north side of Bluewater Highway affected the volumes in individual isolatable sections, but did not affect the total volume in comparison with the Draft EIS.

Use of the response actions described would minimize the impacts associated with an oil spill. With implementation of the safety measures and BMPs described above, impacts on groundwater due to an oil spill would be direct and indirect, adverse, and depending on the size of the spill, could be short-term or long-term, and moderate to major.

Contaminated Groundwater

Contaminated groundwater from facilities identified within 0.25 mile of the Project workspace could be encountered during construction. The Beamer Shell Gas Station identified in Table 3.3.3-2 is located up-gradient, 334 feet from the Project workspace. The leaking petroleum storage tank caused groundwater contamination and is currently undergoing remediation. Additionally, the O.F. Ewing Lease, Manvel Field site is active and elevated levels of contaminants have been reported in shallow groundwater from 2 to 16 feet. Groundwater sampling reports are submitted annually for the site. If contaminated groundwater is encountered (e.g., odor, staining, sheen, drums, other containers potentially containing contaminants) during construction of the onshore pipelines, the construction contractor would bring an industrial hygienist or other suitable professional on site to determine what additional safety precautions are necessary. The Applicant would implement its Unanticipated Discovery of Contamination Plan (Appendix O; BMP #4 in Appendix N) in the event contaminated soil or groundwater is encountered, which includes, in part:

- The Applicant's Chief Inspector, EI, or designee would consult with SPOT Project personnel to determine whether notifications are required to an appropriate response agency.
- If an immediate or imminent threat to human health or the environment does not exist or has been abated, the Applicant's EI in coordination with the construction contractor would takes steps to contain the contamination. Measures may include:
  - Installing trench breakers;
  - Placing spoil on plastic sheeting;
  - Covering spoil with plastic sheeting;
  - Diverting stormwater away from the contaminated area; and/or
  - Other necessary steps to minimize the chance of contaminant migration.
- If contaminated spoil does not require off-site disposal, contaminated soils would be properly maintained until the pipeline is lowered into the trench and backfilling could occur.
- During backfilling, the Applicant's EI and/or the construction personnel would take reasonable steps to ensure the contaminated soil is contained to the original area of contamination.
- Should trench dewatering be required for contaminated groundwater, then the water would be either discharged elsewhere (if allowable under applicable discharge permits) or disposed off site. If discharge or off-site disposal did not occur at the time of dewatering, then contaminated groundwater would be temporarily stored in frac tanks until ready for discharge or off-site disposal.

Therefore, impacts associated with encountering contaminated groundwater would be direct, adverse, short-term to long-term, and minor to moderate depending on what contaminants are present in groundwater and where disposal would occur.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the Stormwater Pollution Prevention Plan (SWPPP, BMP #14 in Appendix N). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

3.3.4. Surface Water

3.3.4.1. Existing Conditions

Surface water resources consist of rivers, streams, lakes, ponds, and larger open water systems, as well as natural and manmade features, and are defined by properties such as seasonal flow and water quality, including salinity. Surface water resources are commonly used for consumption, irrigation, recreation, and industrial activities. The area of influence for considering potential impacts on surface waters includes resources that would be within the onshore pipelines and terminal workspaces, as well as hydrologically connected water resources immediately downstream of construction workspaces.

The Project would cross 129 waterbodies (128 crossings associated with pipeline facilities and workspace and 1 crossing associated with an access road), including 48 perennial waterbodies, 21 intermittent waterbodies, 50 ephemeral waterbodies, and 10 ponds. Perennial waterbodies are waterbodies that have a continuous flow; intermittent waterbodies are waterbodies that have a seasonal, discontinuous flow; ephemeral waterbodies are waterbodies that have an isolated flow—one which only occurs during rain events; and ponds are isolate perennial waterbodies with no direct hydrologic connectivity with other waterbodies.

Table 3.3.4-1 summarizes the flow regime of waterbody crossing by pipeline segment. A complete list of waterbody crossings is included in Table 3.3.4-5.

The USACE Galveston District determines navigable waters on a case-by-case basis through the USACE Section 10 permitting process. The onshore terminal and pipelines would cross 13 Section 10 waters in the USACE Galveston District.

Table 3.3.4-1: Waterbody Crossings by the Onshore Pipeline and Terminal

Flow Regime	Number of Waterbodies Crossed by the Centerline [a]
ECHO to Oyster Creek Pipeline	
Ephemeral [b]	48
Intermittent [c]	20
Perennial [d]	35
Pond [e]	7
Total ECHO to Oyster Creek Crossings	**110**
Oyster Creek to Shore Pipelines	
Ephemeral	2
Intermittent	1
Perennial	12
Pond	3
Total Oyster Creek to Shore Crossings	**18**
Access Road	
Perennial	1
Total Access Road Crossings	**1**

Source: SPOT 2019ff

ECHO = Enterprise Crude Houston
[a] The numbers in this column refer to the number of distinct waterbodies that would be crossed by the onshore pipeline centerline. Some individual waterbodies may be crossed multiple times.
[b] Ephemeral: isolated flow, only during rain events.
[c] Intermittent: seasonal flow, discontinuous.
[d] Perennial: continuous flow.
[e] Pond: isolated perennial waterbody, no direct hydrologic connectivity with other waterbodies.

Watersheds

The proposed Project is within the West Galveston Bay and the Austin-Oyster watersheds (USGS 2018a). A summary of pipeline components and watersheds is provided in Table 3.3.4-2.

Table 3.3.4-2: Watersheds Crossed by the Onshore Pipelines and Terminals for the SPOT Project

Project Component	Watershed(s) [a]	Hydrologic Unit Code (HUC8) [a]	Approximate Milepost Range	Approximate Watershed Drainage Area (square miles)
ECHO Terminal	West Galveston Bay	12040204	0	1,213
ECHO to Oyster Creek Pipeline	West Galveston Bay	12040204	0-32	1,213
	Austin-Oyster	12040205	33-50	697
Oyster Creek Terminal	Austin-Oyster	12040205	NA	697
Oyster Creek to Shore Pipelines	Austin-Oyster	12040205	0-12	697
MLV 1, 2, 3, and 4 – ECHO to Oyster Creek Pipeline	West Galveston Bay	12040204	7, 15, 24, and 32 [b]	1,213
MLV 5 and 6 – ECHO to Oyster Creek Pipeline	Austin-Oyster	12040205	38, 47 [c]	697
MLV 7 and shoreline MLV – Oyster Creek to Shore Pipelines	Austin-Oyster	12040205	5, 12 [d]	697

NA = not application; MLV = mainline valve

[a] Source: USGS 2020

[b] Values represent the milepost location for MLVs 1 through 4.

[c] Values represent the milepost location for MLVs 5 and 6.

[d] Values represent the milepost location for MLV 7 and shoreline MLV.

Surface Water Classification

Section 303(d) of the CWA requires that states review, establish, and revise water quality standards for the surface waters within their state. Each state develops a classification system and establishes monitoring and mitigation programs. Any waters that fail to support their designated use are considered impaired waters and are listed as such on a state's 303(d) list of impaired waters. Title 30, Chapter 307 of The Texas Administrative Code, also known as the Texas Surface Water Quality Standards, classifies the four categories of designated surface water use and the conditions that must be met for each category of use to be fully supported, partially supported, or not supported. These designated use categories are:

- Aquatic life
- Contact recreation
- Public water supply
- Fish consumption

Each designated category is evaluated by a statewide water quality assessment program on the numerical or narrative limits for their biological, chemical, and physical properties. These conditions are monitored in segments and subsegments of state-designated waterbodies. In order to manage the large number of surface waters in the state, TCEQ identifies the major surface waters and classifies them as segments. The TCEQ aggregates segments of waterbodies by basin. Basins are classified as either river basins, coastal basins, bay basins, or GoM basins. The TCEQ is responsible for enforcing and maintaining these state water quality standards along with determining the appropriate uses for the state's surface waters. The TCEQ assesses the condition and status of the state's surface water quality every 2 years (TCEQ 2019d).

Impaired Surface Waters

The TCEQ utilizes a statewide water quality assessment program to assess water quality parameters for each segment and subsegment to identify whether the designated use is fully supported, partially supported, or not supported. The segments and subsegments are then assigned to one of five categories:

- Category 1—attaining the water quality standard and no use is threatened;
- Category 2—attaining some of the designated uses, no use is threatened, and insufficient or no data and information are available to determine if remaining uses are attained or threatened;
- Category 3—insufficient or no data and information to determine if any designated use is attained;
- Category 4—standard is not supported or is threatened for one or more designated uses but does not require the development of a total maximum daily load (TMDL);
  - Category 4a—TMDL has been completed and approved by the USEPA;
  - Category 4b—other pollution control requirements are reasonably expected to result in the attainment of the water quality standard in the near future;
  - Category 4c—nonsupport of the water quality standard is not caused by a pollutant;
- Category 5—Category 5 is the 303(d) list; the waterbody does not meet applicable water quality standards or is threatened for one or more designated uses by one or more pollutants;
  - Category 5a—TMDL is underway, scheduled, or will be scheduled;
  - Category 5b—review of the water quality standards will be conducted before a TMDL is scheduled; and
  - Category 5c—additional data and information will be collected before a TMDL is scheduled (TCEQ 2018c).

A list of impaired waters crossed by the Project is provided in Table 3.3.4-3.

Table 3.3.4-3: Major Impaired Surface Waters and Segments Crossed by SPOT Project Onshore Pipelines

Basin Name	Segment Name	TCEQ Impairment Classification	Impairment Category/Reason
San Jacinto-Brazos Coastal Basin	Clear Creek above Tidal	Contact recreation and fish consumption	5a/PCBs in edible tissue
San Jacinto-Brazos Coastal Basin	Chocolate Bayou above Tidal	Contact recreation	5c/bacteria
San Jacinto-Brazos Coastal Basin	Chocolate Bayou above Tidal	Contact recreation	5c/bacteria
San Jacinto-Brazos Coastal Basin	Austin Bayou above Tidal	Contact recreation	5c/bacteria
San Jacinto-Brazos Coastal Basin	Flores Bayou	Contact recreation	5c/bacteria
San Jacinto-Brazos Coastal Basin	Bastrop Bayou	Contact recreation	5c/bacteria
San Jacinto-Brazos Coastal Basin	Oyster Creek	Contact recreation	5c/bacteria

Source: TCEQ 2018b, 2018c

PCB = polychlorinated biphenyls; TCEQ = Texas Commission on Environmental Quality

Nationwide Rivers Inventory

The Nationwide Rivers Inventory (NRI) is a listing of more than 3,200 free-flowing river segments in the United States that are believed to possess one or more “outstandingly remarkable” values (NPS 2019a). There are no NRI rivers crossed by the SPOT Project. A reach of the Neches River north of its confluence with Pine Island Bayou is the nearest NRI river to the Project, is located about 74.5 miles northeast of the existing ECHO Terminal, and is within a separate watershed from the SPOT Project.

Flood Hazard Zones

Executive Order 11988, Floodplain Management, requires each Federal agency to ensure that the potential effects of any action it may take in a floodplain be evaluated. According to Federal Emergency Management Agency National Flood Insurance Rate Maps, the proposed Oyster Creek Terminal would be located within the 100-year flood zone and portions of the onshore pipelines would cross both 100-year flood zones and 500-year flood zones, as detailed in Table 3.3.4-4. MLVs 1, 5, 7, and the shoreline MLV are all located in the 100-year flood zone (FEMA 2020a). The remaining sections of onshore pipelines and the existing ECHO Terminal are not located in a flood hazard zone.

Table 3.3.4-4: Flood Hazard Zones Crossed by the SPOT Project

Project Component/County	Miles of Pipeline in the 100-Year Flood Zone	Miles of Pipeline in the 500-Year Flood Zone
ECHO to Oyster Creek Pipeline		
Harris (MP 0 to MP 9.5)	6.2	0
Brazoria (MP 9.5 to MP 50.1)	14.1	0.97
Total	**20.3**	**0.97**
Oyster Creek to Shore Pipelines		
Brazoria (MP 0 to MP 12.2)	11.2	0.89
Total	**11.2**	**0.89**

SPOT 2019a, Application, Vol IIb, Section 2; FEMA 2020a

MP = milepost

3.3.4.2. Waterbody Crossing Procedures

A description of alternative pipeline routes evaluated to minimize impacts on waterbodies is provided in Section 2.5, Alternative Onshore Pipeline Routes. A complete list of waterbody crossings and crossing methods are provided in Table 3.3.4-5.

Table 3.3.4-5: Waterbodies Crossed and Crossing Methods for the SPOT DWP Onshore Pipelines

Pipeline Segment/ Milepost	Feature ID	Flow Regime	Waterbody Name	Crossing Method	Approximate Crossing Length at Centerline [a] (feet)	Temporary Impacts (acres)	Permanent Impact (acres)
ECHO to Oyster Creek Pipeline							
0.4	SE001	Intermittent	unnamed waterbody	HDD 1	33.18	0.00	0.00
1.4	SB001	Perennial	Tributary to Turkey Creek	HDD 3	37.60	0.00	0.00
1.9	SB002	Perennial	Sub-tributary to Turkey Creek	HDD 4	16.71	0.00	0.00
2.2	SB003	Intermittent	Turkey Creek	HDD 5	23.35	0.00	0.00
2.4	SA001	Perennial	Turkey Creek	Bore 2	6.00	0.00	0.00
2.7	SA003	Ephemeral	Sub-tributary to Turkey Creek	HDD 6	1.76	0.00	0.00
3.4	SA004	Perennial	unnamed waterbody	HDD 7	19.78	0.00	0.00
3.7	SA005	Perennial	unnamed waterbody	HDD 7	45.16	0.00	0.00
6.3	SA007	Ephemeral	unnamed waterbody	Open Cut	3.01	0.01	0.00
6.5	SA008	Perennial	unnamed waterbody	Open Cut	17.54	0.05	0.00
6.7	SA009	Ephemeral	unnamed waterbody	Open Cut	2.02	0.01	0.00
7.4	SA010	Perennial	Tributary to Clear Creek	HDD 10	13.87	0.00	0.00
7.6	SE003	Perennial	Tributary to Clear Creek	HDD 10	20.01	0.00	0.00
8.9	SB004	Ephemeral	unnamed waterbody	Bore 12	0.00	0.00	0.00
9.0	SB005	Perennial	unnamed waterbody	Open Cut	4.86	0.02	0.00
9.4	PB005	Pond	unnamed pond	HDD 11	73.01	0.00	0.00
9.5	SB006	Perennial	Clear Creek [g]	HDD 11	25.66	0.00	0.00
9.7	SB007	Ephemeral	unnamed waterbody	Open Cut	22.78	0.08	0.00
10.7	SB008	Ephemeral	Tributary to Clear Creek	Open Cut	12.00	0.25	0.00
11.2	SB009	Ephemeral	unnamed waterbody	Bore 16	3.00	0.000	0.00
11.3	SB010	Perennial	unnamed waterbody	Open Cut	28.93	0.15	0.00
11.4	SB012	Ephemeral	unnamed waterbody	Open Cut	2.55	0.01	0.00
11.7	SB011	Ephemeral	unnamed waterbody	Bore 17	7.76	0.00	0.00
12.5	PB002	Pond	unnamed pond	HDD 12	0.04	0.00	0.00
13.2	SB013	Ephemeral	Tributary to North Fork Marys Creek	Bore 19	6.00	0.00	0.00
13.4	SB014	Perennial	North Fork Marys Creek	HDD 13	27.68	0.00	0.00
13.4	SB015	Ephemeral	Tributary to North Fork Marys Creek	HDD 13	0.00	0.00	0.00
15.1	SB016	Perennial	American Canal	Bore 21	35.98	0.00	0.00
16.4	SC033	Perennial	Sub-tributary to Mustang Bayou	Open Cut	12.46	0.04	0.00
16.4	SC034	Perennial	Sub-tributary to Mustang Bayou	Open Cut	11.29	0.03	0.00

Pipeline Segment/ Milepost	Feature ID	Flow Regime	Waterbody Name	Crossing Method	Approximate Crossing Length at Centerline [a] (feet)	Temporary Impacts (acres)	Permanent Impact (acres)
17.5	SC032	Perennial	Mustang Bayou	Bore 29	106.39	0.00	0.00
17.6	SC031	Ephemeral	unnamed waterbody	Open Cut	8.14	0.02	0.00
19.2	SB017	Ephemeral	Sub-tributary to Chocolate Bayou	Open Cut	0.00	0.01	0.00
19.2	SB018	Ephemeral	Sub-tributary to Chocolate Bayou	Open Cut	10.00	0.02	0.00
19.2	SB019	Ephemeral	Sub-tributary to Chocolate Bayou	Open Cut	9.40	0.02	0.00
19.4	SB020	Perennial	Sub-tributary to Chocolate Bayou	Open Cut	48.98	0.11	0.00
19.8	SB021	Perennial	Chocolate Bayou [g]	Open Cut	16.98	0.03	0.00
21.7	SB023	Perennial	Briscoe Canal	Bore 32	44.96	0.00	0.00
22.3	SA015	Ephemeral	Tributary to Briscoe Canal	Open Cut	22.14	0.06	0.00
22.5	SA016	Ephemeral	unnamed waterbody	Open Cut	2.13	0.01	0.00
23.3	SA017	Intermittent	Chocolate Bayou	Open Cut	20.11	0.05	0.00
23.6	SA013	Intermittent	Tributary to Chocolate Bayou	Open Cut	33.61	0.08	0.00
23.6	SA014	Intermittent	Tributary to Chocolate Bayou	Open Cut	11.30	0.06	0.00
24.1	SA018	Intermittent	unnamed waterbody	Open Cut	31.52	0.07	0.00
24.6	SB042	Ephemeral	Tributary to West Fork Chocolate Bayou	Open Cut	11.91	0.03	0.00
24.8	SB043	Perennial	West Fork Chocolate Bayou	Open Cut	23.52	0.06	0.00
25.1	SA011	Ephemeral	unnamed waterbody	HDD 14	14.98	0.00	0.00
25.3	PA012	Pond	unnamed pond	HDD 14	0.00	0.00	0.00
25.5	SB025	Perennial	Tributary to West Fork Chocolate Bayou	HDD 14	17.77	0.00	0.00
26.6	SB030	Perennial	Tributary to West Fork Chocolate Bayou	Bore 34	41.12	0.00	0.00
27.9	SB036	Perennial	Sub-tributary to Hayes Creek	HDD 15	0.00	0.00	0.00
28.0	PB007	Pond	unnamed pond	HDD 15	0.00	0.00	0.00
28.0	SB037	Perennial	Tributary to Hayes Creek	HDD 15	21.91	0.00	0.00
28.1	SB046	Ephemeral	unnamed waterbody	HDD 15	6.00	0.00	0.00
28.2	SB047	Ephemeral	unnamed waterbody	HDD 15	8.00	0.00	0.00
29.5	SB027	Perennial	Tributary to South Texas Water Company Canal	Bore 37	25.04	0.00	0.00
29.5	SB028	Perennial	Tributary to South Texas Water Company Canal	Bore 37	23.07	0.00	0.00

Pipeline Segment/ Milepost	Feature ID	Flow Regime	Waterbody Name	Crossing Method	Approximate Crossing Length at Centerline [a] (feet)	Temporary Impacts (acres)	Permanent Impact (acres)
29.6	SB029	Intermittent	Tributary to South Texas Water Company Canal	Open Cut	9.37	0.03	0.00
29.6	SB031	Ephemeral	unnamed waterbody	Open Cut	0.00	0.01	0.00
29.9	SB032	Ephemeral	unnamed waterbody	Open Cut	5.78	0.01	0.00
30.3	SB033	Perennial	Tributary to South Texas Water Company Canal	Open Cut	51.63	0.12	0.00
30.4	SB034	Ephemeral	unnamed waterbody	Open Cut	0.00	0.01	0.00
30.7	SC020	Ephemeral	unnamed waterbody	Open Cut	15.87	0.04	0.00
31.9	SC002	Intermittent	Tributary to South Texas Water Company Canal	Open Cut	45.36	0.11	0.00
32.1	SC003	Ephemeral	Sub-tributary to South Texas Water Company Canal	Open Cut	4.12	0.01	0.00
32.5	SC017	Perennial	unnamed waterbody	HDD 16	47.05	0.00	0.00
33.6	SB056	Perennial	Tributary to Austin Bayou	Open Cut	50.37	0.13	0.00
33.6	SB057	Perennial	unnamed waterbody	Bore 39	30.00	0.00	0.00
33.9	SB055	Ephemeral	Sub-tributary to Austin Bayou	Bore 40	4.00	0.00	0.00
33.9	SX011	Ephemeral	unnamed waterbody	Bore 40	4.00	0.00	0.00
34.6	SC019	Intermittent	Sub-tributary to Austin Bayou	Open Cut	23.58	0.06	0.00
34.7	SC028	Perennial	Austin Bayou [g]	Bore 41	25.34	0.00	0.00
34.9	SC029	Ephemeral	Tributary to Austin Bayou	Open Cut	8.36	0.02	0.00
35.3	SC023	Intermittent	unnamed waterbody	Bore 42	15.00	0.00	0.00
35.6	SC024	Intermittent	unnamed waterbody	Open Cut	15.13	0.03	0.00
35.6	SC025	Ephemeral	unnamed waterbody	Open Cut	10.00	0.00	0.00
35.6	SF007	Ephemeral	Sub-tributary to South Texas Water Company Canal	Open Cut	26.78	0.04	0.00
35.9	SC026	Ephemeral	unnamed waterbody	Open Cut	6.00	0.01	0.00
36.4	PC027	Pond	unnamed pond	Open Cut	15.35	0.22	0.00
36.4	SA020	Ephemeral	unnamed waterbody	Open Cut	2.00	0.00	0.00
36.7	SA022	Ephemeral	unnamed waterbody	Open Cut	4.91	0.01	0.00
36.9	SA023	Ephemeral	unnamed waterbody	Open Cut	5.00	0.01	0.00
37.3	SA024	Ephemeral	unnamed waterbody	Open Cut	4.00	0.01	0.00
37.4	SA025	Perennial	unnamed waterbody	Open Cut	49.58	0.12	0.00
38.2	SC030	Intermittent	Tributary to Flores Bayou	Open Cut	21.78	0.05	0.00
38.4	SA026	Perennial	Flores Bayou [g]	Bore 43	24.64	0.00	0.00
38.4	SA027	Ephemeral	Tributary to Flores Bayou	Bore 43	0.00	0.00	0.00
38.9	SA028B	Intermittent	Tributary to Flores Bayou	Open Cut	5.01	0.04	0.00

Pipeline Segment/ Milepost	Feature ID	Flow Regime	Waterbody Name	Crossing Method	Approximate Crossing Length at Centerline [a] (feet)	Temporary Impacts (acres)	Permanent Impact (acres)
39.1	SA029	Intermittent	unnamed waterbody	Open Cut	22.47	0.12	0.00
39.6	SA031	Ephemeral	unnamed waterbody	Open Cut	10.38	0.02	0.00
39.7	SA032	Ephemeral	unnamed waterbody	Open Cut	9.87	0.02	0.00
39.8	SA033	Ephemeral	unnamed waterbody	Open Cut	7.53	0.02	0.00
40.0	SA034	Intermittent	unnamed waterbody	Open Cut	22.34	0.05	0.00
40.2	SA035	Intermittent	unnamed waterbody	Open Cut	9.93	0.02	0.00
40.6	SA036	Perennial	unnamed waterbody	Open Cut	92.35	0.24	0.00
40.7	SB051	Ephemeral	unnamed waterbody	Open Cut	27.28	0.08	0.00
40.9	SB050	Ephemeral	Sub-tributary to Flores Bayou	Open Cut	3.04	0.01	0.00
41.5	SB049	Ephemeral	Sub-tributary to Flores Bayou	Open Cut	4.09	0.01	0.00
41.6	SB048	Ephemeral	Sub-tributary to Flores Bayou	Bore 44	24.52	0.00	0.00
42.1	SB044	Ephemeral	unnamed waterbody	Bore 46	4.00	0.00	0.00
42.1	SB045	Ephemeral	unnamed waterbody	Bore 46	8.00	0.00	0.00
43.1	PC012	Pond	unnamed pond	HDD 17	0.00	0.00	0.00
43.1	SC011	Intermittent	Tributary to Tigner-Farrer Reservoir	HDD 17	47.40	0.00	0.00
43.4	SC013	Ephemeral	Sub-tributary to Tigner-Farrer Reservoir	HDD 17	0.00	0.00	0.00
43.4	SC014	Intermittent	Sub-tributary to Tigner-Farrer Reservoir	HDD 17	14.94	0.00	0.00
43.5	SC015	Intermittent	Sub-tributary to Tigner-Farrer Reservoir	HDD 17	18.39	0.00	0.00
44.1	SC016	Intermittent	Sub-tributary to Bastrop Bayou	Bore 50	24.44	0.00	0.00
46.1	SB052	Ephemeral	unnamed waterbody	Bore 54	8.95	0.00	0.00
48.3	SB054	Perennial	Bastrop Bayou [f]	HDD 18	213.65	0.00	0.00
48.6	PX001	Pond	unnamed pond	HDD 18	0.00	0.00	0.00
Oyster Creek to Shore Pipelines							
1.6	PB015	Pond	unnamed pond	N/A	0.00	0.04	0.00
1.7	SB063	Perennial	Tributary to Bastrop Bayou [f]	Open Cut	44.79	0.07	0.00
1.9	SF003	Intermittent	Big Slough [g]	HDD 1 - OCS	363.77 [b]	0.00	0.00
2.1	SF004	Ephemeral	unnamed waterbody	Open Cut	0.00	0.07	0.00
2.2	PX008	Pond	unnamed pond	Open Cut	31.22	0.01	0.00
2.5	SB072	Ephemeral	Tributary to Salt Bayou	Open Cut	6.67	0.02	0.00
5.2	SB073	Perennial	Salt Bayou	Open Cut	164.46	0.27	0.00
6.4	PF001	Pond	unnamed pond	Open Cut	96.43	0.08	0.00
8.1	SF001B	Perennial	Oyster Creek [f]	HDD 2 - OCS	2,584.32	0.00	0.00

Pipeline Segment/ Milepost	Feature ID	Flow Regime	Waterbody Name	Crossing Method	Approximate Crossing Length at Centerline [a] (feet)	Temporary Impacts (acres)	Permanent Impact (acres)
8.5	SX002	Perennial	Tributary to Oyster Creek	Open Cut	70.58	0.41	0.00
8.8	PX005	Pond	unnamed pond	N/A	0.00	0.54	0.00
8.8	SX004	Perennial	Tributary to Oyster Creek	Open Cut	590.27	1.30	0.00
9.6	SB061F	Perennial	Tributary to Oyster Creek	Open Cut	77.37	0.18	0.00
9.7	SB061C	Perennial	Oyster Creek [f]	Open Cut	62.38	0.67	0.00
9.8	SB061B	Perennial	Oyster Creek [f]	Open Cut	96.91	0.31	0.00
10.0	SB061A	Perennial	Oyster Creek [f]	HDD 3 – OCSP	851.51	0.00	0.00
10.7	SB058	Perennial	Oyster Creek [f]	HDD 4 – OCSP	1,197.46	0.00	0.00
11.3	SB060	Perennial	Oyster Creek/ICW [f]	HDD 5 – OCSP	1,289.71	0.00	0.00
11.8	SB059	Perennial	Swan Lake [f]	HDD 5 - OCSP	2,303.35	0.00	0.00
12.1	PC008	Pond	unnamed pond`	Open Cut	15.67	0.2	0.00
Oyster Creek to Shore Crossing/Subsea Pipelines							
NA	OC001	Open Water	Gulf of Mexico [f]	Open Water	281,302.00 [c]	1,212 [d]	0.00
Access Road							
Unknown	SB062	Perennial	Tributary to South Texas Water Company Canal	Culvert - Existing	17.00 [e]	0.00	0.01 [e]
Project Total					**293,342.42**	**1,219.13**	**0.01**

Source: SPOT 2019ff

ECHO = Enterprise Crude Houston; HDD = horizontal directional drill; ICW = Intracoastal Waterway; ID = identification; NA = not applicable; OCSP = Oyster Creek to Shore Pipelines

[a] Value of 0 indicates the feature is only crossed by workspace.

[b] Crossing length includes the total crossing length of two pipelines because stream is within a dual pipeline segment.

[c] The crossing length provided in this table was included in response to Information Request #214 on October 16, 2019 (SPOT 2019ff). However, the analysis within this EIS is based on an offshore pipeline length of 46.9 statute miles (247,632 feet) as presented in the application.

[d] This acreage is based on the impact acreage provided in the application.

[e] Existing impacts. The access road crossing of SB062 is an existing unimproved private road with a conveyance device that allows unimpeded stream flow. The unimproved road and conveyance device would be used as-is; if improvements are required, it would not result in an expansion of the current footprint.

[f] Identified by Texas General Land Office as state-owned submerged lands.

[g] Identified by Texas General Land Office as state-owned submerged lands in a letter dated March 9, 2020; Applicant indicates the crossing area is not considered state-owned submerged lands based on Texas General Land Office geographic information system data (SPOT 2021a).

Open Cut Construction Method

The Applicant proposes to use an open-cut construction method at 69 waterbodies, including 19 perennial, 13 intermittent, 33 ephemeral, and 4 ponds. A trench would be excavated across the streambed and banks using backhoes, dozers, mechanical ditchers, and/or draglines. For most open-cut crossings, equipment would be staged and operated outside the water's edge when water is present, unless approved by the USACE to operate in the streambed. Trench spoil would be placed in upland areas where possible. Where storage in wetlands or waterbodies would be required, alternating piles would be used to allow sheet flow. Following excavation, prefabricated pipe strings would be lowered into the trench, fitted with buoyancy control, and covered with backfill. Backfilling would start at the center of the stream and work back towards the bank. Following backfilling, the streambed would be stabilized using standard restoration methods (e.g., stabilize stream banks and install temporary sediment barriers within 24 hours of completing instream construction activities) and temporary vehicle crossings would be removed. Appendix M includes a full description of restoration methods. For waterbodies that are greater than 100 feet wide, the Applicant would install the pipeline with a minimum of 48 inches of cover, rather than the typical 36 inches.

Trenchless Crossing Methods

The Project would cross 59 waterbodies, including 28 perennial, 8 intermittent, 17 ephemeral, and 6 ponds, using a trenchless method (i.e., bore or HDD). The Applicant has proposed to use the bore method to cross 23 waterbodies and the HDD method to cross 36 waterbodies. Trenchless crossing methods are described in more detail under Specialized Construction Procedures in Section 2.2.5, Onshore Construction and Installation.

Water for Bore and Horizontal Directional Drill Operations

The Applicant would use the bore or HDD method at 101 locations, including crossing 59 waterbodies. Throughout the drilling process, a slurry made of non-toxic bentonite clay and water, referred to as drilling mud, would be circulated through the drilling tools to lubricate the drill bit, remove drill cuttings, and hold the bore hole open. Special additives may also be required, typically during the pilot-hole phase, but would constitute a small fraction of the drilling fluid, which is generally considered to have low toxicity. The Applicant would use water obtained from locally approved vendors to create the drilling mud, and estimates that a total of about 4,255,536 gallons would be required, including 3,418,010 gallons for HDDs and 837,526 gallons for bores.

During bore and HDD operations, the drilling mud returns would be circulated through mud pits to remove the drill cuttings. After completion of the bore and HDD operations, the recovered drill mud would be removed from the pits and disposed of in locally approved land farms.

Hydrostatic Testing and Dust Control

Before the pipelines would be placed into service, the Applicant would conduct hydrostatic testing to verify the structural integrity of all pipelines and terminal facilities. Hydrostatic testing would be conducted in accordance with PHMSA requirements (49 CFR § 195.505 and 195.588) to ensure the system is capable of withstanding the appropriate test pressure for 8 hours. Testing involves filling the pipelines or terminal components with water, pressurizing it, and then monitoring for pressure losses due to leaks in the system. Any leaks would be repaired and retested. The Applicant would withdraw about 47 million gallons of water from the firewater pond that would be constructed at the Oyster Creek Terminal, or would obtain water from municipal sources to conduct hydrostatic testing (Table 3.3.4-6).

Table 3.3.4-6: Water Requirements for Hydrostatic Testing of Onshore Pipelines and Terminals

Facility Component	Volume (gallons)
ECHO Terminal Modifications	521,857
ECHO to Oyster Creek Pipeline	13,183,596
Oyster Creek Terminal (1 storage tank)	24,573,483
Oyster Creek Terminal (piping)	2,274,814
Oyster Creek to Shore Pipelines	6,412,193
Total for Onshore Pipeline and Terminal Components	**46,965,943**

Source: SPOT 2019ccc

The Applicant does not anticipate treatment of the hydrostatic test water, and no chemicals or desiccant would be used to dry the pipe; therefore, no testing of hydrostatic test water would be conducted prior to use. Following testing, hydrostatic test water would be returned or sent to the firewater pond at the Oyster Creek Terminal.

The Applicant would manage dust control by implementing the measures outlined in the Applicant's Fugitive Dust Control Plan. The Applicant would complete dust control activities in accordance with all appropriate regulations. Because weather conditions are variable, it is impossible to predict the precise volume of water needed for dust suppression.

3.3.4.3. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on surface water resources. The study area within which potential impacts were assessed includes the onshore SPOT Project area and areas that are hydrologically connected to surface waters that would be affected by the Project.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on surface water have been evaluated based on their potential to:

- Violate a Federal, state, local, or Federally recognized international water quality criterion or waste discharge requirement;
- Cause irreparable harm to human health, aquatic life, or beneficial uses of aquatic ecosystems;
- Degrade coastal or terrestrial (lakes, rivers, wetlands, tidal environments) water quality; and/or
- Increase contaminant levels in the water column, sediment, or biota to levels shown to have the potential to harm organisms, even if the levels do not exceed the formal water quality criteria.

The remainder of this section describes potential impacts from Project construction and operation on onshore surface water resources, including flood hazard zones, from clearing of vegetation, ground disturbance, in-stream construction, soil compaction, surface water runoff, refueling of vehicles and equipment, open-cut stream construction, trenchless crossings and potential inadvertent returns of drilling fluid, hydrostatic test water discharge, and accidental spills of hazardous materials.

Construction of the Project would result in impacts on surface water resources within the onshore workspace, as well as hydrologically connected waters immediately downstream of the Project. Surface waters could be affected by construction activities that include clearing and grading of streambanks, in-stream trenching, trench dewatering, inadvertent returns from HDD operations, and potential spills or leaks of hazardous materials. Potential effects on surface waters from these activities may include:

- Modifications of aquatic habitat
- Increased runoff and the rate of in-stream sediment loading
- Turbidity
- Decreased DO concentrations
- Releases of chemical and nutrient pollutants from sediments
- Thermal effects
- Modification of riparian areas
- Introduction of chemical contaminants such as fuel and lubricants

To minimize these impacts, the Applicant would:

- Revegetate pipeline right-of-way
- Recontour to prior topography
- Site the new onshore terminal to avoid crossing waterbodies
- Collocate pipelines with other existing linear energy corridors where possible
- Minimize crossing waters of the United States

Trenching and backfilling would temporarily increase the amount of sediments released downstream. The extent of downstream sediment migration would depend on sediment loads, stream velocity, turbidity, bank composition, and sediment particle size. Stream contours could be altered due to in-stream construction and could result in changes to the stream bottom contours, stream dynamics, and could increase downstream erosion or deposition. In-stream construction could cause resuspension of sediments due to trenching and could cause erosion of the cleared right-of-way, which would result in increased turbidity that would reduce light penetration and photosynthetic oxygen production. In-stream disturbance could also release contaminated sediments in the streambed. The resuspension of organic material and sediments could result in a decrease of DO concentration in the affected area that could cause a temporary displacement of motile organisms such as fish, and could kill non-motile organisms in the affected area.

Riparian vegetation communities would be temporarily disturbed by stream bank clearing during pipeline installation, which would reduce riparian vegetation and expose soils to erosional forces. Heavy construction equipment could cause compaction of near surface soils, which could lead to increased runoff into surface waters in the vicinity of the construction right-of-way. Increased surface runoff could also transport sediment from adjacent uplands to surface waters, which could cause increased turbidity and sedimentation in receiving waters. Disturbance of the streambed and bank could also increase the risk of scour following construction.

Vehicle refueling or storage of fuel, oil, or other hazardous materials near surface waters could lead to contamination. If a spill were to occur, downstream water quality could be degraded and could result in acute and chronic toxic effects on aquatic organisms.

Stormwater would fall under the Construction General Permit issued by the USEPA. The Applicant has committed to coordinating with the Texas Parks and Wildlife Department (TPWD) to obtain any required sand and gravel permits.

Open Cut Stream Construction

As noted above, the Project would cross 69 waterbodies, including 19 perennial waterbodies, 13 intermittent waterbodies, 33 ephemeral waterbodies, and 4 ponds, using the open-cut construction method. Table 3.3.4-5 includes a complete list of waterbody crossings and crossing methods. Section 3.3.4.2, Water Resources, Surface Water, Waterbody Crossing Procedures, describes open-cut crossing method. Clearing of the stream banks could cause erosion and sedimentation into the waterbody and excavation of the streambed would cause increased turbidity in the water column. The Applicant would minimize effects on surface waters during construction by implementing the construction and mitigation measures included in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures, which includes:

- Constructing the crossing as close to perpendicular to the waterbody as site conditions allow (BMP #5 in Appendix N);
- Requiring non-essential construction equipment to cross waterbodies using an equipment bridge (BMP #5);
- Maintaining adequate flow rates throughout construction to protect aquatic life and prevent an interruption of existing downstream uses (BMP #5);
- Locating equipment refueling areas, concrete coating activities, and hazardous material storage to areas at least 100 feet from surface waters (BMP #5);
- Parking equipment at least 100 feet from the waterbody edge (BMP #5);
- Requiring the use of drip pans for heavy equipment parked overnight within the Project workspace (BMP #32);
- Placing excavated material from the trenchline at least 10 feet from the top of the waterbody bank (BMP #5);
- Installing sediment barriers across the entire construction right-of-way at all waterbody crossings (BMP #5);
- Installing temporary erosion and sediment control measures throughout construction until streambanks and adjacent upland areas are stabilized (BMP #5);
- Requiring bank stabilization and reestablishing bed and bank contours and riparian vegetation after construction (BMP #5);
- Limiting post-construction maintenance of vegetated buffer strips adjacent to waterbodies (Appendix M, Construction BMPs; BMP #1 in Appendix N); and

- Implementing the Applicant's Onshore Construction Spill Response Plan if a spill or leak occurs during construction (Appendix F; BMP #3 in Appendix N).

The Applicant would restore the streambed to preconstruction conditions and remove any temporary vehicle crossings (BMP #5 in Appendix N). The Applicant would stabilize streambanks within 24 hours of completing in-stream construction activities (BMP #5). Streambanks would be revegetated following pipeline installation, and post-construction vegetation maintenance would be limited to the permanent right-of-way pursuant to the Applicant's Construction BMPs. Semi-annual vegetation management would occur along the Project right-of-way. With the implementation of these BMPs, impacts on waterbodies crossed using the open-cut construction method would be direct, adverse, short-term, and moderate.

Trenchless Crossings

As described above, the Applicant proposes to use a trenchless crossing method (i.e., bore or HDD) at 59 waterbodies, including 28 perennial waterbodies, 8 intermittent waterbodies, 17 ephemeral waterbodies, and 6 ponds. The Applicant proposes to use the bore method to cross 23 waterbodies and the HDD method to cross 36 waterbodies. Table 3.3.4-5 includes a complete list of waterbody crossings and crossing methods. The potential effects on waterbodies associated with a trenchless crossing method would be minor because the pipeline would be installed below the bed and banks of the waterbody, would limit the clearing of riparian vegetation to the width of the permanent easement, and would avoid trenching the bed and banks.

The primary effect that could result from use of a trenchless crossing method would be an inadvertent release of drilling fluid directly or indirectly into the waterbody. During bore or HDD operations, unfavorable ground conditions could lead to a leak through fractures in the material underlying the waterbody, in the area of the mud pits or tanks, or along the drill path. Although drilling fluid is composed of non-toxic materials, large quantities released into a waterbody could affect fisheries or other aquatic organisms by causing turbidity and/or temporarily coating the streambed with the bentonite clay mixture. The risk of an inadvertent release is greatest when the drill bit is working near the surface.

The Applicant conducted a data search to assess the general feasibility for using the HDD construction method. The Applicant indicated that the HDDs proposed for the SPOT Project would occur in suitable soils of the Beaumont Formation. The Beaumont Foundation is composed of ancient river sediments that deposited silt and sand in belts and channels, and deposited muds and clay in flood basins (Garcia 1991). In the Houston-Galveston area, muds of the Beaumont Formation are overlain by sand. The thickness of the Beaumont Formation varies across the coastal plains, and is estimated to be several hundred feet thick in the Texas Coastal plain and several thousand feet thick in the Louisiana Coastal plain (Garcia 1991). As noted in its response, the Applicant believes the soils of the Beaumont Formation are suitable for the HDD construction method and provided examples of several successful HDD crossings in the region (e.g., an 18-inch natural gas pipeline crossing of the Houston Ship Channel and a 30-inch pipe crossing of the Sabine-Neches Waterway in Port Arthur, Texas) (SPOT 2019jj).

As described in Section 3.3.4.2, Water Resources, Surface Water, Waterbody Crossing Procedures, trenchless crossings would require 4,255,536 gallons of water that would be sourced from locally approved vendors.

To minimize the impacts of an inadvertent return, the Applicant would implement measures outlined in their HDD Contingency Plan (Appendix M; BMP #6 in Appendix N), such as establishing containment structures where necessary and working with regulatory agencies in accordance with applicable regulations and permit conditions to determine the necessary course of action. The Applicant has also indicated that vacuum trucks, booms, absorbent pads, shovels, and hay bales would be available and maintained at each HDD site for cleanup in the event of an inadvertent release. With these measures in place, the impacts from bore and HDD construction methods would be direct, adverse, short-term, and minor.

Flood Hazard Zones

The Project is located in an area where the risk of hurricanes exists. In 2018, Hurricane Harvey brought 30-54 inches of rain to southeast Texas (USGS 2018b). This record-breaking event was deemed a 500-year storm based on storm gauge data. As described above, 31.5 miles of pipelines would be located within the 100-year flood zone and 1.9 miles would be located in the 500-year flood zone. The existing ECHO Terminal is located in a minimal flood hazard area; therefore, the risk of flooding would be negligible. The proposed Oyster Creek Terminal would be located within the 100-year flood zone.

While it is not likely that the subsurface pipelines would be directly affected by flooding or storm surge, the pipelines could be exposed in locations that experience severe flooding or storm surges. The installation of subsurface pipelines would result in temporary disturbance of the flood zone. Following construction, the pipeline right-of-way would be restored to preconstruction contours and elevations, and would be seeded to promote rapid revegetation. Aboveground facilities would be designed and constructed to maintain integrity during flooding events in accordance with American Society of Civil Engineers / Structural Engineering Institute 7-16 (Minimum Design Loads and Associated Criteria for Buildings and Other Structures) and any requirements identified by the USACE. Additionally, the Applicant indicated that bridge structures exposed to storm surge at the Oyster Creek Terminal would be constructed for a hurricane with 18-foot storm surge. Additional information about flood zones and storm surge are included in Section 3.8.5.2, including mitigation measures the Applicant has agreed to implement at the Oyster Creek Terminal. Therefore, impacts on flood zones due to construction would be direct, adverse, short-term, and negligible and there would be no impacts on flood zones due to operation of the SPOT Project. In turn, impacts on the Applicant's onshore facilities from flooding or storm surge could occur and would be direct, adverse, short-term, and could be minor to major.

Hydrostatic Testing

As described in Section 3.3.4.2, Water Resources, Surface Water, Waterbody Crossing Procedures, the Applicant estimates that 46,965,943 gallons of hydrostatic test water would be required for testing the pipelines and terminal facilities. Water would be obtained from the Oyster Creek Terminal firewater pond or from municipal sources. If the firewater pond is used, the withdrawal of large volumes of water could result in temporary loss of habitat, change in water temperature and DO levels, and entrainment or impingement of fish or other aquatic organisms that inhabited the pond after it was constructed. Water quality could be affected if any chemicals are added to the water during the testing process; however, the Applicant does not propose to use additives for hydrostatic test water, as noted in Section 3.3.4.2, Waterbody Crossing Procedures.

There would be no surface water impacts if municipal water sources were used for hydrostatic testing. If the firewater pond were used, impacts would likely be direct, adverse, short-term, and negligible because the pond would have been recently constructed and large numbers of aquatic species would likely be absent. Additionally, the pond outfall structure would only allow the release of water during unusual or severe rain events. Therefore, turbidity and sedimentation caused from discharge back to the firewater pond would be contained within the pond and would not affect any downstream waters.

Aboveground Facilities Impacts

One perennial waterbody (SB062) would be crossed by a permanent access road for MLV 4. The access road is an existing, unimproved private road with a conveyance device already in place that allows for unimpeded water flow. There would be no other permanent waterbody crossings associated with the Project and no surface water impacts are anticipated during Project operation. Therefore, there would be no impacts on surface water from construction or operation of aboveground facilities.

Accidental Spills of Hazardous Materials

Accidental spills or leaks of hazardous materials associated with Project construction, the refueling or maintenance of vehicles, and the storage of fuel, oil, and other fluids could have immediate effects on aquatic resources and could contaminate waterbodies downstream of the release point. The greatest risk to surface waters due to accidental spills during construction would be associated with refueling or storage of fuel, oil, or other fluids. If not adequately cleaned up, contaminated soil could continue to leach and add pollutants to water resources long after a spill occurred. By restricting the location of refueling and storage areas, and by cleaning up any inadvertent releases, the potential effects associated with spills or leaks of hazardous liquids would be avoided or minimized.

To minimize surface water impacts, the Applicant would implement its Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), which includes:

- Secondary containment for the storage of hazardous materials (BMP #3);
- Secondary containment capable of holding 110 percent of the volume of hazardous materials (BMP #3);
- Daily inspections of tanks for leaks (BMP #3); and
- Restricting refueling and transferring of liquids to pre-designated locations away from sensitive areas (BMP #3).

The Construction Spill Response Plan also specifies measures to contain and clean up a spill if one were to occur, including:

- Using adsorbent pads for minor leak cleanup (BMP #3);
- Stopping or diverting flow to temporary containment areas (BMP #3);
- Immediately constructing temporary containment structures, if necessary (BMP #3); and
- Collecting, storing, and properly disposing of contaminated materials (BMP #3).

During construction, the Applicant's EIs would ensure compliance with the Construction Spill Response Plan. With implementation of the measures contained in the Construction Spill Response Plan, impacts on surface water due to an inadvertent release of hazardous materials during construction would be direct, short-term, adverse, and minor.

During operation, an oil spill on land could lead to contamination of surface waters. If oil reached a stream, the level of contamination would depend on the volume of oil, time of year, and stream velocity. At a minimum, oil would adhere to vegetation and stream banks, and would cause immediate adverse effects on aquatic organisms. If oil reaches standing water such as a lake or pond, it would spread over the water surface until it covers the entire waterbody or until it reaches a minimum thickness. Oil that does not evaporate would adhere to the shoreline. The effects on aquatic organisms in a pond or lake would be dependent on the volume of oil released and the ability of aquatic species to avoid the spill.

To minimize the impact from an oil spill, the pipelines would be constructed with shut-off valves to allow sections of the pipeline to be isolated. Storage tanks at the Oyster Creek Terminal would be contained within a concrete ring lined with an impermeable membrane. A leak detection system would be installed within the concrete ring for each storage tank. The seven new storage tanks would be installed within a secondary containment berm designed per NFPA requirements, and would be capable of containing 110 percent of the capacity of one storage tank.

The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3). Oil would flow from the opening under operating pressure until the line is depressurized and the leaking segment is isolated. The Applicant provided hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions). These include:

- Booming-containment
- Skimming
- Physical herding
- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

Use of the response actions described would minimize the impacts associated with an oil spill. With implementation of the safety and response actions described above, impacts on surface waters due to an oil spill would be direct and adverse, and depending on the size of the spill, time of year, and stream velocity, could be short-term or long-term, and minor to major.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (BMP #3 in Appendix N), Construction

BMPs (Appendix M; BMP #1 in Appendix N), and the SWPPP (BMP #14 in Appendix N). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

3.3.5. Wetlands

Wetlands are areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions (Environmental Laboratory 1987). Examples of wetlands include swamps, marshes, and bogs. Wetlands serve important biological, physical, and chemical functions, including providing wildlife food, habitat, recreation opportunities, flood control, and water quality improvement.

Under Section 404 of the CWA, the USACE is authorized to issue permits for activities that would result in the discharge of dredge or fill material into, or the dredging of, waters of the United States such as wetlands. Under Section 401 of the CWA, states are required to certify that proposed dredging or filling of waters of the United States meets state water quality standards.

3.3.5.1. Existing Conditions

The Applicant delineated wetlands along the proposed pipeline route and at the Oyster Creek Terminal site during field surveys conducted in 2018. Wetland boundaries were delineated using the USACE Wetland Delineation Manual (Environmental Laboratory 1987) and the Atlantic and Gulf Coastal Plains Regional Supplement (USACE 2010). The Applicant classified wetlands based on Cowardin type, which is a widely used system that categorizes wetlands based on systems (e.g., palustrine) and classes (e.g., emergent, scrub-shrub, and forested). The Applicant completed wetland surveys within a 300-foot-wide corridor during 2018. A total of about 100.5 acres of wetlands would be affected by construction of the Project, including about 39.9 acres of palustrine emergent wetlands, 2.8 acres of palustrine scrub-shrub wetlands, 6.7 acres of palustrine forested (PFO) wetlands, 45.1 acres of estuarine emergent wetlands, and 6.0 acres of estuarine scrub-shrub wetlands. Table 3.3.5-1 identifies the nearest milepost, Project component, Cowardin classification, watershed, crossing method, and acreage of each wetland that would be affected by the Project.

Table 3.3.5-1: Onshore Wetlands Crossed by the SPOT DWP Project

Project Component/ Milepost	Feature ID	Cowardin Class	HUC 8 Watershed	Crossing Method	Construction Impacts [a] (acres)	Conversion Impacts [b] (acres)	Permanent Impacts [c] (acres)
ECHO to Oyster Creek Pipeline							
0.3	WE005	PFO	West Galveston Bay	HDD #1	0.05	0.05	0.00
0.3	WE006	PEM	West Galveston Bay	HDD #1	0.06	0.00	0.00
0.3	WE006C	PFO	West Galveston Bay	HDD #1	0.18	0.18	0.00
0.4	WE004	PEM	West Galveston Bay	HDD #1	<0.01	0.00	0.00
0.8	WE003	PEM	West Galveston Bay	HDD #2	0.02	0.00	0.00
1.0	WE002	PEM	West Galveston Bay	HDD #2	0.08	0.00	0.00
1.0	WE002	PSS	West Galveston Bay	HDD #2	0.21	0.09	0.00
1.1	WB001	PEM	West Galveston Bay	Temporary workspace	0.21	0.00	0.00
1.1	WB002	PEM	West Galveston Bay	Temporary workspace	0.11	0.00	0.00
1.1	WE001	PEM	West Galveston Bay	Open cut/Bore #1	0.30	0.00	0.00
1.5	WB004	PEM	West Galveston Bay	Open cut	0.12	0.00	0.00
1.6	WB003	PEM	West Galveston Bay	Open cut	0.81	0.00	0.00
1.6	WB005	PEM	West Galveston Bay	Temporary workspace	0.30	0.00	0.00
1.8	WB006	PEM	West Galveston Bay	Temporary workspace	0.09	0.00	0.00
2.1	WB007	PEM	West Galveston Bay	Temporary workspace	0.29	0.00	0.00
2.3	WB008	PEM	West Galveston Bay	HDD #5	0.23	0.00	0.00
2.8	WA003	PEM	West Galveston Bay	HDD #6	0.01	0.00	0.00
3.6	WA004	PEM	West Galveston Bay	HDD #7	0.02	0.00	0.00
3.7	WA005	PEM	West Galveston Bay	HDD #7	0.02	0.00	0.00
3.8	WA006	PEM	West Galveston Bay	HDD #7	0.02	0.00	0.00
3.8	WA007	PEM	West Galveston Bay	HDD #7	0.02	0.00	0.00
3.8	WA008	PEM	West Galveston Bay	HDD #7	0.13	0.00	0.00
4.1	WA009	PEM	West Galveston Bay	Open cut	0.04	0.00	0.00
4.6	WA010	PEM	West Galveston Bay	HDD #8	0.03	0.00	0.00
4.7	WA011	PEM	West Galveston Bay	HDD #8	0.00	0.00	0.00
4.7	WA012	PEM	West Galveston Bay	HDD #8	0.05	0.00	0.00
4.8	WA013	PEM	West Galveston Bay	Temporary workspace	0.11	0.00	0.00
5.0	WA014	PEM	West Galveston Bay	Temporary workspace	0.03	0.00	0.00
5.1	WA015	PEM	West Galveston Bay	Temporary workspace	0.01	0.00	0.00
6.0	WA016	PEM	West Galveston Bay	Open cut	0.79	0.00	0.00
6.0	WA016	PSS	West Galveston Bay	Temporary workspace	0.04	0.00	0.00
6.1	WA017	PEM	West Galveston Bay	Temporary workspace	0.03	0.00	0.00

Project Component/ Milepost	Feature ID	Cowardin Class	HUC 8 Watershed	Crossing Method	Construction Impacts [a] (acres)	Conversion Impacts [b] (acres)	Permanent Impacts [c] (acres)
6.1	WA018	PEM	West Galveston Bay	Open cut	0.10	0.00	0.00
6.1	WA018	PSS	West Galveston Bay	Temporary workspace	0.04	0.00	0.00
6.3	WA019	PEM	West Galveston Bay	Temporary workspace	0.10	0.00	0.00
6.3	WA020	PEM	West Galveston Bay	Open cut	0.04	0.00	0.00
6.4	WA021	PEM	West Galveston Bay	Temporary workspace	0.08	0.00	0.00
7.0	WA022	PFO	West Galveston Bay	Temporary workspace	0.02	0.02	0.00
7.1	WA024	PEM	West Galveston Bay	Open cut	0.12	0.00	0.00
7.1	WA026	PSS	West Galveston Bay	Temporary workspace	0.05	0.00	0.00
7.2	WA025	PEM	West Galveston Bay	Temporary workspace	0.10	0.00	0.00
7.9	WB009	PEM	West Galveston Bay	Open cut	0.16	0.00	0.00
7.9	WB010	PEM	West Galveston Bay	Temporary workspace	<0.01	0.00	0.00
9.4	WB021	PSS	West Galveston Bay	HDD #11	0.06	0.06	0.00
11.1	WB011	PEM	West Galveston Bay	Temporary workspace	0.06	0.00	0.00
12.5	WB012	PFO	West Galveston Bay	Temporary workspace	0.14	0.14	0.00
13.2	WB013	PFO	West Galveston Bay	Temporary workspace	0.05	0.05	0.00
13.2	WB014	PFO	West Galveston Bay	Temporary workspace	0.15	0.15	0.00
14.6	WB016	PEM	West Galveston Bay	Open cut	0.10	0.00	0.00
15.7	WF020	PEM	West Galveston Bay	Open cut	0.04	0.00	0.00
15.9	WF023	PEM	West Galveston Bay	Open cut	0.47	0.00	0.00
17.8	WC020	PEM	West Galveston Bay	Open cut	0.05	0.00	0.00
18.1	WB017	PEM	West Galveston Bay	Open cut	0.36	0.00	0.00
18.1	WB017	PFO	West Galveston Bay	Temporary workspace	0.42	0.42	0.00
19.4	WB025	PEM	West Galveston Bay	Open cut	0.31	0.00	0.00
20.6	WA029	PFO	West Galveston Bay	Open cut	0.09	0.09	0.00
20.8	WA030	PFO	West Galveston Bay	Open cut	0.05	0.05	0.00
21.2	WB027	PEM	West Galveston Bay	Open cut	0.03	0.00	0.00
22.6	WA033	PEM	West Galveston Bay	Temporary workspace	<0.01	0.00	0.00
23.2	WA035	PEM	West Galveston Bay	Temporary workspace	0.02	0.00	0.00
23.4	WA038	PEM	West Galveston Bay	Open cut	0.64	0.00	0.00
23.7	WA039	PEM	West Galveston Bay	Open cut	4.20	0.00	0.00
24.1	WA040	PEM	West Galveston Bay	Open cut	0.93	0.00	0.00
24.2	WB030	PEM	West Galveston Bay	Open cut	0.02	0.00	0.00
24.5	WB031	PEM	West Galveston Bay	Open cut	0.30	0.00	0.00
24.7	WB032	PEM	West Galveston Bay	Open cut	0.53	0.00	0.00
24.7	WB032	PSS	West Galveston Bay	Open cut	0.28	0.01	0.00
24.8	WB033	PEM	West Galveston Bay	Open cut	0.01	0.00	0.00

Project Component/ Milepost	Feature ID	Cowardin Class	HUC 8 Watershed	Crossing Method	Construction Impacts [a] (acres)	Conversion Impacts [b] (acres)	Permanent Impacts [c] (acres)
25.0	WA027	PEM	West Galveston Bay	Temporary workspace	0.01	0.00	0.00
25.1	WA028A	PEM	West Galveston Bay	Open cut/HDD #14	0.05	0.00	0.00
25.1	WA028B	PEM	West Galveston Bay	Open cut/HDD #14	0.10	0.00	0.00
26.7	WB028	PFO	West Galveston Bay	Open cut	0.26	0.26	0.00
27.1	WB029	PEM	West Galveston Bay	Open cut	0.03	0.00	0.00
31.6	WC002	PEM	West Galveston Bay	Open cut	0.08	0.00	0.00
31.7	WC003	PEM	West Galveston Bay	Temporary workspace	0.20	0.00	0.00
32.0	WC004	PSS	West Galveston Bay	Open cut	0.43	0.13	0.00
32.2	WC001	PEM	Austin-Oyster	Open cut	0.02	0.00	0.00
32.3	WB052	PEM	Austin-Oyster	Open cut	0.51	0.00	0.00
32.4	WC001	PFO	Austin-Oyster	HDD #16	0.66	0.66	0.00
32.6	WC015	PEM	Austin-Oyster	HDD #16	0.11	0.00	0.00
32.6	WC015	PFO	Austin-Oyster	HDD #16	0.01	0.01	0.00
34.3	WB045	PEM	Austin-Oyster	Open cut	0.05	0.00	0.00
34.5	WC016	PEM	Austin-Oyster	Open cut	0.31	0.00	0.00
35.5	WC017A	PEM	Austin-Oyster	Open cut	0.50	0.00	0.00
35.5	WC017B	PEM	Austin-Oyster	Open cut	1.80	0.00	0.00
35.9	WC018	PEM	Austin-Oyster	Open cut	5.98	0.00	0.00
36.9	WA042	PFO	Austin-Oyster	Temporary workspace	0.01	0.01	0.00
38.5	WA043	PEM	Austin-Oyster	Open cut	0.00	0.00	0.00
38.9	WA045	PSS	Austin-Oyster	Temporary workspace	0.01	0.00	0.00
39.1	WA047	PEM	Austin-Oyster	Temporary workspace	0.03	0.00	0.00
39.2	WA048	PEM	Austin-Oyster	Open cut	0.27	0.00	0.00
42.1	WB035	PSS	Austin-Oyster	Temporary workspace	0.01	0.00	0.00
42.3	WD005	PEM	Austin-Oyster	Temporary workspace	0.01	0.00	0.00
42.3	WD006	PEM	Austin-Oyster	Temporary workspace	0.01	0.00	0.00
42.4	WD007	PEM	Austin-Oyster	Temporary workspace	0.03	0.00	0.00
42.4	WF031	PEM	Austin-Oyster	Open cut	0.14	0.00	0.00
42.5	WF032	PEM	Austin-Oyster	Open cut	0.01	0.00	0.00
42.6	WC007	PEM	Austin-Oyster	Temporary workspace	0.10	0.00	0.00
42.7	WC008	PEM	Austin-Oyster	Temporary workspace	0.04	0.00	0.00
42.9	WC009	PEM	Austin-Oyster	Open cut	0.34	0.00	0.00
43.1	WC010	PEM	Austin-Oyster	HDD #17	0.10	0.00	0.00
43.3	WC011	PEM	Austin-Oyster	HDD #17	0.09	0.00	0.00
43.6	WC012	PEM	Austin-Oyster	Open cut	6.10	0.00	0.00
44.4	WC013B	PEM	Austin-Oyster	Temporary workspace	0.01	0.00	0.00

Project Component/ Milepost	Feature ID	Cowardin Class	HUC 8 Watershed	Crossing Method	Construction Impacts [a] (acres)	Conversion Impacts [b] (acres)	Permanent Impacts [c] (acres)
45.0	WB037	PSS	Austin-Oyster	Temporary workspace	0.04	0.00	0.00
45.0	WB038	PEM	Austin-Oyster	Temporary workspace	0.09	0.00	0.00
45.0	WB038	PFO	Austin-Oyster	Temporary workspace	0.04	0.04	0.00
46.9	WB040	PSS	Austin-Oyster	Bore #55	0.08	0.02	0.00
46.9	WD002	PEM	Austin-Oyster	Temporary workspace	0.02	0.00	0.00
46.9	WD004	PEM	Austin-Oyster	Bore #55	0.04	0.00	0.00
48.0	WB042	PEM	Austin-Oyster	Open cut	0.61	0.00	0.00
48.2	WB041	PEM	Austin-Oyster	HDD #18	0.03	0.00	0.00
48.5	WD008	PFO	Austin-Oyster	HDD #18	0.07	0.07	0.00
48.6	WD010	PEM	Austin-Oyster	HDD #18	0.02	0.00	0.00
48.8	WF008	PEM	Austin-Oyster	HDD #18	0.05	0.00	0.00
48.8	WX013	PEM	Austin-Oyster	Temporary workspace	<0.01	0.00	0.00
49.0	WF009	PEM	Austin-Oyster	Open cut	0.02	0.00	0.00
49.0	WF009	PFO	Austin-Oyster	Temporary workspace	0.04	0.04	0.00
49.2	WF010	PFO	Austin-Oyster	Temporary workspace	0.72	0.72	0.00
49.3	WF010	PSS	Austin-Oyster	Temporary workspace	0.23	0.00	0.00
49.3	WF011	PSS	Austin-Oyster	Temporary workspace	0.03	0.00	0.00
ECHO to Oyster Creek Pipeline Totals					**35.08**	**3.27**	**0.00**
Oyster Creek Terminal							
50.1	WB071	PEM	Austin-Oyster	End of ECHO to Oyster Creek Pipeline within terminal site workspace	3.82	0.00	3.82
NA	WB072	PEM	Austin-Oyster	Terminal site workspace	2.20	0.00	2.20
0.2	WB072B	PFO	Austin-Oyster	Start of OCSP within terminal site workspace	0.18	0.00	0.18
Oyster Creek Terminal Totals					**6.20**	**0.00**	**6.20**
Oyster Creek to Shore Pipelines							
0.3	WB043	PEM	Austin-Oyster	Open cut	0.53	0.00	0.05
0.4	WB043	PFO	Austin-Oyster	Temporary workspace	1.25	1.25	0.00
0.9	WF030	PEM	Austin-Oyster	Open cut	0.32	0.00	0.00
1.1	WF029	PEM	Austin-Oyster	Open cut	0.45	0.00	0.00
1.1	WF029	PSS	Austin-Oyster	Temporary workspace	0.41	0.00	0.00
1.3	WB056	PFO	Austin-Oyster	Temporary workspace	2.35	2.35	0.00
1.3	WB056A	PEM	Austin-Oyster	Open cut	0.35	0.00	0.00
3.9	WB063	PSS	Austin-Oyster	Open cut	0.09	0.03	0.00
4.8	WB064	PEM	Austin-Oyster	Temporary workspace	0.01	0.00	0.00

Project Component/ Milepost	Feature ID	Cowardin Class	HUC 8 Watershed	Crossing Method	Construction Impacts [a] (acres)	Conversion Impacts [b] (acres)	Permanent Impacts [c] (acres)
5.1	WB065	PSS	Austin-Oyster	Temporary workspace	0.06	0.00	0.00
5.2	WB065	PEM	Austin-Oyster	Open cut	0.27	0.00	0.00
5.2	WB065A	PEM	Austin-Oyster	Open cut	0.78	0.00	0.00
5.2	WB065A	PSS	Austin-Oyster	Temporary workspace	0.10	0.00	0.00
5.2	WB065B	PSS	Austin-Oyster	Open cut	0.02	0.00	0.00
5.2	WB065C	PSS	Austin-Oyster	Open cut	0.06	0.00	0.00
5.4	WB067	PSS	Austin-Oyster	Open cut	0.20	0.03	0.00
5.6	WB069	PEM	Austin-Oyster	Open cut	0.07	0.00	0.00
5.6	WB069	PSS	Austin-Oyster	Temporary workspace	0.34	0.02	0.00
6.0	WB070A	PEM	Austin-Oyster	Open cut	0.02	0.00	0.00
6.1	WF007	PEM	Austin-Oyster	Open cut	0.08	0.00	0.00
7.2	WF001	PEM	Austin-Oyster	Temporary workspace	0.03	0.00	0.00
7.6	WF006	PEM	Austin-Oyster	Open cut	0.01	0.00	0.00
8.0	WF003	PEM	Austin-Oyster	HDD #2 - OCSP	0.18	0.00	0.00
8.0	WF004	PEM	Austin-Oyster	Open cut	0.07	0.00	0.00
8.0	WF005	PEM	Austin-Oyster	Open cut	0.09	0.00	0.00
8.4	WF014	EEM	Austin-Oyster	Temporary workspace	0.09	0.00	0.00
8.5	WF015	EEM	Austin-Oyster	Open cut	1.84	0.00	0.00
8.6	WX005	EEM	Austin-Oyster	Open cut	3.31	0.00	0.00
8.8	WF033	EEM	Austin-Oyster	Open cut	0.20	0.00	0.00
8.9	WB058	EEM	Austin-Oyster	Temporary workspace	0.06	0.00	0.00
8.9	WB060	EEM	Austin-Oyster	Temporary workspace	0.09	0.00	0.00
8.9	WE034	EEM	Austin-Oyster	Temporary workspace	0.05	0.00	0.00
8.9	WF034	EEM	Austin-Oyster	Temporary workspace	0.06	0.00	0.00
9.0	WB059	EEM	Austin-Oyster	Temporary workspace	0.01	0.00	0.00
9.0	WB061	EEM	Austin-Oyster	Open cut	0.52	0.00	0.00
9.1	WB062	EEM	Austin-Oyster	Temporary workspace	<0.01	0.00	0.00
9.2	WF017	EEM	Austin-Oyster	Open cut	0.11	0.00	0.00
9.6	WF016	EEM	Austin-Oyster	Open cut	2.41	0.00	0.00
9.7	WB057	ESS	Austin-Oyster	Open cut	1.63	0.24	0.00
9.9	WB057	EEM	Austin-Oyster	Open cut/ HDD #3 - OCS	9.66	0.00	0.00
10.1	WB051	EEM	Austin-Oyster	Open cut/ HDD #3 - OCSP	9.50	0.00	0.00
10.1	WB051	ESS	Austin-Oyster	HDD #3 - OCSP	1.72	0.40	0.00
10.1	WB051B	EEM	Austin-Oyster	HDD #3 - OCSP	0.80	0.00	0.00

Project Component/ Milepost	Feature ID	Cowardin Class	HUC 8 Watershed	Crossing Method	Construction Impacts [a] (acres)	Conversion Impacts [b] (acres)	Permanent Impacts [c] (acres)
10.5	WB049	EEM	Austin-Oyster	Open cut/ HDD #4 - OCSP	5.25	0.00	0.00
10.6	WB046	EEM	Austin-Oyster	Open cut/ HDD #4 - OCSP	7.41	0.00	0.00
10.6	WB049	ESS	Austin-Oyster	Open cut/ HDD #4 - OCSP	0.11	0.10	0.00
10.6	WB049A	ESS	Austin-Oyster	Open cut/ HDD #4 - OCSP	0.60	0.00	0.00
11.0	WB047	EEM	Austin-Oyster	Open cut/ HDD #5 - OCSP	0.31	0.00	0.00
11.0	WB047	ESS	Austin-Oyster	Open cut/ HDD #5 - OCSP	1.66	0.20	0.00
11.1	WB047B	EEM	Austin-Oyster	Open cut/ HDD #5 - OCSP	0.20	0.00	0.00
11.1	WB047C	EEM	Austin-Oyster	Open cut/ HDD #5 - OCSP	0.11	0.00	0.00
11.1	WX012	EEM	Austin-Oyster	HDD #5 - OCSP	0.00	0.00	0.00
11.2	WB048	ESS	Austin-Oyster	HDD #5 - OCSP	0.30	0.00	0.00
11.4	WX008B	ESS	Austin-Oyster	HDD #5 - OCSP	0.00	0.00	0.00
11.4	WX010	EEM	Austin-Oyster	HDD #5 - OCSP	0.00	0.00	0.00
11.5	WX008B	EEM	Austin-Oyster	HDD #5 - OCSP	0.00	0.00	0.00
11.6	WX009 [d]	ESS	Austin-Oyster	HDD #5 - OCSP	0.00	0.00	0.00
12.0	WB050 [e]	EEM	Austin-Oyster	Open cut/ HDD #5/MLV - OCSP	3.11	0.00	0.10
Oyster Creek to Shore Pipelines Totals					**59.26**	**4.62**	**0.15**
Project Totals					**100.54**	**7.89**	**6.35**

Source: SPOT 2019qq; SPOT 2020c

DWP = Deepwater Port; ECHO = Enterprise Crude Houston; EEM = estuarine emergent; ESS = estuarine scrub-shrub; HDD = horizontal directional drill; HUC = hydrologic unit code; NA = not applicable; OCSP = Oyster Creek to Shore Pipelines; PEM = palustrine emergent, PFO = palustrine forested; PSS = palustrine scrub-shrub; SPOT – Sea Port Oil Terminal

Note: SPOT Project application indicates that all wetlands have been delineated along the Project route.

[a] Construction impacts include all wetlands within the temporary right-of-way, additional temporary workspace, permanent easement, workspace associated with Oyster Creek Terminal, and access roads. Therefore, the conversion impacts and permanent impacts are a subset of (i.e., are included in) the construction impacts.

[b] Conversion impacts apply to PFO wetlands within all workspaces and to PSS and ESS wetlands within the permanent easement.

[c] Impacts to features associated with HDD or bore points are representative of potential temporary surface impacts for construction activities, such as right-of-way access, temporary workspace, staging, and/or conversion impacts within the permanent easement that would be cleared and maintained for line patrolling during Project operation.

[d] Wetland WX009 was not included in the Wetland Delineation Report or the USACE 404 permit application, and the Applicant's response to USCG and MARAD's information request identified it as "EES." USCG and MARAD have assumed this is an ESS wetland based on review of aerial imagery.

[e] Following publication of the Draft EIS, the Applicant has changed the proposed location of the shoreline MLV from the south side of Bluewater Highway in open land to the north side of Bluewater Highway in an EEM wetland to minimize construction impacts on the public beach and nearby residences. The USACE will be responsible for evaluating mitigation requirements, if any, for this permanent impact.

Wetland Classifications

Wetland classifications were assigned using the Cowardin classification system described by Cowardin et al. (1979). Wetlands crossed by the Project are classified as palustrine (freshwater wetland) and estuarine, and are defined by their dominant vegetation layer (emergent, scrub-shrub, or forested), as described below.

Palustrine Emergent Wetlands

Palustrine emergent (PEM) wetlands in the Project area are dominated by rooted herbaceous and grass-like plants that stand erect above the water or ground surface. Vegetation is present for most of the growing season in most years (Cowardin et al, 1979). Common emergent species identified along the proposed pipeline include longtom (*Paspalum denticulatum*), southern cutgrass (*Leersia hexandra*), woodrush flatsedge (*Cyperus entrerianus*), jointed flatsedge (*C. articulates*), alligator weed (*Alternathera philoxeroides*), mountain spike-rush (*Eleocharis montana*), stiff spadeleaf (*Centella erecta*), purple river-hemp (*Sesbania punicea*), buttonweed (*Diodia virginiana*), broadleaf cattail (*Typha latifolia*), swamp smartweed (*Persicaria hydropiperoides*), and seaside American-aster (*Symphyotrichum subulatum*).

Palustrine Scrub-Shrub Wetlands

Palustrine scrub-shrub (PSS) wetlands are those wetlands that are dominated by woody vegetation less than 20 feet tall. Plant species include true shrubs, young trees, and trees or shrubs that are small or stunted due to environmental conditions. PSS wetlands may be relatively stable communities or transitional areas between herbaceous and forested habitats (Cowardin et al. 1979). PSS wetlands, therefore, often display a combination of immature species found in forested communities and species found in herbaceous wetland communities. Common shrub species identified in field surveys include Jesuit's-bark (*Iva frutescens*), poison-bean (*Sesbania drummondii*), deciduous holly (*Ilex decidua*), Chinese tallow (*Triadica sebifera*), and eastern baccharis (*Baccharis halimifolia*).

Palustrine Forested Wetlands

PFO wetlands are dominated by trees and shrubs at least 20 feet tall with a tolerance to a seasonally high water table (Cowardin et al. 1979). PFO wetlands in the Project area are dominated by mature trees, but lower canopies including shrubs, herbaceous, and wood vines were also present. Dominant species identified in PFO wetlands include sugarberry (*Celtis laevigata*), black willow (*Salix nigra*), eastern cottonwood (*Populus deltoides*), Chinese tallow, green ash (*Fraxinus pennsylvanica*), American elm (*Ulmus americana*), cedar elm (*U. crassifolia*), and eastern baccharis.

Estuarine Emergent Wetlands

The estuarine emergent (EEM) wetlands occurring within tidal areas of the survey corridor are composed of an herbaceous layer dominated by turtleweed (*Batis maritima*), dwarf saltwort (*Salicornia bigelovii*), coastal salt grass (*Distichlis spicata*), bushy seaside tansy (*Borrichia frutescens*), saltwater cord grass (*Spartina alterniflora*), and Gulf cord grass (*S. spartinae*).

Estuarine Scrub-Shrub Wetlands

The estuarine scrub-shrub (ESS) wetlands consist of tidal wetland areas dominated by woody species. The dominant shrubs occurring within the survey corridor include Jesuit's-bark and eastern baccharis. Some ESS wetlands include an herbaceous layer populated by sorrelvine (*Cissus trifoliata*), Gulf cord grass, turtleweed, dwarf saltwort, and bushy seaside tansy.

3.3.5.2. Wetland Construction Procedures

The construction right-of-way would be the same in wetlands as in uplands, with a right-of-way of 100 feet wide for the ECHO to Oyster Creek Pipeline and 150 feet wide for the Oyster Creek to Shore Pipelines. The Applicant would cut vegetation to ground level and limit stump removal to areas directly over the trench. Silt fence would be installed at the edges of the right-of-way to minimize the potential for sediment runoff. If water is present in the trench, trench plugs would be left in the trench before its entrance into the wetland. The hydrologic integrity of the wetland would be maintained by installing trench breakers where the trench enters and exits the wetland. Where possible, ATWS would be located at least 50 feet from the edge of wetlands (BMP #5 in Appendix N).

Where soils are stable and are not saturated at the time of crossing, standard pipeline construction methods similar to those described for uplands would be used with additional wetland-specific protections. The additional protection methods that the Applicant would employ include:

- Stripping topsoil from either the full work area or from the trench and subsoil storage area (Appendix M, Construction BMPs; BMP #1 in Appendix N);
- Limiting the time the trench remains open (BMP #5 in Appendix N);
- Limiting the use of equipment operating in wetlands (BMP #5);
- Installing trench breakers on the upland boundary of each wetland (BMP #5); and
- Using equipment mats in wetlands where rutting could occur (Appendix M, Construction BMPs; BMP #1 in Appendix N).

In saturated wetlands with standing water or unstable soils, timber mats or crushed stone on geotextile fabric would be installed at work surfaces adjacent to the trench. Topsoil segregation would not be possible in saturated wetlands. Pipe stringing and fabrication may occur within the wetland or in adjacent ATWS. Trenchless construction techniques (i.e., HDD and bore) would also be used to cross under certain wetlands, as identified in Table 3.3.5-1.

3.3.5.3. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on wetlands. The study area within which potential impacts were assessed included the Project workspaces and any areas that would be hydrologically connected to wetlands affected by the Project (i.e., within the same watershed).

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on wetlands have been evaluated based on their potential to:

- Violate a Federal, state, local, or Federally recognized international water quality criterion or waste discharge requirement;
- Cause irreparable harm to human health, aquatic life, or beneficial uses of aquatic ecosystems;
- Degrade coastal or terrestrial (lakes, rivers, wetlands, tidal environments) water quality; and/or
- Increase contaminant levels in the water column, sediment, or biota to levels shown to have the potential to harm organisms, even if the levels do not exceed the formal water quality criteria.

The remainder of this section describes potential impacts Project construction and operation would have on wetlands from ground disturbance, soil compaction, conversion of wetlands to a different wetland type, installation of impervious surfaces, and accidental spills of hazardous materials. This section also discusses the Applicant's proposed compensatory mitigation for unavoidable impacts on wetlands.

Construction would affect a total of 100.5 acres of wetlands, as summarized in Table 3.3.5-2. The primary impact of pipeline construction and operation on wetlands would be the temporary alteration of wetland vegetation and the permanent conversion of forested and scrub-shrub wetlands to emergent wetlands over the maintained permanent easement.

Table 3.3.5-2: Wetlands Affected by the Construction and Operation of the SPOT Project

	Wetland Impacts (acres) [a]											
	PEM		PSS		PFO		EEM		ESS		Total	
Facility	**Cons.**	**Oper.**	**Cons.**	**Oper.** [b]	**Cons.**	**Oper.** [b]	**Cons.**	**Oper.**	**Cons.**	**Oper.**	**Cons.**	**Oper.**
ECHO Terminal	0	0	0	0	0	0	0	0	0	0	0	0
ECHO to Oyster Creek Pipeline	30.6	0	1.5	0.3	3.0	3.0	0	0	0	0	35.1	3.3
Oyster Creek Terminal	6.0	6.0	0	0	0.2	0.2	0	0	0	0	6.2	6.2
Oyster Creek to Shore Pipelines	3.3	0.1	1.3	0.1	3.6	3.6	45.1	0	6.0	0.9	59.3	4.7
Access Roads	0	0	0	0	0	0	0	0	0	0	0	0
MLVs	0	0	0	0	0	0	0	0.1	0	0	0	0.1
Project Total	**39.9**	**6.1**	**2.8**	**0.4**	**6.7**	**6.7**	**45.1**	**0.1**	**6.0**	**0.9**	**100.5**	**14.2**

Source: SPOT 2019qq; SPOT 2020c

EEM = estuarine emergent; ESS = estuarine scrub-shrub; MLV=Mainline Valve; PEM = palustrine emergent; PFO = palustrine forested; PSS = palustrine scrub-shrub

Note: Totals may not match sum of addends due to rounding.

[a] The permanent impacts are a subset of (i.e., are included in) the construction impacts.

[b] Operational acreages include conversion of PSS, PFO, and ESS to emergent wetland types.

Pipeline Construction

The construction right-of-way would be 100 feet wide for the ECHO to Oyster Creek Pipeline and 150 feet wide for the Oyster Creek to Shore Pipelines. Impacts on emergent wetlands would be short-term because ground contours would be restored following construction and emergent wetlands would revegetate quickly, typically within 1 to 3 years.

In scrub-shrub and forested wetlands, woody vegetation would be removed from the construction right-of-way. Following construction, ground contours would be restored and right-of-way would be reseeded. The 50-foot-wide permanent easement would be maintained in an herbaceous state during Project operation, and areas outside the permanent easement would be allowed to return to preconstruction conditions. Vegetation in scrub shrub wetlands typically reestablishes within 3 to 5 years, while forested vegetation may take several years to decades until a mature forest community becomes reestablished. Compensatory mitigation may be required for temporal losses longer than 12 months, as well as for conversion losses or permanent wetland impacts.

The use of heavy equipment in wetlands during construction could result in soil compaction or rutting that would alter natural hydrologic and soil conditions, potentially inhibiting germination of native seeds and the ability of plants to establish healthy root systems. Impacts on wetlands could include temporary changes in hydrology and water quality during construction. Combining topsoil with subsoil during trench excavation could alter nutrient availability and soil chemistry, thereby debilitating recruitment of native wetland vegetation. Removal of wetland vegetation during construction could alter the ability of wetlands to function as flood and erosion control buffers. Discharges from stormwater, dewatering structures, or hydrostatic testing could transport sediments and pollutants into wetlands, thereby affecting water quality.

Most impacts on wetlands from construction of the pipelines would be short-term and minor because the Applicant would restore preconstruction contours and protect the wetland hydrology. The Applicant would minimize the unavoidable wetland impacts by implementing measures outlined in the Applicant's Construction BMPs (Appendix M; BMP #1 in Appendix N). Additionally the Applicant would comply with conditions specified in its pending CWA Section 404 and Section 401 permits. Specific measures the Applicant would implement to minimize the effects on wetlands include:

- Locating extra workspaces at least 50 feet from wetland boundaries, except where site-specific conditions warrant otherwise (BMP #5 in Appendix N);
- Requiring the use of drip pans for heavy equipment parked overnight within the Project workspace (BMP #32 in Appendix N);
- Cutting vegetation just above ground level, leaving existing root systems in place, and limiting the pulling of stumps and grading activities to directly over the trenchline except where required for safety (BMP #5);
- Using low-ground-weight construction equipment or operating equipment on timber mats in saturated soils to prevent rutting (BMP #5);
- Installing sediment barriers immediately after initial ground disturbance at the edge of boundary between wetlands and uplands, immediately upslope of the wetland boundary, and along the edge of the right-of-way as necessary to contain spoil and to protect adjacent wetland areas (BMP #5);
- Segregating the top 12 inches of topsoil from the trenchline except in areas where standing water is present or soils are saturated (BMP #5);

- Installing silt fence on the downslope side of spoil piles or around the perimeter of the spoil pile to prevent erosion into adjacent sensitive resources (BMP #7 in Appendix N) (SPOT 2019z);
- Installing trench plugs as necessary to maintain the original wetland hydrology (BMP #5);
- Restoring preconstruction contours to maintain the original wetland hydrology (BMP #5);
- Prohibiting the use of lime or fertilizer in wetlands (BMP #5);
- Seeding restored wetlands with annual ryegrass and/or an agency approved wetland seed mix, unless standing water is present (BMP #5); and
- Prohibiting the use of herbicides or pesticides within 100 feet of wetlands or waterbodies except as specified by the appropriate land management or state agency (BMP #5).

In addition to the above mitigation measures, the Applicant would provide compensatory mitigation for the permanent conversion of PFO (6.6 acres) and PSS (0.4 acre) wetlands to PEM wetlands, permanent conversion of ESS (0.9 acres) to EEM wetlands; and the temporary impacts on 2.7 acres of PSS wetlands. The Applicant proposes to purchase mitigation bank credits from the Columbia Bottomlands Conservation Mitigation Bank, the Lower Brazos River Mitigation Bank, and the Gulf Coastal Plains Mitigation Bank. The Conceptual Compensatory Mitigation Plan requires review and approval by the USACE as part of the Section 404 permit process. The Applicant's compensatory wetland mitigation plan is described in more detail in Section 3.3.5.4, Water Resources, Wetlands, Compensatory Mitigation and a copy of the plan is included in Appendix P. Implementation of the Applicant's Construction BMPs would minimize wetland impacts during construction, and compensatory mitigation would offset the unavoidable loss of wetlands due to conversion from one wetland type to another.

Therefore, with suitable mitigation measures in place, the impacts on wetlands due to construction and operation of the onshore pipelines would be direct, adverse, short-term to long-term, and minor to moderate, depending on the type of wetland affected and the amount of time it would take for the wetland vegetation to reestablish.

In the event of an inadvertent release of drilling mud during HDD installation, bentonite clay could be released into wetlands. Though bentonite clay is non-toxic, it could cause smothering of vegetation and benthos. The Applicant would implement the measures described in its HDD Contingency Plan to minimize impacts as much as practicable. Impacts on wetlands due to an inadvertent release of drilling mud would be direct, adverse, short-term, and minor to major, depending on the amount of drilling mud released, the time of year, and the level of impact associated with clean-up.

Aboveground Facilities

Modifications at the ECHO Terminal would not result in any impacts on wetlands, as none are present at the existing terminal site. Construction of the Oyster Creek Terminal would result in the permanent loss of about 6.2 acres of wetlands, including 6.0 acres of PEM wetlands and 0.2 acre of PFO wetlands for construction of terminal facilities. The Applicant would implement the appropriate BMPs described above for construction activities at the terminal site. As described above, the Applicant proposes to purchase mitigation bank credits from the Columbia Bottomlands Conservation Bank (CBCMB), the Lower Brazos River Mitigation Bank (LBRMB), and the Gulf Coastal Plains Mitigation Bank (GCPMB) to offset unavoidable adverse impacts on wetlands. The Applicant's compensatory wetland mitigation plan is described in more detail in Section 3.3.5.4, Water Resources, Wetlands, Compensatory Mitigation. Therefore, the adverse impacts on wetlands due to the construction of the Oyster Creek Terminal would be adequately mitigated and reduced to less than substantial levels. Wetland impacts from construction of onshore aboveground facilities would be direct, adverse, long-term, and minor.

Accidental Spills of Hazardous Materials

Contamination caused by spills of hazardous materials during construction could impact wetlands. The greatest risk to wetland resources due to accidental spills during construction would be associated with refueling or storage of fuel, oil, or other fluids. If not adequately cleaned up, contaminated wetlands could have long-term impacts on wetland dependent species. By restricting the location of refueling and storage areas, and by cleaning up any inadvertent releases, the potential effects associated with spills or leaks of hazardous liquids would be avoided or minimized.

To minimize wetland impacts, the Applicant would implement its Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), which includes:

- Secondary containment for the storage of hazardous materials (BMP #3);
- Secondary containment capable of containing 110 percent of the volume of hazardous materials (BMP #3);
- Daily inspections of tanks for leaks (BMP #3); and
- Restricting refueling and transferring of liquids to pre-designated locations away from sensitive areas (BMP #3).

The Onshore Construction Spill Response Plan (Appendix F) also specifies measures to contain and clean up a spill if one were to occur, including:

- Use adsorbent pads for minor leak cleanup (BMP #3);
- Stop or divert flow to temporary containment areas (BMP #3);
- Immediately construct temporary containment structures, if necessary (BMP #3); and
- Collect, store, and properly dispose of contaminated materials (BMP #3).

During construction, the Applicant's EIs would ensure compliance with the Onshore Construction Spill Response Plan. With implementation of these measures, impacts on wetlands due to an inadvertent release of hazardous materials during construction would be direct, adverse, short-term, and minor.

During operation, an oil spill on land could lead to contamination of wetlands either directly by oil flowing into the wetland or indirectly by contaminated groundwater reaching nearby wetlands. The impacts on wetlands would vary depending on time of year and the presence of water in the wetland. Some oil would evaporate and some oil would adhere to vegetation. The effects on wetland vegetation would vary based on growth stage of the plant at the time of oiling, the amount of oil that reached the wetland, and the timing of the release. Vegetation is most vulnerable during the growing season. The worst-case scenario could include complete defoliation. Mobile wetland dependent species would likely avoid the spill, but long-term contamination could affect the wetland for many years.

To minimize the impacts of an oil spill, the pipelines would be constructed with shutdown valves to allow sections of the pipeline to be isolated. Shutdown valves would limit the continuous flow of oil once a leak is detected. Storage tanks at the Oyster Creek Terminal would be contained within a concrete ring lined with an impermeable membrane. A leak detection system would be installed within the concrete ring for each storage tank. The seven new storage tanks would be installed within a secondary containment berm designed per NFPA requirements and would be capable of containing 110 percent of the capacity of one storage tank. The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3). Oil would flow from the opening under operating pressure until the line is depressurized and the leaking segment is isolated.

The Applicant provided hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions). These include:

- Booming-containment
- Skimming
- Physical herding
- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

Use of the response actions described would minimize the impacts associated with an oil spill. With implementation of the safety and response actions described above, impacts on wetlands due to an oil spill would be direct and adverse, and depending on the size of the spill and time of year, could be short-term or long-term, and minor to major.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the SWPPP (BMP #14 in Appendix N). The Applicant would also adhere to the conservation measures established for the Eastern Black Rail in Section 5.1.4 of the Addendum to the BA (Appendix E2). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

3.3.5.4. Compensatory Mitigation

The Applicant's Conceptual Compensatory Mitigation Plan is based on the results of its functional assessment of affected wetlands and complies with the USEPA's 404(b)(1) guidance, as well as the USACE's mitigation requirements outlined in 33 CFR Part 332. To mitigate for the permanent loss of

6.0 acres of PEM wetlands and 0.2 acre of PFO wetlands at the Oyster Creek Terminal site, the permanent loss of 0.1 acre along the Oyster Creek to Shore Pipelines, the conversion of 6.6 acres of PFO wetlands, 0.4 acre of PSS wetlands, and the temporary impacts on 2.7 acres of PSS wetlands the Applicant proposes to purchase mitigation credits from two mitigation banks, based on interim hydrogeomorphic (more commonly known as iHGM) wetland functional assessments and the service area that would cover the respective mitigation needs. The Applicant also proposes to mitigate for the temporal functional loss of tidal fringe (ESS) and PSS wetlands by purchasing credits from USACE approved mitigation banks. The USACE will be responsible for evaluating the compensatory mitigation requirements for impacts to wetland WB050, an EEM wetland, where the shoreline MLV would be placed and result in approximately 0.1 acre of permanent impact not currently accounted for in the Applicant's mitigation plan.

For impacts occurring in the Austin-Oyster Watershed, the Applicant proposes to purchase forested credits from the CBCMB to offset impacts on PFO, PSS, and PEM wetlands. Using the appropriate functional capacity units (FCUs), the Applicant would mitigate for the forested wetland FCUs based on a 1:1 ratio because impacts would be in-kind and occur in the primary service area for the CBCMB. Non-forested credits are not currently available at CBCMB. The purchase of forested credits would be considered out-of-kind mitigation and would require a higher ratio; the Applicant proposes to mitigate at a ratio of 1.5:1 for PSS and PEM FCUs. The Project would require 18.402 credits for impacts in the primary service area. For impacts occurring within the bank's secondary service area that encompasses a portion of the West Galveston Bay Watershed, the Applicant would apply a secondary service area multiplier for PFO credits and apply both an out-of-kind multiplier and secondary service multiplier to mitigate for the functional loss of non-forested wetlands totaling an additional 1.479 credits.

For Project impacts that occur in portions of the West Galveston Bay Watershed not within the CBCMB secondary service area, the Applicant would purchase credits from the LBRMB. Project impacts would fall within the secondary service area of the LBRMB, which requires purchase of FCUs at 1.5:1 ratio. Based on the functional assessment of affected wetlands, the Applicant would purchase 0.1 suite of non-forested wetland credits and 0.3 suite of forested wetland credits for a total purchase of 1.2 credits from the LBRMB.

For the Project's temporal impacts to EES wetlands, the Applicant proposes to purchase in-kind mitigation credits from the GCPMB located within about 15 miles of the bank's secondary service area and is the nearest bank with tidal wetland credits. The Applicant proposes to purchase a credit suite based on the functional assessment, rounded up, for a total of 9.2 credits.

Table 3.3.5-3: Summary of the Minimum Suites Required and the Mitigation Ratios Applied for Each Mitigation Bank

Mitigation Bank	Service Area	Wetland Class	Impact Suite (FCU)	Service Area Multiplier	Out-of-Kind Multiplier	Total Suites (FCU)	Total Credits
CBCMB	Primary	Non-forested	3.047	1	1.5	4.570 [a]	19.881
		Forested	1.564	1	NA	1.564 [a]	
	Secondary	Non-forested	0.085	1.5	1.5	0.191 [a]	
		Forested	0.201	1.5	NA	0.302 [a]	
LBRMB	Secondary	Non-forested	0.044	1.5	NA	0.1 [a, b]	1.2
		Forested	0.170	1.5	NA	0.3 [a, b]	
GCPMB	Outside Service Area	Estuarine scrub/shrub	1.505	1.5 (out of service area)	NA	2.3 [a, c]	9.2

Source: SPOT 2021a

CBCMB = Columbia Bottomlands Conservation Mitigation Bank; FCU = functional capacity units; GCPMB = Gulf Coastal Plains Mitigation Bank; LBRMB = Lower Brazos River Mitigation Bank; NA = not applicable

[a] Total suite includes physical, biological, and chemical functional credit units.

[b] Rounded up to the nearest 0.10.

[c] Total suite includes biota, botanical, physical, and chemical functional credit units.

A copy of the complete mitigation plan is included in Appendix P. Should the USACE Galveston District deny the proposed mitigation, or the banks not be able to provide the required mitigation credits, the Applicant would prepare a permittee-responsible mitigation plan or pursue other banking options in accordance with USACE requirements.

3.3.6. Physical Oceanography

3.3.6.1. Existing Conditions

The physical oceanography of the GoM includes physical conditions and processes within the ocean, and the motions and physical properties of the marine water. These conditions and processes, discussed in more detail below, include bathymetry (i.e., the measurement of water depth in the ocean), wave action, tides, winds, and currents. Bottom sediments of the GoM are discussed in Section 3.8, Geologic and Soil Resources.

Bathymetry

The proposed Project would be located on the continental shelf of the GoM. Over time, sediment discharge associated with freshwater inflow from the Mississippi River and Atchafalaya River tributaries (along with an array of smaller drainages) has created a shallow shelf on the GoM's northern rim. This "continental shelf" slopes gradually from the coastline to the shelf break, where water depths range from approximately 387 to 492 feet (Mitchell 1988). Continental shelves are shallower than the open ocean. Beyond the shelf break, the seafloor extends outwards to the continental slope to meet a part of the deep ocean called the abyssal plain. Figure 3.3.6-1 depicts the depth contours in the vicinity of the SPOT DWP and offshore pipelines.

The Applicant conducted a geophysical survey in October and November 2018 using a sub-bottom profiler to collect high definition bathymetry and geophysical data to identify features of potential concern (e.g., seafloor debris). Bathymetry surveys conducted for the Project identified slopes of approximately 12 feet per mile from the HDD exit point (approximately 5,500 feet from shore) to the first curve of the offshore pipeline route. Further from shore, the seafloor slopes at a rate of approximately 2 feet per mile, becoming more gradual (approximately 1 to 2 feet per mile) until the pipeline reaches the SPOT DWP site. The seafloor is largely featureless, with trawl scars evident in some locations, and small (less than 15 feet tall) pinnacle outcrops near the SPOT DWP. Bathymetry surveys conducted by the Applicant (Figure 3.3.6-1) indicate that water depths within the proposed SPOT DWP survey area range from 110 to 117 feet, with the proposed terminal site being located in water 115 feet deep. The seafloor at the proposed SPOT DWP site is largely featureless with some pockmarks (typically the result of gas and/or water venting from the subsurface) and trawl scars.

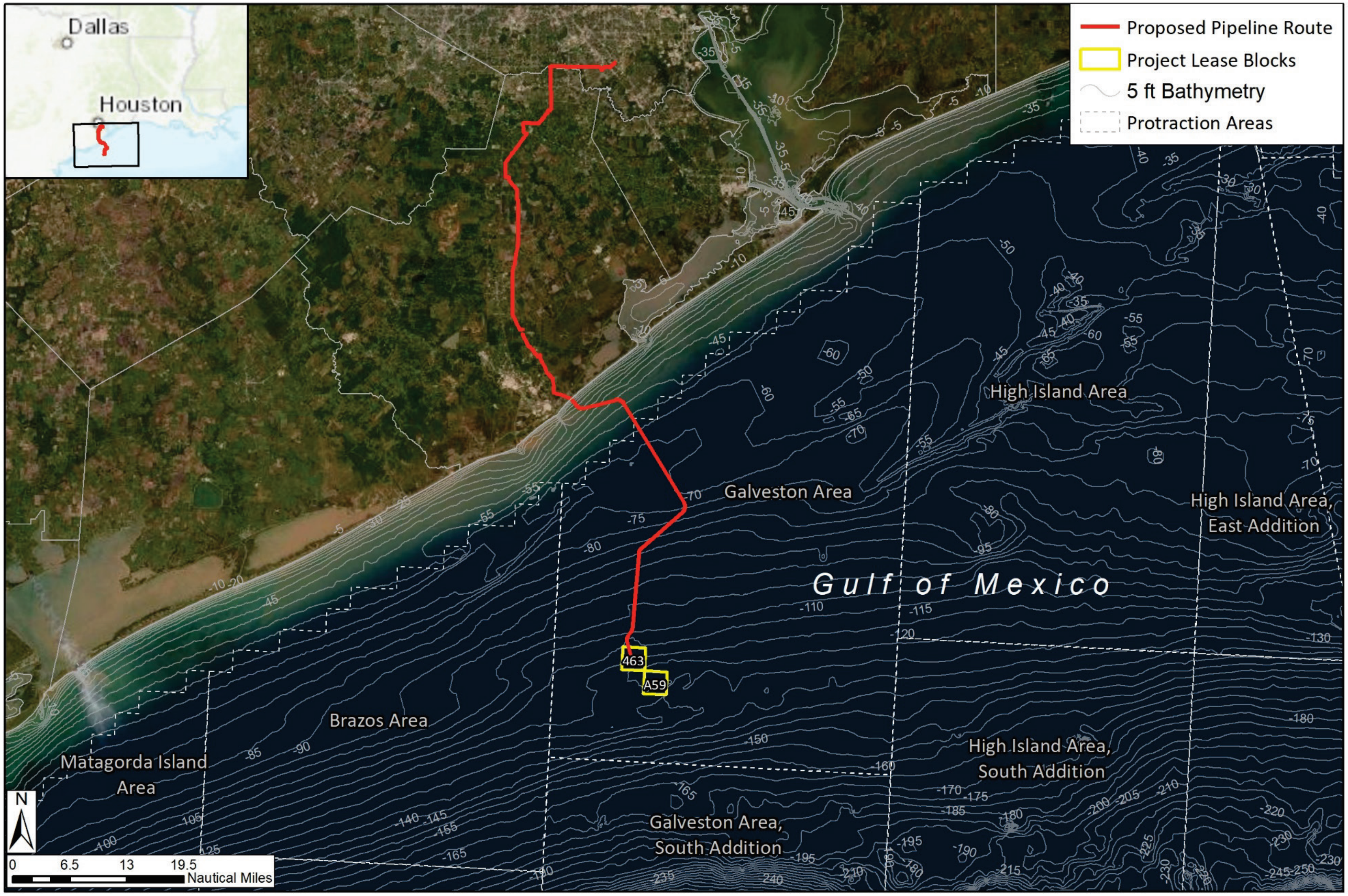


Figure 3.3.6-1: Bathymetry Map of Area Proximal to SPOT Deepwater Port

Temperature and Salinity

Ambient seawater temperatures along the Texas Gulf Coast range from 53 to 85°F seasonally (Current Results 2019). Salinity varies from 18 to 40 parts per trillion along the Texas Gulf Coast, varying seasonally with the changes in freshwater input and currents (NOAA 2019b).

Wave Action

The Applicant analyzed data from the GoM Oceanographic Study, a comprehensive hindcast database developed for the GoM by OceanWeather (2018), including data for the period 1980 through 2017. OceanWeather determined that wave direction is predominantly from the south and southeast in the GoM. The proposed Project location experiences a mixture of wind-generated waves and occasional swells. The annual mean significant wave height is 4.4 feet near the proposed SPOT DWP, with higher mean wave heights occurring in the fall, winter, and spring periods as compared to summer. Significant wave heights exceed 7.1 feet 10 percent of the time and exceed 9.9 feet 1 percent of the time. Generally, wave heights are less than 6 feet and wave periods are less than 8 seconds 80 percent of the time.

Tides

The tides in the GoM are semi-diurnal; semi-diurnal cycles experience two high tides and two low tides of near-equal size every lunar day. Tidal heights for the Freeport, Texas area have a tidal range of approximately 1 to 2 feet (NOAA 2019f). The average tidal current speed is less than 0.7 meter per second along the Texas coast near the Project site (Johnson 2008).

The GoM typically has tropical conditions during hurricane season, from May through November, when severe wind and tidal conditions can occur. During hurricanes and tropical storms, the speed of surface currents increases and cools surface water temperatures, mixing the stratified layers in the water column (University of Rhode Island 2015). Storm surges during heavy storms extend inland beyond the high tide line, and can cause infrastructure and material damage to surrounding structures.

Winds

The climate along the northern GoM is a mixture of tropical and temperate zone conditions. Winds are variable near the coast due to moving cyclonic storms characteristic of the continent and the land/sea breeze regime, with less variability over open waters. During the months of June, July, and August, the winds move onshore and northerly; from October through April, the winds move offshore and west/southwesterly (Johnson 2008).

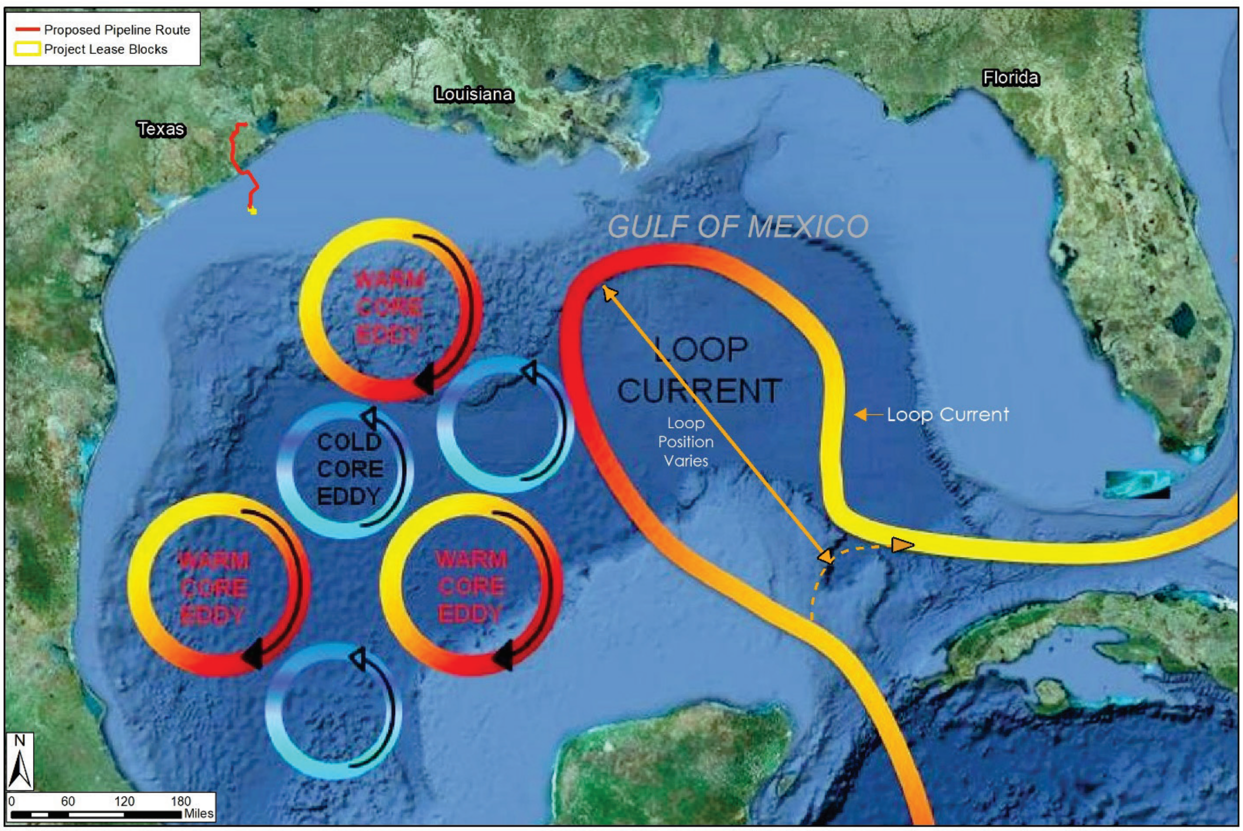
Warm air mixing with cold air can produce hurricanes in the GoM. Most hurricanes enter the GoM through the Yucatan Channel between May and November (National Weather Service 2019). On average, tropical cyclones (i.e., tropical storms and hurricanes) with wind speeds of 39 miles per hour occur every 1 to 2 years, and hurricanes with wind speeds of 74 miles per hour occur every 4 to 5 years. Hurricanes with wind speeds up to 110 miles per hour occur on average every 25 years.

Currents

Water currents in the GoM are largely driven by the Loop Current. The Loop Current is a surface current composed of warm water that travels north from the Caribbean and enters the GoM through the Yucatan Strait and exits through the Florida Strait (Figure 3.3.6-2) (NOAA 2018b).

If the Loop Current bulges into the northern GoM, eddies can form and break off from the main current (Collow 2010). These eddies rotate counter-clockwise (cyclonic) and move west/southwest at about 2 to 3 miles per day (Collow 2010). These eddies can affect regional current patterns and can remain active for longer than 1 year (Sass 2011).

Along the Texas coastal shelf, the nearshore currents run from north to south, except in summer when hot winds make the surface currents unpredictable (Sass 2011). At the continental shelf edge, the currents move north, making a counter-clockwise gyre off the coast of Texas (Sass 2011). The coastal current is influenced by the input of freshwater from the Mississippi and Atchafalaya River systems (Sass 2011).



Source: Texas Pelagics 2021

Figure 3.3.6-2: Gulf of Mexico Currents

3.3.6.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from the construction and operation of the offshore components of the SPOT Project. The study area within which potential impacts were assessed includes the area that would be affected physically by Project activities during construction and operation.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on physical oceanography have been evaluated based on their potential to:

- Cause irreparable harm to human health, aquatic life, or beneficial uses of aquatic ecosystems; and/or
- Degrade marine water quality.

The remainder of this section describes potential impacts from Project construction and operation on physical oceanography from seafloor disturbance and installation of equipment.

Construction Impacts and Mitigation

Construction of the offshore pipelines, SPOT DWP, and associated facilities would cause minor changes to the seafloor within the construction footprint. Direct disturbance of about 1,212 acres would occur during construction of the offshore pipelines and approximately 1 acre during construction of the platform, PLEMs, and SPM buoys. Trenching of the subsea pipeline would result in additional impacts due to sediment deposition over a maximum area of about 11,797 acres based on model results (SPOT 2019hh). Construction of the offshore pipelines and SPOT DWP could cause small local changes to currents in the vicinity of the structures during installation. However, these changes would be temporary and localized. Construction of the offshore pipelines and SPOT DWP would not affect tides, winds, or wave action in the GoM. As such, impacts on physical oceanography from construction of the Project would be direct, adverse, short-term, and negligible.

Operation Impacts and Mitigation

The DWP pilings, PLEMs, and SPM buoys would alter the seafloor for the life of the Project. Approximately 0.4 acre would be affected, causing a permanent change to the bathymetry at the SPOT DWP, PLEMs, and SPM buoys. The offshore pipelines would be buried at least 3 feet below the natural bottom elevation; therefore, no permanent changes to the seafloor bathymetry over the pipelines would occur.

The DWP, PLEMs, and SPM buoys could create minor current changes, but these would be limited to a small area around the platform piles, PLEMs, and SPM buoys. Due to the relatively small size of the Project within the GoM, changes to currents would be direct, long-term, minor, and localized. It cannot be determined at this time whether impacts would be adverse or beneficial.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor. Maintenance impacts would be similar to those described for construction. Impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible.

3.3.7. Coastal and Marine Environment and Marine Water Quality

3.3.7.1. Existing Coastal Environment

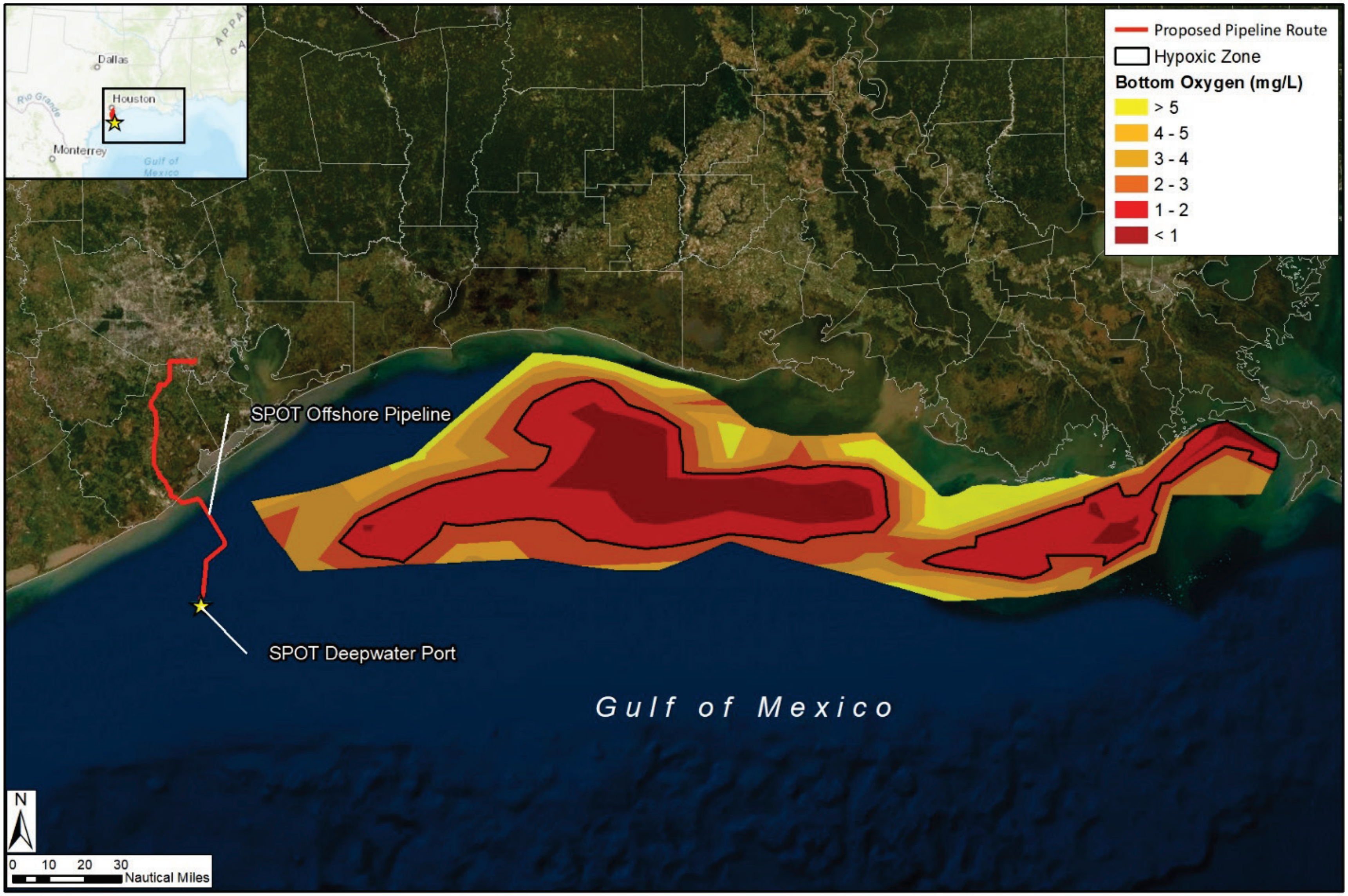
The offshore pipelines and SPOT DWP would be located within coastal waters in the GoM, as determined by the TCMP's Texas coastal zone. Coastal environments are important for wildlife (see Section 3.5, Wildlife and Aquatic Resources; Section 3.7, Threatened and Endangered Species; and the BA [Appendix E1, Biological Assessment and Essential Fish Habitat Assessment]) and human activities such as fishing (see Section 3.14, Socioeconomics). The Brazos River and Oyster Creek are larger waterbodies that supply freshwater inputs into the GoM near the Project area.

The GoM covers a surface area of approximately 580,000 square miles, and coastal water quality along this shoreline is highly affected by human activity, as nearly two-thirds of North America's surface water runoff empties into the GoM (WorldAtlas 2019). While dependent on seasonal fluctuations and geography, this runoff typically results in lower water quality with reduced water clarity, low DO levels, and an increase in toxic algal blooms, generally rating coastal water quality as fair to poor (Kennicutt 2017b).

Runoff from several rivers into the GoM has caused an excess of nutrients, primarily nitrogen and phosphorus, resulting in hypoxia.[1] Hypoxic conditions are present when oxygen levels in the water are less than 2 mg/L, which can lead to the death of organisms in coastal waters. This hypoxic zone is commonly referred to as the "dead zone," as discussed in Section 3.3.2, Water Resources: Existing Threats. These conditions threaten biological resources, and hypoxic water conditions have been known to occur across the Louisiana shelf west of the Mississippi River and into the upper Texas coast. While the size of this hypoxic zone varies annually, in 2017 the largest recorded hypoxic zone since 1985 was measured at approximately 8,776 square miles (Turner and Rabalais 2017). The 2019 hypoxic zone was measured in late July and was the eighth largest ever recorded. The hypoxic zone covered an area of about 6,952 square miles. The 2019 hypoxic zone was smaller than predicted due to mixing in the GoM caused by Hurricane Barry. Researchers also noted that the dead zone quickly reformed and expanded once Hurricane Barry passed (NOAA 2019j). The data indicates that the SPOT DWP component would be located approximately 28 nautical miles southwest of the 2017 delineated hypoxic area and the offshore pipelines would be located approximately 32 miles from the edge of the 2019 hypoxic zone (Figure 3.3.7-1).

DO concentrations are at their highest levels near the water's surface, where atmospheric exchange and photosynthetic productivity occurs most, and decreases in concentration with depth (USGS 2019a). In contrast, the inverse trend is found for nutrient levels, with their highest concentrations found at depth, and lowest levels found at the water's surface (NOAA 2019h; Zhao and Quigg 2014).

[1] Hypoxia is the deficiency of oxygen in an environment.



Source: NOAA 2019j

Figure 3.3.7-1: Gulf of Mexico 2019 Hypoxic Zone Measured July 23–29, 2019

3.3.7.2. Existing Marine Environment

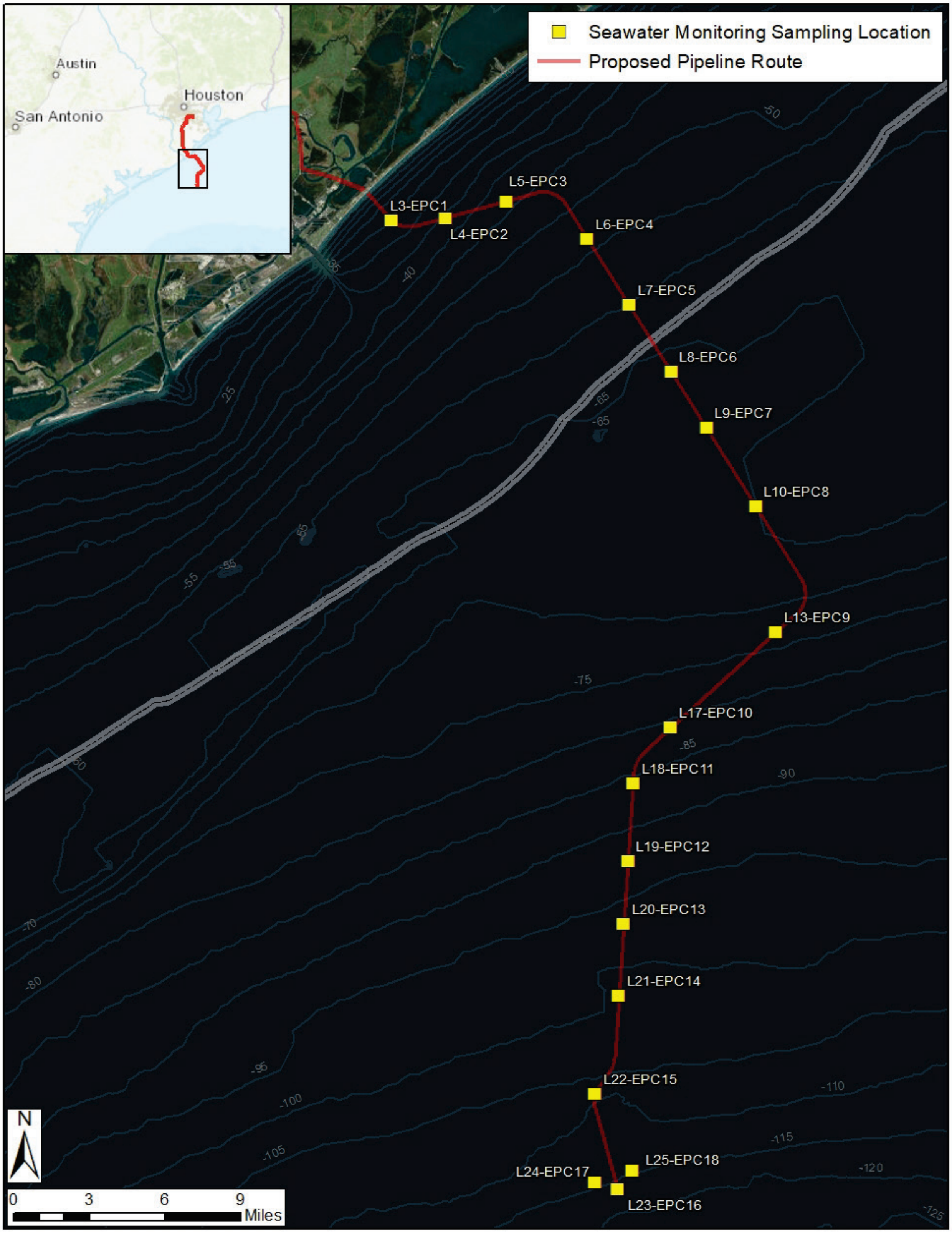
Once outside the influence of coastal anthropogenic processes and surface water runoff, water quality in the marine environment of the OCS typically improves (Kennicutt 2017b). Exceptions to this are waters just above naturally-occurring hydrocarbon (oil and gas) seeps, as well as localized and ephemeral effects on water quality due to the discharge of produced waters around oil and gas platforms (Kennicutt 2017a). OCS waters receive fewer pollutant discharges from human activities and experience greater mixing rates than coastal areas due to the large volume of receiving water (Kennicutt 2017b).

In the central GoM, hydrocarbon seeps are widespread and contribute hydrocarbons to the surface sediments and water column. The estimated total volume of oil seepage in the GoM exceeds 42 million gallons a year (Kennicutt 2017a). In addition to hydrocarbon seeps within the GoM, water quality can be affected by naturally occurring chemicals from methane seeps, hydrate mounds, and subsurface brines (Vigneron et al. 2017), which can contribute to the additional carbon load in deeper waters, and the observed decreased oxygen levels from enhanced chemical and biological oxygen demand.

3.3.7.3. Existing Marine Water Quality

Coastal water quality is influenced by currents, tides, freshwater inputs, and precipitation. Most recently, coastal water quality has been affected by anthropogenic influences, such as agricultural runoff, oil and gas exploration and development, and increased human population, which have degraded water quality in the GoM (Kennicutt 2017a; Kennicutt 2017b). In general, water quality in coastal waters of the GoM is fair to poor, due to the influence of human activity. Low DO, reduced water clarity, and toxic algal blooms are common in the GoM, but are highly localized and season-dependent (Kennicutt 2017b). Water quality in Galveston Bay, which is near the Project area, has been in a declining trend since 1976, but generally remains above a level required to support aquatic life (Gonzalez 2011; Galveston Bay Foundation 2019). Non-point source pollution, spills of toxic substances, and introduction of non-native species contribute to the low water quality in the Galveston Bay area. Offshore water quality is generally better than coastal water quality but can still be affected by similar problems. The hypoxic zone can extend over the continental shelf in Texas, and development offshore can negatively affect water quality by introducing pollutants to the offshore environment (Kennicutt 2017b).

Water quality data are limited within the general vicinity of the Project area; therefore, the Applicant collected additional data from 18 sampling stations throughout the water column between November 3, 2018 and November 8, 2018. Of these 18 stations, 15 were located along the proposed offshore pipelines and 3 stations were located at the SPOT DWP platform. Sampling occurred at three different depths (near surface, mid-water, and near bottom), with one sample collected at each depth interval for a total of 54 samples. Samples were analyzed for the following physical, chemical, and biological parameters: pH, temperature, turbidity, conductivity/salinity, DO, oxidation reduction potential, total suspended solids (TSS), TDS, biological oxygen demand, chemical oxygen demand, nutrients, target analyte list metals, mercury, chlorinated pesticides and polychlorinated biphenyls, VOCs, and semi-volatile organic compounds. Figure 3.3.7-2 shows the sample locations. Table 3.3.7-1 summarizes water quality sampling results for the SPOT DWP stations and the offshore pipeline stations.



Sources: Applicant GIS data; SPOT 2019a, Volume IIa, Appendix H

Figure 3.3.7-2: Water Quality Sampling Locations

Nutrient concentrations were predominately below the reporting limits, with only one total phosphorus concentration detected above the reporting limit. Nitrate/nitrite concentrations were all below the laboratory reporting limits. Thirteen of the 54 samples had detected ammonium concentrations, and TSS concentrations were below 12 mg/L at 51 of 54 stations. Three stations along the offshore pipelines had higher TSS levels than the remaining 54 stations (greater than 17 mg/L). Higher TSS levels indicate higher turbidity levels. All TDS concentrations, which indicate salinity levels, were normal for seawater.

Table 3.3.7-1: Summary of Water Quality Baseline Sampling Results

Measured Parameter	Reporting Limit [a]	CCC Toxicity Reference Value [b]	SPOT DWP Sampling Points [c]		Offshore Pipeline Sampling Points [c]	
			Minimum (mg/L)	Maximum (mg/L)	Minimum (mg/L)	Maximum (mg/L)
Biological and Physical						
BOD	2 mg/L	NA	BDL	2	BDL	BDL
COD	300 mg/L	NA	BDL	BDL	BDL	BDL
Nitrate/Nitrite	10 mg/L	NA	BDL	BDL	BDL	BDL
Ammonium	0.05 mg/L	NA	BDL	0.062	BDL	0.62
Total Phosphorus	0.05 mg/L	NA	BDL	BDL	BDL	0.058
TDS [d]	10 mg/L	NA	34,600	39,000	29,500	38,700
TSS	2 mg/L	NA	5.16	8.78	3.47	30.0
Metals						
Aluminum	0.01-0.5	NA	BDL	BDL	0.01	0.209
Antimony	0.02-0.1	NA	BDL	BDL	BDL	BDL
Arsenic	0.002-0.1	0.036 mg/L	BDL	BDL	0.002	0.004
Barium	0.04-0.2	0.2 [e]	BDL	BDL	BDL	BDL
Beryllium	0.02-0.1	0.1 [e]	BDL	BDL	BDL	BDL
Cadmium	0.02-0.1	0.0088 mg/L [f]	BDL	BDL	BDL	BDL
Calcium	25-50	NA	439	508	302	490
Chromium [g]	0.004-0.2	0.05 mg/L	BDL	BDL	BDL	BDL
Cobalt	0.005-0.25	0.01 h	BDL	BDL	BDL	BDL
Copper	0.002-0.1	0.0031 mg/L	BDL	BDL	BDL	BDL
Iron	0.2-10	0.05 mg/L [e]	BDL	BDL	BDL	BDL
Lead	0.02-0.1	0.008 mg/L	BDL	BDL	BDL	BDL
Magnesium	10-20	NA	1,340	1,530	975	1,490
Manganese	0.005-0.25	0.1 mg/L [e]	BDL	BDL	BDL	0.006
Mercury	0.00002-0.0002	0.00094	BDL	BDL	BDL	BDL
Nickel	0.002-0.1	0.0082	BDL	BDL	BDL	BDL
Potassium	10-20	NA	390	474	279	502
Selenium	0.02-0.1	0.071 mg/L	BDL	BDL	0.002	0.03
Silver	0.02-0.1	NA	BDL	BDL	BDL	BDL
Sodium	20-100	NA	10,400	12,300	8,250	12,400
Thallium	0.02-0.1	0.017 [h]	BDL	BDL	BDL	BDL
Vanadium	0.005-0.25	0.05 [h]	BDL	BDL	BDL	0.005

Measured Parameter	Reporting Limit [a]	CCC Toxicity Reference Value [b]	SPOT DWP Sampling Points [c]		Offshore Pipeline Sampling Points [c]	
			Minimum (mg/L)	Maximum (mg/L)	Minimum (mg/L)	Maximum (mg/L)
Zinc	0.004-0.2	0.081 mg/L	BDL	BDL	BDL	0.004
Chlorinated Pesticides and PCBs	0.05 to 0.5 µg/L					
VOCs	1 to 2 µg/L					
SVOCs	0.11 to 1.1 µg/L					

Source: SPOT 2019a, Application, Volume IIa, Appendix H, "SPOT Water Quality Environmental Baseline Survey: Seawater Monitoring, Offshore Texas."

µg/L = micrograms per liter; BDL = below detection limits; BOD = biological oxygen demand; CCC = criterion continuous concentration; COD = chemical oxygen demand; DWP = deepwater port; mg/L = milligrams per liter; NA = not applicable; PCB = polychlorinated biphenyl; SPOT = Sea Port Oil Terminal; SVOC = semi-volatile organic compound; TDS = total dissolved solids; TSS = total suspended solids; VOC = volatile organic compound

[a] Ranges in reporting values due to dilution factors required for each sample based on salinity level.

[b] CCC toxicity reference values from Buchman 2008.

[c] Result range is across the three water depths (near surface, mid-water; and near bottom).

[d] Typical TDS concentrations in offshore seawater distant from freshwater input are <35,000 mg/L (SPOT 2019a, Volume IIa, Appendix H).

[e] British Columbia Water Quality Guidelines, working or recommended, as published in Buchman 2008.

[f] CCC provided in NOAA Screening Quick Reference Table is noted herein (Buchman 2008), but is different from the USEPA National Recommended Water Quality Criteria of 0.0079 mg/L for cadmium (USEPA 2019a).

[g] Refers to chromium VI.

[h] Australian and New Zealand environmental concern levels and Trigger Values, as published in Buchman 2008.

The Applicant also analyzed the samples for dissolved fractions for metals in the water and in the water matrix particulates. Typically, dissolved metals are more bioavailable. Toxicity reference values (TRVs), or toxic effects thresholds, are considered the USEPA's National Recommended Water Quality Criterion Continuous Concentration (Buchman 2008) to determine where baseline water quality measurements are equal to or greater than regulatory thresholds for toxicity. Calcium, magnesium, potassium, and sodium are all normal chemical components in seawater and were detected in all samples; however, there are no TRVs for these metals. Mean concentrations for these constituents increased with water depth. Antimony, barium, beryllium, cadmium, chromium, cobalt, copper, iron, mercury, lead, nickel, silver, and thallium concentrations did not exceed laboratory reporting limits for any samples (see SPOT 2019a, Volume IIa, Appendix H, "SPOT Water Quality Environmental Baseline Survey: Seawater Monitoring, Offshore Texas," for the full sampling report).

Detected concentrations of aluminum, arsenic, manganese, selenium, vanadium, and zinc were all below their respective TRVs.

3.3.7.4. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on the coastal and marine environment. The study area within which potential impacts were assessed encompasses the area that would be affected directly and indirectly within the GoM by

Project activities during construction and operation, including the extent of the marine environment that could be affected based on the sediment transport modeling the Applicant conducted for the Project.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on the coastal and marine environments have been evaluated based on their potential to:

- Violate a Federal, state, local, or Federally recognized international water quality criterion or waste discharge requirement;
- Cause irreparable harm to human health, aquatic life, or beneficial uses of aquatic ecosystems;
- Degrade marine or coastal water quality; and/or
- Increase contaminant levels in the water column, sediment, or biota to levels shown to have the potential to harm organisms, even if the levels do not exceed the formal water quality criteria.

The remainder of this section describes potential impacts from Project construction and operation on the coastal and marine environment and marine water quality from seafloor disturbance, including use of the jet sled and pile driving, suspension of sediment within the water column (i.e., turbidity), discharge and withdrawal of hydrostatic test water, accidental spills and releases during construction, scour, oil spills during operation, and operational seawater withdrawals and discharges, including those from VLCCs or other crude oil carriers.

The primary parameters that can influence water quality include water temperature, salinity, TDS, TSS, turbidity, and nutrient levels.

Construction Impacts and Mitigation

Construction related impacts on water quality would include increased turbidity from disturbance of the seafloor and introduction of pollutants from water discharges and accidental spills.

Offshore Pipeline and SPOT DWP Construction

Impacts associated with pipeline installation would involve direct impacts on the seafloor due to anchoring of vessels involved in the construction process, dropping each pipeline off the construction barge through the water where it would settle on the seafloor, jetting to bury the pipelines, and excavation of the HDD exit pit for installation of the offshore pipelines from the shore crossing to approximately 5,500 feet offshore.

The composition of the seafloor along the offshore Project route includes sand, silty sand, silty clay, and sandy silty clay. BOEM requires that the pipelines be buried at least 3 feet below the natural bottom elevation to prevent potential impacts on the pipeline caused by high currents and storms, anchors, and fishing gear (30 CFR § 250.1003(a)(1)). Burial of the pipeline and excavation of the HDD exit pit would result in resuspension of about 29.4 million cubic feet of sediments. Dredged materials would be sidecast within the 100-foot-wide construction workspace and would cause increased turbidity in the water column. The coarse sediments would resettle first and the finer sediments would remain in suspension for a longer period.

Water quality would also be affected by installation of the SPM buoys, PLEMs, and pilings associated with the platform. The platform would be supported by 8 piles, 72 inches in diameter, and the PLEMS would be supported by a total of 16 piles, 30 inches in diameter. Sediment displacement and increased turbidity would occur during pile installation. During platform installation, anchor components would be tested under load, which would result in temporary impacts exceeding 100 feet in soft sediments. However, these temporary impacts would be negligible due to the small size and short-term nature of the impact. Permanent disturbance to the about 0.4 acre of seafloor and would be equal to the footprint of the pilings and anchors, as well as the associated components of the SPM buoys and PLEMs.

The Applicant provided a sediment fate and transport model for offshore construction activities: pipeline trenching and jetting, pile driving, and HDD exit pit excavation (SPOT 2019g). The model simulated the addition of sediment to the water column and deposition of sediment away from the disturbance due to resuspension of sediment from construction activities in different sediment types and under varying tidal, bathymetric, current, and wind conditions. The model focused on near bottom sediments, which is where the disturbance would take place, and considered a concentration of 10 mg/L to indicate an increase in turbidity. The Applicant selected 10mg/L because it represents the typical concentration of TSS in coastal waters of the GoM (SPOT 2019dd).

Disturbance from offshore pipeline installation would cause increases in turbidity over a maximum area of about 19,044 acres and turbidity would attenuate to background levels within 24 hours after the end of the disturbance. The total volume of water that would experience increased turbidity is estimated to be 152,400 cubic meters (SPOT 2019dd). Pipeline installation would also cause sedimentation greater than 1 millimeter (mm) (0.04 inch) up to a maximum area of about 6,210 acres (SPOT 2019hh). The two pipelines would be trenched in at different times; therefore, turbidity would not be additive, but sedimentation would be additive in adjacent areas. Disturbance from pile installation would cause increases in turbidity over a maximum area of about 0.25 acre that would attenuate to background levels within hours after the end of the disturbance (SPOT 2019dd). Pile installation would also cause sedimentation greater than 0.04 inch over a maximum area of about 0.02 acre. The platform piles are spaced 50 to 60 feet apart, so turbidity and sedimentation deposition would not overlap for installation of the eight piles. No modeling was conducted for installation of the PLEM pilings, but because the pile size would be smaller (30-inch vs. 72-inch), the associated turbidity and sedimentation impacts would also be smaller. The models show that disturbance from excavation and backfilling of the HDD exit pit would cause increases in turbidity over a maximum area of about 6.2 acres that would attenuate to background levels shortly after the end of the disturbance. HDD exit pit excavation and backfilling would also cause sedimentation greater than 0.04 inch over a maximum area of about 4.8 acres. The Applicant modeled HDD exit pit excavation and backfilling; however, the Applicant indicated the HDD exit pit would be allowed to backfill naturally due to currents and wave action (SPOT 2019bb).

Excess suspended sediments or increased turbidity cause a decrease in water clarity by altering light transmission through the water column, which in turn affects marine wildlife, as discussed in Sections 3.4, Habitats, through 3.7, Threatened and Endangered Species. Offshore pipeline and SPOT DWP construction would result in increased turbidity, but levels would return to baseline levels with current and tidal action shortly after disturbance. As such, impacts from construction of the SPOT Project in the GoM would be direct, adverse, short-term, and minor.

Hydrostatic Testing

The offshore pipelines would be hydrostatically tested and the water discharged in compliance with any conditions in the NPDES permit. Approximately 14 million gallons of seawater would be used for hydrostatic testing, and corrosion inhibitors would be added to the test water during testing and, therefore, released into the GoM when hydrostatic test water is discharged to the GoM. Hydrostatic test water would be withdrawn at a rate of 5,800 to 14,600 gallons per minute (gpm) and would be filtered through one or more sieves with a final mesh screen size no courser than 5/16-inch. The Applicant anticipates using a corrosion inhibitor with propylene glycol and polyoxyalkylenes. No information about polyoxyalkylene toxicity is available, but propylene glycol has been shown to be relatively non-toxic in marine and freshwater environments and is highly water soluble (Canadian Council of Ministers of the Environment 2006). Many microorganisms help propylene glycol rapidly biodegrade in both aerobic and anaerobic conditions. Therefore, it is considered “readily biodegradable” and is not expected to persist in either a terrestrial or aquatic environment, making it unlikely to bioaccumulate or biomagnify in an aquatic ecosystem (West et al. 2014). After pressure testing is complete, the pipeline would be dewatered, cleaned, and dried using air to run a series of pipeline pigs through the system. The hydrostatic test seawater would be discharged at a rate of 4,000 gpm, which would take approximately 60 hours; discharge would occur via the platform deck drain that flows back to the GoM. Discharge rates of seawater from hydrostatic testing in one location could cause scouring on the seafloor. The amount of turbidity caused by scour would be dependent on the currents and location of discharge; the Applicant does not plan to use diffusers. The discharge outlet would be located about 15 feet below the surface of the water. Due to the volume and rate of water discharges, scour is likely to occur near the platform, but would be limited to less than 3 days. The seafloor would return to preconstruction conditions once hydrostatic test water discharges are complete.

Withdrawals of seawater would not affect the water quality of the GoM due to their relatively small volumes compared to the size of the GoM. The release of corrosion inhibitors into the GoM would have direct, adverse, short-term, negligible impacts on water quality. Discharges would meet requirements of the individual NPDES permit for hydrostatic test water discharges; therefore, impacts on water quality would be direct, adverse, short-term, and minor. Impacts on aquatic resources, including benthic species and ichthyoplankton, and fisheries are discussed in Section 3.5, Wildlife and Aquatic Resources, and 3.6, Estuarine and Marine Fisheries, respectively. Impacts on ichthyoplankton are also discussed in Appendix S, Ichthyoplankton Impact Assessment.

Accidental Spills and Releases

Accidental spills and releases could come from vessels, inadvertent releases of drilling mud during HDD operations, and fluid and debris releases from the platform or vessels. Accidental spills of hazardous materials could include gasoline, oil, hydraulic fluids, drilling muds, or diesel fuel, all of which would have an adverse effect on the surrounding environment.

The Applicant would install approximately 1 mile of the subsea pipelines nearest the shore using the HDD construction method. This method of construction could result in the inadvertent release of drilling mud or other lubricants if a fracture occurs during the drilling process. However, the density of drilling mud (65 to 89 pounds per cubic foot) is greater than the density of seawater (64.2 pounds per cubic foot), and the non-toxic bentonite materials would be expected to settle on the seafloor. In order to limit the potential effects on marine water quality, the Applicant would implement its HDD Contingency Plan (Appendix L). The temporary and localized increase in turbidity from a potential inadvertent return in the GoM would not likely have a substantial impact on water quality. As described in the HDD Contingency Plan, if an inadvertent return is identified, "the HDD contractor will evaluate the release to determine if containment structures are warranted and can effectively contain the release. When making this determination, the HDD contractor will also consider if placement of containment structures will cause additional adverse environmental impacts."

Construction vessels used for installation of the offshore pipelines and SPOT DWP would require refueling and maintenance during construction. There would also be up to ten support vessels (i.e., supply vessels and barges) used during construction. Inadvertent spills of hazardous materials could occur during these activities and affect water quality. The extent of the impact would be related to a number of factors, including what the spilled material was, the currents and winds, and the size of the spill. Vessels used for installation of the offshore pipelines would be equipped with spill containment and cleanup equipment to respond to small, accidental releases on-deck. For large spill events, the Applicant would mobilize a shore-based emergency response team. These measures would minimize the extent and impacts from a spill in marine waters. All vessels used for construction would operate in accordance with Spill Prevention, Control, and Countermeasure plans and have spill containment kits and spill response plans on board (SPOT 2019x).

Operation Impacts and Mitigation

Operation-related impacts on water quality would include scour around the platform pilings; accidental releases of fuel, oil, and other substances; and water quality impacts from withdrawals and discharges during operations at the SPOT DWP and for the VLCCs or other crude oil carriers.

Operational Seawater Withdrawals

Seawater would be withdrawn from the GoM for use at both the SPOT DWP and for use by VLCCs or other crude oil carriers. The withdrawal needs for both are outlined in the following sections, along with a discussion on impacts on water quality from these withdrawals.

SPOT DWP Operational Withdrawals

Seawater would be withdrawn from the GoM for SPOT Project operations to supply the firewater system, potable water system, sewage treatment system, and utility water. A summary of SPOT DWP seawater withdrawal is provided in Table 3.3.7-2. Approximately 46 million gallons of seawater would be used annually at the SPOT DWP. Compared to the large volume of seawater in the GoM as a whole, water withdrawals for operation of the SPOT DWP would be minimal in volume. As such, seawater withdrawals to support operation of the SPOT DWP would result in direct, adverse, long-term, and negligible impacts on water quality in the GoM.

Table 3.3.7-2: Seawater Usage at the SPOT Deepwater Port

Equipment	System	Intake Rate	Period
Jockey water pump	Water main	20 gpm each pump	Maximum flowrate, run continuously to feed water users on platform. Excess water flows overboard.
Firewater pump	Water main	4,000 gpm each pump	Maximum flowrate, run only for testing (once per month and 12 hours per quarter) and emergencies
Water maker [a]	Potable water system	9,624 gpd	Continuous, includes water maker reject water
Sewage treatment unit [a]	Utility water	1,980 gpd	Continuous, to maintain sanitary waste system operation
Utility water hoses [a]	Utility water	1,440 gpd	Intermittent, deck and equipment washdown

Sources: SPOT 2019a, Volume IIa, Section 2; SPOT 2019oo

gpd = gallons per day; gpm = gallons per minute

[a] Water intake for the water maker, sewage treatment unit, and utility water hoses are included in the total water intake provided for the jockey water pump.

VLCC Operational Withdrawals

VLCCs and other crude oil carriers would require cooling water exchange while moored at the SPOT DWP. At a surface water temperature of 72°F, one VLCC moored for a single loading event would require intake of 400,000 to 530,000 gallons per hour of cooling water. Compared to the large volume of seawater in the GoM as a whole, water withdrawals for VLCC engine cooling water would be minimal in volume. As such, seawater withdrawals to support operation of VLCCs or other crude oil carriers for the SPOT Project would result in direct, adverse, long-term, and minor impacts on water quality in the GoM.

Operational Discharges

Operational discharges for the SPOT Project would include potable water system effluent, firewater, sewage treatment, domestic wastewater, and deck drainage. A summary of discharges that would be made is provided in Table 3.3.7-3. The Applicant has applied to the USEPA for a NPDES permit; any operational discharges from the platform would be subject to the terms of that permit.

Platform discharges would use vertical downward-oriented discharge pipes that would extend from the platform to a depth of approximately 15 feet below the water's surface. There would be two discharge pipes for the SPOT DWP platform. One would discharge only stormwater and the second would co-mingle discharges from the sewage treatment facility and potable water system. All discharges would be seawater, with the exception of the potable water effluent, which would discharge concentrated seawater, and discharges from the sewage treatment system and the open drain sump, which would be freshwater discharges.

Table 3.3.7-3: Operational Discharges at the SPOT Deepwater Port

Discharge	Estimated Discharge Rate	Discharge Treatment	Source of Discharge
Main deck open drainage	175,560 gpd	Capture and separate oil/grease in sump for transfer to closed drain system	Deck drainage
Jockey water pump	28,800 gpd	Biocide, then either used in Utility/Potable Water/ Firewater header or goes directly overboard	Risers below jockey pump at northwest and southwest legs
Firewater pumps	35,520,000 gpy	Biocide	Risers below jockey pumps at northeast and southeast legs
Potable water effluent	2,634,570 gpy	Hyperstrain filter reject water	From jockey pump to living quarters
Sewage Treatment and Domestic Wastewater	1,600,890 gpy	Filter, break up solids, chlorinate, then discharge overboard in accordance with NPDES permit	From jockey pump supply header, through water treatment and living quarters to overboard discharge line from cellar deck at southwest leg
Utility water	1,440 gpd	Filter and biocide	From jockey water pump supply header to deck users and into sump
Open sump drain	175,560 gpd	Separate oils, pump oils back into the system	From deck drains to overboard discharge disposal line from cellar deck at northwest leg

Source: SPOT 2019a, Volume IIa, Section 3

gpd = gallons per day; gpy = gallons per year

SPOT DWP Operational Discharges

Operational discharges from the SPOT DWP would include:

- Potable water system effluent
- Domestic wastewater and sewage treatment
- Deck drainage
- Firewater pump system test water discharges

Drinking water would be withdrawn from the GoM, treated with reverse osmosis; potable water effluent would then be discharged into the GoM at a rate of approximately 7,200 gpd. This effluent would not have chemical treatment or additives, and would be discharged directly into the GoM via a dedicated overboard line. Due to the salt removal process, the effluent would have very high salinity concentrations. The salinity at the discharge point would be high, but would dissipate quickly due to tides and currents. A sanitary waste unit would treat human waste, sewage, and other graywater before discharge overboard into the GoM. The sewage treatment system would aerate the water, settle out particles, and disinfect sewage water prior to releasing into the GoM. Treated sanitary wastewater effluent would contain no measurable total residual chlorine from the disinfection process consistent with an approved method established in 40 CFR Part 136. In addition, the system would be designed to meet USCG (33 CFR Part 159) and IMO MEPC 159 (55) certified Type II standards, and discharges would comply with NPDES permit requirements.

The SPOT DWP platforms would have an open drain system that captures rain water and other precipitation, and would capture the water along with any oils or grease and route it to platform sumps. Discharge amounts would vary by the amount of rainfall; however, estimates are included in

Table 3.3.7-2 as main deck open drainage. The sump system would capture the oil/grease and release the water overboard to the GoM. Personnel onboard the platform would inspect the surface of the water near the discharge point to identify any oil sheens and respond appropriately according to the Operational Spill Plan that would be developed for use during Project operation.

The firewater system pumps would be tested once per week and for 12 hours per quarter; water usage and discharge are provided in Table 3.3.7-2. Approximately 184 gallons of biocide would be used per week in the firewater pumps prior to discharge to prevent buildup of bacteria in the system. Approximately 44 gallons of biocide would be used in the jockey pumps per week. The regular release of water treated with biocides could degrade water quality by altering the pH of the water around the platform, which could affect marine life (Sections 3.4, Habitats through 3.7, Threatened and Endangered Species).

Discharges from the platform would occur through vertical downward-oriented discharge pipes that would extend from the platform to a depth of approximately 15 feet below the surface of the water. Due to the volumes and rates of the discharges, scour could occur on the seafloor, which would increase turbidity around the platform.

SPOT DWP platform discharges of domestic and sanitary water, platform deck drainage, and firewater system testing would meet regulatory requirements of the NPDES permit for discharging into the GoM, which would minimize the risk of degrading water quality from discharge of these waters. The Applicant conducted discharge modeling for discharges at the SPOT DWP. Intermittent discharges, such as those from the jockey water pumps, the open drain sump, and the firewater pumps would have temporary plumes, while the persistent discharges from the potable water system and sewage discharges would have permanent plumes. At a distance of 328 feet, discharges would be diluted between factors of 16 to 1,267 times less than at the plume source. The radius of the plume at a distance of 328 feet would range from 10 to 374 feet. Dilution would occur more quickly for discharges of seawater than for freshwater or concentrated seawater. Temperature related effects from water discharges at the SPOT DWP platform would be unlikely, as the temperatures of the discharges are expected to be similar to the ambient water temperature in the GoM. The model also predicted that some discharge plumes from the SPOT DWP platform and from VLCCs mooring at the SPMs would co-mingle, but in every scenario the plumes would be sufficiently diluted before the plume trajectories crossed paths.

Discharges at the SPOT DWP platform would generally mix quickly with surrounding seawater; however, there could be impacts on water quality from discharges of concentrated seawater and freshwater, as well as from persistent discharges. As such, impacts on water quality from intermittent discharges at the SPOT DWP would be direct, adverse, short-term, and minor, while impacts from persistent discharges would be direct, adverse, long-term, highly localized, and minor.

VLCC Discharges

All Project-related activities would comply with Federal regulations to control the discharge of operational wastes, such as bilge and ballast waters, trash and debris, and sanitary and domestic waste generated from vessels associated with the proposed Project. VLCCs and other crude oil carriers may discharge water associated with ballast and cooling water into the GoM while at the SPOT DWP, but domestic or sanitary water onboard the VLCCs or other crude oil carriers would be held in storage tanks. In its draft OPSMAN, the Applicant would specify the restriction of VLCCs to discharge bilge water within the safety zone of the SPOT DWP. Vessels that release oil or oily ballast water at the SPOT DWP (including within the anchorage area) would be held responsible for all cleanup costs.

Vessels visiting the SPOT DWP would be required by the Applicant to abide by the following regulations:

- 33 CFR § 155.330 (Oily Mixture [Bilge Slops]/Fuel Oil Tank Ballast Water Discharges on U.S. Non-Oceangoing Ships);
- 33 CFR § 155.370 (Oily Mixture [Bilge Slops]/Fuel Oil Tank Ballast Water Discharges on Oceangoing Ships of 10,000 Gross Tons and Above and Oceangoing Ships of 400 Gross Tons and Above That Carry Ballast Water in Their Fuel Oil Tanks);
- 46 CFR Part 151 (Barges Carrying Bulk Liquid Hazardous Material Cargoes);
- 49 CFR Part 192 (U.S. Department of Transportation—Transportation of Natural and Other Gas by Pipeline); and
- 49 CFR Part 195 (U.S. Department of Transportation—Transportation of Hazardous Liquids by Pipeline).

VLCCs and other crude oil carriers would exchange ballast water in accordance with IMO Standards; these standards include having a ship-specific ballast water management plan, carrying a record book, and exchange of water mid-ocean or with an on-board ballast water treatment system (IMO 2019b). Mid-ocean exchange (200 miles or further from shore) of ballast water can flush coastal organisms from foreign ports and thus reduce the potential for introducing non-native species to the port of call. As oil and gas exports have increased from GoM ports, there has been a corresponding increase in ballast water discharge volumes in U.S. waters and is expected to continue to increase (Holzer et al. 2017). Not all vessels operating in GoM waters currently have a ballast water treatment system, but mid-ocean ballast water exchange increased substantially between 2005 and 2020. Beginning in 2016, there has been an increasing number of vessels with ballast water treatment systems (Figure 3.3.7-3) (National Ballast Information Clearinghouse 2021). Further, the number of vessels with ballast water treatment systems, including those that would call on the proposed DWP, will continue to increase over the life of the Project, which would minimize the potential risk of spreading invasive species from ballast tanks.

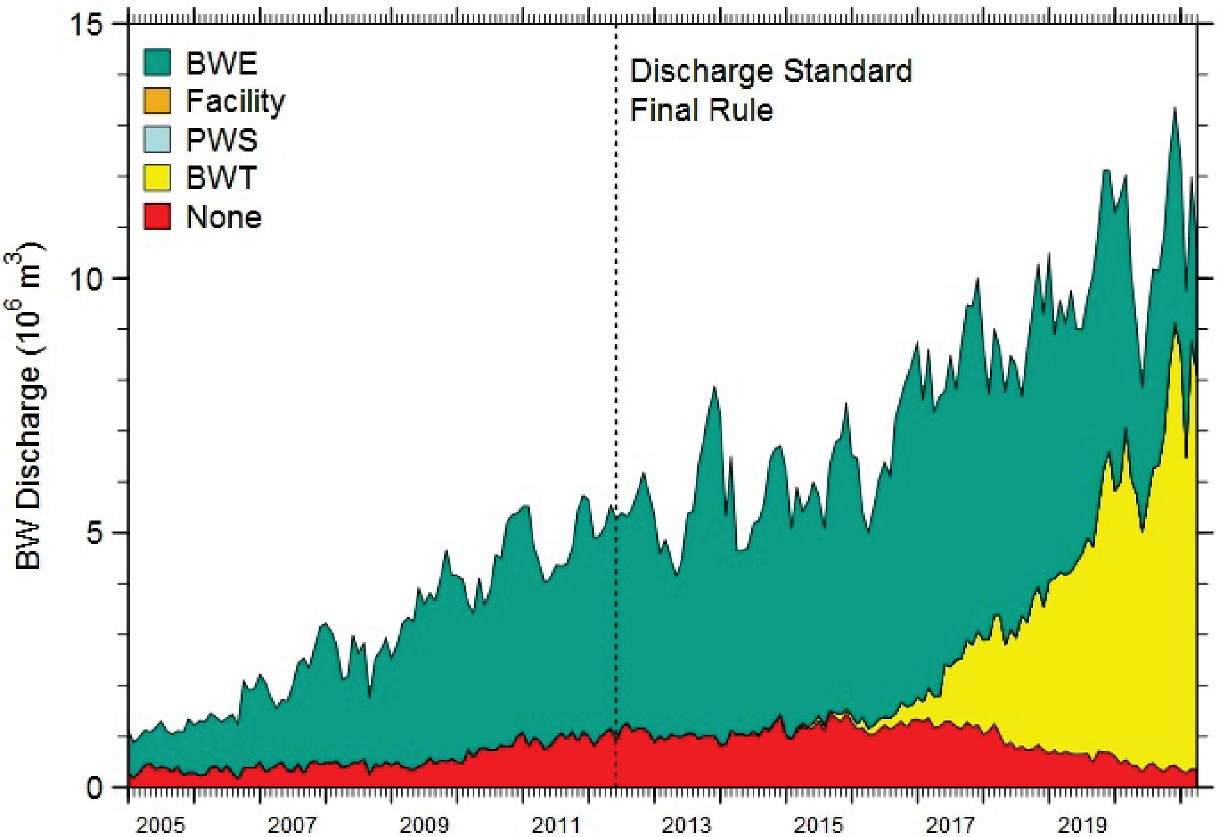
VLCCs would exchange up to 1.6 million gallons of ballast water per hour for the duration of the 24-hour loading period, totaling approximately 38 million gallons per ship while moored at the SPOT DWP. Some VLCCs or other crude oil carriers would continue to exchange water mid-ocean during transit, which would not result in impacts on water quality in the GoM. Ballast water would be discharged at a maximum rate of 26,667 gpm. Discharge water would be the same temperature as the ambient water temperature and contain a total suspended solids concentration of 30 parts per million. Sedimentation and turbidity from ballast water would not be substantial.

As described above for cooling water withdrawals, one VLCC moored for a single loading event would require 400,000 to 530,000 gallons per hour of cooling water. Cooling water would be discharged at a maximum rate of 8,806 gpm, and would typically be approximately 50 degrees Fahrenheit (°F; 10 degrees Celsius [ºC]) above ambient temperatures. The Applicant conducted discharge modeling and determined at a distance of 328 feet there would be a temperature increase in the discharge plume of approximately

32.5 °F (0.25 ºC) to 32.7°F (0.4 ºC) in winter and 32.5 °F (0.25 ºC) to 32.6 °F (0.36 ºC) in summer. The radius of the plume at a distance of 328 feet would be up to approximately 98 feet. The model also predicted that some discharge plumes from the SPOT DWP platform and from VLCCs mooring at the SPMs would co-mingle, but in every scenario, the plumes would be sufficiently diluted before the plume trajectories crossed paths.

The Applicant would not permit VLCCs or other crude oil carriers to make discharges from deck drains while moored at the SPM buoys, and would require all VLCC or other crude oil carrier deck drains to be closed while vessels are within the SPOT DWP safety zone. As such, no water quality impacts are expected from VLCC or other crude oil carrier deck runoff discharges.

VLCC or other crude oil carrier discharges would result in minimal increases in temperature in a small area immediately surrounding the ship. As such, impacts on water quality from VLCC or other crude oil carrier discharges would be direct, adverse, long-term, and minor.



Source: National Ballast Information Clearinghouse 2021

BWE = ballast water exchange; BWT = ballast water treatment; EEZ = exclusive economic zone; m^3 = cubic meters; PWS = public water supply

Note: Total monthly overseas ballast water discharge (originating outside the U.S./Canadian EEZ) according to ballast water management type, where total = None + BWT +PWS + Facility + BWE. Discharge was constrained to reported events that occurred with U.S. Territorial waters. Bold ticks mark January of each year. Data from the National Ballast Information Clearinghouse (NBIC 2021).

Figure 3.3.7-3: Overseas Ballast Water Discharge to the Gulf of Mexico Coast by Ballast Water Management Type (2005-2021)

SPOT DWP and Pipeline Operation

Scour

The small changes to currents around the platform pilings could result in scour locally. Scour would increase turbidity, but would be restricted to a small area around each of the 24 piles. As such, impacts on water quality from scour would be highly localized, direct, adverse, short-term, and minor.

Accidental Releases of Fuel, Oil, and Other Chemicals

Accidental releases of fuel, oil, or other chemicals during operation could occur at the offshore pipelines, VLCCs or other crude oil carriers and accompanying vessels, or the SPOT DWP. The extent of the impact on water quality would be dependent on the extent of the spill and the material spilled. The Applicant would design the offshore platform such that equipment on the decks with the potential to release hydrocarbons is installed above drain/drip pans or within contained areas that would collect rainwater, wash water, and other fluids, which would be pumped or gravity-drained to the sump tank for separation.

The SPOT DWP would require storage of fuels, chemicals, and lubricants for consumption during operation. A list of those materials is provided in Table 3.3.7-4.

Table 3.3.7-4: Summary of Fuels, Chemicals, and Lubricants to be Stored at the SPOT DWP

Item	Purpose	Storage Capacity	Storage Container
Nitrogen	Vapor recovery pipeline pigging	21,000 gallons (500 bbl)	Transportable International Maritime Organization/United Nations tanks
Propane	Enrichment fuel for marine vapor combustion unit	32,722 gallons (779 bbl)	Transportable International Maritime Organization/United Nations tanks
Diesel fuel	Fuel for power generation	70,980 gallons (1,690 bbl)	One crane pedestal storage tank, two diesel storage tanks, and re-fill via supply boat
Lube oil	Lubrication for various equipment	385 gallons (9 bbl)	55-gallon drums
Engine coolant	Cool lube oil and equipment	330 gallons (8 bbl)	55-gallon drums
Biocide	Bacteria control	1,100 gallons (26 bbl)	Transportable intermediate bulk container tanks
Aqueous Film-Forming Foam	Firefighting foam	5,565 gallons (133 bbl)	Transportable DOT containers
Hydraulic oil	Hydraulic power unit	150 gallons (4 bbl)	Pressurized accumulator
Refrigerant	HVAC	450 pounds	Transportable DOT cylinders

Source: SPOT 2019a, Volume IIa, Section 1

bbl = barrel; DOT = Department of Transportation; HVAC = heating, ventilation, and air conditioning

The largest volume of potential contaminants stored on the platform would be diesel fuel, which the Applicant has modeled. Aside from diesel fuel, no other modeling was conducted for a release of the other fuels, chemicals, and lubricants that would be stored on the platform. The maximum storage capacity of any of these items is relatively small, and an accidental spill would likely be even less than the maximum storage capacities described in Table 3.3.7-4. With the implementation of mitigation measures such as drip pans and storage devices to collect any release, the potential for release would be small, but would be present over the life of the Project. Therefore, any discharges of these contaminants would be direct, adverse, long-term, and minor.

Using BOEM's NEPA planning document for evaluating potential oil spills for this type of facility, the Applicant provided modeling of a most likely scenario spill of 2,200 bbl of oil released over 1 hour for heavy crude (Western Canadian Select [WCS]), lighter crude (West Texas Intermediate [WTI]), and condensate. The Applicant also modeled a worst credible discharge for approximately 71,000 gallons of diesel fuel based on capacity of a supply vessel or platform storage capacity. In general, lighter oils evaporate more quickly upon surfacing than heavier oils, which are more persistent in the environment. Based on the model, Table 3.3.7-5 shows the percent of shoreline habitats in the GoM that would be oiled with more than 1 gram/square meter of oil for each oil type during a most likely scenario spill. For all oil types, most oiling occurred on coastal barrier beaches and the estimated time for oil to reach the shoreline is included in Table 3.3.7-6. Table 3.3.7-7 shows the concentrations of polycyclic aromatic hydrocarbons (PAHs) in the water column for the most likely scenario spills. The effects of PAHs on marine organisms are described in Sections 3.4, Habitats, through 3.7, Threatened and Endangered Species, and in the BA.

Table 3.3.7-5: Percent of Shoreline Habitats Oiled by > 1 g/m²

Shoreline Type	Percent of Habitat in the GoM Oiled for Each Habitat and Oil Type			
	West Texas Intermediate	Western Canadian Select	Condensate	Diesel Fuel
Rocky shore	0.8% (1 mile)	0.8% (1 mile)	NA	NA
Gravel/cobble beach	8.7% (43 miles)	14.3% (71 miles)	1.2% (6 miles)	NA
Sand beach—United States	2.5% (61 miles)	5.6% (134 miles)	NA	NA
Sand beach—Mexico/Cuba	NA	0.4% (19 miles)	NA	NA
Mudflat	0.4% (7 miles)	0.1% (2 miles)	0.03% (< 1 mile)	NA
Wetland	0.2% (13 miles)	0.1% (8 miles)	NA	NA
Artificial/manmade	2.1% (20 miles)	0.7% (7 miles)	NA	1.0% (10 miles)
Percent of Total Shoreline Oiled	**0.8% (146 miles)**	**1.4% (243 miles)**	**0.04% (7 miles)**	**0.05% (9 miles)**

Source: SPOT 2019p

g/m² = gram per square meter; GoM = GoM; NA = not applicable

Table 3.3.7-6: Minimum Time for Oil to Reach the Shore and Maximum Surface Area of Floating Oil for the Most Likely Scenario Oil Spill

Oil Spill Scenario	Minimum Time to Reach Shore (Days)	Maximum Surface Area km² (>1 µm)
2,200 bbl release of West Texas Intermediate	2.5	21,960
2,200 bbl release of Western Canadian Select	4.0	58,506
2,200 bbl release of condensate	6.7	18,675
70,980 gallon release of diesel fuel	3.5	913

Source: SPOT 2019ee

µm = micrometer; bbl = barrel, the unit of volume for crude oil, 1 bbl is equal to 42 U.S. gallons; km² = square kilometer

Table 3.3.7-7: Modeled Results of PAH in the Water Column for the Most Likely Scenario Oil Spill

	West Texas Intermediate	Western Canadian Select	Condensate	Diesel Fuel
Maximum dose (ppb-hours) [a]	4,756	5,518	1,650	694.4
Volume for maximum dose (m^3) [b]	80,640	35,960	76,210	79,330

	West Texas Intermediate	Western Canadian Select	Condensate	Diesel Fuel
Average dose in volume >1 ppb (ppb-hours) [c]	1,416	2,492	558.2	150.9
Volume contaminated >1 ppb (km^3) [d]	0.0445	0.150	0.112	0.167
Volume contaminated >10 ppb (km^3) [d]	0.0110	0.049	0.025	0.005
Max exposure time >1 ppb (hours) [e]	162	180	288	624
Max exposure time >10 ppb (hours) [e]	43	83	151	252

Source: SPOT 2019ee

km^3 = cubic kilometers; m^3 = cubic meters; PAH = polycyclic aromatic hydrocarbon; ppb = parts per billion; ppb-hours = parts per billion per hours

[a] Maximum dose (concentration x exposure duration) at any single time step in any location.

[b] Volume of water that contained the maximum dose.

[c] Average dose in all waters that had dissolved oil concentrations > 1 ppb.

[d] Volume of water that exceeded 1 ppb and 10 ppb at any given time.

[e] Maximum number of hours with exposure concentrations >1 or >10 ppb.

The Applicant would develop and implement an operational spill response plan to minimize the impacts if a spill were to occur.

In addition, the SPOT DWP platform would abide by regulations in 30 CFR Part 250 (“Oil-Spill Response Requirements for Facilities Located Seaward of the Coast Line”), 33 CFR § 151.10 (“Control of Oil Discharges”), and 33 CFR § 151.73 (“Operating Requirements: Discharge of Garbage from Fixed or Floating Platforms”).

Oil spill response methods on shorelines would vary based on the type of spill material, amount of material spilled, the type of habitat affected, and species affected. Response methods could include use of sorbents, barriers and berms, manual oil removal, debris removal, vacuuming, water flushing, natural recovery, sediment reworking, flooding, steam cleaning, sand blasting, solidifiers, cleaning agents, nutrient enrichment, natural microbe seeding, and in-situ burning. Oil spill response methods for offshore habitats would be largely dependent on the type of material spilled. Response methods offshore could include natural recovery, booming, skimming, physical herding, manual oil removal, use of sorbents, debris removal, dispersants, emulsion-treating agents, elasticity modifiers, herding agents, solidifiers, and in-situ burning (see Appendix I, Summary of Hypothetical Oil Spill Response Actions).

In order to reduce the risk of accidental releases during oil transfer to VLCCs or other crude oil carriers, the VLCCs or other crude oil carriers would be equipped with drip trays, as recommended by the Oil Companies International Marine Forum guidelines. Typically these trays would have a 50 bbl capacity. In addition, the SPOT DWP platform would have a raised boundary bar with drain scuppers that are plugged during connecting/disconnecting operations, which would act as a collection point for releases. In addition, per the Oil Companies International Marine Forum guidelines, the floating oil hoses would be equipped with a manual butterfly valve and a blank flange at the end. Floating hoses would be connected or disconnected on the platform over the drip tray to reduce the chance of spilled material entering the GoM. With the implementation of containment systems as described, the potential of a large spill occurring would be minimized. Spills from VLCC or other crude oil carrier connections are not expected to be substantial due to the secondary containment used at connection points.

Additionally, the pipeline system would be built with emergency shutdown valves, which would allow crude oil to be sealed into a number of isolatable sections in the event of a leak or rupture. The design would allow the offshore pipelines to be isolated from the Oyster Creek Terminal and the platform. Shutdown valves would be located on each incoming and departing crude oil/vapor recovery pipeline, between the Oyster Creek Terminal and the MLV at the shore crossing, and between the shore crossing MLV and the platform. The volume of oil leaked would be limited to the oil available in the section between valves when the shutdown valves are closed. Table 3.3.7-8 describes the isolatable sections and the volume of oil available in each section.

The Applicant would implement its operational spill response plan in the event of a spill and would take the appropriate steps necessary to minimize the effects of a spill. With implementation of the safety mechanisms designed in the system and appropriate response actions, impacts on marine water quality due to an oil spill would be direct, adverse, short-term to long-term, and minor to major, depending on the size of the spill and time of year.

Table 3.3.7-8: SPOT Project Isolatable Sections

Isolatable Section	Oil Volume (cubic feet)	Oil Barrels (bbl)
ECHO Terminal - MLV100	263,493	46,930
MLV100 - MLV200	307,160	54,708
MLV200 - MLV300	333,658	59,427
MLV300 - MLV400	294,470	52,447
MLV400 - MLV500	210,869	37,557
MLV500 - MLV600	342,242	60,956
MLV600 - Oyster Creek Terminal	117,937	21,005
Oyster Creek Terminal Incoming Metering and Manifold	125,832	22,412
Oyster Creek Terminal Storage Tanks	3,366,000 [a]	599,510
Oyster Creek Terminal Export Metering and Pumps	2,400,000	427,458
Oyster Creek Terminal - MLV700	197,060	35,098
MLV700 – Shore Crossing [b]	251,945	44,873
Subsea Pipeline [b]	1,775,392	316,211
Spot Platform Oil Metering	320,000	56,994
Subsea Flowline and Oil PLEM	10,000	1,781
Buoy	10,000	1,781
Very Large Crude Carrier	11,269,000	2,007,095

Sources: Most data from SPOT 2019a, Volume IIa, Appendix M; SPOT 2019w, Metric Conversion 2018

MLV = mainline valve; PLEM = pipeline end manifold

[a] It is assumed that the storage tank operating level would be 50 percent, resulting in a maximum release of half of the capacity shown here.

[b] Relocating MLV 7 to the north side of Bluewater Highway affected the volumes in individual isolatable sections, but did not affect the total volume in comparison with the Draft EIS.

Regulation 37 of the International Convention for the Prevention of Pollution from Ships (MARPOL) Annex I requires all oil tankers of 150 gross tonnage and greater to carry an approved Shipboard Oil Pollution Prevention Plan, which describes measures to be taken when an oil pollution incident has occurred or a ship is at risk of one. These measures would minimize and mitigate spills from VLCCs or other crude oil carriers greater than 150 gross tons in the GoM during operation of the SPOT Project (IMO 2019a). In addition to the VLCCs and other crude oil carriers, four service vessels would be used during operation of the SPOT DWP. Inadvertent spills of hazardous materials could occur from these vessels and affect water quality. The extent of the impact would be related to a number of factors, including what the spilled material was, the currents and winds, and the size of the spill. To minimize the potential of an inadvertent release from these four service vessels and any other vessels in use during operation of the Project, such as supply vessels, the Applicant would develop an Operational Spill Plan as part of the OPSMAN.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Releases of Fuel, Oil, or Other Chemicals. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.4. HABITATS

3.4.1. Definition of the Resource

This section describes habitats, which are part of the biotic environment associated with the proposed SPOT DWP. Habitats are composed of the natural environment in which organisms live. For example, habitat for a deer would include areas where deer would find adequate food sources (e.g., plants, fruits, acorns, and other nuts), water (e.g., lakes, streams), and shelter. Habitat for plants would include nutrients obtained from soil, water, and space to grow. Both upland and aquatic areas contain habitats and, for the purposes of this EIS, MARAD and the USCG have defined the various habitats as vegetation, oyster reefs, and marine protected areas (MPAs). The upland and aquatic habitats in the vicinity of the proposed Project provide food, shelter, and reproductive areas for wildlife and aquatic species. These resources may be affected by construction and operation of the Project.

3.4.2. Existing Threats

According to the TPWD, the most substantial threat to onshore Texas habitats is fragmentation due to the break-up of large landholdings into smaller tracts. As formerly large land tracts are broken up, the smaller tracts may each have different land uses, resulting in loss of habitat and the introduction of exotic species (TPWD 2019h).

Threats to oyster reefs come from many sources. Texas oyster reefs have been in decline for many years and are affected by increased fishing pressure, hurricanes, tropical storms, droughts, flood events, and unsustainable practices of individuals (CCA 2017). The ocean acts as a carbon sink and as it continues to absorb carbon dioxide from the atmosphere, the ocean becomes more acidic, which reduces the survival, calcification, growth, and development of mollusks (Kroeker et al. 2013).

Threats to MPAs in the vicinity of the Project are due to changes in the marine environment primarily stemming from the petrochemical industry, port activities, and climate change. Development of the petrochemical industry has fueled, in part, some of the local changes in biodiversity, including loss of wetlands and land subsidence. Some of the busiest ports in the United States are supported by the petrochemical industry, which results in more vessel traffic, more underwater noise affecting marine organisms, and a greater risk of vessel strikes for species living in the GoM (The Nature Conservancy 2002). Marine biodiversity is also threatened by human activities at sea such as commercial fishing, shipping, oil and gas activities, and pollution (Seas at Risk 2016).

3.4.3. Vegetation

3.4.3.1. Existing Conditions

Onshore Vegetation

Ecoregions

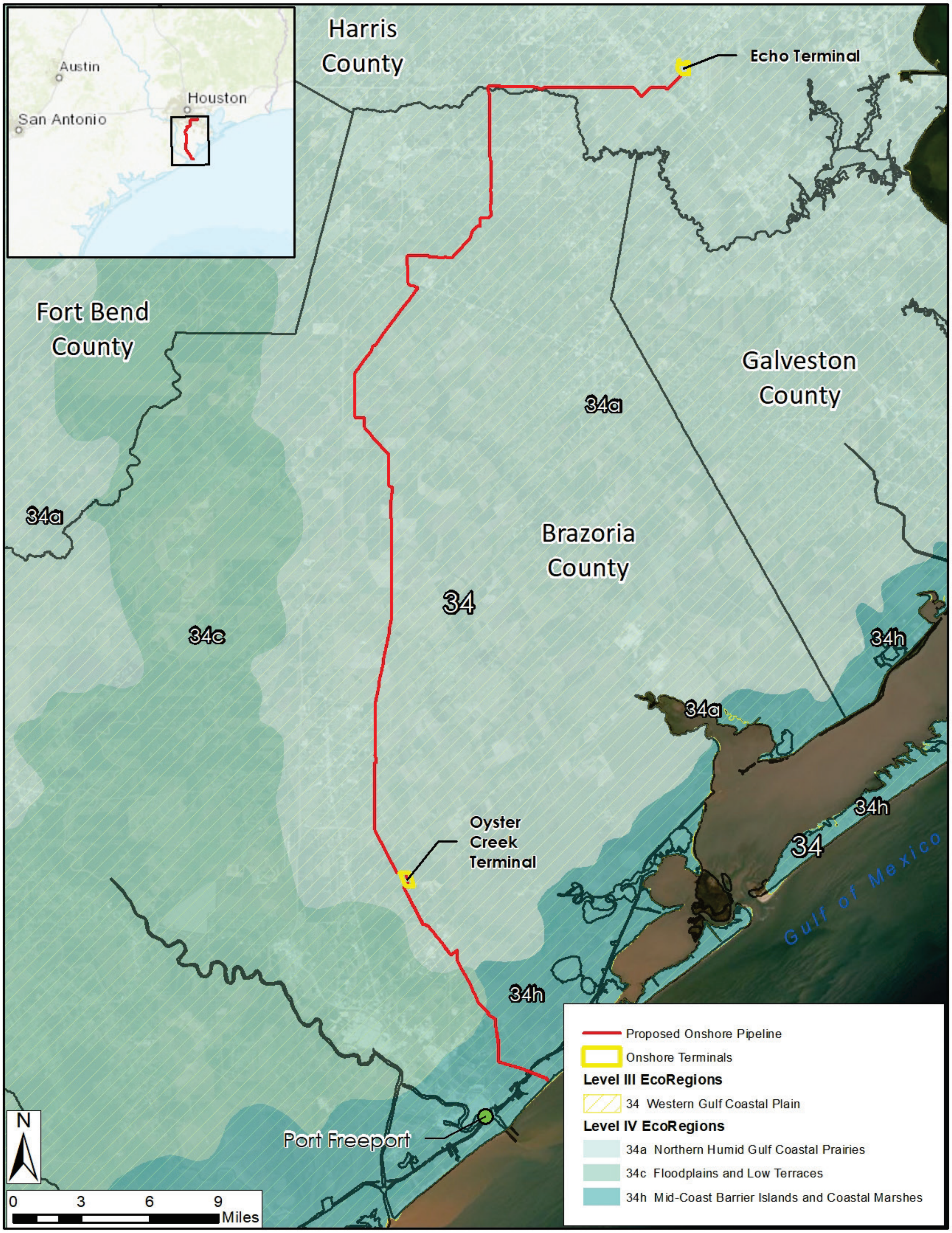
The proposed Project is located within the Western Gulf Coast Plain ecoregion (USEPA 2013a). The USEPA (2013a) describes this ecoregion as a relatively flat area dominated by grassland and one in which industrial land use, including oil and gas production, is common. TPWD (2014b) describes the area as Gulf Prairies and Marshes that contain streams and rivers, canals, coastal barrier islands, salt grass marshes, tidal channels, and bays and estuaries, and with acidic sands and sandy loam soils, interspersed with clays along river bottoms. This ecoregion is characterized as a slowly drained, nearly level plain at an elevation of less than 150 feet. Rivers and streams flow through the area to reach the GoM. Characteristics of the region also include coastal barrier islands, tall woodlands and river bottomlands, bays and estuaries surrounded by salt grass marshes, tallgrass prairie remnants, and oak mottes (small stand of trees) and oak parklands near the coast. The growing season lasts the majority of the year, typically for more than 300 days. This ecoregion is characterized by warm temperatures and high humidity. Rainfall averages 30 to 50 inches per year and falls fairly uniformly throughout the year. The native vegetation in this ecoregion is dominated by tallgrass prairies and also includes live oak woodlands as well as mesquite and acacia brush. Although much of the native habitat within this ecoregion has been urbanized or converted to agricultural use, important migratory bird habitat still exists in the region (TPWD 2014b).

The onshore pipeline and terminal components would cross three USEPA Level IV Ecoregions: (1) Northern Humid Gulf Coastal Prairies; (2) Mid-Coast Barrier Islands and Coastal Marshes; and (3) Floodplains and Low Terraces (Figure 3.4.3-1) (Griffith et al. 2004).

Northern Humid Gulf Coastal Prairies. This ecoregion is a gently sloping coastal plain dominated by grasslands, with a few clusters of oak (*Quercus* spp.) mottes or maritime woodlands. Almost all of the coastal plains have been converted to some form of cropland, rangeland, or pasture, or to urban and industrial land uses. Many areas have extensive networks of drainage canals, and the invasive Chinese tallow (*Triadica sebifera*) is common (Griffith et al. 2007).

Mid-Coastal Barrier Islands and Coastal Marshes. This ecoregion includes barrier islands, brackish, saline, and freshwater marshes, and tidal flat sands and clays. Salt marsh and wind-tidal flats are associated with barrier islands while fresh and brackish marshes are primarily associated with river-mouth delta areas. Native vegetation includes grassland composed of sea-oats (*Uniola paniculata*), bluestem

(*Andropogon* spp.), gulfdune paspalum (*Paspalum monostachyum*), common reed (*Phragmites australis*), and soilbind morning-glory (*Ipomoea* spp.), as well as cordgrass (*Spartina* spp.) and Gulf saltgrass (*Distichlis spicata*) in the more saline zones. Some areas include redbay (*Persea borbonia*), sweetbay (*Laurus nobilis*), and dwarf southern live oak (*Q. minima*). The region includes commercially important shrimp, oyster, and blue crab fisheries (Griffith et al. 2007).



Source: USEPA 2013b

Figure 3.4.3-1: Level III and Level IV Ecoregions Crossed by the SPOT Project

Floodplains and Low Terraces. This ecoregion includes bottomland forest consisting of pecan (*Carya illinoinensis*), water oak (*Q. nigra*), elm species (*Ulmus* spp.), and coastal live oak (*Q. virginiana*). Bald cypress (*Taxodium distichum*) is found along some larger streams. Some terraces in the region consist of black hickory (*Carya texana*), post oak (*Q. stallata*), and winged elm (*Ulmus alata*). Large portions of the floodplain forest have been converted to pasture and cropland (Griffith et al. 2007).

Land Cover Categories

The TPWD, in cooperation with private, state, and Federal partners, developed a land classification system for Texas that includes 398 classes at 10-meter (33 feet) spatial resolution (Elliott 2014). Based on review of TPWD land cover categories, the onshore pipelines and terminal facilities (existing ECHO Terminal and proposed Oyster Creek Terminal) would intersect 38 land cover categories, which have been grouped into 21 more general vegetation types and are presented in Table 3.4.3-1. Gulf Coast: Coastal Prairie is the dominant vegetation community type identified within the Project footprint, and accounts for more than half of the onshore pipeline route. About 84 percent of the Oyster Creek Terminal site is composed of Columbia Bottomlands: Grasslands and Gulf Coast: Coastal Prairie.

Table 3.4.3-1: TPWD-Defined Vegetation Communities Crossed by the Onshore Pipelines

General Land Cover	Distance (Miles)	Representative Species
Coastal and Sandsheet: Deep Sand Grassland	0.1	Sea oats (*Uniola paniculata*), Gulf croton (*Croton punctatus*), gulfdune paspalum (*Paspalum monostachyum*), marshhay cordgrass (*Spartina patens*), seacoast bluestem (*Schizachyrium scoparium* var. *littorale*), wooly tidestromia (*Tidestromia lanuginose*)
Coastal: Sea Oxeye Daisy Flats	<0.1	Sea oxeye daisy (*Borrichia frutescens*)
Coastal: Tidal Flat	0.1	Unvegetated or very sparsely vegetated flats affected by tidal fluctuations.
Columbia Bottomlands: Shrubland	0.7	Common buttonbush (*Cephalanthus occidentalis*), black willow (*Salix nigra*), swamp privet (*Forestiera acuminate*), roughleaf dogweed (*Cornus drummondii*), Chinese tallow (*Triadica sebifera*), yaupon (*Ilex vomitoria*), coastal live oak (*Quercus agrifolia*), sugar hackberry (*Celtis laevigata*)
Columbia Bottomlands: Grassland	2.7	Bermuda grass (*Cynodon dactylon*), bahia grass (*Paspalum notatum*), Italian ryegrass (*Lolium multiflorum*), perennial rye grass (*Lolium perenne*)
Columbia Bottomlands: Hardwood Forest and Woodland; Mixed Evergreen; Live Oak	3.6	Coastal live oak (*Quercus agrifolia*), plateau live oak (*Quercus fusiformis*), water oak (*Quercus nigra*), American elm (*Ulmus americana*), green ash (*Fraxinus pennsylvanica*)
Columbia Bottomlands: Riparian Deciduous Shrubland	<0.1	Western soapberry (*Sapindus saponaria*), common buttonbush (*Cephalanthus occidentalis*), rattlebox (*Sesbania drummondii*), honey mesquite (*Prosopis glandulosa*), huisache (*Vachellia farnesiana*)
Columbia Bottomlands: Riparian Grassland	0.3	King Ranch bluestem (*Bothriochloa ischaemum*), Bermuda grass (*Cynodon dactylon*), bahia grass (*Paspalum notatum*), Egyptian ryegrass (*Lolium perenne*), baccharis, green flat sedge (*Cyperus virens*)
Columbia Bottomlands: Riparian Hardwood Forest and Woodland; Mixed Evergreen	0.2	Coastal live oak, delta arrowhead (*Sagittaria platyphylla*); bald cypress (*Taxodium distichum*), green ash (*Fraxinus pennsylvanica*); coastal live oak, black willow
Grass Farm	<0.1	Bermuda grass, crabgrass, white clover (*Trifolium repens*), chickweed (*Stellaria media*)

General Land Cover	Distance (Miles)	Representative Species
Gulf Coast: Coastal Prairie	33.9	Little bluestem (*Schizachyrium scoparium*), switchgrass (*Panicum virgatum*), Gulf muhly (*Muhlenbergia capillaris*), bushy bluestem (*Andropogon glomeratus*), sideoats grama (*Bouteloua curtipendula*), fewflower panicgrass (*Dicanthelium oligosanthes*)
Gulf Coast: Salty Prairie	<0.1	Gulf cordgrass (*Spartina spartinae*), little bluestem, switchgrass, rat-tail smutgrass (*Sporobolus indicus*), goldenrod
Gulf Coast: Salty Prairie Shrubland	0.1	Shrubby sumpweed (*Iva frutescens*), honey mesquite, Carolina wolfberry (*Lycium carolinianum*), baccharis
Native Invasive: Invasive Woody Vegetation	3.2	Baccharis, honey mesquite, salt cedars, shrubby sumpweed, sugar hackberry (*Celtis laevigata*), water oak (*Quercus nigra*), cedar elm (*Ulmus crassifolia*), sweetgum (*Liquidambar styraciflua)*, winged elm (*Ulmus alata*), yaupon
Non-native Invasive Woody Vegetation	1.7	Chinese tallow, Chinese privet (*Ligustrum sinense*)
Pine Plantation	0.4	Loblolly pine (*Pinus taeda*), shortleaf pine (*Pinus echinata*), southern red oak (*Quercus falcate*), post oak (*Quercus stellate*), eastern red cedar (*Quercus stellate*), yaupon
Pineywoods: Pine-Hardwood Forest or Plantation	0.1	Loblolly pine, longleaf pine (*Pinus palustris*), shortleaf pine (*Pinus echinata*), black hickory (*Carya texana*), sweetgum (*Liquidambar styraciflua*)
Post Oak Savanna: Live Oak Motte and Woodland	<0.1	Post Oak, blackjack oak (*Quercus marilandica*), plateau live oak (*Quercus fusiformis*), black hickory
Row Crops	2.9	Cotton (*Gossypium arboretum*), corn (*Zea mays*), soybean (*Glycine max*), rice (*Oryza sativa*), alfalfa (*Medicago sativa*)
Urban	8.0	Consists of built-up areas and transportation corridors
Barren	<0.1	None

Source: Elliot 2014

Sensitive Vegetation Communities

The Columbia Bottomlands: Forest and Woodlands are a TPWD vegetation community type that the USACE defines as "waters of the United States that are dominated by bottomland hardwoods in the Lower Brazos and San Bernard River basins" (USACE 2017). The vegetation community encompasses areas managed by Brazos Bend State Park, San Bernard National Wildlife Refuge (NWR), and Matagorda County Birding Nature Center, and is protected by the USACE through regional conditions on most Nationwide Permits for projects that cross through Columbia Bottomlands (USACE 2017). The Project would not intersect the Columbia Bottomlands habitat protected by USACE regional conditions for Nationwide Permits.

The USACE considers coastal dune swales[2] within the backshore and dune areas of the Texas Coast Dune and Coastal Grasslands to be wetlands and/or other waters of the United States (USACE 2017). They are often formed adjacent to beaches fronting tidal waters of the United States, and are protected by the GLO under Natural Resources Code Title 2, Subtitle E, Chapter 63, Subchapter A (GLO 2005). The TPWD coastal communities intersected by the Project workspace would include:

[2] "Coast interdunal swales are marshes, moist grasslands, dense shrubs, or damp flats in linear depressions formed between successive dune ridges as sandy barrier islands, capes, or beach plans build seaward" (FNAI 2010).

- Coastal and Sandsheet: Deep Sand Grassland
- Coastal and Sandsheet: Deep Sand Grassland Swale Marsh
- Coastal: Salt and Brackish High Tidal Marsh
- Coastal: Salt and Brackish Low Tidal Marsh
- Coastal: Sea Ox-eye Daisy Flats
- Coastal: Tidal Flat

Federally Listed Plant Species

The Texas prairie dawn-flower (*Hymenoxys texana*) was identified as having the potential to occur in the vicinity of the onshore pipelines and Oyster Creek Terminal. The species was Federally listed as endangered in 1989 and is also state-listed as endangered by the TPWD. It is a member of the Asteraceae family and is a single-stemmed or branching annual that can grow up to 6 inches. It is found in small, conspicuous, sparsely vegetated areas of fine, sandy, and compact soils. Its flowering period is from early March through mid- to late-April and it produces yellow, cone-shaped seed heads (USFWS 2015f). Texas prairie dawn-flower occurs at the base of small mounds (pimple mounds) in grasslands in poorly drained, sparsely vegetated areas. It is also found in almost barren areas on slightly salty soils (TPWD 2019m). Further discussion and an impact analysis for the Texas prairie dawn-flower are included in Section 6.2.7 of the BA (Appendix E1).

Priority Protection Habitat

The GLO, in consultation with the TPWD and other government and non-governmental organizations, established Priority Protection Habitats, which are coastal habitat areas that are to be protected during spills of hazardous materials. The Oyster Creek to Shore Pipelines would cross two of these habitat types as detailed in Table 3.4.3-2: Swan Lake and Oyster Creek (GLO 2017). The Swan Lake habitat has three species of vegetation with high priority rank, including cordgrass (*Spartina alterniflora*), Gulf cordgrass (*Spartina spartinae*), and submerged aquatic widgeon grass (*Ruppia maritima*). The Oyster Creek habitat has two species of vegetation with high priority rank, including cordgrass marsh moving to transitional marsh of Gulf cordgrass.

Table 3.4.3-2: GLO Priority Protection Habitat Crossed by the Oyster Creek to Shore Pipelines

Priority Protection Habitat	Element	Species Priority Rank	Description	Distance Crossed (miles)
Oyster Creek	Birds	Medium	Shorebirds and wading birds	0.2
	Fish	High	Fish invertebrate nursery, oysters	
	Wetlands	High	Cordgrass (*Spartina alterniflora*) marsh moving to transitional marsh of Gulf cordgrass (*Spartina spartinae*)	
Swan Lake, adjacent marsh and marsh west of Oyster Creek	Birds	Medium	Shorebird and wading bird usage with numbers of roseate spoonbill (*Platalea ajaja*)	0.6
	Fish	High	Fish nursery with expanses of oysters	
	Wetlands	High	Cordgrass marsh to transitional marsh of Gulf cordgrass; widgeon grass (*Ruppia maritima* [SAV])	

Source: NatureServe 2019a

GLO = Texas General Land Office; SAV = submerged aquatic vegetation

Note: The shoreline mainline valve site is located within the Swan Lake Priority Protection Habitat.

Noxious and Invasive Plants

Texas Administrative Code Section 19.300(a) lists the noxious and invasive weeds found in Texas. The Applicant conducted a noxious weed survey along the onshore pipeline route and Table 3.4.3-3 lists species that were identified within the Project workspace. Alligator weed *(Alternanthera philoxeroides)*, balloon vine *(Cardiospermum halicacabum)*, and Chinese tallow were the most common species identified.

Table 3.4.3-3: Noxious and Invasive Weeds Observed Within the Survey Corridor for the Onshore Pipeline

Common Name	Scientific Name
Alligator weed	*Alternanthera philoxeroides*
Balloon vine	*Cardiospermum halicacabum*
Chinese tallow	*Triadica sebifera*
Giant reed	*Arundo donax*
Hedge bindweed	*Calystegia sepium*
Torpedo grass	*Panicum repens*

Source: SPOT 2019a, Application, Volume IIb, Appendix D

Chinese tallow was the most abundant noxious and invasive species identified along the onshore pipeline route. It was found in agricultural fields as well as urban environments. Chinese tallow is an aggressive woody invader of wetland, coastal, and disturbed habitats, and is known to reduce native species diversity and richness, and alter natural ecosystem structure and function. Chinese tallow is an early successional tree with life history traits that enable it to thrive in unstable or unpredictable environments (e.g., high fecundity, relatively small size, short generation time, and the ability to disperse propagules widely) (McCormick 2005).

Alligator weed was identified in low numbers in agricultural fields. It is found across the southern United States and is able to spread and reproduce rapidly when stems are cut, making it challenging to eradicate.

Alligator weed grows in mats along wet areas, and can be found in areas with moist cultivated soils (TISI 2014a). Originating in the Paraná River region of South America, it was first documented near Mobile, Alabama in 1897 and is believed to have been introduced to the United States as part of ship ballast water (Buckingham 1996). Introduced insect species, such as the alligator weed flea beetle (*Agasicles hygrophila*) and the alligator weed stem borer (*Vogtia malloi*), have provided some biological control of this species (Van Driesche et al. 2002). Alligator weed was documented mainly in wetlands, depressions, and drainage ditches within the Project boundary.

Balloon vine was identified in both agricultural fields and along roads. This creeper vine can grow to 10 feet tall and survive winters in mild climates, causing it to smother and kill native vegetation in the southeastern United States (Dempsey 2011). Balloon vine was identified in uplands along the proposed pipeline rights-of-way.

Giant reed (*Arundo donax*) was identified among Chinese tallow in one location in an agricultural field within the onshore pipeline workspace. It is an invasive perennial grass that can grow in clumps up to 20 feet tall and chokes riversides and stream channels (TISI 2014b). The species spreads when root and stem rhizomes take root in a new location after removal from its original location, or by road shoulder grading (USDA 2017). By crowding out native species, the giant reed suppresses native growth and reduces wildlife habitat.

Hedge bindweed (*Calystegia sepium*) seldom occurred in the proposed onshore pipeline surveyed workspace. Native to the United States, this perennial vine produces rhizomes and seeds that withstand winter months, allowing them to disperse year-round (Melymuka 2013; USDA n.d.a). This species populates disturbed areas, most commonly edges of cropland, fence rows, roadsides, and mesic prairies (Melymuka 2013), and was observed in upland areas along the Project pipeline route.

Torpedo grass (*Panicum repens*) was identified in urban areas in the southern portion of the onshore pipelines corridor. It can be found in both major aquatic and terrestrial areas, and can aggressively spread due to dissemination by rhizomes. In some marshy shores and coastal areas, torpedo grass was used for shoreline stabilization, as well as waterfowl habitat (USDA n.d.b). Once established, colonies are difficult to eradicate or contain, and can dominate habitats with wet sandy or organic soil (TISI 2014c). Throughout the southeastern United States, methods for removing torpedo grass have included burning, mowing, and disking; however, the most successful method of reducing torpedo grass has been glyphosate herbicide (Smith et. al 1993).

Offshore Vegetation

Seagrasses grow in shallow salty and brackish waters and provide shelter and food to a diverse community of aquatic species including fish, crabs, turtles, and marine mammals and birds (Reynolds 2018). Commercial and sport fisherman harvest species from seagrass meadows, as they provide critical habitat for coastal fauna including flounder (Family Bothidae), redfish (*Sciaenops ocellatus*), speckled trout (*Cynoscion nebulosus*), and blue crab (*Callinectes sapidus*). The primary food sources for these species occupy the same habitat, including microscopic algae, polychaete worms, small crustaceans, and other small invertebrates. Seagrasses also provide shelter and food to other species, stabilize sediment, oxygenate the water column, reduce harmful bacteria, and reduce greenhouse gases (GHGs) (UTAUS 2019).

There are six species of seagrass common in the GoM, five of which are found along the Texas coast. There are an estimated 235,000 acres of seagrass beds found along the Texas coast, with the closest beds located in Christmas Bay (part of the Galveston Bay complex) over 35 nautical miles from the SPOT DWP location and approximately 4.3 nautical miles from the offshore HDD exit pit.

Seagrass beds are critical to ecosystem health and have many benefits to other species. Environmental disturbances such as hurricanes, large storms, and aggressive currents can uproot seagrass. As these are short-lived and irregular events, seagrasses can recolonize and recover quickly compared to anthropogenic disturbances such as dredging, channeling, and excess nutrient runoff from urbanization. Dredging and channeling reduces seagrass biomass, can bury the grasses, and increases turbidity in the water column allowing less sunlight to reach the seagrasses. Nutrient runoff from developing industrial and agricultural facilities, specifically runoff containing nitrogen and phosphorous, drains into coastal waters and changes the natural, baseline quality of seawater that seagrasses need to develop and grow (UTAUS 2019).

Sargassum is another offshore vegetation community that grows annually off the Texas coast in otherwise open water areas offshore. *Sargassum* is a brown seaweed (algae) that forms floating mats or "islands" in the GoM (Casazza and Ross 2011). This seaweed lives about 1 year and begins growing in the western GoM in March before moving eastward while expanding (Gower and King 2011). Generally, *Sargassum* is most prominent in the GoM in summer; it is designated as critical habitat for loggerhead sea turtles, and provides suitable foraging habitat and refugia for sea turtles and many fishes (Gower and King 2011; NMFS 2013; Casazza and Ross 2011) (see Section 3.7.1.2, NEPA Evaluations for Federally Listed Species and the BA in Appendix E1 for additional details).

3.4.3.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on vegetation resources. The study area within which potential impacts were assessed includes the proposed Project workspace, as it is the only area in which vegetation would be disturbed.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on vegetation have been evaluated based on their potential to degrade the ecological significance of the vegetation community.

The remainder of this section describes the effects of Project construction and operation on onshore and offshore vegetation, including priority protection habitats, from ground disturbance, soil compaction, introduction or increased spread of invasive species, and accidental spills of hazardous materials.

Onshore Vegetation Communities

Construction of the proposed Project would result in vegetation disturbance due to clearing and trenching along the pipeline rights-of-way and the construction and modification of terminal facilities. Vegetation could also be affected by accidental spills of hazardous materials.

For habitats, temporary impacts are generally those that occur during construction but that return to preconstruction conditions very soon after construction, while short-term impacts usually take longer (i.e., up to 3 years) to return to preconstruction conditions. Long-term impacts are those where revegetation generally takes longer than 3 years, but still returns to the preconstruction condition within the life of the Project. Permanent impacts are those in which vegetation resources would not return to preconstruction conditions during the life of the Project.

The rights-of-way widths vary by pipeline segment and are provided in Table 3.4.3-4. Construction of the onshore pipelines, extra workspace, access roads, and Oyster Creek Terminal would impact about 1,134 acres of land. Modifications at the ECHO Terminal would occur on about 3.2 acres within the existing terminal facilities. The majority of construction impacts for the entire Project, including workspace associated with onshore pipelines, access roads, and the Oyster Creek Terminal, would occur in herbaceous vegetation communities (about 812.7 acres), and about 20.4 acres of scrub-shrub habitat and 151.3 acres of forested habitat (including native and non-native woody vegetation) would also be disturbed or permanently modified.

Table 3.4.3-4: Onshore Pipeline Right-of-Way Widths

Pipeline Segment	Length (miles)	Construction Right-of-Way Width (feet)	Operation Right-of-Way Width (feet)
ECHO to Oyster Creek Pipeline	50.1	100	30
Oyster Creek to Shore Pipelines	12.1	150	50

Source: SPOT 2019a, Application, Vol. IIb, TR01
ECHO = Enterprise Crude Houston

Pipelines

Construction Impacts

Impacts on vegetation resources as a result of pipeline construction could include increased soil compaction and erosion, spread of noxious or invasive species, and a reduction in forested lands. The Applicant would install and maintain temporary erosion controls throughout construction as described in its Construction BMPs (Appendix M; BMP #1 in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures), and would decompact soils in agricultural, residential, and wetland areas (BMP #1). To mitigate the spread of non-native and invasive species, the Applicant would adhere to the recommendations in its Revegetation Plan and has committed to developing a final Revegetation Plan in coordination with TPWD (Appendix Q; BMP #8 in Appendix N).

During clearing activities, the Applicant would cut and remove woody vegetation and stumps. The construction contractor would install erosion control devices as required (Appendix M, Construction BMPs; BMP #1 in Appendix N). Chipped woody material may be removed from the site or spread across upland areas at a depth that would not prevent regrowth of vegetation. Any chipped woody material stockpiled on site would be stored in a way that prevents transport to wetlands or waterbodies. Following construction, the Applicant would restore ground contours as closely as possible to preconstruction contours and would reseed the right-of-way with approved seed mixes (BMP #1).

The majority of the onshore pipelines, MLV sites, and access road construction would occur in herbaceous vegetation communities (about 690 acres), much of which would be collocated with existing utility corridors or roadways (see Table 3.4.3-5). Consequently, many impacts would occur in previously disturbed areas. These impacts would be short-term because the area would return to preconstruction conditions within 3 years after completion of construction activities.

Impacts on agricultural lands would be temporary to short-term because these areas are disturbed regularly for crop production and would typically return to their previous condition shortly after completion of construction and restoration activities. The Applicant would segregate at least 12 inches of topsoil across the full work area or from the trench and subsoil storage area in agricultural lands to mitigate impacts on subsequent crop production (BMP #1).

Table 3.4.3-5: Impacts on Vegetation Communities from the SPOT Project

	ECHO to Oyster Creek Pipeline and MLVs		Oyster Creek to Shore Pipelines and MLVs		Oyster Creek Terminal		Access Roads	
Community Type	**Construction Impacts (acres) [a]**	**Operation Impacts (acres)**	**Construction Impacts (acres) [a]**	**Operation Impacts (acres)**	**Construction Impacts (acres)**	**Operation Impacts (acres)**	**Construction Impacts (acres)**	**Operation Impacts (acres)**
Coastal and Sandsheet: Deep Sand Grassland	0.0	0.0	1.8	0.9	0.0	0.0	0.0	0.0
Coastal: Sea Ox-eye Daisy Flats	0.0	0.0	<0.1	<0.1	0.0	0.0	0.0	0.0
Coastal: Tidal Flat	0.0	0.0	0.4	0.4	0.0	0.0	0.0	0.0
Columbia Bottomlands: Shrubland	<0.1	<0.1	10.7	3.8	5.2	5.2	1.6	1.6
Columbia Bottomlands: Grassland	4.1	1.5	32.9	11.0	59.8	59.8	0.7	0.4
Columbia Bottomlands: Hardwood Forest and Woodland; Mixed Evergreen; Live Oak	40.4	11.6	8.2	2.5	0.0	0.0	1.0	0.9
Columbia Bottomlands: Riparian Deciduous Shrubland	0.3	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Columbia Bottomlands: Riparian Grassland	4.0	1.0	0.0	0.0	0.0	0.0	0.2	0.1
Columbia Bottomlands: Riparian Hardwood Forest and Woodland; Mixed Evergreen; Live Oak	2.0	0.5	0.2	0.2	0.0	0.0	0.1	0.1
Grass Farm	0.6	<0.1	0.0	0.0	0.0	0.0	0.0	0.0
Gulf Coast: Coastal Prairie	443.1	94.6	24.1	6.9	0.0	0.0	3.3	1.8
Gulf Coast: Salty Prairie	0.03	0.3	53.3	16.4	57.6	57.6	0.2	0.2
Gulf Coast: Salty Prairie Shrubland	0.0	0.0	2.6	0.6	0.0	0.0	0.0	0.0
Native: Invasive Woody Vegetation	41.1	8.3	7.6	2.1	9.5	9.5	0.4	0.4
Non-Native: Invasive Woody Vegetation	18.9	2.6	13.2	3.9	0.8	0.8	0.3	0.3
Pine Plantation	3.9	0.9	1.7	0.6	0.0	0.0	0.1	<0.1
Pineywoods: Pine – Hardwood Forest or Plantation	0.9	0.3	0.0	0.0	0.0	0.0	0.0	0.0
Post Oak Savanna: Live Oak Motte and Woodland	1.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Row Crops	40.8	10.6	0.0	0.0	0.0	0.0	<0.1	<0.1
Urban	137.1	11.4	1.0	0.7	1.1	1.1	0.0	0.0

	ECHO to Oyster Creek Pipeline and MLVs		Oyster Creek to Shore Pipelines and MLVs		Oyster Creek Terminal		Access Roads	
Community Type	**Construction Impacts (acres) [a]**	**Operation Impacts (acres)**	**Construction Impacts (acres) [a]**	**Operation Impacts (acres)**	**Construction Impacts (acres)**	**Operation Impacts (acres)**	**Construction Impacts (acres)**	**Operation Impacts (acres)**
Barren	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Waterbodies	0.1	0.1	7.0	4.8	0.0	0.0	0.0	0.0
Wetland	6.4	1.3	73.2	18.6	6.1	6.1	0.2	0.1
Total	**745.1**	**145.2**	**237.9**	**73.4**	**140.1**	**140.1**	**8.0**	**5.9**

Source: SPOT 2019mm, 2019zz, 2019aaa

ECHO = Enterprise Crude MLV = mainline valve

[a] Construction impacts include construction and operation workspace, including MLVs.

Note: Total acreage may not sum exactly due to rounding.

In forested areas where existing corridors would be expanded or a new corridor would be required, tree canopy would be removed, which would change the understory and cause an edge effect[3] on adjacent lands. Additionally, clearing of linear corridors through forests increases access by people and also allows predators easier access to what were interior forest areas. Increased predation rates occur where linear corridors modify habitats (Pickell et al. 2014). Though temporary workspaces would be allowed to return to their preconstruction condition, it could take decades for forested areas to regrow and resemble the forest vegetation present before construction, resulting in long-term impacts.

Trees on the edge of the right-of-way could be damaged during clearing activities and roots could be damaged by soil disturbance and compaction, which could result in decreased health and viability of the trees. Some edge trees may be susceptible to wind damage because they would no longer benefit from the stability of a surrounding forest. Clearing of forested areas within the temporary construction right-of-way would result in long-term impacts to about 105.5 acres of forested land.

In order to mitigate these short-term and long-term impacts on vegetation communities and aid in the revegetation of disturbed habitats, the Applicant would implement the following BMPs included in Appendix N, List of Applicant's BMPs and Agency Recommended Mitigation Measures:

- Limit ground disturbance to the construction rights-of-way and other approved workspaces (BMP #9 in Appendix N);
- Prevent the mixing of topsoil and subsoil by stripping at least 12 inches of topsoil from the full work area or from the trench and subsoil storage area in non-inundated jurisdictional wetlands, agricultural parcels, residential areas, and other areas as requested by the landowner in order to maintain good soil condition for revegetation (Appendix M, Construction BMPs; BMP #1 in Appendix N);
- Maintain separation of salvaged topsoil and subsoil throughout all construction activities (Appendix M; BMP #1 in Appendix N);
- Use low-ground-weight construction equipment or operate normal equipment on timber mats in standing water, saturated wetlands, or areas where construction equipment causes ruts or mixing of topsoil and subsoil (Appendix M; BMP #1 in Appendix N);
- Decompact subsoils in agricultural, residential, and wetland areas via plow or other deep tillage method (Appendix M; BMP #1 in Appendix N);
- Restore the disturbed area to preconstruction contours (Appendix M; BMP #1 in Appendix N); and
- Reseed all disturbed areas in accordance with the Revegetation Plan (Appendix Q; BMP #8 in Appendix N) and any agency requirements.

Following construction, lands currently dominated by herbaceous vegetation would revegetate quickly, often within one growing season after seeding and otherwise typically within 3 years. Cleared scrub-shrub vegetation communities within the temporary workspace would likely require 3 to 5 years to regain their

[3] Edge effects are the effects experienced by organisms in the remaining ecosystem fragment (e.g., forest fragment) to the conditions of a different surrounding ecosystem. When different community types are separated by an abrupt transition (i.e., edge), edge effects are the result of the interaction between the two communities and may cause changes in the biotic and abiotic conditions (Murcia 1995).

woody composition, and forested lands within the temporary workspace would be allowed to revegetate. With implementation of Project BMPs described above, impacts from the construction of Project pipelines and MLVs would be direct, adverse, short-term, and minor for herbaceous and scrub-shrub communities, and direct, adverse, long-term, and moderate for forested communities.

Noxious and Invasive Plants

During construction, noxious or invasive plants could be spread or introduced into new areas due to disturbance of the existing vegetation community. To mitigate the spread of invasive species, the Applicant would:

- Limit traffic on the onshore pipeline rights-of-way by using “no access” signs, fences, or gates, as applicable, to limit off-road vehicular traffic and reduce rutting and disturbance (BMP #10 in Appendix N);
- Fill and grade ruts and disturbed areas, as necessary (Appendix Q, Revegetation Plan; BMP #8 in Appendix N);
- Reseed the construction right-of-way with approved seed mix (BMP #8);
- Conduct a noxious and invasive species survey of the Project right-of-way after the post-construction growing season and take control actions (chemical and/or mechanical control practices) in locations where noxious and/or invasive species densities are higher in the right-of-way than on adjacent lands (BMP #8); and
- Remove successfully treated noxious or invasive species, if possible, and reseed those areas with desirable species (BMP #8).

Operation Impacts

During operation, the 30-foot-wide and 50-foot-wide permanent rights-of-way would be maintained in an herbaceous state through semi-annual vegetation management. Trees outside the permanent easement with roots that could compromise the integrity of the onshore pipeline may be selectively cut and removed. These impacts would result in the permanent conversion of about 6 acres of forested land to herbaceous land based on the TPWD land cover categories.

A total of 18 new or improved access roads used for construction or operation of the pipeline would affect vegetation. Impacts associated with temporary access roads would be comparable to those described above during construction. Following construction, the Applicant would restore nine access roads to preconstruction condition and would permanently maintain nine access roads, which would convert about 5.9 acres of vegetation to developed land.

Periodic vegetation management during Project operation would not substantially alter herbaceous communities; however, scrub-shrub vegetation and forested communities within the permanent easement would be converted to herbaceous cover for the life of the Project. The Applicant indicated that it would conduct semi-annual vegetation management to maintain herbaceous cover within the permanent rights-of-way. To mitigate for unavoidable impacts, the Applicant would provide compensatory mitigation for the conversion of scrub-shrub and forested wetlands, as described in Section 3.3.5.4, Water Resources, Surface Water, Compensatory Mitigation. While certain trees would be cleared if roots pose a risk to the integrity of the pipeline, the direct removal of trees within the permanent rights-of-way would be unlikely during the life of the Project, as periodic vegetation management would prevent their establishment. With implementation of Project BMPs described above and compensatory mitigation for impacts on scrub-shrub and forested wetlands, impacts from operation of Project pipelines and MLVs would be direct, adverse, short-term, and minor for herbaceous and scrub-shrub communities, and direct, adverse, long-term, and moderate for forested communities.

Terminal Facilities

Modifications to the ECHO Terminal would affect approximately 3.2 acres of land; however, all impacts would occur within the existing fenced facility, on land maintained in an herbaceous state. Therefore, impacts on vegetation within the ECHO Terminal workspace would be direct, adverse, long-term, and negligible.

Long-term and permanent impacts on vegetation communities within the Oyster Creek Terminal site would occur due to vegetation clearing, grading, and placement of the terminal facilities on the site. The majority of the 140.1 acres within the Oyster Creek Terminal would be converted to urban/industrial land cover, which would result in the loss of the vegetation communities and permanent impacts for the life of the Project. Adjacent communities would be affected by light and noise, and the increased risk of invasive species due to disturbance of the site. Areas intended to be maintained as vegetation within the Oyster Creek Terminal site would be seeded with an NRCS-approved seed mix and vegetation management would occur as needed to comply with local ordinances, applicable PHMSA right-of-way practices, and other operational needs. Any use of herbicides would be consistent with manufacturer’s instructions. To minimize impacts at the Oyster Creek Terminal, the Applicant would:

- Avoid paving and gravel where possible (BMP #11 in Appendix N);
- Avoid surveyed wetlands to the extent possible (BMP #12 in Appendix N); and
- Use containment berms to preserve outlying herbaceous areas (BMP #13 in Appendix N).

Therefore, impacts on vegetation communities due to the construction and operation of the Oyster Creek Terminal would be direct, adverse, long-term, and moderate.

Accidental Spills of Hazardous Materials

Contamination caused by spills of hazardous materials during construction could impact vegetation communities. Sources of contaminants could include inadvertent releases of drilling mud during HDD operations or from accidental spills of hazardous materials including gasoline, oil, hydraulic fluids, or diesel fuel. The level of impact would depend on the phase of the SPOT Project, with spills occurring during construction likely to be less harmful than spills of crude oil during Project operation.

An inadvertent return of drilling mud could coat the ground surface and alter existing vegetation if not cleaned up. To minimize impacts of an inadvertent return, the Applicant would implement measures outlined in its HDD Contingency Plan (Appendix N; BMP #6 in Appendix N), such as establishing containment structures where necessary and working with regulatory agencies to determine the necessary course of action. Additionally, vacuum trucks, booms, absorbent pads, shovels, and hay bales would be available and maintained at each HDD site for cleanup in the event of an inadvertent release. With these measures in place, impacts on vegetation due to an inadvertent release of HDD drilling mud would be direct, adverse, short-term, and minor.

Impacts on vegetation communities could be associated with accidental releases of fuel, oil, and other chemicals during construction. Diesel oil is phytotoxic to plants and, depending on the contamination level, can decrease the ability of certain species to germinate (Adam and Duncan 1999). To minimize these impacts, the Applicant would implement its Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), which includes:

- Secondary containment for the storage of hazardous materials (BMP #3);
- Secondary containment capable of containing 110 percent of the volume of hazardous materials (BMP #3);
- Daily inspections of tanks for leaks (BMP #3);
- Providing spill response kits at all secondary containment areas (BMP #3);
- Providing fire extinguishers and spill response kits on all vehicles used to transport fuel (BMP #3); and
- Restricting refueling and transferring of liquids to pre-designated locations away from sensitive areas (BMP #3).

The Applicant would also implement its SWPPP to minimize effects of contaminants in stormwater runoff through post construction stabilization (BMP #14 in Appendix N).

Impacts on vegetation would be more substantial if an oil spill occurred during Project operation. At a minimum, oil would adhere to vegetation along its flow path and may cause defoliation and/or die-off. To minimize the impacts of an oil spill, the pipelines would be constructed with shutdown valves to allow sections of the pipeline to be isolated. Storage tanks at the Oyster Creek Terminal would be contained within a concrete ring lined with an impermeable membrane. The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3).

Oil would flow from the opening under operating pressure until the line is depressurized and the leaking segment is isolated. If a leak occurred during Project operation, the Applicant would implement the Enterprise Products oil spill response plan for onshore facilities in Brazoria and Harris counties. With implementation of the safety design features for onshore facilities and the mitigation measures described above, impacts on vegetation due to an oil spill would be direct and adverse, and depending on the size of the spill, could be short-term or long-term and minor to major.

Priority Protection Habitats

The identification and protection of Priority Protection Habitats designated by the GLO are not mandated by state regulations, but are incorporated into the operational layers of the Oil Spill Response Mapper maintained by GLO. This Geographic Information System (GIS) tool is used to inform responders of those areas in need of rapid protection in the event of a spill. The Applicant provided oil spill trajectory and fate modeling reports that modeled the most likely scenario oil spill onshore and offshore, and provided a separate report describing the impacts of an oil spill on different community types, including salt marshes and seagrass meadows (SPOT 2019c, 2019d, 2019p, 2019w, and 2019ee). The model indicated that the potential effects on vegetation would vary based on the growth stage of the plants, the volume of oil, and the time of year; and could include defoliation to complete die-offs. Vegetation exposed to oil during the growing season would be most vulnerable, with lethal threshold estimates occurring at 5,000 grams per square meter (g/m^2) and sublethal thresholds occurring at 1,000 g/m^2. Recovery of vegetation communities could occur within 1 year or could take more than a decade depending on the factors above (SPOT 2019c, 2019d, 2019p, and 2019ee). The model results are provided in the Oil Spill Trajectory and Fate Modeling Report (SPOT 2019w). Vegetation analysis conducted following the Deepwater Horizon (DWH) oil spill documented increased erosion of marsh habitats in areas with the highest level of oiling (Silliman et al. 2016). If an onshore or offshore oil spill occurred and reached the Priority Protection Habitats, the impacts could be major.

The Applicant would implement its Onshore Construction Spill Response Plan for leaks that occurred during construction (Appendix F; BMP #3 in Appendix N), and provided the following hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions):

- Booming-containment
- Skimming
- Physical herding
- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

Use of the response actions listed above would minimize the impacts associated with an oil spill. Any leaks would be contained and remedied as soon as possible in compliance with the Applicant's Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N) and operational spill response plan. With implementation of these measures, impacts on Priority Protection Habitats during construction or operation of the Project would be direct, adverse, short-term to long-term, and minor to major.

Offshore Vegetation

Construction of the offshore marine components, including the SPOT DWP and subsea pipelines, would affect approximately 27.2 to 30.8 nautical miles of seafloor off the coast of Brazoria County, Texas. Installation of the pipelines would temporarily disturb the seabed, but would not impact any offshore vegetation because no vegetation is present in the proposed disturbance area.

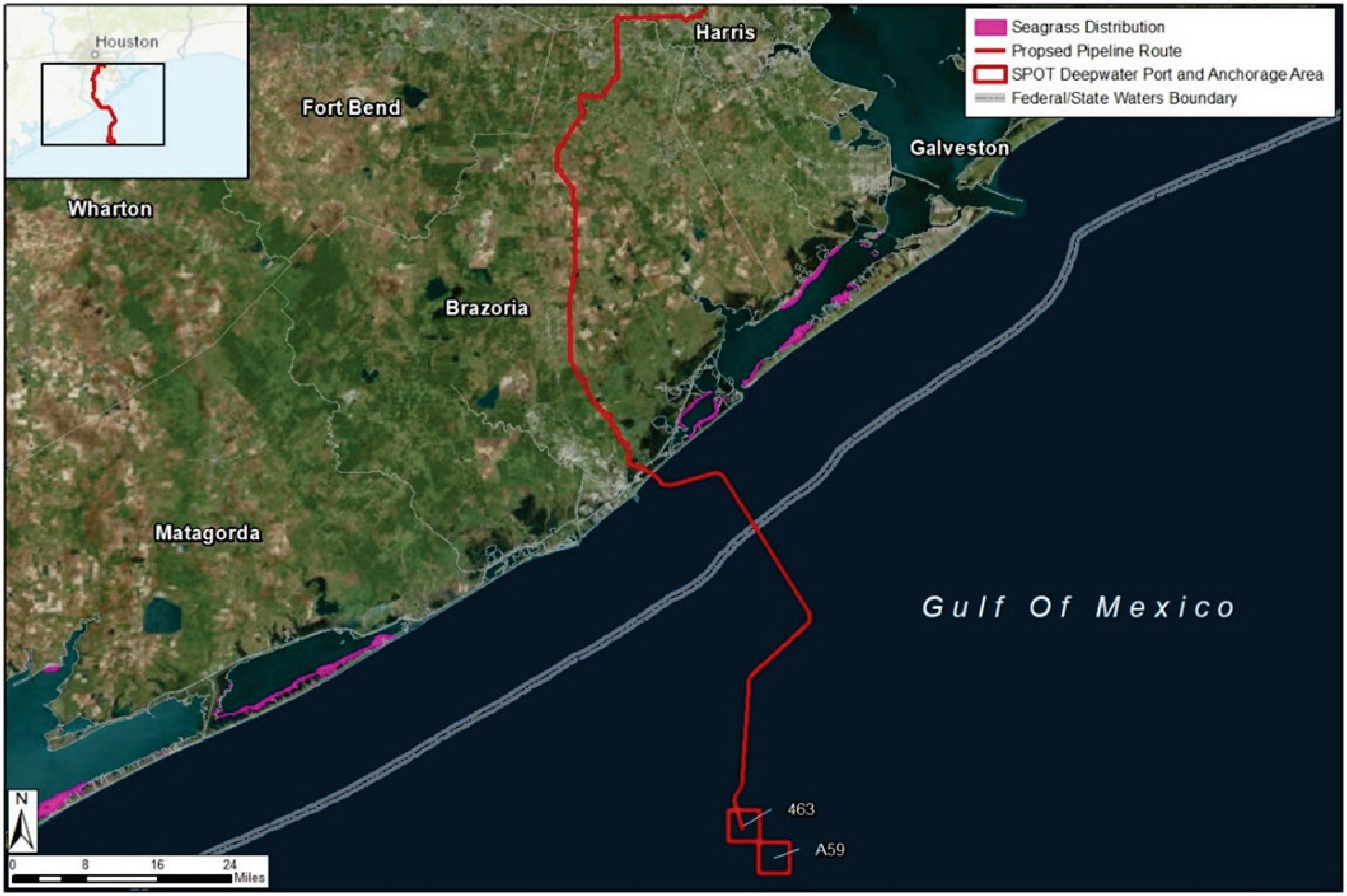
As discussed in Section 3.4.3.1, Habitats, Vegetation, Existing Conditions, data available on the TPWD GIS website show that the closest seagrass beds are located in Christmas Bay (part of the Galveston Bay complex) over 35 nautical miles from the SPOT DWP location and approximately 4.3 nautical miles from the HDD exit pit (Figure 3.4.3-2). Due to this distance, Project construction would have no impacts on seagrass beds. *Sargassum* is a seasonal seaweed that grows in the open water areas on the continental shelf and forms floating mats that could be present during construction and operation of the Project.

Construction activities would not have any impact on the density of *Sargassum* mats. Vessels transiting the area during construction or to call on the facility during operation could scatter *Sargassum* mats when they pass through. Additionally, the wakes and surface water disruption associated with vessel transit could affect the distribution of *Sargassum*. However, this would not affect the amount of *Sargassum* matting and would not affect prey abundance and cover within the *Sargassum*. In its recent Biological Opinion for oil and gas program activities, NMFS (2020m) indicated it did not believe that the breaking up of *Sargassum* mats has occurred at a large enough scale for the essential functions of the *Sargassum* community to be affected. Therefore, disruption of *Sargassum* due to vessel traffic associated with the Project would not adversely affect *Sargassum* habitat.

During operation, VLCCs or other crude oil carriers may discharge ballast water at the DWP. Ballast water exchange, if it occurs, could affect *Sargassum* habitat because as of publication of this Final EIS, not all vessels have installed ballast water treatment systems to prevent the spread of exotic species. Introduction of exotic organisms could change the *Sargassum* habitat directly, or introduce organisms that would change the prey composition within the *Sargassum* that sea turtles rely on. It is unknown if ballast water exchange would introduce exotic species, but if it did, the impact would be direct and indirect, adverse, long-term, and minor to major.

As previously noted, the Applicant provided most likely scenario oil spill models, which indicated that seagrass beds could be exposed to oil from any of the modeled oil types. Additionally, depending on the season, *Sargassum* may also be present if an oil spill occurred. The effects on seagrasses or *Sargassum* mats would depend on the level of exposure and would be similar to those described above for Priority Protection Habitats.

As described in Section 3.4.3.2, Habitats, Vegetation, Impacts and Mitigation, Priority Protection Habitats, the Applicant would implement its Onshore Construction Spill Response Plan for leaks that occurred (Appendix F; BMP #3 in Appendix N) and would develop an operational spill response plan for accidental releases during Project operation as described above. Any releases would be contained and remedied as soon as possible in compliance with the spill plans. With implementation of these measures, impacts on seagrasses or *Sargassum* during construction or operation of the Project would be direct, adverse, short-term to long-term, and moderate to major.



Source: TPWD 2015b

Figure 3.4.3-2: Seagrass Distribution Nearest to SPOT Deepwater Port

Planned and Unplanned Maintenance

Onshore Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the SWPPP (BMP #14 in Appendix N). The Applicant would also adhere to the conservation measures established for the Eastern Black Rail in Section 5.1.4 of the Addendum to the BA (Appendix E2). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

Offshore Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above in the Accidental Spills of Hazardous Materials section. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.4.4. Oyster Reefs

3.4.4.1. Existing Conditions

Oyster reefs occur in subtidal and intertidal zones of coastal waters in the GoM. They are formed when large groups of oyster shells fuse together to form a reef-like structure. Oyster reefs provide important habitat for other marine species including shellfish, invertebrates, and fish, and create nursery habitats for many species including fish, crabs, and shrimp. Oysters filter the water that passes over them, and the cleaner water can help support underwater grasses. Oyster reefs also provide shoreline protection by reducing wave energy (NMFS 2019a).

The primary authority for managing oyster reefs in Texas is the TPWD. Oyster reefs are considered EFH and are afforded additional protection compared to other wetlands. Oyster reefs are also designated as coastal natural resource areas and as critical habitat under the TCMP administered by the GLO. Under the TCMP, the goal for oyster reefs is no net loss of functions and values. Therefore, GLO may require compensatory mitigation for any adverse impacts on oyster reefs. The Applicant conducted field surveys to identify oyster reefs along the onshore pipeline route. Approximately 0.5 acre of oyster reefs would occur within the construction workspace of the SPOT Project (Figure 3.4.4-1).

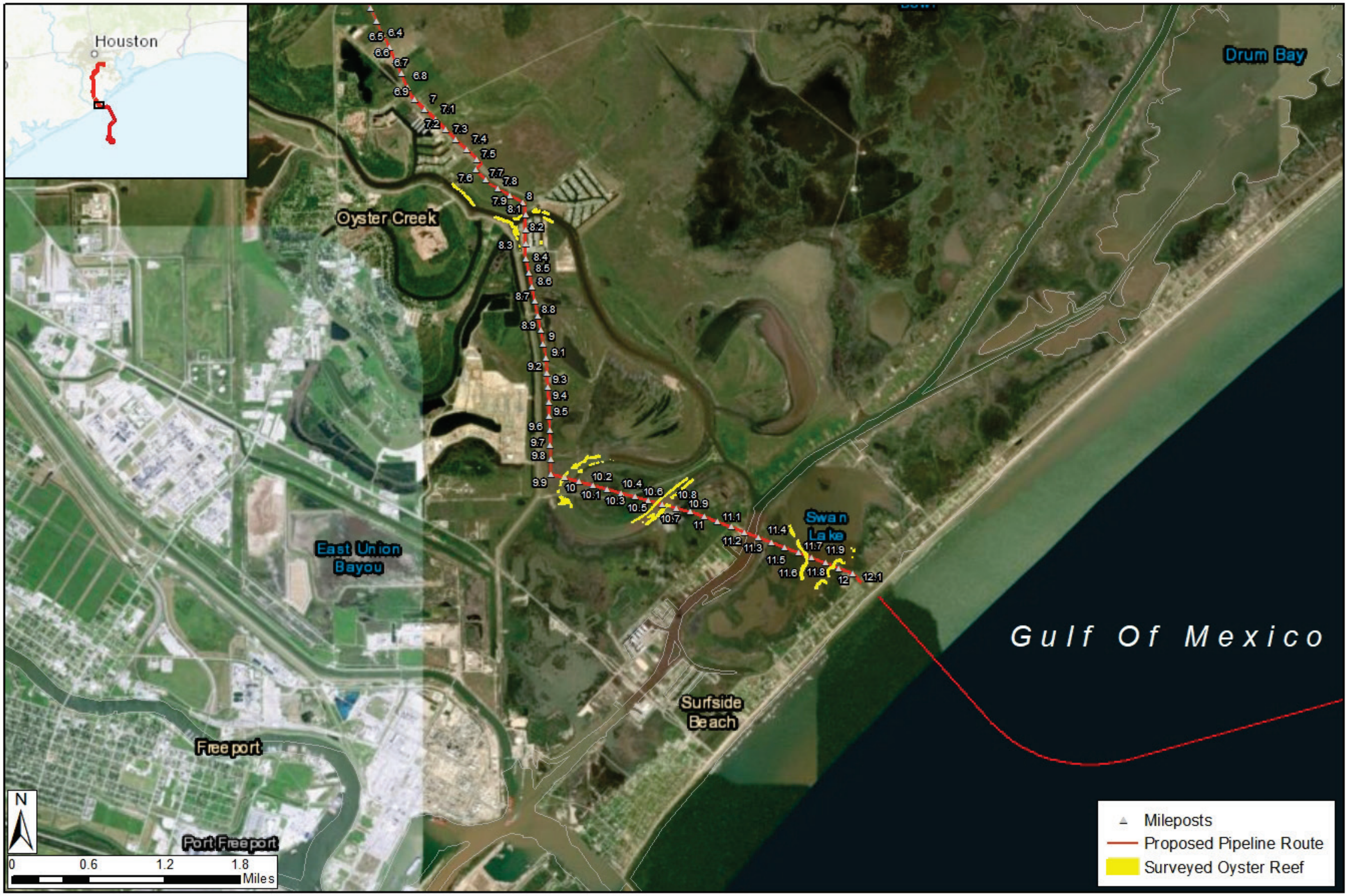


Figure 3.4.4-1: Oyster Reefs Identified Along the Oyster Creek to Shore Pipeline Route

3.4.4.2. Impacts and Mitigation

Recent research indicates oysters can detect sound and may respond with valve closure. Pile driving, vessel traffic, explosive sounds, drilling, and wind turbines all generate sounds detectable by oysters (Charifi et al. 2017). Therefore, construction activities may be detectable by oysters, but construction activities (e.g., pile driving) that would generate the loudest sounds would be located too far from oyster reefs to elicit a response. The existing oyster reefs would be crossed using the HDD method, which would minimize the level of noise exposure from onshore construction, but some increase in noise and vibration may be detectable. Therefore, impacts on oysters due to construction noise would be indirect, adverse, short-term, and negligible. The Applicant proposes to cross all oyster reefs via the HDD method; therefore, it is unlikely work would be conducted in these areas during operation. As such, operation of the Project would not affect oyster reefs.

Contamination caused by spills of hazardous materials during construction and operation of the Project could impact oyster reefs. Because the Project would cross oyster reefs using the HDD method, the likelihood of accidental release of hazardous material from a construction vessel would be low. However, if an oil spill occurred during Project operation, oyster reefs could be affected. The Applicant provided modeling for the release of heavy crude and light crude oil products from onshore pipelines. Should a spill occur, spill plumes could reach both Oyster Creek and Swan Lake where oyster reefs are known to occur. Based on the Applicant's modeling of most likely scenarios, the spill plumes associated with each oil type would reach both Oyster Creek and Swan Lake (SPOT 2019c, 2019d, 2019p, and 2019ee).

Using BOEM's NEPA planning document for evaluating potential oil spills for this type of facility, the Applicant also provided modeling of a most likely scenario offshore spill of about 2,200 bbl of oil over 1 hour for heavy crude (WCS), lighter crude (WTI), and condensate. The Applicant also modeled a worst credible spill of approximately 71,000 gallons of diesel fuel, which would be the maximum capacity of diesel fuel stored for the Project. The model simulations represented the fate of each spill over a 60-day period and represented different times of year; WCS occurred in fall (November), WTI occurred in mid-summer (July), condensate occurred in late summer (August), and diesel fuel occurred in spring (May).

For WCS, the model predicted:

- An estimated 243 miles of shoreline would be contaminated by >1 g/m^2 of oil along the Texas coast and part of Mexico; and
- Over a 60-day period, 34 percent of WCS oil would evaporate, 47 percent would reach shore, 4 percent would remain in the water column, 0.2 percent would settle in sediments, and 14 percent would biodegrade.

For WTI, the model predicted:

- An estimated 146 miles of shoreline would be contaminated by >1 g/m^2 of oil from Galveston Bay to East Matagorda Bay, and
- Over a 60-day period; 64.8 percent of WTI oil would evaporate, 18.5 percent would reach shore, 0.8 percent would remain in the water column, 9.7 percent would settle in sediments, and 6.2 percent of WTI would biodegrade.

For condensate, the model predicted:

- An estimated 7 miles of shoreline west-northwest of the spill site on the outer coast seaward of East Matagorda Bay would be contaminated with >1 g/m^2 of oil; and
- Over a 60-day period, 88 percent of the oil would evaporate, 0.05 percent would reach shore, 4 percent would remain in the water column, 0.4 percent would settle in sediments, and 8 percent would biodegrade.

For diesel fuel, the model predicted:

- About 10 miles of shoreline along Galveston Island would be contaminated with >1 g/m^2 of oil;
- Over a 60-day period, 61.7 percent would evaporate, 0.02 percent would reach shore, 4.2 percent would remain in the water column, 8.9 percent would settle in sediments, and 25 percent would biodegrade; and
- Within the first day after release, diesel fuel either evaporated or was dispersed into the water column (SPOT 2019p).

An oil spill would release PAH into the water column where they can persist in the water or in the sediments where they settle. Volatilization and oxidation result in elimination of low molecular weight PAHs from the water column, but adsorption of high molecular weight PAHs occurs on particles in the water and bottom sediments (Olayinka et al. 2018). The bioavailability of chemicals is generally highest in true solution in the water and is lower for chemicals in solid or adsorbed forms. The effect of PAHs on marine organisms is dependent on the bioavailability of PAHs, the exposure time, and the ability of the organism to metabolize the compounds (NRC 2003). The model for the most likely scenario oil spill also included an evaluation of the concentrations of PAHs in the water column. PAHs are one of the most toxic constituents found in oil. PAHs that have not been metabolized can be toxic, while some reactive metabolites can result in biochemical changes in the body and can also cause cell damage that results in mutations, tumors, and cancer (Kannan and Perrotta 2008). Based on model results provided by the Applicant, the highest dose of PAHs in water would occur during a release of WCS at the platform. All four of the modeled spills resulted in the potential for exceeding the acute effects threshold for plankton (100 parts per billion per hours [ppb-hours]); a release of WTI and WCS could both exceed the acute effects threshold for fish and pigmented invertebrates (1,000 ppb-hours). Therefore, the potential exists for acute effects to occur in the water volumes provided in Table 3.4.4-1. However, the report also indicates that PAH concentrations exceeding 1 part per billion (ppb) would only occur for a short time and the distribution would be patchy before diluting to levels below the threshold of concern (SPOT 2019ee). Tables 3.3.7-5 and 3.3.7-6 show the percentage of shoreline habitats oiled and the estimated time for oil to reach the shoreline, respectively.

In addition to oil spill modeling provided by the Applicant, USCG requested that a third party conduct worst credible oil spill modeling and risk assessment to support the SPOT DWP license application process. The third-party Spill Risk Analysis is included in Appendix H and the third-party Oil Spill Modeling Report is included in Appendix X. For purposes of this EIS, impact analyses are based on the Applicant's model of a most likely scenario oil spill. The worst credible scenario model evaluated nearshore (2 miles off the coastline) and offshore (at the SPOT DWP) spills of WCS, WTI, and condensate (Figure 3.4.4-2). The modeled worst credible discharge assumed a subsea oil spill resulting from a rupture of both crude oil export pipelines caused by a dropped or dragged anchor, and included inputs for the maximum time to shut down flow during each of the four seasons. The release would occur in two phases: the early phase occurs during the first 30 minutes resulting in 63,750 bbl of oil released before shutdown occurs, and the late phase occurs after shutdown while the lines drain resulting in a release of 623,522 bbl. The total volume modeled was 687,272 bbl. For a worst credible scenario, it was assumed that no response efforts took place to mitigate the impacts of the spill. The model was only for the GoM and did not include habitats on the shore side of the barrier islands.

Table 3.4.4-1: Modeled Results of Polycyclic Aromatic Hydrocarbon in the Water Column

	2,200 bbl Release of West Texas Intermediate	2,200 bbl Release of Western Canadian Select	2,200 bbl Release of Condensate	70,980 gallon Release of Diesel Fuel
Maximum dose (ppb-hours) [a]	4,756	5,518	1,650	694.4
Volume for maximum dose (m^3) [b]	80,640	35,960	76,210	79,330
Average dose in volume >1 ppb (ppb-hours) [c]	1,416	2,492	558.2	150.9
Volume contaminated >1 ppb (km^3) [d]	0.0445	0.150	0.112	0.167
Volume contaminated >10 ppb (km^3) [d]	0.0110	0.049	0.025	0.005
Max exposure time >1 ppb (hours) [e]	162	180	288	624
Max exposure time >10 ppb (hours) [e]	43	83	151	252

Source: SPOT 2019ee

bbl = barrel of crude oil; km^3 = cubic kilometers; m^3 = cubic meters; ppb = parts per billion; ppb-hours = parts per billion–hours

[a] Maximum dose (concentration x exposure duration) at any single time step in any location.

[b] Volume of water that contained the maximum dose.

[c] Average dose in all waters that had dissolved oil concentrations > 1 ppb.

[d] Volume of water that exceeded 1 ppb and 10 ppb at any given time.

[e] Maximum number of hours with exposure concentrations >1 or 10 ppb.

In 40 percent of the model runs for a nearshore spill of condensate, oil missed the shoreline, turned, and went out to sea while the other 60 percent of model runs affected the Freeport shoreline. A spill at the SPOT DWP would have a greater potential to impact more shoreline area and more of the GoM due to the ocean currents carrying the oil farther than when the oil spill is close to shore where currents have less of an effect. Model results for shoreline oiling and maximum GoM surface area affected are presented in Table 3.4.4-2, and results of the area affected by dissolved aromatic hydrocarbons (includes both PAHs and the mono-aromatic hydrocarbons such as benzene, toluene, ethylbenzene, and o-, m-, and p-xylene isomers) are presented in Table 3.4.4-3. Plots showing the fate of oil and PAHs under each scenario are included in Section 4.6.3.3, Crude Oil Spread and Slick Migration Modeling.

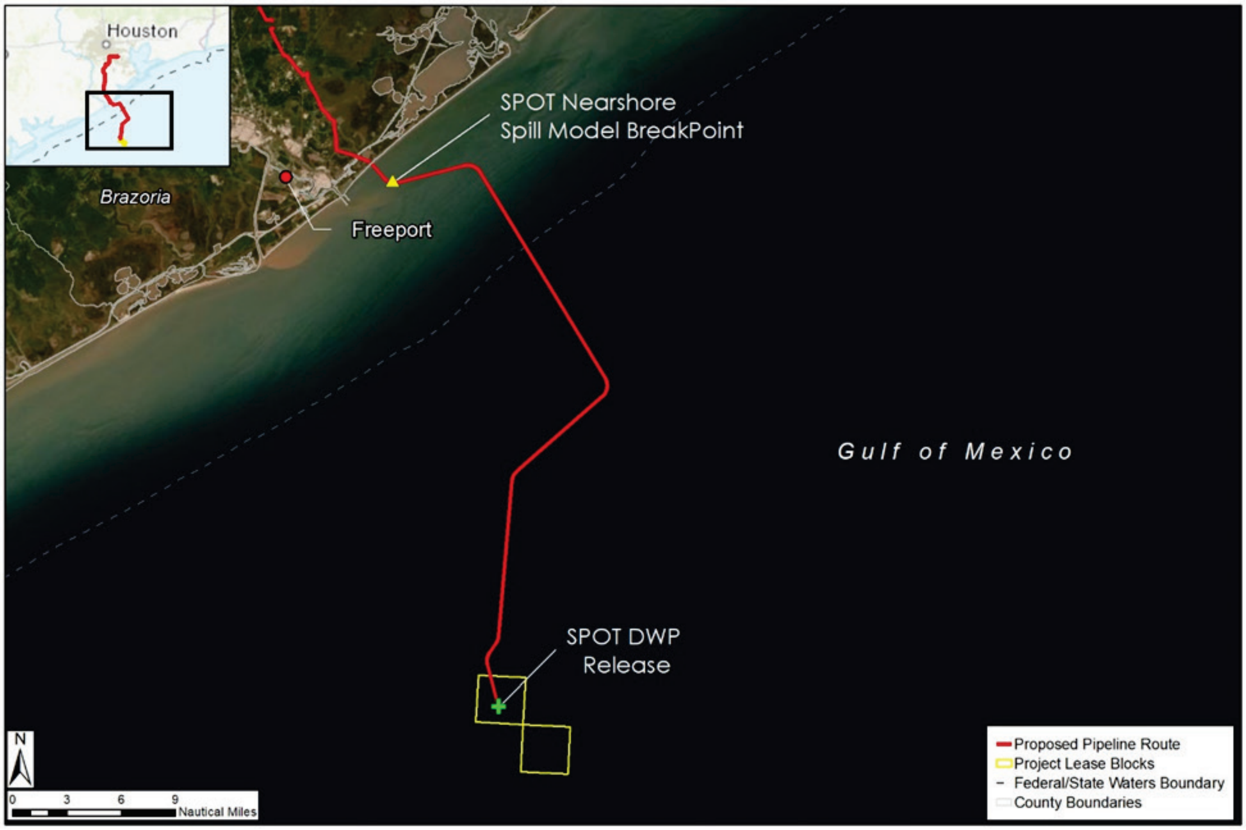


Figure 3.4.4-2: Selected Spill Locations—Nearshore and at the Deepwater Port

Table 3.4.4-2: Spill Model Results for the Release of 687,272 Barrels of Oil

Spill Location/ Oil Type/ Season	Maximum Barrels of Oil to Reach Shoreline	Maximum Miles of Shoreline Oiled	Miles of Shoreline Oiled >1 g/m^2	Miles of Shoreline Oiled >100 g/m^2	Shortest Time for Oil to Contact Shoreline (days)	Maximum Surface Area (mi^2) Oil >1.0 µm
Nearshore Spill (2 miles off the coastline)						
Western Canadian Select						
Winter	503,049	94.2	2.63	2.63	0.25	15,982
Spring	536,286	91.1	1.53	1.53	0.25	2,281
Summer	489,344	40.2	1.98	1.98	0.25	302
Fall	499,738	78.8	6.84	6.84	0.25	4,158
West Texas Intermediate						
Winter	423,229	90.2	2.42	2.42	0.25	15,185
Spring	453,357	91.6	1.76	1.76	0.25	2,123
Summer	440,594	35.1	1.98	1.98	0.25	302
Fall	392,201	84.6	3.67	3.67	0.25	4,965
Condensate						
Winter	363,870	82.0	2.42	2.42	0.25	14,578
Spring	393,536	78.2	1.53	1.53	0.25	2,686
Summer	327,607	36.8	3.29	3.29	0.25	309
Fall	327,771	64.8	3.23	3.23	0.25	3,098
Offshore Spill (at SPOT DWP)						
Western Canadian Select						
Winter	206,883	130.1	59.2	59.2	1.75	17,751

Spill Location/ Oil Type/ Season	Maximum Barrels of Oil to Reach Shoreline	Maximum Miles of Shoreline Oiled	Miles of Shoreline Oiled >1 g/m^2	Miles of Shoreline Oiled >100 g/m^2	Shortest Time for Oil to Contact Shoreline (days)	Maximum Surface Area (mi^2) Oil >1.0 µm
Spring	312,363	171.1	98.2	98.2	1.75	12,065
Summer	233,866	141.9	55.8	55.8	1.5	7,608
Fall	163,757	124.4	83.9	83.9	2.25	15,201
West Texas Intermediate						
Winter	166,707	95.4	94.6	94.6	2.5	14,079
Spring	181,664	141.2	63.3	63.3	1.75	11,198
Summer	173,502	142.9	52.1	52.1	1.5	8,178
Fall	95,946	100.6	57.8	57.8	2.5	11,368
Condensate						
Winter	107,336	94.8	28.6	28.6	2	13,090
Spring	124,283	121.5	39.3	39.3	1.75	9,816
Summer	77,451	118.2	49.4	49.4	1.75	895
Fall	65,849	100.6	49.8	49.8	2.5	11,404

Source: Appendix X, Oil Spill Modeling Report

mi^2 = square mile; ppb = parts per billion; SPOT DWP = Sea Port Oil Terminal Deepwater Port

g/m^2 = gram per square meter; µm = micrometer; mi^2 = square mile; SPOT DWP = Sea Port Oil Terminal Deepwater Port

Table 3.4.4-3: Area Affected by Dissolved Aromatic Hydrocarbons

Spill Location/Season	Maximum Area (mi^2) of DAH >5 ppb		
	Western Canadian Select	West Texas Intermediate	Condensate
Nearshore Spill (2 miles off the coastline)			
Winter	7,867	7,418	7,819
Spring	3,060	2,636	3,425
Summer	582	570	626
Fall	2,275	3,349	2,536
Offshore Spill (at SPOT DWP)			
Winter	8,592	8,031	8,839
Spring	4,996	8,704	8,388
Summer	6,272	6,874	2,169
Fall	8,871	7,979	6,883

Source: Appendix X, Oil Spill Modeling Report

mi^2 = square mile; ppb = parts per billion; SPOT DWP = Sea Port Oil Terminal Deepwater Port

Oysters are stationary filter feeders that are exposed to any toxins in the water they filter. During the DWH oil spill, crude oil was released into the GoM for 87 days and more than 1 million gallons of oil dispersants were used. Some oil dispersants contained nonylphenol ethoxylates, which, when broken down, can form nonylphenol. Nonylphenol is recognized as an endocrine disruptor and it is known to bioaccumulate in some organisms (Judson et al. 2010; Diehl et al. 2012). Research following the DWH oil spill found that exposure to oil, dispersed oil, and/or dispersant were highly toxic to all life stages of *C. virginica* and have lethal and sublethal effects on the oysters. Sublethal effects include growth impairment and reduced settlement success, which would reduce survival (Vignier et al. 2016). In addition to the concentration and duration of exposure, the toxic effects of crude oil are also influenced by temperature, ultraviolet radiation, and salinity, which can increase the toxic effects on marine organisms (Vignier et al. 2016). Either a land-based or an offshore oil spill could cause oil contamination of oyster reefs and the impacts would be direct, adverse, short-term to long-term, and moderate to major, depending on the size of the spill.

Planned and Unplanned Maintenance

Periodic maintenance of onshore and subsea pipelines would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above (Accidental Spills of Hazardous Materials). Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and negligible.

3.4.5. Marine Protected Areas

Many areas of the marine environment in the United States have some level of Federal, state, or local management or protection. MPAs have conservation or management purposes, defined boundaries, and some legal authority to protect resources. Nationally, MPAs are defined in Executive Order 13158 as "any area of the marine environment that has been reserved by federal, state, territorial, tribal, or local laws or regulations to provide lasting protection for part or all of the natural and cultural resources therein."

The National Marine Protected Area Center developed an MPA classification system that provides definitions and qualifications for the various terms within Executive Order 13158. The system uses five functional criteria to objectively describe the key features of most MPAs:

1. Conservation focus (i.e., natural heritage, cultural heritage, or sustainable production);
2. Level of protection (i.e., no access, no impact, no take, zoned with no-take areas, zoned multiple use, or uniform multiple use);
3. Permanence of protection (i.e., permanent, conditional, or temporary);
4. Constancy of protection (i.e., year-round, seasonal, or rotating); and
5. Ecological scale of protection (i.e., ecosystem or focal) (NOAA 2011a).

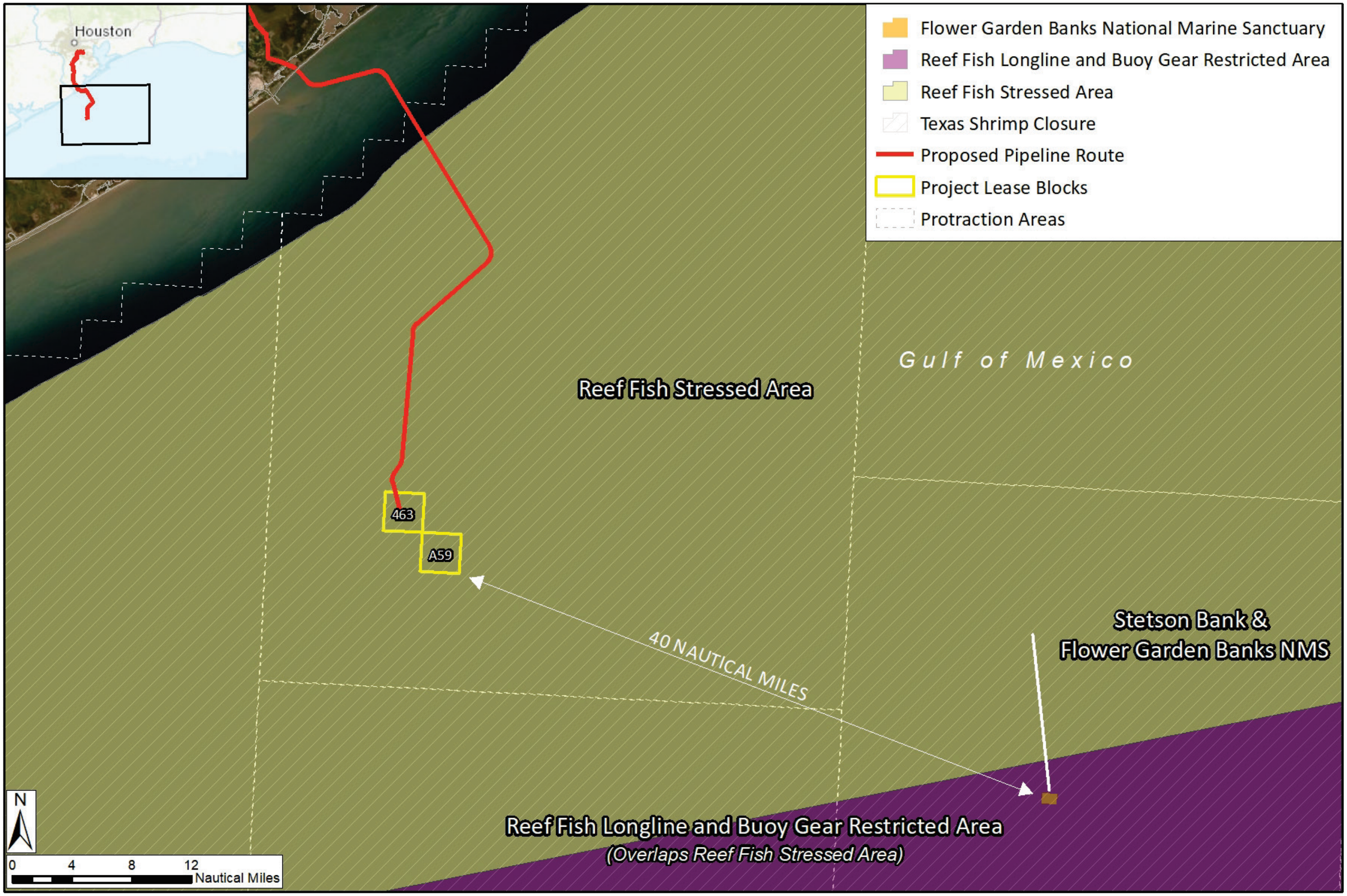
MPAs cover about 40 percent of the GoM (NOAA 2011b), are designated and managed at all levels of government by a variety of agencies, and have been established by more than 100 legal authorities. MPAs vary widely in purpose, legal authorities, managing agencies, management approaches, level of protection, and restrictions on human uses. They have been designated to achieve objectives ranging from the conservation of biodiversity, to the preservation of sunken historic vessels, to the protection of spawning species important to commercial and recreational fisheries (NOAA 2012b). The levels of protection provided by these MPAs range from fully protected (i.e., no-take) reserves to sites allowing multiple uses including fishing, recreation, and industrial uses.

3.4.5.1. Existing Conditions

Coastal states and territories manage approximately 75 percent of the MPAs, most of which are typically small; MPAs in the GoM compose about 6 percent of MPAs in U.S. waters (NOAA 2012a; NOAA 2011b). As shown on Figure 3.4.5-1, portions of the offshore pipelines and the SPOT DWP would be located within three MPAs: Reef Fish Stressed Area, Reef Fish Longline and Buoy Gear Restricted Area, and Texas Shrimp Closure. The Reef Fish Stressed Area was established in 1984 by the Gulf of Mexico Fishery Management Council (GMFMC) to relieve stress on reef-fish populations from year-round recreational fishing. The GMFMC established the Reef Fish Longline and Buoy Gear Restricted Area in 1990 to protect spawning reef-fish populations from year-round commercial fishing with specific types of gear. The GMFMC established the Texas Closure in 1981 for a seasonal restriction to increase yield and value of shrimp. The protective measures in place for the Reef Fish Stressed Area and Reef Fish Longline and Buoy Gear Restricted Area are related to gear and year-round restrictions for fishing (50 CFR §§ 622.34 and 622.35). The Texas Closure includes seasonal gear restrictions (50 CFR § 622.55) (Coleman et al. 2004).

The closest MPA sanctuary to the proposed Project is the Flower Garden Banks National Marine Sanctuary (FGBNMS), which is approximately 40 nautical miles to the southeast of the SPOT DWP (Figure 3.4.5-1). The FGBNMS was established in 1992 in the northwestern portion of the Gulf of Mexico Large Marine Ecosystem, nearly 96 nautical miles off the coast of Texas and Louisiana. It is the only sanctuary in the GoM. On January 19, 2021, NOAA announced the final rule to expand the sanctuary to include 14 additional reefs and banks in the northwestern GoM and increase the total area from 56 square miles to 160 square miles (86 Fed. Reg. 11 [January 19, 2021]). The final rule will become effective in accordance with the National Marine Sanctuaries Act; NOAA will publish the effective date in the Federal Register.

Coral reefs in the GoM have a variable amount of coral cover with FGBNMS having the highest coral cover in the wider Caribbean region. FGBNMS had historically experienced minimal bleaching events or other coral diseases, but in 2016 a large bleaching event (likely caused by low DO) affected nearly 82 percent of the corals at East Flower Garden Bank. The 2016 bleaching event also resulted in the mortality of many sponges, mollusks, crustaceans, and echinoderms (e.g., starfish). However, more than 25 years of monitoring documents that abundant fish assemblages and nearly 60 percent of coral cover remains at FGBNMS (Gil-Agudelo et al. 2020). The SPOT DWP would be about 40 nautical miles northwest of Stetson Bank, which is the closest part of FGBNMS to the Project.



Source: NMFS 2017d

Figure 3.4.5-1: SPOT Project in Relation to Flower Garden Bank National Marine Sanctuary and Marine Protected Areas

3.4.5.2. Impacts and Mitigation

The three MPAs within the proposed Project area are related to fishing restrictions. The construction and operation of Project would have no effect on the implementation of designated fishing restrictions. The Stetson Bank and FGBNMS, one type of MPA that protects the entire ecosystem but still allows some fishing, is about 40 nautical miles from the location of the SPOT DWP. Construction and operation of the Project would have no direct effect on FGBNMS as the sanctuary is located further away than any anticipated effects described in this EIS. However, though not anticipated, an oil spill could occur during Project operation that would reach portions of the FGBNMS, and the effects would be adverse, short-term to long-term, and minor to major, depending on the size and timing of the spill.

3.4.6. Gulf Ecological Management Sites

The TPWD describes the Gulf Ecological Management Sites (GEMS) Program as “an initiative of the Gulf of Mexico Foundation, the EPA Gulf of Mexico Program and the five Gulf of Mexico states” (TPWD 2014c). The GEMS Program is intended to further conservation efforts in the GoM and since its inception in 1996, each Gulf state has designated ecologically important marine areas as GEMS. In Texas, three GEMS are located in relatively close proximity to the location of the SPOT DWP: Christmas Bay Coastal Preserve, Freeport Liberty Ship Reef Complex, and FGBNMS (Figure 3.4.6-1) (TPWD 2014c).

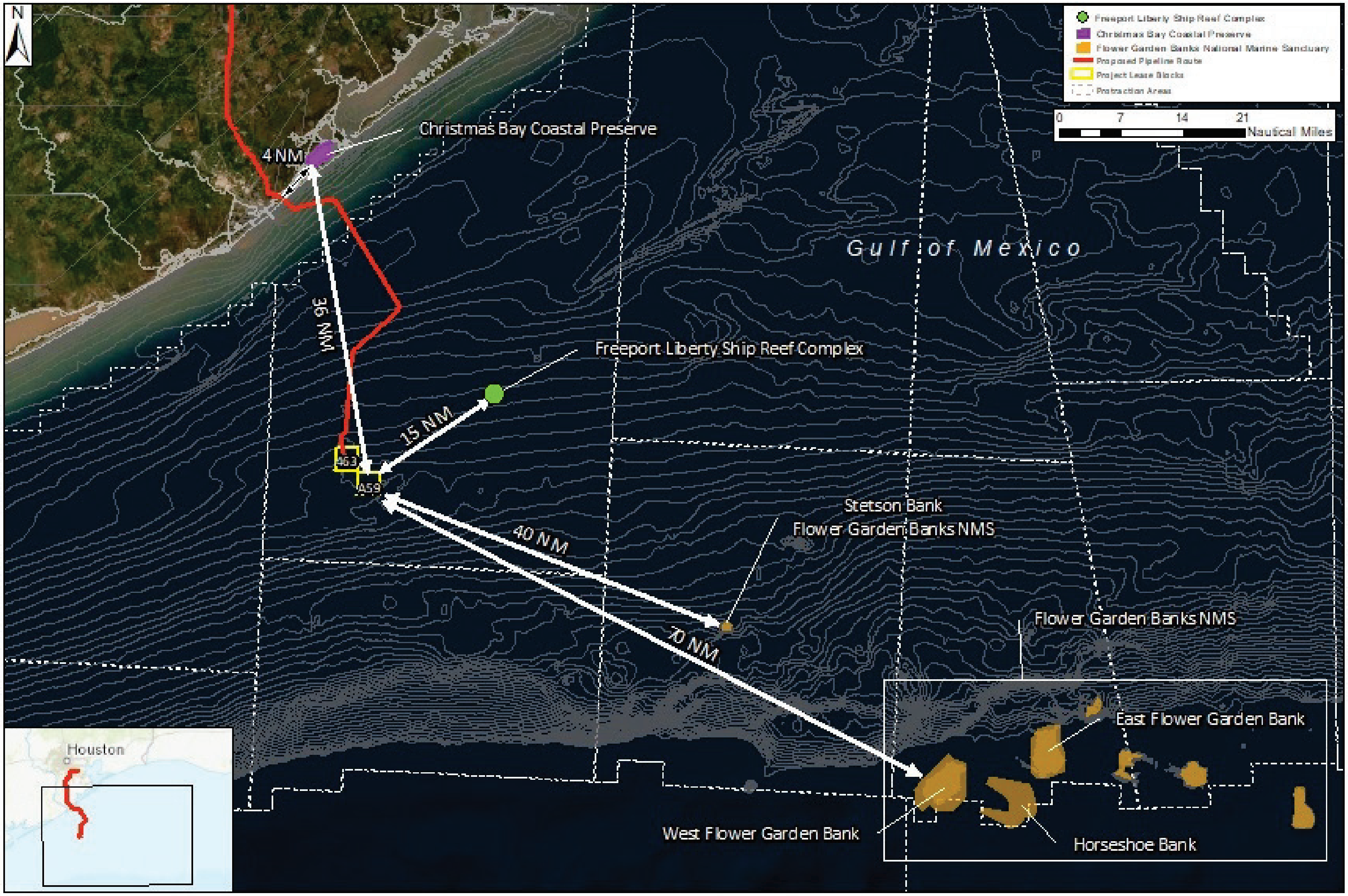
3.4.6.1. Existing Conditions

Christmas Bay Coastal Preserve

Located in Brazoria County, Texas, the Christmas Bay Coastal Preserve is a shallow 4,173-acre embayment situated in the southwest portion of Galveston Bay. The area remains largely undisturbed by human activity. It is composed of extensive fresh and saline marshes and meandering streams that flow into the western Galveston Bay estuary. The area also supports about 250 acres of seagrass beds. Christmas Bay provides important nursery and foraging habitat to both resident and migratory waterfowl and shorebirds. Christmas Bay also supports extensive oyster reefs and hard clams are found in the shallow-water perimeters of the preserve (TPWD 2014d). The offshore pipelines would be 4 nautical miles west of the preserve and the SPOT DWP would be 36 nautical miles south of the preserve.

Freeport Liberty Ship Reef Complex

Located in water depths of about 100 feet off the coast of Freeport, Texas, the Freeport Liberty Ship Reef Complex is composed of two ships, six Rigs-to-Reef structures, and various other components. The reef structure provides habitat for numerous fish species including amberjack, snapper, cobia, Atlantic spadefish, triggerfish, sharks, grouper, damsel fish, butterflyfish, blennies, and numerous invertebrates (TPWD 2002). The SPOT DWP would be located about 15 nautical miles southwest of the reef complex.



Source: NOAA National Marine Sanctuaries 2021

NM = nautical miles

Figure 3.4.6-1: Gulf Ecological Management Sites in Proximity to the SPOT Deepwater Port

Flower Garden Banks National Marine Sanctuary

As noted in Section 3.4.5.1, the nearest portion of FGBNMS is located about 40 nautical miles from the SPOT DWP. The sanctuary is composed of coral-dominated reefs that support a diverse community of species including manta rays, whale sharks, spotted eagle rays, hammerhead sharks, sea turtles, and large corals. The SPOT DWP would be about 40 nautical miles northwest of the nearest portion of FGBNMS and 70 nautical miles northwest of some of the larger portions of FGBNMS.

3.4.6.2. Impacts and Mitigation

Construction of the offshore marine components, including the SPOT DWP and subsea pipelines, would affect approximately 27.2 to 30.8 nautical miles of seafloor off the coast of Brazoria County, Texas. Installation of the pipelines would temporarily disturb the seabed due to HDD exit pit excavation and burial of the subsea pipeline. As described in Section 3.4.3.2, the Christmas Bay Coastal Preserve is located about 4.3 nautical miles from the offshore HDD exit pit and is the closest location to any Project activities. Based on the sediment modeling reports, the trajectory and area of impact affected by pipe burial of the subsea pipelines indicates there would be no effect on any GEMS (SPOT 2019g, 2019dd, and 2019hh).

An accidental release of hazardous materials during construction or operation could affect any of the three GEMS. The impacts on offshore vegetation at the Christmas Bay Coastal Preserve would be the same as those described in Section 3.4.3.2, Offshore Vegetation. The impacts on species using any of the GEMS would be similar to those impacts described in the impacts and mitigation descriptions included in Sections 3.4.4, Oyster Reefs; 3.5.5, Benthic Resources; 3.5.6, Plankton; 3.5.7, Marine Mammals (Non-Endangered); 3.6, Estuarine and Marine Fisheries; Section 3.7, Threatened and Endangered Species; and Appendix E1, Biological Assessment.

3.5. WILDLIFE AND AQUATIC RESOURCES

3.5.1. Definition of the Resource

The proposed Project would affect onshore wildlife and migratory birds, freshwater fisheries, marine mammals, benthic resources, and plankton. Inland wildlife, birds and freshwater fish rely on upland, wetland, and stream habitats for food, shelter, and reproduction. Migratory birds may also rely on coastal habitats and estuarine wetlands, while marine species rely on coastal, nearshore, and offshore habitats of the GoM.

3.5.2. Existing Threats

For inland and coastal areas, TPWD indicates that fragmentation due to the break-up of large landholdings into smaller tracts is a substantial threat to this region. As formerly large land tracts are broken up, the smaller tracts may each have different land uses, resulting in the loss of habitat (including loss of wetlands), introduction of exotic species, increased hunting pressure, and proliferation of potential predators including domestic cats and dogs (TPWD 2019h). In addition, the Houston area has experienced rapid development of the petrochemical industry and has some of the busiest port facilities, both of which have altered the biodiversity of the region. Rising sea levels from climate change, as predicted by researchers, will alter many of the coastal habitats (The Nature Conservancy 2002).

Threats to the estuarine and marine ecosystems of the GoM include freshwater inflows, hypoxia, introduction of invasive aquatic species, oil spills, and toxic algae blooms (Watson et al. 2015; NOAA NCCOS 2014). Other threats include fishing, habitat loss, industrial development, pollution, and bycatch. Threats to the marine ecosystems may disproportionately affect species that depend upon certain habitats for all or part of their life cycle. The loss of seagrass and coral, or changes in estuarine habitats can render some places uninhabitable or result in reduced fitness of species present (Strongin et al. 2020).

Alterations of the inland natural landscape, increased water use, discharge of pollutants, and the creation of navigation channels all contribute to changes in salinity regimes and sediment deposition in the GoM. When channelization occurs, freshwater inflows are interrupted, which leads to decreased base flow to estuaries during the dry season and increased freshwater flow during the wet season. These changes can result in rapid salinity changes, increased sediment deposition, displacement of fishes, and changes to the plant community. Additionally, damming, channelizing, and/or dredging of flood-prone rivers can cause changes in sediment deposition patterns, timing, and volume of inflow (Watson et al. 2015).

Hypoxia is another major threat to the GoM. Each year, the GoM develops a hypoxic zone or "dead zone." The dead zone is an area of little to no oxygen that forms when excess nutrients from the Mississippi River drain into the GoM and cause an overgrowth of algae. When the algae dies and sinks, it results in oxygen levels near the bottom that are too low to support most marine life. The size of the hypoxic area varies annually due to local and regional climate variability, as well as ocean dynamics (NOAA 2019h).

Toxic algae blooms and oil spills are also threats to the marine environment. Some algae produce toxins that are harmful to fish, mammals, birds, and humans. Acute exposure to toxic algae can cause death in marine species, but little is known about the level of exposure that causes long-term harmful effects in marine mammals, such as chronic epilepsy, heart disease, and reproductive failure. Additional research is also being conducted to learn more about the harmful effects from oil spills as a result of the DWH spill in 2010 (NOAA NCCOS 2014).

3.5.3. Wildlife

Wildlife species occurring in the Project area are characteristic of the habitats provided by the plant communities in these areas. Detailed information on these communities is included in Section 3.4.3, Habitats, Vegetation. Wildlife protected under the MMPA are described in Section 3.5.7, Marine Mammals (Non-Endangered), and wildlife protected under the Endangered Species Act (ESA) are described in Section 3.7, Threatened and Endangered Species, and in the BA (Appendix E1). This section discusses terrestrial wildlife species and coastal, marine, and migratory birds that could be affected by the SPOT Project, including Bald and Golden Eagles protected under the Bald and Golden Eagle Protection Act (BGEPA).

3.5.3.1. Existing Terrestrial Wildlife Resources

The Project facilities would cross habitats that support a variety of wildlife species. Vegetation cover type and density are important environmental factors influencing wildlife habitat and species distribution.

Variations in vegetation communities and other conditions, such as topography and existing land use, influence the quality and availability of wildlife habitat within the Project area.

The Project would affect about 1,134 acres of land within the following cover types:

- Herbaceous land (grassland)
- Upland forest
- Shrubland
- Planted/cultivated land
- Open water
- Barren land
- Wetlands
- Developed land

Existing vegetation conditions and acres affected by construction and operation of the Project are described in Section 3.4.3, Habitats, Vegetation.

The greatest wildlife diversity and density is found in natural habitats such as grasslands, scrub-shrub habitats, and extensive contiguous forests. Habitats in agricultural lands such as pastures, croplands, and hayfields harbor generalist wildlife species, consisting primarily of small mammals and white-tailed deer (Hibbitts et al. 2013). Representative wildlife species that could be found in the cover types within the Project area are described in Table 3.5.3-1.

In addition to the wildlife listed above, invertebrates may also occur in all habitats crossed by the Project. Common invertebrate species in the Project area include mosquitos, butterflies, bees, earthworms, snails, mussels, and crayfish.

Wildlife in Brazoria County, including game species, is managed by the Oak-Prairie Wildlife District of the TPWD. Upland game species in this district include dove, quail, and turkey, although their numbers have been reduced through development, overgrazing, and modern farming practices. Mottled ducks occur in moderate numbers in wetland habitats (fresh and brackish marsh ponds and flooded fields), and the nearby Brazoria NWR allows waterfowl hunting on approximately 6,500 acres inside its borders. White-tailed deer hunting is popular statewide, including in Brazoria County. The onshore pipeline route may cross areas suitable for game species, or areas that may currently be used for hunting.

Table 3.5.3-1: Representative Species within Onshore Vegetation Communities for the SPOT Deepwater Port Project

Land Cover	Vegetation Community/Habitat Description	Representative Species
Herbaceous land	Areas dominated by grass or other herbaceous vegetation. While grazing may occur, these areas are not managed intensively.	Eastern harvest mouse (*Reithrodontomys humulis*), house mouse (*Mus musculus*), hispid cotton rat (*Sigmodon hispidus*), sparrows (*Ammodrammus* spp.)
Forest	All non-wetland forested and woodland communities, including deciduous, coniferous/evergreen, and mixed deciduous/coniferous forest	White-tailed deer (*Odocoileus virginianus*), feral hog (*Sus scrofa*), coyote (*Canis latrans*), bobcat (*Lynx rufus*), common raccoon (*Procyon lotor*), eastern cottontail (*Sylvilagus floridanus*), ground skink (*Scincella lateralis*), common five-lined skink (*Plestiodon fasciatus*), Texas rat snake (*Pantherophis obsoleta lindheimeri*), Pileated Woodpecker (*Dryocopus pileatus*), American Crow (*Corvus brachyrhynchos*), American Robin (*Turdus migratorius*)
Shrubland	Areas dominated by shrubs less than 15 feet tall, including true shrubs, young trees, or trees stunted by environmental conditions	House mouse, coyote, northern mockingbird (*Mimus polyglottos*), Texas rat snake, ground skink
Planted/cultivated	All areas where the vegetation is managed for agriculture, including pastureland, hayfields, and crop growth	Common raccoon, Virginia opossum (*Didelphis virginiana)*, eastern gray squirrel (*Sciurus carolinensis)*, Texas rat snake, Eastern Meadowlark (*Sturnella magna*), Cattle Egret (*Bubulcus ibis*)
Open water	Features such as rivers, lakes, and ponds not normally associated with a vegetation class	American alligator (*Alligator mississippiensis*), red-eared slider (*Trachemys scripta elegans*), softshell turtles (*Apalone* spp.), water snakes (*Nerodia* spp.), bullfrog (*Lithobates catesbeianus*), leopard frog (*Lithobates sphenocephala*), bronze frog (*Lithobates clamitans*), various waterfowl
Barren land	Areas of bedrock, slides, sand dunes, gravel pits, and other accumulations of earthen materials. Vegetation generally covers less than 15% of these areas.	Eastern fence lizard (*Sceloporus undulatus*), ground skink, killdeer (*Charadrius vociferus*); other species may seek shelter in rock piles or other structures
Wetlands	Areas where the soil is periodically saturated or covered with water. Includes saturated or submerged areas where grasses and herbaceous plants are the predominant cover as well as saturated or submerged areas where trees or shrubs are the predominant cover. Also includes areas saturated or submerged in saltwater or brackish water, such as tidal marshes.	American beaver (*Castor canadensis*), marsh rice rat (*Oryzomys palustris*), nutria (*Myocastor coypus*), bullfrog (*Lithobates catesbeianus*), green tree frog (*Hyla cinerea*), common musk turtle (*Sternotherus odoratus*), water snakes, Red-winged Blackbird (*Agelaius phoeniceus*), Great Blue Heron (*Ardea herodias*), Laughing Gull (*Leucophaues atricilla*)
Developed land	All areas of human development, including low, medium, and high intensity development and open land. Includes human-placed vegetation such as residential lawns and landscaping as well as remnants of various natural communities persisting in areas of low-density development.	Common raccoon, Virginia opossum, eastern gray squirrel, green anole (*Anolis carolinensis*), brown anole (*Anolis sagrei*), Gulf Coast toad (*Incilius nebulifer*), Great-tailed Grackle (*Quiscalus mexicanus*), Mourning Dove (*Zenaida macroura*), Northern Mockingbird (*Mimus polyglottus*)

Source: Elliott 2014; Wiken 2011

Significant or Sensitive Wildlife Habitats

Sensitive wildlife habitat includes state or Federal lands managed to support wildlife, areas designated by conservation organizations as providing critical habitat for wildlife species, and other areas identified through consultation with state and Federal resource agencies. The Project would avoid crossing state or Federally managed lands or other sensitive areas. The nearest managed land to the Project is the Brazoria NWR. At its closest points, workspace for the Oyster Creek to Shore Pipelines would be about 1,709 feet from the west side and 1,390 feet from the south side of the Brazoria NWR (Figure 3.5.3-1). Other areas of note are the Justin Hurst Wildlife Management Area located about 5.7 miles to the southwest; Follets Island Coastal Management Area located about 8 miles to the northeast; San Bernard NWR located about 3.5 miles to the west-southwest (note that the San Bernard NWR includes many individual tracts, and this distance is in reference to the nearest tract); the Quintana Neotropical Bird Sanctuary located 3.3 miles to the west-southwest; and Matagorda Peninsula Coastal Management Area located about 26.5 miles to the southwest. There are no other Federal- or state-managed significant or sensitive habitats within 20 miles of the Project.

Important Bird Areas

The National Audubon Society in the United States administers the Important Bird Area (IBA) program. The goal of the IBA is to identify and conserve a network of sites that provide critical habitat for birds. Site selection uses standardized criteria through a collaborative effort with non-governmental conservation organizations, government agencies, local conservation groups, academics, birders, and others (Burger and Liner 2005).

The closest IBA is the Columbia Bottomlands IBA, which is located about 2 miles southwest of the Oyster Creek to Shore Pipelines workspace. Therefore, no IBAs would be affected by the Project.

3.5.3.2. Existing Coastal, Marine, and Migratory Birds

All native migratory game and non-game birds are protected under the MBTA. Both the onshore and offshore Project components are located within the Central Flyway, one of four major migratory routes for birds in North America. Some migratory bird species are found in Texas year-round, some only during the breeding season, and some only for brief periods during migration (Shackleford 2005). The Quintana Neotropical Bird Sanctuary is a 4-acre site west-southwest of the proposed Project that supports a small grove of salt cedars and functions as an important stopover site during the spring migration for many songbirds, including warblers, orioles, tanagers, and grosbeaks (Galveston.com 2022). Historically, there were seven reported occurrences of colonial waterbird rookeries within 1 mile of the proposed pipeline. However, no rookeries have been observed within that distance since 1992 (SPOT 2019a).

While the MBTA protects all native migratory bird species, some species are given priority when considering impacts on migratory birds and are referred to as birds of conservation concern (BCC). The basic geographic unit for identifying BCCs is the Bird Conservation Region (BCR), and it is the most useful to Federal agencies and others attempting to comply with the principles of the MBTA (USFWS 2008b; USFWS 2021). While the majority of birds prefer inland terrestrial habitat, some species such as gulls, terns, petrels, shearwaters, plovers, and sandpipers prefer coastal areas and open marine waters (BOEM 2016b). The onshore components of the SPOT Project are located within BCR 37 (Gulf

Coastal Prairie) and the offshore components are in Marine Bird Conservation Region (MBCR) M20. Table 3.5.3-2 lists the 42 BCC that could occur in BCR 37 and MBCR M20. Federally listed threatened and endangered species are not included in the BCC list, but are discussed in Section 3.7.1, Threatened and Endangered Species, Federally Listed Threatened and Endangered Species, and the BA (Appendix E1), and state-listed species are discussed in Section 3.7.2, Threatened and Endangered Species, State-Listed Threatened and Endangered Species.

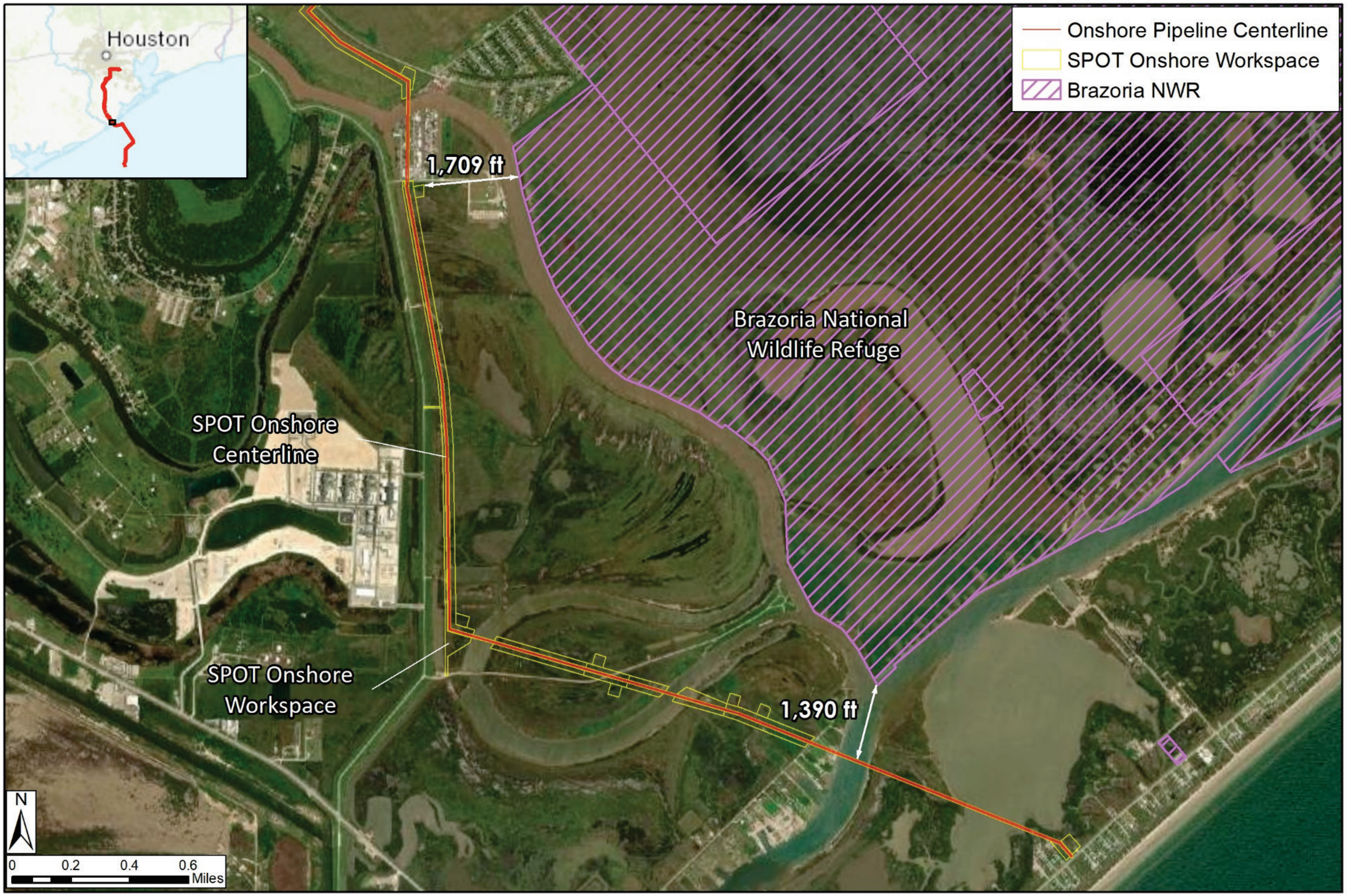


Figure 3.5.3-1: Distance from Oyster Creek to Shore Pipelines to Brazoria National Wildlife Refuge

Table 3.5.3-2: Birds of Conservation Concern in Regions 37 and M20 that Could Be Affected by the SPOT Deepwater Port Project

Common Name [a]	Scientific Name [a]	Regional Breeding Status [a]	Habitat in the Project Area [b]	Breeding Dates [c]	Project Facilities [d]
BCR 37					
Chimney Swift	*Chaetura pelagica*	Breeding	Urban and suburban areas with vertical surfaces	late April to August	All onshore pipelines, Oyster Creek Terminal
King Rail	*Rallus elegans*	Breeding	Freshwater and brackish marshes	January to September	Oyster Creek to Shore Pipelines
Yellow Rail	*Coturnicops noveboracensis*	Nonbreeding	Coastal salt marshes, damp meadows	NA	Oyster Creek to Shore Pipelines
American Oystercatcher	*Haematopus palliatus*	Breeding	Shorelines, tidal flats, mudflats, salt marshes	February to mid- July	Oyster Creek to Shore Pipelines
American Golden-Plover	*Pluvialis dominica*	Nonbreeding	Grasslands, prairies, pastures	NA	All onshore pipelines
Wilson's Plover	*Charadrius wilsonia*	Breeding	Shorelines, tidal flats, estuaries	early April to early September	Oyster Creek to Shore Pipelines
Mountain Plover	*Charadrius montanus*	Nonbreeding	Grasslands	NA	All onshore pipelines
Snowy Plover (Interior/Gulf Coast)	*Charadrius nivosus nivosus* (Interior/Gulf Coast)	Breeding	Shorelines, bare upper beaches and sandy flats	mid-April to late July	Oyster Creek to Shore Pipelines
Whimbrel	*Numenius phaeopus*	Nonbreeding	Shorelines, mudflats, marshes, estuaries, lagoons	NA	Oyster Creek to Shore Pipelines
Long-billed Curlew	*Numenius americanus*	Nonbreeding	Wetlands, tidal estuaries, mudflats, flooded fields	NA	Oyster Creek to Shore Pipelines
Hudsonian Godwit	*Limosa haemastica*	Nonbreeding	Mudflats, marshes, tidal flats	NA	Oyster Creek to Shore Pipelines
Marbled Godwit	*Limosa fedoa*	Nonbreeding	Shorelines, tidal flats, mudflats	NA	Oyster Creek to Shore Pipelines
Ruddy Turnstone (Atlantic)	*Arenaria interpres morinella*	Nonbreeding	Shorelines, sandy beaches, mudflats	NA	Oyster Creek to Shore Pipelines, shore crossing
Red Knot (*Pacific*)	*Calidris canutus roselaari*	Nonbreeding	Shorelines, intertidal marine habitats, coastal inlets, estuaries, bays	NA	Oyster Creek to Shore Pipelines, shore crossing
Dunlin (Hudson Bay)	*Calidris alpine arcticola*	Nonbreeding	Shorelines, estuaries, lagoons	NA	Oyster Creek to Shore Pipelines, shore crossing
Buff-breasted Sandpiper	*Calidris subruficollis*	Nonbreeding	Plowed fields, pastures	NA	Oyster Creek to Shore Pipelines
Pectoral Sandpiper	*Calidris melanotos*	Nonbreeding	Wet grassy areas, plowed farm fields, freshwater and salt marshes	NA	Oyster Creek to Shore Pipelines
Short-billed Dowitcher	*Limnodromus griseus*	Nonbreeding	Shorelines, mudflats, marshes, tidal flats	NA	Oyster Creek to Shore Pipelines

Common Name [a]	**Scientific Name [a]**	**Regional Breeding Status [a]**	**Habitat in the Project Area [b]**	**Breeding Dates [c]**	**Project Facilities [d]**
Lesser Yellowlegs	*Tringa flavipes*	Nonbreeding	Marshes, mudflats, shorelines	NA	All onshore pipelines, Oyster Creek Terminal
Willet	*Tringa Semipalmata*	Breeding	Beaches, bayshores, marshes, mudflats	mid-April to early June	Oyster Creek to Shore Pipelines, shore crossing
Least Tern (Atlantic/ Interior)	*Sternula antillarum antillarum/athalassos*	Breeding	Shorelines	early April to early August	Oyster Creek to Shore Pipelines
Gull-billed Tern	*Gelochelidon nilotica*	Breeding	Shorelines, marshes, plowed fields	late spring through summer	Oyster Creek to Shore Pipelines
Forster's Tern	*Sterna forsteri*	Breeding	Freshwater, brackish, and saltwater marshes	early April to mid-July	Oyster Creek to Shore Pipelines
Sandwich Tern	*Thalasseus sandvicensis*	Breeding	Seacoasts, bays, estuaries, mudflats	mid-April to mid-July	Oyster Creek to Shore Pipelines, shore crossing
Black Skimmer	*Rynchops niger*	Breeding	Shorelines, mudflats, estuaries	mid-March to early September	Oyster Creek to Shore Pipelines, shore crossing
Reddish Egret	*Egretta rufescens*	Breeding	Shorelines, salt marshes, tidal flats, lagoons	early March to late July	Oyster Creek to Shore Pipelines
Swallow-tailed Kite	*Elanoides forficatus*	Breeding	Pine forests, cypress swamps, wet prairies, fresh and brackish marshes, hardwood hammocks	late February to early July	All onshore pipelines, Oyster Creek Terminal
Red-headed Woodpecker	*Melanerpes erythrocephalus*	Breeding	Deciduous woodlands, river bottoms, recent clearings, grassland with scattered trees	late February to late August	All onshore pipelines, Oyster Creek Terminal
Loggerhead Shrike (Eastern)	*Lanius ludovicianus excubitorides/migrans*	Breeding	Farmland, pastures, prairies, riparian areas	March to September	All onshore pipelines, Oyster Creek Terminal
Sprague's Pipit	*Anthus spragueii*	Nonbreeding	Farmland, grasslands	NA	Oyster Creek to Shore Pipelines
LeConte's Sparrow	*Ammodramus leconteii*	Nonbreeding	Marshes, farmland, coastal prairies	NA	All onshore pipelines, Oyster Creek Terminal
Seaside Sparrow (Atlantic/Gulf)	*Ammodramus maritima maritima/pennisulae/ macgillivraii/fisheri/sennetti*	Breeding	Coastal marshes with *Spartina*, rushes, saltgrass	early April to late July	Oyster Creek to Shore Pipelines
Henslow's Sparrow	*Centronyx henslowii*	Breeding	Wet meadows, weedy pastures, cultivated hayfields	unknown	All onshore pipelines, Oyster Creek Terminal
Prothonotary Warbler	*Protonotaria citrea*	Breeding	Forested wetlands	mid-April to July	All onshore pipelines, Oyster Creek Terminal

Common Name [a]	**Scientific Name [a]**	**Regional Breeding Status [a]**	**Habitat in the Project Area [b]**	**Breeding Dates [c]**	**Project Facilities [d]**
Pyrrhuloxia	*Cardinalis sinuatus*	Breeding	Desert scrublands, riparian woodlands, upland desert, farm fields with hedgerows	March to August	All onshore pipelines
Painted Bunting	*Passerina ciris*	Breeding	Forest edges, developed land	March to August	All onshore pipelines, Oyster Creek Terminal
Dickcissel	*Spiza americana*	Breeding	Grasslands, farmland	early April to mid-August	All onshore pipelines, Oyster Creek Terminal
MBCR M20					
Band-rumped Storm-Petrel (Atlantic)	*Hydrobates castro* (Atlantic)	Nonbreeding	Rocky shorelines, offshore	NA	SPOT DWP, offshore pipelines
Black-capped Petrel	*Pterodroma hasitata*	Nonbreeding	Offshore, oceanic waters	NA	SPOT DWP, offshore pipelines
Cory's Shearwater	*Calonectris diomedea*	Nonbreeding	Offshore, oceanic waters	NA	SPOT DWP, offshore pipelines
Audubon's Shearwater	*Puffinus lherminieri*	Nonbreeding	Offshore, oceanic waters	NA	SPOT DWP, offshore pipelines
Magnificent Frigatebird	*Fregata magnificens*	Nonbreeding	Coastal waters, offshore, oceanic waters	NA	SPOT DWP, offshore pipelines

Source: [a] USFWS 2021; [b] The Cornell Lab of Ornithology 2021; [c] Benson and Arnold 2001

NA = not applicable (species does not breed in BCR 37); DWP = deepwater port; SPOT = Sea Port Oil Terminal

[d] Project facilities include pipeline workspace and mainline valves.

Bald Eagle

The Bald Eagle (*Haliaeetus leucocephalus*) is protected under the MBTA and BGEPA. BGEPA protects the Bald Eagle by prohibiting the take, possession, exchange, or transport of any Bald Eagle unless allowed by permit. "Take" under BGEPA includes incidental disturbance from construction activities that cause injury, behavioral changes, or nest abandonment. Additionally, the National Bald Eagle Management Guidelines were developed to minimize disturbance impacts on the species (USFWS 2007). Bald Eagles are known to occur around the Project area, and have been documented within 0.5 mile of the onshore pipeline route (eBird 2018). It is a large raptor with a brown/black body and wings, and when mature, has a white head and tail feathers. They inhabit wooded areas near coasts, lakes, marshes, and other open bodies of waters. Bald Eagles breed along the Gulf Coast of Texas from October to May. Afterwards, some eagles migrate north, while others remain as year-round residents. The Bald Eagle's diet consists mostly of waterfowl, fish, and small mammals such as squirrels and raccoons, but they also scavenge carrion. The main threats to Bald Eagles are habitat loss, lead poisoning, and wind turbines (TPWD 2019c).

3.5.3.3. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on wildlife resources. The study area within which potential impacts were assessed includes the Project workspace and adjacent areas that would be affected by light or noise.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on wildlife have been evaluated based on their potential to:

- Degrade the recreational, ecological, or scientific viability or significance of a biological resource;
- Measurably change the population density or distribution of an important species in the region; and/or
- Directly affect nesting migratory birds protected under the MBTA.

The remainder of this section describes the effects from construction and operation of the Project on wildlife from clearing of vegetation, ground disturbance, conversion of vegetation types, construction traffic, human presence during construction, construction lighting, installation of impervious surfaces, operational lighting, accidental spills of hazardous materials, and discharge of hydrostatic test water.

Onshore Pipelines

Construction of the onshore pipelines, including MLVs, would affect about 982.8 acres of land, including 138.2 acres of urban land, 138.7 acres of forested land, and 13.6 acres of shrubland, as defined in Section 3.5.3.1, Wildlife and Aquatic Resources, Existing Terrestrial Wildlife Resources. Following construction, the Applicant would restore ground contours as closely as possible to preconstruction contours and would reseed the right-of-way with approved seed mixes (Appendix M, Construction BMPs; BMP #1 in Appendix N). Reseeding would be conducted in accordance with conditions set forth in the Project's Revegetation Plan (Appendix Q; BMP #8 in Appendix N) or as requested by individual landowners. During operation, 217.9 acres of wildlife habitat within the permanent right-of-way would be maintained in an herbaceous state due to periodic vegetation management of the permanent pipeline easement. This maintenance would result in the permanent conversion of about 33.3 acres of forest and 4.5 acres of shrubland to herbaceous cover.

Impacts on wildlife from the construction of onshore pipelines would include displacement, stress, and direct mortality of some individuals. The effect would be greater on less mobile species, including burrowing species, than on more mobile species such as birds and mammals that could flee the Project area. Less mobile species could become trapped in any trench left open overnight. Mobile wildlife would likely move to suitable nearby habitat, which could cause increased competition and disease due to overcrowding. Other adverse impacts from displacement of wildlife could include increased predation and conflict among predators. Increased predation rates occur where linear corridors modify habitats (Pickell et al. 2014). Larger mammals such as coyotes and deer are likely to avoid the construction area and the resulting disturbance. Construction vehicle traffic could result in increased wildlife mortality from collisions. The Applicant would implement a speed limit of 10 miles per hour to minimize the impacts on wildlife from vehicle collisions (BMP #15, in Appendix N). To minimize impacts to wildlife, the Applicant would install escape ramps every 98 yards wherever the trench is left open overnight, would inspect the trench each morning prior to beginning construction, and would use appropriate hazing methods to flush wildlife from the trench (see details in BMP #21).

Disturbance from construction of the SPOT Project could affect nesting, foraging, and stopover habitat for migratory birds. The increased human presence, as well as noise and vibration associated with Project activities would likely cause sensory disturbances of migratory and coastal birds. The resulting effects would be intermittent and short-term, occurring during work hours and ceasing when construction activities move from a given area. Birds could be injured or suffer mortality due to fleeing an area of disturbance. Additionally, disturbance during the breeding season could result in nest abandonment. To mitigate the impacts associated with construction clearing, the Applicant would either clear outside the nesting season or coordinate with USFWS to develop measures to minimize impacts on migratory birds (BMP #16, in Appendix N). Because construction activities would be short-term and episodic, sensory disturbance effects associated with construction activities may affect individuals but would not likely have notable effects on any local populations of migratory birds.

The Applicant has indicated that it would conduct semi-annual vegetation management to maintain herbaceous cover within the permanent rights-of-way during Project operation. If vegetation management occurred during the breeding season between April 15 and August 1, migratory birds could suffer disturbance or mortality. Birds may flee the area of disturbance or may abandon their nest. Nest destruction could occur for low or ground nesting species. Additionally, fledgling mortality could occur if they were not be able to clear the area and avoid vegetation management equipment.

Lighting and noise from construction activities could also impact wildlife in areas adjacent to the onshore pipelines by causing behavioral changes in foraging and breeding activities. Behavioral changes would be most prevalent in greenfield areas where the pipelines would not be collocated with existing utilities. Artificial lighting used for construction activities between sunset and sunrise may disorient migratory birds as some birds use natural light sources and patterns for navigation or other critical biological behaviors. However, the Applicant would conduct 24-hour construction for a limited number of locations (e.g., HDDs). During nighttime HDD work, the Applicant would direct light downward or toward active construction to minimize impacts on wildlife and birds in adjacent habitats (BMP #17 in Appendix N). Noise would cause wildlife to disperse to adjacent habitats with fewer construction activities. The stresses associated with wildlife dispersal are not anticipated to result in any measureable effects on any species at the individual or population level.

Construction and operation of the pipelines could cause habitat degradation and fragmentation. In forested areas, the duration of effects would be long-term due to the time it takes for forest habitat to return to preconstruction conditions, and because some forested habitat would be permanently converted to herbaceous cover due to routine vegetation management during Project operation. Some wildlife species that rely on shrub-scrub or forested habitat for foraging, breeding, and nesting could be adversely affected by the long-term loss of these cover types. Other species that prefer open land would benefit from the permanent or temporary habitat conversion. Forest fragmentation could increase in certain locations due to Project construction and operation, thus reducing the amount of habitat for interior forest species. However, because most of the Project would be constructed in previously disturbed areas, construction and operation maintenance activities would not likely result in population-level effects on wildlife.

Habitat removal and/or modification of existing habitats during construction and operation would have indirect effects on migratory birds. The impact of grading, clearing, and excavation of non-forested lands would be for a short duration because herbaceous, residential, and agricultural lands typically return to their preconstruction condition in 1 to 5 years while forested areas would take decades to return to preconstruction conditions, if at all. The indirect effects of clearing forest would extend to adjacent off-site areas due to edge effect. These areas would no longer function as interior forest and would be more susceptible to invasion by noxious or invasive weeds. At MLV sites, small areas would be converted to industrial land use, but suitable habitat would remain in adjacent areas. These impacts would not likely cause population-level effects. As previously discussed, following construction, the Applicant would restore the disturbed areas to preconstruction contours and would reseed the rights-of-way with approved seed mixes. Wildlife would gradually return to the disturbed areas for travel, refuge, nesting, and foraging, though there may be a shift in species utilization due to the conversion of scrub-shrub and forested habitats to herbaceous cover. Operational impacts on forested communities would compose about 12.4 percent of total pipeline operational impacts. Right-of-way maintenance during Project operation would temporarily disturb species utilizing the pipeline corridors.

To minimize impacts due to pipeline construction, the Applicant would implement the following BMPs:

- Collocate new pipelines within and adjacent to existing linear rights-of-way where possible (BMP #18 in Appendix N);
- Limit nighttime construction, traffic, noise, and lighting (BMP #19);
- Downshield lighting and the minimum light intensity necessary for safety would be used (BMP #20);
- At HDD locations, direct lighting downward or directly at active construction, where feasible, while maintaining safety (BMP #17);
- Inspect open trenches for wildlife each morning before beginning construction (BMP #21);
- Adhere to Construction BMPs, Construction Spill Response Plan, and HDD Contingency Plan (Appendix M, F, and L; BMPs #1, #3, and #6 in Appendix N);
- Limit access on the right-of-way with use of signs, fences, and/or gates (BMP #10); and
- Enforce a 10 mile-per-hour speed limit within, to, and from all construction workspaces (BMP #15).

The Applicant also provided several reports (Appendix R, SPOT Project Onshore Noise Impact Reports) in responses to information requests addressing construction noise, and has committed to employing the following mitigation measures when construction noise exceeds background levels:

- Prohibit unnecessary idling of internal combustion engines (BMP #22 in Appendix N);
- Require that all equipment be shut off when not in use (BMP #22);
- Require that all equipment be kept in good repair and all worn, loose, and unbalanced machine parts be replaced as soon as possible (BMP #22);
- Require that all stationary noise-generating equipment such as air compressors or portable power generators be kept as far as possible from neighboring houses (BMP #22);
- Designate a disturbance coordinator who would be responsible for responding to any complaints about facility noise, address the complaints, and implement reasonable measures to correct the problem (BMP #22); and
- Use mufflers on appropriate equipment during operation (BMP #22).

To minimize the potential introduction of invasive species, the Applicant would comply with the recommendations provided in the Revegetation Plan (Appendix Q; BMP #8 in Appendix N), which include:

- Limit traffic to the onshore pipeline rights-of-way by using “no access” signs, fences, or gates, as applicable, to limit off-road vehicular traffic and reduce rutting and disturbance (BMP #8);
- Ensure that equipment and vehicles arrive at the work site clean and free of soil and debris capable of transporting undesirable seeds or other propagules by requiring the contractor to use compressed air or other means to remove soil and propagules from machinery and vehicles following work at invasive plant infested sites (BMP #8);
- Require the construction contractor to use weed-free straw or hay bales for sediment barrier installation and/or mulch (BMP #8);
- Reseed the construction right-of-way with weed-free, native species suitable for rapid and competitive growth in Texas coastal plains; seed mixes would be approved by NRCS (BMP #8);
- Conduct a noxious and invasive species survey of the Project right-of-way after the post-construction growing season and take control actions (chemical and/or mechanical control practices), if warranted (BMP #8); and
- Remove successfully treated noxious or invasive species, if possible, and reseed those areas with desirable species (BMP #8).

To minimize impacts due to pipeline operation, the Applicant would prohibit the use of herbicides or pesticides within 100 feet of wetlands or waterbodies (BMP #5).

The impacts associated with pipeline construction and operation could result in increases in wildlife and bird mortality, disturbance due to noise and lighting, and habitat fragmentation and degradation. While these impacts would have direct and indirect adverse impacts on some wildlife, the Project would not likely have any population-level impacts on any particular species; therefore, impacts on wildlife would be short-term to long-term and minor. The Project would not likely have any population-level effects on birds, but impacts associated with semi-annual vegetation management of the right-of-way could result in direct and indirect, adverse, long-term, and minor to moderate impacts on migratory birds depending on the frequency of vegetation management during the nesting season.

Bald Eagles are protected under the MBTA and BGEPA, and the National Bald Eagle Management Guidelines were established to aid the public in understanding the activities that could disturb these birds. The closest Bald Eagle nest is reported to be about 0.5 mile from the onshore pipeline, which is outside the recommended 660-foot buffer for this type of activity. The Applicant conducted field surveys along the Project route and noted that no trees large enough to support eagle nests were observed in the Project area. The Applicant would conduct a Bald Eagle survey prior to initiating Project construction for areas within 0.5 mile of onshore facilities where potentially suitable habitat exists. Any nests would be documented. Additionally, the Applicant would contact USFWS and TPWD to obtain the most current Bald Eagle nesting data and if any nests were present within the Project workspace, it would comply with all recommendations in the National Bald Eagle Management Guidelines to minimize or avoid “take” of any Bald Eagles (BMP #33).

Based on the location of the currently known nearest nest and the Applicant’s commitment to following the recommendations in the National Bald Eagle Management Guidelines, impacts on nesting or breeding Bald Eagles are not anticipated; however, if a transient Bald Eagle were to visit the Project area during construction, impacts would be direct or indirect, adverse, short-term, and negligible.

Terminal Facilities

Modifications to the existing ECHO Terminal would result in additional impacts on about 3.2 acres of land; however, all impacts would occur within the existing fenced facility on land maintained in an herbaceous state. Wildlife and birds in these areas, if present, are likely already acclimated to the permanent noise and lighting associated with terminal operations. The proposed modifications to the ECHO Terminal would also be minimal in comparison to the rest of the facility. Therefore, impacts associated with modifications to the ECHO Terminal would be direct, adverse, long-term, and negligible.

Construction of the new Oyster Creek Terminal would affect 140.1 acres of land, of which 117.4 acres are grassland, 10.3 acres are forested, 6.1 acres are wetland, 5.2 acres are shrubland, and 1.1 are developed land. Following construction, most of the site would be converted to industrial land cover (i.e., roads, structures) and any vegetated areas would be maintained in an herbaceous state.

Wildlife at the Oyster Creek Terminal would be permanently displaced by conversion of these areas to non-vegetated and/or impervious cover (i.e., storage tanks, paved roads, gravel roads) or to maintained herbaceous vegetation. In addition, construction could cause direct mortality to some species during clearing and grading activities. Increases in ambient noise and lighting during construction and operation may also decrease wildlife use in adjacent habitats. The Applicant intends to adhere to applicable lighting regulations and industry standards. All outdoor lighting fixtures will contain protective globes and refractors to minimize blue-light emissions (BMP #37). Operational lighting at the Oyster Creek Terminal and any MLV sites would be downshielded, and would be the minimum light intensity necessary for safety and security. The Applicant has also committed to conducting a lighting study during detailed engineering to determine the light color, intensity, and size at the Oyster Creek Terminal. Nocturnal wildlife species may also be disturbed due to the occasional need for nighttime construction. While these impacts could all occur and affect individuals, the overall impacts on wildlife at a population level associated with construction and operation of the Oyster Creek Terminal would be direct and indirect, adverse, long-term, and minor.

Construction of the Oyster Creek Terminal would result in the permanent loss of nesting, foraging, and stopover habitat for migratory birds within the boundary of the terminal site. Migratory birds would also experience sensory disturbance and would likely avoid active construction. Migratory birds that traditionally inhabit the undisturbed areas adjacent to the Oyster Creek Terminal site may also be permanently displaced due to lighting and noise from facility operations. However, some migratory bird and wildlife species would acclimate and utilize adjacent suitable habitats. Displacement would not likely have any population-level impacts on any particular species; thus, impacts on birds due to noise and lighting would be direct and indirect, adverse, long-term, and moderate.

Hydrostatic Test Water Discharges

As described in Section 3.3.4.2, Water Resources, Surface Water, Waterbody Crossing Procedures, the Applicant would conduct hydrostatic testing to verify the integrity of all installed pipelines and terminal facilities. The Applicant would withdraw about 47 million gallons of water from the firewater pond that would be constructed at the Oyster Creek Terminal, or would obtain water from municipal sources to conduct hydrostatic testing. Construction of the firewater pond would occur in advance of hydrostatic testing, which would provide ample time for aquatic species to inhabit and utilize the pond. Withdrawal of water from the firewater pond could cause entrainment or impingement of aquatic species in the pond.

No chemical additives would be used in hydrostatic test water for onshore components. Water used for onshore hydrostatic testing would be cascaded down the onshore pipeline for reuse, and then subsequently returned to the firewater pond at the Oyster Creek Terminal upon completion of testing. The return of discharged hydrostatic test water would cause increased turbidity and scour in the firewater pond. Any species remaining in the pond at the time of discharge would be temporarily affected. Frogs would likely leave the pond during the disturbance, but would return after discharges stopped. Furthermore, the pond would be designed with sufficient capacity to hold the water without discharging to downstream waters except during unusual or severe rain events. As such, impacts on aquatic species from the withdrawal and discharge of hydrostatic test water from and to the firewater pond at the Oyster Creek Terminal would be direct, adverse, short-term, and negligible.

Offshore Facilities

Marine Debris

About one-third of sea birds are estimated to ingest marine debris (i.e., plastic) (NOAA Marine Debris Program 2014b). Additionally, 19 species of sea birds have become entangled in marine debris in the United States. The majority of entanglements were associated with fishing gear, but 8.3 percent of entanglements were associated with other marine debris (NOAA Marine Debris Program 2014a). The Applicant would develop and implement an operational spill response plan to minimize the potential for a release of debris from the platform. Additionally, the potential for vessels to release waste in marine waters would be low because all vessels calling on the SPOT DWP would be required to adhere to

MARPOL Annex V stipulations. Therefore, the Project is not expected to be a source of debris and impacts on sea birds from ingestion of, or entanglement in, debris associated with the SPOT Project would be direct, adverse, short-term, and negligible.

Lighting

Artificial lighting used for nighttime construction and for the platform during Project operation could impact coastal, marine, and migratory birds. Artificial lighting used on the platform may disorient birds, as some birds use natural light sources and patterns for navigation or other critical biological behaviors. Poor weather conditions such as rain, fog, and low cloud cover can further disorient birds and increase their attraction to artificial lights, leading to collisions. These effects increase during bird migrations (Ronconi et al. 2015). Nocturnal bird kills occur where lighted objects project skyward into their flight path (Wiese et al. 2001). Seabirds have died from starvation after circling platforms and flares for days and there have been documented cases of direct mortality of hundreds or thousands of birds flying into flares (Wiese et al. 2001).

Artificial lighting at the platform would be required for safety during construction and operation. During construction, the Applicant intends to adhere to applicable lighting regulations and industry standards, while using the minimum amount of nighttime lighting needed for safety and security. All outdoor lighting fixtures would contain protective globes and refractors to minimize blue-light emissions (BMP #37) and the Applicant would downshield light (where practicable) (SPOT 2020d).

During operation, the Applicant would adhere to applicable lighting regulations and industry practice and standards. All outdoor lighting fixtures would contain protective globes and refractors to minimize blue-light emissions (BMP #37). Operational lighting at the platform would include marine lanterns on all four corners at an elevation of 68 feet. These lanterns would flash approximately 60 times per minute. The platform would have rotating beacons, as would the VLCCs or other crude oil carriers when connected to the SPOT DWP. The SPOT DWP would be marked with four, lighted yellow navigation buoys for marking the four corners of Galveston Area lease block 463. Floating hoses would be lit along the entire length with yellow and red (tail hose section) lights flashing 50 to 70 times per minute. The anchorage area would be marked with three, white lighted buoys at each of the corners, except the northwest corner, which is also the southeast corner of lease block 463 and would be marked with a yellow buoy as previously noted. Lighting for the helideck would be consistent with the *API RP 2L – Recommended Practice for Planning, Designing, and Constructing Heliports for Fixed Offshore Platforms* (SPOT 2019aa). Additionally, Table 3.5.3-3 provides the estimated number of lights, pending final design, that would be used on the SPOT DWP platform.

Table 3.5.3-3: Estimated Number of Lights for the SPOT Deepwater Port Platform

Deck	V-Spring Poles [a]/ LED Fixture Quantity (Mounting Height: About 8 ft 6 in)	Ceiling/Pendant Mounted LED Fixture Quantity (Mounting Height: About 15 ft)	Floodlights (Mounting Height: About 20 ft)	Total Number of Lights	Total Number Plus 20 Percent
Main Deck	30	12	7	49	59
Cellar Deck	38	0	12	50	60
Sump Deck	28	3	0	31	38
Laydown Deck	14	0	0	14	17
Stair Towers / Crane Platforms	35	0	0	35	42
Total	**145**	**15**	**19**	**179**	**216**

Source: SPOT 2019aa

ft = feet; in = inches; LED = light-emitting diode; SPOT = Sea Port Oil Terminal

[a] V-Spring poles would be placed every 20 feet around the perimeter.

Artificial lighting associated with the SPOT DWP would likely attract birds that could collide with lights on the platform. The vapor combustion system would be composed of an enclosed flare; therefore birds would not be attracted to the flare. As noted above, the SPOT DWP would be located within the Central Flyway, which is one of the major migratory routes in North America; therefore, impacts on coastal, marine, and migratory birds would be direct, adverse, long-term, and moderate.

Helicopter Flights

During Project operation, the Applicant anticipates one round-trip helicopter flight per week between shore and the SPOT DWP. Coastal, marine, or migratory birds could be struck by the helicopter during the weekly flights. However, birds would be expected to avoid the aircraft while in flight. Therefore, impacts on coastal, marine, and migratory birds due to helicopter flights would be direct, adverse, short-term, and negligible.

Accidental Spills of Hazardous Materials

Contamination caused by spills of hazardous materials during construction could impact wildlife and migratory birds. Sources of contaminants could include inadvertent releases of drilling mud during HDD operations or from accidental spills of hazardous materials including gasoline, oil, hydraulic fluids, or diesel fuel, all of which would have a negative effect on the surrounding environment. The level of impact would depend on the phase of the SPOT Project, with spills occurring during construction likely to be less harmful than spills of crude oil during Project operation.

An inadvertent return of drilling mud could coat the ground surface and alter existing vegetation, thereby affecting wildlife habitat in the area if not cleaned up. To minimize impacts of an inadvertent return, the Applicant would implement measures outlined in its HDD Contingency Plan (Appendix L, BMP #6 in Appendix N), such as establishing containment structures where necessary and working with regulatory agencies to determine the necessary course of action. With these measures in place, impacts on wildlife habitat due to an inadvertent release of HDD drilling mud would be direct or indirect, adverse, short-term, and minor.

Any release of hydrocarbons onshore or offshore, including an inadvertent release of gasoline, oil, hydraulic fluids, or diesel fuel, during construction or operation of the Project could affect coastal, marine, and migratory birds. Blood tests reveal that migrating common loons had elevated levels of petroleum-derived PAHs following the DWH oil spill, but it is unclear if the levels are high enough to have adverse effects on the species' health, reproduction, or survival (Paruk et al. 2014). The effects of an oil spill could be indirect due to habitat degradation or have direct effects on some individuals. Direct contact with hazardous material could damage the thermal insulation and buoyancy of their feathers, leading to hypothermia, stress, injury, and/or mortality. Birds exposed to sufficient concentrations of PAHs in ingested oil experience long-term chronic effects and disruption of thyroid function that is critical for energy metabolism, resulting in a low survival rate for these birds. Seabirds are particularly vulnerable and their exposure pathways include contact with crude oil floating on the water surface, inhalation, and ingestion (Troisi et al. 2016; King et al. 2021).

To minimize the impacts of an onshore oil spill, the pipelines would be constructed with shut-off valves to allow sections of the pipeline to be isolated. The shut-off valves for the onshore pipelines are located, on average, approximately 7 miles apart. Storage tanks at the Oyster Creek Terminal would be contained within a concrete ring lined with an impermeable membrane. The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3). In addition, the Applicant would implement its Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), which includes:

- Storing hazardous materials on level ground within secondary containment, and at least 100 feet from wetlands or waterbodies, and 200 feet from water wells;
- Conducting daily inspections of secondary containment areas;
- Replacing any deteriorated or leaking containers;
- Providing spill response kits in all containment areas;
- Providing secondary containment capable of containing 110 percent of the volume of hazardous materials being stored; and
- Immediately cleaning up any leaks or spills.

The Applicant would also implement its SWPPP (BMP #14 in Appendix N) to minimize effects of contaminants in stormwater runoff through post-construction stabilization. Therefore, impacts on wildlife from an onshore oil spill would be direct or indirect, adverse, short-term to long-term, and minor to major, depending on the volume of oil released and the exposure of species to the release. Impacts on Federally listed threatened and endangered species are discussed in the BA (Appendix E1) and impacts on state-listed species are discussed in Section 3.7.3, Threatened and Endangered Species, Impacts and Mitigation.

Impacts would be more substantial if an oil spill occurred during Project operation due to a ruptured pipeline. At its closest points, the Brazoria NWR is within 1,390 feet and 1,709 feet of the proposed pipelines. At a minimum, oil would adhere to vegetation along its flow path, which could directly or indirectly affect wildlife that rely on those vegetation communities, including vegetation and wildlife in the NWR. Fouling by oil can limit thermoregulatory processes of both birds and mammals. Exposure of land-based animals would mainly occur on the feet and legs, but contamination could spread to fur or feathers through grooming or preening. Fur bearing animals and birds can experience feeding and motility problems due to contact with oil and could inhale toxic volatiles. Oil reaching wetland habitats could affect the reproductive capability of invertebrates or could cause smothering of some species (SPOT 2019c, 2019d, 2019p, and 2019ee). Amphibians exposed to petroleum products or PAHs may experience reduced growth or be prevented from completing metamorphosis (Albers 2003). Research also suggests that toxins, including PAHs, are transferred from adult snapping and painted turtles to their eggs and may result in developmental abnormalities, reduced hatching success, and reduced survival of juveniles (Bell et al. 2006).

To minimize the impacts of an oil spill, the pipelines would be constructed with shut-off valves to allow sections of the pipeline to be isolated. Storage tanks at the Oyster Creek Terminal would be contained within a concrete ring lined with an impermeable membrane. The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3 in Section 3.3.3.2, Water Resources, Groundwater, Impacts and Mitigation). Impacts on wildlife would be direct or indirect, adverse, short-term to long-term, and minor to major, depending on the volume of oil released and the exposure of species to the release. Impacts on marine mammals and threatened and endangered species are discussed in Section 3.5.7, Wildlife and Aquatic Resources, Marine Mammals (Non-Endangered), and in the BA (Appendix E1).

The potential effects of an offshore oil spill on marine and coastal birds during Project operation would depend on their level of exposure. Using BOEM's NEPA planning document for evaluating potential oil spills for this type of facility, the Applicant provided modeling of a most likely scenario spill of about 2,200 bbl of oil released over 1 hour for heavy crude (WCS), lighter crude (WTI), and condensate. The Applicant also evaluated about a 71,000-gallon diesel fuel spill, which would be the maximum capacity of diesel fuel stored for the Project. The model simulations represented the fate of each spill over a 60-day period and represented different times of year. The simulation for WCS was based on conditions in fall (November), the simulation for WTI was based on conditions in mid-summer (July), the simulation for condensate was based on conditions in late summer (August), and the simulation for diesel fuel was based on conditions in spring (May). As part of the modeling results, the Applicant included an analysis of the potential biological effects of a crude oil spill.

For WCS, the model predicted:

- The maximum surface exposure concentration of 5 to 10 g/m^2 (appears as fresh black oil, mousse, and sheens) would occur westward up to 62 miles from the spill site;
- A surface exposure concentration of <3 g/m^2 would spread to 93 miles southeast of the spill site;
- An estimated 243 miles of shoreline would be contaminated by >1 g/m^2 of oil along the Texas coast and part of Mexico; and
- Over a 60-day period, the model predicts that 34 percent of WCS oil would evaporate, 47 percent would reach shore, 4 percent would remain in the water column, 0.2 percent would settle in sediments, and 14 percent would biodegrade.

For WTI, the model predicted:

- A maximum surface exposure concentration of 5 to 10 g/m^2 (appears as metallic sheen) would occur within the immediate vicinity of the spill site;
- A surface exposure concentration of <3 g/m^2 (appears as rainbow sheen) would spread up to 62 miles west of the spill site;
- An estimated 146 miles of shoreline would be contaminated by >1 g/m^2 of oil from Galveston Bay to East Matagorda Bay; and
- Over a 60-day period, 64.8 percent of WTI oil would evaporate, 18.5 percent would reach shore, 0.8 percent would remain in the water column, 9.7 percent would settle in sediments, and 6.2 percent of WTI would biodegrade.

For condensate, the model predicted:

- A maximum surface oil exposure concentration of 1 to 3 g/m^2 (appears as a sheen) would occur within the immediate vicinity of the spill site;
- A concentration of <1 g/m^2 would occur within 45 miles east and west of the spill site with lower concentrations (<1 g/m^2) appearing as scattered colorless sheens;
- An estimated 7 miles of shoreline west-northwest of the spill site on the outer coast seaward of East Matagorda Bay would be contaminated with >1g/m^2 of oil; and
- Over a 60-day period, 88 percent of the oil would evaporate, 0.05 percent would reach shore, 4 percent would remain in the water column, 0.4 percent would settle in sediments, and 8 percent would biodegrade.

For diesel fuel, the model predicted:

- A maximum surface exposure concentration of 50 to 100 g/m^2 (appears as true color) would occur within the immediate vicinity of the spill site;
- A maximum surface oil exposure concentration of <5 g/m^2 (appears as a sheen) would occur up to 22 miles northwest of the spill site;
- About 10 miles of shoreline along Galveston Island would be contaminated with >1 g/m^2 of oil;
- Over a 60-day period, 61.7 percent would evaporate, 0.02 percent would reach shore, 4.2 percent would remain in the water column, 8.9 percent would settle in sediments, and 25 percent would biodegrade; and
- Within the first day after release, diesel fuel either evaporated or was dispersed into the water column (SPOT 2019p).

In addition to spill modeling provided by the Applicant, USCG requested that a third party conduct a worst credible oil spill modeling and risk assessment to support the SPOT DWP license application process and the results are described briefly in Section 3.4.4.2, Habitats, Oyster Reefs, Impacts and Mitigation, and in full in Safety Section 4.6.3, Potential Impacts from Oil Spills Onshore and Offshore.

The third-party Spill Risk Analysis is included in Appendix H and the Oil Spill Modeling Report is included in Appendix X.

Safety mechanisms such as shutdown valves built into the pipeline system would prevent a continuous release of oil. The Applicant provided the following hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions):

- Booming-containment
- Skimming
- Physical herding
- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

Use of the response actions described would minimize the impacts associated with an oil spill. Additionally, given the current technologies and safety features that the Applicant would employ, the potential of a spill occurring is relatively low. However, the effects of a spill would vary based on the volume of oil released and the time of year of that release. Impacts on migratory, coastal, and marine birds would be direct or indirect, adverse, short-term or long-term, and minor to major, depending on the size of the spill and the level of exposure to the release.

Planned and Unplanned Maintenance

Onshore Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the SWPPP (BMP #14 in Appendix N). The Applicant would also adhere to the conservation measures established for the Eastern Black Rail in Section 5.1.4 of the Addendum to the BA (Appendix E2). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

Offshore Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Spills of Hazardous Materials. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.5.4. Freshwater Fisheries

3.5.4.1. Existing Conditions

The proposed Project is located in the Western Gulf Coast Plain Ecoregion (USEPA 2013a) and the Texas Gulf Coast Prairies and Marshes region (TPWD 2014b). This region is crossed by rivers and streams flowing to the GoM. Forty-nine families and 268 species of fishes are known to inhabit the freshwaters of Texas (Hubbs et al. 2008). Non-game fish families include lamprey (Family Petromyzontidae), sturgeons (Family Acipenseridae), paddlefish (Family Polyodontidae), gar (Family Lepisosteidae), bowfin (Family Amiidae), mooneyes (Family Hiodontidae), minnows (Family Cyprinidae), suckers (Family Catastomidae), characins (Family Characideae), bullhead catfishes (Family Ictaluridae), pirate perch (Family Aphredoderidae), killifish (Family Fundulidae), livebearers (Family Poeciliidae), silversides (Family Atherinidae), sunfish (Family Centrarchidae), pygmy sunfish (Family Elassomatidae), darters (Family Percidae), drum (Family Sciaenidae), and cichlids (Family Cichlidae) (Klym and Garrett 2006).

Popular recreational species include bass (largemouth [*Micropterus salmoides*], smallmouth [*Micropterus dolomieu*], spotted [*Micropterus punctulatus*], Guadalupe [*Micropterus treculii*], Alabama [*Micropterus henshalli*], striped [*Morone saxatilis*], white [*Morone chrysops*], yellow [*Morone mississippiensis*], and hybrid), catfish (channel [*Ictalurus punctatus*], blue [*Ictalurus furcatus*], channel/blue hybrids and subspecies, and flathead [*Pylodictis olivaris*]), crappie (white [*Pomoxis annularis*], black [*Pomoxis nigromaculatus*], their hybrids and subspecies), alligator gar [*Atractosteus spatula*], paddlefish, saugeye, shad (gizzard [*Dorosoma cepedianum*] and threadfin [*Dorosoma petenense*]), sunfish (various including bluegill [*Lepomis macrochirus*], redear [*Lepomis microlophus*], green [*Lepomis cyanellus*], warmouth [*Lepomis gulosus*], and longear [*Lepomis megalotis*]), trout (rainbow [*Oncorhynchus mykiss*] and brown [*Salmo trutta*]), and walleye (*Sander vitreus*) (TPWD 2019i).

Construction of the proposed onshore pipelines would include 129 waterbody crossings (Table 3.5.4-1). Perennial streams and ponds support permanent populations of freshwater fishes while intermittent streams can be important spawning habitat for some freshwater fishes (Hooley-Underwood et al. 2018). This pipeline would also cross freshwater wetlands that are intermittently dry and not likely to support permanent freshwater fish populations.

Table 3.5.4-1: Waterbodies Crossed by Onshore Pipelines and Access Roads

Flow Regime	Number of Waterbodies Crossed by the Centerline [a]
ECHO to Oyster Creek Pipeline	
Ephemeral [b]	48
Intermittent [c]	20
Perennial [d]	35
Pond [e]	7
Total ECHO to Oyster Creek Crossings	**110**
Oyster Creek to Shore Pipelines	
Ephemeral [b]	2
Intermittent [c]	1
Perennial [d]	12

Flow Regime	Number of Waterbodies Crossed by the Centerline [a]
Pond [e]	3
Total Oyster Creek to Shore Crossings	**18**
Access Road	
Perennial [d]	1
Total Access Road Crossings	**1**

Source: SPOT 2019ff

ECHO = Enterprise Crude Houston

[a] The numbers in this column refer to the number of distinct waterbodies that would be crossed by the onshore pipeline centerline. Some individual waterbodies may be crossed multiple times.

[b] Ephemeral: isolated flow, only during rain events.

[c] Intermittent: seasonal flow, discontinuous.

[d] Perennial: continuous flow.

[e] Pond: isolated perennial waterbody, no direct hydrologic connectivity with other waterbodies.

3.5.4.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on freshwater fisheries. The study area within which potential impacts were assessed includes the perennial and intermittent streams and ponds that would be crossed by the Project as well as those areas that are hydrologically connected to surface waters affected by the Project.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on freshwater fisheries have been evaluated based on their potential to:

- Degrade the commercial, recreational, ecological, or scientific viability or significance of a biological resource;
- Measurably change the population size (density) or change the distribution of an important species in the region;
- Introduce new, invasive, or disruptive species in the proposed Project area;
- Violate a Federal, state, local, or Federally recognized international water quality criterion or waste discharge requirement;
- Degrade surface water quantity or quality; and/or
- Cause irreparable harm to human health or aquatic life.

The remainder of this section describes the effects of Project construction and operation on freshwater fisheries from the open-cut waterbody crossing method, inadvertent releases of drilling fluid from trenchless crossings, and accidental spills of hazardous materials. It is unlikely that impacts on freshwater fisheries would occur during operation of the Project. However, accidental spills or maintenance could affect freshwater fisheries, as discussed below.

Open-Cut Construction

Construction of the pipelines would involve the open-cut construction method at 12 perennial and 13 intermittent streams along the ECHO to Oyster Creek Pipeline and 7 perennial waterbodies along the

Oyster Creek to Shore Pipelines. The remaining perennial and intermittent waterbodies would be crossed using a trenchless method (i.e., bore or HDD). Waterbody crossing methods are included in Table 3.3.4-5.

The open-cut construction method, as described in Section 3.3.4.2, Water Resources, Surface Water, Waterbody Crossing Procedures, would involve clearing vegetation on the stream bank and disturbance of the stream bank and bed due to trenching. For most open-cut crossings, the Applicant would operate equipment outside the water's edge unless approved by the USACE to operate in the streambed. Spoil would be placed at least 10 feet from the water's edge or in additional temporary workspace and sediment barriers would be used to prevent the flow of spoil into the waterbody (BMP#5 in Appendix N). During open-cut crossings, clearing, trenching, backfilling, and grading would cause turbidity and sedimentation in the crossing area and downstream from the crossing. Larger particles would settle faster than smaller particles and fish would likely avoid the disturbed area. However, increased turbidity can affect the foraging behavior of fish, such as by increasing the time spent foraging and decreasing total prey consumption (Swanbrow Becker et al. 2016). Increased turbidity could also decrease the level of DO in the water column, thereby causing suffocation of eggs and larvae of fish and invertebrates. Increases in siltation can damage fish gill membranes, destroy eggs of aquatic species, and degrade spawning and nursery areas in the area (USFWS 2013a). The downstream effect or turbidity would depend on the stream velocity at the time of crossing.

At open-cut crossings, the Applicant would implement the measures outlined in its Construction BMPs (Appendix M; BMP #1 in Appendix N), which include:

- Completing all minor waterbody (less than 10 feet wide) crossings within 24 hours (BMP #5);
- Completing all intermediate waterbody (more than 10 feet but less than 100 feet) crossings within 48 hours (BMP #5);
- Storing spoil at least 10 feet from the water's edge or within additional temporary workspace (BMP #5);
- Installing sediment barriers across the entire construction right-of-way to prevent flow of spoil into the waterbody (BMP #5);
- Installing temporary trench plugs at all waterbody crossings, as necessary, to prevent diversion of water into upland portions of the pipeline trench and to keep any accumulated trench water out of the waterbody (Appendix M; BMP #1 in Appendix N);
- Stabilize waterbody banks and install temporary sediment barriers within 24 hours of completing instream construction activities (BMP #5); and
- Installing permanent slope breakers across the construction right-of-way at the base of slopes as needed to prevent sediment transport into the waterbody (BMP #5).

Additionally, the Applicant would implement its SWPPP (BMP #14) and Construction BMPs (Appendix M; BMP #1 in Appendix N), which would include the use and maintenance of erosion control devices to prevent erosion into wetlands and waterbodies. With implementation of these BMPs, impacts on freshwater fisheries from construction of the Project would be direct, adverse, short-term, and minor.

Trenchless Construction Methods

The Applicant would use the HDD or bore construction method to cross 28 perennial and 8 intermittent streams, and would avoid disturbance of shoreline vegetation at these crossings, which would reduce the risk of sediment deposition in the waterbody. An inadvertent return of drilling fluid could smother eggs present at the site of the release. The HDD and bore construction methods are described in Section 3.3.4.2, Water Resources, Surface Water, Waterbody Crossing Procedures. The Applicant would implement measures outlined in its HDD Contingency Plan (Appendix M; BMP #6 in Appendix N) to minimize any impacts associated with an inadvertent return of non-toxic drilling fluid, such as establishing containment structures where necessary and working with regulatory agencies in accordance with applicable regulations and permit conditions to determine the necessary course of action (BMP #6). The Applicant has also indicated that vacuum trucks, booms, absorbent pads, shovels, and hay bales would be available and maintained at each HDD site for cleanup in the event of an inadvertent release (BMP #6).

Accidental Spills of Hazardous Materials

Contamination caused by spills of hazardous materials during construction could impact freshwater fish. Sources of contaminants could come from accidental spills of hazardous materials including gasoline, oil, hydraulic fluids, or diesel fuel. The level of impact would depend on the phase of the SPOT Project, with spills occurring during construction likely to be less harmful than spills of crude oil during Project operation.

The effects on freshwater fisheries due to an inadvertent release of hazardous materials during construction and operation would be similar to those described in the Section 3.5.3.3, Wildlife and Aquatic Resources, Wildlife, Accidental Spills of Hazardous Materials. Impacts from any accidental spills on freshwater fisheries during construction would be direct, adverse, short-term, and minor. Impacts that occurred due to an operational crude oil spill that reached a waterbody would be direct, adverse, short-term to long-term, and minor to major, depending on the volume of oil released and the exposure of species to the release.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the SWPPP (BMP #14 in Appendix N). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

3.5.5. Benthic Resources

The GoM has a surface area of over 395 million acres and connects to the Atlantic Ocean via the Straits of Florida and to the Caribbean Sea via the Yucatan Channel. The majority of water enters through the Yucatan Channel, which is narrow (less than 160 kilometers [99 miles] wide) and deep (1,650 to

1,900 meters [5,413 to 6,234 feet]), and leaves through the Straits of Florida (less than 160 kilometers [99 miles] wide and 800 meters [2,625 feet] deep). This flow of water creates a circular flow in the GoM referred to as the Loop Current (GMFMC 2004). Almost two-thirds of the U.S. land area drains into the GoM via the Mississippi River. More than half of the freshwater flow into the Gulf is the combined discharge of the Mississippi and Atchafalaya rivers, which has a major influence on salinity levels in coastal waters on the Texas/Louisiana continental shelf (GMFMC 2004). Major habitats in the GoM include the continental shelf, continental slope and abyssal plain, methane seeps, and corals and live bottoms (Rowe 2017). The continental shelf is formed by the deposition of soft sediments carried downstream and deposited, particularly from the Mississippi Delta (Sammarco et al. 2014; Ward and Tunnell 2017). Sediments eroded from land dominate the coastal systems. Sand dominates in the barrier-inlet systems and mud dominates in estuaries and lagoons (Davis 2017).

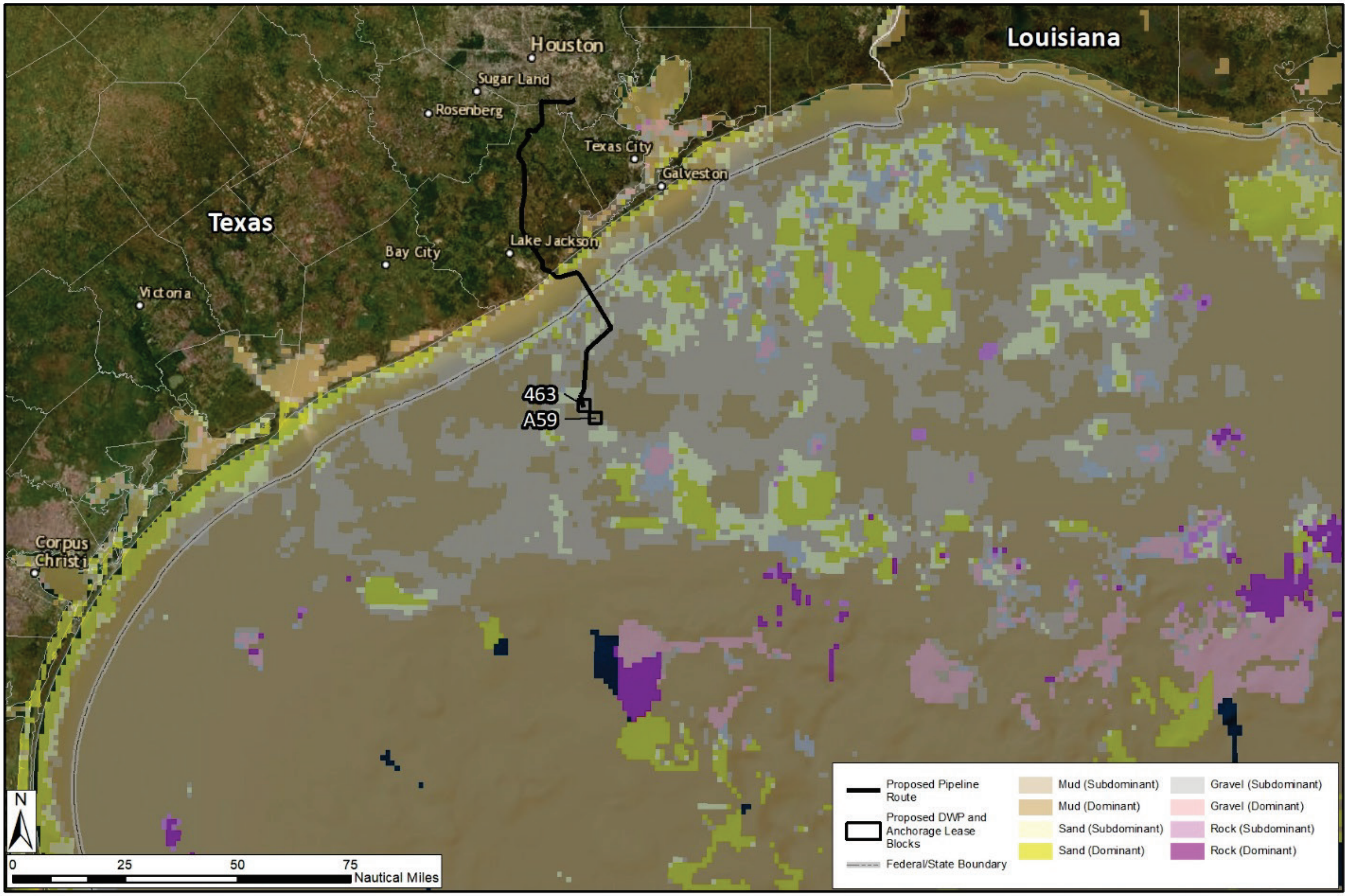
Though hard bottom communities are far less common than soft bottom communities in the GoM, they provide unique habitats that include shallow and deepwater corals, pinnacles, topographic features, artificial reefs, and methane seeps (Ward and Tunnell 2017). The closest coral reef system to the Project area is the FGBNMS, which is located approximately 40 nautical miles southeast of the proposed SPOT DWP site. The coral community at FGBNMS is isolated and is located on two salt diapirs (Sammarco et al. 2014).

3.5.5.1. Existing Conditions

Benthic resources in the northern GoM include level-bottom soft sediment (i.e., mud, sand), hard bottom (e.g., gravel, rock), and artificial reefs. The Project would predominantly cross mud and sand on the continental shelf (Figure 3.5.5-1). The continental shelf encompasses the perimeter of the GoM and supports various habitats and organisms. Benthic invertebrates include both infaunal (living within the sediment matrix) and epifaunal (living on or in close association with the seafloor) organisms (Ward and Tunnell 2017). In general, assemblages of benthic invertebrate species tend to vary with depth/distance from shore, sediment type, and organic richness (Miller and Wheeler 2004). Communities that live in soft sediment include a wide range of size classes as shown in Table 3.5.5-1 (Rowe 2017). The northern shelf consists mainly of fluvial mud (silt and clay, with some sand) and the fauna are considered temperate. Table 3.5.5-2 provides estimated animal densities and species composition of the meiofauna, macrofauna, epibethic megafauna, and demersal fishes and Figure 3.5.5-2 shows the location of these estimates.

Common trends identified in the northern GoM include:

- Macrofauna are found in highest densities in the nearshore/inshore environment while the outer-shelf margin has the lowest densities;
- A diverse assemblage of macrofauna is present, with polychaete annelid worms being most common, and amphipod crustaceans and bivalve mollusks also present in large numbers; and
- The main faunal groups were identified parallel to the coast within predictable depth ranges (Rowe 2017).



Source: Jenkins 2011

Figure 3.5.5-1: Bottom Sediment Types in the Gulf of Mexico

There is a trophic[4] link between plankton and plankton consumers because benthic organisms feed on plankton and detritus, and are then preyed upon by larger invertebrates and fishes. Phytoplankton, dominated by diatoms and dinoflagellates, algae, and detritus derived from land, form the base of the offshore bottom community food chain. Infaunal suspension feeders, including bivalve mollusks and mole crabs, consume the phytoplankton and detritus. Polychaetes ingest the sediment and consume the detritus. The epifauna organisms such as gastropods, starfish, decapod crustaceans (shrimp and crabs), and fish consume the infaunal organisms (NOAA 2019d). Benthic organisms also add complexity to soft bottom sediments by providing physical substrate.

Table 3.5.5-1: Level-Bottom Seafloor Assemblage Size Groupings

Size Class	Size
Microbiota	<1 µm (bacteria and Archaea), and protists up to 40 µm
Meiofauna	≥40 but <500 µm
Macrofauna	250–500 µm, depending on location
Megafauna	>1 cm (0.4 inch)
Demersal fishes	205 cm (6.7 feet)

Source: Rowe 2017

µm = micrometer; cm = centimeter

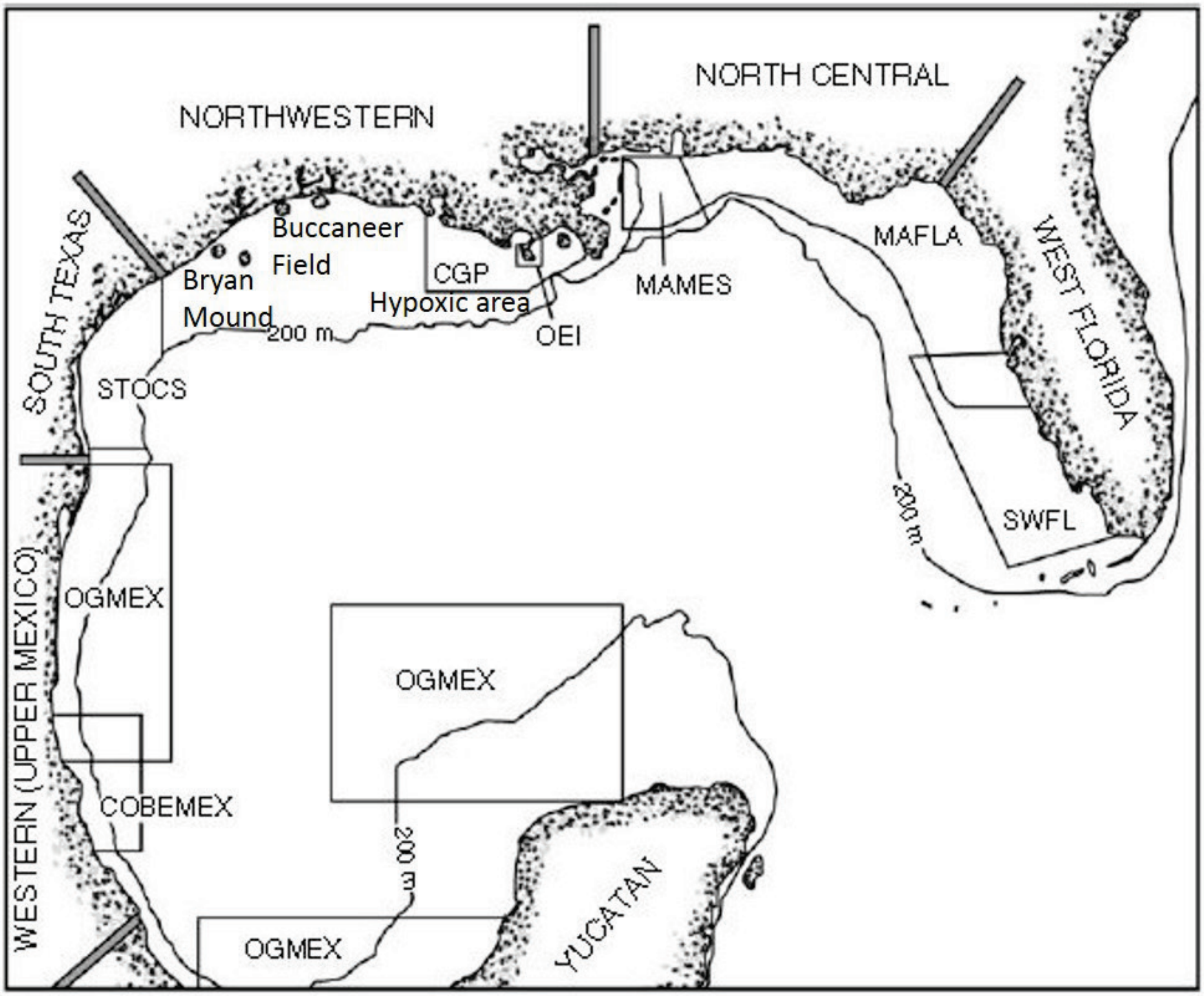
Table 3.5.5-2: Comparison of Macroinfaunal Assemblages on the Continental Shelf of the Northern Gulf of Mexico

Location/Area	Nearshore Densities (Inner shelf <50 meters) (Mean per square meter)	Offshore Densities (Outer shelf > 50 meters) (Mean per square meter)	Total No. of Species
STOCS (South Texas Outer Continental Shelf)	2,707	229	837
MAFLA (Mississippi Alabama Florida)	5,268	575	1,691
Hypoxic area (stretches west from the central Mississippi Delta to the border with Texas)	3,741	NA	185
Buccaneer field	5,850	NA	352
Bryan mound	1,109	NA	-
CGP	6 to 12,576	NA	576
SWFL (Southwest Florida)	3,245 to 15,821	NA	414

Source: Excerpted from Rowe 2017

NA = not applicable; 50 meters =164 feet

[4] Relating to feeding and nutrition.



Source: Excerpted from Rowe 2017

Note: See Table 3.5.5-2 for descriptions of these areas.

Figure 3.5.5-2: Regional Studies of the Continental Shelf of the Gulf of Mexico

3.5.5.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on benthic resources. The study area within which potential impacts were assessed includes the shoreline from Brazoria County, Texas to the proposed SPOT DWP, and the areas outside the construction right-of-way that would be affected by construction activities (particularly jet sledding).

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on benthic organisms have been evaluated based on their potential to:

- Degrade the ecological viability or significance of the resource;
- Introduce new, invasive, or disruptive species in the proposed Project area;

- Measurably change the population size (density) or change the distribution of an important species in the region; and/or
- Reduce quality and/or quantity of EFH as defined by the Magnuson-Stevens Fishery Conservation and Management Act, causing adverse effects, such as direct or indirect physical, chemical, or biological alteration of the waters or substrate, and loss of or injury to benthic organisms, prey species, their habitat, and other ecosystem components.

The remainder of this section describes potential impacts from construction and operation of the Project on benthic resources from habitat alteration and loss due to seafloor disturbance and sediment deposition; direct mortality due to sediment deposition, turbidity, operational water withdrawals and discharges; and accidental spills of hazardous materials, including oil spills during operation.

Activities associated with construction and operation of the proposed Project that could impact benthic resources include:

- HDD activities
- Pipeline construction
- Vessel anchoring
- Dredging/jet sledding
- Pile driving
- Fixed platform, PLEM, and SPM buoy installations
- Hydrostatic testing
- Accidental spills

Habitat Alteration and Loss

As discussed above, the Project predominantly crosses soft-bottom habitat on the continental shelf. Direct impacts on benthic organisms would include localized disruption, crushing, turnover, and burial, which could lead to secondary effects on fish species by reducing prey availability.

The Applicant would install approximately 1 mile of the subsea pipelines nearest the shore using the HDD construction method. The HDD exit holes would be located within the 100-foot construction corridor. A pit would be excavated to tie-in the HDD portion of the pipelines with the offshore jet-installed portions. The excavated sediments would be placed next to the pit, which would be allowed to naturally backfill due to currents and wave action upon completion of the tie-in. The excavation would take place using a bucket dredge for a duration of approximately 1 hour. Although the Applicant modeled both excavation and backfilling of the HDD exit pit, in response to Information Request #187, it also indicated that the exit pit would be allowed to backfill naturally due to currents and wave action (SPOT 2019bb).

For HDD exit pit activities, the model predicted that the total water volume that would experience increased turbidity (greater than 10 mg/L) is estimated to be 152,400 cubic meters and would occur over a maximum area of about 6.2 acres. Turbidity would attenuate to background levels shortly after the disturbance ends. HDD exit pit excavation and backfilling would cause sediment deposition > 1 mm (0.04 inch) over a maximum area of about 4.8 acres. Sediment deposition would be additive due to excavation and backfilling in the same location (SPOT 2019g, 2019dd, and 2019hh). This sediment deposition could lead to smothering and burial of benthic resources.

Pipeline installation would result in direct short-term disturbance of approximately 1,212 acres of benthic habitat along the proposed pipeline route due to dropping the assembled pipes off the construction barge where it would settle on the seafloor before being buried, as well as disturbance of about 3,106 acres of seafloor due to burial of the pipeline. An additional 1 to 2 acres of benthic habitat would be affected by additional activities such as support vessel anchoring (SPOT 2020a). Anchoring of the pipe installation barges could crush fish eggs, larvae, and/or benthic macroinvertebrates in the sediments.

The assembled pipe would be buried to a minimum of 3 feet using the jet sledding technique. The Applicant provided a sediment transport model (SPOT 2019g, 2019dd, and 2019hh) to determine potential impacts from the movement of sediments during construction of the Project. The model showed sediment deposition > 1 mm (0.04 inch) would occur over about 3,106 acres for burial of one pipeline. The coarse sediments would resettle before the finer sediments. Sediment deposition would be additive in adjacent areas due to installation of two pipelines adjacent to each other and would result in sediment deposition of > 1 mm (0.04 inch) over a maximum area of about 6,210 acres.

The deep burial of some bivalve species can lead to reduced condition and survival through starvation or suffocation (De Goeij and Luttikhuizen 1998). Most bivalves in estuarine environments are adaptable to changes in turbidity. Infauna are accustomed to burrowing through sediment and would likely be able to handle increased sediment deposition without adverse effects (Newell et al. 1998). Lab studies have shown that demersal eggs and larvae are sensitive to increased turbidity and sediment deposition at levels of sediment accumulation > 1 mm (0.04 inch), and that persistent suspended sediments can cause burial or abrasion to eggs and reduced swimming or settling ability in larvae (Berry et al. 2011; Wilber and Clarke 2001). Additionally, turbidity occurring during the spawning season could disproportionately affect some benthic species. These impacts would be temporary and benthic organisms would recolonize the area once construction is complete.

The SPM buoys would be attached to the seafloor with six fluke anchors per buoy. There would be a direct loss of benthic habitat within the footprint of the fluke anchors for the SPM buoys, and a long-term disturbance to benthic habitat would occur over about 0.182 acre for each SPM buoy (for a total of about 0.364 acre) due to anchor chains dragging on the seafloor during operation. A total of about 0.0016 acre (70 square feet) would be affected by concrete sinkers associated with the service vessel moorings. The effects associated with dragging anchor chains would depend on water depth, wind, currents, chain length, and the size of the anchor and chain. Live-bottom areas are affected most by anchor damage that could include crushing and breaking of live/hard bottoms (MMS 2001). Soft-bottom habitats such as those in the Project area are not typically affected as greatly by anchor chains. Benthic organisms would be crushed beneath the anchors and chains and impacts would be direct, adverse, long-term, and minor.

The platform for the SPOT DWP would be supported by eight 72-inch diameter steel piles driven to a depth of 380 feet, as well as sixteen 30-inch diameter steel piles installed for the PLEMs. Direct mortality of 100 percent of non-mobile benthic resources would occur in the footprint of the 24 piles. Installation of the piles would result in long-term loss of habitat and cause direct impacts such as injury, mortality, or displacement of mobile organisms. However, as the footprint of the SPOT DWP piles is small in comparison to the available surrounding habitat, impacts on benthic resources from pile installation during construction, and presence of piles during operation, would be direct, adverse, long-term, and minor.

Benthic communities tend to be resilient and recover fairly quickly from direct disturbances; however, a change in the characteristics of the seabed after construction may result in changes to the community assemblage. Benthic communities recover from a direct, physical disturbance at various rates; some recover as quickly as 6 months and others can take 2 years or more to recover (Germano et al. 1994; Rhoads et al. 1978; Saffert and Murray 1999). Habitats with estuarine muds and frequent disturbance typically recover more quickly, while habitats consisting of sands and gravels take longer (Newell et al. 1998). The Project location consists of a variety of sediment types including mud, sand, and gravel (Figure 3.5.5-1). Based on the ability of benthic communities to recover and the relatively small footprint compared to the surrounding area, construction of the SPOT Project would result in direct, adverse, short-term to long-term, and minor impacts on benthic resources as a result of seafloor disturbance.

Water Quality

Construction activities, including dropping the pipe off the barge, jet sledding, anchor setting for SPM buoys, and pile driving, would result in increased suspended sediments and turbidity in the water column. The sediment type and duration of the activity would determine the level and longevity of increased turbidity. Larger particles such as gravel and sand would settle more quickly than smaller particles such as mud. Turbidity sensitive habitats such as topographic live-bottom features, oyster reefs, or seagrass beds are not known to occur in the offshore Project area.

Jet sledding for pipeline burial would also disrupt benthic habitat through resuspension of sediments, which could disrupt filter-feeding mechanisms and interfere with ingestion and respiration of sedentary invertebrates (Berry et al. 2003). The Applicant provided a sediment fate and transport model for offshore construction activities: pipeline trenching and jetting, pile driving, and HDD exit pit excavation (SPOT 2019g, 2019dd, and 2019hh). In addition to modeling sediment deposition, the model simulated the addition of sediment to the water column resulting from construction activities in different sediment types and under varying tidal, bathymetric, current, and wind conditions. The model predicted that offshore pipeline installation would cause increased turbidity (greater than 10 mg/L) over a maximum area of about 19,044 acres that would attenuate to background levels within 24 hours after the disturbance ends. Because the two pipelines would be trenched in at different times, turbidity plumes would not overlap. For pile installation, the model predicted increased turbidity (greater than 10 mg/L) over a maximum area of about 0.25 acre that would attenuate to background levels shortly after the disturbance ends. The 72-inch platform piles would be spaced 50 to 60 feet apart, and the model predicted no overlap in turbidity for installation of the eight piles. No modeling was conducted for installation of the PLEM pilings, but because the pile size would be smaller (30-inch vs. 72-inch), the associated turbidity and sediment deposition impacts would also be smaller. Finally, the model predicted that excavation and backfilling of the HDD exit pit would cause increased turbidity (greater than 10 mg/L) over a maximum area of about 6.2 acres that would attenuate to background levels shortly after the disturbance ends.

Increased turbidity alters light transmission through the water column and can affect more sensitive species, like larval stages and filter-feeders, which can experience clogged feeding and respiration apparatuses and dilution of food resources, requiring additional sorting and energy expenditure

(Speckman et al. 2005; Todd et al. 2015). Higher turbidity can also lead to reduced predator responses (Essink 1999). Most bivalves in estuarine environments are adaptable to changes in turbidity and would likely to be able to handle increased turbidity without adverse effects. The effects would be limited to the period during and immediately following jet sledding and are expected to return to ambient conditions within 24 hours of ceasing construction activities. As such, benthic resources would experience indirect, adverse, short-term, minor impacts from turbidity during construction.

Water Intake and Discharges

As described in Section 3.3.7, Water Resources, Coastal and Marine Environment and Marine Water Quality, VLCCs or other crude oil carriers calling on the SPOT DWP would comply with applicable standards and regulations. With adherence to ballast water exchange standards and regulations, impacts from ballast water discharge on benthic communities are not anticipated.

Other operational discharges at the SPOT DWP would occur at a depth of 15 feet below the water surface, and withdrawals for VLCC or other crude oil carrier cooling water would occur off the seabed; therefore, impacts on benthic communities from water intake are not expected.

Accidental Spills of Hazardous Materials

An inadvertent return of drilling mud into the GoM during HDD operations for the shoreline crossing could affect benthic invertebrates. Bentonite has been shown to affect growth and reproduction in scallops and could impact benthic communities. Changes in benthic species diversity, abundance, and community structure have been observed from 328 to 3,281 feet from the release location (Ellis et al. 2012). Benthic fish species would be expected to move away from the spilled material and would therefore not be buried by the drilling mud. The Applicant would implement its HDD Contingency Plan (Appendix L, BMP #6 in Appendix N), which would minimize impacts on benthic communities if a release of drilling mud occurred. As discussed previously, benthic communities are resilient and can recover relatively quickly. Therefore, the impacts associated with an inadvertent release of drilling mud would be direct, adverse, short-term, and minor.

Spills during refueling and maintenance of construction vessels or operational support vessels, or a leak from the pipelines during Project operation could affect benthic habitats. The Applicant’s modeling of a most likely scenario oil spill shows that some portion of all modeled spills would occur in the water column and would settle on the seafloor. A worst-case spill (as described in Section 4.6, Third-Party Crude Oil Spill Analysis) may cover larger areas and thus impact more resources. The underlying effects of an oil spill would be the same, but would differ in magnitude. Immobile filter feeders cannot avoid exposure to contaminants that can hinder respiration, mobility, digestion, growth, and reproduction (Earth Gauge 2011). An oil spill would release PAH into the water column where they can persist in the water or in the sediments where they settle. Volatilization and oxidation result in elimination of low molecular weight PAHs from the water column, but adsorption of high molecular weight PAHs occurs on particles in the water and bottom sediments (Olayinka et al. 2018). The bioavailability of chemicals is generally highest in true solution in the water and is lower for chemicals in solid or adsorbed forms. The effect of PAHs on marine organisms is dependent on the bioavailability of PAHs, the exposure time, and the ability of the organism to metabolize the compounds (NRC 2003). Bivalves cannot metabolize PAH; consequently, bioavailable toxins accumulate in their body tissues. In contrast, crustaceans, such as crabs, can eliminate PAHs from their systems as body waste so benthic invertebrates differ in their capacity to tolerate contaminants (Earth Gauge 2011; Hale et al. 2018). Table 3.4.4-2 presents the results of the Applicant's modeling of PAH in the water column.

To minimize the impacts associated with an accidental release of oil or other chemicals during construction, all vessels would be equipped with spill containment and cleanup equipment to respond to small, accidental releases of a half-barrel or less. In the event of a large spill during operation, a shore-based emergency response team would be mobilized. The Applicant would develop an operational spill response plan that would include the measures it would implement. The Applicant provided the following hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions):

- Booming-containment
- Skimming
- Physical herding
- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

In addition, all vessels would be required to have a USCG-approved Vessel Response Plan, consistent with 33 CFR Part 155, and abide by other Federal regulations described in Section 3.3.7.4, Water Resources, Coastal and Marine Environment, Impacts and Mitigation. To minimize the impacts of a large spill, the Project would be constructed with the ability to isolate sections along the pipelines and various components. The volumes in the isolatable sections range from 10,000 to 11,269,000 cubic feet (ft^3) as shown in Table 3.3.3-3. Minor releases of hydrocarbons during construction or operation could cause direct and indirect, adverse, short-term, and minor impacts on benthic invertebrates, though bioaccumulation could occur. Impacts associated with a major release of oil during operation would be indirect and direct, adverse, long-term, and minor to major depending on the volume of oil released, the time of year, and the exposure of species to the release.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Spills of Hazardous Materials. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.5.6. Plankton

Plankton are drifters and are the most abundant organisms in the GoM. They are essential to the marine food web and are important as food sources for all major groups of larger organisms, including those of economic importance to recreational or commercial fisheries (large invertebrates and finfish) or charismatic megafauna (e.g., mammals, birds, turtles). Plankton are composed of photosynthetic phytoplankton and heterotrophic zooplankton and range in size from microscopic bacteria and plants to larger animals. Plankton size classes range from picoplankton (under 2 micrometers), to megaplankton (over 200 mm) as shown in Table 3.5.6-1 (MarineBio Conservation Society 2019). Phytoplankton are single-celled plants that synthesize organic matter from carbon dioxide. Zooplankton are animals of various sizes that consume the organic matter produced by the phytoplankton. Zooplankton are classified by their stage of development. Meroplankton are plankton for only a portion of their life cycle; they are larvae that take on a completely different appearance as adults and include species that develop into worms, mollusks, crustaceans, coral, echinoderms, fishes, or insects. Holoplankton are plankton for their entire life cycle (MarineBio Conservation Society 2019). Fish eggs, larvae, and juveniles are classified as ichthyoplankton and can grow into important pelagic and benthic fishes (Rowe 2017).

Table 3.5.6-1: Plankton Size Groupings

Size Class	Size
Picoplankton	<2 µm
Nanoplankton	2–20 µm
Microplankton	20–200 µm
Mesoplankton	0.2–20 mm
Macroplankton	20–200 mm
Megaplankton	>200 mm

Source: MarineBio Conservation Society 2019

µm = micrometer; mm = millimeter

Phytoplankton require light and inorganic nutrients for primary production. In the GoM, nitrate is typically the limiting nutrient, but phosphate can be limiting in some cases. Primary production in the GoM is highest closer to shore where riverine and estuarine environments are providing an input of nutrients. There is no good source of nitrate in the central GoM, which results in low levels of primary production.

Zooplankton drift in currents and are the intermediary step between the phytoplankton and species of economic importance such as pelagic fishes. Most zooplankton migrate daily, swimming to the surface waters (upper 164 feet) at night and descending during daylight hours. This migration typically occurs in the top 328 feet of the water column, but may extend down to 3,281 feet. Zooplankton are present in higher densities nearshore, and are highest closest to shore and adjacent to river mouths (Rowe 2017).

Ichthyoplankton are an important part of the zooplankton community as they are a food source for each other and other organisms. The distribution of ichthyoplankton is related to where adult fish spawn, as well as to ocean currents and sea-surface temperatures (Rowe 2017). Researchers collect ichthyoplankton in order to estimate the size of adult populations and monitor population trends (SWFSC 2014).

3.5.6.1. Existing Conditions

The majority of fishes in the GoM have pelagic larval stages. The length of time spent in the egg and larval stages varies from 10 to 100 days, depending on the species. Ichthyoplankton is abundant in the northern GoM and peak seasons for ichthyoplankton concentrations on the shelf are spring and summer. Larval densities are lowest during the winter (Table 3.5.6-2). The distribution of fish larvae is dependent on the spawning behavior of adults, physical and biological parameters that vary spatially and temporally, duration of the pelagic larval stage, behavior of larvae, and larval mortality and growth. Two of the most influential hydrographic features in the GoM are the Mississippi River discharge plume and the Loop Current. The turbidity from the discharge plume creates feeding and growth opportunities for larvae. The Loop Current and eddies can be associated with higher densities of zooplankton and micronekton (BOEM 2012a).

Table 3.5.6-2: Seasonality and Peak Seasonal Occurrence of Select Larval Fishes (<10 millimeter standard length) in the Northern Gulf of Mexico

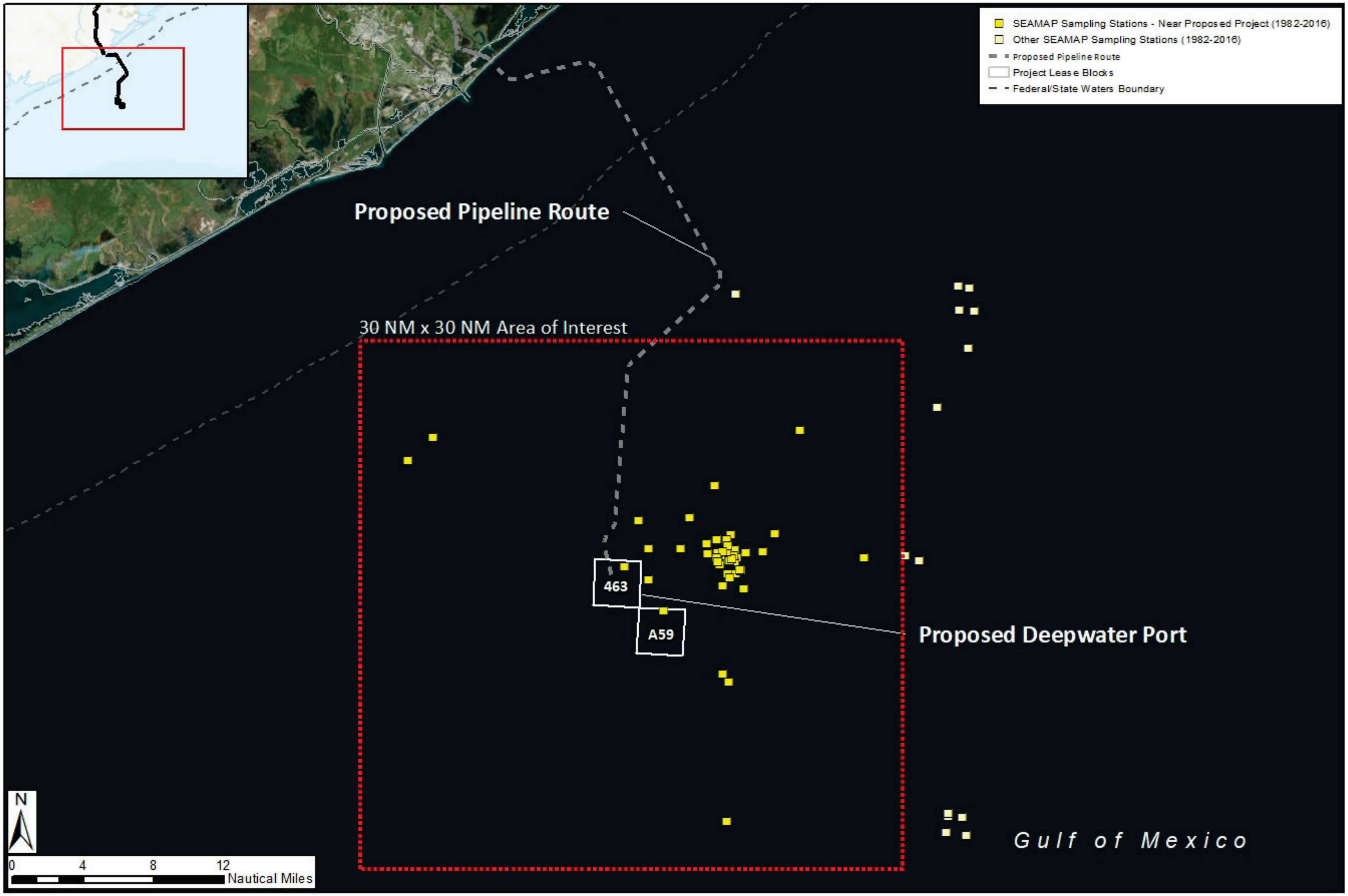
			Month (January through December)											
Family	**Common Name**	**Scientific Name**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Herring and Menhaden	Gulf menhaden	*Brevoortia patronus*	*	*	X	X					X	X	X	*
	Round herring	*Etrumeus teres*	*	*	*	X	X	X					X	X
	Atlantic thread herring	*Opisthonema oglinum*			X	X	*	*	*	*	X	X	X	
Anchovy	Striped	*Anchoa hepsetus*	X	X	*	*	*	*	*	*	*	X	X	X
	Bay	*Anchoa mitchilli*	X	X	*	*	*	*	*	*	*	X	X	X
	Longnose	*Anchoa nasuta*	X	X	*	*	*	*	*	*	*	X	X	X
Sea Bass and Grouper	Sand perch	*Diplectrum formosum*	X	X	X	X	*	*	*	*	X	X	X	X
	Pygmy sea bass	*Serraniculus pumilio*					X	*	*	*	*	X	X	
Jacks, scads, pompanos, and relatives	Blue runner	*Caranx crysos*			X	X	X	*	*	*	X	X	X	
	Atlantic bumper	*Chloroscombrus chrysurus*				X	X	*	*	*	*	X		
	Round scad	*Decapterus punctatus*			X	*	*	*	*	*	*	X	X	
	Rough scad	*Trachurus lathami*	*	*	X	X	X						X	X
	Dolphin	*Coryphaena hippurus*					X	X	X	X	X	X	X	
Snapper	Red	*Lutjanus campechanus*				X	X	*	*	*	X	X	X	
	Gray	*Lutjanus griseus*				X	X	*	*	*	X	X	X	
	Lane	*Lutjanus synagris*				X	X	*	*	*	X	X	X	

			Month (January through December)											
Family	**Common Name**	**Scientific Name**	**J**	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
Majorras, Porgies	Pigfish	*Orthopristis chrysoptera*	X	X	*	X	X							
	Sheepshead	*Archosargus Probatocephalus*	X	*	*	*	X							
	Pinfish	*Lagodon rhomboids*	*	*	X	X						X	X	*
Drums, Croakers, Seatrout	Spotted seatrout	*Cynoscion nebulosus*		X	X	*	*	*	*	*	X	X		
	Spot	*Leiostomus xanthurus*	*	X	X	X						X	X	*
	Atlantic croaker	*Micropogonias undulates*	*	X	X	X					X	*	*	*
	Red drum	*Sciaenops ocellatus*								X	*	*	X	
Spadefish	Atlantic spadefish	*Chaetodipterus faber*				X	X	*	*	*				
Mackerels, Tunas, Wahoo	Bullet mackerel	*Auxis rochei*	X	X	X	X	*	*	*	*	*	X	X	
	Little tunny	*Euthynnus alletteratus*				X	*	*	*	*	*	X	X	
	Skipjack tuna	*Euthynnus pelamis*				X	X	X	X	X	X	X		
	King mackerel	*Scomberomorus cavalla*					X	X	X	*	*	X	X	
	Spanish mackerel	*Scomberomorus maculatus*				X	X	X	X	*	*	X		
	Bluefin tuna	*Thunnus thynnus*				X	X	X						
Butterfish	Gulf butterfish	*Peprilus burti*	*	*	*	X	X	X	X	X	X	X	*	*

Source: Ditty et al. 1988

X = Seasonality: * = Peak Seasonal Occurrence

NMFS began conducting ichthyoplankton surveys in the GoM in 1982 as part of the Southeast Area Monitoring and Assessment Program (SEAMAP). In order to assess ichthyoplankton abundance, the Applicant used SEAMAP data from a 30- by 30-nautical-mile coverage of SEAMAP sampling stations near the proposed SPOT DWP location (Figure 3.5.6-1). The Applicant indicated that net data collected between 1982 and 2016 for 82 SEAMAP stations within the established block showed an overall fish larvae density of 0.22 per cubic meter, whereas the density of fish eggs averaged 2.97 eggs per cubic meter. While these data are specific to the time period referenced, ichthyoplankton data generally vary widely both seasonally and annually. A total of 156 taxonomic groups were represented in the larvae samples collected from the 82 stations; the samples also included a group of unidentified fish (SPOT 2019vv). Fish eggs are not identified to taxa level.



Source: Gulf States Marine Fisheries Commission 2015

Figure 3.5.6-1: SEAMAP Sampling Stations near the SPOT Deepwater Port

The most abundant larval taxa, in decreasing order of abundance, and the phylogenetic level they represent, are:

- Gobiidae (gobies)
- Engraulidae (anchovies/sardines)
- Sciaenidae (*Micropogonias undulatus*—Atlantic croaker)
- Paralichthyidae (*Syacium papillosum*—dusky flounder)
- Cynoglossidae (*Symphurus* spp.—tonguefishes)
- Clupeidae (*Brevoortia* spp.—menhaden)
- Ophidiidae (cusk-eels)
- Bothidae (flounders)

The Applicant provided a ranked list identifying the top 20 taxa found cumulatively for all 82 stations and their average larval abundance in a million gallons of filtered seawater, as presented in Table 3.5.6-3.

Table 3.5.6-3: Larval Taxa Identified for 82 SEAMAP Stations near the Proposed SPOT Deepwater Port Site

Rank	Taxa	Common Name	Average Number per Mgal of Seawater in the SPOT DWP Block
1	Gobiidae	goby	5,707
2	Engraulidae	anchovies & sardines	3,810
3	*Micropognias undulatus*	Atlantic croaker	3,478
4	*Syacium papillosum*	dusky flounder	3,191
5	*Syacium* spp.	large-toothed flounder	2,162
6	*Symphurus* spp.	tonguefish	1,759
7	Cynoglossidae	tonguefish	1,589
8	*Brevoortia* spp.	menhaden	1,531
9	Ophidiidae	cusk-eel	1,099
10	Bothidae	left-eye flounder	974
11	*Bregmaceros* spp.	codlet	886
12	*Chloroscombrus chrysurus*	Atlantic bumper	866
13	*Etrumeus teres*	round herring	773
14	Unidentified fish	NA	740
15	Pleuronectiformes	flatfish	738
16	*Trachurus lathami*	rough scad	726
17	Clupeidae	ray-finned fish	719
18	*Harengula jaguana*	scaled sardine	694
19	*Diplectrum* spp.	perch	685
20	Clupeiformes	herring and anchovy	678

Source: SPOT 2019a, Application, Volume IIa, Section 6

Mgal = million gallons; SEAMAP = Southeast Area Monitoring and Assessment Program; SPOT DWP = Sea Port Oil Terminal Deepwater Port; spp. = species

3.5.6.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project. The study area within which potential impacts were assessed includes the shoreline from Brazoria County, Texas to the proposed SPOT DWP, and the areas outside the construction right-of-way that would be affected by construction activities (particularly jet sledding).

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on plankton have been evaluated based on their potential to:

- Degrade the ecological viability or significance of the resource;
- Measurably change the population size (density) or change the distribution of an important species in the region; and/or
- Reduce quality and/or quantity of EFH as defined by the Magnuson-Stevens Fishery Conservation and Management Act, causing adverse effects, such as direct or indirect physical, chemical, or biological alteration of the waters or substrate, and loss of or injury to planktonic organisms and their habitat, and other ecosystem components.

The remainder of this section describes potential impacts from construction and operation of the Project on plankton resources from sediment deposition and turbidity due to seafloor disturbance, including jet sledding and pile driving, hydrostatic test water intake and discharge, operational water intakes and discharges, including those from VLCCs or other crude oil carriers, and accidental spills of hazardous materials.

Activities associated with construction and operation of the proposed Project that could impact plankton include:

- Pipeline construction
- Dredging/jet sledding
- Hydrostatic testing
- Operational vessel activities
- Accidental spills

Water Quality

As described in Section 3.5.5.2, Wildlife and Aquatic Resources, Benthic Resources, Impacts and Mitigation, jet sledding, pile driving, and anchor setting would result in increased suspended sediments and turbidity in the water column. Increases in turbidity would affect the vertical and horizontal density of phytoplankton production via shading (Carmack et al. 2004). The effects on phytoplankton productivity would influence zooplankton population and community structure and consequently ichthyoplankton populations and the higher trophic level species that feed on plankton communities. Increased suspended sediments are particularly damaging to pelagic eggs and could cause egg abrasion and mortality if persistent within the water column (Wilber and Clarke 2001). As described in Section 3.5.5.2, Wildlife and Aquatic Resources, Benthic Resources, Impacts and Mitigation, the increased turbidity would be limited to the period during and immediately following jet sledding, anchor setting, and pile driving activities. Because ambient conditions are expected to return within 8 hours of ceasing construction activities, plankton would experience direct, adverse, short-term, and minor impacts during construction of the SPOT DWP.

Water Intake and Discharges

During construction, water intake and discharges would occur during hydrostatic testing. Testing would be conducted in accordance with NPDES permit requirements. Approximately 14 million gallons of seawater would be withdrawn from the GoM for hydrostatic testing and corrosion inhibitors would be added to the test water. Hydrostatic test water would be withdrawn at a rate of 5,800 to 14,600 gpm. Water withdrawals could lead to impingement and entrainment of phytoplankton, zooplankton, and ichthyoplankton. The intake volume would occur in a relatively small area compared to the size of the GoM. Intake screens with a screen mesh size no courser than 8 mm (5/16-inch) would be placed on pipes to minimize potential entrainment of fish; however, planktonic organisms, larvae, and eggs would likely pass through the screening due to their size. Some plankton would also likely be impinged on the screen due to their limited swimming ability and size compared to the intake flow rates. One hundred percent mortality of all affected organisms is assumed at water intakes. As discussed previously, SEAMAP data within the SPOT DWP block showed an overall fish larvae density of 0.22 fish larvae per cubic meter and 2.97 fish eggs per cubic meter. Based on the use of 14 million gallons of seawater for hydrostatic testing without the use of mesh intake screens, approximately 11,660 fish larvae and 157,399 fish eggs would be lost due to hydrostatic testing. The Applicant would comply with any permitting requirements for the Project related to water withdrawals. Although some ichthyoplankton would be lost during hydrostatic test water withdrawal, the total amount lost would be small compared to the populations present in the GoM. As such, impacts would be direct, adverse, short-term, and negligible.

As described in Section 3.5.5.2, Wildlife and Aquatic Resources, Benthic Resources, Impacts and Mitigation, discharge of the hydrostatic test water during construction could cause increased turbidity and would release corrosion inhibitors into the GoM. Corrosion inhibitors can be harmful to plankton, depending on the concentration and type of inhibitor (Ogeleka et al. 2011). The Applicant anticipates using a corrosion inhibitor with propylene glycol and polyoxyalkylenes. No information about polyoxyalkylene toxicity is available, but propylene glycol has been shown to be relatively non-toxic in marine and freshwater environments and is highly water soluble (Canadian Council of Ministers of the Environment 2006). Any impacts associated with the release of these inhibitors into the GoM would be temporary. Impacts on plankton from hydrostatic test water discharges are expected to be direct, adverse, short-term, and minor.

Routine water intake and discharges during operation would occur from the SPOT DWP platform and from vessels mooring to the DWP, including ballast water exchange, engine cooling, bilge water, wastewater, scrubber water, general deck drainage, emergency water reserves, and any other typical vessel operational requirements. The annual water use at the DWP would be 46.032 million gallons, and cooling water volume for a single VLCC would be about 4.628 billion gallons annually. The combined water intake is expected to amount to 4.674 billion gallons annually. As discussed previously, SEAMAP data within the SPOT DWP block showed an overall fish larvae density of 0.22 fish larvae per cubic meter and 2.97 fish eggs per cubic meter. The Applicant provided an Ichthyoplankton Impact Assessment (Appendix S) to estimate the number of fish eggs and larvae entrained annually (Table 3.5.6-4). One hundred percent mortality is assumed for all entrained organisms. Tables 3.5.6-5 and 3.5.6-6 show the projected entrainment values for eggs and larvae. These numbers were used to model the impacts to the four identified species of concern. Additional details are provided in Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigation. The northern GoM is highly productive and the estimated loss of plankton due to water withdrawals is within one standard deviation of 12 years of available Texas landings data (red snapper). Texas does not collect landings data for the other anchovy, gulf menhaden, or red drum, but it is reasonable to assume the same is true for these species given the productivity in the GoM. Therefore, based on the estimated entrainment of eggs and larvae, impacts from water intake would result in direct, adverse, long-term, and minor impacts on plankton.

As described in Section 3.3.7.4, Coastal and Marine Environment, Impacts and Mitigation, VLCCs or other crude oil carriers calling on the SPOT DWP would comply with applicable standards and regulations. With adherence to these regulations, impacts from ballast water discharge on plankton are not anticipated.

Table 3.5.6-4: Projected Annual Estimates of Entrainment

Project Component/Resource Type [a]	Lower 95% Confidence Limit	Annual Mean	Upper 95% Confidence Limit
DWP Operation			
Fish Eggs	173,789	278,628	383,467
Fish Larvae	405,817	740,559	1,075,301
VLCC Cooling Water			
Fish Eggs	17,473,610	28,014,685	38,555,760
Fish Larvae	40,802,961	74,459,620	108,116,280
Totals			
Fish Eggs	17,647,399	28,293,313	38,939,227
Fish Larvae	41,208,778	75,200,179	109,191,581

Source: SPOT 2021f

DWP = deepwater port; VLCC = very large crude carriers

[a] Ballast water intake was removed from this analysis in response to IR #334 (SPOT 2021f).

Table 3.5.6-5: Projected Annual Larval Entrainment Values

Species [a]	Associated Taxa in SEAMAP Data	Lower 95% Confidence Limit	Annual Mean	Upper 95% Confidence Limit
DWP Operation				
Bay Anchovy	F. Engraulidae, *Anchoa* spp.	343,511	526,195	708,880
Gulf Menhaden	F. Clupeidae, *Brevoortia patronus*	48,200	134,684	221,168
Red Snapper	F. Lutjanidae, *L. campechanus*	16,883	22,344	27,805
Red Drum	F. Sciaenidae, *S. ocellatus*	-2,777	57,335	117,448
VLCC Cooling Water				
Bay Anchovy	F. Engraulidae, *Anchoa* spp.	34,538,353	52,906,402	71,274,451
Gulf Menhaden	F. Clupeidae, *Brevoortia patronus*	4,846,285	13,541,826	22,237,368
Red Snapper	F. Lutjanidae, *L. campechanus*	1,697,533	2,246,598	2,795,663
Red Drum	F. Sciaenidae, *S. ocellatus*	-279,210	5,764,793	11,808,796

Species [a]	Associated Taxa in SEAMAP Data	Lower 95% Confidence Limit	Annual Mean	Upper 95% Confidence Limit
Totals				
Bay Anchovy	F. Engraulidae, *Anchoa* spp.	34,881,864	53,432,597	71,983,331
Gulf Menhaden	F. Clupeidae, *Brevoortia patronus*	4,894,485	13,676,510	22,458,536
Red Snapper	F. Lutjanidae, *L. campechanus*	1,714,416	2,268,942	2,823,468
Red Drum	F. Sciaenidae, *S. ocellatus*	-281,987	5,822,128	11,926,244

Source: SPOT 2021f

DWP = deepwater port; SEAMAP = Southeast Area Monitoring and Assessment Program; VLCC = very large crude carriers
[a] Ballast water intake was removed from this analysis in response to IR #334 (SPOT 2021f).

Table 3.5.6-6: Projected Annual Egg Entrainment Values

Species [a]	Associated Taxa in SEAMAP Data	Lower 95% Confidence Limit	Annual Mean	Upper 95% Confidence Limit
DWP Operation				
Bay Anchovy	F. Engraulidae, *Anchoa* spp.	162,429	248,811	335,193
Gulf Menhaden	F. Clupeidae, *Brevoortia patronus*	3,599	10,056	16,512
Red Snapper	F. Lutjanidae, *L. campechanus*	8,193	10,843	13,494
Red Drum	F. Sciaenidae, *S. ocellatus*	-432	8,918	18,268
VLCC Cooling Water				
Bay Anchovy	F. Engraulidae, *Anchoa* spp.	16,331,414	25,016,722	33,702,030
Gulf Menhaden	F. Clupeidae, *Brevoortia patronus*	361,825	1,011,037	1,660,249
Red Snapper	F. Lutjanidae, *L. campechanus*	823,799	1,090,256	1,356,713
Red Drum	F. Sciaenidae, *S. ocellatus*	-43,429	896,669	1,836,768
Totals				
Bay Anchovy	F. Engraulidae, *Anchoa* spp.	16,493,843	25,265,533	34,037,223
Gulf Menhaden	F. Clupeidae, *Brevoortia patronus*	365,424	1,021,093	1,676,761
Red Snapper	F. Lutjanidae, *L. campechanus*	831,992	1,101,099	1,370,207
Red Drum	F. Sciaenidae, *S. ocellatus*	-43,861	905,587	1,855,036

Source: SPOT 2021f

DWP = deepwater port; SEAMAP = Southeast Area Monitoring and Assessment Program; VLCC = very large crude carriers
[a] Ballast water intake was removed from this analysis in response to IR #334 (SPOT 2021f).

Discharges from the platform would occur through vertical downward-oriented discharge pipes that would extend from the platform to a depth of approximately 15 feet below the water surface. Due to the volumes and rates of the discharges, scour could occur on the seafloor, which would increase turbidity around the platform.

SPOT DWP platform discharges of domestic and sanitary water, platform deck drainage, and firewater system testing would meet regulatory requirements of the NPDES permit for discharging into the GoM, which would minimize the effects on plankton from discharge of these waters. The Applicant conducted discharge modeling for discharges at the SPOT DWP. Intermittent discharges, such as those from the jockey water pumps, the open drain sump, and the firewater pumps would have temporary plumes, while the persistent discharges from the potable water system and sewage discharges would have permanent plumes. At a distance of 328 feet, discharges would be diluted between factors of 16 to 1,267 times less than at the plume source. The plume radius at a distance of 328 feet would range from 10 to 374 feet. Dilution would occur more quickly for discharges of seawater than for freshwater or concentrated seawater. Temperature-related effects from water discharges at the SPOT DWP platform would be unlikely, as the temperatures of the discharges are expected to be similar to the ambient water temperature in the GoM. The model also predicted that some discharge plumes from the SPOT DWP platform and from VLCCs mooring at the SPMs would co-mingle, but in every scenario the plumes would be sufficiently diluted before the plume trajectories crossed paths.

Discharges at the SPOT DWP platform would generally mix quickly with surrounding seawater; however, there could be impacts on water quality from discharges of concentrated seawater and freshwater, as well as from persistent discharges. As such, impacts on plankton from intermittent discharges at the SPOT DWP would be direct, adverse, short-term, and minor, while impacts from persistent discharges would be direct, adverse, long-term, highly localized, and minor.

Accidental Spills of Hazardous Materials

As previously noted, there could be accidental releases of drilling mud during the shoreline HDD. A release of oil from the pipelines or fuel from vessels during construction and operation of the Project could also occur. The impacts of spills on plankton are caused either by the physical nature of the oil (physical contamination and smothering) or by its chemical components (toxic or mutagenic effects and bioaccumulation). Plankton present in the area of a spill would be incapable of avoiding the contamination. Ichthyoplankton has been found to be substantially more adversely affected by oil spills than adult fish and marine vertebrates (Carls et al. 1999; Hose et al. 1996; Murawski et al. 2016). Decades of research indicates that even very low concentrations of PAHs from crude oil can have detrimental effects on developing fish embryos, but those concentrations and their effects depend on various factors including weathering of the oil, the number of aromatic rings in the PAHs, and the oil source (Collier et al. 2013; Esbaugh et al. 2016). Some of the more commonly identified defects include craniofacial development defects and defects of circulatory function. Researchers also found that zebrafish experienced deformities in developmental processes such as programmed cell death and skeletal muscle phenotypes after the DWH spill; but the severity of these changes decreased with declines in some components in the oil (de Soysa et al. 2012).

Oil spill impacts would depend on the type of oil and depth of the spill. Surface floating oil can affect eggs and phytoplankton near the surface, while the dispersed oil that dissolves in the water column could become bioavailable and toxic to zooplankton and ichthyoplankton. Whether effects are lethal or sublethal (e.g., behavioral, affecting feeding activity, metabolic rates, or reproductive success) depends on exposure time, dose, hydrocarbon mixture toxicity, and sensitivity of the life stages present. As described in Section 3.4.4.2, Habitats, Oyster Reefs, Impacts and Mitigation, the Applicant modeled the most likely scenario oil spill for three types of oil and for diesel fuel. The model predicts that 4 percent of WCS, 0.8 percent of WTI, 4 percent of condensate, and 4.2 percent diesel fuel would remain in the water column. The Applicant's model also predicted PAH in the water column (Table 3.4.4-2). The modeling report indicates that PAH concentrations exceeding 1 ppb would only occur for a short time and the distribution would be patchy before diluting to levels below the threshold of concern (SPOT 2019c, 2019d, 2019p, and 2019ee).

To minimize the impacts associated with an accidental release of oil or other hazardous materials during construction, all vessels would be equipped with spill containment and cleanup equipment to respond to small, accidental releases of a half-barrel or less. In the event of a large spill during operation, a shore-based emergency response team would be mobilized. The Project would develop an operational spill response plan and all vessels would be required to have a USCG-approved Vessel Response Plan, consistent with 33 CFR Part 155. In addition, vessels would abide by other Federal regulations as described in Section 3.3.7.4, Water Resources, Coastal and Marine Environment, Impacts and Mitigation. To minimize the potential occurrence of a large spill, the Project was designed with the ability to isolate sections along the pipelines. The pipeline can be isolated from the Oyster Creek Terminal and the platform. During a large leak or rupture, MLVs along the pipelines would close as part of the emergency shutdown, isolating sections along the pipe. The volumes in the isolatable sections range from 10,000 to 11,269,000 ft^3 as shown in Table 3.3.3-3. Minor releases of hydrocarbons could cause indirect and direct, short-term, adverse, and minor to moderate impacts on plankton, depending on the size of the release. A major release would cause indirect and direct, adverse, short-term effects, and effects of greater magnitude (i.e., more widespread, higher mortality, larger population impact) because the larger volume of oil could lead to a longer exposure at higher concentrations of toxic components.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Spills of Hazardous Materials. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.5.7. Marine Mammals (Non-Endangered)

This section is limited to the discussion of offshore non-endangered marine mammals protected by the MMPA. Federal ESA-listed and state-listed marine mammals are discussed in Section 3.7, Threatened and Endangered Species, and the BA (Appendix E1).

3.5.7.1. Existing Conditions

The GoM is a highly diverse ecosystem that includes 15,419 species comprising microbes, plants, and animals within 40 phyla (Fautin et al. 2010). As many as 32 species of marine mammals could occur in the GoM, but several are either unlikely to occur or are only occasional visitors. There are 22 species of marine mammals that can be reliably described as regular inhabitants of the GoM (Würsig 2017), including some ESA-listed species, which are addressed in Section 3.7.1 and in Appendix E1. Species diversity is likely related to the availability of multiple features/habitats throughout the Gulf. As described in Section 3.3.6.1, over time, sediment discharge associated with freshwater inflow from the Mississippi River and Atchafalaya River tributaries (along with an array of smaller drainages) has created a shallow shelf on the GoM's northern rim. This "continental shelf" slopes gradually from the coastline to the shelf break, where water depths range from approximately 387 to 492 feet (Mitchell 1988). Continental shelves are shallower than the open ocean. Beyond the shelf break, the seafloor extends outwards to the continental slope to meet a part of the deep ocean called the abyssal plain. Three marine mammal species occur primarily in inshore/coastal or shelf waters less than 656 feet (200 meters) deep and 19 species occur over the continental slope and/or the deep oceanic waters of the GoM (Würsig 2017).

Whaling records provide the earliest data for marine mammals in the GoM. Historical records indicate that whaling operations between 1788 and 1877 primarily harvested sperm whales, as well as baleen whales, small delphinids, and killer whales (Würsig 2017). Except for West Indian manatees and common bottlenose dolphins, most marine mammal data about population size, distribution, and habitat use is incomplete. Stock assessments are conducted periodically by both aerial and shipboard surveys, but do not occur at the frequency necessary to produce population estimates with low variance. Therefore, stock assessments based on surveys conducted in the same area in different years can produce very different results (Würsig 2017). Nevertheless, trends in populations can be detected and rapid population declines have been observed.

Anthropogenic influences affect the marine environment and are stressors for marine species in the GoM. Recent research suggests that behavioral and immunological changes in marine mammals caused by human disturbance can make them behave in ways that increases their potential to be exposed to pathogens or to infect others (Collier et al. 2021). Some of the major stressors in the marine environment include ever-increasing vessel traffic, underwater noise, debris entanglement and ingestion, bycatch, prey depletion, chemical contamination, oil pollution, nesting beach impacts, and climate change (Würsig 2017, Frasier et al. 2020, Sanganyado and Liu 2021). Unusual mortality events (UMEs) in which there is a “significant die-off in a marine mammal population” may be an indicator of the chronic stress in the environment (Frasier et al. 2020). One such event in the GoM, UME #50, occurred from March 2010 to July 2014 and resulted in the stranding of 1,141 marine mammals. There have been subsequent UMEs in different parts of the GoM affecting bottlenose dolphins (NMFS 2022a).

The identified cause of UME #50 was “human interaction.” Notably, UME #50 coincided with the DWH oil spill. The DWH oil spill occurred when the Macondo well suffered a blow out in April 2010 and released about 4 million barrels of oil into the GoM for 87 days before being capped in July 2010 (USEPA 2022a). The release was permanently stopped in September 2010. The 2010 DWH oil spill resulted in the largest oil spill in the history of offshore drilling and resulted the use of an unprecedented volume of dispersants, as well as the first usage of deep dispersant injection. About 1.84 million gallons of dispersants were applied, with 1.07 million gallons applied to surface slicks and 0.77 million gallons injected on the seafloor at the Macondo wellhead (USEPA 2022a). Consequently, the DWH involved the release of dispersed oil into deepwater and pelagic habitats, creating a deep plume at about 3,600 feet deep (1100 meters) that has not been observed in other spills (USEPA 2022a, Frasier et al. 2020).

Oil released to the marine environment is transformed through physical, chemical, and biological processes, and is transported by wind and currents. The fate of spilled oil includes evaporation, surface slick formation, dispersion in the water column, and accumulation in sediments. However, the fate of spilled oil varies by water depth. Compared to surface environments, deep-water environments have lower temperatures, higher salinity, and lack light, which increases the half-life of PAHs (one of the toxic components of crude oil). These conditions increase the persistence of PAHs in the environment, but reduce their bioavailability (Kuppusamy et al. 2020).

The deep plume created by the use of dispersants at the wellhead has led researchers to believe that deep-diving species were exposed to the deep plume during foraging dives. Furthermore, dispersants likely caused a large volume of oil to never reach the surface, and that oil likely eventually settled on the seafloor, which would have affected benthic organisms and could have increased exposure of benthic feeding organisms like some dolphins and sea turtles, and possibly Rice’s whales (Frasier et al. 2020).

Deep-sea corals provide important nutrient cycling in deepwater habitats. A study of biodiversity of corals in the GoM and western Atlantic, analyzed the regional deep-sea coral biodiversity patterns over a 58-year period. The analysis found that corals on the GoM continental slope exhibited a gradual decline from 2008 to 2012, while those on the northern GoM slope showed a rapid decline in 2008 (Zimmerman et al. 2020). In a review of research about the DWH oil spill, Bracco et al. (2020) summarized research on the effects of the DWH on deep coldwater corals on the continental slope. In the fall of 2010, corals within lease block MC294 (Mississippi Canyon) at a depth of about 4,495 feet (1,370 meters) were discovered with what appeared to be covered in “dark flocculent material that contained a mixture of Macondo oil and dispersant.” Similar findings occurred in corals found in even deeper water from about 5.6 to 13.7 miles (about 9 to 22 kilometers [km] from the well). Sediments in the vicinity of the coral communities also contained abundant amounts of Macondo oil and dispersants. Further, it appears that the most damaged coral communities occurred in areas below the deepwater plume. The damage slowed after 2 years but remains severe, and 7 years after the DWH spill, coral branch loss in the corals affected was higher than normal (Bracco et al. 2020, Gil-Agudelo et al. 2020).

Nearly a decade after the DWH oil spill, researchers met to summarize the effects of the spill on vertebrate species and identify gaps in the understanding of oil toxicity. Takeshita et al. (2021) reported that the toxic responses identified were consistent across all taxa and included: “impairment of stress responses and adrenal gland function, cardiotoxicity, immune system dysfunction, disruption of blood cells and their function, effects on locomotion, and oxidative damage.” Impacts included both molecular and cellular effects that led to organ dysfunction, and whole system effects that reduced fitness, growth, reproductive potential, and survival. The level of exposure affected the outcome with those exposed to the highest doses or concentrations of contaminants experiencing multi-organ system failure (Takeshita et al. 2021, Ruberg et al. 2021).

There are several pathways by which marine mammals can be exposed to oil and oil compounds, including through the skin, through the lungs while breathing, and through ingestion of exposed prey. In the case of the DWH spill, exposure likely occurred for the deep diving species foraging within the deep plume. The effects of DWH included both acute and chronic effects, and some species were likely more strongly affected than others based on their seasonal presence in the GoM. For example, year-round residents such as sperm whales, *Kogia* species, and mid-frequency cetaceans, among others, likely experienced direct oil exposure. Some species that move seasonally that were directly affected early on may have reduced their exposure over time as they moved to other areas. Other species like Cuvier’s beaked whale are unlikely to have been directly affected due to their seasonal absence during the time of the spill (Frasier et al. 2020).

In addition to the effects in deep oceanic waters of the GoM, shoreline habitats were also affected by the DWH oil spill. Oil reached many shoreline habitats and estuaries within the bays of the GoM. These ecosystems provide shelter and food sources, especially for nearshore species such as the bottlenose dolphin.

Climate change is another factor affecting the GoM. Climate change affects oceans in many ways such as increasing sea temperatures, altering seawater chemistry (e.g., pH, salinity), and mixing. These changes can result in shifts in species presence, changes in feeding behavior, loss of prey, loss of habitat, and increased energy demands for thermoregulation, all of which may lead to reduced fitness. Loss of prey may lead to insufficient nutrition for lactating females, which may result in insufficient milk production and lower reproductive success (Sanganyado and Liu 2021).

Nineteen species of non-endangered marine mammals or cetaceans were reviewed for potential presence in the area of the GoM where the SPOT Project has been proposed and are discussed in more detail below. Table 3.5.7-1 includes a summary of marine mammals protected under MMPA, and the likelihood of occurrence near the proposed Project. Baseline information is included for each species in the following sections. Marine mammal hearing groups are provided in Table 3.5.7.2.

Table 3.5.7-1: Gulf of Mexico Marine Mammal Summary with Likelihood of Occurrence

Common Name	Scientific Name	Potential Occurrence in VLCC or Other Crude Oil Carrier Transit Routes from the EEZ	Potential Occurrence During Construction of the Subsea Pipeline and DWP [a]
Atlantic spotted dolphin	*Stenella frontalis*	Possible	Likely
Blainville's beaked whale	*Mesoplodon densirostris*	Possible	Unlikely
Bottlenose dolphin	*Tursiops truncatus*	Possible	Likely
Clymene dolphin	*Stenella clymene*	Possible	Unlikely
Cuvier's beaked whale	*Ziphius cavirostris*	Possible	Unlikely
Dwarf sperm whale	*Kogia sima*	Possible	Unlikely
False killer whale	*Pseudorca crassidens*	Possible	Unlikely
Fraser's dolphin	*Lagenodelphis hosei*	Possible	Unlikely
Gervais' beaked whale	*Mesoplodon europaeus*	Possible	Unlikely
Killer whale	*Orcinus orca*	Possible	Unlikely
Melon-headed whale	*Peponocephala electra*	Possible	Unlikely
Pantropical spotted dolphin	*Stenella attenuata*	Possible	Possible
Pygmy killer whale	*Feresa attenuata*	Possible	Unlikely
Pygmy sperm whale	*Kogia breviceps*	Possible	Unlikely
Risso's dolphin	*Grampus griseus*	Possible	Possible
Rough-toothed dolphin	*Steno bredanensis*	Possible	Unlikely
Short-finned pilot whale	*Globicephala macrorhynchus*	Possible	Unlikely
Spinner dolphin	*Stenella longirostris*	Possible	Unlikely
Striped dolphin	*Stenella coeruleoalba*	Possible	Unlikely

Source: Waring et al. 2016; Hayes et al. 2019

DWP = deepwater port; EEZ = exclusive economic zone; VLCC = very large crude carrier

[a] Likely = Species has regular sightings; Possible = Species occurs on a semi-regular basis; Unlikely = Species occurs only occasionally

Table 3.5.7-2: Hearing Groups of Marine Mammals in the Gulf of Mexico

Hearing Group	Marine Mammal Type	General Hearing Range [a]
Low-frequency cetaceans	Baleen whales [b]	7 Hz to 35 kHz
Mid-frequency cetaceans	Dolphins, toothed whales, beaked whales, and bottlenose whales	150 Hz to 160 kHz
High-frequency cetaceans	True porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagemorhynchus cruciger* and *L. australis*)	275 Hz to 160 kHz

Source: NMFS 2016

Hz = hertz; kHz = kilohertz

[a] The hearing range represents all species within the range; individual species may have narrower hearing ranges (Southall et al. 2007).

[b] All low-frequency cetaceans occurring in the GoM are federally listed species and are addressed in detail in the Biological Assessment (Appendix E1).

Atlantic Spotted Dolphin

Atlantic spotted dolphins (*Stenella frontalis*) occur throughout the warm temperate, subtropical, and tropical waters of the Atlantic Ocean (NMFS 2019c). They occur in two distinct forms, of which only the large and heavily spotted form occurs in the GoM. Within the GoM, there are two independent populations, one that occurs in continental shelf waters (typically less than 328 feet) from Texas to Mexico, and one that is concentrated in shelf waters of the eastern GoM to the Florida panhandle. There appears to be some overlap between the two populations between Mobile Bay and Cape San Blas (Waring et al. 2016). Atlantic spotted dolphins usually live in coastal or continental shelf waters that are 65 to 820 feet deep, but are sometimes found in deeper oceanic waters (NMFS 2019c). The last abundance estimates for Atlantic spotted dolphin combined surveys conducted on the outer continental shelf in fall 2000 to 2001 and in oceanic waters during spring and summer of 2003 and 2004 for a total estimate of 37,611 (Waring et al. 2016). Atlantic spotted dolphins were among the species impacted by UME #50, which occurred in the northern GoM from March 2010 through July 2014.

Atlantic spotted dolphins are usually found in groups of fewer than 50 individuals but may travel in larger groups of around 200 animals. School sizes vary in both size and composition and groups may form according to age and sex and they are known to form associations with bottlenose dolphins. Females become sexually mature around age 9 to 10 years and males reach sexual maturity at 18 years old. Typically, females give birth every 3 to 4 years and nursing may last anywhere from 3 to 5 years. Natural mortality of first-year young averages 24 percent (Herzing and Perrin 2018).

Like other dolphin species in the GoM, they are mid-frequency cetaceans (NMFS 2016). Their echolocation signals are similar to those used by other dolphins (Herzing and Perrin 2018). Researchers note that the varied whistles produced by this species were related to specific types of behaviors. They used longer whistles at higher frequencies during fast movement at the water surface, while pursuing prey, participating in aerial behavior, and while making physical contact (Azevedo 2010). Atlantic spotted dolphins hear best at a frequency of about 40 kilohertz (kHz) and the upper limit of hearing occurs above 120 kHz (Greenhow 2013).

The Atlantic spotted dolphin diet consists of small fish, invertebrates, and cephalopods (e.g., squid and octopi). They often work together and, in some places, are known to form temporary mixed-species feeding aggregations that may include tuna, birds, and other cetaceans (NMFS 2019c; Herzing and Perrin

2018). This species may also hunt alone and use their beaks to dig in the sand on the seafloor to catch hidden prey. Threats to this species include entanglement in fishing gear, ocean noise, and human harassment and illegal feeding activities (NMFS 2019c).

Blainville's Beaked Whale and Gervais' Beaked Whale

Blainville's beaked whales (*Mesoplodon densirostris*) live in tropical to temperate waters worldwide while Gervais' beaked whales (*Mesoplodon europaeus*) occur primarily in tropical, subtropical, and temperate waters of the Atlantic Ocean and the deeper waters of the northern GoM (NMFS 2019g; NMFS 2020d; Waring et al. 2013). It is difficult to distinguish different species of beaked whales in the GoM during surveys. Therefore, population size includes a combined abundance estimate for both Blainville's beaked whale and Gervais' beaked whale, with the most current estimate based on summer 2017 and summer/fall 2018 oceanic surveys in the GoM totaling 98 (Hayes et al. 2021). The previous estimate of 149 was based on summer surveys from 2009 (Waring et al. 2013). Spring and summer surveys indicate a wide distribution of beaked whales in the GoM, generally in waters greater than about 1,640 feet (Waring et al. 2013). Blainville's beaked whales inhabit deep, offshore waters (656 to 3,281 feet) off the continental shelf that often include steep underwater geological structures such as banks, submarine canyons, seamounts, and continental slopes (NMFS 2019g).

Stocks of Blainville's beaked whales inhabiting U.S. waters have been divided into three groups: Hawaiian stock, northern GoM stock, and western North Atlantic stock. Two stocks (the northern GoM and the North Atlantic) are considered strategic[5] (NMFS 2019g).

Mesoplodon beaked whales are shy animals that inhabit deep waters. Consequently, they are not frequently observed and remain generally inconspicuous for the relatively short periods they are at the water's surface. Little is known about many aspects of *Mesoplodon* biology, include gestation or lactation periods, or species longevity, but like other cetaceans, females give birth to one calf at a time (Pitman 2018).

Beaked whales (mid-frequency cetaceans) vocalize using clicks for echolocation and navigation purposes, but vocalizations usually occur when whales are in water deeper than 200 meters (656 feet). The only known vocalization used by beaked whales are clicks, and the range and speed of these clicks differentiate their purpose. Generally, rapid clicks are associated with prey capture and can occur at frequencies of up to 200 kHz. Clicks used in navigation help orient individuals to their surroundings and typically occur within a range of 2 to 20 kHz (MacLeod 2018).

Mesoplodon whales are suction feeders that hunt in deep water where they prey primarily on cephalopods, mysid shrimp, and small fish. They detect prey acoustically while diving to depths of at least 1,600 to 3,300 feet. During foraging, they use distinct clicks that change in rate and type as they approach prey items (Pitman 2018; NMFS 2019g).

Mesoplodon whales can be found alone or in small social groups of about three to seven animals, but can occur in larger groups of up to 15 animals. Threats to this species include entanglement in fishing gear,

[5] The term "strategic stock" is defined as a marine mammal stock: (1) for which the level of direct human-caused mortality exceeds the potential biological removal level; (2) which, based on the best available scientific information, is declining and is likely to be listed as a threatened species under the ESA within the foreseeable future; or (3) which is listed as threatened or endangered under ESA (81 Fed. Reg. 70097).

marine debris, hunting, and ocean noise (NMFS 2019g; NMFS 2020d; Pitman 2018). Noise associated with seismic surveys and military sonar exercises are also believed to be a threat to the species, as strandings of beaked whales have occurred in conjunction with military sonar exercises (Pitman 2018).

Bottlenose Dolphin

Bottlenose dolphins (*Tursiops truncates*) occur globally in temperate and tropical waters. They use a wide variety of habitats, including harbors, bays, gulfs, and estuaries. They occur in nearshore coastal waters, deeper waters associated with the continental shelf, as well as offshore oceanic waters. In the northern GoM, they inhabit both coastal and offshore waters. There are 46 stocks along the Atlantic Coast and GoM that are considered strategic (NMFS 2019b). Based on genetic and photographic evidence, inhabitants of specific nearshore bays, estuaries, and sounds (BSE) make up relatively discrete stocks, with residents that tend to remain in a particular BSE long-term. In Texas, at least four BSEs have been identified with resident dolphins (i.e., Matagorda-Espiritu Santo Bay, Aransas Pass, San Luis Pass, and Galveston Bay). Resident dolphins from various BSEs may move seasonally between the inshore habitats and Gulf coastal waters; some BSEs also exhibit increased abundance in spring or fall, which may occur in Galveston Bay. Differences in the ecology and habitat use have also been reported for dolphins from different BSEs. For example, squid is not a part of the diet of resident dolphins in Sarasota Bay, Florida, while squid are eaten by dolphins in nearby areas. Resident dolphins that occupy some bays have been documented to move seasonally out of the bay and into GoM waters in fall/winter, and return to the bay in spring/summer. Such movements are thought to occur in Matagorda Bay and seasonal changes in abundance of bottlenose dolphins are thought to occur in Galveston Bay (Hayes et al. 2019). Abundance estimates for BSE dolphin stocks occurring closest to the Project site are provided in Table 3.5.7-3 and a map showing estuary locations in relation to the SPOT DWP is shown on Figure 3.5.7-1.

Table 3.5.7-3: BSE Abundance Stock Estimates

Gulf of Mexico Estuary	Common Bottlenose Dolphin Abundance Estimate	Distance to SPOT DWP (miles)
Matagorda Bay/Tres Palacios Bay/Lavaca Bay	61	72
West Bay	32	56
Galveston Bay/East Bay/Trinity Bay	152	80

Source: Hayes et al. 2019

Figure 3.5.7-1: Estuaries with Bottlenose Dolphin Populations in Relation to the SPOT Deepwater Port

Abundance estimates for the bottlenose dolphin continental shelf stock is separate from the BSE stocks. There may be some overlap between coastal stocks and the continental shelf stock, but researches do not believe that interbreeding or significant mixing occurs between these stocks. Dolphins in the continental shelf stock occur at water depths of 20 to 200 meters (65.6 to 656.2 feet). The current abundance estimate for the continental shelf stock based on spring, summer, and fall 2011, and winter 2012 surveys is 51,192 dolphins (Waring et al. 2016). The Northern Gulf of Mexico oceanic stock includes dolphins inhabiting ocean waters from the 200-meter isopleth to the United States EEZ. The current abundance estimate for the oceanic stock is 7,462 based on summer 2017 and summer/fall 2018 ocean surveys (Hayes et al. 2021).

Bottlenose dolphins can live 40 years or more; the age of sexual maturity varies based on the population, but generally occurs between 5 to 15 years old. The gestation period is about 1 year, and young may nurse as long as 20 months. Calves remain with their mother for 3 to 6 years (NMFS 2019b). Bottlenose dolphins exhibit regional differences in reproduction. For example, bottlenose dolphins on the Texas coast give birth most frequently in early spring while bottlenose dolphins on the west coast of Florida give birth most frequently in mid to late summer (Urian et al. 1996).

Bottlenose dolphins can be found traveling individually or in groups, with the groups constantly changing, breaking apart, and reforming. The continuously fluctuating bottlenose dolphin is referred to as a tactile fission-fusion society (NMFS 2019b; Henderson and Würsig 2007). They are social animals with a complex social structure. Bonds between mother and calf are strong prior to weaning but, generally, associations between different individuals may vary daily. Social structure within different bottlenose dolphin populations also varies and may be driven, in part, by resource predictability, prey availability, benefit or cost of forming associations, and habitat features. Researchers have reported strong bonds between males in many populations under various circumstances, while females tended to form looser associations with other females, perhaps related to reproductive status or other factors such as defense from predators (Moreno and Acevedo-Gutiérrez 2016; Stanton and Mann 2012). Basic social groups may also include nursery groups and mixed sex juvenile groups (Wells and Scott 2018).

Whistles, echolocation clicks, and burst-pulse sounds are the main categories of sounds produced by bottlenose dolphins that fall in the mid-frequency cetacean hearing group. Similar to how humans use names, research suggests that bottlenose dolphins develop signature whistles that are specific to individuals. The signature whistle for each individual remains stable once it is developed as a newborn. Individuals copy the whistles of other individuals, and will exchange signature whistles when they encounter one another. Whistles are also used to remain in contact with other dolphins, including individuals who may be more than 5 kilometers (3.1 miles) away. Echolocation clicks are believed to be used for navigation, foraging, communication, and predator detection with peak frequencies in the 40 to 130 kHz range. Dolphins appear to use the burst-pulse sounds as part of their social-interactions. Researchers also report that dolphins can use low-frequency narrow band social calls and calls that are context specific associated with food (Wells and Scott 2018). Research indicates that 150 kHz is the upper limit of dolphin hearing (Au 2018).

Bottlenose dolphin behavior and habitat use is flexible. Using photo identification, researchers identified two distinct populations of bottlenose dolphins in the San Luis Pass area of Galveston Bay and found they use adjacent habitats differently. One group is considered a resident population while the other is considered more transient. The resident group exhibits group foraging behavior and primarily forages in the bays and pass. Conversely, the transient population remains on the Gulf side of the Galveston Island where they forage individually in coastal waters of the GoM. When the two populations periodically mix in GoM waters, they appear to be traveling or are engaged in social behavior (Henderson and Würsig 2007). Further, researchers note that habitat use shifts seasonally in the Galveston Bay area, likely as a result of prey movement. Most fish and invertebrate prey species that occur in the Galveston Bay estuary migrate to GoM waters during fall and winter. This shift in prey availability may result in a corresponding shift in dolphin distribution, particularly in the San Luis Pass area, which does not appear to support dolphins in winter (Maze and Würsig 1999).

The bottlenose dolphin diet consists of fish, cephalopods, and/or crustaceans (e.g., crabs and shrimp) and they use a variety of techniques to pursue and capture prey, including passive listening and/or high-frequency echolocation. They may also hunt cooperatively to trap schools of fish (NMFS 2019b). Typically, bottlenose dolphins swallow their prey whole. However, bottlenose dolphins in the northern GoM from Louisiana to Florida have developed a unique feeding technique in which they decapitate marine catfish and only consume the posterior portion of the fish (Ronje et al. 2017). Researchers have also studied the diet of bottlenose dolphins to learn more about their habitat use. In a study from Sarasota Bay, Florida, researchers examined the stomach contents of stranded dolphins and found their diets were composed exclusively of fish, and those fish were primarily associated with seagrasses. A fish-only diet is different than the diet of other bottlenose dolphins in the northern GoM whose diet usually includes cephalopods. Additionally, 21 years of observational records showed that dolphins in the area fed near seagrasses in waters 2 to 3 meters (6.7 to 9.8 feet) deep about 23 percent of the time. Furthermore, researchers found that all prey consumed by bottlenose dolphins in Sarasota Bay are known to be sound producers, which suggests the importance of passive listening as an important feeding strategy (Barros and Wells 1998).

Threats to this species include disease, biotoxins, pollution, habitat alteration, vessel collisions, human harassment, entanglement in fishing gear, energy exploration and oil spills, and underwater noise (NMFS 2019b). These dolphins are known to suffer mortality and serious injury due to vessel strikes (Wells and Scott 2018). Bottlenose dolphins are mid-frequency cetaceans that use sound for various functions including foraging, navigation, orientation, and communication (Li et al. 2011). These functions are critical to daily life, and where they live may affect their ability to carry out these functions. Exposure to underwater noise would vary based on habitat use. For example, bottlenose dolphins foraging in nearshore shallow seagrass beds may be more exposed to anthropogenic sounds associated with recreational boating while continental shelf populations may be more exposed to anthropogenic sounds associated with shipping traffic, fishing, naval activities, and oil and gas exploration. However, recent research indicates that bottlenose dolphins and some larger dolphin species (i.e., false killer whales) are able to reduce their hearing sensitivity by as much as 20 decibels (dB) when exposed to warning signals prior to exposure to noises loud enough to elicit a behavioral response (Hickok 2017). This ability may help bottlenose dolphins use a large range of habitats in a noisy underwater environment.

Clymene Dolphin

Clymene dolphins (*Stenella clymene*) are endemic to the deep tropical and sub-tropical waters of the Atlantic and the GoM. NMFS divided the Clymene dolphin into two stocks for management: the northern GoM stock and the western North Atlantic stock. Sightings of these animals in the northern GoM occur primarily over the deeper waters (820 to 16,400 feet) off the continental shelf and primarily west of the Mississippi River (NMFS 2019e). The estimated abundance from oceanic surveys conducted in summer 2009 was 129 (Waring et al. 2013). The most current abundance estimate is 513 for the GoM population based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). Little is known about the life history of the species. They are believed to reach sexual maturity when they are about 5.9 feet long (Jefferson 2018a).

The acoustic behavior of Clymene dolphins (mid-frequency cetaceans) is not well studied, but they are considered vocal and use whistles in the frequency range of 6 to 19 kHz (Jefferson 2018a). Limited information is available about the feeding ecology of the species, but they are known to dive to feed on small fish, squid, and octopi, including some species that migrate vertically in the water column. They sometimes feed at night when prey moves closer to the water's surface (Jefferson 2018a; NMFS 2019e).

Typical groups of Clymene dolphins include 60 to 80 individuals, but they sometimes travel in groups of several hundred in parts of their range (NMFS 2019e). In the GoM, the average size of Clymene dolphin groups is 42 individuals. Stranding information for this dolphin suggests that large schools are composed of a single sex. These dolphins are known to ride bow waves, and may approach vessels traveling nearby (Jefferson 2018a). Threats to this species include entanglement in fishing gear and ocean noise (NMFS 2019e).

Cuvier's Beaked Whale

Cuvier's beaked whales (*Ziphius cavirostris*) have the most extensive range of all beaked whales and occur globally in most oceans and seas (NMFS 2020a). This species occurs in the deep, oceanic waters of the GoM (Waring et al. 2013) and are known as "champion divers" because of their ability to take deep dives for extended periods of time (Whale and Dolphin Conservation 2020). Based on summer 2009 oceanic surveys, the abundance estimate was 74 (Waring et al. 2013). The most current abundance estimate in the northern GoM for this whale is 18 and is based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). Cuvier's beaked whales feed during both day and night and are thought to be suction feeders, meaning they suction their food from the water column. They are believed to feed primarily on squid where they opportunistically prey on individuals or schools of squid. They also sometimes eat fish and crustaceans (Baird 2018a).

As with other beaked whales described above, Cuvier's beaked whales are mid-frequency cetaceans and vocalize using clicks for both echolocation and navigation purposes, but vocalizations usually occur when whales are in water deeper than 200 meters (656 feet). The only known vocalization used by beaked whales are clicks, and the range and speed of these clicks differentiate their purpose. Generally, rapid clicks are associated with prey capture and can occur at frequencies of up to 200 kHz. Clicks used in navigation help orient individuals to their surroundings and typically occur within a range of 2 to 20 kHz (MacLeod 2018).

Little is known about the life history of Cuvier's beaked whales. Females reach sexual maturity when they are about 19 feet long and males are sexually mature at about 18 feet long. One photo identified female in Hawaii had a calving interval of 6 years (Baird 2018a).

Threats to these whales include ocean noise (particularly navy sonar noise), entanglement in fishing gear, and ingestion of plastics pollution (Whale and Dolphin Conservation 2020). Because they are susceptible to impacts from high-intensity sounds, especially naval sonar, and because of their deep diving ability, these whales can suffer from decompression sickness if a sudden noise causes them to surface too quickly (Baird 2018a; Whale and Dolphin Conservation 2020).

Dwarf Sperm Whale and Pygmy Sperm Whale

Dwarf sperm whales (*Kogia sima*) are toothed whales found globally in temperate and tropical seas; pygmy sperm whales inhabit temperate, subtropical, and tropical waters worldwide. These species are unlikely to approach vessels and typically avoid both vessels and planes, making it difficult for researchers to study them. Consequently, little is known about their population size (NMFS 2020b; NMFS 2020h). Both species occur in oceanic waters of the northern GoM. It is difficult to differentiate between dwarf and pygmy sperm whales at sea, so stock estimates in the northern GoM are combined for *Kogia* species; the abundance estimate based on summer 2009 oceanic surveys was 186 (Waring et al. 2013). The most current, combined abundance estimate for these whales is 336 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021).

Researchers have noted some slight differences between the species such as the dwarf sperm whales' preference for warmer waters or differences in feeding locations. Pygmy sperm whales feed in deep water seaward of the continental shelf while dwarf sperm whales may use shallower waters of the continental shelf and slope for feeding (McAlpine 2018). Neither species is frequently found at the water's surface, but when they are, they are typically swimming slowly or lying still (NMFS 2020b; NMFS 2020h). Dwarf sperm whales frequently occur alone or in small groups with up to about 16 animals (NMFS 2020b) and pygmy sperm whales are usually found alone or in small groups with six or seven individuals (NMFS 2020h). Both species belong to the high-frequency cetacean hearing group and use clicks for echolocation with a peak frequency of 129 kHz and 127 kHz for dwarf and pygmy sperm whales, respectively (NMFS 2016; Merkens et al. 2018).

As many as 55 cephalopod species have been identified as prey for these whales. Their diets also include crustaceans and fish. *Kogia* species are believed to feed both in the water column and near or at the seafloor where they find prey using echolocation. Dwarf sperm whales can dive at least 1,000 feet to capture prey (NMFS 2020b) and pygmy sperm whales can feed at depths greater than 3,500 feet (McAlpine 2018).

Limited information is available about reproduction in *Kogia* species. Dwarf sperm whales are believed to reach sexual maturity at age 3 to 5 and pygmy sperm whales are sexually mature at about age 5. The gestation period for both species is believed to be about 11 to 12 months and there is evidence that some females produce calves in successive years (McAlpine 2018).

Threats to dwarf sperm whales include entanglement in fishing gear, marine debris, ocean noise, and vessel strikes (NMFS 2020b). Evidence suggests a propensity for *Kogia* species to ingest plastic bags, latex gloves, and balloons. As noted above, *Kogia* species are known to lie quietly at the water surface, which can sometimes make them vulnerable to vessel strikes (McAlpine 2018). The potential for vessel strikes is higher in areas with heavy ship traffic (NMFS 2020b). Finally, as with other whale species, evidence suggests that stranding events may be associated with the use of military sonar (McAlpine 2018).

False Killer Whale

False killer whales (*Pseudorca crassidens*) are toothed whales that primarily inhabit deep ocean waters of tropical and subtropical oceans but may occur closer to shore around oceanic islands (NMFS 2020c; Baird 2018b). In the northern GoM, false killer whales typically occur in deep oceanic waters (Würsig 2017). False killer whales are typically found in the deep waters of the eastern GoM and the current abundance estimate for this whale is 494 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). However, because they are top predators, false killer whales are rare (Baird 2018b). False killer whales form subgroups with strong social bonds comprised of a few individuals that remain together for years, and these subgroups are associated with larger aggregations (NMFS 2020c; Baird 2018b). They are known to associate with common bottlenose dolphins and rough-toothed dolphins. There are also documented occurrences of long-term associations with bottlenose dolphins (Baird 2018b).

False killer whales are a long-lived species, with females living into their 60s and males living into their 50s. Females reach sexual maturity around 9 to 12 years old and are thought to produce calves every 6 to 7 years. Males are sexually mature in their late teens (Baird 2018b). This species is active both day and night, and are cooperative hunters. As top predators, they can swim at high speeds, make deep dives, and jump completely out of the water while hunting. They primarily prey on large fish and squid, and may converge at capture sites where they share food (NMFS 2020c; Baird 2018b). False killer whales are within the mid-frequency cetacean hearing group (NMFS 2016). Based on hearing tests conducted on a false killer whale in Hawaii, the most sensitive hearing range for this species is from 16 to 64 kHz and corresponds with the peak frequency of echolocation pulses documented for the species (Thomas et al. 1988). In another study from 1992, one individual produced echolocation clicks with most peak frequencies between 40 and 104 kHz, and had good hearing within that frequency range. The same individual experienced hearing loss at frequencies above about 34 kHz by 2008 (Kloepper et al. 2010). Threats to false killer whales include competition with fisheries, fisheries interactions, environmental contaminants, small population size, and hunting (NMFS 2020c; Baird 2018b).

Fraser's Dolphin

Fraser's dolphins (*Lagenodelphis hosei*) occur in warm, temperate, subtropical, and tropical oceans of the world. They typically occupy deep oceanic waters (about 3,300 feet deep), but can sometimes be found near coastlines with deep coastal water. Fraser's dolphins are deep divers and are often found near nutrient rich upwelling areas (NMFS 2022b, Dolar 2018). Based on summer 2017 and summer/fall 2018, the most current abundance estimate for this species in the GoM is 213 (Hayes et al. 2021).

Fraser's dolphins have cone-shaped teeth they use to catch prey. Their diet consists of deep-sea fish, crustaceans, squid, and octopus. They can make foraging dives up to about 1,500 to 2,000 feet. Fraser's dolphins form tight groups of 10 to 100 individuals, but can be found in groups of up to 1,000. They have been observed with melon-headed whales, short-finned whales, Risso's dolphins, spinner dolphins, pantropical spotted dolphins, and sperm whales (NMFS 2022b, Dolar 2018).

Life expectancy is about 16 to 18 years, and males reach sexual maturity around age 7 to 10. Females are sexually mature at 5 to 8 years and have a 12.5-month gestation period. Calving occurs about every 2 years in different seasons from spring to fall (NMFS 2022b, Dolar 2018). The primary threat to this species is being caught in fishing gear. This species is also hunted for meat and oil in Indonesia, Japan, the Lesser Antilles, the Philippines, and Sri Lanka (NMFS 2022b).

Killer Whale

Killer whales (*Orcinus orca*) are toothed whales that are the most widely distributed cetacean and occur in every ocean worldwide. This species, though widely distributed, is more abundant in colder waters (NMFS 2020e). The abundance estimate based on summer 2009 oceanic surveys was 28 (Waring et al. 2013) and the current abundance estimate is 267 in the northern GoM based on summer 2017 and summer/fall 2018 oceanic surveys. This species occurs almost exclusively in the deeper waters of the Gulf (Hayes et al. 2021). Killer whales are very social, and live in family groups called pods with a few to more than 20 animals. Their social structure is associated with maternal lineage, and social structure varies among different groups globally (Ford 2018).

Killer whales are apex predators with the ability to feed on a wide variety of vertebrate and invertebrate species. Some groups feed primarily on fish, while others prey on marine mammals. Foraging tactics vary by region and by prey species (Ford 2018). Killer whales hunt in a coordinated fashion using teamwork to capture prey. Their diet varies depending on where they live and the hunting strategy they were taught (NMFS 2020e). Killer whales (mid-frequency cetaceans) are highly vocal, but some groups are acoustically quiet while hunting. Vocalizations among pods are distinct, and the entire pod appears to share call repertoires (Ford 2018). Research indicates this species detects sounds covering a wide range of frequencies from 0.5 to 105 kHz, but are most sensitive to frequencies from 18 to 42 kHz (Bain et al. 1993; Szymanski et al. 1999). Researchers found that the echolocation clicks of wild killer whales correspond with the most sensitive frequency recorded in an audiogram (20 kHz) (Syzmanski et al. 1999). Similar to other marine mammals, sounds received directly from the front of the animal effect these whales than sounds that are received from the side or behind them (Bain et al. 1993).

Life history and reproduction data are based largely on long-term photo-identification studies conducted on British Columbia and Alaska, but it is not known if the life history parameters are shared by other populations in different regions. Based on these studies, females reach sexual maturity and birth their first viable calf at about age 12 to 14 years. There is about a 5-year interval between calves. Calving peaks in winter, but may occur at other times. Calves are typically weaned between age 1 and 2 years. About 43 percent of neonates die within the first 6 months. Males reach sexual maturity at about age 15 years. The average lifespan of females is 50 years and about 30 years for males (Ford 2018). Threats to killer whales include lack of prey, contaminants, oil spills, vessel traffic, and underwater noise (NMFS 2020e; Ford 2018).

Melon-headed Whale

Melon-headed whales (*Peponocephala electra*) are toothed whales that occur globally throughout tropical to sub-tropical waters (NMFS 2020f). In the northern GoM, this species is usually found in water depths greater than 2,625 feet and west of Mobile Bay, Alabama. The abundance estimate based on summer 2009 oceanic surveys was 2,235 (Waring et al. 2013). The most current abundance estimate for melon-headed whales in the northern GoM is 1,749 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). They are often found in mixed aggregations with Fraser's dolphins, and have also been identified with other mammals including spinner dolphins, rough-toothed dolphins, common bottlenose dolphins, short-finned pilot whales, and pantropical spotted dolphins (Perryman and Danil 2018). Melon-headed whales often occur in groups of hundreds to over 1,000 animals (NMFS 2020f). Females reach sexual maturity at about age 7 and produce a new calf every 3 to 4 years. Males are sexually mature at about 12 to 15 years old (Perryman and Danil 2018). This species may briefly ride the bow wave of transiting vessels and may ride the bow wave for longer periods when vessels are moving at slow speeds (Perryman and Danil 2018).

Melon-headed whales feed at night on a diet of fish, squid, cuttlefish, and shrimp from the mesopelagic zone, but may also forage from the littoral zone to the bathypelagic zone. Observations of the species suggest a routine of foraging at night and resting in the morning, with the afternoon spent socializing. They are mid-frequency cetaceans and vocalize using clicks, burst-pulse sounds, and whistles, and are known to use repeated calls, which may help them recognize other individuals or groups. The frequency range of their vocalizations is from 890 to 23.5 kHz, which likely corresponds to their hearing range (NMFS 2016; Perryman and Danil 2018).

Although longline fishing and ocean noise are considered potential threats to the species, total human-caused mortality and serious injury for the GoM stock is not known and none has been documented (NMFS 2020f). There has been an increase in perfluorocarbons and flame retardants in some melon-headed whales from Japan. In some samples from Hawaii and Japan, polychlorinated biphenyl (PCB) levels have been high enough to possibly cause toxic effects. Elevated levels of metals have also been detected in the liver of melon-headed whales (Perryman and Danil 2018).

Pantropical Spotted Dolphin

The range of Pantropical spotted dolphins (*Stenella attenuate*) includes all tropical and subtropical waters worldwide (NMFS 2019d). The abundance estimate based on summer 2009 oceanic surveys was 50,880 (Waring et al. 2016). The most current abundance estimate for the species in the northern GoM is 37,195 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). Pantropical spotted dolphins in the northern GoM occur over the lower continental slope and in waters greater than 3,200 feet (Perrin 2018a). During the day, pantropical spotted dolphins are usually found in water between 300 and 1,000 feet deep but move into deeper waters at night in search of prey. Their diet consists primarily of mesopelagic cephalopods and fishes (NMFS 2019d). Pantropical spotted dolphins are mid-frequency cetaceans (NMFS 2016). Their hearing is most sensitive at 10 kHz and the cutoff frequency in which they experience high-frequency hearing loss is 14 to 20 kHz (Greenhow 2013).

Females are sexually mature around 9 to 11 years of age. The gestation period is about 11.2 to 11.5 months and the calving interval is about 2 to 3 years, but varies based on population status. Calves are weaned at about 9 months old, but may continue nursing up to 2 years old. Males are sexually mature at 12 to 15 years of age. Pantropical spotted dolphins usually occur in groups of 700 to 1,000 animals, and are often found schooling with other dolphin species. Threats to this species include entanglement in fishing gear, human harassment and illegal feeding activities, and hunting (NMFS 2019d). Underwater noise associated with oil exploration may also be a threat to this species (Perrin 2018a).

Pygmy Killer Whale

Pygmy killer whales (*Feresa attenuate*) are toothed whales that occur in deep waters of tropical and subtropical parts of the world. Primarily inhabiting warmer waters with concentrated prey, they are sometimes found close to shore near oceanic islands, but occur only in deep oceanic waters of the northern GoM (NMFS 2020g; Waring et al. 2013). Pygmy killer whales are naturally rare and are usually the least-common delphinid within their range (Baird 2018c). The abundance estimate based on summer 2009 oceanic surveys was 152 (Waring et al. 2013). The most current abundance estimate for this species in the northern GoM is 613 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021).

Pygmy killer whales are often found in groups of 12 to 50 individuals, but may occur in groups with hundreds of individuals (NMFS 2020g). According to Baird (2018c), larger groups could be cases of mistaken identity, as these whales are difficult to distinguish from other melon-headed whales that are known to occur in large groups. Pygmy killer whale groups have been documented to occur in long-term stable groups and have some long-term associations (Baird 2018c). Almost nothing is known about the life history of this species. Based on data collected from a stranded lactating female, it appear that females may reproduce by the time they reach a length of about 6.6 feet (Baird 2018c). They are classified as mid-frequency cetaceans (NMFS 2016). A hearing sensitivity study conducted on two stranded pygmy killer whales indicated that the hearing threshold is between 20 and 60 kHz, with a peak hearing sensitivity at 40 kHz (Montie et al. 2011).

These whales are believed to feed at night on a diet composed primarily of cephalopods (squid and octopus) and fish. They are believed to feed opportunistically on injured dolphins (Baird 2018c). Unlike many other dolphins, pygmy killer whales are less active and are often found resting motionless at the water surface with all individuals oriented in the same direction (NMFS 2020g; Baird 2018c). The main threats to this species are entanglement in fishing gear and ocean noise (NMFS 2020g).

Risso's Dolphin

Risso's dolphins (*Grampus griseus*) occurs worldwide in temperate, subtropical, and tropical oceans. Their preferred habitat appears to be mid-temperate waters of the continental shelf and slope and may also concentrate around steep shelf-edge areas. They inhabit deep waters from about 650 to 3,200 feet with steep bottom topography, but are also known to inhabit shallower coastal areas (NMFS 2019f; Hartman 2018). The abundance estimate based on the summer 2009 oceanic surveys was 2,442 (Waring et al. 2016). The most current abundance estimate of this species in the northern GoM is 1,974 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021).

Risso's dolphins are social animals and are usually found in groups of 10 to 30, although they are sometimes found individually, in pairs, or even in loose aggregations of hundreds or thousands of animals (NMFS 2019f; Hartman 2018). Associations with other delphinid species are common and there have been reports of wild hybrids with bottlenose dolphins. They have a complex social structure and mating system, through there is limited reproduction information available. Females are sexually mature at about 8 to 10 years old and males reach sexual maturity at about 10 to 12 years old. The gestation period is about 13 to 14 months and the females can produce calves about every 4 years. The peak calving season varies by region with a summer calving season reported for the North Atlantic. In some populations, nursing females occupy smaller areas and occur closer to the coast (Hartman 2018).

This species spends daytime hours socializing, traveling, and resting. Foraging may begin in the late afternoon and continues through the night. Risso's dolphins use echolocation clicks while foraging and mainly prey on squid, octopus, and cuttlefish from the mesopelagic zone (about 650 to 3,200 feet) (Hartman 2018). Risso's dolphins are considered mid-frequency cetaceans, though there is limited data specific to Risso's dolphin hearing (NMFS 2016; Greenhow 2013). One recent study of two mother/calf pairs found they are most sensitive to sounds at a frequency of 40 kHz, with a cutoff frequency at about 120 kHz (Greenhow 2013). Threats to this species include entanglement in fishing gear, water contaminants, and ocean noise (NMFS 2019f). Ingestion of marine debris (e.g., plastic) may also be a threat to this species (Hartment 2018).

Rough-toothed Dolphin

Rough-toothed dolphins (*Steno bredanensis*) occur worldwide in tropical and warmer temperate waters (NMFS 2020i). In the northern GoM, they occur primarily in the deeper oceanic waters, but have also been found in continental shelf waters. Nearly all sightings of this species occur in waters deeper than 328 feet, with most occurring deeper than 3,281 feet. Hayes et al. (2017) reported an abundance estimate of 624 in the northern GoM based on summer 2009 oceanic surveys. However, the current abundance estimate is unknown because there were no sightings of this species during the summer 2017 or summer/fall 2018 oceanic surveys (Hayes et al. 2021). These dolphins form close groups of about 10 to 20 animals, but sometimes occur in groups with 100 or more animals in different parts of the world

(NMFS 2020i; Jefferson 2018b). They are known to associate with other marine mammals, and lone animals have been spotted with short-finned pilot whales and Fraser's dolphins. Of the many cetaceans, rough-toothed dolphins are considered to be the most intelligent (Jefferson 2018b).

Females reach sexual maturity at about 8 to 9 years old and males are sexually mature at about 5 to 10 years old. Little else is known about their life history but a summer calving peak has been reported off Hawaii (Jefferson 2018b).

There is limited data on the acoustic behavior of rough-toothed dolphins, but they are grouped with other mid-frequency cetaceans and are known to produce echolocation clicks from 10 to 90 kHz and short-duration whistles with an average frequency range of 2.5 to 10 kHz (NMFS 2016; Caruso et al. 2019). Rough-toothed dolphins forage during the day and their diet is primarily composed of squid and various fishes. Both coastal and oceanic prey species are taken. There are physical adaptations that suggest this species is capable of long, deep dives. These dolphins are not fast swimmers, but are known to ride bow waves and to skim the water surface at moderate speeds (Jefferson 2018b). Threats to this species include entanglement in fishing gear, underwater noise, and hunting (NMFS 2020i).

Short-finned Pilot Whale

Short-finned pilot whales (*Globicephala macrorhynchus*) are long-lived toothed whales that inhabit tropical, subtropical, and warm temperate oceans worldwide (NMFS 2020j; Olson 2018). In the northern GoM, they typically occur along the continental slope in water deeper than 328 feet, but also occur in the deeper oceanic waters. The abundance estimate based on summer 2009 oceanic surveys was 2,415 (Waring et al. 2016). The most current abundance estimate in the northern GoM is 1,321 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). The species is sexually dimorphic; compared to females, adult males have a larger melon, a larger dorsal fin, and are longer. One potential reason for the larger size may be that it helps males defend their school from predators (Olson 2018).

Pilot whales are a nomadic species, although there are reports of some resident populations in different parts of the world. Mixed species groups are frequently observed and may occur with other dolphins or whales, but the most common association is with common bottlenose dolphins (Olson 2018). They are social whales that live in stable groups typically comprised of close matrilineal associations with 15 to 30 animals. Females stay in the same group throughout their lives, while males may leave their birth group to join other schools (NMFS 2020j). However, there is also evidence to suggest that male pilot whales may remain in their birth group but mate with females from other groups when multiple groups form large aggregations. Females reach sexual maturity at age 9 years and males are sexually mature at age 13 to 16 years (Olson 2018). Calves may nurse for 3 years or more and the female birth interval is every 5 to 8 years (Olson 2018; NMFS 2020j).

Short-finned pilot whales (mid-frequency cetaceans) use a variety of vocalizations, including echolocation buzzes and clicks while foraging and tonal and pulsed calls associated with social interactions. They use group-specific calls within their matrilineal family group. Their calls have an average frequency of about 7,870 Hertz (Hz) (Olson 2018). The peak hearing sensitivity reported from four stranded females was 40 kHz, with an upper limit of 80 to 120 kHz (Greenhow 2013).

Using echolocation to hunt, short-finned pilot whales primarily feed on squid and other cephalopods, and also sometimes eat fish. Pilot whales have been documented to move seasonally based on squid distribution (Olson 2018). These whales use deep, high-speed dives while foraging and typically hunt in water 1,000 feet or more deep. Threats to short-finned whales include entanglement in fishing gear and vessel strikes. These whales are also hunted in Japan and the Lesser Antilles (NMFS 2020j). Pilot whales accumulate heavy metals because of their place high on the food web, which may cause toxic effects. Finally, underwater noise caused by commercial shipping, marine construction, oil and gas exploration activities, and military sonar can alter pilot whale diving and acoustic behavior, and can cause physical injury or mortality (Olson 2018).

Spinner Dolphin

Spinner dolphins (*Stenella longirostris*) occur worldwide in all tropical and most subtropical waters (NMFS 2020k). In the northern GoM, they generally occur east of the Mississippi River in waters deeper than 328 feet (Waring et al. 2013). The abundance estimate in the northern GoM based on summer 2009 oceanic surveys was 11,441 (Waring et al. 2013). The most current abundance estimate is 2,991 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). Social structure and school size is widely varied and flexible, and schools can include only a few individuals to more than 1,000. Sexual maturity occurs around 8 to 9 years old in females and around ages 7 to 10 years for males. Breeding is generally seasonal, but seasonality is more pronounced in some regions than others. The gestation period is about 10 months and calves may nurse for 1 to 2 years. Females produce calves about every 3 years (Perrin 2018b; NMFS 2020k).

Like other dolphins, spinner dolphins are mid-frequency cetaceans and use a variety of vocalizations including clicks, "screams," burst-pulse sounds and whistles based on the social context (NMFS 2016; Hawai'I Marine Mammal Consortium 2020). Spinner dolphins hear best at a frequency of about 40 kHz and the upper limit of hearing occurs above 120 kHz (Greenhow 2013). Though the reason that spinner dolphins spin is unknown, some suggest it is because the violent spin and re-entry creates a large underwater bubble plume that can be used to communicate an echolocation target to other members of the school that may be widely dispersed (Perrin 2018b).

Spinner dolphins are nighttime hunters and take advantage of the movements of their prey, which moves from deep oceanic waters to shallower waters (i.e., 650 to 1,000 feet) at night. Prey items include small fish, shrimp, and squid. While resting, spinner dolphins remain in a tight formation without touching and move as a synchronous group. They prefer to rest in areas with open, sandy bottoms where it is easier to spot potential predators. Threats to the species include marine debris, underwater noise, disease, and human interactions and viewing pressure (NMFS 2020k).

Striped Dolphin

Striped dolphins (*Stenella coeruleoalba*) occur worldwide in tropical to warm temperate oceanic waters (NMFS 2019w). They are usually found from the continental slope in water deeper than 328 feet to deep oceanic waters (Archer 2018; Waring et al. 2013). The abundance estimate based on summer 2009 oceanic surveys was 1,849 (Waring et al. 2013). The most current abundance estimate for the species in the northern GoM is 1,817 based on summer 2017 and summer/fall 2018 oceanic surveys (Hayes et al. 2021). Striped dolphins form tight, cohesive groups that vary in size by region. School sizes can range from 10 to 30 individuals to several hundred individuals. The schooling system is complex, with varying groups of juveniles, adults, and mixed schools; schools may also be divided by breeding status. Sexual maturity in females occurs between age 5 and 13 years, and occurs in males between age 7 and 15 years. Mating occurs seasonally and the gestational period is 12 to 13 months (Archer 2018). Females give birth in summer or autumn (NMFS 2019w). The hearing ability of a striped dolphin (mid-frequency cetacean) was documented within a frequency range from 29 to 123 kHz with a peak sensitivity at 64 kHz (Kastelein et al. 2003).

The striped dolphin diet varies by region and includes prey from throughout the water column. They feed on fish, squid, and octopus. Foraging typically occurs when prey migrates toward the water surface in the evening and during the early nighttime hours (Archer 2018). Threats to this species include entanglement or capture in commercial fishing gear, environmental toxins, which lowers their disease immunity, and hunting (NMFS 2019w). Striped dolphins in Japanese waters have experienced a dramatic increase in organohalogen compounds from flame retardants polybrominated diphenyl ethers and hexabromocyclodolecane (Archer 2018).

3.5.7.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on marine mammals. The study area within which potential impacts were assessed includes the shoreline from Brazoria County, Texas to the proposed SPOT DWP and potential VLCC or other crude oil carrier transit routes extending to the U.S. EEZ in the GoM.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on marine mammals have been evaluated based on their potential to:

- Violate a legal standard for protection of a species;
- Degrade the commercial, recreational, ecological, or scientific viability or significance of a biological resource; and/or
- Measurably change the population size (density) or change the distribution of an important species in the region.

The remainder of this section describes potential impacts from construction and operation of the Project on marine mammals from turbidity and sediment deposition due to seafloor disturbance, hydrostatic test water discharge, artificial lighting on vessels and at the platform, underwater noise, vessel strikes, and accidental spills of hazardous materials, including oil spills during operation.

Bottlenose dolphin, Atlantic spotted dolphin, pantropical spotted dolphin, and Risso's dolphin could occur in the Project area during construction and all 18 species described in Section 3.5.7.1, Wildlife and Aquatic Resources, Marine Mammals (Non-Endangered), Existing Conditions could be encountered along the vessel transit routes during Project operation (see Table 3.5.7-1). The impact of the proposed Project on these species would vary depending on habitat usage and occurrence. Federally listed threatened or endangered mammals are discussed in Section 3.7, Threatened and Endangered Species, and Appendix E1, Biological Assessment.

Specific activities associated with construction and operation of the proposed Project that could impact marine mammals include:

- Pipeline construction
- HDD activities
- Dredging/jet sledding
- Pile driving
- Hydrostatic testing
- Artificial lighting
- Fixed platform discharges
- Marine debris
- Entanglements
- Operational vessel activities
- Helicopter flights
- Maintenance activities
- Accidental spills of hazardous materials

General Construction

Construction of the subsea pipelines would cause turbidity and sediment deposition due to pipeline construction, pile driving activities, and the discharge of hydrostatic test water. Burial of the pipeline would result in resuspension of sediments. The coarse sediments would resettle first and the finer sediments would remain in suspension for a longer period. The Applicant provided a sediment fate and transport model that predicted:

- Offshore pipeline trenching of one pipeline would result in increased turbidity greater than 10 mg/L over a maximum area of 19,044 acres that would attenuate to background levels within 24 hours after the disturbance ends;
- Excavation of the HDD pit would result in increased turbidity greater than 10 mg/L over a maximum area of about 6.2 acres that would attenuate to background levels shortly after the disturbance ends;
- Installation of platform piles would result in increased turbidity greater than 10 mg/L up over a maximum area of about 0.25 acre that would attenuate to background levels within hours after the disturbance ends;
- Sediment deposition > 1 mm would occur over a maximum of about 6,210 acres;
- Excavation and backfilling of the HDD pit would cause sediment deposition > 1 mm over a maximum of about 4.8 acres; and
- Installation of the platform piles would cause sediment deposition > 1 mm over a maximum area of about 0.02 acre (Appendix S, Ichthyoplankton Impact Assessment).

The subsea pipelines would be hydrostatically tested before being placed into use. The hydrostatic test seawater would be discharged at a rate of 4,000 gpm, and would take approximately 60 hours; discharge would occur via the platform deck drain that flows back to the GoM. Discharge rates of seawater from hydrostatic testing in one location could cause scouring on the seafloor. The amount of turbidity caused by scour would be dependent on the currents and location of discharge; diffusers are not planned to be used. The discharge outlet would be located about 15 feet below the surface of the sea. Due to the volume and rate of water discharges, scour is likely to occur near the platform, but would be limited to less than 3 days.

There is limited research on the direct effects of turbidity on marine mammals. Based on available information, increased turbidity is unlikely to have a direct effect on marine mammals, although indirect effects on marine mammals could occur due to changes in prey availability as a result of increased turbidity (Todd et al. 2015). Seafloor disturbance and sediment deposition could also result in the mortality of benthic organisms that may be prey for some marine mammals. However, benthic habitats generally recover quickly and the size of the disturbance would be relatively small compared to the size of the GoM. A more detailed discussion of benthic resources is located in Section 3.5.5, Wildlife and Aquatic Resources, Benthic Resources. There would be no direct impacts on marine mammals due to construction related turbidity, and sediment deposition and indirect impacts would be adverse, short-term, and negligible.

Construction activity associated with the subsea pipelines and offshore components would result in increased activity in the area. As noted in Section 3.5.5, Benthic Resources, the subsea pipeline and DWP occur along the continental shelf over areas composed primarily of mud and sand in water depths to about 115 feet. No significant hard-bottom features were identified. Most marine mammals in the GoM occur in deeper waters and are unlikely to be affected by increased activity near the Project site. However, nearshore and coastal species (e.g., several species of dolphins) could be affected by the increased level of activity leading to a temporary disruption of behavioral patterns. They may avoid the area, which could affect their ability to access prey or communicate, or could result in disruption during the calving period. Impacts on marine mammals from general construction activity would be direct and indirect, adverse, short-term, and minor, depending on the timing of construction activities.

Unlike other dolphins, bottlenose dolphins are divided into different stocks within the GoM and those stocks are not thought to regularly overlap, meaning that certain populations are limited to a specific area. Abundance estimates from different seasons suggest that seasonal movement of resident dolphins from Galveston Bay and Matagorda Bay stocks into the GoM occurs (Hayes et al. 2019), and therefore could be present in the Project area. A dolphin’s diet is flexible, but because they exhibit strong site fidelity, they are more vulnerable to adverse environmental conditions such as pollutants and oil spills. Vulnerability in species increases even more for those with specialized diets and high site fidelity (Cloyed et al. 2021). Impacts on bottlenose dolphin could be moderate because even though significant suitable habitat exists within the larger GoM, resident dolphins may be unwilling to move outside their “home range,” which could affect their ability to access prey or could cause them to experience other disturbances.

Artificial Lighting

Artificial lighting would be used during construction and operation of the Project. Offshore construction would occur 24 hours per day and would require suitable lighting. During Project operation, the SPOT DWP would use lighting necessary for safe operation of the facility. Details of the lighting associated with the DWP platform are provided in Table 3.5.3-3. Vessels calling on the SPOT DWP would also utilize nighttime lighting. Ocean lighting is a growing concern among scientists due to the increasing illumination of the coastal zone (Depledge et al. 2010). There is limited research regarding artificial lighting on the marine environment, but a new study suggests that marine food webs in the coastal zone are being affected (Boot 2017).

The Applicant would adhere to lighting regulations in 33 CFR Part 149, which are associated with safety. Platform and vessel lighting would cause increased lighting in the GoM, and would attract some species to the area. Some marine mammals could be attracted to the platform seeking prey that would be attracted to nighttime construction lighting or that would congregate at the platform during operation. However, this would likely be limited to those species who use coastal and nearshore waters (e.g., bottlenose dolphins) due to the relatively shallow water depth (i.e., 115 feet) associated with the DWP and the preference for many GoM marine mammals to use waters deeper than 300 feet. Impacts on marine mammals from artificial lighting during construction would be direct and indirect, adverse, short-term, and minor to major, depending on the activity occurring when the species are present. For example, if a marine mammal were attracted to the construction area by artificial lighting during nighttime pile driving activities, they could experience permanent injury. During Project operation, impacts would be direct and indirect, adverse, long-term, and minor. The addition of artificial light from the new platform could change prey availability, but the change is unlikely to be substantial enough to permanently alter prey availability for species in the area. Activities at the platform may cause some behavioral response in marine mammals utilizing the area.

Marine Debris

Solid waste could be inadvertently released from the platform or from vessels calling on the DWP. Floating debris including plastic particles and waste can be mistaken for food and ingested by marine mammals, sea turtles, and fish. Marine species can also become entangled in some marine debris. Ingestion of marine debris can have a variety of effects including, but not limited to, ulceration or laceration in the digestive tract leading to infection or internal bleeding, blockage of the digestive tract resulting in reduced nutrient update, retention of ingested debris, and reduction of the urge to feed. Marine mammals, including 26 species of toothed whales, are confirmed to have ingested marine debris (NOAA Marine Debris Program 2014b). Large quantities of marine debris (including plastics) occur worldwide, with concentrations found in shipping lanes, fishing areas, and ocean convergence zones. Plastic debris may float or sink and has been identified on the seafloor worldwide. Densities as high as 112 items per kilometer (0.6 mile) composed of about 70 percent plastic have been found in coastal canyons (Simmonds 2012). Some species appear more likely to be affected by ingestion of debris, likely due to their feeding habits. Simmonds (2012) provided a compilation of ingestion data from various sources that included documented ingestion by sperm whales, pygmy sperm whales, beaked whales (including Cuvier’s and Gervais’ beaked whales), Risso’s dolphin, short-finned pilot whales, Atlantic spotted dolphin, and rough-toothed dolphin, among others, with some incidences resulting in mortality.

Entanglement in marine debris can reduce the swimming and feeding abilities of marine animals and may result in injury or mortality (NOAA Marine Debris Program 2014a). The Applicant would develop and implement an operations spill response plan to minimize the potential for a release of debris from the platform. Additionally, the potential for vessels to release waste in marine waters would be low because all vessels calling on the SPOT DWP would be required to adhere to MARPOL Annex V stipulations.

Therefore, the Project is not expected to be a source of debris, although some incidental debris could be released, and impacts on marine mammals from ingestion of, or entanglement in, debris associated with the SPOT Project would be direct, adverse, long-term, and minor.

Underwater Noise

Underwater noise associated with pipeline installation/trenching, pile driving, and marine vessel traffic would increase sound levels both temporarily and permanently in the GoM. Table 3.5.7-4 provides the thresholds at which five types of marine mammals would experience temporary or permanent changes to hearing sensitivity from exposure to underwater anthropogenic sources of noise.

The standard unit of sound measurement is dB. The dB scale is a measure used to quantify sound power or sound pressure. A sound power level describes the acoustical energy of a sound and is independent of the medium in which the sound is traveling. Because sound consists of variations in pressure, the unit for measuring sound is referenced to a unit of pressure, the Pascal (Pa). A dB is defined as the ratio between the measured sound pressure level (SPL) in microPascals (μPa) and a reference pressure. In water, the sound reference level is decibels relative to 1 microPascal (dB re 1 μPa), which relates to the amplitude of a sound wave's loudness with a pressure of 1 μPa.

Pile Driving, Jet Sledding, and Vessel Traffic

Impacts due to pile driving, jet sledding, and vessel traffic could affect marine mammals because of their dependency on sound as a primary sense for navigation, finding prey, avoiding predators, and communicating with other marine fauna. Marine mammals' behavioral responses to noise range from no response to panic and flight (Southall et al. 2007). Displacement (both short and long distance) has been observed for cetaceans in response to in-water noise and can cause marine animals to move into less suitable habitat or into high traffic areas where they may be at risk of vessel collision.

Research suggests that stress due to noise can lead to long-term health problems, and may pose increased health risks for populations by weakening the immune system and potentially affecting fertility, growth rates, and mortality (Romano et al. 2004).

Noise can also cause masking, which is the interference of a marine mammal's ability to send and receive acoustic signals due to the presence of another sound. Low-frequency cetaceans are particularly vulnerable to the effects of acoustic masking caused by anthropogenic noise and researchers are beginning to recognize this threat (Clark et al. 2009). Over the past decades, commercial shipping has become more prevalent, which in turn has led to an overall increase in underwater noise (Wright 2008). Increased underwater noise affects the ability of whales and dolphins to communicate, search for prey, and avoid predators. However, Clark et al. (2009) report that assessing the effects of the ever-increasing chronic noise at the individual and population level has been difficult to evaluate.

The potential impacts on marine mammals due to various construction activities (e.g., jet sledding, anchor handling, and pile driving) and operation of the Project were analyzed. Source levels used in these analyses are provided in Section 3.13.4.2, Underwater Construction, Table 3.13-13. Acoustic injury and disturbance thresholds for marine mammals are included in Table 3.5.7-4. Based on these analyses, there would be no zone of potential injury for marine mammals due to noise generated by construction vessels or during jet sledding activities, but marine mammals would experience noise disturbance over various distances as shown in Table 3.5.7-5. Our analysis is based clarifications the Applicant provided regarding underwater noise (SPOT 2020b, 2021c).

Table 3.5.7-4: Acoustic Injury and Disturbance Thresholds for Marine Mammals

Hearing Group	Permanent Injury, Peak (SPL dB re 1μPa)[a]	Permanent Injury, Cumulative (SEL_{cum} dB re 1 μPa^{2}s)[a]		Temporary Injury, Peak (SPL dB re 1μPa)[a]	Temporary Injury, Cumulative (SEL_{cum} dB re 1 μPa^{2}s)[a]		Behavioral Response, RMS SPL (dB re 1μPa) [b]	
	Impulsive	Impulsive	Non-impulsive	Impulsive	Impulsive	Non-impulsive	Impulsive	Non-impulsive
Low-frequency cetaceans	219	183	199	213	168	179	160	120
Mid-frequency cetaceans	230	185	198	224	170	178	160	120
High-frequency cetaceans	202	155	173	196	140	153	160	120
Phocid pinnipeds (underwater)	218	185	201	212	170	181	160	120
Otariid pinnipeds (underwater)	232	203	219	226	188	199	160	120

dB re 1 μPa = decibels relative to 1 microPascal; dB re 1 μPa2s = decibels relative to 1 microPascal squared normalized to 1 second; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level

[a] Source: NMFS 2016; 2018c

[b] Source: 70 Fed. Reg. 7 (January 11, 2005)

Table 3.5.7-5: Behavioral Disturbance Threshold Distances Associated with Various Construction Activities

Project Activity	**Behavioral Response Threshold Distances 120 dB re 1 µPa (RMS SPL)**
HDD	4.3 meters / 14.1 feet
Jet trenching	1,584.9 meters / 5,198.8 feet
General construction – small vessels	464.2 meters / 1,522.8 feet
Dive support vessel	7,244.4 meters / 23,767.6 feet
Tug boat – in transit	2,928.6 meters / 9,608.4 feet
Tug boat – anchor handling	2,154.4 meters / 7,068.4 feet

Source: SPOT 2020b, 2021c

dB = decibels; dB re 1 µPa = decibels relative to 1 microPascal; HDD = horizontal directional drill; RMS = root mean square; SPL = sound pressure level

Eight, 72-inch-diameter steel piles would be installed using a conventional impact hammer operating off a derrick barge. Installation would occur 24 hours per day over the course of 10 days. The hammer would strike 1,278 times per hour, and would operate for 2 hours every 6 hours for each of the eight piles. The Applicant estimates that each 72-inch pile would require a maximum of 10,224 hammer strikes per pile and installation of the eight 72-inch piles would take about 10 days. Installation of the 16, 30-inch-diameter steel piles would occur 24 hours per day with strikes occurring every 40 minutes and an estimated maximum of 408 strikes per pile. One pile would be installed every 8 hours and it would take about 5.3 days to complete installation of all 16, 30-inch piles. The Applicant analyzed the potential impacts on marine mammals due to pile driving. Table 3.5.7-6 provides the distances within which injury or behavioral responses would occur if a marine mammal were present during pile driving activities. The Applicant proposes to implement a soft start procedure, which involves ramping up the intensity of the hammer strikes prior to operating at full capacity, and would give marine mammals an opportunity to leave the area prior to the production of maximum sound energy during pile driving activities (BMP #23). The Applicant would also use a bubble curtain system and implement stop work if marine mammals were observed approaching or were within the Level A ensonified zone (BMP #23). The complete list of mitigation measures is included in BMP #23 of Appendix N, List of BMPs.

Table 3.5.7-6: Threshold Distances for Injury to and Behavioral Response of Marine Mammals for 30-inch and 72-inch Mitigated and Unmitigated Impact Driven Steel Piles

Project Component/Pile Type/ Installation Method	Threshold Distance						
	Low-frequency Cetacean Injury Thresholds		Mid-frequency Cetacean Injury Thresholds		High-frequency Cetacean Injury Thresholds		Behavioral Response Threshold
	219 dB re 1 μPa (Peak SPL)	183 dB re 1 μPa²s (SEL_{cum})	230 dB re 1 μPa (Peak SPL)	185 dB re 1 μPa²s (SEL_{cum})	202 dB re 1 μPa (Peak SPL)	155 dB re 1 μPa²s (SEL_{cum})	160 dB re 1 μPa (RMS SPL)
Maximum Pile Strikes (408 strikes per 30-inch pile; 10,224 strikes per 72-inch pile) [a]							
PLEM/30-inch steel/impact hammer, unmitigated [b]	2.5 m/ 8.2 ft	1,142.7 m/ 3,749.0 ft	NA	40.6 m/ 133.2 ft	34.1 m/ 111.9 ft	1,361.1 m/ 4,465.6 ft	1,585 m/ 5,200 ft (1 mile)
PLEM/30-inch steel/impact hammer, mitigated [c]	NA	390.2 m/ 1,280.2 ft	NA	13.9 m/ 45.6 ft	11.7 m/ 38.4 ft	464.8 m/ 1,524.9 ft	541 m/ 1,775 ft
Platform/72-inch jacketed steel/impact hammer, unmitigated [b]	11.7 m/ 38.4 ft	25,457.7 m/ 83,522.6 ft (15.8 miles)	2.2 m/ 7.2 ft	905.4 m/ 2,970.5 ft	158.5 m/ 520.0 ft	30,324.0 m/ 99,488.2 ft (18.8 miles)	10,000 m/ 32,808 ft (6.2 miles)
Platform/72-inch jacketed steel/impact hammer, mitigated [c]	4.0 m/ 13.1 ft	8,692.6 m/ 28,519.0 ft (5.4 miles)	NA	309.2 m/ 1,014.4 ft	54.1 m/ 177.5 ft	10,354.3 m/ 33,970.8 ft (6.4 miles)	3,415 m/ 11,204 ft (2.1 miles)
Minimum Pile Strikes (194 strikes per 30-inch pile; 5,365 strikes per 72-inch pile) [a]							
PLEM/30-inch steel/impact hammer, unmitigated [b]	2.5 m/ 8.2 ft	696.1 m/ 2,283.8 ft	NA	24.8 m/ 81.4 ft	34.1 m/ 111.9 ft	829.2 m/ 2,720.5 ft	1,585 m/ 5,200 ft (1 mile)
PLEM/30-inch steel/impact hammer, mitigated [c]	NA	237.7 m/ 779.9 ft	NA	8.5 m/ 27.9 ft	11.7 m/ 38.4 ft	283.1 m/ 928.8 ft	541 m/ 1,775 ft
Platform/72-inch jacketed steel/impact hammer, unmitigated [b]	11.7 m/ 38.4 ft	16,562.2 m/ 54,337.9 ft (10.3 miles)	2.2 m/ 7.2 ft	589.1 m/ 1,932.7 ft	158.5 m/ 520.0 ft	19,728.1 m/ 64,724.7 ft (12.3 miles)	10,000 m/ 32,808 ft (6.2 miles)
Platform/72-inch jacketed steel/impact hammer, mitigated [c]	4.0 m/ 13.1 ft	5,655.2 m/ 18,553.8 ft (3.5 miles)	NA	201.1 m/ 659.8 ft	54.1 m/ 177.5 ft	6,736.3 m/ 22,100.7 ft (4.2 miles)	3,415 m/ 11,204 ft (2.1 miles)

dB = decibels; dB re 1 μPa = decibels relative to 1 microPascal; dB re 1 μPa2s = decibels relative to 1 microPascal squared normalized to 1 second; m = meters; ft = feet; NA = not applicable; peak = peak sound pressure, PLEM = pipeline end manifold; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPM = single-point mooring; SPL = sound pressure level (see Section 3.13.1 for additional information)

[a] Source: SPOT 2020b, 2021c

[b] The unmitigated thresholds presented assumes no mitigation measures.

[c] The mitigated injury thresholds presented were calculated assuming the use of a single, confined, bubble curtain for 72-inch piles and a single, unconfined bubble curtain for 30-inch piles. Both are calculated using a maximum 7 decibel source level noise reduction, but the final source level reduction could be less.

Note: NA indicated that the source level was lower than the threshold and so modeling did not proceed.

MARAD and USCG estimated the potential impacts on marine mammals due to vessel traffic. Based on that analysis, vessels transiting in the GoM would cause behavioral disturbance to marine mammals, but would not result in injury to low or mid-frequency cetaceans. The greatest disturbance would occur when a vessel is operating within the safety zone of the DWP. The threshold distances for disturbance are provided in Table 3.5.7-7.

Table 3.5.7-7: Threshold Distances for Behavioral Response of Marine Mammals Due to VLCC Traffic Associated with Operation of the SPOT Project

Vessel Speed	Behavioral Response Threshold Distance
	RMS SPL (120 dB re 1µPa)
VLCC Transit Fast (15 knots)	21,279 feet (4.0 miles)
VLCC Transit Slow (12 knots)	26,879 feet (5.1 miles)
VLCC Safety Zone Transit (3 knots)	108,637 feet (20.6 miles)

dB re 1 µPa = decibels relative to 1 microPascal; RMS = root mean square; SPL = sound pressure level; VLCC = very large crude carrier

Impacts of the proposed Project during construction from construction vessels, jet sledding, and pile driving activities on non-endangered marine mammals would vary depending on the species and habitat usage. Marine mammals are extremely mobile and may be able to avoid most disturbances. Jet sledding and vessel noise would not cause injury to marine mammals, but they would experience a behavioral disturbance within about 1 mile of the activity. These impacts would be direct, adverse, short-term, and negligible to minor.

The Applicant indicates that construction of the subsea pipelines would take 18 to 20 months to complete, and anchor handling activities would occur during that time. Any marine mammals within about 1.3 miles of anchor handling activities could experience a behavioral response to these activities. Dolphins, the most likely species to occur in the nearshore areas, could experience disturbance due to anchor handling noise and, due to their high site fidelity, could remain near construction activities. However, as construction progresses away from shore, disturbance to the species would likely be reduced. Fewer marine mammals would be expected to occur further offshore and near the DWP platform because the platform would be located in about 115 feet of water while most marine mammals in the GoM occur in deeper waters. Impacts on dolphins that live in the nearshore waters of the GoM from anchor-handling activities would be direct, adverse, long-term (lasting as much as 20 months), and minor to moderate.

Pile driving could cause injury to marine mammals over distances described in Table 3.5.7-7 and would depend on the species, the type of pile being installed, and whether mitigation measures were employed. Behavioral disturbance could occur over a maximum distance of about 6.2 miles, but is likely to be less with implementation of appropriate mitigation measures. Noise associated with pile driving could also cause behavioral disturbance including displacement of marine mammals, which can be particularly detrimental to species with high site fidelity. Research suggests that displacement can result in increased stress, reduced foraging success, and may also affect survival and reproduction (Forney et al. 2017). Dolphins are most likely to be closest to pile driving activities, and research indicates that masking can occur up to 40 kilometers (24.9 miles) from the source (David 2006). However, dolphins have directional hearing and are able to adjust their vocalization amplitude and frequency, as well as the content of their signals, which means that the behavioral response observed in dolphins may be due to changes in prey distribution rather than a direct response to the noise (David 2006). The Applicant would use Protected Species Observers during pile driving activities to monitor the 72-inch pile mid-frequency cetacean Level A ensonified area for the presence of marine mammals, which would reduce the potential for impacts on marine mammals most likely to be present in the area. However, because monitors can only observe animals at or near the water surface, there is still some potential for marine mammals not visible to the Protected Species Observers to be impacted by pile driving activities. These impacts would be direct and indirect, adverse, short-term to long-term (long-term if permanent damage to hearing occurred), and minor to major, depending on whether a marine mammal experienced an injury. Impacts from VLCC transit noise would not cause injury to marine mammals, but when vessels would be operating within the safety zone, marine mammals within about 20.6 miles of the activity would be disturbed. Disturbance of marine mammals would also occur while vessels are transiting in the GoM at distances of about 4 miles for vessels traveling at 15 knots and 5.1 miles for vessels traveling at 12 knots. These impacts would be direct, adverse, short-term (i.e., the period of time when the vessel is transiting in a particular spot) and long-term (i.e., the life of the project), and minor.

Helicopter Flights

Some level of noise would also be generated due to an anticipated once-weekly helicopter trip to the platform. The low-frequency noise produced by a helicopter radiates forward and is generally transmitted underwater in a cone shape (Erbe et al. 2016). Therefore, the underwater noise generated from a passing helicopter would be brief, but would be influenced by the altitude of the helicopter as it passes as well as the water depth and bottom conditions. Noise occurring in shallow water would spread farther than in deep water (Picher-Labrie 2019).

Disturbance due to noise generated from once-weekly helicopter trips between the shore and platform could cause behavioral effects on marine mammals present in the area. Helicopters project sound forward in a cone shape, and whales would likely need to be in the immediate vicinity of the passing helicopter to experience disturbance effects. Helicopter flights associated with the Project would cause brief and infrequent disturbance. The Applicant anticipates that each helicopter flight would be between 34 to 40 miles lasting from 13 to 18 minutes at flight speeds ranging from 120 to 140 knots. Therefore, noise impacts on marine mammals associated with helicopter traffic would be direct, adverse, short-term (i.e., during once weekly flights) and long-term (i.e., for the life of the project), and negligible.

Vessel Strikes

Vessel strikes pose a threat and may result in injury or mortality to non-endangered marine mammals during construction and operation of the Project. Vessel speed is the primary factor in the probability of a vessel strike, and of the strike being lethal (Vanderlaan and Taggart 2007).

Construction

During construction, the Applicant estimates that a total of 31 vessels would be needed, but a limited number would be used at any one time. Construction vessel speeds would vary; barges and tugs would generally be intermittently stationary or moving at speeds of 14 knots or less during Project component installation. Smaller support vessels of 16 to 49 feet could reach speeds of up to 35 knots, especially when transporting crews or supplies to or from the Project area. Vessels would be associated with each phase of construction and are presented in Table 3.5.7-8 and Table 3.5.7-9 provides the number of days anticipated for each phase of offshore construction. Increases in vessel traffic could also occur on a temporary basis in response to a spill of hazardous material during construction.

Table 3.5.7-8: Number of Construction Vessels Required for Installation of SPOT Project Components

Facility Component	Pipelay Barge or Trenching Barge	Anchor Handling Tugs	Supply Vessel	Heavy Lift Vessel	Support Tugs with Cargo Barges	Dynamically Positioned Dive Support Vessel and 4-point Dive Support Vessel	Construction Barge	Jack-Up Boat	Survey Vessel	Total
Pipe laying	1	2	1	0	4	0	0	0	1	9
Trenching	1	2	1	0	0	0	0	0	0	4
Platform	0	2	1	1	3	0	0	1	0	8
SPM & PLEM	0	1	1	0	2	2 [a]	1	0	0	7
Pre-Commissioning and Hydrostatic Testing	0	0	1	0	0	1	0	1	0	3

Source: SPOT 2019f

PLEM = pipeline end manifold; SPM = single point mooring

[a] One dynamically positioned dive support vessel and one 4-point dive support vessel.

Table 3.5.7-9: Time Period for Offshore Construction Activities

Facility Component	Number of Days Required for Installation
Pipeline installation (pipelay spread)	454
Jet sledding (pipe trenching spread)	198
Platform Installation (including hook-up and commissioning)	102
PLEM and SPM buoy installation	52
Hydrostatic testing	14

Source: SPOT 2021b

PLEM = pipeline end manifold; SPM = single point mooring

To minimize the risk of vessel collisions during construction, all construction related and support vessels would follow NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners when transiting to, from, and around the proposed SPOT DWP (BMP #24 in Appendix N). All in-water construction activities would also follow the Standard Manatee Conditions for In-Water Work (BMP #25), which would also benefit non-endangered marine mammals. Marine mammals are mobile and are generally able to avoid many disturbances. A vessel strike during construction would result in direct, adverse impacts on marine mammals. With implementation of the proposed BMPs, the risk of vessel strike is reduced, but an impact could cause injury or mortality depending on the vessel size and speed at the time of impact.

Operation

The SPOT DWP would be located in Galveston Area lease block 463, and would be about 16 nautical miles west of the nearest approach fairway. The Applicant analyzed publicly available vessel traffic data and indicated that 751 vessels transited through this lease block over a 2-year period, from January 1, 2016 to December 31, 2017. The Applicant indicates that an estimated 365 vessels would call on the DWP annually, which would result in double the average annual vessel traffic in the area during Project operation.

Additionally, overall vessel traffic is increasing throughout the GoM. MARAD (2013) reported that 10 of 132 U.S. ports accounted for 55.5 percent of calls by large oceangoing vessels in 2011, with Houston being the busiest port for tanker calls. Some of the other top 10 busiest U.S. ports included Texas City, Galveston, Corpus Christi, New Orleans, Mobile, Freeport, and Pascagoula, all within the GoM (MARAD 2013). MARAD (2013) also reported that in 2011, the United States ranked second in overall vessel calls, with tanker calls on U.S. ports accounting for almost 12 percent of all global tanker calls. Data shows that there were 38,075 tanker calls in the GoM in 2016 (Linden Houston, MARAD, Pers. Comm., July 26, 2019). The general characteristics of the crude oil carriers that could call on the SPOT DWP are provided in Table 3.5.7-10.

Table 3.5.7-10: General Characteristics of Crude Oil Carriers that Could Call on the SPOT Deepwater Port

Characteristic	VLCC	Suezmax	Aframax
Length [a]	1,092 feet	900 feet	820 feet
Beam [a]	197 feet	164 feet	105 feet
Draft [a]	71 feet	66 feet	49 feet
Deadweight tonnage (maximum load) [b]	325,000 metric tonnes	200,000 metric tonnes	120,000 metric tonnes
Estimated maximum capacity [a]	2,000,000 barrels	1,000,000 barrels	750,000 barrels

Source: [a] SPOT 2019a, Vol IIa, TR01; [b] Oil Tanks 2020

VLCC = very large crude carrier

The 71-foot draft associated with VLCCs would put any species within that portion of the water column at risk of vessel collision. The faster the vessel is traveling, the more likely the collision would lead to mortality. The Applicant estimates that VLCCs would travel at 12 to 15 knots outside of the SPM safety zone and ATBA. VLCC approach and departure maneuvering from the SPMs would not exceed 3 knots.

In the Biological Opinion for the Jacksonville Harbor Deepening and Widening Project, NMFS (2014) cited numerous studies indicating that the probability of serious injury or death increased significantly as vessel speed increases. Vanderlaan and Taggart (2007) reported that at vessel speeds of 15 knots there was about an 80 percent chance of lethal injury. When vessel speed was reduced to about 8.6 knots, the risk of lethal injury was reduced to 20 percent. Research also indicates that there are probably many more vessel strikes that are either not detected or not reported, potentially because they happened in remote areas or because the animal never washed up on shore (Jensen and Silber 2003). During Project operation, the greatest risk for a vessel strike would occur outside the SPM safety zone and ATBA within the greater GoM, when VLCCs or other crude oil carriers are traveling at higher speeds. Marine mammals within the upper 75 feet of the water column would be at greatest risk. The risk of a vessel collision is low due to the mobility of marine mammals, but it cannot be completely discounted. The USCG does not have the authority to enforce vessel speeds outside the Safety Zones that would be established for the Project, and is not authorized to create new vessel speed areas. With the increase in vessel traffic in marine mammal habitat, a vessel strike is possible, but not quantifiable. The impact would be direct and adverse, and could be lethal.

Entanglement

Marine animals could become entangled in anchor lines during construction or operation of the SPOT Project. During construction, anchor-handling tugs would support the pipeline installation barge and would use a minimum of two stem anchors, two bow anchors, and four breast anchors. A deadman anchor would also be used during pipeline installation in the GoM. Anchors would be set and raised repeatedly during the installation of the two subsea pipelines. The Applicant anticipates that construction vessels would use steel wire rope mooring lines for construction vessel stabilization. Each mooring line (8 to 10 per vessel/barge) would be up to 1,500 meters (4,921.3 feet) long with a diameter from 28 to 52 millimeters (1.1 to 2.0 inches). Expected rope tautness would be 2 to 12 tonnes per mooring line with heavy lift vessel mooring lines approaching 30 tonnes. Ropes would be spread out radially to about 30 degrees from one another. The use of ropes of any kind is not expected during Project operation.

The SPM system would use fluke anchors and anchor chains to secure the buoy in position. The two SPM buoys would each be held in place by 6 fluke anchors and anchor chains, for a total of 12 anchors. Each of the 2 SPM buoys would consist of 6 stud link chain/steel grade R4S anchor chains (for a total of 12 SPM buoy anchor chains), 4 inches thick, equally spaced on a 1,043-foot radius circle with 1,080 feet of anchor chain between the anchor and the chain stopper on the buoy. About 45 kilo-pounds (kips) (20 metric tons) of tension at the hangoff location and 30 kips (14 metric tons) of tension where it touches the seabed. Anchor chains used to hold the SPM buoys and other navigation aids in place during Project operation could also pose a threat to marine species. As a catenary[6] system, anchor chains would provide some slack, enough play to allow the buoys to move with wave action and changing tides in the GoM. In addition to anchor chains associated with the SPM buoys, VLCC and other crude carriers would use anchors to secure their position while in the anchoring area waiting to enter the DWP.

Little information is available about the relative risk of entanglement in mooring devices by marine species. Harnois et al. (2015) report that the characteristics of the mooring lines and the configurations influence the risk posed by these devices. The lowest entanglement risk of marine species is associated with taut mooring configurations, and the mooring layout, mooring line length, and line material are all factors that influence the risk of entanglement (Harnois et al. 2015). Catenary systems pose a greater risk, especially those that include nylon ropes, but other important factors include device spacing, mooring design, and array layout (Benjamins et al. 2014). Anchor lines associated with the SPM buoys would be spaced more than 1,000 feet apart, thus reducing the potential for marine species to become entangled. Large marine fauna (e.g., baleen whales) are at greatest relative risk of entanglement (Benjamins et al. 2014), but most large marine mammals would not be present in the Project area due to the relatively shallow water depth at the DWP. Secondary entanglement is entanglement of marine species on fishing gear or debris, that then becomes snagged on underwater infrastructure such as anchor lines.

A common threat to many marine animals is entanglement in fishing gear, while entanglement with anchor lines is less common. The NOAA Marine Debris Program (2014a) documented entanglements in 6 of 10 baleen whale species, 5 of 65 toothed whale species, bottlenose dolphins, and other marine animals. The majority of entanglement reports are associated with fishing gear, while entanglement in other marine debris can also occur. In 2017, a humpback whale in Alaska became entangled in an anchor

[6] Catenary is "a curve that describes the shape of a flexible hanging chain or cable" (Carlson 2021).

line of a cruise ship (NMFS, Alaska Regional Office 2017) and in 2019, NOAA and the USCG freed a whale entangled in fishing gear and a weather buoy mooring (Coast Guard News 2019). Marine mammals could become entangled in mooring lines composed of steel wire ropes used during construction. However, the Applicant has committed to providing protected species observers that would monitor in-water activity and ensure the zone of influence is clear of marine mammals. SPM buoys would be held in place with anchor chains. Chains are less likely than rope to be associated with entanglement, but the potential risk of entanglement cannot be discounted. The anchor chains used for the SPM buoys would not have protrusions that would catch on fishing gear or debris, reducing the risk of secondary entanglements. The impact on marine mammals due to entanglement would be direct, adverse, long-term, and minor.

Accidental Spills of Hazardous Materials

Contamination caused by spills of hazardous materials during construction could impact marine mammals. Sources of contaminants could come from inadvertent releases of drilling mud during HDD operations or from accidental spills of hazardous materials including gasoline, oil, hydraulic fluids, or diesel fuel. The level of impact would depend on the phase of the SPOT Project, with spills occurring during construction likely to be less harmful than spills of crude oil during Project operation.

The Applicant would install approximately 1 mile of the subsea pipelines nearest the shore using the HDD construction method. This method of construction could result in the inadvertent release of drilling mud or other lubricants if a fracture occurs during the drilling process. The density of drilling mud (65 to 89 pounds per ft^3) is greater than the density of seawater (64.2 pounds per ft^3), and the non-toxic bentonite materials would be expected to settle on the seafloor, which could smother benthic species that may be prey items for marine mammals. In order to limit the potential effects on marine life and habitats, the Applicant would implement its HDD Contingency Plan (Appendix L; BMP #6 in Appendix N). With these measures in place, impacts on marine mammals due to an inadvertent release of HDD drilling mud would be indirect, adverse, short-term, and negligible.

An inadvertent release of gasoline, oil, hydraulic fluids, or diesel fuel could occur during refueling and maintenance of construction vessels or operational support vessels, and a release of crude oil could occur during Project operation. The extent of the impact would be related to a number of factors, including the nature of the spilled material, the currents and winds, and the size of the spill. Using BOEM's NEPA planning document for evaluating potential oil spills for this type of facility, the Applicant provided modeling of a most likely scenario spill of about 2,200 bbl of oil over 1 hour for heavy crude (WCS), lighter crude (WTI), and condensate. The Applicant also modeled a worst credible spill of about 71,000 gallons of diesel fuels, which would be the maximum capacity of diesel fuel stored for the Project.

For WCS, the model predicted:

- The maximum surface exposure concentration of 5 to 10 g/m^2 (appears as fresh black oil, mousse, and sheens) would occur westward up to 62 miles from the spill site;
- A surface exposure concentration of <3 g/m^2 would spread to 93 miles southeast of the spill site;
- An estimated 243 miles of shoreline would be contaminated by >1 g/m^2 of oil along the Texas coast and part of Mexico; and

- Over a 60-day period, the model predicts that 34 percent of WCS oil would evaporate, 47 percent would reach shore, 4 percent would remain in the water column, 0.2 percent would settle in sediments, and 14 percent would biodegrade.

For WTI, the model predicted:

- A maximum surface exposure concentration of 5 to 10 g/m^2 (appears as metallic sheen) would occur within the immediate vicinity of the spill site;
- A surface exposure concentration of <3 g/m^2 (appears as rainbow sheen) would spread up to 62 miles west of the spill site;
- An estimated 146 miles of shoreline would be contaminated by >1 g/m^2 of oil from Galveston Bay to East Matagorda Bay, and
- Over a 60-day period, 64.8 percent of WTI oil would evaporate, 18.5 percent would reach shore, 0.8 percent would remain in the water column, 9.7 percent would settle in sediments, and 6.2 percent of WTI would biodegrade.

For condensate, the model predicted:

- A maximum surface oil exposure concentration of 1 to 3 g/m^2 (appears as a sheen) would occur within the immediate vicinity of the spill site;
- A concentration of <1 g/m^2 would occur within 45 miles east and west of the spill site with lower concentrations (<1 g/m^2) appearing as scattered colorless sheens;
- An estimated 7 miles of shoreline west-northwest of the spill site on the outer coast seaward of East Matagorda Bay would be contaminated with >1g/m^2 of oil; and
- Over a 60-day period, 88 percent of the oil would evaporate, 0.05 percent would reach shore, 4 percent would remain in the water column, 0.4 percent would settle in sediments, and 8 percent would biodegrade.

For diesel fuel, the model predicted:

- A maximum surface exposure concentration of 50 to 100 g/m^2 (appears as true color) would occur within the immediate vicinity of the spill site;
- A maximum surface oil exposure concentration of <5 g/m^2 (appears as a sheen) would occur up to 22 miles northwest of the spill site;
- About 10 miles of shoreline along Galveston Island would be contaminated with >1 g/m^2 of oil;
- Over a 60-day period, 61.7 percent would evaporate, 0.02 percent would reach shore, 4.2 percent would remain in the water column, 8.9 percent would settle in sediments, and 25 percent would biodegrade; and
- Within the first day after release, diesel fuel either evaporated or dispersed into the water column (SPOT 2019c, 2019d, and 2019p).

An oil spill would release PAHs into the water column where they can persist in the water or in the sediments where they settle. Volatilization and oxidation result in elimination of low molecular weight

PAHs from the water column, but adsorption of high molecular weight PAHs occurs on particles in the water and bottom sediments (Olayinka et al. 2018). The bioavailability of chemicals is generally highest in true solution in the water and is lower for chemicals in solid or adsorbed forms. The effect of PAHs on marine organisms is dependent on the bioavailability of PAHs, the exposure time, and the ability of the organism to metabolize the compounds (NRC 2003). The model for the most likely scenario oil spill also included an evaluation of the concentrations of PAHs in the water column. Based on model results, the highest dose of PAHs in water would occur during a release of WCS at the platform. All four of the modeled spills resulted in the potential for exceeding the acute effects threshold for plankton (100 ppb-hours); while a release of WTI and WCS could both exceed the acute effects threshold for fish and pigmented invertebrates (1,000 ppb-hours). Therefore, the potential exists for acute effects to occur in the water volumes provided in Table 3.5.7-11. However, the report also indicates that PAH concentrations exceeding 1 ppb would only occur for a short time and the distribution would be patchy before diluting to levels below the threshold of concern (SPOT 2019ee). As previously noted, the evaluation of effects of an oil spill used model results from the Applicant's most-likely oil spill scenario, but results of the worst credible scenario model are provided in Section 4.6.3, Potential Impacts from Oil Spills Onshore and Offshore.

Table 3.5.7-11: Modeled Results of Polycyclic Aromatic Hydrocarbon in the Water Column

	2,200 bbl Release of West Texas Intermediate	2,200 bbl Release of Western Canadian Select	2,200 bbl Release of Condensate	70,980 gallon Release of Diesel Fuel
Maximum dose (ppb-hours) [a]	4,756	5,518	1,650	694.4
Volume for maximum dose (m^3) [b]	80,640	35,960	76,210	79,330
Average dose in volume >1 ppb (ppb-hours) [c]	1,416	2,492	558.2	150.9
Volume contaminated >1 ppb (km^3) [d]	0.0445	0.150	0.112	0.167
Volume contaminated >10 ppb (km^3) [d]	0.0110	0.049	0.025	0.005
Max exposure time >1 ppb (hours) [e]	162	180	288	624
Max exposure time >10 ppb (hours) [e]	43	83	151	252

Source: SPOT 2019ee

bbl = barrel of crude oil; km^3 = cubic kilometers; m^3 = cubic meters; ppb = parts per billion; ppb-hours = parts per billion–hours

[a] Maximum dose (concentration x exposure duration) at any single time step in any location.

[b] Volume of water that contained the maximum dose.

[c] Average dose in all waters that had dissolved oil concentrations > 1 ppb.

[d] Volume of water that exceeded 1 ppb and 10 ppb at any given time.

[e] Maximum number of hours with exposure concentrations >1 or 10 ppb.

PAHs are one of the most toxic constituents found in oil. PAHs that have not been metabolized can be toxic, while some reactive metabolites can result in biochemical changes in the body and can also cause cell damage that results in mutations, tumors, and cancer (Kannan and Perrotta 2008). Any release of these hazardous materials would cause direct adverse impacts on marine mammals present at the time of the release. Early studies suggested cetaceans would be able to detect and avoid oil and that oil would not adhere to their skin. However, field observations and photographic evidence collected after the DWH oil spill, which released millions of barrels of oil into the GoM for 87 days, documented cetaceans swimming through oil and oil sheen, and that oil not only adhered to their skin, but also persisted (Dias et al. 2017). Scientists studied how the DWH oil spill affected cetaceans from 2010 to 2015. Numerous cetacean exposure pathways and their effects were identified (Takeshita et al. 2017). Exposure likely occurred through a combination of pathways including contaminated air, water, and sediment that were inhaled, ingested, aspirated, and absorbed. The effects of these exposures could include localized skin and eye wounds, lung disease, gastrointestinal injury, and effects on adrenal glands, reproduction, and the liver (Takeshita et al. 2017; Schwacke et al. 2014; Venn-Watson et al. 2015, Ruberg et al. 2021, Takeshita et al. 2021). NMFS (2018a) reported 14 dolphin and whale live strandings during the DWH oil spill and more than 150 dolphins and whales found dead during the oil spill response. Evidence also suggests that pulmonary abnormalities and impaired stress response observed in dolphins exposed to oil can persist for at least 4 years, even as general health shows some improvements (Smith et al. 2017).

Because metals and are known to accumulate in marine animal tissue, Wise et al. (2014) collected skin samples from sperm whales to evaluate if metals identified in crude oil from the DWH spill were found in whales. Of the metals identified, nickel (Ni) and chromium (Cr) are known human and animal carcinogens, and are known to damage DNA. Wise et al. (2014) found both Ni and Cr in whale tissue, with the highest concentrations found in whales that were nearest the accident. They also found that concentrations of Ni and Cr were significantly higher than concentrations found in non-resident GoM sperm whales. Though the source of these metals in the GoM is unknown, it is plausible that the elevated metal concentrations found in whales resulted from inhalation during burnoff efforts (Wise et al. 2014).

In addition to the direct effects of oil and dispersants, cleanup and containment operations also may have an effect on marine mammals. Cleanup may include containing oil in booms, skimming oil at the ocean surface, and burning. Cleanup would also involve a large number of vessels and aircraft in the coastal and offshore habitats bringing increased noise levels and human presence into marine mammal habitats. These activities could stress and disturb marine mammals, potentially displacing them from important feeding or breeding grounds and disrupting normal behavior. Furthermore, if a marine mammal were within the vapor dispersion and/or flash fire hazard zones from a potential condensate or crude oil spill, an immediate adverse impact could occur if an ignition source were encountered and the species could not avoid the area.

To mitigate impacts during construction, vessels used for installation of the offshore pipelines would be equipped with spill containment and cleanup equipment to respond to small, accidental releases on-deck. These measures would minimize the extent and impacts from a small spill in marine waters and minimize the impacts on marine mammals.

To minimize the impacts of an oil spill, the pipelines would be constructed with shutdown valves to allow sections of the pipeline to be isolated. The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3). In the event of an oil spill, the Applicant would mobilize a shore-based emergency response team. The Applicant would develop an operational spill response plan that would include the measures it would implement. The Applicant provided the following hypothetical actions it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions):

- Booming-containment
- Skimming
- Physical herding

- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

In addition, all vessels would be required to have a USCG-approved Vessel Response Plan consistent with 33 CFR Part 155, and abide by other Federal regulations as described in Section 3.3.7.4, Water Resources, Coastal and Marine Environment, Impacts and Mitigation. The potential of an oil spill occurring is relatively low, but the effects of crude oil contamination on marine mammals could be substantial; therefore, impacts on marine mammals would be direct, adverse, short-term to long-term, and minor to major, depending on the volume of hazardous material released and the exposure of species to the release.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Spills of Hazardous Materials. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.6. Estuarine and Marine Fisheries

3.6.1. Definition of the Resource

This section describes estuarine and marine fisheries, which are part of the biotic environment associated with the proposed SPOT DWP. Estuarine fisheries occur in nearshore areas that are tidally influenced and experience variations in salinity, partly due to freshwater runoff. Marine fisheries occur offshore in the open ocean. Estuarine and marine fisheries, as described in this EIS, include common species in the GoM as well as the fish important to the local commercial and recreational fishing industry.

3.6.2. Existing Threats

Threats to estuarine and marine fisheries are primarily associated with threats to the habitats or environment where fish live. Estuaries are transitional areas between land and sea; consequently, anthropogenic activities such as draining, filling, damming, and dredging cause the immediate destruction of estuarine habitats. Other impacts to estuarine habitats come from pollution. Historically, people used waterbodies and estuaries to discard waste, which degrades water quality, and, consequently, impacts organisms that rely on these habitats, particularly fish and shellfish (NOAA 2017a). Threats to the marine environment arise from coastal development and the installation of dams and barriers that block fish migration, which is essential for some species. Pollution is another factor that affects the marine environment and degrades coastal environments. Nutrient runoff is responsible for algal blooms and the dead zone that develops annually in the GoM (NMFS 2017e). Climate change is also affecting the marine environment and warmer ocean temperatures, and the acidification of the oceans affects the ability of coral reefs to grow or causes coral bleaching (Van Hooidonk et al. 2014; Frieler et al. 2012). Impacts on corals can result in a reduction or degradation of available habitat for fishes that utilize them. Loss of seagrass habitat results in the reduction of available nursery habitat for many fishes, which can affect overall reproduction levels (NMFS 2017e).

3.6.3. Existing Conditions

The GoM has a relatively high biodiversity, partly due to the diversity of habitats ranging from coastal marshes to the deep-sea. Major habitats in the GoM include the continental shelf, continental slope, abyssal plain, methane seeps, corals, and live bottoms (Rowe 2017) as detailed in Section 3.5.5.1, Wildlife and Aquatic Resources, Benthic Resources, Existing Conditions. Soft-bottom habitat is predominant in the offshore GoM. *Sargassum* is a large brown seaweed that grows in the shelf waters and provides important habitat for many juvenile fishes in the Project area (Gower and King 2011, Casazza and Ross 2011). The GoM is a productive fishery, but changes in abundance and diversity have been documented since the DWH oil spill. A study conducted after the DWH oil spill documented a significant decline in euphausiid abundance and biomass between 2011 and early 2017 (La Spina 2020). Because these small crustaceans are an important component in the diet of fish and other higher trophic level consumers, a reduction in euphausiid abundance could affect fisheries.

Recent research on 10 grouper species in each region of the GoM indicates PAH contamination occurs throughout the GoM. In the region where the DWH spill occurred, elevated PAH concentrations and reduced fitness were documented in fish and there continues to be an increasing trend in PAH concentrations in fish livers, which suggests a continued chronic exposure potentially resulting from the resuspension of PAHs in the sediments and from other oil spills, river inputs, and seeps (Pulster et al. 2019).

The northern GoM has one of the most productive fisheries in the world, with approximately 25 percent of the U.S commercial fish landings and 40 percent of the recreational harvest (Chen 2017). Commercial landings in the GoM in 2016 totaled 1.7 billion pounds of finfish and shellfish. In 2016, 2.7 million recreational anglers took 19.5 million fishing trips in the GoM region (NMFS 2018b). The northern GoM is a highly productive fishery area with 1,443 finfish species representing 223 families (Chen 2017). Key finfish species of high commercial and/or recreational importance in the GoM are listed by habitat in Table 3.6.3-1.

Table 3.6.3-1: Key Finfish Species of High Commercial and/or Recreational Importance in the GoM Listed by Habitat

Habitat	Finfish Species
Benthic	Rock hind grouper (*Epinephelus adscensionis*), yellowfin grouper *(Mycteroperca venenosa*), scamp grouper (*Mycteroperca phenax*), red hind (*Epinephelus guttatus*), Atlantic goliath grouper (*Epinephelus itajara*), Nassau grouper (*Epinephelus striatus*), red grouper (*Epinephelus morio*), gag grouper (*Mycteroperca microlepis*), yellowedge grouper (*Hyporthodus flavolimbatus*), mutton snapper (*Lutjanus analis*), blackfin snapper (*Lutjanus buccanella*), red snapper *(Lutjanus campechanus*), lane snapper (*Lutjanus synagris*), silk snapper (*Lutjanus vivanus*), yellowtail snapper (*Ocyurus chrysurus*), Vermillion snapper (*Rhomboplites aurorubens*), tilefish (*Lopholatilus chamaeleonticeps*), blueline snapper (*Lutjanus kasmira*), golden snapper (*Lutjanus inermis)*, red drum (*Sciaenops ocellatus*), black drum *(Pogonias cromis*), bluefish (*Pomatomus saltatrix*), common snook (*Centropomus undecimalis*), Crevalle jack (*Caranx hippos*), spotted seatrout (*Cynoscion nebulosus*), and striped mullet (*Mugil cephalus*)
Pelagic and highly migratory	Skipjack (*Katsuwonus pelamis*), albacore (*Thunnus alalunga*), bigeye (*Thunnus obesus*), Atlantic bluefin tuna (*Thunnus thynnus*), yellowfin tuna (*Thunnus albacores*), small tunas, Atlantic blue marlin (*Makaira nigricans*), White marlin (*Tetrapturus albidus*), Atlantic sailfish (*Istiophorus albicans*), and Atlantic swordfish (*Xiphias gladius*)
Pelagic	Dolphinfish (*Coryphaena hippurus*), Spanish mackerel (*Scomberomorus maculatus*), cobia (*Rachycentron canadum*), Atlantic thread herring (*Opisthonema oglinum*), king mackerel (*Scomberomorus cavalla*), Spanish sardine (*Sardinella aurita*), menhaden (*Brevoortia* spp.), and greater amberjack (*Seriola dumerili*)

Source: Chen 2017

3.6.3.1. Managed Fisheries

The GGMFMC and NMFS manage fishery resources in Federal waters of the GoM (from 9 to 200 miles off the coast of Texas). They are required to prepare fishery management plans (FMPs) for all Federally managed species. Relevant FMPs developed by the GMFMC include:

- Coastal Migratory Pelagics
- Coral
- EFH
- Red Drum
- Reef Fish
- Shrimp
- Spiny Lobster

NMFS manages the FMP for Highly Migratory Species (HMS), including billfish, tuna, swordfish, and sharks (GMFMC 2016).

3.6.3.2. Commercial Fisheries

The proposed Project area is located in commercially fished areas of the GoM. In 2016, the GoM accounted for 18 percent of landings and 16 percent of the value of the U.S. commercial landings (NMFS 2017a). Gulf-wide landings from 2008 to 2018 ranged from 1,249,828,199 pounds to 1,768,542,061 pounds with an average of 1,494,964,825 pounds. Landings in Texas ranged from 72,980,750 pounds to 102,269,079 pounds with an average of 85,644,949 pounds (NMFS 2021a; NMFS

2021b). On average, Texas contributed approximately 6 percent of the landings and 26 percent of the revenue in the GoM from 2008 to 2018 (Table 3.6.3-2).

Table 3.6.3-2: Commercial Fisheries Landings and Values for the GoM and Texas (2008–2018)

	GoM		Texas	
Year	**Pounds**	**Value ($)**	**Pounds**	**Value ($)**
2008	1,294,589,591	674,234,117	72,980,750	176,108,582
2009	1,597,453,859	604,457,375	102,269,079	154,647,765
2010	1,276,154,134	805,182,749	79,502,665	173,099,562
2011	1,768,542,061	781,260,742	96,919,905	225,141,468
2012	1,669,000,270	932,348,372	90,159,341	205,759,804
2013	1,352,106,771	1,067,476,226	83,583,262	258,123,745
2014	1,249,828,199	857,020,945	78,027,106	263,614,326
2015	1,555,633,767	888,577,565	84,228,435	180,445,868
2016	1,736,636,005	872,500,855	79,365,928	205,129,439
2017	1,401,517,990	604,457,375	90,673,278	230,632,944
2018	1,543,150,428	890,424,247	84,384,688	211,847,821

Source: NMFS 2021a; NMFS 2021b

$ = U.S. dollars; GoM = Gulf of Mexico

The most important fishery in the GoM in terms of landings revenue is the shrimp fishery, composed of brown shrimp (*Farfantepenaeus aztecus*), pink shrimp (*Farfantepenaeus duorarum*), white shrimp (*Litopenaeus setiferus*), and red shrimp (*Pleoticus robustus*).

In 2018, shrimp dominated the landings revenue in the GoM region, making up 44 percent of revenue and 14 percent of landings. The other dominant landings in the GoM region were oysters (*Crassostrea virginica*), blue crab (*Callinectes sapidus*), menhaden (*Brevoortia patronus*), and red snapper (*Lutjanus campechanus*) (NMFS 2021a). The shrimp fishery is also the largest commercial fishery in Texas, although oysters, red snapper, and blue crab also contribute a large portion of the commercial fish landings (NMFS 2021b).

3.6.3.3. Recreational Fisheries

Recreational fishing is an important activity in the GoM and inland waterways. About 2.7 million Gulf Coast residents participated in recreational marine fishing in 2016, catching over 144 million fish (NMFS 2018b). Spotted seatrout (*Cynoscion nebulosus*), gray snapper (*Lutjanus griseus*), red drum (*Sciaenops ocellatus*), sand seatrout (*Cynoscion arenarius*), and red snapper (*Lutjanus campechanus*) were the most commonly caught non-bait species by numbers of fish. By weight, the largest harvests were for spotted seatrout, red snapper, red drum, king mackerel (*Scomberomorus cavalla*), Spanish mackerel (*Scomberomorus maculatus*), and striped mullet (*Mugil cephalus*). Table 3.6.3-3 summarizes the recreational species caught most commonly in waters offshore Texas.

Table 3.6.3-3: Texas Recreational Harvest of Key Species (Thousands of Fish)

Species	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	Average
Spotted seatrout (*Cynoscion nebulosus*)	917	810	732	1137	810	796	590	825	1025	982	746	852
Red drum (*Sciaenops ocellatus*)	266	285	264	347	323	269	247	241	288	300	276	283
Black drum (*Pogonias cromis*)	82	98	165	129	257	150	139	128	138	165	139	144
Sand seatrout (*Cynoscion arenarius*)	152	111	127	227	177	151	147	110	135	96	60	136
Atlantic croaker (*Micropogonias undulatus*)	64	117	125	157	157	152	117	214	126	67	64	124
Southern flounder (*Paralichthys lethostigma*)	64	47	30	92	96	92	71	85	104	77	42	73
Sheepshead (*Archosargus probatocephalus*)	46	34	49	57	143	84	39	51	106	60	84	68
Red snapper (*Lutjanus campechanus*)	41	31	33	36	34	48	40	50	31	45	55	40

Source: NMFS 2021c

3.6.4. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on estuarine and marine fisheries. The study area within which potential impacts were assessed includes the shoreline from Brazoria County, Texas to the proposed SPOT DWP, and marine waters to the EEZ.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on fisheries resources have been evaluated based on their potential to:

- Degrade the commercial, recreational, or ecological viability or significance of the resource;
- Measurably change the population size (density) or change the distribution of an important species in the region;
- Introduce new, invasive, or disruptive species in the proposed Project area; and/or
- Reduce quality and/or quantity of EFH as defined by the Magnuson-Stevens Fishery Conservation and Management Act, causing adverse effects, such as direct or indirect physical, chemical, or biological alteration of the waters or substrate, and loss of or injury to fisheries resources, their habitat, and other ecosystem components.

The remainder of this section describes potential impacts from construction and operation of the Project on estuarine and marine fisheries from loss of habitat and direct mortality due to seafloor disturbance, installation of the underwater structures, turbidity from jet sledding, pile driving, and anchor setting, water intakes and discharges, including hydrostatic testing and those from VLCCs or other crude oil carriers, underwater noise from pile driving and from VLCC or other crude oil carrier transit, vessel strikes, artificial lighting, and accidental releases of hazardous materials, including oil spills during operation.

3.6.4.1. Habitat Impacts

As discussed above, the offshore pipeline crosses soft-bottom habitat on the continental shelf. Impacts on fish would vary from species to species due to distribution, abundance, habitat use, and life history. Anchoring by pipe installation barges could have direct impacts on fish by crushing fish eggs or larvae. Impacts on benthic organisms could include localized disruption, crushing, and burial, which could result in secondary impacts on fish by reducing prey availability. A more thorough discussion of benthic habitat impacts as a result of construction and operation is included in Section 3.5.5.2, Wildlife and Aquatic Resources, Benthic Resources, Impacts and Mitigation. If burial of the offshore pipelines cannot reach the required depth, the Applicant would use concrete mats or sandbags to cover those sections of offshore pipelines. However, the use of mats would be a last resort and would not cover the entire length of the offshore pipelines. Mats or sandbags would be placed in a way that would not obstruct or impede trawling. Based on the relatively small impacts on benthic habitat compared to available surrounding habitat, impacts on fisheries due to benthic habitat disturbance would be indirect, adverse, short-term to long-term, and negligible.

During operation, the SPOT DWP would convert open water habitat to an artificial reef-like habitat in the marine environment and would likely function as a fish aggregating device (FAD) that attracts fish by providing a place for them to congregate. FADs are purposely deployed to draw pelagic fish to targeted areas by commercial, recreational, and artisanal fishers (Fisheries and Aquaculture 2010). The SPOT DWP would provide a suitable environment for encrusting organisms such as algae and invertebrates to attach, thereby providing a food source and shelter for fish. Oil and gas platforms support substantial coral communities in the northern GoM. Platforms provide settlement cues for demersal and reef fish, increasing the likelihood of settlement and recruitment on the newly added structure (Sammarco et al. 2014). As epibenthic[7] species begin to recolonize, other larger fish would likely be attracted to the new habitat because it would provide prey, shelter, and potential spawning habitat (Andersson et al. 2009). This potentially beneficial impact spreading across the trophic levels is known as the “reef effect” (Langhamer 2012). While the reef effect may be beneficial to some species, it could have adverse impacts on other species, potentially increasing their risk of predation (Copping et al. 2016). Further, it remains unclear what the effects of FADs are on highly migratory species (Snodgrass et al. 2020). As the footprint of the converted habitat is small in comparison to the available surrounding habitat, impacts on fisheries would be direct, both adverse and beneficial (depending on the species), long-term, and negligible.

[7] Epibenthic species are those that live on or just above the bottom sediments (Smithsonian Environmental Research Center 2015).

3.6.4.2. Water Quality

As discussed in Section 3.5.5.2, Wildlife and Aquatic Resources, Benthic Resources, Impacts and Mitigation, construction activities, including dropping the pipe off the barge, jet sledding, anchor setting for SPM buoys, and pile driving would result in increased turbidity and the resuspension of sediments. Fishes in the proposed Project area are adapted to somewhat turbulent conditions due to small-scale temporary events such as tropical storms and hurricanes that are common in the northern GoM (BOEM 2012a). Furthermore, fish would typically avoid areas with increased suspended sediments (Wenger et al. 2017). Except for jet sledding, these activities would result in minor changes in water quality and would result in direct, adverse, short-term, and negligible impacts on fish.

The resuspension of sediments during jet sledding for pipeline burial could disrupt filter-feeding mechanisms and interfere with ingestion and respiration of sedentary invertebrates (Berry et al. 2003). Increased turbidity in the water column could also result in physical impairment of fish species, causing potential turbidity-induced clogged gills (i.e., suffocation or abrasion of sensitive epithelial tissue) and alteration of foraging behavior for visual predators (Wenger et al. 2017). The Applicant indicated that construction would result in the resuspension of about 29.4 million cubic feet of sediments. Based on the sediment transport model results, the burial of one of the offshore pipelines would result in turbidity and resuspended sediments in the water column for 37 days, over a maximum area of about 19,044 acres that would attenuate to background levels within 24 hours after the disturbance ends. The total volume of water that would experience increased turbidity is estimated to be 152,400 cubic meters (SPOT 2019g, 2019dd, and 2019hh). Fish would typically avoid areas of increased suspended sediment (Wenger et al. 2017). As fishes are well adapted to occasional turbulent conditions, would likely avoid turbid areas, and would have substantial suitable habitat outside the sediment plume, any fishes present would experience direct, adverse, short-term, and minor impacts during construction.

3.6.4.3. Water Intake and Discharges

Water intake and discharge activities during construction include hydrostatic testing and jet sledding. Water intake can result in the entrainment or impingement of aquatic resources. Early life stages would be most susceptible to entrainment. To calculate that loss, the Applicant conducted ichthyoplankton studies at the proposed SPOT DWP site using the available SEAMAP data and calculated the adult loss equivalents for species that would be affected. Species of concern in the SPOT DWP area include red drum, red snapper, Gulf menhaden (*Brevoortia patronus*), and bay anchovy (*Anchoa* spp.). Red drum and red snapper are managed, high-value recreational and/or commercial species. Gulf menhaden are also fished commercially and bay anchovy are important as a prey fish for these and other species.

Hydrostatic test water would be drawn from surrounding seawater in accordance with the NPDES permit. Approximately 14 million gallons of water from the GoM would be withdrawn during the one-time hydrostatic testing of the pipelines at a rate of 5,800 to 14,600 gpm. Screens no courser than 8 mm (5/16-inch) would be fitted to intake structures for hydrostatic test water withdrawals to reduce potential impingement of marine organisms. Jet sledding uses high-pressure water jets through forward-facing jetting nozzles to soften the seabed and high-pressure compressed air to remove the slurry beneath the pipe and allow burial of the pipeline. Entrainment of fish eggs, fish larvae, or benthic species is possible during the water intake process, which could cause direct injury or mortality of organisms. The level of impact depends on the time of year and which species are present in the area at the time of intake. The Applicant would adhere to any permit requirements related to water withdrawals. The intake volume is relatively small compared to the size of the GoM.

After pressure testing is complete, the pipeline would be dewatered, cleaned, and dried, using air to run a series of pipeline pigs through the system. The hydrostatic test water would be discharged back into the GoM at a rate of approximately 4,000 gpm and would take about 60 hours; discharge would occur via the platform deck drain, which flows, back to the GoM. The test water discharge outlet would be located about 15 feet below the surface of the sea. Additional hydrostatic testing details are included in Section 3.3.7, Water Resources, Coastal and Marine Environment, Impacts and Mitigation. The use of intake screens on the pipe would minimize potential entrainment of ichthyoplankton and impingement of fishes. The discharged water would include corrosion inhibitors used during hydrostatic testing. The Applicant anticipates using a corrosion inhibitor with propylene glycol and polyoxyalkylenes. No information about polyoxyalkylene toxicity is available, but propylene glycol has been shown to be relatively non-toxic in marine and freshwater environments and is highly water soluble (Canadian Council of Ministers of the Environment 2006). Impacts on fishes due to hydrostatic testing are expected to be direct, adverse, short-term, and minor.

Routine water intake and discharges during operation would occur from vessels mooring at the SPOT DWP, including ballast water exchange, engine cooling, bilge water, wastewater, scrubber water, general deck drainage, emergency water reserves, and any other typical vessel operational requirements. Additional details on water intake and discharges for the SPOT DWP and VLCCs are provided in Tables 3.6.4-1 and 3.6.4-2. Water intake at the SPOT DWP would be about 46.032 million gallons annually. Cooling water volume for a single VLCC would be about 4.628 billion gallons annually. There would be no water intake associated with ballast water at the deepwater port. The combined water intake is expected to amount to 4.674 billion gallons annually.

Table 3.6.4-1: SPOT Deepwater Port Operational Seawater Usage

Equipment	System	Rate	Period
Jockey Water Pump	Water Main	20 gpm each ($0.001\ m^3/sec$)	Maximum flowrate, run continuously to feed water users on platform. Excess water flows overboard
Firewater Pump	Water Main	4,000 gpm each ($0.25\ m^3/sec$)	Maximum flowrate, run only for testing and emergencies
Water Maker	Potable Water System	9,624 gpd ($36.4\ m^3/day$)	Continuous, includes potable water system reject water
Sewage Treatment Unit	Utility Water	1,980 gpd ($7.5\ m^3/day$)	Continuous, to maintain sanitary waste system operation
Utility Water Hoses	Utility Water	1,440 gpd ($5.5\ m^3/day$)	Intermittent, deck and equipment washdown
VLCC	Cooling Water	528,344 gph ($2,000\ m^3/hour$)	Continuous, to prevent overheating

Source: SPOT 2019a Application, Vol. IIa, TR02; SPOT 2019oo;

gpd = gallons per day; gph = gallons per hour; gpm = gallons per minute; m^3 = cubic meters; sec = second; VLCC = very large crude carrier

Table 3.6.4-2: Water Discharge Rates during Operation at the Proposed SPOT Deepwater Port

ID	Stream	Maximum Flow Rate (gpm)	Assumed Temperature (description)	Assumed Salinity (description)
D1	Jockey Water Pump 1*	20	ambient	Sea water
D2	Jockey Water Pump 2*	20	ambient	Sea water
D3	Water Maker Effluent	5.5	ambient	concentrated sea water
D4	Sewage Treatment	3.05	ambient	fresh
D5	Open Drain Sump*	1,463	ambient	rainwater (fresh)
D6	Firewater Pump 1*	4,000	ambient	sea water
D7	Firewater Pump 2*	4,000	ambient	sea water
VLCC1	VLCC – Ballast	26,667	ambient	sea water
VLCC2a	VLCC – Cooling Water Summer	8,806	ambient + 10°C	sea water
VLCC2b	VLCC – Cooling Water Winter	8,806	ambient + 10°C	sea water

SPOT 2019o

°C = degrees Celsius; gpm = gallons per minute; m^3 = cubic meters; VLCC = very large crude carrier

* Streams with intermittent discharges as needed.

The Applicant provided an Ichthyoplankton Impact Assessment (Appendix S) to estimate the number of fish eggs and larvae entrained annually during operation of the DWP and VLCC cooling water. The annual mean of fish eggs entrained was calculated to be 28,293,313 and the annual mean of fish larvae entrained was calculated to be 75,200,179. This would equate to the loss of 47,579 age-1 equivalents of the four species of concern (red drum, red snapper, Gulf menhaden, and bay anchovy, see Table 3.6.4-3). Based on the estimated economic impacts, impacts on the Gulf menhaden fishery and bay anchovy as a prey species would be direct, adverse, long-term, and minor. Impacts on the red drum recreational and red snapper commercial and recreational fisheries would be direct, adverse, long-term, and minor.

Table 3.6.4-3: Summary of Annual Impacts on Fish Species of Concern from Water Withdrawals

Species [b]	Age-1 Equivalents Lost [a]	Pounds of Fish Lost	Estimated Economic Impact
DWP Operation			
Bay Anchovy (*Anchoa* spp.)	292	1.26	NA
Gulf Menhaden (*Brevoortia patronus*)	119	24	$0-$2.16
Red Snapper (*L. campechanus*)	9	16	$0-$71.52
Red Drum (*S. ocellatus*)	48	239	$0-$621.40
VLCC Cooling Water			
Bay Anchovy (*Anchoa* spp.)	29,389	126.83	NA
Gulf Menhaden (*Brevoortia patronus*)	11,976	2,379	$0-$214.11
Red Snapper (*L. campechanus*)	938	1,635	$0-$7,308.45
Red Drum (*S. ocellatus*)	4,808	24,046	$0-$62,519.60
Totals			
Bay Anchovy (*Anchoa* spp.)	29,681	128	NA
Gulf Menhaden (*Brevoortia patronus*)	12,095	2,403	$0-$216.27
Red Snapper (*L. campechanus*)	947	1,651	$0-$7,397.97
Red Drum (*S. ocellatus*)	4,856	24,285	$0-$63,141.00

Source: SPOT 2021f

DWP = deepwater port; NA = not applicable; VLCC = very large crude carriers

[a] Age-1 equivalents represent the number of individuals of each taxon that would have been expected to survive to age 1 year had they not been entrained.

[b] Ballast water intake was removed from this analysis in response to IR #334 (SPOT 2021f).

Routine discharges from the SPOT DWP during operation would include brown water (from domestic sources such as bathtubs, showers, sinks, washing machines, etc.), black water (sanitary sewage), and stormwater. Discharges from the platform would be via two downward-oriented discharge pipes that extend from the platform to a depth of approximately 15 feet below the water's surface. One pipe would discharge only stormwater and the second would co-mingle discharges from the sewage treatment facility, potable water system, and reject water discharge. Additional details regarding routine discharges are provided in Section 3.3.7, Water Resources, Coastal and Marine Environment and Marine Water Quality, Impacts and Mitigation. The Applicant conducted discharge modeling for discharges at the DWP (SPOT 2019o). Intermittent discharges, such as those from the jockey water pumps, the open drain sump, and the firewater pumps would have temporary plumes, while the persistent discharges from the water maker and sewage discharges would have permanent plumes. At a distance of 328 feet, discharges would have dilutions varying between a factor of 16 to 1,267. The size of the plume at a distance of 328 feet would range from 10 to 374 feet. Dilution would be more efficient for discharges of seawater than for freshwater or concentrated seawater. Temperature related effects from water discharges at the SPOT DWP platform would be unlikely since temperatures are expected to be at ambient temperatures. The model also predicted that some discharge plumes from the DWP platform and from VLCCs mooring at the SPMs would co-mingle, but in every scenario the plumes would be sufficiently diluted before the plume trajectories crossed paths. Discharges at the DWP platform would generally mix quickly with surrounding seawater; however, there could be minor impacts on water quality from discharges of concentrated seawater and freshwater discharges and persistent discharges in a small area around the discharge location. All marine vessel discharges would be required to comply with NPDES permit requirements for discharges to waters of the U.S. from an offshore facility. Since all discharges would meet NPDES permit requirements, routine discharges would have indirect, adverse, long-term, and minor impacts on fisheries.

VLCCs and other crude oil carriers would exchange ballast water to maintain proper ballast and stability in accordance with IMO Standards; these standards include having a ship-specific ballast water management plan, carrying a record book, and exchange of water mid-ocean or from an onboard ballast water treatment system (IMO 2019b). There is potential for water discharge during loading operation. VLCCs would exchange up to 1.6 million gallons per hour for the duration of the 24-hour loading period, totaling approximately 38 million gallons per ship. Ballast water would be discharged at a maximum rate of 26,667 gpm. Discharge water would be the same temperature as ambient water temperature and contain a TSS concentration of 30 parts per million. Sediment deposition and turbidity from ballast water would not be substantial. As described in Section 3.3.7, Water Resources, Coastal and Marine Environment and Marine Water Quality, Impacts and Mitigation, VLCCs or other crude oil carriers calling on the SPOT DWP would comply applicable standards and regulations. With adherence to standards and regulations, impacts from ballast water discharge on fisheries would be indirect, adverse, long-term, and minor.

3.6.4.4. Underwater Noise

Activities during construction and operation of the SPOT DWP would generate noise that could be perceived by fish. Activities likely to cause noise impacts would include pile driving (for the platform and PLEMs), jet sledding, anchor placement, and vessel traffic. The greatest noise impacts associated with construction would be from pile-driving activities. Noise emitted from anchoring would be caused by equipment entering and exiting the water, equipment landing on the seafloor, and noise emitted from jet sledding caused by high-pressure water and air used to bury the pipelines. Noise associated with operation would occur from increased vessel traffic as vessels approach the SPM buoys, maneuvering to properly moor and connect floating hoses, and engine noise during loading.

The SPOT DWP would include the installation of eight 72-inch-diameter steel piles for the platform that would be driven into the seafloor to a depth of 380 feet. The piles would be installed using a conventional impact hammer operating off a derrick barge. Platform piles would require 1,278 strikes per hour and operation would occur 24 hours per day over the course of 10 days. The hammer would operate for 2 hours every 6 hours. This process would be repeated eight times and would result in an estimated maximum of 10,224 strikes per pile. There would then be a 12-hour welding and cool down period and installation of the eight piles is expected to take about 10 days.

Sixteen 30-inch-diameter piles would be installed to a depth of 60 feet below sea bottom elevation for installation of the PLEMs. Pile driving for the PLEMs would occur 24 hours per day with strikes occurring every 40 minutes and an estimated maximum of 408 strikes per 30-inch pile. One pile would be installed every 8 hours and installation of all 16 piles is expected to take about 5.3 days.

Typical underwater SPLs produced by pile type and installation method are summarized in Table 3.6.4-4.

Table 3.6.4-4: Typical Underwater Sound Pressure Levels Produced by Pile Types and Installation Method

Pile Type/ Installation Method	Peak SPL (dB re 1 µPa)	SEL_{cum} (dB re 1 µPa^{2}s)	RMS SPL (dB re 1 µPa)
30-inch steel/impact hammer	210	183	193
72-inch steel/impact hammer	220	194	205

Source: Caltrans 2015

dB re 1 µPa = decibels relative to 1 microPascal; dB re 1 µPa2s = decibels relative to 1 microPascal squared normalized to 1 second; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level

Underwater noise effects criteria for fish have been established by the Fisheries Hydroacoustic Working Group (a coalition of NMFS; the USFWS; the Federal Highway Administration; DOT offices from California, Oregon, and Washington; and national experts on sound propagation). The underwater sound exposure criteria for fish are presented in Table 3.6.4-5.

Table 3.6.4-5: Underwater Noise Criteria for Fish

Hearing Group	Injury Criteria, Peak SPL (dB re 1 µPa)	Injury Criteria, SEL_{cum} (dB re 1 µPa^{2}s)	Behavioral Response, RMS SPL (dB re 1 µPa)
Fish ($\geq$ 2 grams)	206	187	150
Fish (< 2 grams)	206	183	150

Source: FHWG 2008; WSDOT 2019

dB re 1 µPa = decibels relative to 1 microPascal; dB re 1 µPa2s = decibels relative to 1 microPascal squared normalized to 1 second; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level

Table 3.6.4-6 provides the distances within which injury or behavioral responses would occur if a fish were present during pile driving activities.

Noise effects on fish include behavioral responses, masking, physiological stress responses, hearing loss, injury, and mortality. In addition, percussive effects from activities such as pile driving can damage fish swim bladders and cause temporary or permanent injury. To reduce the impacts from pile driving, the Applicant would implement a “soft start” procedure (BMP #23 in Appendix N), which involves ramping up the intensity of the hammer strikes prior to operating at full capacity, and would give fish an opportunity to leave the area prior to the production of maximum sound energy. The Applicant would also use cushion blocks during pile driving activities (BMP #33 in Appendix N).

Table 3.6.4-6: Threshold Distances for Injury to and Behavioral Response of Fish for the 30-inch and 72-inch Impact Driven Steel Piles

Pile Type / Installation Method	Threshold Distances			
	Injury Threshold			Behavioral Response Threshold
	206 dB re 1 µPa (Peak SPL)	187 dB re 1 µPa²s (SEL_{cum}) (Fish ≥ 2 Grams)	183 dB re 1 µPa²s (SEL_{cum}) (Fish < 2 Grams)	150 dB re 1 µPa (RMS SPL)
Maximum Pile Strikes (408 strikes per 30-inch pile; 10,224 strikes per 72-inch pile)				
SPM/PLM 30-inch (0.76-meter) steel/impact hammer, unmitigated [a]	18 m/ 59 ft	298 m/ 978 ft	550 m/ 1,804 ft	7,356 m/ 24,134 ft (4.6 miles)
SPM/PLM 30-inch (0.76-meter) steel/impact hammer, mitigated [b]	6 m/ 20 ft	102 m/ 335 ft	188 m/ 617 ft	2,512 m/ 8,241 ft (1.6 miles)
Jacket 72-inch (1.83-meter) steel/impact hammer, unmitigated [a, c]	86 m/ 282 ft	8,577 m/ 28,140 ft (5.3 miles)	8,577 m/ 28,140 ft (5.3 miles)	46,416 m/ 152,283 ft (28.8 miles)
Jacket 72-inch (1.83-meter) steel/impact hammer, mitigated [b, c]	29 m/ 95 ft	2,929 m/ 9,610 ft (1.8 miles)	2,929 m/ 9,610 ft (1.8 miles)	15,849 m/ 51,998 ft (9.8 miles)
Minimum Pile Strikes (194 strikes per 30-inch pile; 5,365 strikes per 72-inch pile) [c]				
SPM/PLM 30-inch (0.76-meter) steel/impact hammer, unmitigated [a]	18 m/ 59 ft	181 m/ 594 ft	335 m/ 1,099 ft	7,356 m/ 24,134 ft (4.6 miles)
SPM/PLM 30-inch (0.76-meter) steel/impact hammer, mitigated [b]	6 m/ 20 ft	62 m/ 203 ft	114 m/ 374 ft	2,512 m/ 8,241 ft (1.6 miles)

Source: SPOT 2020b; SPOT 2021c

dB re 1 µPa = decibels relative to 1 microPascal; dB re 1 µPa2s = decibels relative to 1 microPascal squared normalized to 1 second; PLEM = pipeline end manifolds; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level; SPM = single point mooring (see Section 3.13.1 for additional information)

[a] The unmitigated thresholds presented assume no mitigation measures.

[b] The mitigated injury thresholds presented were calculated assuming the use of a single, confined, bubble curtain for 72-inch piles and a single, unconfined bubble curtain for 30-inch piles. Both are calculated using a maximum 7 decibel source level noise reduction, but the final source level reduction could be less; the information is provided under worst-case scenario.

[c] Threshold distances are the same for both maximum and minimum pile strikes for the 72-inch piles.

As shown in Table 3.6.4-6, fish could experience injury or behavioral disturbance under any scenario during pile driving activities. Noise levels from pile-driving activities can cause fish to avoid the immediate area, increasing the distance between the fish and the noise source and minimizing the potential for injury. Pile driving can cause lethal and sublethal effects on nearby fish by damaging swim bladders and causing barotrauma and temporary hearing loss (Wenger et al. 2017; Popper and Hastings 2009; Halvorsen et al. 2012; Kolden and Aimone-Martin 2013; Casper et al. 2013). Fish with swim bladders could experience ruptured capillaries due to sudden pressure changes associated with loud, impulsive sounds that cause the swim bladder to rapidly expand and contract (Caltrans 2015). However, fish are most likely to experience behavioral effects, such as moving away from the source of the noise, and a reduced ability to find prey or avoid predators due to masking of natural sounds (Dickerson et al. 2001; Voellmy et al. 2014). There is also evidence that pile driving causes increased acute stress responses and repeated exposure reduces overall fitness of exposed fish (Debusschere et al. 2015).

Impacts on fish from underwater noise during pile driving activities would be direct, adverse, short-term, and minor to moderate, depending on the proximity of fish to pile driving activities.

The Applicant utilized criteria from the NMFS Greater Atlantic Regional Fisheries Office to determine potential injury and behavioral impacts from jet trenching, as an analog for jet sledding. The source level used by the Applicant for modeling jet trenching noise impacts was 168 dB re 1 µPa, as measured 1 meter (3.3 feet) from the sound source. The results indicated that no potential injury zone was expected for fish; however, behavioral harassment could occur within about 51.8 feet from the jet sled. Fish would likely move away from the jet sled due to the noise and seabed disturbance it causes. Impacts from jet sledding would be direct, adverse, short-term, and minor.

Sound generated by vessels, such as VLCCs or other crude oil carriers and support tugs, could also have adverse impacts on fish. Studies have shown that adults exhibit avoidance response to engine noise (Jørgensen et al. 2004). Noise from vessel traffic increases background noise in marine habitats and can cause acoustic masking of sounds important for biological functions, such as interfering with mating in some species. Increased background noise may cause some hearing loss in fish. Background noise, such as sounds associated with vessel traffic, may also increase stress levels in fish and cause impacts on the immune system (URI and Inner Space Center 2019; Popper and Hastings 2009). The SPOT DWP would allow for up to two VLCCs or other crude oil carriers to moor at the SPM buoys and connect with the buoys via hawser lines. The maximum frequency of loading VLCCs or other crude oil carriers would be up to 365 per year, although other smaller crude oil transport vessels may be loaded. Table 3.6.4-7 provides the distances within which injury or behavioral responses would occur if a fish were present near transiting vessels.

Table 3.6.4-7: Threshold Distances for Injury to and Behavioral Response of Fish Due to Vessel Traffic Associated with the SPOT Project

Fish Size	Injury Criteria, SEL_{cum} (dB re 1 µPa²s)	Behavioral Response, RMS SPL (dB re 1 µPa)	Approximate Distance to Injury (feet)	Distance to Behavioral Disturbance (feet)
Fish (≥ 2 grams)	187	150	28	8,214
Fish (< 2 grams)	183	150	52	8,214

dB re 1 µPa = decibels relative to 1 microPascal; dB re 1 µPa²s = decibels relative to 1 microPascal squared normalized to 1 second; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level

Fish have been shown to react when engine and propeller sounds exceed a certain level. Avoidance reactions have been observed in fish such as cod and herring when vessel sound levels were 110 to 130 dB (Ona and Godø 1990), but others have found that fish may be attracted to stationary vessels (silent, engines running, and in dynamic-positioning) and vessels underway (Røstad et al. 2006). Any avoidance reactions would last minutes longer than the vessel's presence at any one location (Mitson and Knudsen 2003; Ona et al. 2007). Fish would need to be close to the vessel to be injured, but fish as far away as about 1.6 miles would experience behavioral disturbance. Direct, adverse, long-term, and minor impacts on fish would result from noise generated by vessels associated with the SPOT Project.

3.6.4.5. Vessel Strikes

Construction and operation of the SPOT DWP would lead to an increase in vessel traffic in the Project area. Offshore construction would require about 25 vessels as summarized in Table 3.5.7-5. During

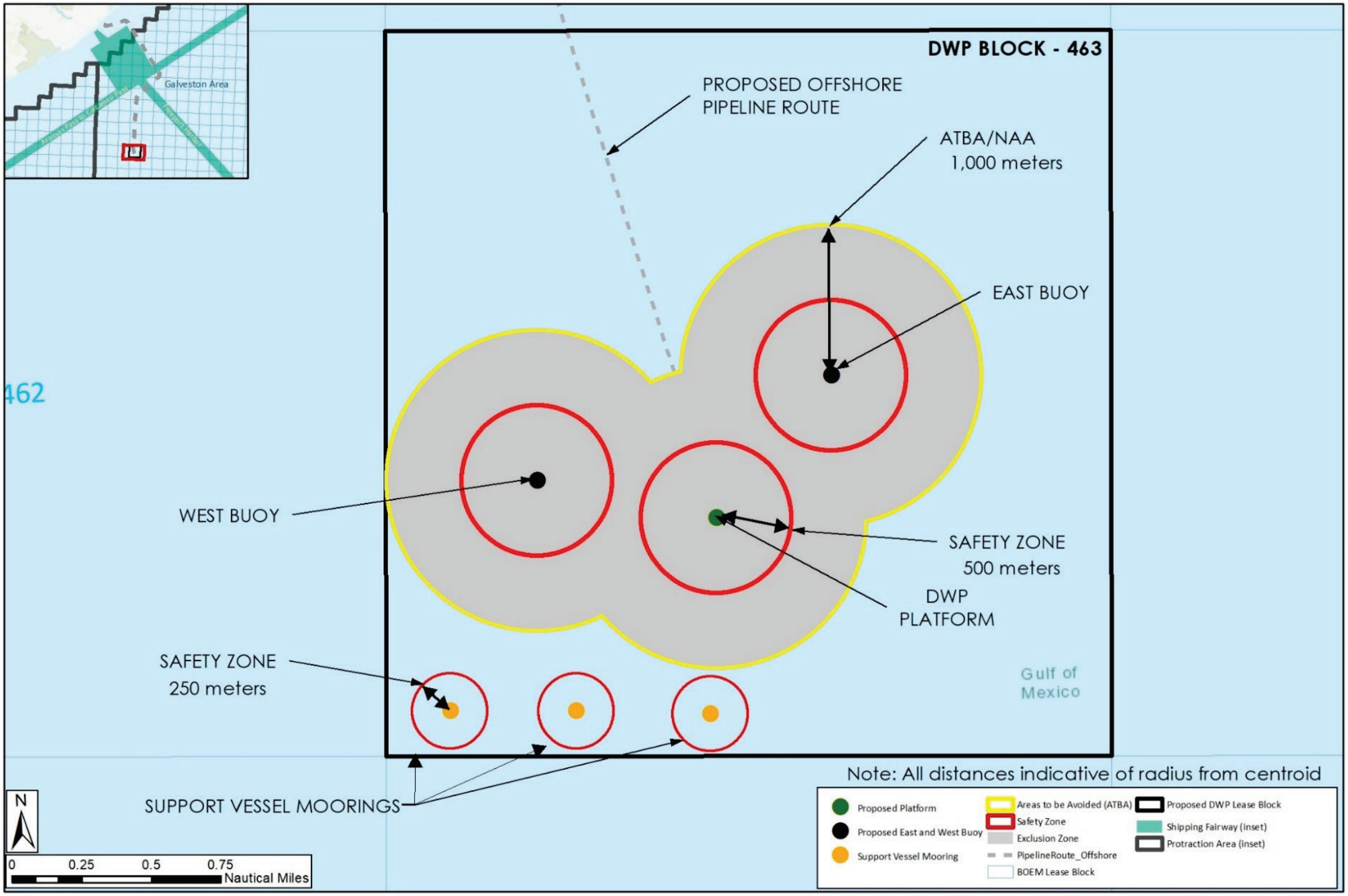
Project operation, the Project would require five support vessels, including two tug boats, one maintenance vessel/supply boat, one emergency response tug/vessel, and one helicopter (approximately once per week) for the life of the Project. The Applicant anticipates a maximum of 365 vessel calls per year by VLCCs or other crude oil carriers. The general characteristics of the crude oil carriers that could call on the SPOT DWP are provided in Table 3.5.7-7.

During construction activities, vessels supporting installation of the SPOT DWP facilities or laying the pipelines would be intermittently stationary or slow moving. Small vessels of 16 to 49 feet may be used for light work or to transport crews and could travel at speeds up to 35 knots. The impacts of construction and operational support vessels on fisheries would be indirect, adverse, short-term, and negligible due to the ability of most fish to detect vessel movements and utilize avoidance behavior.

The 71-foot draft associated with VLCCs would put any species within that portion of the water column at risk of vessel collision; the faster the vessel is traveling, the more likely the collision would lead to mortality. The Applicant estimates that VLCCs would travel at 12 to 15 knots outside of the SPM safety zones and ATBAs. VLCCs and other crude oil carriers would perform approach and departure maneuvering from the SPMs at speeds not to exceed 3 knots. Adult fish are generally able to detect and avoid oncoming vessels. Juvenile fish, larvae, and eggs may be injured or killed after contacting a ship or its propellers. Sharks, such as whale sharks (*Rhincodon typus*), are at risk for being struck by vessels as numerous collisions with whale sharks have been recorded worldwide. A whale shark study in the Gulf of Tadjoura, Djibouti, found that 65 percent of the observed whale sharks had scarring from boat and propeller strikes (Rowat et al. 2007). The University of Southern Mississippi Gulf Coast Research Laboratory (2019) reports that during an 8-year period from 2002 through 2010, a total of 370 whale shark sightings were reported. There seems to be some seasonality to the presence of whale sharks in the region with most sightings southwest of the Mississippi Delta occurring during summer months, and shifting to the northeast of the Mississippi Delta during the fall (University of Southern Mississippi Gulf Coast Research Laboratory 2019). The potential presence of whale sharks in the Project area would likely occur most often during summer, but vessels transiting in the GoM could encounter them at any time. Because this species has long been known to be susceptible to vessel strikes, it is possible that a whale shark could be struck by VLCCs or other crude oil carriers transiting in the GoM. The impact would be direct and adverse, but is not quantifiable.

Specific areas near the proposed SPOT DWP may be closed to fishing due to safety concerns during construction; these closures would typically be small in size and closed for a period of several days. These impacts would be direct, adverse, short-term, and negligible.

The Project would have designated safety zones and an ATBA/NAA around the two SPM buoys and the platform during operation, as well as a safety zone around the support vessel moorings (Figure 3.6.4-1). The actual size of the ATBA that would be requested of the IMO would be determined through the advice and consent of the USCG. The safety zones would restrict vessel traffic, including recreational and commercial fishing, within 728 acres around these facilities. The ATBA/NAA (which would likely include restrictions on bottom trawling) would discourage (to the point of effectively restricting) another 1,318 acres. This may create a minor beneficial effect on pelagic fishes as it would create a no-take zone that would protect them from fishing pressure.



ATBA = area to be avoided; DWP = deepwater port

Figure 3.6.4-1: Safety Zones and Limited Access Areas for the SPOT Deepwater Port

Demersal recreation and commercial hook-and-line fisheries would not be substantially affected by the safety zone due to the lack of hard-bottom habitat, used by demersal species. Coastal pelagic recreational fishermen may be affected due to restrictions on trolling activities within the safety zone. The impact on fisheries would be beneficial to the fish and adverse to the fishermen. Overall, the increase in hard bottom habitat and decrease in fishing pressure would have a direct, beneficial, long-term, negligible impact on fisheries. The safety zone may negatively impact trawling activities of commercial shrimp fisheries, although the safety zone is relatively small compared to the potential commercial shrimp habitat. Impacts on commercial shrimp fisheries would be direct, adverse, long-term, and negligible from an overall fisheries perspective.

3.6.4.6. Artificial Lighting

During construction, lighting would be limited to that necessary to complete HDD and pile driving activities. Lights would be affixed to offshore infrastructure for navigational purposes and safety during operation. The platform would be marked with marine lanterns on all four corners at an elevation of 68 feet. These lanterns would flash approximately 60 times per minute. The platform would have rotating beacons, as would the VLCCs or other crude oil carriers when connected to the SPOT DWP. The SPOT DWP would be marked with four lighted yellow navigation buoys for marking the four corners of Galveston Area lease block 463. Floating hoses would be lit along the entire length with yellow and red (tail hose section) lights flashing 50 to 70 times per minute. The anchorage area would be marked with three white lighted buoys at each of the corners, except the northwest corner, which is also the southeast corner of lease block 463, and would be marked with a yellow buoy as previously noted. Additional lighting that would be used on the SPOT DWP platform is provided in Table 3.5.3-3.

Illumination of surface waters in the vicinity of the SPOT DWP could cause artificially induced aggregations of small organisms that rely on sun or moonlight to determine movement patterns, resulting in increased predation by larger species. This lighting may alter behavior of fish in the immediate vicinity by causing fish to school and move towards the artificial light source (Marchesan et al. 2005), which may be mistaken for natural light. Kuvers et al. (2018) report that a fish's daytime behavior is affected by its exposure to artificial nighttime lighting. For example, fish exposed to any level of nighttime lighting emerged from their daytime hiding places more quickly, and fish exposed to bright light spent more time in open areas. This research suggests that fish exposed to nighttime lighting may be at greater risk of predation at any time. Behavior changes are expected to be long-term and localized. The SPOT DWP would be required to meet all lighting stipulations noted in 33 CFR Part 149 for safety purposes and would limit the amount of total lighting used to that required for safety and navigational concerns only. During construction, lighting would be limited to specific activities as described above. Therefore, lighting impacts on fisheries due to construction would be direct adverse, short-term, and negligible. Lighting would be present at the DWP throughout Project operation. Therefore, the impacts on fisheries due to lighting during operation would be direct, adverse, long-term, and minor to moderate.

3.6.4.7. Marine Debris

Marine debris can be ingested by fish and researchers estimate that about 35 percent of fishes have ingested marine debris. The Applicant would develop and implement an operational spill response plan to minimize the potential for a release of debris from the platform. Additionally, the potential for vessels to release waste in marine waters would be low because all vessels calling on the SPOT DWP would be required to adhere to MARPOL Annex V stipulations. Therefore, the Project is not expected to be a source of debris, and impacts on fisheries and fish species from ingestion of marine debris associated with the SPOT Project would be direct, adverse, long-term, and negligible.

3.6.4.8. Commercial and Recreational Fishing

Specific areas near the proposed SPOT DWP may be closed to fishing due to safety concerns during construction; these closures would typically be small in size and closed for a period of several days. These impacts would be direct, adverse, short-term, and negligible.

As noted in Section 3.6.4.5, Vessel Strikes, the Project would have designated safety zones and an ATBA/NAA around the two SPM buoys and the platform during operation, as well as a safety zone around the support vessel moorings (Figure 3.6.4-1). The actual size of the ATBA that would be requested of the IMO would be determined through the advice and consent of the USCG. The safety zones would restrict vessel traffic, including commercial and recreational fishing, within 728 acres around these facilities. The ATBA/NAA (which would likely include restrictions on bottom trawling) would discourage (to the point of effectively restricting) another 1,318 acres. This may create a minor beneficial effect on pelagic fishes as it would create a no-take zone that would protect them from fishing pressure.

3.6.4.9. Accidental Releases of Hazardous Materials

Contamination caused by releases of hazardous materials during construction could impact fishery resources. Sources of contaminants could come from inadvertent releases of drilling mud during HDD operations or from accidental spills of hazardous materials including gasoline, oil, hydraulic fluids, or diesel fuel. The level of impact would depend on the phase of the SPOT Project, with spills occurring during construction likely to be less harmful than spills of crude oil during Project operation. The Applicant would comply with all Federal regulations to control the discharge of trash and debris from the SPOT DWP. No measurable impacts on fisheries are anticipated from ingestion of marine debris during construction and operation of the proposed SPOT DWP.

The Applicant would install about 1 mile of subsea pipelines using the HDD construction method. This method could result in the inadvertent release of drilling mud or other lubricants. The release of drilling mud into the seabed could contaminate sediment and/or water quality and increase turbidity. The density of drilling mud (typically 65 to 89 pounds per ft^3) is greater than the density of seawater (642 pounds per ft^3) and the non-toxic bentonite clay would be expected to settle on the seafloor. As such, the bentonite would have a short duration in the water column with negligible to minor impacts on species in the area. However, benthic species would be affected as the drilling mud settles on the seafloor. Benthic fish species would be expected to move away from the spilled material and would, therefore, not be buried by the drilling mud. A change in the benthic community could have an indirect effect on fish species that prey on benthic organisms. See Section 3.5.5, Wildlife and Aquatic Resources, Benthic Resources for greater discussion on benthic resources. In the event of an inadvertent release, the Applicant would implement its HDD Contingency Plan (Appendix L; BMP #6 in Appendix N). Implementation of the HDD Contingency Plan would minimize risk of exposure to drilling mud after the event of an accidental release, limiting potential impacts on fish and their habitats. Therefore, impacts on fishery resources would be indirect, adverse, short-term, and negligible.

An inadvertent release of gasoline, oil, hydraulic fluids, or diesel fuel could occur during refueling and maintenance of construction vessels or operational support vessels, and a release of crude oil could occur during Project operation. The extent of the impact would be related to a number of factors, including the nature of the spilled material, the currents and winds, and the size of the spill. The Applicant provided modeling of a most likely scenario spill of about 2,200 bbl of oil over 1 hour for heavy crude (WCS), lighter crude (WTI), and condensate, and for a worst credible spill of about 71,000 gallons of diesel fuel, which would be the maximum capacity of diesel fuel stored for the Project (SPOT 2019c, 2019d, 2019p, and 2019ee). Model results are described in Section 3.5.7.3, Wildlife and Aquatic Resources, Marine Mammals (Non-Endangered), Impacts and Mitigation.

The accidental release of fuel, oil, or other chemicals could affect fisheries, with larger spills having a greater impact. A large spill would cause direct mortality in the immediate area, but mobile fishes would generally leave the area (MMS 2007). Previous studies have shown that small fuel or chemical spills (less than or equal to 1 barrel) would not affect fishes in the offshore GoM (MMS 2007; BOEM 2012a). A substantial spill could pose a risk to water quality that could impact fish and subsequently affect commercial and recreational fisheries. During operation, an accidental release of crude oil could also occur from a leak in the subsea pipelines, PLEMs, or from VLCCs or other crude oil carriers.

Crude oils are composed of thousands of chemical compounds including hydrocarbons, aromatic hydrocarbons, resins, asphaltenes, and polar compounds containing nitrogen, sulfur, or oxygen atoms known as nitrogen sulfur oxygen compounds. PAHs, among others, are typically associated with crude oil toxicity, and these compounds are taken up by oil-exposed organisms (Incardona et al. 2013). PAHs are one of the most toxic constituents found in oil. Evidence suggests that these compounds can have an adverse effect on numerous fish species including increased mortality and population declines (Walker 2011). Hawkins et al. (1990) report that some PAHs cause cancer in fish. Heintz et al. (2000) reported that fish exposed to PAH concentrations as low as less than 18 ppb experienced a 25 percent reduction in survival. After exposure ended, another 15 percent experienced mortality before reaching maturity. Those effects resulted from exposure to 2- to 4-ring PAHs, which have often been thought to be inconsequential to aquatic organisms. Other effects on fish exposed to PAHs can include tumor development, reduced reproductive success, and various types of endocrine disruption and immunotoxicity. These effects can cause impacts across generations (Collier et al. 2013). Table 3.5.7-8 provides the modeled concentrations of the PAHs in the water column for the most likely scenario spills.

NOAA (2019k) reports that both shellfish and finfish may be unaffected, or affected for a short period of time, by an oil spill due to a limited route of exposure when oils float to the surface. However, when spills occur in shallow or confined waters, effects on shellfish and finfish can be substantial. Because shellfish are indiscriminate filter-feeders and do not have the same enzymes as finfish to break down contaminants, and because they are relatively immobile, shellfish may be exposed to oil or contaminants. Juvenile and adult finfish are mobile, can be more selective of prey items, and have enzymes that enable them to detoxify many oil compounds. There are cases where light oils or petroleum products can cause fish mortality (NOAA 2019k).

The effects of oil spills on fish early life stages are more substantial than that reported for shellfish and finfish, generally. Results of numerous studies on the effects of crude oil on fish early life stages following the 1989 Exxon Valdez oil spill indicated that that the greatest impacts occurred in the cardiovascular system (Incardona et al. 2013). Three pelagic fish species (bluefin tuna, yellowfin tuna, and amberjack) studied using DWH field-collected oil samples showed that exposure to 1 to 15 micrograms per liter total PAH concentrations caused defects in cardiac function, including disruption in the circulatory system, pericardial edema, and other malformations in all three species (Incardona et al. 2014). Following the DWH oil spill, Incardona et al. (2013) reported that fish embryos and larvae exposed to the type of crude released during the DWH spill experienced similar cardiotoxicity as that reported following the Exxon Valdez spill. The lasting cardiac defects described by Incardona et al. (2015) result in juveniles with abnormal hearts and reduced cardiorespiratory function, which leads to long-lasting effects on survival and population recruitment.

To mitigate these impacts, vessels used for installation of the offshore pipelines would be equipped with spill containment and cleanup equipment to respond to small, accidental releases of a half-barrel or less. These measures would minimize the extent and impacts from a small spill in marine waters and minimize the impacts on fishery resources. Impacts from a small spill during construction would be direct, adverse, short-term, and minor.

To minimize the impacts of a large oil spill, the pipelines would be constructed with shutdown valves to allow sections of the pipeline to be isolated. The volume of oil that would be released due to a leak would be limited to the amount of oil that leaked prior to detection and the volume remaining in the isolatable section (see Table 3.3.3-3). In the event of an oil spill, the Applicant would mobilize a shore-based emergency response team. The Applicant would develop an operational spill response plan that would include the measures it would implement. The Applicant provided the following hypothetical actions that it would take in the event of an oil spill during Project operation (Appendix I, Summary of Hypothetical Oil Spill Response Actions):

- Booming-containment
- Skimming
- Physical herding
- Use of sorbents
- Debris removal
- Use of dispersants
- Use of emulsion-treating agents
- Use of elasticity modifiers
- Use of herding agents
- Use of solidifiers
- In-situ burning

Additionally, all vessels would be required to have a USCG-approved Vessel Response Plan, consistent with 33 CFR Part 155, and abide by other Federal regulations as described in Section 3.3.7.4, Water Resources, Coastal and Marine Environment, Impacts and Mitigation. The potential of an oil spill occurring is relatively low, but the effects of crude oil contamination on fishery resources could be substantial, especially in the early life stages.

An oil spill would have adverse impacts on both shellfish and finfish, with greater adverse impacts in shallow coastal waters. As described above, the potential occurrence of a large oil spill is relatively low because the Project is designed to limit the volume of oil that could be released due to a leak in one of the pipelines. Clean-up procedures would be implemented that would further minimize the impacts on fish. However, impacts from a spill could be long-term due to changes in reproductive success of affected fish. Therefore, a large oil spill during Project operation would have the potential to result in direct, adverse, short-term to long-term, and moderate to major impacts on fishes.

3.6.4.10. Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Spills of Hazardous Materials. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.7. THREATENED AND ENDANGERED SPECIES

3.7.1. Federally Listed Threatened and Endangered Species

Special status species are those species for which state and Federal agencies afford an additional level of protection by law, regulation, or policy. Included in this category are Federally listed and Federally proposed species that are protected under the ESA, as amended, and species otherwise granted special status at the state and Federal level (e.g., protected under the MMPA of 1972).

Federal agencies are required under Section 7 of the ESA, as amended, to ensure that any actions authorized, funded, or carried out by the agency would not jeopardize the continued existence of Federally listed threatened or endangered species, or result in the destruction or adverse modification of designated critical habitat of a Federally listed species. Together, as the lead Federal agencies, MARAD and the USCG are required to coordinate with the USFWS and NMFS to determine whether Federally listed threatened or endangered species or designated critical habitat are found in the vicinity of the Project, and to determine the Project's potential effects on those species or critical habitats.

If a project occurs in an area where listed species and/or designated critical habitat may be present, the lead Federal agency must determine if the project would affect the listed species or critical habitat. If the lead Federal agency determines the project would not likely adversely affect species or critical habitat, it can provide the information within the EIS or in the form of a BA, and request concurrence from the USFWS and/or NMFS. If the USFWS and/or NMFS agrees, it would provide concurrence in writing and consultation would be complete. If a project would likely adversely affect a listed species and/or its critical habitat, the lead Federal agency must prepare a BA and also request formal consultation. In response, the USFWS and/or NMFS would issue a Biological Opinion as to whether the Federal action would likely jeopardize the continued existence of a listed species, or result in the destruction or adverse modification of designated critical habitat.

MARAD and the USCG have developed a BA for the SPOT Project to be used for consultation required under the ESA (see Appendix E1). MARAD and the USCG requested concurrence from the USFWS and NMFS with the findings of effect for Federally listed species. Table 3.7.1-1 summarizes the potential for the Project to affect these species and the ESA determination of effect. Further discussion of Federally and state-listed species and the assessment of potential impacts are provided below in Section 3.7.3, Threatened and Endangered Species, Impacts and Mitigation, and in Appendix E1, Biological Assessment.

The January 2020 BA was developed based on a review of publicly available information, agency correspondence, and field surveys, and resulted in an analysis for 28 Federally listed threatened or endangered species 2 species that were candidates for listing under the ESA, and 1 area of designated critical habitat. At the time of publication of the Draft EIS on January 31, 2020, MARAD and the USCG concluded that the Project would have *no effect* on eight of the Federally listed threatened or endangered species or on the critical habitat and they were not discussed further in the Draft EIS. The Draft EIS also concluded the Project would be *not likely to adversely affect* the remaining 20 Federally listed species and would be *not likely to jeopardize the continued existence* of the 2 candidate species. On April 23, 2020, the USFWS provided concurrence on the findings of effect for Piping Plover, Red Knot, Whooping Crane, West Indian manatee, the five nesting sea turtles (green, hawksbill, Kemp’s ridley, leatherback, and loggerhead), and the Texas prairie dawn-flower. Subsequent to receiving the concurrence letter from the USFWS, the status of Eastern Black Rail changed from a candidate species to a threatened species under ESA (effective November 9, 2020). Further, the USFWS published a notice of 12-month finding on a petition to list the monarch butterfly and found that listing is warranted but precluded by higher priority actions (85 Fed. Reg. 243, December 17, 2020). Therefore, MARAD and the USCG submitted an addendum to the BA to the USFWS on August 11, 2021 to address the Eastern Black Rail and monarch butterfly (see Appendix E2). On September 29, 2021, USFWS provided concurrence on the findings of effect for the Eastern Black Rail and monarch butterfly. Copies of agency correspondence are included in Appendix D.

Subsequent to submittal of the BA to NMFS on January 10, 2020 and to publication of the Draft EIS on January 31, 2020, additional information became available related to species under NMFS’ jurisdiction that had the potential to change the effects determinations; therefore, consultation with NMFS is ongoing. NMFS advised MARAD and the USCG that formal consultation was initiated on April 8, 2020, but that a revision to the BA was not necessary. As such, no effects determinations have been updated in Table 3.7.1-1. To address the concerns raised by NMFS through consultation, and to address numerous public and NGO comments received following publication of the Draft EIS, Section 3.7.1.2, NEPA Evaluations was added and Section 5.3.2, Cumulative Impacts of the Proposed Action on Biological Resources has been updated to provide additional information. The dwarf seahorse was removed as a candidate species based on a NMFS (2020o) finding that listing was not warranted; therefore, no additional analysis has been provided for this species, as impacts evaluated for fish in Section 3.6, Estuarine and Marine Fisheries, would also apply to the seahorse.

3.7.1.1. ESA Effects Determinations

Table 3.7.1-1: Threatened, Endangered, or Candidate Species Potentially Occurring Within the SPOT Project Area

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Species under U.S. Fish & Wildlife Service Jurisdiction (Onshore)				
Birds				
Eastern Black Rail *Laterallus jamaicensis* [l]	Threatened [a]/ Threatened	Habitat fragmentation and conversion; sea level rise; land management practices (e.g., burning, mowing); severe weather events (USFWS 2019g).	Inhabits densely vegetated salt or freshwater marshes dominated by tuft-forming cordgrass (USFWS 2019c).	*Is not likely to adversely affect* Construction workspace could temporarily affect suitable habitat; disturbance from construction noise and potential effects due to spills and inadvertent releases of HDD drilling fluid.
Piping Plover *Charadrius melodus* [j]	Threatened [a]/ Threatened	Development and construction; dredging; beach stabilization; sand placement; loss of prey due to shoreline modifications; climate change; storm events; spills of contaminated materials; energy development (USFWS 2015g).	Breeding habitat is in the northern great plains, the shorelines of the great lakes, and the Atlantic coast. Wintering habitat consists of intertidal beaches and mudflats with sparse to no vegetation (USFWS 2019d, 2019e). There are multiple records in the vicinity of the Project, one of which is within 1 mile and another within 5 miles (eBird 2018).	*Is not likely to adversely affect* Breeding habitat does not occur in action area. Temporary disturbance would occur in wintering habitat (GoM shoreline) due to construction noise, spills, and potential inadvertent returns of drilling fluid. Direct impacts would be avoided by use of the HDD method.
Red Knot *Calidris canutus rufa* [j]	Threatened [a]/ Threatened	Food availability; climate change; habitat loss (USFWS 2018c).	Inhabits coastal marine and estuarine habitats with large areas of exposed intertidal sediments. Winters along the Gulf Coast of Texas (USFWS 2013b).	*Is not likely to adversely affect* Temporary disturbance due to construction noise. An inadvertent spill could impact thermal insulation and buoyancy. Impacts on coastal wintering habitat would be temporary.
Whooping Crane *Grus americana* [j]	Endangered [a]/ Endangered	Limited genetic pool; habitat loss and degradation; collisions with power lines; spills (Canadian Wildlife Service and USFWS 2007).	Inhabits salt marshes dominated by salt grass, dry prairies, and cypress or oak forests. Uses potholes surrounded by bulrush for nesting (USFWS 2018b).	*Is not likely to adversely affect* Would be temporarily disturbed from noise and human activity. Loss of a small amount of stopover and feeding habitat, but abundant suitable habitat is available including the Brazoria NWR.

Common Name/ Scientific Name	**Federal/State Status**	**Key Threats**	**Habitat**	**ESA Effects Determination** [e]
Mammals				
West Indian Manatee *Tricheceus manatus latirostris* [j]	Threatened [b]/ Threatened	Habitat loss; vessel strikes; entanglement in fishing gear; harmful algal blooms; cold temperatures; extreme weather; disease (USFWS 2019h).	Inhabits tropical and subtropical estuaries, freshwater rivers, and coastal waters. Relies on access to natural springs or warm freshwater ponds that contain aquatic vascular vegetation. They seek out quiet areas in riverine habitat for feeding, resting, mating, and nursing (USFWS 2008a).	*Is not likely to adversely affect* Uncommon off Texas coast, but if present could be affected by construction noise, vessel strike, and inadvertent spills. The Applicant would comply with Standard Manatee Conditions for In-Water Work.
Reptiles				
Green sea turtle *Chelonia mydas* [j]	Threatened/ Threatened	Beach lighting; habitat alteration; non-native vegetation; climate change; installation of sea walls (USFWS 2017).	Nests from June through September on isolated tropical and subtropical beaches with gentle sloping (1° F–5° F) and minimal disturbance (USFWS 2015a).	*Is not likely to adversely affect* Not known to nest in the onshore Project area. If present, lighting could disorient hatchlings and drive away adults and noise could decrease nesting success. All of these impacts would last at least one nesting season. See Section 3.7.2 for revised discussion.
Hawksbill sea turtle *Eretmochelys imbricata* [j]	Endangered/ Endangered	Illegal trade; habitat loss and degradation; artificial lighting; nest predation; climate change (USFWS 2015b).	Nests from April to November on tropical and subtropical undisturbed deep sand beaches. Females climb over reefs and rocks to nest in beach vegetation. Nests nocturnally up to five times a season in 14-day intervals (USFWS 2015b).	*Is not likely to adversely affect* Not known to nest in the onshore Project area. If present, lighting could disorient hatchlings and drive away adults and noise could decrease nesting success. All of these impacts would last at least one nesting season. See Section 3.7.2 for revised discussion.
Kemp's Ridley sea turtle *Lepidochelys kempii* [j]	Endangered/ Endangered	Illegal trade; habitat loss and degradation; artificial lighting; human presence; oil spills; nest predation; climate change (NMFS, USFWS, and SEMARNAT 2011; Hawkes et al. 2009).	Nests from April to July on tropical and subtropical soft sand beaches that are backed by dunes in Texas and Mexico. Nests diurnally up to 3 times a season in 14- to 28-day intervals (USFWS 2015c). Known to nest on beaches in Brazoria County (Shaver, Pers. Comm., April 29, 2019).	*Is not likely to adversely affect* Known to nest in the Project area. Artificial lighting can disorient hatchlings and cause adults to avoid the area. Noise could decrease nesting success. Construction activities could make portions of the nesting beaches unsuitable for at least one nesting season, but no long-term impacts are expected. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Leatherback sea turtle *Dermochelys coriacea* [j]	Endangered/ Endangered	Illegal trade; habitat loss and degradation; artificial lighting; human presence; non-native vegetation; nest predation; climate change (NMFS and USFWS 1998; Hawkes et al. 2009).	Nests from March to July on tropical and temperate sandy beaches backed with vegetation and in close proximity to deep rough seas. Beaches must be sloped sufficiently so that the distance to dry sand is limited (USFWS 2015d).	*Is not likely to adversely affect* Not known to nest in the onshore Project area. If present, lighting could disorient hatchlings and drive away adults and noise could decrease nesting success. All of these impacts would last at least one nesting season. See Section 3.7.2 for revised discussion.
Loggerhead sea turtle *Caretta caretta* [j]	Threatened/ Threatened	Habitat loss and degradation; oil spills; artificial lighting; nest predation; climate change (NMFS and USFWS 2008; Hawkes et al. 2009).	Nests nocturnally from April to September on open undeveloped sand beaches and along narrow bays, commonly in association with other sea turtle species (USFWS 2015e). Known to nest on beaches in Brazoria County (Shaver 2019, Pers. Comm., April 29, 2019).	*Is not likely to adversely affect* Known to nest in the Project area. Artificial lighting can disorient hatchlings and cause adults to avoid the area. Noise could decrease nesting success. Construction activities could make portions of the nesting beaches unsuitable for at least one nesting season, but no long-term impacts are expected. See Section 3.7.2 for revised discussion.
Invertebrates				
Monarch butterfly *Danaus plexippus* [k, l]	Candidate/ NA	Availability, distribution, and quality of milkweeds; loss of nectar-producing vegetation; loss of suitable overwintering habitat; insecticide and pesticide exposure; and climate change (USFWS 2020).	Requires diversity of nectar-producing vegetation communities during breeding and migration; requires milkweed (*Asclepias* spp.) mixed with other nectar-producing resources. Overwintering habitat for North American migrants is in mountainous areas west of Mexico City that contain specific microhabitat provided by the oyamel fir tree (*Abies religiosa*) (USFWS 2020).	*Is not likely to jeopardize the continued existence of the species* The monarch butterfly uses Texas as part of its spring breeding habitat and coastal Texas is part of its migration route. Potentially suitable habitat would be temporarily disturbed by construction. Loss of potentially suitable habitat would occur at the new terminal site. During operation, the right-of-way would be maintained in an herbaceous state and suitable vegetation may be available. Minor long-term impacts would occur at the new terminal site.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Plants				
Texas prairie dawn-flower *Hymenoxys texana* [j]	Endangered/ Endangered	Habitat loss and degradation; herbicide use; non-native vegetation (USFWS 2015f).	Inhabits poorly drained, sparsely vegetated open grasslands or slightly saline soils. Flowers from late February to early April (USFWS 2015f).	*Is not likely to adversely affect* Limited, if any, suitable habitat in Project area. Temporary disturbance and potential introduction of invasive species could occur if species is present.
Species Under NMFS Jurisdiction (Offshore)				
Mammals				
Fin whale *Balaenoptera physalus* [h]	Endangered [b]/ Endangered	Vessel strikes; entanglement in fishing gear; reduced prey availability due to climate and ecosystem change; ocean noise (NMFS 2019k).	This low-frequency cetacean inhabits deep offshore waters in oceans around the world, commonly found North of 30º North. Migrates seasonally to higher latitudes in search of higher food concentration areas. Occurs rarely in the GoM (NMFS 2019k).	*Is not likely to adversely affect* Species could be encountered along vessel transit routes within the EEZ. Densities in the GoM are low; vessel strike is unlikely. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Rice’s whale *Balaenoptera ricei* [h] (formerly known as Gulf of Mexico Bryde’s whale [*Balaenoptera edeni*])	Endangered [b]/ NA	Vessel strikes; ocean noise; energy exploration; oil spills and responses (NMFS 2019l).	This low-frequency cetacean is a non-migratory, year-round resident, of the GoM. They are most commonly observed along the northeastern GoM in depths from 328 to 1312 feet, in an area designated as a Biologically Important Area off the west coast of Florida, far from the Project site (NMFS 2019l).	*Is not likely to adversely affect* Resident species in the GoM, but unlikely to be found near DWP site. If present in the area during construction, could be affected by temporary changes in water quality and underwater noise. The greatest threats would be from vessel strikes and oil spills, but the potential of occurrence is low. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
North Atlantic right whale *Eubalaena glacialis* [h]	Endangered [b]/ NA	Entanglement in fishing gear; vessel strikes; underwater noise (NMFS 2019m).	This low-frequency cetacean is a highly migratory whale that commonly inhabits the coastal waters of eastern North America and the GoM. This whale spends much of its time at or near the water surface. This whale occurs almost exclusively in Atlantic coastal waters, and is only rarely found in the GoM (NMFS 2019m).	*Is not likely to adversely affect* Species could be encountered along vessel transit routes within the EEZ. Densities in the GoM are low; vessel strike is unlikely. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Sei whale *Balaenoptera borealis* [h]	Endangered [b]/ NA	Vessel strikes; entanglement in fishing gear; loss of prey availability due to climate and ecosystem change; ocean noise (NMFS 2019n).	This low-frequency cetacean inhabits deep-water oceans from subtropical to subpolar climates across the world. Has had few sightings in the GoM. (NMFS 2019n).	*Is not likely to adversely affect* Species could be encountered along vessel transit routes within the EEZ. Densities in the GoM are low; vessel strike is unlikely. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Sperm whale *Physeter microcephalus* [h]	Endangered [b]/ NA	Vessel strikes; entanglement in fishing gear; ocean noise; marine debris; climate change; and oil spills and contaminants (NMFS 2019o).	This mid-frequency cetacean inhabits deep water (2,000–10,000 feet) of the world’s oceans throughout the year. In the GoM are present year-round west of Florida and south of the Mississippi River Delta (NMFS 2019o).	*Is not likely to adversely affect* Resident species in the GoM could be encountered near the Project site during construction. Could be affected by increased turbidity, sediment deposition, benthic disturbances, noise, and vessel traffic. Construction impacts would be short-term and risk of vessel strike would be long-term. As this species density is generally low in the GoM, impacts are not expected to be substantial. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	**Federal/State Status**	**Key Threats**	**Habitat**	**ESA Effects Determination** [e]
Reptiles				
Green sea turtle *Chelonia mydas* [h]	Threatened/ Threatened	Habitat loss on nesting beaches; loss of coral reefs; bycatch in fishing gear; intentional killing; vessel strikes; ocean pollution/debris (NMFS 2019y).	Inhabits shallow waters inside reefs bays and inlets unless migrating. Commonly observed in lagoons and shoals with marine grass and algae. Hatchlings seek refuge and food in *Sargassum* habitat (USFWS 2015a).	*Is not likely to adversely affect* Species would likely avoid construction areas and could be temporarily displaced from suitable habitat by construction activities. Risks associated with vessel strikes and oil spills are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Hawksbill sea turtle *Eretmochelys imbricata* [h]	Endangered/ Endangered	Habitat loss on nesting beaches; loss of coral reefs; bycatch in fishing gear; intentional killing; vessel strikes; ocean pollution/debris (NMFS 2019z).	Inhabits rocky shores, coral reefs, islands, and shallow coastal areas. Rarely seen in water deeper than 65 feet. Hatchlings seek refuge in floating sea vegetation (USFWS 2015b). Floating *Sargassum* provides important habitat for juvenile hawksbills (NMFS 2020m).	*Is not likely to adversely affect* Species would likely avoid construction areas and could be temporarily displaced from suitable habitat by construction activities. Risks associated with vessel strikes and oil spills are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Kemp's ridley sea turtle *Lepidochelys kempii* [h]	Endangered/ Endangered	Bycatch in fishing gear; harvest of eggs; ocean pollution/marine debris (NMFS 2019aa).	Adults inhabit nearshore muddy or sandy bottom waters. Hatchlings and juveniles occupy open-ocean habitat with floating *Sargassum* where they drift with the vegetation (USFWS 2015c).	*Is not likely to adversely affect* Species would likely avoid construction areas and could be temporarily displaced from suitable habitat by construction activities. Risks associated with vessel strikes and oil spills are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Leatherback sea turtle *Dermochelys coriacea* [h]	Endangered/ Endangered	Bycatch in fishing gear; harvest of eggs; vessel strikes; nesting beach habitat loss and alteration; ocean pollution/marine debris; and climate change (NMFS 2021e).	Inhabits the tropical and temperate open oceans worldwide. Leatherbacks spend more time in the open ocean than other sea turtles, and undertake the longest migration between breeding and feeding sites of any other sea turtle in the GoM (USFWS 2015d; NMFS 2021e).	*Is not likely to adversely affect* Species would likely avoid construction areas and could be temporarily displaced from suitable habitat by construction activities. Risks associated with vessel strikes and oil spills are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Loggerhead sea turtle *Caretta* [h]	Threatened/ Threatened	Bycatch in fishing gear; nesting beach habitat loss and degradation; ocean pollution/ marine debris; direct harvest of turtles and eggs; vessel strikes; organochlorine pesticides (NMFS 2021f; NMFS 2014)	Inhabits a wide range of habitats, from hundreds of miles offshore, to inshore areas like bays, lagoons, marshes, creeks, ship channels, and mouths of large rivers. Commonly utilizes coral reefs and rocky areas for feeding (USFWS 2015e).	*Is not likely to adversely affect* Species would likely avoid construction areas and could be temporarily displaced from suitable habitat by construction activities. Risks associated with vessel strikes and oil spills are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Fish				
Giant manta ray *Manta birostris* [h]	Threatened/ NA	Targeted fisheries and bycatch; ingestion of plastic marine debris, tourism; environmental contaminants; vessel strikes; entanglement; climate change (Miller and Klimovich 2017).	A migratory species that inhabits temperate, tropical, and subtropical oceans worldwide, typically near productive coastlines. They forage in areas based on prey abundance, from pelagic to shallow waters. Nurses at Flower Gardens Banks National Marine sanctuary (NMFS 2017c).	*Is not likely to adversely affect* Species could be present in Project area and along vessel transit routes but would exhibit avoidance behavior due to noise from construction activities. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Gulf sturgeon *Acipenser oxyrinchus desotoi* [h]	Threatened/ NA	Contaminants (especially that settle on the bottom where they feed); dredging; climate change (NMFS 2019p).	Inhabits rivers, tributaries, and estuaries for most of the year and migrates into Gulf waters for the coolest months of the year. When in the ocean, they prefer shallow waters with strong tidal currents and clean sand substrata. Swims upstream for spawning (NMFS 2019p).	*Is not likely to adversely affect* Project area is not within species range. Potential impacts associated with an oil spill would be negligible. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	**Federal/State Status**	**Key Threats**	**Habitat**	**ESA Effects Determination** [e]
Nassau grouper *Ephinephelus striatus* [h]	Threatened/ NA	Fishing and lack of effective regulations and enforcement (NOAA 2019q).	Inhabits tropical and subtropical waters of the western North Atlantic. Generally inhabit shallow reefs. Juveniles are found in nearshore shallow microalgae and seagrass habitats (NOAA 2019q).	*Is not likely to adversely affect* The DWP site is not within species range and vessels transiting would not likely encounter this reef fish. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Oceanic Whitetip Shark *Carcharhinus langimanus* [h]	Threatened/ Threatened	Incidental bycatch in commercial fisheries and harvest for international trade (NOAA 2019r).	Inhabits the surface of deep open marine waters on the outer continental shelf or near islands. They prefer surface mixed layer in warm waters above 68º F (NOAA 2019r).	*Is not likely to adversely affect* This species could be encountered along vessel transit routes. Risks associated with vessel strikes and oil spills are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Smalltooth sawfish *Pristis pectinate* [h]	Endangered/ Endangered	Habitat loss (NOAA 2019s).	Inhabits the coasts of the GoM, particularly in Florida. Historic range included Texas coasts. Juveniles inhabit shallow estuaries. Once mature, they can be found in estuaries, near beaches, and along deep-water reefs. Lives in water warmer than 64º F (NOAA 2019s).	*Is not likely to adversely affect* Although suitable habitat is present, this species' current distribution does not extend into Texas waters. It is unlikely that it would be found in the Project area. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Dwarf Sea Horse *Hippocampus zosterae* [h]	Previous Candidate [f]/ NA	Loss of seagrass beds; oil pollution; commercial trade of sea horses; inadequate regulatory protections (NOAA 2019t).	Inhabit shallow waters of the western Atlantic Ocean and GoM. This species is a habitat specialist that is completely dependent on areas populated with seagrasses. Distribution is proportional to abundance of seagrass (NOAA 2019t).	*Is not likely to jeopardize the continued existence of the species* Species is unlikely to be present in the Project area as no seagrass beds are present. The risks associated with an oil spill are not quantifiable [i]. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Invertebrates				
Rough cactus coral *Mycetophyllia ferox* [h]	Threatened [c]/ NA	Ocean warming and acidification due to climate change; disease; habitat degradation (Henry et al. 2018).	Rough cactus coral is one of the reef-building corals in the order Scleractinia. They are generally found in shallow reef environments and are one of the least common species. These corals require a hard substrate, temperatures typically between 77 ºF, and adequate light and water flow (50 CFR Part 223).	*No effect* Project area is not within species range. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Pillar coral *Dendrogyra cylindrus* [h]	Threatened [c]/ NA	Ocean warming, leading to coral bleaching (Hughes et al. 2018).	Pillar coral is one of the reef-building corals in the order Scleractinia. They are typically found as scattered, isolated colonies in warm marine waters off the southeast coast of Florida and throughout the Caribbean. These corals require a hard substrate, temperatures typically between 77 to 86 °F, and adequate light and water flow (NatureServe 2019b).	*No effect* Project area is not within species range. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Lobed star coral *Orbicella annularis* [h]	Threatened/ NA	Ocean warming, leading to coral bleaching (Hughes et al. 2018).	Lobed star coral is one of the reef-building star corals in the order Scleractinia. Star corals are part of the *Orbicella* species complex and were historically dominant components of coral reefs in the Caribbean. Reef-building corals require a hard substrate, mean temperatures typically between 77 °F to 86 °F, and adequate light and water flow (Henry et al. 2018). This coral is present in the FGBNMS (NMFS 2020m).	*No effect* Project area is not within species range. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Mountainous star coral *Orbicella faveolata* [h]	Threatened/ NA	Ocean warming, leading to coral bleaching (Hughes et al. 2018).	Mountainous star coral is one of the reef-building star corals in the order Scleractinia. Star corals are part of the *Orbicella* species complex and were historically dominant components of coral reefs in the Caribbean. Reef-building corals require a hard substrate, mean temperatures typically between 77 °F to 86 °F, and adequate light and water flow (UWI 2017). This coral is present in the FGBNMS (NMFS 2020m).	*No effect* Project area is not within species range. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Boulder star coral *Orbicella franksi* [h]	Threatened/ NA	Ocean warming, leading to coral bleaching (Hughes et al. 2018).	Boulder star coral is one of the reef-building star corals in the order Scleractinia. Star corals are part of the *Orbicella* species complex and were historically dominant components of coral reefs in the Caribbean. Reef-building corals require a hard substrate, mean temperatures typically between 77 °F to 86 °F, and adequate light and water flow (UWI 2016). This coral is present in the FGBNMS (NMFS 2020m).	*No effect* Project area is not within species range. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Staghorn coral *Acropora cervicornis* [h]	Threatened [c]/ NA	Ocean warming, leading to coral bleaching (Hughes et al. 2018).	This species is a branching coral typically found in shallow water areas with a lot of wave action. Staghorn coral is one of the Acroporids that was a dominant reef-building species in Florida and the Caribbean. Their distribution includes the Bahamas, south Florida, and the Caribbean (NMFS 2019u).	*No effect* This coral is not present in the Project area; transiting vessels would not be in shallow reef habitat. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.
Elkhorn coral *Acropora palmate* [h]	Threatened [d]/ NA	Ocean warming, leading to coral bleaching (Hughes et al. 2018).	This species is a branching coral typically found in shallow water areas with a lot of wave action. Elkhorn coral is one of the Acroporids that was a dominant reef-building species in Florida and the Caribbean. Their distribution includes the Bahamas, south Florida, and the Caribbean (NMFS 2019v). This coral is present in the FGBNMS (NMFS 2020m).	*No effect* Project area is not within species range. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

Common Name/ Scientific Name	Federal/State Status	Key Threats	Habitat	ESA Effects Determination [e]
Critical Habitat				
Sargassum habitat [h]	NA/NA	NA	Floats and accumulates on the surface of shallow coastal tropical and temperate marine waters. Provides refuge for juvenile sea turtles as well as other marine species. (Bryant 2015; NOAA 2018c)	*No effect* The Project would have no impact on factors influencing *Sargassum* communities such as currents, temperature, native species, or water depth. We entered formal consultation with NMFS on April 8, 2021. See Section 3.7.2 for revised discussion.

°F = degrees Fahrenheit; CFR = Code of Federal Regulations; DWP = Deepwater Port; EEZ = Exclusive Economic Zone; ESA = Endangered Species Act; FGBNMS = Flower Garden Banks National Marine Sanctuary; GoM = Gulf of Mexico; HDD = horizontal directional drill; NA = not applicable; NMFS = National Marine Fisheries Service; NWR = national wildlife refuge; SPOT = Sea Port Oil Terminal; VLCC = very large crude carrier; TCESFO = Texas Coastal Ecological Services Field Office

[a] Species protected under MBTA (see Section 3.5.3.2, Wildlife and Aquatic Resources, Wildlife, Existing Coastal Marine, and Migratory Birds).

[b] Species protected under MMPA (see Section 3.5.5, Wildlife and Aquatic Resources, Benthic Resources).

[c] Colonies located at Dry Tortugas National Park.

[d] Colonies located at Flower Garden Banks National Marine Sanctuary and Dry Tortugas National Park.

[e] Full assessment of each Federally listed species and critical habitat determined to be potentially affected are provided in the BA and BA Addendum (see Appendices E1 and E2, respectively). Full assessment of each state-listed species determined to be potentially affected are provided in Section 3.7.2, Threatened and Endangered Species, State Listed Threatened and Endangered Species. Impacts are identified based on the potential for the species to occur within or in proximity to the Project footprint or along the vessel transit route.

[f] Dwarf sea horse was previously a candidate for listing. On July 28, 2020, NMFS published a Status Review Report and found the species does not warrant listing at this time. Appendix E1, Biological Assessment and Essential Fish Habitat Assessment, has not been revised with this change in status as the BA is currently in review by NMFS (NMFS 2020o).

[g] Due to the status change of Eastern Black Rail, an addendum to the BA has been provided to the USFWS to reflect potential impacts on the species (see Appendix E2).

[h] Consultation for this species is ongoing.

[i] Not quantifiable means the impacts cannot reasonably be predicated or measured and are, thus, unknown.

[j] Received concurrence from the USFWS on April 23, 2020. A copy of the concurrence letter is included in Appendix D.

[k] Due to the recent addition of the monarch butterfly as a candidate species, an addendum to the BA has been provided to the USFWS to reflect potential impacts on the species (see Appendix E2). Candidate species do not have legal status under the ESA.

[l] Received concurrence from the USFWS on September 29, 2021. A copy of the concurrence letter is included in Appendix D.

3.7.1.2. NEPA Evaluations for Federally Listed Species

This section contains an evaluation of potential impacts on Federally listed species from a NEPA perspective. Threats to Federally listed species vary and some of the specific threats for each species are described in the BA (Appendix E1). More generally, climate change continues to increase air and ocean temperatures, alter ocean acidity, raise sea levels, increase ocean stratification, decrease the extent of sea ice, decrease ocean oxygen levels, and alter ocean circulation patterns. Increased temperatures can alter habitat, modify species' use of existing habitats, change precipitation patterns, and increase storm intensity (USEPA 2016a; USEPA 2016b; NASA 2019; Love et al. 2013; NMFS 2020m). Climate change may result in changes in species abundance, distribution, and migration patterns, and is a threat that contributes to the potential extinction of ESA-listed species (NMFS 2020m).

Birds may respond to rising global temperatures by expending more energy on thermoregulation, which could result in reduced fitness. They may also shift their range to areas that do not provide the same or sufficient resources to support their needs. Reproductive success may decline due to the de-synchronization of reproduction aligning to maximum food resources. As plant life cycles advance with warming temperatures, insect activity changes. Since bird migration is related to photoperiod, not temperature, birds may not arrive in breeding grounds until after prime insect activity has occurred, resulting in a shortage of food resources and reduced reproductive success. Finally, increasing droughts and wildfires may destroy habitat or nests (King and Finch 2013).

In a recent Biological Opinion addressing marine organisms, NMFS (2020m) cites numerous sources relating to potential effects on species and their habitats due to climate change. Changes in ocean conditions may change the abundance of prey species, leading to changes in predator populations. For example, if climate induced changes to squid size, hatch timing, growth rates, and size at maturity predicted by Pecl and Jackson (2008) occur, ESA-listed species such as sperm whales, whose diet is primarily composed of cephalopods, could be adversely affected (NMFS 2020m).

Sea turtles could be affected by climate change due to rising sea levels that would reduce available nesting beaches. Additionally, rising temperatures could affect the sex ratio of sea turtles because sex is determined by temperature (NMFS 2020m). Increase of the ocean's acidity reduces available carbon that organisms use to build shells, which can alter food webs offshore (USEPA 2016a; NASA 2019; Love et al. 2013). More acidic oceans results in a reduction of calcium carbonate, which is an essential component for coral reefs (NMFS 2020m). Increasing ocean acidification also affects the ability of larvae from some marine organisms (e.g., sea urchins and oysters) to develop properly, and causes some fish larvae to lose their sense of smell, making them more vulnerable to predation. These effects may alter the number of larvae able to mature and reproduce (USEPA 2016e).

Threatened or Endangered Birds

Federally listed migratory and resident birds may occur within the Project area, particularly in estuarine and coastal areas. Construction and operation of the Project could affect nesting, foraging, and stopover habitat for resident or migratory birds. Construction and operation impacts may result from noise, vibration, vegetation clearing, ground disturbance, nighttime lighting, and oil spills and would be similar to those described for non-listed birds in Section 3.5.3.3, Wildlife Impacts and Mitigation. With implementation of BMPs included in Appendix N, impacts on migratory and resident Federally listed birds would be direct and indirect, adverse, short-term to long-term, and minor.

Threatened or Endangered Mammals

Six Federally listed marine mammals could occur in nearshore or offshore habitats of the GoM. The five Federally listed whales occupy deep water along the shelf break or abyssal plain, while the West Indian manatee occupies nearshore habitats, especially habitats with grassbeds used for foraging. No manatee foraging habitat is present at the Project site and manatees are only occasional visitors along the Texas coast. Based on the lack of suitable habitat, none of the Federally listed marine mammals are expected to be present at the DWP during construction and would not likely be affected by construction activities. During operation, marine mammals could be affected by vessel noise, vessel strikes, marine debris, and oil spills. An in-depth discussion of the potential effects of the Project on marine mammals is included in Section 3.5.7.2, Wildlife and Aquatic Resources, Marine Mammals (non-Endangered), Impacts and Mitigations and the BA (Appendix E1). Based on those analyses, impacts on Federally listed marine mammals resulting from vessel noise and marine debris would be direct, adverse, long-term, and minor. Impacts resulting from vessel strikes would be direct, adverse, long-term, and minor to major, depending on the speed of the vessel if a strike were to occur. The potential for an oil spill to occur is low, but if one did occur, impacts would be direct, adverse, long-term, and minor to major, depending on the size of the spill.

Threatened or Endangered Reptiles

Nesting Sea Turtles

Five Federally listed sea turtles occur in the GoM and nest on GoM beaches from Mexico to Florida. Kemp's ridley and loggerhead sea turtles are known to nest on Texas beaches near the SPOT Project and Kemp's ridley sea turtles exhibit strong nest fidelity (USFWS 2015c, Shaver Pers. Comm., May 19, 2021). Recent nesting data are provided in Table 3.7.1-2 and Figure 3.7.1-1 depicts the nesting beaches in relation to the SPOT Project.

Table 3.7.1-2: Sea Turtle Nests in the Vicinity of the SPOT Project

Year [a]/Species	Quintana Beach (Number of Nests)	Surfside Beach (Number of Nests)	Brazoria County, north of Surfside (Number of Nests)	Total Nests
2020				
Kemp's ridley sea turtle (*Lepidochelys kempii*)	0	3	4	7
Loggerhead sea turtle (*Caretta caretta*)	0	0	1	1
2019				
Kemp's ridley sea turtle	0	2	4	6
Loggerhead sea turtle	0	0	0	0
2018				
Kemp's ridley sea turtle	1	6	4	11
Loggerhead sea turtle	0	0	0	0

Year [a]/Species	Quintana Beach (Number of Nests)	Surfside Beach (Number of Nests)	Brazoria County, north of Surfside (Number of Nests)	Total Nests
2017				
Kemp's ridley sea turtle	1	1	2	4
Loggerhead sea turtle	0	0	1	1
2016				
Kemp's ridley sea turtle	1	4	0	5
Loggerhead sea turtle	0	0	0	0
2015				
Kemp's ridley sea turtle	1	1	1	3
Loggerhead sea turtle	0	0	0	0

Source: Donna Shaver, Pers. Comm., May 19, 2021.

[a] No green, hawksbill, or leatherback sea turtle nests were documented at these locations from 2015 through 2020.

Figure 3.7.1-1: Sea Turtle Nesting Beaches in the Vicinity of the SPOT Project

Nesting sea turtles could be affected by lighting, noise and human disturbance, habitat changes, and contamination from oil spills. A complete analysis of the effects of the Proposed Action on nesting sea turtles is included in Section 6.2.6 of the BA (Appendix E1). The Applicant proposes to conduct the shore crossing in an existing residential area using the HDD method, which would minimize adverse impacts on sea turtles during construction. The Project would not result in adverse impacts during operation unless an oil spill occurred. Therefore, impacts on nesting sea turtles from construction of the Project would be indirect, adverse, short-term, and minor.

Sea turtles are still recovering from the DWH oil spill. NMFS (2020n) estimated the spill killed as many as 7,600 large juvenile and adult sea turtles, 166,000 small juvenile sea turtles, and 35,000 hatchlings. It will take decades to recover from the loss because sea turtles mature slowly. Although population trends are often based on the number of nesting females, annual nesting fluctuations are influenced by multiple factors and may not reliably capture population trends or the effects of a single spill event. There have been large fluctuations in nesting in the years following the DWH; a record high of nesting Kemp's ridley sea turtles occurred Gulf-wide in 2017 and the 2019 GoM nesting season was a 10-year low for the species (NMFS 2020n). Though the DWH had a clear adverse impact on Kemp's ridley and other sea turtles, other environmental and biological factors also influence reproduction (NMFS 2020n), making it impossible to point to one single event. For example, a recent study in the northern GoM (Benscoter et al. 2021) found smaller-sized reproductive female loggerhead sea turtles than what is considered a standard size for reproduction in this species. The study also found behavioral differences between the smaller and standard-sized reproductive females, with smaller females exhibiting shorter migration distances, shallower migration water depths, and foraging in shallower water. The behavioral differences may correspond with exposure to different threats (e.g., vessel strikes, algal blooms). Further, the turtles' smaller size may result in a smaller clutch size, fewer clutches per season, a smaller egg size, and reduced reproductive effort (Benscoter et al. 2021), all of which affects the recovery of the species.

An oil spill from the SPOT Project would not result in the magnitude of oil released during the DWH spill, which released millions of barrels of oil into the GoM for 87 days. Furthermore, the potential of an oil spill occurring is low. If a spill did occur, impacts on sea turtles would be direct or indirect, adverse, short-term to long-term, and minor to major, depending on the size and timing of the spill, and if the spill reached nesting beaches.

Sea Turtles in the Marine Environment

In addition to the analysis provided in the BA (Appendix E1), additional information is provided below to address comments received on the Draft EIS and Supplemental Draft EIS. Sea turtles are present in the GoM and are likely to occur in the Project area. Lamont and Johnson (2021) studied species composition, and size and fitness of sea turtles using different neritic habitats (shallow habitats overlying the continental shelf) in the GoM and found that sea turtles (loggerhead, Kemp's ridley, and green) occupy at least two habitat types: sea grass beds and sand bottom. In some cases, green sea turtles were found to continuously forage in suboptimal habitat, foraging on algae rather than moving into seagrass beds, and were found to be smaller and less fit than green sea turtles in seagrass beds. Kemp's ridley sea turtles forage on benthic invertebrates, which were common in both habitat types, and displayed no difference in fitness between habitat types (Lamont and Johnson 2021). Ramirez et al. (2020) documented a decline in growth rates of stranded Kemp's ridley sea turtles aged 0 to 5 years beginning in 2012. Researchers hypothesize that the decline is associated with long-term adverse effects on GoM food webs resulting from the DWH oil spill, as well as changes resulting from increasing population density and climate variability (Ramirez et al. 2020).

Kemp's ridley sea turtles rely on the nearshore GoM waters as a crucial part of their migratory habitat, particularly nearshore areas about 12.4 miles from the coast in average water depths of about 85 feet (Shaver et al. 2016). Hatchling and juvenile sea turtles (loggerhead, Kemp's ridley, green, and hawksbill) rely on *Sargassum* mats for protection and food as described in the BA. *Sargassum* lives about 1 year; it begins growing in the western GoM in March and expands as it moves east (Gower and King 2011). Green sea turtles also occupy nearshore waters off the Texas coast; leatherback sea turtles are highly migratory and primarily occupy oceanic waters but will sometimes forage in coastal waters, and hawksbill sea turtles are widely distributed and occur off the Texas coast (NMFS 2020m). Therefore, sea turtles present during construction or operation of the Project could be adversely affected by underwater noise, vessel strikes, marine debris, or oil spills.

Underwater Noise

Behavioral and injury thresholds for sea turtles are not consistent in the literature and NMFS has indicated that new thresholds will be made public in the coming months. The expected injury thresholds are 232 dB peak and 204 dB cumulative sound exposure level (SELcum), and the behavioral threshold is expected to be 175 dB RMS. However, these thresholds have not been published nor made available publicly to calculate impacts. In an effort to update the impacts on sea turtles from underwater pile driving noise, the Applicant used the established thresholds available in the NMFS GARFO (2009) model for sea turtles and fish. Because the expected sea turtle injury thresholds from NMFS are higher, the corresponding distance to injury would be less than those provided in Table 3.7.1-3. The analysis below is based on a maximum pile strike scenarios of 408 strikes per 30-inch-diameter pile and 10,224 strikes per 72-inch-diameter pile. The minimum pile strike scenarios would be 194 strikes per 30-inch-diameter pile, and 5,365 strikes per 72-inch-diameter pile. Source levels used in this analysis are provided in Section 3.13.4.2, Underwater Construction, Table 3.13-13.

Table 3.7.1-3: Threshold Distances for Injury to and Behavioral Response of Sea Turtles

Project Component/Pile Type/ Installation Method	Threshold Distance 206 dB re 1 µPa (Peak SPL)	187 dB re 1 $\mu Pa^2 s$ (SEL_{cum})	175 dB re 1 µPa (RMS SPL)
Maximum Pile Strikes (408 strikes per 30-inch pile; 10,224 strikes per 72-inch pile)			
PLEM/30-inch steel/impact hammer, unmitigated [a]	18 m / 59 ft	298 m / 978 ft	158 m / 518 ft
PLEM/30-inch steel/impact hammer, mitigated [b]	6 m / 20 ft	102 m / 335 ft	54 m / 177 ft
Platform/72-inch jacketed steel/ impact hammer, unmitigated [a, c]	86 m / 282 ft	8,577 m / 28,140 ft (5.3 miles)	1,000 m / 3,281 ft (0.6 mile)
Platform/72-inch jacketed steel/ impact hammer, mitigated [b, c]	29 m / 95 ft	2,929 m / 9,610 ft (1.8 miles)	341 m / 1,119 ft (0.02 mile)
Minimum Pile Strikes (194 strikes per 30-inch pile; 5,365 strikes per 72-inch pile) [c]			
PLEM 30-inch (0.76-meter) steel/impact hammer, unmitigated [a]	18 m/ 59 ft	181 m/ 594 ft	158 m / 518 ft
PLEM 30-inch (0.76-meter) steel/impact hammer, mitigated [b]	6 m/ 20 ft	62 m/ 203 ft	54 m / 177 ft

Source: SPOT 2020b; SPOT 2021c

dB = decibels; dB re 1 µPa = decibels relative to 1 microPascal; dB re 1 µPa2s = decibels relative to 1 microPascal squared normalized to 1 second; ft = feet; m = meters; peak = peak sound pressure, PLEM = pipeline end manifold; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level (see Section 3.13.1 for additional information)

[a] The unmitigated thresholds presented assumes no mitigation measures.

[b] The mitigated injury thresholds presented were calculated assuming the use of a single, confined, bubble curtain for 72-inch piles and a single, unconfined bubble curtain for 30-inch piles. Both are calculated using a maximum 7 decibel source level noise reduction, but the final source level reduction could be less.

[c] Threshold distances are the same for both maximum and minimum pile strikes for 72-inch piles.

Based on the calculated injury and disturbance distances provided in Table 3.7.1-3, sea turtles could be injured due to cumulative sound pressure as far away as about 5.3 miles, if unmitigated. Sea turtles could also experience behavioral disturbance as far away as 0.6 mile, if unmitigated. However, because the applicant commits to using a bubble curtain system to reduce the noise generated during pile driving, these distances could be reduced depending on the decibel reduction achieved by the noise attenuation device(s). Consultation with NMFS is ongoing, and will include evaluation of the proposed bubble curtain system. Impacts on sea turtles due to underwater noise from pile driving would be direct, adverse, short-term (behavioral) to long-term (injury), and moderate to major.

Vessel Strikes

As indicated in the January 2020 BA (Appendix E1), sea turtles are vulnerable to vessel strikes. Recent Florida research found that 21.5 percent of all strandings were associated with a definitive vessel strike injury (Foley et al. 2019). Furthermore, in its Biological Opinion for the oil and gas regulated activities, NMFS (2020m) calculated the density of sea turtles in the GoM out to the EEZ and estimated both lethal and non-lethal vessel strikes from all vessels and from oil and gas vessels. Additional details are included in the cumulative impacts evaluation in Section 5.3.2.1, Cumulative Impacts of the Proposed Action on Biological Resources. Though there is sufficient evidence that slower vessel speeds reduce the potential for a vessel strike, neither MARAD nor the USCG have the authority to regulate vessel speeds outside the Project's safety zone. Therefore, it is likely that vessel strikes would occur over the life of the Project and impacts on an individual sea turtle due to a vessel strike would be direct, adverse, long-term, and moderate to major, depending on the speed of the vessel, and may result in sea turtle mortality.

Marine Debris

As indicated in the January 2020 BA (Appendix E1), marine debris is a major threat to sea turtles in the GoM. Hatchling and juvenile sea turtles rely on floating *Sargassum* for food and shelter, which may also move towards where debris collects. See Section 5.3.2.1, Cumulative Impacts of the Proposed Action on Biological Resources, for additional details on the effects of marine debris on sea turtles. Interactions with marine debris may be lethal or non-lethal (NMFS 2020m). The Applicant would develop and implement an operational spill response plan to minimize the potential for a release of debris from the platform. Additionally, vessels calling on the SPOT DWP would be required to adhere to MARPOL Annex V stipulations regarding the release of debris. However, it is possible that incremental and accidental releases of debris could occur that would adversely affect sea turtles. Therefore, impacts would be direct, adverse, long-term, and minor.

Oil Spills

Oil spills are described in detail in the January 2020 BA (Appendix E1). Additional information of the effects on sea turtles due to oil spills is provided in Section 5.3.2.1, Cumulative Impacts of the Proposed Action on Biological Resources. If an oil spill occurred during operation of the Project, the impacts on sea turtles would be direct, adverse, long-term, and moderate to major, depending on the size, location, and timing of the spill.

Threatened or Endangered Fish

Of the five Federally listed fish, only the giant manta ray is likely to be present in the Project area. The species is known to occur at the FGBNMS (Stewart et al. 2018) and one was reported off the Alabama coast in 2019 (Osborne 2019), which suggests that giant manta rays may occupy waters along the northern GoM coast. Gulf sturgeon are anadromous fish whose current range extends from Florida to Louisiana, Nassau grouper occur in the southern GoM, oceanic whitetip sharks occupy open ocean, and smalltooth sawfish distribution is limited to Florida. Additional details for each species are included in the BA, Appendix E1. Construction and operation of the Project could result in impacts from water quality, underwater noise, vessel strikes, artificial lighting, marine debris, and oil spills, and would be similar to those described in Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigation.

Giant manta ray is the only Federally listed fish likely to be affected by underwater noise from the Project due to its presence and likely movements along GoM coastal waters. Based on the acoustic analysis for fish, giant manta rays within 5.3 miles could be injured during installation of the 72-inch-diameter piles without noise attenuation devices. That distance would be reduced to about 1.8 miles with noise attenuation. Additionally, giant manta rays within anywhere from 1.6 to 28.8 miles could be disturbed by pile driving activities (Table 3.6.4-6). Impacts on giant manta ray from pile driving would be direct, adverse, short-term, and minor to moderate, depending on their proximity to the activities.

Threatened or Endangered Invertebrates

Corals are not widespread in the GoM, but four of the seven Federally listed corals (boulder star, elkhorn, lobed star, and mountainous star corals) occur in the FGBNMS. Stetson Bank is about 40 nautical miles southeast of the proposed DWP and West Flower Garden Bank is about 70 nautical miles southeast of the proposed DWP; both are part of FGBNMS. The three remaining corals do not occur near the Project area and would not be affected by the Project. Based on 27 years of coral community monitoring at East and West Flower Garden Banks, these coral reefs are some of the healthiest reefs worldwide (Johnston and Weinberg 2018).

Corals reproduce both asexually and sexually. During asexual reproduction, new polyps develop from parent polyps that have reached a certain size. This type of reproduction occurs throughout the life of the coral. Sexual reproduction occurs in about three-quarters of all stony corals, which produce male and female gametes that are released into the water. The eggs and sperm then join and form floating larvae called planulae (NOAA NOS 2013).

Project construction would not affect corals at FGBNMS because none of the impacts associated with the proposed construction activities (e.g., jet trenching or water withdrawals for hydrostatic testing) would overlap with the sanctuary. Similarly, water withdrawals and discharges during operation would not affect species present at FGBNMS, and vessel transits would occur in water deep enough to avoid direct impacts on coral species. However, a worst-case oil spill during Project operation could reach FGBNMS. The effects on coral would depend on many factors including the specific conditions at the time of the spill, the type and quantity of oil spilled, type of exposure, species present, length of exposure, and time of year.

NOAA (2010) reports that plate-like corals are not as sensitive to oil as branching corals, and that the reproductive and early life stages of all corals are more sensitive to the effects of oil. DeLeo et al. (2021) studied the effects of exposure to crude oil and/or dispersants on two branching corals and found that both species were more strongly affected by exposure to a combination of oil and dispersants. Both species exhibited metabolic depression when exposed to oil for only 96 hours, which means they are unlikely to be metabolizing oil in the short term. The study also suggested that as little as 12 hours of exposure to dispersant could cause cell damage as observed through gene expression. However, there were differences in gene expression between the two species studied, which may mean that one species is better able to mitigate cell damage (DeLeo et al. 2021).

For the many stony corals that reproduce sexually, reproduction is synchronized and dependent on multiple factors. At FGBNMS, broadcast spawning events occur 7 to 10 days after the full moon in August when gametes are released over several nights. Slicks of gametes can be observed at the water surface following spawning (NMFS 2020m). An oil spill coinciding with a spawning event could result in gamete mortality and decreased recruitment of new corals. Other potential effects of an oil spill could include smothering by weathered oil or oil mixed with sediment that sinks to the bottom; increased phototoxicity leading to bleaching and mortality caused by fluoranthene, a PAH found in oil; and reduced larval settlement or mortality of existing corals due to effects from dispersants or dispersant oil mixtures (NMFS 2020m; NOAA 2013). The potential for a worst-case oil spill large enough to reach FGBNMS is very low, but if it did occur, the impacts on corals would be direct, adverse, short-term to long-term, and minor to major, depending on the size and timing of the spill.

Threatened or Endangered Plants

As described in the BA (Appendix E1), suitable soils occur for the Texas prairie dawn-flower in about 69.5 acres of the Project workspace. Of that, 47.1 acres are within the existing ECHO Terminal site and are unlikely to support this species because the site is graveled, paved, or otherwise maintained. The remaining 22.4 acres could potentially support the species. However, where suitable soils exist, the pipeline segments would be collocated with existing, maintained utility corridors. One record of this species exists approximately 2.7 miles east of the northern terminus of the onshore pipeline (SPOT 2019a, Application, Vol. IIb, Appendix D). It is unlikely that the plant would be found in a regularly maintained utility corridor; therefore, construction of the Project would be unlikely to affect this species. Impacts would be similar to those described in Section 3.4.3.2, Vegetation, Impacts and Mitigation. The potential for an oil spill to occur is low, and a land-based oil spill is easier to contain than one on water; therefore, impacts on the Texas prairie dawn-flower from an oil spill would be direct, adverse, short-term to long-term, and minor to major, depending on the size and timing of the spill.

Critical *Sargassum* Habitat

As described in the BA (Appendix E1), *Sargassum* is critical habitat for the loggerhead sea turtle. As shown on Figure 7.4.2-1 in the BA (Appendix E1), it begins growing in the western GoM in March and moves eastward as it grows and expands. *Sargassum* typically lives about 1 year (Gower and King 2011). This critical habitat is composed of essential physical and biological features (PBFs) with specific elements that include:

1. Margins of major boundary currents, convergence zones, surface-water downwelling areas, appropriate water temperatures, and concentrated amounts of *Sargassum*.
2. High enough concentrations of *Sargassum* to support adequate prey abundance and cover.
3. Available prey and other material, and animals native to *Sargassum* community such as hydroids, copepods, plants, and cyanobacteria.
4. Near to available currents, deep-enough water (more than 10 meters [33 feet]) to ensure offshore transport out of the surf zone, and foraging, and cover requirements by *Sargassum* for post hatchling loggerheads.

In consideration of these four constituents, it is possible that construction and operation of the Project would affect *Sargassum* habitat. Operation of the Project could temporarily reduce prey items (PBF 3) (i.e., ichthyoplankton) within the habitat due to cooling water intakes by VLCCs calling on the DWP. Any reduction would be expected to be minimal. Prey within the *Sargassum* community could be affected by underwater noise from pile driving. However, potential impacts would depend on the season and the proximity of the *Sargassum* to the pile driving activities.

Vessels could temporarily disturb *Sargassum* habitat, but it is more likely that vessels would avoid direct contact with *Sargassum* so as to prevent the detrimental impacts of operating in *Sargassum*, such as jammed propellers or clogging of water intakes (NMFS 2020m). However, there would be no lasting effect on the PBFs due to vessel disturbance of *Sargassum*.

Ballast water exchange would not affect *Sargassum* or introduce exotic species because as described in Section 3.3.7.4, Coastal and Marine Environment, Impacts and Mitigation, VLCCs or other crude oil carriers calling on the SPOT DWP would comply with applicable standards and regulations to prevent the spread of exotics. Ballast water discharges would be at a similar temperature and salinity to surrounding water.

The DWH oil spill affected vast areas of floating *Sargassum* in the GoM. The spill caused a widespread loss followed by habitat recovery. Based on mesocosm studies conducted after the DWH spill, multiple pathways of injury are associated with oil spills that intersect with *Sargassum*:

- Oil accumulates in the floating mat and causes any animals using the mat to be exposed to high levels of contaminants;
- Oil mixed with dispersants causes *Sargassum* to sink, which removes the habitat from the surface, but increases the potential for vertical movement of contaminants and for those contaminants to reach the sea floor; and
- Decreased oxygen levels surrounding the habitat can adversely affect animals relying on the *Sargassum* mats (Powers et al. 2013).

Sargassum grows quickly and moves constantly, and new patches grow each year in the northern GoM. NMFS (2020m) indicated that nearly one quarter of *Sargassum* in the northern GoM was affected by the DWH spill, but there was a four-fold increase in abundance of *Sargassum* in the 2 years following the spill. Because *Sargassum* density changes in the GoM based on season, the impacts from an oil spill would be different throughout the year. Therefore, impacts on critical *Sargassum* habitat from an oil spill would be direct and indirect, adverse, long-term (the life of the Project), and minor to major depending on the size and timing of the spill.

3.7.2. State-Listed Threatened and Endangered Species

Based on information obtained from the TPWD's (2020a) Rare, Threatened, and Endangered Species of Texas database, 34 state-listed threatened or endangered species in Brazoria and Harris counties have the potential to occur within the Project area and are managed by the TPWD. Of these, 19 state-listed species are also Federally listed as threatened or endangered, and are discussed as appropriate in the BA (Appendix E1). An additional four state-listed species are not likely to be affected by the proposed Project and are not discussed further in this EIS. The remaining 11 state-listed species are listed in Table 3.7.2-1 and are discussed below.

Table 3.7.2-1: State-Listed Threatened and Endangered Species that Could Occur Within the SPOT Project Area

Common Name / (*Scientific Name*)	State Status (County Name)
Reddish Egret (*Egretta rufescens*)	Threatened (Brazoria)
White Faced Ibis (*Plegadis chihi*)	Threatened (Brazoria)
White Tailed Hawk (*Buteo albicaudatus*)	Threatened (Brazoria/Harris)
Wood Stork (*Mycteria Americana*)	Threatened (Brazoria/Harris)
Swallow-tailed Kite (*Elanoides forficatus*)	Threatened (Brazoria/Harris)
Rafinesque's big-eared bat (*Corynorhinus rafinesquii*)	Threatened (Harris)
Alligator snapping turtle (*Macrochelys temminickii*)	Threatened (Brazoria/Harris)

Common Name / (*Scientific Name*)	**State Status (County Name)**
Shortfin mako shark (*Isurus oxyrinchus*)	Threatened (Brazoria/Harris)
Brazos heelsplitter (*Potamilus streckersoni*)	Threatened (Brazoria)
Louisiana pigtoe (*Pleurobema riddellii*)	Threatened (Harris)
Houston daisy (*Rayjacksonia aurea*)	Threatened (Harris)

Source: TPWD 2020a

3.7.2.1. Birds

Reddish Egret

The Reddish Egret (*Egretta rufescens*) is state-listed as threatened. This species is a medium-sized heron, denoted by a grey body with a rusty neck and head. This species inhabits brackish marshes, tidal flats, and shallow salt ponds. The Reddish Egret is a year-round resident of the Texas Gulf Coast. Their diet consists mainly of fish, frogs, and crustaceans (TPWD 2019d). The main threats to Reddish Egrets are habitat loss and harvesting of their natural prey (e.g., crayfish) (IUCN 2019).

White Faced Ibis

The White Faced Ibis (*Plegadis chihi*) is state-listed as threatened. The White Faced Ibis is a crow-sized waterfowl with a long downward curved bill, long dark legs, and a full brown body other than the white rings around their eyes and bill. This species inhabits freshwater marshes, sloughs, and irrigated fields and can also be found in brackish or saltwater habitats. The White Faced Ibis is a year-round resident of the Gulf Coast of Texas. Their diet consists mainly of insects, snails, fish, frogs, crayfish, and earthworms. The main threats to this bird are habitat destruction and poisoning from agricultural effluents (TPWD 2019e).

White Tailed Hawk

The White Tailed Hawk (*Buteo albicaudatus*) is state-listed as threatened. This is a large raptor that inhabits coastal prairies and inland oak forests. White Tailed Hawks are year-round residents on the coastal prairie habitat that would be affected by the Project (eBird 2018). Their diet mainly consists of rabbits and carrion (Audubon 2019). The main threat to the White Tailed Hawk is habitat loss, but collisions with wind turbines, windows, and power lines also pose a threat to this species (Hawkwatch 2018).

Wood Stork

The Wood Stork (*Mycteria americana)* is state-listed as threatened. The Wood Stork is a large wading bird with long black legs, a heavy curved bill, a bare head, and is mostly white with black wings. This species commonly inhabits cypress swamps, marshes, ponds, and lagoons. The Wood Stork is a breeding migrant during the summer along the Texas Gulf Coast. The Wood Stork's diet consists mostly of fish, but they also eat crayfish, crabs, alligators, turtles, frogs, and rodents. The main threat to this bird is habitat destruction (USFWS 2013c).

Swallow-Tailed Kite

The Swallow-tailed Kite (*Elanoides forficatus*) is state-listed as threatened and is a medium-sized raptor with a black back, wings, and tail, while its stomach and head are white. This bird nests and forages in forests with tall trees near open areas, and also inhabits lowland pine forests and plains along river systems and swamplands. This species is a breeding migrant during the summer along the Texas Gulf Coast. The Swallow-tailed Kite's diet consists of small reptiles, frogs, nesting birds, and insects. The main threat to this bird is habitat loss and anthropogenic disturbance (LDWF 2019).

3.7.2.2. Mammals

Rafinesque's Big-Eared Bat

The Rafinesque's big-eared bat (*Corynorhinuss rafinesquii*) is state-listed as threatened. This species is a small brown bat with large ears used for echolocation. This species inhabits tree cavities in bottomland hardwoods, concrete culverts, and abandoned structures. As with most bats, they are nocturnal, and their diet consists of insects such as mosquitos, beetles, flies, and moths. The main threats to this bat are habitat loss of bottomland hardwoods that they traditionally inhabited (TPWD 2019f).

3.7.2.3. Reptiles

Alligator Snapping Turtle

The alligator snapping turtle (*Macrochelys temminickii*) is state-listed as threatened. Alligator snapping turtles have spiky shells with a black head and legs, and a pincer like jaw. This species inhabits rivers, perennial waterbodies, deep lakes, bayous, and swamps. Their diet is mainly composed of other turtles, aquatic rodents like nutria and muskrats, and sometimes nuts, although they will eat anything they can catch or scavenge. Major threats to the alligator snapping turtle are habitat loss and hunting (UGA 2019).

3.7.2.4. Fish

The shortfin mako shark (*Isurus oxyrnchus*) is state-listed as threatened. This species of shark has a pointed snout, can grow up to 13 feet long, and has a dark blue back, blue sides, and a white underside. This species is highly migratory and can be found along the Atlantic coast, the Gulf Coast, and in the Caribbean Sea. The shortfin mako shark's diet consists of marine mammals, other sharks, and large fish such as bluefish, tuna, and swordfish. The main threats to the shortfin mako shark are overfishing and bycatch (NMFS 2020l).

3.7.2.5. Mollusks

Brazos Heelsplitter

The Brazos heelsplitter (*Potamilus streckersoni*) is state-listed as threatened and is a freshwater mollusk with a tan and gray ovular shell. This species is found in the freshwater portions of the Brazos River watershed. The Brazos heelsplitter is a filter feeder that consumes plankton and detritus. The main threat to the Brazos heelsplitter is loss of habitat due to modified flow regimes (Smith et al 2019).

Louisiana Pigtoe

The Louisiana pigtoe (*Pleurobema riddellii*) is state-listed as threatened and is a freshwater mollusk with a tan and dark brown square shell. This species is found in shallow areas of streams and rivers with bottoms that are a mixture of sand, gravel, silt, and clay. The Louisiana pigtoe is a filter feeder that consumes plankton and detritus. The main threats to the species are drought, sand and gravel removal, and human development (NatureServe 2020a).

3.7.2.6. Plants

Houston Daisy

The Houston daisy (*Rayjacksonia aurea*) is state-listed as threatened and is a flowering annual herb with a yellow flower and linear leaves. This species is only found in in sandy soils of Harris and Galveston counties, Texas, and flowers from October to December. Threats to the Houston daisy include habitat loss and competition from woody vegetation and non-native grasses (NatureServe 2020b).

3.7.3. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on state-listed species. Impacts on Federally listed species are discussed in the BA (Appendix E1). The study area within which potential impacts on state-listed species were assessed includes the onshore workspace of the proposed SPOT Project, and adjacent areas that could be affected by construction noise, lighting, or oil spills.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on state-listed species have been evaluated based on their potential to:

- Violate a legal standard for protection of a species or its critical habitat;
- Degrade the commercial, recreational, or ecological viability or significance of the resource;
- Measurably change the population size (density) or change the distribution of an important species in the region;
- Introduce new, invasive, or disruptive species in the proposed Project area; and/or
- Directly affect nesting migratory birds protected under the MBTA.

The remainder of this section describes potential impacts from construction and operation of the Project on state-listed species from vegetation clearing, ground disturbance, human presence during construction, noise, conversion of certain habitat types to impervious surfaces or other habitat types, and accidental spills of hazardous materials, as well as additional mitigation measures the Applicant would apply to reduce potential impacts on state-listed species during construction.

3.7.3.1. Pipeline and Terminal Facilities

Impacts from construction and operation of the onshore pipelines and terminal facilities would be similar to impacts described in Section 3.5.3.3, Wildlife and Aquatic Resources, Wildlife, Impacts and

Mitigation. Construction of the onshore pipelines would involve clearing, grading, trenching, backfilling, restoration of ground contours, and reseeding of the disturbed area. The ECHO to Oyster Creek Pipeline would have a 30-foot-wide permanent easement maintained in an herbaceous condition during Project operation, and the Oyster Creek to Shore Pipelines would have a 50-foot-wide permanent easement maintained in an herbaceous condition. Species present during construction would be displaced, but could return to areas where suitable habitat was available following restoration. Construction of the pipelines could affect nesting, foraging, and stopover locations for migratory birds, and the increased human presence, as well as noise and vibration, would likely cause sensory disturbance to birds. Impacts associated with construction of the Project would be direct and indirect, adverse, short-term, and minor.

The proposed Oyster Creek Terminal would permanently convert vegetation communities to an industrial land use. State-listed species would be permanently displaced from the site, but adjacent suitable habitats would be available. Impacts associated with operation of the Oyster Creek Terminal would be direct and indirect, adverse, long-term, and minor.

To minimize impacts on state-listed species during construction, the Applicant would employ the following measures (BMPs #34 and #21 in Appendix N):

- Provide environmental training for all construction staff prior to initiation of construction activities. Training would include pictures of threatened and endangered species, including pictures of burrows/ nests and pictures of habitats that are preferred by each species.
- Construction staff would be directed to stop work and immediately inform the EI in the event individuals or burrows/nests are encountered. If an individual is present, the EI would only authorize a return to work once the individual has left the workspace on its own. The EI would contact TPWD if an individual remained in the workspace, and may employ exclusionary devices (e.g., silt fencing) to keep the individual out of the nearby workspace. Any removal would be conducted by a certified monitor for the particular species.
- Should encounters with state-listed species occur, the Applicant or EI would file a monthly environmental compliance report to TPWD detailing the encounter(s), action(s) taken, and resulting outcomes.
- Install escape ramps every 98 yards in the open trench to allow wildlife to climb out.
- Hazing methods such as loud shouting or hand clapping would be used to flush any wildlife toward an escape ramp.
- Hazing of any state-listed species would be conducted and/or supervised by a qualified biologist.

3.7.3.2. Accidental Spills of Hazardous Materials

An accidental release of hazardous materials could impact state-listed species. A release of drilling mud could occur during HDD operations. However, the Applicant would implement its HDD Contingency Plan (Appendix L; BMP #6 in Appendix N) to minimize any impacts due to an inadvertent return of drilling mud. An inadvertent release of gasoline, oil, hydraulic fluids, or diesel fuel could occur during construction and operation of the Project. A release of these hazardous materials would cause direct adverse impacts on terrestrial and aquatic wildlife present at the time of the release, and could cause indirect impacts due to habitat degradation.

Any release of hydrocarbons onshore or offshore could affect coastal, marine, and migratory birds. The effects could be indirect due to habitat degradation or have direct effects on some individuals. Direct contact with hazardous material could damage the thermal insulation and buoyancy of their feathers, leading to hypothermia, stress, injury, and/or mortality. A release of hydrocarbons offshore could result in the bioaccumulation of contaminants in the shortfin mako shark due to consumption of contaminated prey (fish) (Walker 2011). Fish are generally not considered to bioaccumulate PAHs due to their ability to convert PAHs into water soluble compounds that are stored in bile for excretion. However, during the process, PAHs and associated metabolites may be reabsorbed or recirculated in the body that allows them to bind with proteins and genetic material. Because fish do not have a well-developed DNA repair system, they may experience toxic effects such as lesions, mutagenesis, teratogenesis, and carcinogenesis (Pulster et al. 2020). Increases in PAH levels in fish, including sharks, were observed following the DWH spill (Walker 2011). However, Pulster et al. (2020) documented a 67 percent decrease in biliary PAHs in shortfin mako sharks between 2012 and 2017, though it is unclear what the decline may mean because the sample size was very small. See Section 3.5.3.3, Wildlife and Aquatic Resources, Wildlife, Impacts and Mitigation, for additional details on impacts, oil spill modeling, and mitigation measures the Applicant would implement to reduce the impacts of an accidental release of hazardous materials. Safety mechanisms such as shut down valves built into the pipeline system would prevent a continuous release of oil and the Applicant would develop an operational spill response plan that would identify measures to be taken in the event of a spill and to reduce the associated impacts. Therefore, impacts on state-listed species from spills would be direct or indirect, adverse, short-term to long-term, and minor to major, depending on the size of the spill and time of year.

3.7.3.3. Planned and Unplanned Maintenance

Onshore Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in an inadvertent release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the SWPPP (BMP #14 in Appendix N). The Applicant would also adhere to the conservation measures established for the Eastern Black Rail in Section 5.1.4 of the Addendum to the BA (Appendix E2). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor, depending on the activity.

Offshore Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in disturbance to the seafloor and discharges of hazardous material. Maintenance impacts would be similar to those described for construction. The Applicant would develop and adhere to an operational spill response plan to guide the cleanup of any spill that occurred during maintenance activities and all vessels would be equipped with spill response kits. The effects of oil spills in the marine environment are discussed above under Accidental Spills of Hazardous Materials. Impacts associated with any other planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.8. Geologic and Soil Resources

This section describes the existing soil and geologic resources that would be located within the onshore and offshore Project areas, and discusses the potential geologic hazards that may be encountered during construction and operation of the Project. In addition, this section discusses mineral and paleontological resources that may be present in the Project area, as well as the geophysical survey conducted by the Applicant.

3.8.1. Definition of the Resource

Soil and geologic resources encompass the characteristics of the soil, sediment, and bedrock located at or near the earth's surface. Geologic hazards are defined as the forces that shape the landscape, such as seismic events and hurricanes. Mineral resources are defined as those that have economic value. Paleontological materials relate to the study of the forms of life existing in prehistoric or geologic times, as represented by the fossils of plants, animals, and other organisms.

3.8.2. Existing Threats

Based on historic records, the occurrence and magnitude of seismic activity and subsidence[8] in the Project area are low. However, existing manmade infrastructure on the seafloor, potential contaminated sites within or nearby the Project workspaces, accidental spills of hazardous materials, and discharges of chemicals into the GoM may be threats to soil, sediment, and geologic resources. In addition, major storms can cause the loss of large quantities of soil.

3.8.3. Regional and Local Geology

3.8.3.1. Existing Conditions

This section summarizes the existing onshore and offshore geologic resources conditions for the proposed Project. This section considers the location of the Project regarding physiographic provinces,[9] as well as topography and other geologic characteristics of the Project area.

Onshore Project Area

The onshore Project area would be located within the West Gulf Coastal Plain region, which falls within the Coastal Plain physiographic province (Carr 1967). The West Gulf Coastal Plain region comprises sediments that were deposited in shallow marine areas, river channels, and delta settings during the Tertiary (approximately 66 million to 2.6 million years ago) and Quaternary (approximately 2.6 million years ago to present day) geologic periods. These sediments accumulated above Paleozoic rocks within a basin structure that formed due to the opening of the North Atlantic Ocean in the late Triassic period.

[8] Ground settlement due to unstable soils and/or groundwater extraction.
[9] Regions with a distinct type of landscape, landforms, rock type, and evolutionary history.

Continued sea level changes and basin subsidence resulted in cyclic and varied deposits of sand, silt, clay, and gravel that measure hundreds of feet thick (Mace et al. 2006). Along the shoreline of the basin, barrier islands and carbonate platforms dating to the recent Holocene epoch consist of quartz-rich sands, small dunes formed by wind activity (i.e., eolian dunes), and washover fans caused by hurricanes (Otvos 1985).

The topography of the onshore Project area is level to gently rolling and includes features such as circular knolls, shallow depressions, and surface expressions of faulting and past stream activity. Elevations range from greater than 50 feet above mean sea level at the northern end of the proposed ECHO to Oyster Creek Pipeline to sea level where the Project would intersect the coastline, with an average slope gradient of 1.2 to 1.4 feet per mile (USDA Soil Conservation Service 1976, 1981).

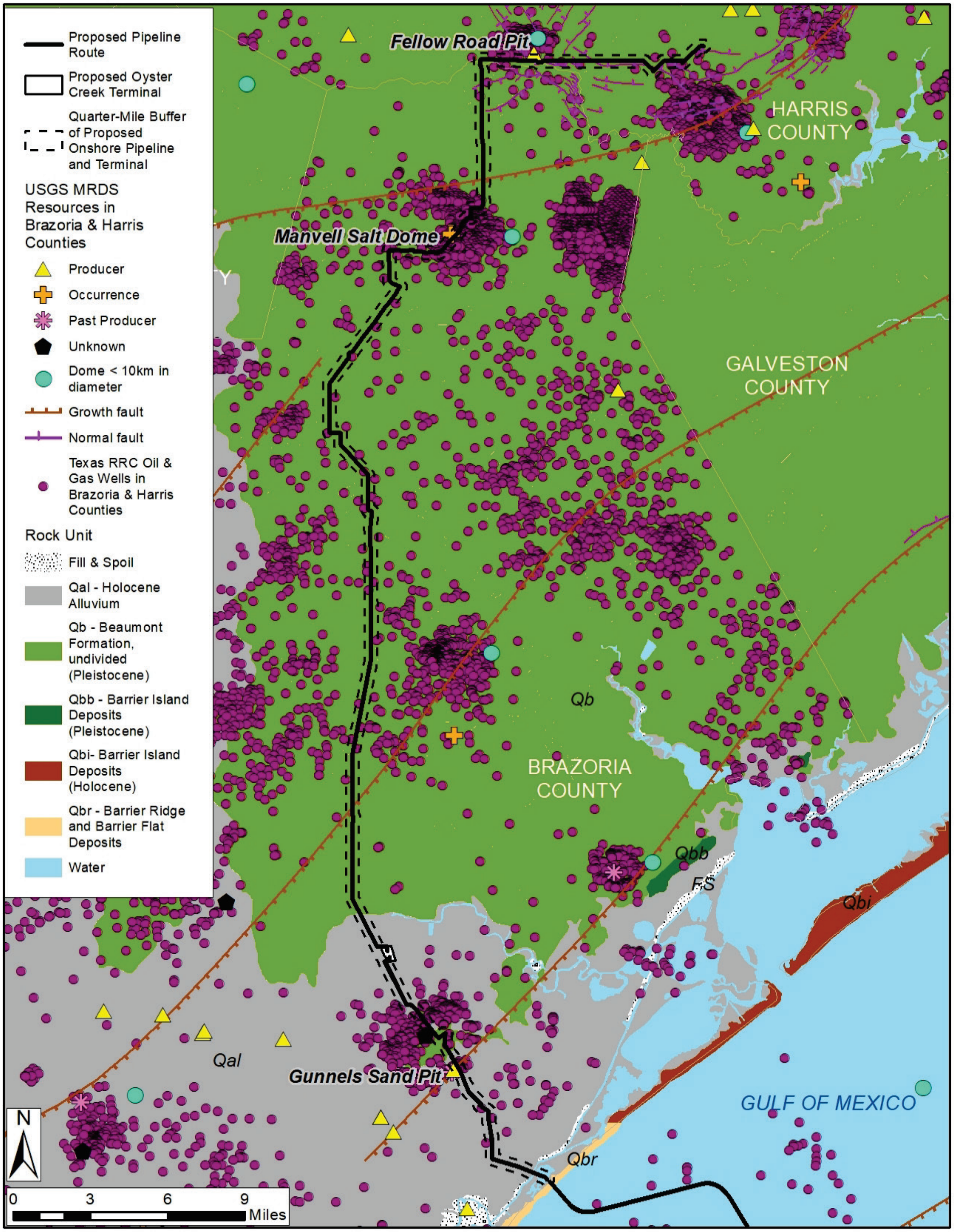
Additionally, the onshore Project area would be located within an area of documented salt deposits. The thickness and density of the overlying marine sedimentary rocks caused the ductile and buoyant salt deposits to move upward and form "salt domes," which deformed the surrounding sedimentary rocks into traps for oil and gas deposits (Galloway 2008). Based on the USGS Mineral Resources Data System database, there are eight documented salt domes that are less than 10 kilometers (6.2 miles) in diameter located within 10 miles of the Project (USGS 2005). Of these eight salt domes, the Bryan Mound, Clemens, and Stratton Ridge salt domes are used for crude oil or light hydrocarbon storage (Seni et al. 1985). Figure 3.8-1 shows the locations of surficial deposits, faults, and salt domes in the onshore Project area. While salt domes are present in the vicinity of the SPOT Project, the Project would not cross any known areas of karst topography.[10] Section 3.8.5, Geologic and Soil Resources, Geologic Hazards, contains additional information regarding salt domes and karst topography.

[10] Karst topography is landscape that is underlain by soluble rocks (e.g., limestone, dolomite) that have been eroded by water over time. It is usually characterized by ridges, towers, fissures, sinkholes, and other characteristic landforms.

Offshore Project Area

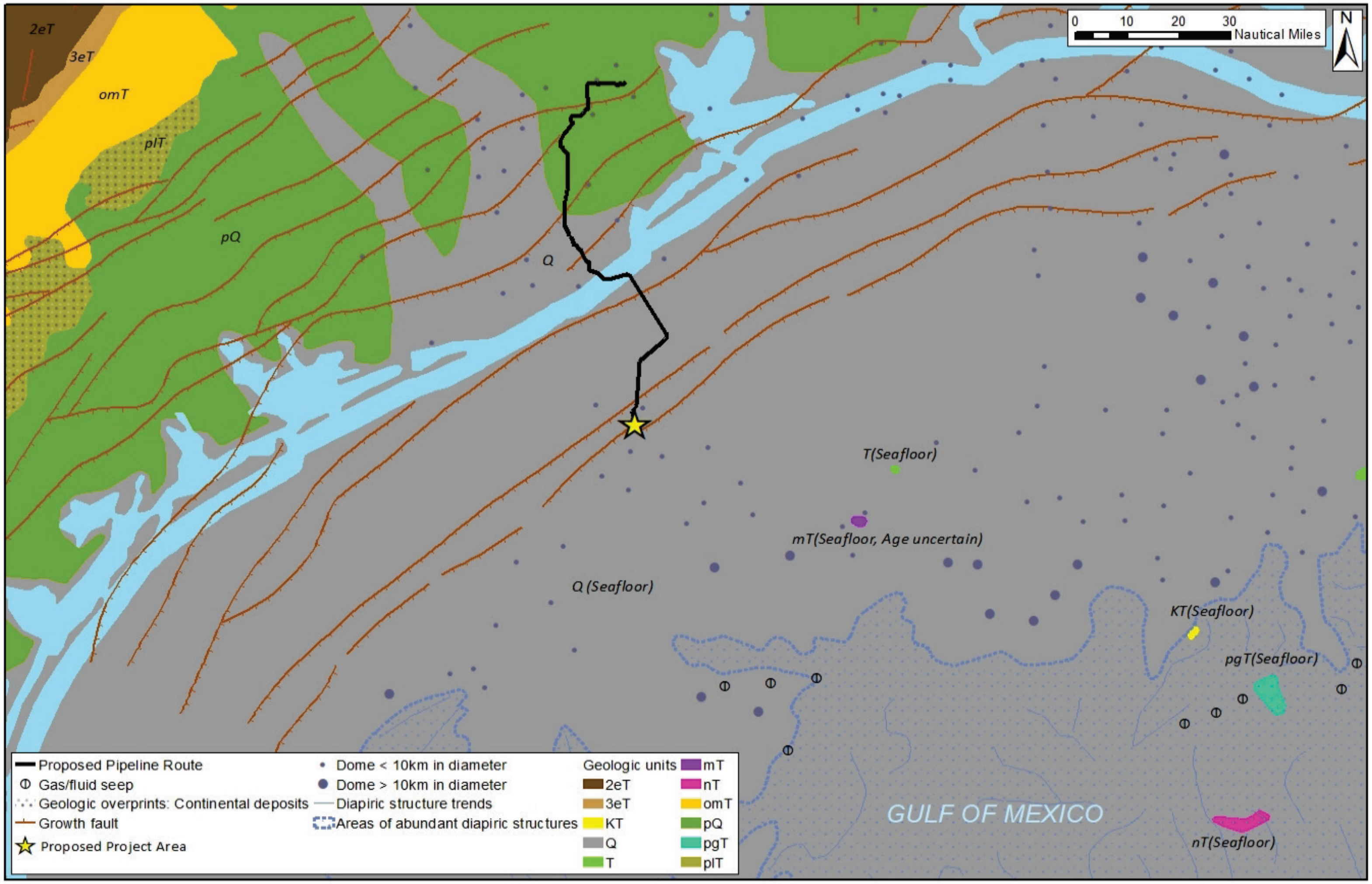
The offshore Project area would be located within the GoM basin, which is part of the Coastal Plain physiographic province (Carr et al. 1967). A series of normal and growth faults border the basin and reflect the gravitational collapse of thick post-rifting sediments within the basin. The SPOT DWP would be constructed on the OCS, which formed primarily due to sea level regression, sediment deposition in deltas and incised channels, and development of carbonate platforms. In some areas with adequate light penetration and suitable conditions, the carbonate platforms support coral-algal reefs (Galloway 2008). According to a geophysical survey of the offshore Project area conducted by the Applicant (SPOT 2019a, Application, Volume III, Attachment 2A), the seafloor slopes to the south or southeast, and the slope gradient ranges from approximately 21 feet per mile near the coast to approximately 2 feet per mile in the proposed offshore platform area. In general, sediments in the GoM consist of sandy silty clay, silty clay, silty sand, and sand (Sheridan and Caldwell 2002). Section 3.8.4.1, Geologic and Soil Resources, Soil and Sediment Characteristics, Existing Conditions, provides a detailed description of offshore sediments in the Project area.

Similar to the onshore Project area, the offshore GoM contains upwelled salt deposits that form structural domes, functioning as traps for oil and gas reserves. Salt domes that are less than 10 kilometers (6.2 miles) in diameter are located near the offshore Project area (Garrity and Soller 2009). The geophysical survey identified isolated pinnacle features exposed above the seafloor that were associated with uplifted dome structures. Figure 3.8-2 illustrates the approximate location of salt domes in the Project area.



Source: RRC 2019a; Garrity and Soller 2009; USGS 2014a

Figure 3.8-1: Geologic Resources in the Onshore Project Area



Source: USGS 2014a; Garrity and Soller 2009

2et = sedimentary rock—maximum age, Middle Eocene; 3et = sedimentary rock—maximum age, Upper Eocene; KT = sedimentary rock—maximum age, Cretaceous; Q = sedimentary rock—maximum age, Quaternary; T = sedimentary rock—maximum age, Tertiary; mT = sedimentary rock—maximum age, Miocene; nT = sedimentary rock—maximum age, Neogene; omT = sedimentary rock—maximum age, Oligocene; pQ = sedimentary rock—maximum age, Pleistocene; pgT = sedimentary rock—maximum age, Paleogene; pIT = sedimentary rock—maximum age, Pliocene

Figure 3.8-2: Seafloor Features in the Project Area

3.8.3.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project. The study area within which potential impacts were assessed includes the SPOT Project workspace and the area within approximately 1 mile to account for any direct or indirect impacts on geologic resources.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on geologic resources have been evaluated based on their potential to:

- Degrade unique geologic features; and/or
- Alter the lithology, stratigraphy, or geologic structures that control or contribute to groundwater quality, the distribution of aquifers and confining beds, and groundwater availability.

The remainder of this section describes potential impacts from Project construction and operation on geologic resources from ground disturbance; seafloor disturbance from jet sledding, pile driving, and anchor placement; and scour.

Onshore Project Area

The impacts on the local geology during construction of the Project would be temporary and limited to the extent of the construction corridor, which would be approximately 100 feet wide for the ECHO to Oyster Creek Pipeline and 150 feet wide for the Oyster Creek to Shore Pipelines. The Applicant proposes to restore the temporarily disturbed areas within the construction corridors to preconstruction topographic contours. As a result of the relatively narrow width of construction workspaces and proposed restoration to preconstruction contours, the impacts from Project construction are anticipated to be direct, adverse, and short-term but minor. During operation of the Project, additional excavations may be necessary for maintenance or repair of the onshore pipelines; however, these excavations would be minimal and temporary. The Project would also include a cathodic protection system with five deep impressed current cathodic protection anode beds. These beds would be wholly within the permanent right-of-way, but would be installed approximately 130 feet deep. Based on the local geology, these five beds would not intersect any sensitive or substantial geologic features. Therefore, the impacts on the local geology from operation of the Project are anticipated to be direct, adverse, short-term, and negligible.

Offshore Project Area

Construction activities in the offshore Project area would include pile driving; jetting the trench to lay the pipelines into the seabed; directional drilling; constructing the platform, SPM buoys, and PLEMs; and use of vessel anchors. These activities would temporarily disturb sediments on the seafloor and may locally alter seafloor bathymetry[11]; however, it is anticipated that the disturbed sediment would redeposit near the disturbances. The two collocated offshore pipeline centerlines would be separated by a distance of approximately 164 feet. Based on the distance between the two pipelines, the jet sled corridors would avoid the identified pinnacle features by at least 500 feet, which would exceed the buffer distance required by BOEM's Notices to Lessees and Operators (NTL) 2009-G39, Biologically-Sensitive Underwater Features and Areas. As such, it is not anticipated that the Project would impact pinnacle

[11] The depths and shapes of the underwater terrain (NOAA 2018d).

features with hard substrates, such as carbonate reefs or outcrops exposed by erosion. Construction vessels, including derrick barges for pile driving, would be dynamically positioned vessels, and other service vessels would moor to the service vessel mooring buoys. The fluke anchors and anchor chains for the two SPM buoys are anticipated to disturb a total of 0.364 acre of seafloor, and concrete sinkers for the service vessel moorings are anticipated to disturb 0.0016 acre (approximately 70 square feet) of seafloor. Based on this information, impacts on the local offshore geology from construction of the proposed offshore pipelines, platform, SPM buoys and PLEMs, and anchors are anticipated to be direct, adverse, short-term, and minor to moderate due to the sediment disturbance and erosion.

Operation of the Project could impact seafloor sediments due to operational scour where the Project components intersect the seafloor; however, based on the geotechnical and geophysical data collected for the Project, a clay layer composes the uppermost sediment horizon, which would not scour as easily as a sandy sediment layer (SPOT 2019a, Application, Volume III, Attachments 2A and 2B; Mostafa 2012). If, during detailed engineering and design, scour is determined to present a concern with regards to the stability or longevity of the Project components, the Applicant would adjust the design to avoid lateral support at a scour depth recommended by a geotechnical expert. A future detailed engineering design would be conducted to evaluate and design the revised pile depth to minimize the potential impacts of scour. The offshore pipeline route and platform footprint would avoid hard substrate seafloor features during construction, and maintenance activities during operation of the Project would impact the area within the previously disturbed footprint. Therefore, impacts on the local offshore geology during operation of the Project would be direct, adverse, long-term, and negligible.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance onshore could involve ground-disturbing activities and impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction BMPs (Appendix M; BMP #1 in Appendix N) and industry standard upland construction plans (BMP #26). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible.

Periodic maintenance offshore could result in disturbance to the seafloor and impacts would be similar to those described for construction. Impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.8.4. Soil and Sediment Characteristics

3.8.4.1. Existing Conditions

This section summarizes the existing onshore soil and offshore sediment resource conditions for the proposed Project. The section considers the location of the Project with regards to soil and sediment types and their characteristics.

Soils

The USDA NRCS Soil Survey Geographic (SSURGO) database and soil descriptions from Brazoria and Harris counties, Texas (USDA Soil Conservation Service 1976, 1981), provide descriptions of soils in the Project area. Table 3.8-1 lists major characteristics of the 23 soil types (series) that the Project would cross, acreages of permanent Project impacts, and total acreages of the construction right-of-way impacts. Appendix T, Soil Maps, provides soil maps for the proposed onshore Project area.

Table 3.8-1: Soil Types and Characteristics within the SPOT Project Area

Soil Series	Prime Farmland or Statewide Importance	Hydric Soil	Drainage Class	Total Construction Impact Area [a, b] (acres)	Total Permanent Impact Area [b] (acres)
Aris-Gessner complex, occasionally ponded	Yes, if drained	Yes	Poorly Drained	9.4	0.2
Bernard clay loam	Yes	No	Somewhat Poorly Drained	161.3	28.7
Bernard Edna complex	Yes	No	Somewhat Poorly Drained	81.4	18.7
Bernard-Urban land complex	No	No	Somewhat Poorly Drained	2.4	0.2
Edna loam	Statewide importance	No	Somewhat Poorly Drained	40.6	10.8
Gessner complex	No	Yes	Poorly Drained	0.4	<0.1
Lake Charles clay	Yes	No	Moderately Poorly Drained	436.1	87.1
Lake Charles-Urban land complex	No	No	Moderately Poorly Drained	17.4	0.6
Asa silty clay loam	Yes	No	Well Drained	15.6	5.5
Bacliff clay	Yes, if drained	Yes	Poorly Drained	3.6	1.0
Edna-Aris complex	Statewide importance	No	Somewhat Poorly Drained	3.5	1.1
Francitas clay loam	No	No	Somewhat Poorly Drained	11.6	7.7
Ijam clay, rarely flooded	No	Yes	Poorly Drained	2.4	0.5
Leton loam, occasionally flooded	No	Yes	Poorly Drained	5.7	1.5
Mustang fine sand, frequently flooded, frequently ponded	No	Yes	Poorly Drained	2.5	0.6
Madre fine sand, occasionally flooded, frequently ponded	No	No	Poorly Drained	1.5	1.5
Narta fine sandy loam, rarely flooded	No	Yes	Poorly Drained	21.1	6.6
Norwood loam, rarely flooded	Yes	No	Well Drained	2.1	0.8
Pledger clay, rarely flooded	Yes	No	Moderately Poorly Drained	105.5	78.1
Churnabog clay, frequently flooded, occasionally ponded	No	Yes	Poorly Drained	6.9	2.0
Surfside clay, occasionally flooded	No	Yes	Very Poorly Drained	144.4	90.9

Soil Series	**Prime Farmland or Statewide Importance**	**Hydric Soil**	**Drainage Class**	**Total Construction Impact Area [a, b] (acres)**	**Total Permanent Impact Area [b] (acres)**
Velasco clay, frequently flooded	No	Yes	Very Poorly Drained	36.0	7.4
Veston silty clay loam, strongly saline, frequently flooded	No	Yes	Poorly Drained	2.1	1.5
			Total	1,113.5	353.0

Source: USDA Soil Conservation Service 1976, 1981; NRCS 2018

[a] Total construction impact area includes permanent workspace, mainline valves, and the Oyster Creek Terminal.

[b] Soil impacts do not include 9.1 acres of temporary impact and 5.0 acres of permanent impact on open water; 3.2 acres of temporary and permanent impact at the ECHO Terminal; and 8.0 acres of temporary impact and 5.9 acres of permanent impact from access roads.

The Project would cross several soils types that meet the definition of soils suitable for agriculture, which the NRCS defines as prime farmland, unique farmland, and farmland of statewide importance. Soils do not need to be actively farmed to be considered agricultural soils; rather, the NRCS bases the definition on the physical and chemical properties of the soils instead of current or historic land use. Specifically, the NRCS defines prime farmland as soils with availability and the best characteristics to grow feed, fiber, forage, food, and oilseed crops. Farmland of statewide importance includes soils that are not prime farmland, but meet many of the characteristics necessary to produce crops (NRCS 2018). Most soils that the Project would cross are considered prime farmland, or would be considered prime farmland if the soils were drained. Two soils that the Project would cross, the Edna loam and Edna-Aris complex, are classified as soils of statewide importance. The Project would not cross any soils classified as unique farmland. A review of NRCS data and visual analysis of aerial photography indicate that soils classified as prime farmland or farmland of statewide importance within proposed Project workspaces may be actively farmed. Of the approximately 859 acres of disturbance within prime farmland or farmland of statewide importance, the analysis estimated that the Project would temporarily disturb about 204 acres of actively farmed land and permanently disturb about 77 acres of actively farmed land.

Hydric soils are poorly drained or very poorly drained and typically form in water-saturated settings (e.g., near wetlands and/or areas of shallow groundwater) such that oxygen-poor conditions develop within the soil profile (NRCS 2018). Excavations within hydric soils may require dewatering, and hydric soils are more prone to rutting and compaction compared to non-hydric soils.

Hydric soils represent one characteristic that may require additional planning for trenching and construction methods to minimize impacts on soils. Other soil characteristics that would affect construction and restoration activities include potential for wind erosion, compaction, and poor revegetation. In addition, acidic soils have an increased potential to corrode concrete or steel. Table 3.8-2 presents a summary of the soils' main characteristics that have the potential to affect the Project.

Table 3.8-2: Soils Crossed and Major Characteristics that May Affect the SPOT Project

Soil Series	Wind Erosion Potential	Compaction Potential	Risk of Corrosion to Concrete	Risk of Corrosion to Steel	Poor Revegetation Potential
Aris-Gessner complex, occasionally ponded	Moderate	Medium	Moderate	High	No
Bernard clay loam	Moderate	Medium	Moderate	High	No
Bernard Edna complex	Moderate	Medium	Moderate	High	No
Bernard-Urban land complex	Low	Medium	Low	High	No
Edna loam	Low	Medium	Moderate	High	No
Gessner complex	Moderate	High	Low	High	Yes
Lake Charles clay	Moderate	Medium	Low	High	No
Lake Charles-Urban land complex	Moderate	Medium	Low	High	No
Asa silty clay loam	High	Medium	Low	Low	No
Bacliff clay	High	Medium	Low	High	No
Edna-Aris complex	High	Medium	Moderate	High	Yes
Francitas clay loam	High	Medium	High	High	Yes
Ijam clay, rarely flooded	Moderate	Medium	Low	High	No
Leton loam, occasionally flooded	Moderate	Medium	High	High	Yes
Mustang fine sand, frequently flooded, frequently ponded	Very High	Low	Moderate	Moderate	Yes
Madre fine sand, occasionally flooded, frequently ponded	Very High	Low	Moderate	Moderate	Yes
Narta fine sandy loam, rarely flooded	High	Medium	High	High	No
Norwood loam, rarely flooded	Moderate	Medium	Low	Low	No
Pledger clay, rarely flooded	Moderate	Medium	Low	High	No
Churnabog clay, frequently flooded, occasionally ponded	Moderate	Medium	Moderate	Moderate	No
Surfside clay, occasionally flooded	Moderate	Medium	High	High	No
Velasco clay, frequently flooded	Moderate	Medium	High	High	Yes
Veston silty clay loam, strongly saline, frequently flooded	High	Medium	High	High	Yes

Source: USDA Soil Conservation Service 1976, 1981; NRCS 2018

Soils are susceptible to erosion from wind and water based on characteristics such as slope, vegetative cover, runoff potential, soil texture and structure, and local climate and topography. Soils with poor revegetation potential tend to be located on steep slopes that lack vegetative cover and may be more susceptible to erosion.

The NRCS defines susceptibility to compaction based on soil properties including water storage, presence of rocks, soil texture, organic content, bulk density, and soil structure. Soils with high compaction potential are typically moisture sensitive and compact readily under the weight of construction equipment, which effectively reduces seedling growth rates. Based on the NRCS SSURGO database, the soils that the Project would cross do not contain rocks or shallow bedrock within the uppermost 3 feet. The Gessner complex is the only soil the Project would cross that exhibits a high susceptibility to compaction.

The Project would cross several soils that the NRCS rates as having a “high” risk of corrosion to concrete and/or uncoated steel (see Table 3.8-2). The potential risk to concrete or uncoated steel depends on characteristics of the soils, including acidity, chemical composition, electrical conductivity, particle size, and moisture (NRCS 2018).

The Project would also cross developed industrial and/or commercial areas, which would increase the potential that contaminated soils or groundwater could be encountered during construction. According to the USEPA "Cleanups in my Community" database, five Superfund sites listed on the National Priority List and nine Federal Emergency Response sites are located within 5 miles of the Project. In addition, four leaking petroleum storage tank sites identified on the TCEQ Central Registry database are located within 0.25 mile of the Project. The sites are not located within the Project footprint or workspaces. Three Operator Cleanup Program (OCP) sites mapped on the Railroad Commission of Texas (RRC) Public GIS Viewer are associated with oil and gas fields and are located within 0.25 mile of the Project workspaces (RRC 2019a). The closest OCP site to the Project is the O.F. Ewing Lease, Manvel Field OCP site, which is classified as active and is located approximately 845 feet northwest of MP 16.3.

Sediments

A geophysical survey and geotechnical investigation identified physical characteristics of sediment along the proposed offshore pipeline route. The geophysical investigation is described in detail in Section 3.8.7, Geologic and Soil Resources, Offshore Geophysical Investigation. The geotechnical survey involved advancing four deep sediment cores to depths ranging from 120 to 400 feet below the seafloor, and collecting shallow sediment samples for geotechnical analysis along the offshore pipeline route and at the site of the SPOT DWP and SPM buoys.

The geotechnical investigation concluded that shallow sediments in the proposed offshore pipeline construction corridor, SPOT DWP site, and SPM buoy area consist of sandy sediments near the coastline that grade into silty clays and clays that represent a low-energy environment beneath the channels at the SPOT DWP. The sandy sediments have varying grain sizes in the fluvial incised channels that exhibit cross-bedding, whereas the silty clays and clays cover the seafloor in the areas where the platform, PLEMs, SPM buoys, and anchors would be installed and deployed. Table 3.8-3 summarizes sediment characteristics encountered in each borehole.

Table 3.8-3: Summary of Sediment Characteristics in Geotechnical Piston Core Samples

Core ID	Easting (feet)	Northing (feet)	Recovery (feet)	Sediment Characteristics
L3-PC1	NA	NA	NA	Not sampled as water was too shallow
L4-PC2	930,129	10,514,525	4	Fat clay
L5-PC3	941,383	10,517,417	2	Lean clay
L6-PC4	956,081	10,510,191	4.5	Fat clay and lean clay
L7-PC5	963,461	10,498,026	4	Silty sand at the mudline, then fat clay at 5 feet below mudline
L8-PC6	971,022	10,485,590	1.5	Lean clay at 0.5 foot below mudline, then silty sand at 1.6 feet below mudline
L9-PC7-2	977,206	10,475,362	10	Sandy lean clay from mudline to 9 feet, then fat clay
L10-PC8-2	985,987	10,460,902	7.5	Clayey sand to 3 feet, then sandy fat clay
L11-PC9-2	989,247	10,455,536	5	Lean clay with sand
L12-PC10-3	991,703	10,451,479	2.5	Clayey sand
L13-PC11-2	989,220	10,438,011	5	Sandy lean clay
L14-PC12-2	979,109	10,429,109	6.5	Sandy lean clay, then lean clay with sand at 2 feet below mudline, then sandy lean clay
L16-PC13	973,912	10,424,617	6	Sandy lean clay at 1 foot below mudline, then silt at 4 feet below mudline

Core ID	Easting (feet)	Northing (feet)	Recovery (feet)	Sediment Characteristics
L17-PC14	969,517	10,420,761	10	Clayey sand, then sandy fat clay at 5 feet, then fat clay at 8.5 feet
L18-PC15-3	962,592	10,410,745	10	Sandy lean clay at 2 feet, then silt with sand at 5 feet, and fat clay at 8 feet
L19-PC16	961,363	10,396,576	4.5	Fat clay
L20-PC17	960,368	10,385029	5.5	Fat clay
L21-PC18	959,231	10,371,922	1.5	Clayey sand
L22-PC19	954,596	10,354,035	6	Sandy lean clay at the mudline, then clayey sand at 1 foot, fat clay with sand at 2 feet, and silty sand at 4 feet
L23-PC20	958,207	10,336,650	8	Fat clay, then sandy fat clay at 6 feet
L24-PC21	954,278	10,338,125	7.5	Silty sand near the mudline, clayey sand at 2 feet, fat clay at 4 feet, and sandy lean clay at 7 feet
L25-PC22	961,046	10,340,151	5.5	Clayey sand, then sandy fat clay at 3 feet, then clayey sand at 4 feet
L26-PC23	955,097	10,349,404	9	Sandy lean clay near the mudline, then fat clay with sand to 6 feet, then sandy fat clay

Source: SPOT 2019a, Application, Volume III, Attachment 2B

NA = not applicable

The geotechnical survey also involved collecting 18 sediment samples, including 1 sample near the shoreline, 14 samples along the pipeline route, and 3 samples in the SPOT DWP area. The laboratory used by the Applicant analyzed the sediment samples for metals, mercury, pesticides, semi-volatile organic compounds, VOCs, PCBs, and total organic carbon (TOC). Table 3.8-4 provides a summary of chemicals that were detected above the laboratory's method detection limit in sediment collected from the offshore Project area. Of these detections, six chemicals were detected that exceeded the NOAA Screening Quick Reference Tables (SQuiRTs)[12] Effects Range-Low concentration. None of the chemicals detected in the samples exceeded the Effects Range-Median concentration, which is a screening benchmark concentration above which adverse effects frequently occur (Long et al. 1995).

Table 3.8-4: Summary of Detected Chemical Results in Sediment Collected from the Proposed Project Area

Chemical	Chemical Group [a]	Number of Detections [b]	Maximum Detected Concentration	Marine SQuiRT ERL [b]	Marine SQuiRT ERMed [b]	Number of SQuiRT Benchmark Exceedances [c]
Toluene	VOC	4	15	NA	NA	NA
Acenaphthylene	SVOC	1	17	44	640	0
Anthracene	SVOC	1	4.1	85.3	1,100	0
Benzo(a)anthracene	SVOC	1	3.1	261	1,600	0
Benzo(a)pyrene	SVOC	2	5.3	430	1,600	0
Benzo(b)fluoranthene	SVOC	2	4.7	NA	NA	NA
Benzo(k)fluoranthene	SVOC	1	2.2	NA	NA	NA
Chrysene	SVOC	5	5.7	384	2,800	0
Dibenzofuran	SVOC	1	41	63.4	--	0
Fluoranthene	SVOC	3	5.6	600	5,100	0
Fluorene	SVOC	1	55	19	540	1

[12] SQuiRT benchmark levels are preliminary screening concentrations for chemicals in various environmental media, in this case marine sediments, which are used to evaluate the potential risks to coastal habitats from sediment that may be contaminated with organic and inorganic compounds.

Chemical	Chemical Group [a]	Number of Detections [b]	Maximum Detected Concentration	Marine SQuiRT ERL [b]	Marine SQuiRT ERMed [b]	Number of SQuiRT Benchmark Exceedances [c]
Indeno[1,2,3-c,d]pyrene	SVOC	2	3.5	NA	NA	NA
Naphthalene	SVOC	2	530	160	2,100	1
Phenanthrene	SVOC	1	65	240	1,500	0
Pyrene	SVOC	10	6.8	665	2,600	0
4,4'-DDD	Pesticide	1	1.1	2	20	0
4,4'-DDE	Pesticide	1	5.2	2.2	27	1
4,4'-DDT	Pesticide	1	1.6	1	7	1
Aldrin	Pesticide	1	1.8	NA	NA	NA
Alpha-BHC	Pesticide	1	1.1	NA	NA	NA
Beta-BHC	Pesticide	3	55	NA	NA	NA
Delta-BHC	Pesticide	1	0.94	NA	NA	NA
Dieldrin	Pesticide	1	2.8	0.02	8	1
Endosulfan I	Pesticide	1	13	NA	NA	NA
Endosulfan II	Pesticide	1	1.8	NA	NA	NA
Endrin	Pesticide	1	3	NA	NA	NA
Endrin aldehyde	Pesticide	1	1.1	NA	NA	NA
Gamma-chlordane	Pesticide	1	2.9	NA	NA	NA
Heptachlor	Pesticide	1	0.69	NA	NA	NA
Heptachlor epoxide	Pesticide	1	9.1	NA	NA	NA
Arsenic	Metal	18	17.4	8.2	70	1
Barium	Metal	18	181	NA	NA	NA
Cadmium	Metal	13	0.51	1.2	9.6	0
Chromium	Metal	18	32.90	81	370	0
Lead	Metal	18	23.80	46.7	218	0
Selenium	Metal	18	1.14	NA	NA	NA
Silver	Metal	18	0.07	1	3.7	0
Mercury	Mercury	18	0.0201	0.15	0.71	0
Total organic carbon	TOC	18	0.67	NA	NA	NA

Source: Buchman 2008

ERL = Effects Range-Low; ERMed = Effects Range-Median; NA = not applicable; SQuiRT = Screening Quick Reference Table; SVOC = semi-volatile organic compound; TOC = total organic carbon

[a] VOCs, SVOCs, and pesticides are reported in micrograms per kilogram (µg/kg), and metals and TOC are reported in milligrams per kilogram (mg/kg).

[b] Effects Range-Low and Effects Range-Median are used in marine toxicology to describe the concentration below which adverse effects rarely occur (ERL) and the concentration above which adverse effects frequently occur (ERM; Long et al. 1995).

[c] Number of samples with detections or exceedances out of 18 analyzed samples.

3.8.4.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would implement to minimize impacts on soil and sediment resources. The study area within which potential impacts were assessed includes the SPOT Project workspace and the area within approximately 1 mile to account for any direct or indirect impacts on soils or sediments.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on soil and sediment resources have been evaluated based on their potential to:

- Increase erosion potential; and/or
- Alter soil or sediment composition, structure, or function.

The remainder of this section describes the potential impacts on soil and sediments from Project construction and operation.

Soils

Activities that would result in impacts on soils during construction would include clearing, grading, and excavating, as well as the movement of construction vehicles, which could result in rutting and compaction from heavy equipment. In total, the Project would temporarily impact approximately 859.1 acres of soils suitable for agriculture and approximately 234.5 acres of hydric soils (including those that could be suitable for agriculture if drained). The Project would permanently impact approximately 232.0 acres of soils suitable for agriculture and approximately 112.2 acres of hydric soils.

The NRCS evaluated the proposed onshore Project area in accordance with the Farmland Protection Policy Act. Based on the farmland value in the Project area and acreage of prime farmland that the Project would permanently convert, the NRCS determined that the Project would not require further evaluation or protection measures (see Appendix D, Agency Correspondence).

The Applicant would minimize potential adverse impacts on hydric soils by implementing BMPs as specified in the Construction BMPs (Appendix M and BMP #1 in Appendix N) for wetland crossings, including:

- Minimizing the length of time that hydric soils are disturbed (BMP #5 in Appendix N);
- Installing sediment barriers immediately upslope of the wetland boundary to prevent off-site transport of sediment (BMP#5); and
- Properly installing timber mats or other stabilization measures to minimize rutting in wetlands (BMP #5).

To minimize the potential adverse impacts on soils classified as soils suitable for agriculture, the Applicant would segregate the topsoil (i.e., at least 12 inches, or the entire layer where topsoil is less than 12 inches deep) from the subsoil in separate windrows or stockpiles within the construction right-of-way and would install silt fence on the downslope sides of the piles to minimize erosion (BMP #7 in Appendix N). The Applicant would de-compact subsoil in agricultural areas using a plow or other method following construction activities (see Appendix M, Construction BMPs; BMP #1 in Appendix N). The MARAD and USCG recommend that, if construction results in substantial rutting in uplands and if rutting or compaction results in the mixing of topsoil and subsoil in wetlands, the Applicant would install temporary timber mats to minimize rutting or compaction (BMP #1).

In general, the Applicant would implement and maintain appropriate erosion and sediment controls until restoration activities are complete in accordance with the Applicant's Construction BMPs (Appendix M and BMP #1 in Appendix N). Compaction and erosion may occur due to routine maintenance activities during operation of the Project; however, the Applicant would apply the following BMPs:

- Testing for compaction using a penetrometer or other appropriate method where construction has disturbed agricultural or residential areas (BMP #26);
- Tilling the soil with a plow to de-compact the soil, and plowing the subsoil in areas where the topsoil has been segregated (BMP #26); and
- Installing temporary erosion controls such as slope breakers, sediment barriers, or mulch to stabilize the disturbed area during construction activities (BMP #26).

As BMPs would be implemented as described above, the adverse impacts of compaction and erosion would be direct, adverse, long-term, and minor to moderate.

Based on the results of a front-end engineering design study and as presented in Section 2.2, Detailed Description of the Proposed Action, the Project would involve installing a cathodic protection system and manufacturing pipe with a protective coating to mitigate potential pipe corrosion from high-risk soils. Protective coating is a requirement of 49 CFR § 192.455 for buried or submerged pipelines installed after 1971, and the coating specifications are described in 49 CFR § 192.461. In addition, aboveground storage tanks and other structures would be constructed with concrete mixed locally to withstand corrosion from local soil conditions. The use of local materials would more closely match the chemical and other characteristics present within the onshore pipeline workspace, thereby reducing the potential of corrosion.

To minimize the potential impacts on soil from unexpected spills, the Applicant would follow procedures provided in the Onshore Construction Spill Response Plan (Appendix F; BMP #3 in Appendix N). Some of the measures would include:

- Storing hazardous materials in temporary (i.e., secondary), secured containment systems that are designed to hold 10 percent more than the stored hazardous materials volume, with routine integrity inspections of containment and tanks (BMP #3);
- Refueling equipment farther than 100 feet from waterbodies and 200 feet from existing water wells (BMP #3);
- Notifying the Environmental Inspector of reportable spills (BMP #3);
- Using absorbent pads and other materials as appropriate to absorb spilled substances (BMP #3); and
- Disposing of contaminated media and decontaminating equipment in accordance with the Construction Spill Response Plan (BMP #3).

With implementation of these BMPs, impacts on soils from inadvertent spills during construction would be direct, adverse, short-term, and minor to moderate depending on the size of the spill. If an oil spill occurred during operation, impacts on soils would be direct, adverse, short-term to long-term, and minor to major, depending on the size of the spill. Minor unplanned excavations may occur during operation of the Project; however, these impacts on soils would be direct, adverse, short-term, and negligible.

As described in Section 3.8.4.1, Geologic and Soil Resources, Soil and Sediment Characteristics, Existing Conditions, several documented contaminated sites are located near the onshore Project area. If visibly or olfactorily contaminated soils are encountered during construction of the Project, the Applicant would halt construction, evacuate personnel to an upwind area, and bring a qualified health and safety professional on site to evaluate and recommend additional safety precautions, as needed. Potentially contaminated soil may be screened and/or sampled for laboratory analysis, and the Applicant would notify appropriate agencies. If the contaminated soil does not require disposal at an off-site facility, the Applicant would properly contain and protect the contaminated soil while the pipeline is lowered into the trench, then backfill the trench with the contaminated soil in its original location per requirements described in 30 Texas Administrative Code § 350.36(a). If contaminated soils cannot be placed back into the excavation, the Applicant would backfill the excavation with clean soil and send the material to an authorized and appropriate waste management facility. These procedures are described in the Applicant's Unanticipated Discovery of Contamination Plan (Appendix O; BMP #4 in Appendix N). If these procedures are followed, impacts of construction on existing contaminated sites would be direct, adverse, short-term, and negligible.

As discussed in Section 3.3, Water Resources, the Applicant conducted a data search to assess the general feasibility of using the HDD construction method. The results indicated that the HDDs proposed for the SPOT Project would occur in suitable soils of the Beaumont Formation, which is composed of ancient river sediments that deposited silt and sand in belts and channels, and deposited muds and clay in flood basins (Garcia 1991). In the Houston-Galveston area, muds of the Beaumont Formation are overlain by sand. The thickness of the formation varies across the coastal plains, and is estimated to be several hundred feet thick in the Texas Coastal plain and several thousand feet thick in the Louisiana Coastal plain (Garcia 1991). The Applicant believes the soils of the Beaumont Formation are suitable for the HDD construction method and provided examples of several successful HDD crossings in the region, such as a crossing of the Houston Ship Channel by an 18-inch natural gas pipeline and a 30-inch pipe crossing of the Sabine-Neches Waterway in Port Arthur, Texas (SPOT 2019jj). As such, failure of the proposed HDDs is not anticipated, and impacts on soils from HDD activities would be direct, adverse, long-term, and minor.

Sediment

Construction of the proposed Project would disturb seafloor sediments by driving piles, installing the pipelines and HDD boreholes, and constructing the platform, vessel anchors, SPM buoys, and PLEMs. Based on results of a sediment fate and transport model that assessed the sediment impacts of jetting, pile driving, and HDD excavation and backfill during construction of the Project (SPOT 2019g, 2019dd, 2019hh), the offshore pipeline installation would re-suspend approximately 17,562,160 cubic feet of sediment. Depending on the timing of pipeline installations using the jet sled (two pipelines installed separately or both pipelines installed at the same time), the deposition of suspended sediment greater than 0.04 inch thick (1 mm) would impact approximately 3,823 acres (installed simultaneously) or 6,210 acres (installed separately) of the seabed. Based on the sediment fate and transport model and estimates of direct impact to the seafloor, other potential disturbances include the following:

- Excavating by sidecasting material from the HDD bore pit using a bucket dredge and subsequently backfilling the pit (if necessary, as the Applicant has proposed to allow the exit pit to backfill naturally) would re-suspend approximately 1,024 cubic feet of sediment and cause suspended sediment to re-deposit at a thickness greater than 0.04 inch over an area of approximately 2.2 acres.

- Driving eight piles for the SPOT DWP into the seabed would directly impact approximately 0.005 acre (approximately 218 square feet) of seabed and cause suspended sediment to re-deposit at a thickness greater than 0.04 inch within an area of approximately 0.017 acre (approximately 741 square feet).
- The fluke anchors and anchor chains would impact approximately 0.36 acre for the SPM buoys, and the concrete sinkers for the service vessel moorings would impact 0.0016 acre (approximately 70 square feet) of the seabed.

Based on analytical results of sediment samples collected from the Project area, none of the chemical concentrations in sediment exceeded the SQuiRT Effects Range-Median screening benchmark (SPOT 2019a, Application, Volume IIa, Appendix I). In addition, the sediment fate and transport model described above indicated that TSS would temporarily increase above background levels in the offshore Project area from jetting, pile driving, and HDD excavation and backfill. The model predicted that pipeline installation would cause excess TSS concentrations (greater than 10 mg/L) at the bottom of the water column up to approximately 2.5 miles (4 kilometers) to the southwest of the proposed route. In contrast, the model predicted that pile driving would cause excess TSS concentrations up to approximately 30 feet southwest of each of the eight pile locations, and the HDD pit excavation and backfill would increase TSS up to approximately 890 feet southwest of the pit location.

Based on the model results, Project construction would alter sediment composition and structure; however, the excess TSS concentrations would be temporary and short-term, as the model predicted that sediment re-deposition would attenuate on a scale of hours following the disturbances. Therefore, the impact on the seafloor during construction of the Project would be, direct, adverse, short-term, and moderate.

During operation of the Project, actions of tides and/or natural or vessel-induced currents may cause sediment scour where the Project components intersect the seafloor. Clay is prevalent at the mudline at the SPOT DWP, and would be unlikely to scour to the same degree as sandy sediments (Mostafa 2012). If, during detailed engineering and design, scour is determined to present a concern with regards to the stability or longevity of the Project components, the Applicant would adjust the design to avoid lateral support at a scour depth recommended by a geotechnical expert. Therefore, impacts on the local offshore sediments from operation of the Project are anticipated to be direct, adverse, long-term, and negligible.

A release of fuel, oil, or other hazardous materials could occur during construction and operation. The effects of these releases are described in detail in Section 3.3.7.4, Coastal and Marine Environment; 3.4.3.2, Priority Protection Habitats; and Section 3.5.5.2, Benthic Resources. The effects of a spill during construction or operation would be direct, adverse, short-term to long-term, and minor to major, depending on the size of the spill.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance onshore could involve ground-disturbing activities or result in a spill of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (BMP #3), Construction BMPs (Appendix M; BMP #1 in Appendix N), and industry standard upland construction plans (BMP #26).

Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

Periodic maintenance offshore could result in disturbance to the seafloor. Maintenance impacts would be similar to those described for construction. Impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.8.5. Geologic Hazards

Geologic hazards are naturally occurring or induced conditions that can result in damage to land and structures, or cause injury to people. Potential geologic hazards in the onshore Project area include seismic activity related to earthquakes, movement along existing faults, ground settlement due to subsidence, flooding and storm surges, and shoreline erosion. The potential offshore geologic hazards include seismicity related to earthquakes and seafloor subsidence.

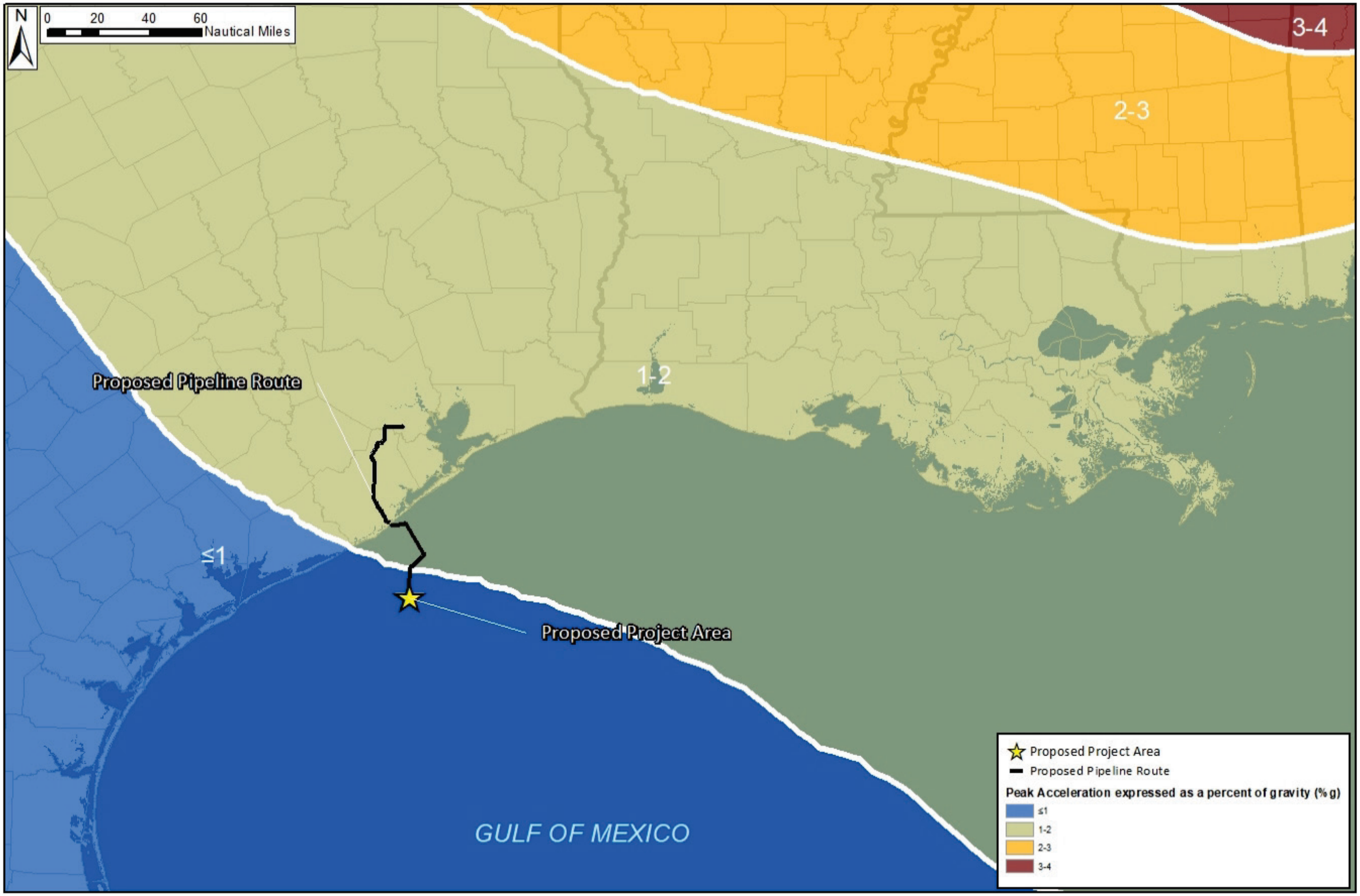
3.8.5.1. Existing Conditions

Seismicity and Faults

Seismicity refers to the frequency, intensity, and distribution of earthquakes within a given area. As the GoM is located along a passive tectonic margin, seismic activity consists of sparse and low-magnitude events. According to the USGS Earthquake Hazards Program (USGS 2018c), the closest earthquakes to the onshore Project area occurred in 1995 and 2015, and were magnitude 2.7 and magnitude 3.1 (Richter scale) events, respectively. These earthquakes took place about 92 miles west of the onshore Project area. Two magnitude 4.8 earthquakes occurred in 2011 and 2012. These earthquakes had the highest magnitude rating, and occurred about 164 miles southwest and 167 miles northeast of the Project onshore storage/supply components, respectively.

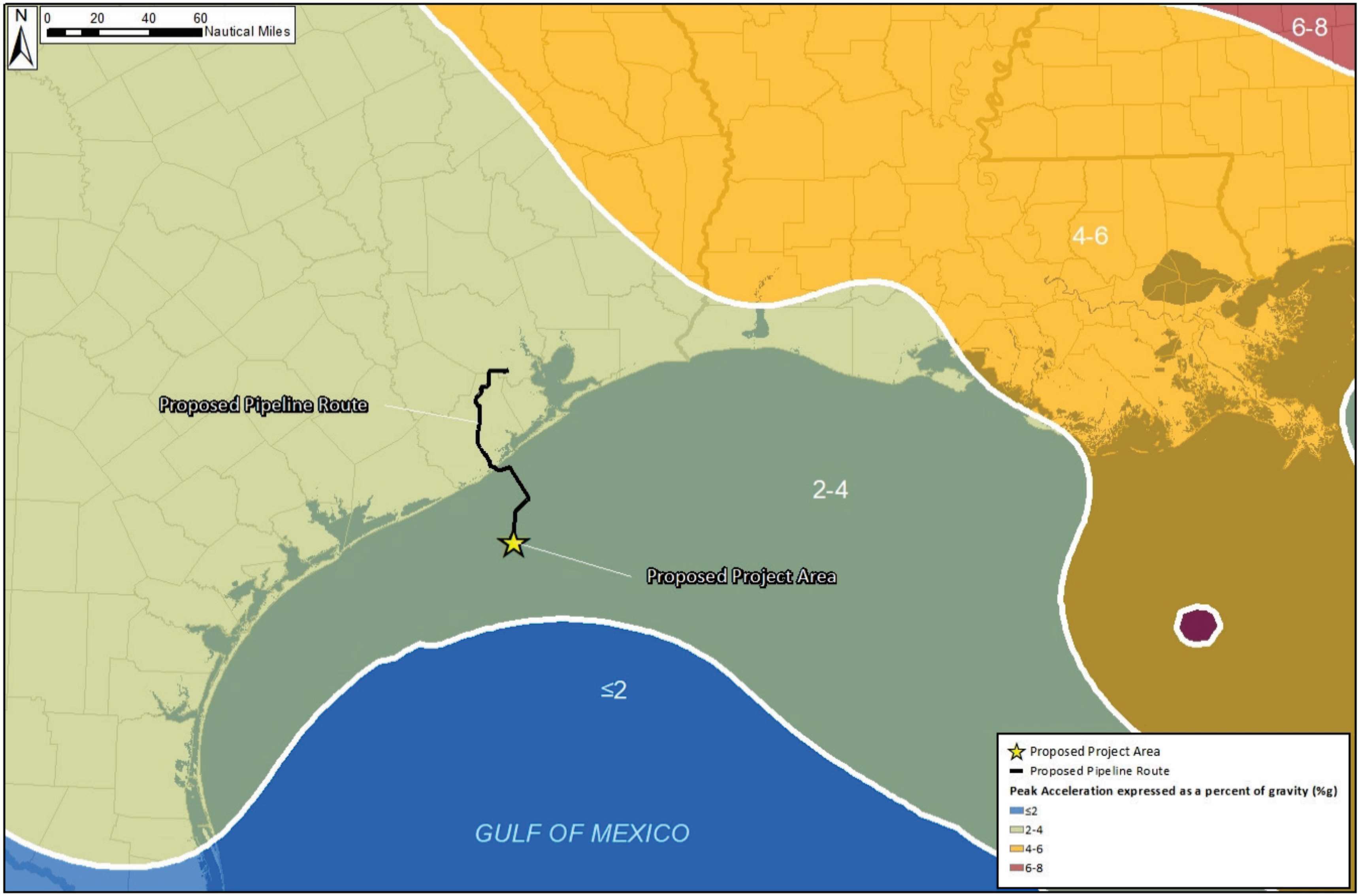
The USGS Hazard Mapping Program (USGS 2014b) produced probabilistic seismic hazard maps that show an estimate of the probability that ground motion would exceed a certain value, the peak ground acceleration (pga), in 50 years. The maps are generally based on the historic distribution, frequency, and magnitude of earthquakes in the United States. The pga, or the force caused by shaking, is expressed as a percentage of gravity (g). Low percentage g values, such as those depicted in the Project area on Figures 3.8-3 and 3.8-4, reflect low ground acceleration values (1 to 4 percent g) and are generally associated with low seismic risk. In the Project area, there is a 10 percent probability of exceeding 1 to 2 percent g within a 50-year period (a 475-year recurrence interval) and a 2 percent probability of exceeding 2 to 4 percent g within a 50-year period (a 2,475-year recurrence interval; USGS 2014b). Figure 3.8-3 is a seismic hazard map of the Project area that shows a 10 percent probability of exceedance. Figure 3.8-4 is a seismic hazard map of the Project area that shows a 2 percent probability of exceedance.

A fault is a fracture or fracture zone where two blocks of rock move relative to each side of the fracture. Fault movement can occur rapidly during an earthquake or slowly as a result of fault creep. Displacement along a fault during an earthquake can range from inches to tens of feet, depending on the earthquake magnitude (USGS 2018c).



Source: USGS 2014b

Figure 3.8-3: Seismic Hazard Map, Peak Ground Acceleration (10% Probability of Exceedance in 50 Years)



Source: USGS 2014b

Figure 3.8-4: Seismic Hazard Map, Peak Ground Acceleration (2% Probability of Exceedance in 50 Years)

A regional-scale series of curved growth faults, or extensional faults that form during sediment deposition at passive margins (Galloway 2008), frame the structural limits of the GoM basin and are located within the onshore Project area. The belt of growth faults formed due to rapid and thick sediment accumulation within the basin that followed the rifting event associated with the opening of the North Atlantic Ocean. Rifting that would eventually form the GoM began in the late Triassic period along the Mid-Atlantic Ridge and caused the separation of the North and South American plates (Galloway 2008). The post-rift sedimentary sequence collapsed under the gravitational weight of the overlying sediments and spread toward the east (Wheeler and Crone 2000).

The Geologic Map of North America indicates that the onshore Project components would cross three growth faults, two of which trend northeast–southwest, and the third fault trending east–west (Garrity and Soller 2009). In addition, the Geologic Database of Texas, which provides a higher resolution database of fault locations, indicates that the onshore Project would be located within 1 mile of 27 normal faults,[13] which form due to extensional forces; some of these normal faults are associated with past upward movement of salt domes located near the Project area (USGS 2014a). The Project would cross 9 of these 27 normal faults. Table 3.8-5 and Figure 3.8-1 provide the locations of the growth and normal faults within 1 mile of the onshore Project area.

Table 3.8-5: Growth and Normal Faults within 1 Mile of the Onshore Pipeline Centerlines

Fault Type	Milepost Begin	Milepost End	Distance from Centerline (feet)	Direction from Centerline
Growth	13.8 EOP MP	14.2 EOP MP	0	Crosses
Growth	25.6 EOP MP	26.2 EOP MP	5,280	West
Growth	42.4 EOP MP	44.9 EOP MP	0	Crosses
Growth	5.4 OSP MP	6.2 OSP MP	0	Crosses
Normal	0.0 EOP MP	0.6 EOP MP	0	Crosses
Normal	0.9 EOP MP	1.1 EOP MP	4,633	West
Normal	1.1 EOP MP	1.9 EOP MP	0	Crosses
Normal	1.1 EOP MP	5.7 EOP MP	0	Crosses
Normal	2.4 EOP MP	4.9 EOP MP	3,294	South
Normal	4.7 EOP MP	5.0 EOP MP	4,859	West
Normal	5.3 EOP MP	5.8 EOP MP	0	Crosses
Normal	5.5 EOP MP	6.2 EOP MP	0	Crosses
Normal	5.5 EOP MP	5.8 EOP MP	2,500	North
Normal	5.6 EOP MP	6.1 EOP MP	1,358	South
Normal	5.6 EOP MP	5.8 EOP MP	3,074	South
Normal	5.6 EOP MP	5.8 EOP MP	4,029	South
Normal	5.7 EOP MP	6.1 EOP MP	3,323	West
Normal	5.8 EOP MP	6.9 EOP MP	0	Crosses
Normal	5.9 EOP MP	6.1 EOP MP	4,439	South
Normal	6.3 EOP MP	7.1 EOP MP	1,762	North
Normal	6.7 EOP MP	6.9 EOP MP	2,552	West
Normal	6.8 EOP MP	7.1 EOP MP	0	Crosses
Normal	7.1 EOP MP	8.0 EOP MP	2,306	East
Normal	7.1 EOP MP	11.4 EOP MP	705	West
Normal	7.2 EOP MP	7.3 EOP MP	0	Crosses
Normal	7.4 EOP MP	7.8 EOP MP	387	North
Normal	7.5 EOP MP	7.9 EOP MP	3,990	North

[13] Inclined fractures where the blocks have mostly shifted vertically (USGS n.d.)

Fault Type	Milepost Begin	Milepost End	Distance from Centerline (feet)	Direction from Centerline
Normal	7.5 EOP MP	7.8 EOP MP	141	South
Normal	7.8 EOP MP	8.0 EOP MP	3,038	West
Normal	8.1 EOP MP	10.6 EOP MP	0.0	Crosses
Normal	8.6 EOP MP	9.4 EOP MP	2,041	West

Source: USGS 2014a; USGS 2018c

EOP MP = ECHO to Oyster Creek Pipeline milepost; OSP MP = Oyster Creek to Shore Pipelines milepost

The offshore Project area is also located within the GoM basin in a passive continental margin setting with sparse and low magnitude seismic activity (Wheeler and Crone 2000). Figures 3.8-3 and 3.8-4 are the seismic hazard maps that depict pga in the offshore Project area. Similar to the onshore Project area, the seismic maps indicate that there is a 10 percent probability of exceeding 1 percent g within a 50-year period, and a 2 percent probability of exceeding 2 to 4 percent g within a 50-year period in the offshore Project area (USGS 2014b).

In addition, a search of the USGS Earthquake Hazards Program database (USGS 2018c) indicates that 76 recorded earthquakes occurred within a 250-mile radius of the approximate offshore pipeline midpoint (i.e., the halfway point between the shoreline crossing and the SPOT DWP). The closest earthquake to the offshore Project area was a magnitude 3.8 event in 2002 that occurred approximately 93 miles to the south-southeast of the Project. The highest-energy earthquakes near the offshore Project area were magnitude 4.8 events that occurred in 2011 and 2012, which occurred approximately 180 miles to the west-northwest and 239 miles to the north-northeast of the offshore Project area.

According to the Geologic Map of North America, which provides regional scale fault locations, the Project would be located within 10 nautical miles of four northeast-southwest trending growth faults (Garrity and Soller 2009). Table 3.8-6 and Figure 3.8-2 provide the approximate growth fault locations. The geophysical survey conducted by the Applicant in 2018 along the proposed subsea pipeline route identified two east-west trending faults in Galveston Area lease block 426 that intersected the seabed and displayed minimal offset or movement between the sediments on each side of the fault. The survey also identified one fault within Galveston Area lease block 304 that did not intersect the seabed, but showed a 1- to 3-foot displacement between the sediments on each side of the fault.

Table 3.8-6: Growth Faults within 10 Nautical Miles of the Offshore Project Area

Fault Number	Approximate Growth Fault Location	Lease Block
1	Southeast of Project	463
2	West of Project	463
3	Crosses Project	421
4	Crosses Project	280

Source: Garrity and Soller 2009

The shaking associated with earthquakes or other sources of ground vibration may reduce the strength and stiffness of saturated sandy soil in a process referred to as “soil liquefaction.” The potential for soil liquefaction increases if loose, granular sandy or silty soils are saturated with water and subjected to severe shaking. The Project area south of approximate Oyster Creek to Shore Pipelines MP 11.0 contains saturated sandy soils that could be prone to liquefaction under the right circumstances.

Subsidence

Groundwater, oil, or natural gas extraction can cause compaction and subsidence due to withdrawal of fluid from pore spaces in the soil (AEG 2018). Increasing rates of groundwater pumping within the Houston-Galveston area is considered to be a primary cause of subsidence in the area; however, subsurface oil and gas extraction activities have also contributed to subsidence (Baum et al. 2008). The magnitude of subsidence tends to be directly related to the size of the associated oil and gas reservoir (Looff and Looff 2000). Near the onshore Project area, oil and gas extraction is associated with documented salt domes located about 0.9 mile north of ECHO to Oyster Creek Pipeline milepost (EOP MP) 7.2 and 1.7 miles east of EOP MP 15.2 (Garrity and Soller 2009).

Based on results of a GPS monitoring study conducted in the Houston-Galveston area between 1993 and 2000, the estimated subsidence rate ranged from 1.5 to 3 centimeters (0.6 to 1.2 inches) per year, with localized rates up to 6 centimeters (2.4 inches) per year, in an area northwest of Houston. The study also identified an area with a higher rate of subsidence (4.5 centimeters [1.8 inches] per year) near Sugar Land, Texas (USGS 2012).

In the offshore Project area, seafloor subsidence in the GoM is primarily related to the presence of salt diapirs[14] and the potential for collapse of sediment surrounding the diapirs. The Project would not cross areas of known karst topography (Hosman 1996; Weary and Doctor 2014).

Shoreline Erosion

Shoreline erosion and land loss along the Texas coast are directly related to rates of subsidence, sea level change, and the frequency and magnitude of storm surges. Land along the shoreline retreats gradually as ground settlement lowers the land surface while sea level rises, while discrete storm events may cause substantial shoreline erosion due to wind and wave action. Based on shoreline measurements collected between the 1930s and 2012, the average long-term shoreline retreat ranged from 4.1 to 4.2 feet per year along the Texas coast. Along the upper Texas coast between the Colorado River and Sabine Pass, the average shoreline retreat was 5.5 feet per year; however, the average long-term shoreline change rate where the onshore and offshore Project areas meet ranges from -1.6 to 1.6 feet per year (Paine et al. 2014).

According to aerial photographs that NOAA collected in 2015 and 2017, Hurricane Harvey's landfall along the Texas coast caused beach inundation and dune erosion at a location approximately 1.5 miles from Oyster Creek to Shore Pipelines MP 12.2. In 2015, NOAA predicted that there was an 88 percent probability that storms would overwash dunes in the area (USGS 2017).

Flooding and Storm Surges

The relative elevations of land and ocean surfaces determine the relative sea level. According to NOAA's Galveston Island long-term tide gauge measurements, sea level rise rates from 1990 to the present are 0.09 to 0.25 inch per year (Paine et al. 2013). The Sixth Assessment Report prepared by the Intergovernmental Panel on Climate Change (IPCC) estimates that the sea level rise in Freeport, located

[14] A diapir is defined as an "upward-directed, dome-like intrusion of a lighter rock mass, e.g., salt of granite, into a denser cover" (Allaby 2013).

approximately 2 miles southwest of the Project, may be approximately 0.67 meter (2.2 feet) compared to current levels by 2060 and 0.82 meter (2.7 feet) by 2070 assuming a "high" level scenario of greenhouse gas emissions (denoted as SSP3-7.0) (IPCC 2021).

In addition to observed sea level rise, NOAA recorded 64 hurricanes and 57 tropical storms between 1850 and 2013 that were located along the Texas coast, including Hurricane Ike, which hit the Texas coast in September 2008 (Paine et al. 2013). In addition, Hurricane Harvey flooded the Texas coast in August 2017 with over 60 inches of rain in 8 days, which exceeded the average annual amount of rain by 15 inches (USGS 2018d). A study of vulnerability to hurricanes, measured by a tropical hazard index, rated Galveston, Texas, with a tropical hazard index of 104 based on tropical storm intensity and frequency. This value is higher than 29 of the 45 locations that were evaluated in the study (Keim et al. 2007). In addition, updated hurricane averages for the 30-year time period between 1991 and 2020 indicate that the number of hurricanes in the Atlantic increased from 12 to 14 named storms, and from 6 to 7 hurricanes compared to the previous 30-year time period between 1980 and 2010. The average number of major hurricanes per year between 1991 and 2020, noted as three major hurricanes per year, remained the same compared to the average between 1980 and 2010 (NOAA 2021). The NOAA study notes that the increase in the average may be related to an improvement in monitoring satellites and technology, and may also reflect a warming ocean and atmosphere (NOAA 2021).

According to available storm surge hazard maps (NOAA 2018e), the Oyster Creek to Shore Pipelines would be located within an area that would experience a storm surge of between 3 and 6 feet above ground surface between MPs 8.1 and 12.2 during a Category 1 hurricane. A Category 2 hurricane is estimated to result in a storm surge of between 3 and 6 feet above ground surface extending inland to about MP 47.0 of the ECHO to Oyster Creek Pipeline. Under a Category 3 scenario, a storm surge of between 3 and 6 feet may extend inland to about MP 45 of the ECHO to Oyster Creek Pipeline, and the onshore Project area located south of about MP 47.5 would experience a storm surge of over 9 feet above ground surface. A Category 4 hurricane is predicted to cause a storm surge of between 3 and 6 feet as far inland as MP 38.5 of the ECHO to Oyster Creek Pipeline, and a Category 5 hurricane would cause a 3- to 6-foot-high storm surge along the ECHO to Oyster Creek Pipeline south of MP 34. Under a Category 5 hurricane scenario, the onshore Project area may experience a 9-foot-high or greater storm surge south of MP 44.6 of the ECHO to Oyster Creek Pipeline.

Table 3.8-7: Storm Surge Heights Above Ground Surface by Hurricane Category at Aboveground Project Facilities

Onshore Project Facility	Category 1	Category 2	Category 3	Category 4	Category 5
Oyster Creek Terminal	<3 feet	>6 feet	>9 feet	>9 feet	>9 feet
MLV #5	N/A	N/A	N/A	N/A	<3 feet
MLV #6	N/A	<3 feet	>6 feet	>9 feet	>9 feet
MLV #7	<3 feet	>6 feet	>9 feet	>9 feet	>9 feet
MLV Shoreline Terminal	3–6 feet	>6 feet	>9 feet	>9 feet	>9 feet

Source: NOAA 2018e

Based on available Federal Emergency Management Agency maps (FEMA 2020a), approximately 674.4 acres of the onshore Project area would be located within a special flood hazard zone, 37.61 acres would be located within a moderate flood hazard zone, and 576.6 acres would be located within a minimal flood hazard zone. Based on revised flood hazard maps, the proposed Oyster Creek Terminal would be located within the 100-year floodplain (FEMA 2020a) in an area with a base flood elevation of 13 feet above mean sea level. The Federal Emergency Management Agency defines the base flood elevation as the elevation of the water surface above mean sea level resulting from a flooding event that has a 1 percent chance of equaling or exceeding that elevation (FEMA 2020b), whereas the NOAA storm surge models predict the storm surge height above the ground surface rather than above sea level (NHC 2022). Section 3.3.4, Water Resources, Surface Water, provides additional details regarding the Project location within the floodplain.

3.8.5.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project. The study area within which potential impacts were assessed includes the SPOT Project workspace and the area within approximately 1 mile to account for any direct or indirect impacts on various geologic hazards.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on geologic hazards have been evaluated based on their potential to increase the potential for geologic hazards to occur, such as seismic events. The remainder of this section describes the potential impacts of seismic activity and faults, subsidence, flooding and storm surges, and shoreline erosion on Project construction and operation, as well as the Project's impacts on those geologic hazards.

Seismicity and Faults

The Project would not have any direct, adverse, or long-term impacts on seismic activity in the Project area. In addition, seismic events within 250 miles of the Project are low-magnitude and sparse, and are unlikely to impact the Project during construction, operation, or decommissioning. The pipeline design would comply with the American Society of Civil Engineers Guidelines for the Seismic Design of Oil and Gas Pipeline Systems to minimize the potential impact where pipelines would cross normal or growth faults. Although loose sandy soils are present in the southern portion of the Project, due to the low-magnitude and sparse seismic events in the region, the likelihood of ground vibration triggering soil liquefaction in this area is low.

Subsidence

As the onshore Project area would not overlie karst terrain (Weary and Doctor 2014), it is unlikely that subsidence due to karst collapse would occur. Due to the presence of oil and gas reservoirs associated with salt domes, and the historic high groundwater pumping rates, subsurface fluid, oil, and gas extraction may potentially increase the rates of land subsidence near the onshore Project area during construction, operation, and decommissioning. However, the pipelines would be designed in accordance with 49 CFR Part 195 and the American Society of Civil Engineers Guidelines for the Seismic Design of Oil and Gas Pipeline Systems to minimize the impact of subsidence on the pipeline construction areas. Compaction-related subsidence may occur as part of Project construction, but the impact would be direct, adverse, long-term, and minor.

The offshore portion of the Project would not have any direct, adverse, or long-term impacts on subsidence in the Project area. The offshore Project area does not overlie karst terrain and, due to the distance from the nearest salt diapir, it is unlikely that the Project would be affected by seabed subsidence. Therefore, the impact of subsidence on offshore Project construction, operation, and decommissioning would be direct, adverse, long-term, and negligible.

Shoreline Erosion

The Oyster Creek to Shore Pipelines would be installed using the HDD method to cross the shoreline. The HDD entry locations for the 36-inch-diameter pipelines would be farther than 400 feet from the shoreline and would be installed approximately 60 to 70 feet below the shoreline surface. Due to the stable nature of the shoreline in the onshore Project area since the 1930s and the anticipated depth of the pipeline installation and distance from the shore, it is unlikely that shoreline erosion would impact the onshore Project area.

Flooding and Storm Surges

The Project area would be subjected to coastal processes including hurricanes, storm surges, and tropical storms throughout the construction, operation, and decommissioning of the Project. Storm surges associated with strong hurricanes (particularly Category 3 or higher) have the potential to reach heights of greater than 9 feet above ground surface within the onshore Project area south of approximately MP 47.5 of the ECHO to Oyster Creek Terminal Pipeline, including at the Oyster Creek Terminal. The terminal design includes a secondary containment berm system surrounding the aboveground storage tanks that would comply with NFPA standards and requirements. The Applicant would implement several of the best practices recommended by the USEPA Region 6 Regional Response Team to prevent or minimize damage to aboveground oil and gas facilities during significant flooding or storm events (USEPA 2016g), including the following for the aboveground storage tanks:

- Filling the tanks to a height 3 to 6 feet higher than the expected storm surge or predicted reach of flood water
- Anchoring the tanks and piping to prevent uplift or flotation
- Using stiffener rings to prevent buckling from wind or water loads
- Removing or securing possible projectile hazards from the facility grounds, to the extent possible
- Ensuring that all storm drains and dewatering intakes are clear and free of debris
- Recording the level of product in each tank to account for any loss or water entry
- Conducting a risk assessment of the facility and developing a detailed timeline for preparing the tanks ahead of an event, and including the assessment in the SPCC Plan, Facility Response Plan, Risk Management Plan or other pollution prevention plan, as applicable (BMP #38 in Appendix N) (SPOT 2022a)

The Applicant would also stay in contact with responsible authorities (e.g., USACE, USCG, USEPA, and state and local agencies), alert local and state health departments in the event of a release or discharge, and contact local emergency organizations (e.g., fire department, emergency management) as needed following a storm event.

Floodplains would be avoided to the extent possible, and where the onshore pipeline would intersect a floodplain, the pipeline would be weighted using concrete coating or concrete sack weights in accordance with Enterprise Engineering Standard STD.4600, Pipeline Design for Onshore Pipelines. Based on Federal Emergency Management Agency maps, the proposed Oyster Creek Terminal would be sited within the 100-year floodplain. To minimize potential impacts of flooding on the aboveground structures, the detailed engineering design for the terminal would follow Brazoria County minimum design requirements by elevating all buildings, aboveground piping, and aboveground equipment with electrical components by 2 feet above the base flood elevation of 13 feet above mean sea level. The design of the terminal would be based on the latest standards and local, state, and federal requirements, including the Minimum Design Loads and Associated Criteria for Buildings and Other Structures (ASCE 7-16). As described in Section 2.6, one of the terminal siting criteria states that the terminal must be located within 16 miles of the shoreline; otherwise, additional pumping units would be required. The nearest potential sites for an alternative outside of the 100-year flood zone would be about 24 miles from shore, just north of Angleton, Texas. The Applicant has indicated that an alternative, suitable site for the Oyster Creek Terminal located outside of the 100-year floodplain does not exist that would be feasible and meet the purpose and need of the Project.

In the offshore Project area, the VLCCs or other crude oil carriers would disconnect from the SPM buoys and vacate the area in the event of an approaching storm. Impacts on the Project due to flooding and storm surges would, therefore, be direct, adverse, long-term, and minor to moderate.

Blasting

As described in Section 3.8.4.1, Geologic and Soil Resources, Soil and Sediment Characteristics, Existing Conditions, the SSURGO database indicated that rocky material and/or shallow bedrock is not present within soils that would be crossed by the Project to a depth of 3 feet. In addition, the soil series crossed by the Project are at least 80 inches thick above a lithic bedrock root restrictive layer, except for the Francitas clay loam, which has a chemical root restrictive layer at a depth of 6 to 18 inches (NRCS 2018). Blasting would not be required during construction or operation of the onshore Project components.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground or seafloor disturbing activities and impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction BMPs (Appendix M; BMP #1 in Appendix N) and industry standard upland construction plans (BMP #26), and impacts on geologic hazards offshore would not be likely to occur. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, long-term, and minor.

3.8.6. Mineral and Paleontological Resources

3.8.6.1. Existing Conditions

Mineral Resources

Mineral resources include ores and active mines, industrial materials (e.g., sand and gravel), and fossil fuels such as coal, oil, and gas. Based on review of the Mineral Resources Data System from the USGS, one sand pit and one salt dome mine are located within 0.25 mile of the onshore Project area. The Gunnels Sand Pit is located approximately 974 feet west of EOP MP 55.5 and is an active sand and gravel producer. The Manville salt dome is located approximately 679 feet west of EOP MP 17 and is a documented halite mineral occurrence; however, the extent of the mineral resource is unknown and there is little or no activity at the site. Table 3.8-8 provides the locations of mineral resources within 0.25 mile of the onshore pipelines by county.

Table 3.8-8: Number of Mineral Resources within 0.25 mile of the Onshore Pipelines by County

Mineral Type	Harris County	Brazoria County
Oil/Gas Well	0	25
Plugged Well	2	99
Dry Hole	16	46
Permitted Location	2	7
Cancelled Location	1	7
Storage Well	0	9
Other RRC Well Type [a]	0	15
Sand and Gravel Producer	1 [b]	1
Salt Dome Occurrence	0	1

Source: RRC 2019a; USGS 2005

RRC = Railroad Commission of Texas

[a] Other well types include injection/disposal well, horizontal drainhole, and sidetrack well surface locations.

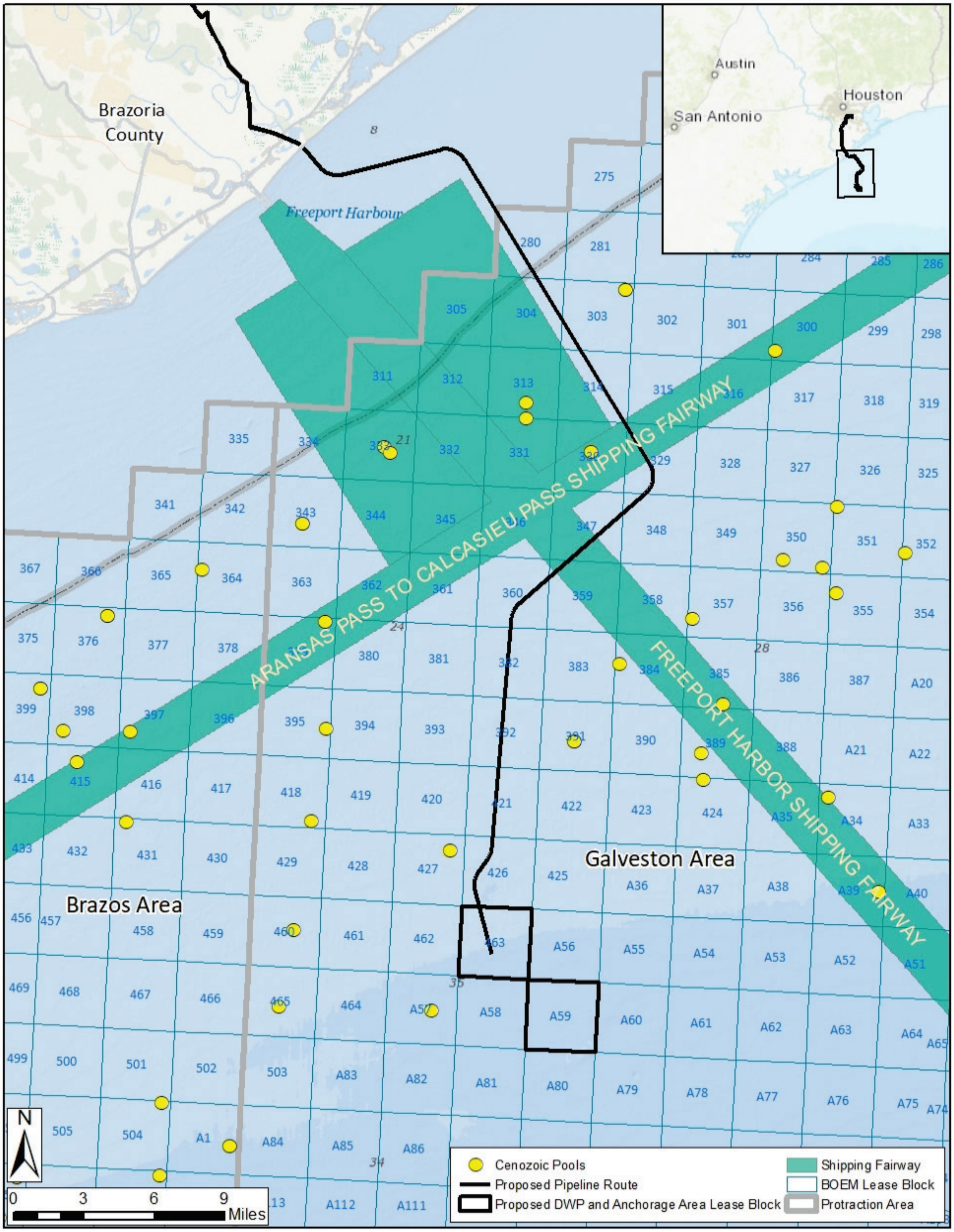
[b] The sand and gravel producer in Harris County is located 1,405.2 feet (greater than 0.25 mile) from the Project area.

The RRC database indicates that 25 active oil and gas wells are located within 0.25 mile of the ECHO to Oyster Creek Pipeline and the Oyster Creek to Shore Pipelines (RRC 2019a). The closest active oil and/or gas well is located approximately 14.4 feet south-southeast of EOP MP 17.9, and the closest plugged well is located approximately 9.4 feet east-southeast of EOP MP 17.8 in Brazoria County (Table 3.8-8).

The proposed offshore Project area would not be located within an OCS active lease block, and would not be located within an area of Mesozoic-age oil and/or gas plays (Figure 3.8-5). However, the offshore pipelines would be adjacent to or intersect Galveston Area lease blocks 303, 330, 391, 427, and A-57, which are known to contain identified Cenozoic hydrocarbon pools (Figure 3.8-5; BOEM 2017a). Cenozoic hydrocarbon pools, or the grouping of reservoir sands that host oil and/or gas based on similar ages and characteristics, have historically produced more oil than other older rock formations in the GoM and have the potential to sustain or increase production rates (Galloway 2009). The geophysical survey identified potential manmade features on the seafloor within the proposed Project area using the magnetometer (MAG). At the time of the geophysical survey, ten pipelines and/or cables and five plugged and abandoned wells were reportedly located within the Project corridor. The survey confirmed the presence of four pipelines/cables and four of the plugged and abandoned wells. Three pipeline/cable locations did not match the as-built coordinates, including a pipeline of unspecified diameter owned by Houston Pipeline, a 9-inch-diameter Hall-Houston Gas Gathering line, and a 20-inch Blue Dolphin pipeline. The survey could not verify the presence of three reported pipelines/cables and one plugged/abandoned well.

Paleontological Resources

Paleontological resources include the preserved fossilized remnants and indirect traces or imprints of plants and animals. In the GoM, deposits from the Cenozoic Era (65 million years ago and younger) may include fossils of shark teeth, clams and snails, coral, and whales. Younger sediments (23 to 5.3 million years ago) may host fossils of reptiles, rodents, amphibians, and petrified wood (Allmon and Wall 2015). Early horse fossils are the primary Pliocene epoch (5.3 to 2.6 million years ago) fossils found in south Texas; however, fragments or rhinoceros and gomphothere (elephant-like proboscideans) have also been found (Baskin and Thomas 2016). The most recent deposits that may include fossils dating to the late Pleistocene are associated with the Beaumont Formation, which dates to about 120,000 to 50,000 years ago, and the terrace fill deposits that overlay the Beaumont Formation that are about 50,000 to 12,000 years old (Baskin 2004). Pleistocene fossils that have been discovered in south Texas include horses, mammoths, turtles and tortoises, giant ground sloths, camels, saber-toothed cats, and bison (Baskin and Thomas 2016). Based on available geologic data and geotechnical sediment samples, no potentially significant vertebrate fossils are present within the proposed Project area.



Source: BOEM 2017a

Figure 3.8-5: Cenozoic Hydrocarbon Pools

3.8.6.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would implement to minimize impacts on mineral and paleontological resources. The study area within which potential impacts were assessed includes the SPOT Project workspace and the area within approximately 1 mile to account for any direct or indirect impacts on these resources.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on mineral and paleontological resources have been evaluated based on their potential to:

- Prevent recovery of mineral resources due to the location of facility locations; and/or
- Degrade or prevent the study or recovery of paleontological resources.

The remainder of this section describes the effects of Project construction and operation on mineral and paleontological resources.

Mineral Resources

Based on the distances of identified sand and gravel producers, halite occurrence, and active oil and gas wells, it is unlikely that the Project would impact these mineral resources. BMPs that the Applicant would implement at nearby documented oil and gas wells would include consulting with the well owner/operators to avoid impact if the wells are present and active (BMP #27 in Appendix N), developing an avoidance plan for the active well located approximately 14 feet from the Project (BMP #28), and/or adjusting the pipeline route, if needed.

The Project would not cross or be located adjacent to known Cenozoic hydrocarbon pools. As such, potential impacts on existing documented mineral resources would be indirect, adverse, long-term, and negligible. Although the proposed Project would not be located within active lease blocks, construction and operation of the Project could adversely impact future hydrocarbon discoveries and development.

Paleontological Resources

Due to the limited extent of the Project corridor relative to the scale of the geologic formations that host fossilized material, and the potential that fossils of more common marine organisms would be present within the Project area, it is unlikely that the Project would encounter significant vertebrate fossils during construction or decommissioning. Therefore, the potential impact of Project construction, operation, and decommissioning on paleontological resources would be direct, adverse, long-term, and negligible.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could occur near active mineral resource areas, resulting in impacts similar to those described for construction. During maintenance activities, the Applicant would consult with well owners/operators (BMP #27 in Appendix N) and develop avoidance plans, if necessary (BMP #28). Maintenance activities would be unlikely to encounter paleontological resources. Therefore, impacts associated with planned or unplanned maintenance would be indirect or direct, adverse, long-term, and negligible.

3.8.7. Offshore Geophysical Investigation

3.8.7.1. Existing Conditions

The Applicant conducted an offshore geophysical investigation conducted between October 1 and November 25, 2018, in accordance with Bureau of Safety and Environmental Enforcement NTL 2008-G05, 2005-G07, and 2011-JOINT-G01. The geophysical survey involved the use of side-scan sonar, multi-beam echo-sounder for bathymetry, sub-bottom profiler, and MAG along the subsea pipeline route, at the platform and SPM buoy sites, and at the anchorage area.

The geophysical survey noted the presence of pockmarks in addition to trawl scars and depressions along the proposed route and at the SPOT DWP site. Pockmarks in the Project area are small circular depressions with diameters generally less than 10 meters (32.8 feet) and depths up to 0.5 meter (1.6 feet); pockmarks of this size are most often associated with a one-time expulsion of sub-seafloor fluids or gas through fine-grained sediments (Hovland et al. 2002). As described in Section 3.8.3.1, Geologic and Soil Resources, Regional and Local Geology, Existing Conditions, the survey identified pinnacle outcrops in Galveston Area lease block 426 that appeared to be associated with an uplifted salt dome.

The sonar scan identified 21 targets along the pipeline route, 2 of which were recorded within 100 feet of the proposed route, and 3 targets within the proposed SPOT DWP area that were not considered significant hazards or archaeological resources. In the anchorage area, the survey did not record any potentially anthropogenic targets.

The MAG survey identified 466 anomalies in Texas state waters and 314 anomalies in Federal waters along the proposed subsea pipeline route. Of these totals, six anomalies in state waters and four anomalies in Federal waters were identified as potential hazards or archaeological resources to be avoided. The survey identified four magnetic anomalies within the proposed SPOT DWP grid; however, the anomalies were located more than 1,000 feet from the proposed SPM buoys and platform and were not considered hazards to the Project. Similarly, the survey recorded 15 magnetic anomalies within the anchorage area (Galveston Area lease block A-59); however, none of the anomalies consisted of ferromagnetic debris large enough to require avoidance. The survey did not identify any magnetic anomalies, sonar targets, or infrastructure in the immediate vicinity of the three tug anchorage zones.

Along the three segments that were surveyed for the proposed subsea pipeline route, the survey confirmed the presence of incised channel cut and fill complexes that range in depth from 9 feet to 30 feet below the seafloor. The water depth ranges from approximately 7 feet below MLLW at a distance of approximately 1,000 feet from the shoreline to 115 feet below MLLW at the termination of the pipeline route at the platform. In the areas of the proposed SPOT DWP and SPM buoy sites (Galveston Area lease block 463), the sub-bottom profiler identified very soft sediments and incised channels to depths of 39 feet below the seafloor. Finally, in the anchorage area (Galveston Area lease block A-59), the survey identified cut and fill channel complexes that reach depths of 65 feet beneath the seabed.

3.8.7.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project. As discussed above, the Applicant conducted a geophysical survey within the offshore SPOT Project workspaces to identify anomalies. The scope of the geophysical survey serves as the study area for assessing potential impacts.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on geophysical anomalies have been evaluated based on their potential to:

- Degrade unique geologic features; and/or
- Directly or indirectly affect submerged infrastructure.

As part of Project design and construction, 30 CFR § 250.1003(a) requires that pipelines located in areas of 200 feet of water or less are buried to a minimum depth of 3 feet below the seafloor (MMS 2001). In areas where the pipelines would cross a navigational fairway, the pipelines would be installed a minimum of 10 feet below the seafloor (49 CFR § 192.327, 49 CFR § 192.612). This requirement is in place to reduce the likelihood of potential impacts on the pipelines from storms, currents, scour, and other OCS operations. Project construction would temporarily suspend seafloor sediments during pipeline installation and construction of the platform, SPM buoys and PLEMs, and construction vessel anchors. These sediments are anticipated to redeposit near the Project area. In addition, the Project would avoid anomalies that were identified through geophysical investigation in state and Federal waters. Given the required pipeline burial depth, characterization of the seafloor topography from the geophysical survey, and identification of magnetic anomalies, Project construction would have direct, adverse, short-term, and minor to moderate impacts on seafloor features.

During operation of the Project, it is unlikely that additional seafloor disturbance would be required that would potentially impact existing seafloor infrastructure, magnetic anomalies, or sediments.

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve seafloor-disturbing activities and impacts would be similar to those described for construction. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.9. CULTURAL RESOURCES

This section discusses the Project's impacts on onshore and offshore cultural resources. The section includes a definition of cultural resources based on applicable Federal laws, executive orders, and state law; a discussion of existing threats to onshore and offshore cultural resources; a description of the existing conditions for onshore and offshore cultural resources; an assessment of Project impacts on cultural resources and proposed mitigations; and conclusions and recommendations.

3.9.1. Definition of the Resource

Cultural resources is an umbrella term for heritage-related resources defined in several Federal laws and executive orders, including the NHPA, NEPA, and the NAGPRA. Table 3.9-1 summarizes Federal laws and executive orders that protect cultural resources. Section 1.6, Permits, Approvals, and Regulatory Requirements, provides additional detail on the NHPA, ARPA, and NAGPRA.

Table 3.9-1: Federal Cultural Resource Laws and Executive Orders

Federal Law or Executive Order	Relevant Cultural Resource Protections
National Environmental Policy Act	Considers cultural and historic effects (40 CFR § 1508.8).
National Historic Preservation Act	Defines historic properties as any prehistoric or historic district, site, building structure, or object included in or eligible for inclusion in the National Register of Historic Places (36 CFR § 800.16.(l)(1)). Properties of religious and cultural significance to Indian tribes and Native Hawaiian organizations may be determined to be eligible for inclusion in the National Register (16 U.S.C. § 470a(d)(6)(A)).
The Native American Graves Protection and Repatriation Act	Requires Federal agencies and Federally assisted museums to return "Native American cultural items" to the Federally recognized Indian tribes or Native Hawaiian groups with which they are associated. Regulations by the National Park Service can be found in 43 CFR Part 10.
The American Indian Religious Freedom Act	States that the U.S. Government will respect and protect the rights of Indian tribes to freely exercise their traditional religions; the courts have interpreted this as requiring agencies to consider the effects of their actions on traditional religious practices.
The Archaeological Resources Protection Act	Prohibits the excavation of archeological resources (anything of archeological interest) on Federal or Indian lands without a permit from the land manager.
The Archeological Data Preservation Act or Archeological and Historic Preservation Act	Requires agencies to report any perceived impacts that their projects and programs may have on archeological, historical, and scientific data, and requires them to recover such data or assist the Secretary of the Interior in recovering them.
The Federal Records Act	Requires that agencies manage documents in such a way as to protect their historical value.
The Abandoned Shipwrecks Act	Asserts U.S. title to abandoned shipwrecks and transfers title to the states.
Executive Order 12898	Requires that agencies try to avoid disproportionate and adverse environmental impacts on low-income and minority populations. Impacts may be cultural—for example, impacts on a culturally important religious, subsistence, or social practice.
Executive Order 13006	Requires that agencies give priority to using historic buildings in historic districts in central business areas to meet their mission requirements.
Executive Order 13007	Requires that agencies try not to damage "Indian sacred sites" on Federal land and avoid blocking access to such sites by traditional religious practitioners.

Sources: CEQ and ACHP 2013 (NEPA and NHPA); National Preservation Institute 2018 (all other citations)

CFR = Code of Federal Regulations; U.S. = United States; U.S.C. = United States Code

Among the Federal laws and executive orders listed in Table 3.9-1, the NHPA provides the most well defined and widely used definition of cultural resources. The NHPA defines cultural resources to include archaeological sites (prehistoric or historic sites containing physical evidence of human activity but no standing structures), architectural resources (historic buildings or other structures), and sites of traditional, religious, or cultural significance to Indian tribes (traditional cultural properties [TCPs]).

The NHPA and its implementing regulations (36 CFR Part 800) represent the principal Federally mandated process for assessing the effects of Federal undertakings on cultural resources. The lead Federal agency for a Federal undertaking performs this assessment through the NHPA Section 106 review process. The purpose of the NHPA Section 106 review is to require Federal agencies to take into account the effects of their undertakings on historic properties.

Compliance with Section 106 involves four principal steps:

1. Initiate Section 106 review with the relevant SHPO, American Indian tribes with historic ties to the region, and other consulting parties;
2. Identify historic properties in the project's APE;
3. Assess adverse effects on historic properties; and
4. Resolve adverse effects (i.e., implement mitigation measures developed in consultation with the SHPO, tribes, and other consulting parties).

As stated in Table 3.9-1, the NHPA defines historic properties as cultural resources eligible for inclusion in the National Register of Historic Places (NRHP). Cultural resources are considered eligible for listing on the NRHP if they meet a set of criteria established by the Secretary of the Interior (36 CFR § 60.4).

The CEQ, the Federal agency charged with implementing NEPA, encourages integration of the NEPA review of effects on cultural resources with other planning and environmental reviews, such as NHPA Section 106 (CEQ and ACHP 2013). The regulations that implement NHPA Section 106 (36 CFR Part 800), encourage agencies to plan Section 106 consultations in coordination with other requirements of other statutes, as applicable, such as NEPA (CEQ and ACHP 2013). As a result, the assessment of impacts on historic properties required by NHPA Section 106 is often incorporated into the NEPA assessment, recognizing, however, that NEPA requires an assessment of impacts on a broader set of cultural resources than the historic properties defined in the NHPA.

The SPOT Project is also subject to Texas state requirements for protecting cultural resources. The principal Texas legislation governing cultural resources is the Antiquities Code of Texas (ACT) (Title 9, Texas Natural Resource Code, Chapter 191). The ACT requires state agencies and political subdivisions of the state—including cities, counties, river authorities, municipal utility districts, and school districts—to notify the Texas Historical Commission (THC), which is the Texas SHPO, of ground-disturbing activity on public land and work affecting state-owned historic buildings. THC staff review the proposed project within 30 days of receipt of the notification and, based on the review, may require an antiquities permit for archeological studies prior to construction (9 Tex. Nat. Res. Code § 191.0525[b]).

The ACT also establishes the designation of State Antiquities Landmark (SALs), which may be applied to state-owned historic buildings and any archeological sites on non-Federal public lands (9 Tex. Nat. Res. Code § 191.091). Under the ACT, all cultural resources on non-Federal public lands in Texas are eligible to be designated as SALs. Historic buildings and other aboveground historic resources must be listed in the NRHP before they can be designated as SALs, but archeological sites do not have to be listed on the NRHP to be considered SALs.

The requirements of the ACT apply to all public lands within Texas, including waters that are "in, on, or under any of the land in the state of Texas, including the tidelands, submerged land, and the bed of the sea" (9 Tex. Nat. Res. Code § 191.002). A portion of the proposed Project would be constructed within Texas offshore jurisdictional waters. As a result, construction of those components would require compliance with the ACT requirements to evaluate direct effects on offshore SALs (9 Tex. Nat. Res. Code § 191.002).

3.9.2. Existing Threats

Any onshore or offshore project or activity that involves ground-disturbing activities has the potential to cause direct physical impacts on known or undiscovered cultural resources. Urban, residential, industrial, and infrastructure developments and extractive industry projects (e.g., oil and gas, mining) pose the greatest threats to onshore and offshore cultural resources along the Texas Gulf Coast and in the GoM. Examples of these types of projects or activities include industrial facility construction (manufacturing, petrochemical, refining, etc.); residential developments; transportation infrastructure construction and maintenance (roads, railways, ship channel dredging, etc.); upstream and midstream oil and gas development (well drilling, pipeline construction, etc.); agricultural and fishing activities that disturb the ground surface or seafloor; and energy project construction (windfarms, solar arrays, power plant construction, transmission lines, etc.). In addition to direct impacts, these types of projects can cause indirect impacts on architectural resources and traditional cultural properties by altering the physical environment or setting of a resource, such as through the temporary and/or permanent introduction of intrusive auditory and/or visual elements.

3.9.3. Existing Conditions

This section summarizes the existing onshore and offshore cultural resource conditions for the proposed Project. It considers them within the proposed Project's affected environment for cultural resources, as defined in NEPA, as well as within the Project's APE.

Under the NHPA, a project's APE is defined as "the geographic area or areas within which an undertaking may directly or indirectly cause alteration in the character or use of historic properties, if present. The APE is influenced by the scale and nature of an undertaking and may be different for different kinds of effects caused by the undertaking" (36 CFR § 800.16[d]). The lead Federal agency is responsible for determining the APE, in consultation with the relevant SHPO or Tribal Historic Preservation Office (THPO). The NHPA Section 106 review considers impacts on historic properties within the Project's direct and indirect APEs. For the purposes of this review, the direct and indirect affected environment for NEPA and the direct and indirect APE for compliance with Section 106 incorporate the same geographic areas.

In a letter sent to the THC on May 31, 2019, MARAD and the USCG recommended the Project APE be defined in terms of three separate but interrelated APEs:

- Offshore Direct APE: The depth and breadth of the seabed that would be affected by any bottom-disturbing activities, including construction of specific components and construction vessel anchoring;
- Onshore Direct APE: The depth and breadth of terrestrial areas that would be affected by any ground-disturbing activities (including the existing ECHO Terminal modifications, ECHO to Oyster Creek Pipeline, Oyster Creek Terminal, and the Oyster Creek to Shore Pipelines); and
- Onshore Indirect APE: The viewshed from which onshore, aboveground Project components would be visible (see Appendix D, Agency Correspondence).

As currently designed, the only proposed offshore Project components that would be visible above the waterline are the SPOT DWP platform and the SPMs. Because these Project components would be located 27.2 to 30.8 nautical miles off the coast of Texas, MARAD and the USCG have stated that these Project components would not indirectly alter the character or use of any historic properties. As a result, MARAD and the USCG do not believe the undertaking has an indirect offshore APE.

In a June 14, 2019, response to the MARAD and USCG letter, the THC stated that they concurred with the recommended direct onshore and offshore and indirect onshore APEs, and agreed that the undertaking did not have an offshore indirect APE (THC 2019a). For the purpose of this NEPA review, the affected environment for cultural resources is the same as the NHPA Section 106 APE. The principal difference between the NHPA Section 106 and NEPA reviews is that the NEPA review considers potential Project impacts on all cultural resources while the NHPA Section 106 review only considers impacts on historic properties.

The onshore direct APE includes:

- Addition of measurement skids and electric motor-driven pumps at the existing ECHO Terminal to supply crude oil to the new proposed Oyster Creek Terminal;
- One 36-inch-diameter pipeline connecting the existing ECHO Terminal to the new proposed Oyster Creek Terminal;
- One connection from the existing Rancho II 36-inch-diameter pipeline to the ECHO to Oyster Creek Pipeline;
- The construction and operation of the proposed Oyster Creek Terminal in Brazoria County, Texas;
- Two collocated 36-inch-diameter crude oil pipelines from the proposed Oyster Creek Terminal to the proposed shore crossing and SPOT DWP pipeline infrastructure; and
- Ten MLVs—six within the permanent right-of-way of the ECHO to Oyster Creek Pipeline and four within the permanent right-of-way of the Oyster Creek to Shore Pipelines.

The onshore indirect APE includes:

- The proposed Oyster Creek Terminal viewshed.[15]

The offshore APE includes:

- One fixed offshore platform;
- Two SPM buoys that would connect to moored VLCCs or other crude oil carriers for loading;
- Four PLEMs (two per SPM buoy) that would provide the interconnection between the pipelines and the SPM buoys;
- Four 30-inch-diameter pipelines to deliver crude oil from the platform to the PLEMs;
- Four 16-inch-diameter vapor recovery pipelines (two per PLEM) to transfer recovered vapors from the VLCC or other crude oil carrier to three vapor combustion units on the platform;
- Two new collocated 36-inch-diameter crude oil pipelines that would connect the SPOT DWP platform to the onshore component; and

[15] As currently designed, the USCG does not believe the construction of the additional measurement skids and electric motor-driven pumps at the existing ECHO Terminal has the potential to indirectly affect historic properties; as a result, the relatively small viewsheds for these components are not included in the onshore indirect APE.

- Areas that may be disturbed by construction vessel anchoring.

In addition to the onshore areas of direct and indirect effect for cultural resources described above, activities associated with construction of subsurface proposed Project components could result in temporary indirect impacts on cultural resources by altering resource setting due to the temporary introduction of construction equipment and aboveground facilities or infrastructure.

Prior to submitting the application, the Applicant sent information letters to 24 Indian tribes with ancestral, cultural, and/or historic connections to southeast Texas. The 24 tribes included 22 Federally recognized tribes and 2 state-recognized tribes (Table 3.9-2; SPOT 2019a, Application, Volume IIa, Sections 6 and 7).

Table 3.9-2: Native American Tribes Contacted by the Applicant and MARAD/USCG

Indian Tribe	Contacted by the Applicant	Contacted by MARAD/USCG
Federally Recognized Tribes		
Absentee Shawnee Tribe of Oklahoma		X
Alabama-Coushatta Tribe of Texas	X	X
Alabama-Quassarte Tribal Town	X	X
Apache Tribe of Oklahoma	X	X
Caddo Nation of Oklahoma	X	X
Cherokee Nation of Oklahoma	X	X
Choctaw Nation of Oklahoma		X
Comanche Nation of Oklahoma	X	X
Coushatta Tribe of Louisiana	X	X
The Delaware Nation	X	X
Fort Sill Apache Tribe of Oklahoma	X	X
Jicarilla Apache Nation		X
Kialegee Tribal Town	X	X
Kickapoo Tribe of Oklahoma	X	X
Kickapoo Traditional Tribe of Texas	X	X
Kiowa Tribe of Oklahoma	X	X
Mescalero Apache Tribe	X	X
Muscogee Creek Nation of Oklahoma		X
Osage Nation		X
Poarch Band of Creek Indians	X	X
Quapaw Tribe of Oklahoma	X	X [a]
Seminole Nation of Oklahoma	X	X
Thlopthlocco Tribal Town	X	X
Tonkawa Tribe of Oklahoma	X	X
Tunica-Biloxi Tribe of Louisiana	X	X
The United Keetoowah Band of Cherokee Indians	X	X
Wichita and Affiliated Tribes	X	X
Ysleta del Sur Pueblo		X
State Recognized Tribes		
American Indians in Texas at the Spanish Colonial Missions	X	X
Lipan Apache Tribe of Texas	X	X

MARAD = U.S. Maritime Administration; USGS = U.S. Coast Guard
[a] The Quapaw Tribe of Oklahoma did not receive a May 1, 2019 letter from MARAD/USCG. MARAD and the USCG invited the Quapaw Tribe THPO to attend an interagency meeting in Lake Jackson, Texas, to discuss the Project in an electronic mail dated March 7, 2019. In response to the invitation, the Quapaw Tribe THPO declined the invitation and declined participating in any subsequent consultations for the Project.

On May 1, 2019, MARAD and the USCG sent letters to 30 Indian tribes (of which 28 are Federally recognized and 2 are state-recognized) with ancestral, cultural, and/or historic connections to southeast Texas to initiate consultations as part of the NHPA Section 106 review for the Project (Table 3.9-2). The letters sent by MARAD and the USCG included a description of the proposed Project and provided the tribes with an opportunity to express any concerns they may have regarding potential effects on cultural resources as a result of construction and operation of the SPOT Project (Appendix D, Agency Correspondence).

MARAD and the USCG received responses from the THPOs of five tribes:

- The Choctaw Nation replied that the region around the Project is outside their area of historic interest;
- The Comanche Nation of Oklahoma stated that they had reviewed the Comanche Nation site files for recorded prehistoric and historic archaeological properties within the Project area and did not find any recorded properties;
- The Coushatta Tribe of Louisiana replied that the Project would not result in any negative impacts on archaeological, historic, or cultural resources of the Coushatta people and that the tribe did not wish to consult further on the Project; however, if inadvertent discoveries are made during the course of the Project the tribe expects to be contacted immediately and reserves the right to consult with MARAD and the USCG at that time;
- The Delaware Nation replied that Brazoria County, Texas is outside their area of concern; and
- The Quapaw Tribe of Oklahoma THPO replied that the Project is outside the tribe's area of interest and they defer any comment to other interested tribal nations.

3.9.3.1. Onshore Existing Conditions

This section summarizes existing onshore cultural resource conditions for the proposed Project. The section includes a summary of investigations sponsored by the Applicant to identify cultural resources within the Project's affected environment or APE; regional onshore prehistory and history; and a summary of known cultural resources within the proposed Project's onshore APE.

In 2018, the Applicant conducted onshore cultural resource investigations in anticipation of applying for a USACE Section 404 permit (SPOT 2019a, Application, Volume IIb, Appendix F). These investigations focused on USACE Section 404 permit review areas (PRAs), including:

- A recommended direct APE consisting of:
  - PRA areas along the ECHO to Oyster Creek Pipeline:
    - Areas within a 300-foot-wide corridor extending 300 feet from either side of ephemeral and intermittent waterways or known wetlands;
    - Areas within a 300-foot-wide corridor extending 600 feet from either side of perennial drainages and major waterway; and
    - Previously recorded cultural resource sites that were bisected by or fell within 300 feet of the USACE PRAs.
  - The 140.1-acre Oyster Creek Terminal area and 0.4-mile access road; and

- An indirect APE for aboveground/architectural resources, consisting of a 0.25-mile area around the proposed Oyster Creek Terminal site (SPOT 2019a, Application, Volume IIb, Appendix F).

In a letter dated November 2, 2018, the THC approved the onshore cultural resources survey scope of work submitted by the Applicant for archaeological investigations in the PRAs, Oyster Creek Terminal site, and access road areas (SPOT 2019a, Application, Volume IIb, Appendix F). In the same response, the THC stated that it was unable to complete its review of the aboveground survey scope of work due to insufficient documentation (SPOT 2019a, Application, Volume IIb, Appendix F).

In 2018, the Applicant's cultural resources subcontractor surveyed 47 PRAs along the proposed ECHO to Oyster Creek Pipeline, covering 8.6 miles of the onshore pipeline APE, the entire 140.1-acre Oyster Creek Terminal area, and the approximately 0.4-mile-long Oyster Creek Terminal access road for archaeological resources. The archaeological investigations consisted of pedestrian survey, the excavation of shovel test pits, and the excavation of 14 backhoe trenches within seven PRAs along the floodplains and alluvial terraces along five river drainages (SPOT 2019u). The 2018 investigations also included a historic standing structure survey of the recommended indirect APE consisting of a 0.25-mile area around the proposed Oyster Creek Terminal site.

In June 2019, the Applicant conducted additional cultural resources investigations to identify cultural resources within the APE defined by MARAD and the USCG in a letter dated May 31, 2019. These investigations consisted of the following actions:

- An intensive archaeological survey of previously uninvestigated portions of the onshore pipeline APE;
- A desktop viewshed analysis to refine the indirect APE for the Oyster Creek Terminal indirect APE; and
- A combined desktop and infield historic standing structure survey of all potential historic properties within a 1-mile radius of the proposed Oyster Creek Terminal and a review of previously listed historic properties within a 2-mile radius of the proposed terminal (SPOT 2019u).

During the 2019 archaeological investigations the Applicant's cultural resources subcontractor used a combination of pedestrian survey, shovel test pit excavation, and hand auguring to investigate a total of 578.5 acres along 37.1 miles of the proposed onshore pipelines APE (SPOT 2019u). The Applicant performed the 2019 archaeological surveys in accordance with the *Texas Historical Commission: Archaeological Survey Standards for Texas* (SPOT 2019u). The combined 2018 and 2019 surveys investigated a total of 45.7 miles of the 62.3-mile-long pipeline route. The remaining 16.6 miles were not surveyed, as they were determined to be inaccessible for subsurface investigations due to inundated landscapes, the presence of existing urban infrastructure, and/or evidence of previous construction activities (SPOT 2019rr).

As part of the 2019 historic standing structure survey, the Applicant refined the extent of the indirect APE recommended by the USCG around the proposed Oyster Creek Terminal by analyzing light detection and ranging (LiDAR) data for the area around the proposed terminal to create a viewshed model. The model combined data on the variations in surface elevation, vegetation, and buildings to identify all areas within 2 miles of the proposed Oyster Creek Terminal from which the terminal would be visible. The model suggested that the proposed Oyster Creek Terminal, in particular the large storage tanks, would be visible from 79 percent of all locations within 2 miles of the terminal (SPOT 2019u).

The Applicant's cultural resources survey and report discusses the viewshed around the existing Jones Creek Facility tank farm, situated in a similar setting as the proposed Oyster Creek Terminal, to determine to what extent the Jones Creek Facility was visible from a distance of 2 miles. The Applicant's cultural resources survey and report concluded that no aspect of the Jones Creek Facility tank farm was visible at 2 miles due to the presence of vegetation and buildings, and because of the topography in the area.

Based on these results of the viewshed model, Jones Creek Facility tank farm assessment, and consultations with the THC and USCG, the Applicant has defined the indirect APE around the proposed Oyster Creek Terminal as extending up to 2 miles from the proposed site (SPOT 2019u). Within the refined APE, the Applicant conducted an infield historic standing structure survey of all potential historic properties within a 1-mile radius of the proposed Oyster Creek Terminal. The Applicant also performed a desktop study to identify any Register of Texas Historic Landmarks (RTHL) and NRHP properties within a 2-mile radius of the proposed Oyster Creek Terminal. The Applicant conducted an infield assessment of RTHL and NRHP properties between 1 and 2 miles from the Oyster Creek Terminal that, based on the viewshed model, could be subject to viewshed impacts from the construction of the terminal. The infield historic standing structure surveys were conducted in accordance with the *Texas Historical Commission: Historic Resources Survey Form Manual* (SPOT 2019u).

Onshore Cultural Context

A cultural or historic context is developed as part of cultural resource investigations to understand the significance of individual cultural resources, relative to larger trends or themes in prehistory or history. The National Park Service defines "historic contexts" as "those patterns or trends in history by which a specific occurrence, property, or site is understood and its meaning (and ultimately its significance) within history or prehistory is made clear" (NPS 1997).

The Applicant developed an onshore cultural context as part of the preconstruction cultural resources investigations of the proposed onshore direct and indirect APE. Table 3.9-3 summarizes the prehistoric and historic contexts for the proposed onshore areas of direct and indirect effect.

The prehistoric and historic contexts suggest there is the potential for prehistoric Indian archaeological resources, historic Euro-American archaeological resources, historic structures, and TCPs within the Project's direct and indirect APEs.

Table 3.9-3: Onshore Cultural Context

Period	Description [a]
Paleoindian Period (11,500-8,500 B.C.E)	Period begins with the arrival of the first human occupants of southeast Texas ca. 11,500 B.C.E. The population consisted of small bands of hunter-gatherers subsisting on a mixed diet of large mammals and edible plants. Isolated finds in southeast Texas include Early Paleoindian fluted Clovis and Folsum projectile points and later San Patrice and Scottsbluff points. Most of the recovered points are of a high-grade lithic material that is scarce or absent in southeast Texas, suggesting the widespread movement of peoples and materials over long distances.
Archaic Period (8,000-1,500 B.C.E.)	Development of a broad subsistence base and evidence of a more intensive exploitation of regionally specific plant and animal resources. This change in subsistence is marked by changes in stone tool production to conform to new hunting techniques, food preparation, and related activities. In southeast Texas, the Archaic sequence is separate for inland groups (ca. 8,000 to 1,500 B.C.E.) and coastal groups (ca. 5,000–2,200 B.C.E.) For the inland groups the Archaic is generally defined by groups of hunter-gatherers inhabiting sites along inland stream courses. For coastal groups, the Archaic (ca. 5,000-2,000 B.C.E) consists of shell midden sites.
Late Prehistoric Period (1,500-500 B.C.E.)	The Late Prehistoric or Ceramic Period in southeast Texas starts with the introduction of ceramics and the bow and arrow. The adoption of the bow and arrow is signified by the appearance of small, light straight and expanded-stem stone arrow point types. The Late Prehistoric or Ceramic Period of southeast Texas is divided into Early and Late sub-periods. Early Ceramic sites along the Texas coast are mostly rangia shell middens found along secondary bay margins or riverine estuaries. Inland, Late Ceramic sub-period is marked by the appearance of bison bone along with a lithic techno-complex of Perdiz arrow points suggesting a subsistence base focused on nomadic bison hunting.
Protohistoric Period (C.E. 1500-1630)	The Protohistoric Period of southeast Texas coincides with the earliest appearance of Euro-Americans on the upper Texas Gulf Coast (ca. C.E. 1500-1700). During this period Indian groups had limited access to European goods, but essentially there is little change from the Late Prehistoric.
Spanish Colonial Period (C.E. 1630-1820)	The Spanish Colonial period is the initial period of sustained Indian and European contact followed by European settlement in Texas. During this time, the central Gulf Coast of Texas was occupied by a group of tribes collectively referred to as the Karankawas. The Karankawas were the first Texas Indians to have contact with European explorers when they met the Panfilo de Narvaez expedition in 1527. Throughout the mid-1700s, Spain carried out a series of missions throughout southeast Texas to establish a permanent foothold in the region and to subdue the Karankawas. The 1763 Treaty of Paris ceded all of the Louisiana Territory west of the Mississippi River, including Texas, to Spain.
Mexico and the Republic of Texas (C.E.1821–1845)	Mexico gained independence from Spain in 1821. Anglo-American settlement began in earnest in modern day Texas when Stephen F. Austin received the first official colonization grant from the Mexican Government to bring 300 Anglo settlers into the area in 1824. The Mexican government built Fort Velasco on the east bank of the Brazos River about 150 yards from the mouth (near the present city of Surfside) in 1830 to increase control over the local American settlements. The Republic of Texas was founded with the Convention of 1836 on March 1, 1836. Texas gained independence from Mexico at the Battle of San Jacinto on April 21, 1836. Ranching and plantations developed on the Brazos and Colorado Rivers during this period with sugarcane and cotton the most common crops exploited by Brazoria County farmers.
Antebellum Texas and the United States (C.E.1845–1861)	In December 1845, Texas became part of the United States of America. During the early to mid-1800s, the Brazos River in Brazoria County was the chief passage for immigration, communication, and commerce from the GoM. By 1840, the port of Houston had begun to draw commercial interests away from the Brazos. Due to the influx and movement of people across the state during this period, new webs of connection were established, linking town sites and settlements. The first rail system in Texas was built in the 1850s, connecting Houston to Cypress.

Period	Description [a]
Civil War and Reconstruction (C.E.1861–1899)	The antebellum Texas economy relied heavily on slave labor, and as such, residents voted overwhelmingly in favor of secession with Texas formally seceding from the Union in January 1861. Fortifications were constructed at Velasco in Brazoria County during the Civil War. As a result of Union military actions in Texas, numerous plantations were destroyed. After the war, emancipation leads to steep decline in agricultural production. Recovery following the Civil War was slow, with principal agricultural exports dropping to a fraction of their pre-war totals. After the war, many freedmen worked for their former masters or started small farms. By the late 1870s the livestock, lumber, and shipping industries had largely recovered, owing in part to railroad expansion and improvements, and use of the Houston Ship Channel.
Modern Period (C.E. 1900-Present)	The continuing expansion of railroad transportation in southeastern Texas during the early 20th century helped improve the economy by connecting farms and plantations in the area to industrial markets. By 1907 the Houston and Brazos Valley Railroad served Velasco, and by 1916, plantations along Oyster Creek were connected by the Sugar Land Railroad. Agriculture continued to play an important role in the local economy well into the first half of the twentieth century. Oil, gas, and sulfur discoveries in Harris and Brazoria counties further diversified the economy. By 1920, oil fields were established in West Columbia, Goose Creek, Tabbs Bay, and Big Creek. Sulfur deposits were mined at Orchard, Bryan Mound, Hoskins Mound, and Stratton Ridge Dome. During the 1930s, petroleum refineries were constructed in Katy and near the San Jacinto River and Buffalo Bayou. The second half of the twentieth century brought a growing reliance on petroleum, mineral extraction and production, manufacturing, and the chemical industry in southeast Texas. In addition, coastal communities in Harris and Brazoria counties began to rely on shrimping and tourism. Currently, the oil and gas industry are the principal drivers of the local economy; however, large portions of the counties are still used for agriculture and cattle production.

B.C.E = Before Common Era; C.E = Common Era

[a] Period descriptions contain information from SPOT 2019a, Application, Volume IIb, Appendix F.

Onshore Cultural Resource Assessment

Background research conducted as part of the 2018 and 2019 intensive archaeological surveys described above identified 27 cultural resources within 0.5-mile of the onshore pipeline APE. The desktop study did not identify any recorded SALs or NRHP properties within 0.5 mile of the onshore pipeline APE, the Oyster Creek Terminal site, or within the boundaries of two proposed laydown yards associated with the Project. Through the desktop study, the Applicant determined that the laydown yards had been previously disturbed during construction of the yards. The desktop study also determined that approximately 28.8 linear miles (38.7 percent) of the 74.5-linear-mile onshore pipeline routes had been surveyed during previous, non-Project sponsored cultural resource investigations and/or had been previously disturbed by the construction of residential, commercial, or industrial developments; roads, railways, and other infrastructure; and underground pipelines (SPOT 2019u).

During the 2018 and 2019 intensive archaeological surveys, the Applicant investigated the following portions of the direct APE:

- The proposed construction right-of-way (100 feet wide for the ECHO to Oyster Creek Pipeline and 150 feet wide for the Oyster Creek to Shore Pipelines) along the previously uninvestigated and/or undisturbed 45.7 linear miles of the proposed 74.5-linear-mile pipeline routes;
- The entire 140.1-acre Oyster Creek Terminal area; and
- The 0.4-mile Oyster Creek Terminal access road (SPOT 2019u).

The Applicant's 2018 and 2019 onshore archaeological investigations identified nine cultural resources within the direct APE: archaeological sites 41BO70, 41BO268, 41BO269, 41BO275, and 41BO283; the Briscoe and American Rice historic canals; and the Brookside (BO-C170) and Oyster Creek (BO-C090, 41BO124) cemeteries (SPOT 2019u, 2019ss). Summary information about these resources is available in Table 3.9-4.

Table 3.9-4: Cultural Resources Revisited or Identified During Onshore Archaeological Investigations

Resources Number/Name	Description	THC Determination of NRHP Eligibility
41BO70	Very little information was available in the THC database for this previously recorded site. An archaeological survey team visited the site and surveyed the portions of the APE nearest to the reported site locations as part of the Applicant's 2018 archaeological survey. The survey team, however, did not document any evidence of site 41BO70 within the project APE.	Undetermined
41BO268	The site is an early-twentieth-century historic farmstead. The THC site form for the site states it consists of multiple structures and cultural features as well as an artifact scatter. The Applicant determined that ongoing construction activity for a different project has destroyed the majority of the site within the current Project APE.	Not Eligible
41BO269	A historic railway feature consisting of a partial railroad grade and tracks. The Applicant revisited the site and determined that the extant railroad grade and tracks extend into the Project's workspace and centerline but did not identify any other structural remains.	Not Eligible
41BO275	The Applicant identified site 41BO275 during archaeological investigations of a PRA in central Brazoria County. The site is an historic artifact scatter dated to the late nineteenth to early twentieth century.	Not Eligible
41BO283	Site consists of two adjacent concrete foundations measuring 25 by 12 meters (82 by 39 feet) located in a cleared and maintained overhead transmission line and subsurface pipeline right-of-way. The Applicant's cultural resources consultant interpreted the slabs as structure foundations. Historic maps suggest the structures were built between 1945 and 1965.	Not Eligible
BO-C170	The Brookside Cemetery was previously illustrated on THC cultural resource maps as being located adjacent to the project APE in Harris County. The Applicant's cultural resources consultant determined that there is no cemetery at the mapped location and, based on their findings, the THC maps were corrected in early 2019.	Not Eligible
BO-C090/ 41BO124	The Oyster Creek cemetery is a historic cemetery established in 1853. The cemetery contains the grave of William Jarvis Cannan (1808-1891), a soldier in the Texas War for Independence.	Unevaluated
Briscoe Canal	Mid-20th century irrigation canal. Project would avoid impacts to the canal by installing the 36-inch onshore pipeline beneath the canal using HDD.	Eligible
American Rice Canal	Mid-20th century irrigation canal. Project would avoid impacts to the canal by installing the 36-inch onshore pipeline beneath the canal using HDD.	Eligible

Source: SPOT 2019u; THC 2019c

APE = are of potential effect; HDD = horizontal directional drilling; NRHP = National Register of Historic Places; PRA = permit review area; THC= Texas Historical Commission

Based on a preliminary assessment of the NRHP eligibility of each site, the Applicant recommended that sites 41BO269 and 41BO283 were not eligible for the NRHP and confirmed that sites 41BO268 and 41BO275 were not eligible for the NRHP. In a letter response from the THC to the Applicant on May 31, 2019, the THC concurred with the NRHP eligibility recommendations for archaeological resources 41BO268, 41BO269, and 41BO275 (SPOT 2019a, Application, Volume IIb, Appendix F; THC 2019b).

In a September 17, 2019, letter to the Applicant, the THC commented on the findings of the 2019 onshore archaeological survey report (THC 2019c) and concurred with the Applicant's recommendation that site 41BO283 is not eligible for inclusion in the NRHP. The THC also stated that the NRHP eligibility of the portions of sites 41BO268 and 41BO275 outside the Project workspace remain undetermined and that the Project would not affect site 41BO70. The THC stated that the draft report submitted by the Applicant was accepted and the Project could proceed without further consultation with the THC, unless significant archaeological deposits were encountered during construction and development of the Project (THC 2019c).

The Applicant's 2018 and 2019 historic standing structure surveys around the proposed Oyster Creek Terminal identified five potential and one previously recorded cultural resource areas within the indirect APE. Five potentially historic-age properties were identified within the 1-mile APE and one RTHL was identified within the 2-mile radius desktop study area (SPOT 2019a, Application, Volume IIb, Appendix F; SPOT 2019u). Table 3.9-5 contains summary information on the resources identified during the surveys and the THC's NRHP eligibility determination for each resource (Appendix D, Agency Correspondence).

Table 3.9-5: Standing Structures Assessed During the Onshore Historic Standing Structure Surveys

Resources Name	Description	THC Determination of NRHP Eligibility
Resource 1a-e	A historic, National-style house built circa 1935 with associated detached garage, secondary garage, secondary house, and two sheds. The resources are located approximately 0.11 mile north of the proposed Oyster Creek Terminal site.	Not Eligible
Resource 2a-d	A singlewide manufactured home, a prefabricated garage, a prefabricated warehouse, and a two-story prefabricated storage facility located approximately 0.74 mile south of the proposed Oyster Creek Terminal site. None of the current resources on the property are of historic-age.	Not Eligible
Resource 3a-e	A primary house and four sheds located approximately 0.64 mile southwest of the proposed Oyster Creek Terminal site. None of the current resources on the property are of historic-age.	Not Eligible
Resource 4	A one-story house dated ca. 1960 located approximately 0.72 mile southwest of the proposed Oyster Creek Terminal site.	Undetermined
Resource 5	A two-story building with a metal roof believed to be a house located approximately 0.92 mile from the proposed Oyster Creek Terminal site. The structure is not of historic-age.	Undetermined
Phair Cemetery	The Phair Cemetery is a RTHL and a registered historic cemetery. Headstones in the cemetery date to the mid-19th through early 20th centuries. It is located approximately 1.36 miles south of the proposed terminal and is the only RTHL within 2 miles of the proposed terminal site. The Applicant's cultural resources consultant determined that the tall trees surrounding the cemetery would obstruct any view of the proposed Oyster Creek Terminal.	Eligible (Registered RHTL)

Source: SPOT 2019u; Appendix D, Agency Correspondence

NRHP = National Register of Historic Places; RTHL = Register of Texas Historical Landmarks; THC= Texas Historical Commission

Only two of the potential historic standing structures identified during the historic structure survey, Resources 1a and Resource 4, were built over 50 years ago and can be considered historic-age structures (SPOT 2019a, Application, Volume IIb, Appendix F; SPOT 2019u).

In a September 17, 2019, email to the Applicant, the THC commented on the Applicant's 2019 historic standing structure report (Appendix D, Agency Correspondence) and concurred with the Applicant's recommendations that Resources 1a-3, 2a-d, and 3a-3 are not eligible for listing on the NRHP. The THC stated that the information provided by the Applicant for Resources 4 and 5 was insufficient to determine the NRHP eligibility of the resources and that the THC considers the NRHP eligibility status of the resources to be undetermined (Appendix D). The THC also stated that the Phair Cemetery was eligible for NRHP listing because it is a listed RTHL (Appendix D).

In the September 17, 2019, email, the THC stated that construction and operation of the Oyster Creek Terminal would have no adverse effect on any of the resources identified in the standing structure survey. The THC determined that because none of the resources are easily visible from main road due to trees, it is highly unlikely that the proposed terminal would be visible from the resources. The THC also stated that for those resources from which the Oyster Creek Terminal may be visible, there are existing modern facilities and structures in their viewsheds. The presence of these existing facilities reduces the potential for adverse effects on the historic resource due to the introduction of new visual elements such as the Oyster Creek Terminal. Based on these findings, the THC determined that the Project would have no adverse effect on the listed, determined eligible, and possibly eligible historic standing structures listed in the report (Appendix D, Agency Correspondence).

3.9.3.2. Offshore Existing Conditions

This section summarizes existing offshore cultural resource conditions for the proposed Project. The section includes a summary of regional offshore prehistory and history, the NEPA affected environment for offshore cultural resources, and a summary of known cultural resources within the proposed Project's offshore APE.

In addition to the offshore area of direct effect, the Project's offshore area of indirect effect for cultural resources includes the areas around the SPOT DWP and SPMs where construction of the aboveground components of these facilities could temporarily or permanently alter the setting of cultural resources. In addition, activities associated with the construction of subsurface Project components could result in temporary indirect impacts on cultural resources by altering resource setting due to the temporary introduction of construction vessels and temporary construction facilities.

Offshore Cultural Context

The Applicant developed an offshore cultural context as part of the preconstruction cultural resources investigations of the proposed offshore direct APE. Table 3.9-6 summarizes the prehistoric and historic contexts for the proposed offshore APE.

Table 3.9-6: Offshore Cultural Context

Period	Description
Prehistoric Period (11,500-2,200 B.C.E.)	During the last glacial maximum and the subsequent end of the Younger Dryas Period, the GoM reached a low sea level limit approximately 131 feet lower than the present day between 11,500 to 20,000 years B.C.E. The identification of preserved Paleoindian sites such as Avery Island, Louisiana; Sabine Pass, Texas; Wacissa River; and Little Salt Springs, Florida; as well as Ray Hole Springs, located approximately 18 nautical miles off the Florida coast support the hypothesis that submerged Paleoindian sites are present across the OCS. Archaic Period coastal occupations are typically associated with shell midden sites created from the detritus associated with the harvesting of various species of shellfish. These sites, along with those associated with the earlier Paleoindian Period, may have been affected by coastal processes associated with the last marine transgression during this period. Previous offshore investigations have shown that intact archaeological sites are preserved along the former land surface now submerged and buried on the OCS. The preservation of prehistoric archaeological sites in a marine environment is least likely in high-energy environments associated with intense wave energy during subsequent sea level transgressions. Intact sites are more likely to be found in low-energy depositional environments where they were gradually covered by fine-grained sediments, such as floodplains, river terraces, point bars, lagoons, ponds, subsiding deltas, and sinkholes prior to sea level rise. Within the proposed Project area, gradual formation of the deltaic lobes generated by the Brazos and Trinity Rivers likely buried any intact, archaeological sites under 3 to 150 feet of sediment. These buried and submerged landforms are typically identified using a variety of high-resolution seismic profilers and geotechnical sampling.
Historic Period (C.E. 1500-present)	Spanish explorers sailed along the coast of modern day Texas in the early 16th century. In C.E. 1554, a Spanish merchant ship convoy sank 50 miles off the coast of Texas south of modern day Corpus Christi. By 1605, Spanish maritime activity in the GoM had increased dramatically. Maritime activity continued to increase through the 17th, 18th, and 19th centuries as vessels from Spain, France, and England followed by vessels from independent Mexico and the United States of America traversed the water for trade and fishing. Ships that sailed along these routes encountered many events that resulted in a number of shipwrecks. In the GoM, causes generally related to shipwrecks include foundering, leaking, capsizing, collision, explosion, fire, abandonment, mechanical malfunction, torpedoes, mines, aerial bombardment, seizure, sabotage, and scuttling to evade capture. This area remains an active zone for maritime commerce. The current Project area runs adjacent to the designated Freeport Harbor Anchorage Area and crosses two designated fairways in Federal waters.

Source: SPOT 2019a, Application, Volume IIa, Section 7

B.C.E = Before Common Era; C.E = Common Era; OCS = outer continental shelf

The cultural context suggests there is the potential for formerly sub-aerially exposed, terrestrial Paleoindian and Archaic period archaeological sites and historic period shipwreck sites on the OCS off the coast of Texas within the Project's offshore area of direct effect.

Offshore Cultural Resources Assessment

The Applicant conducted extensive offshore cultural resource surveys of the Project's area of direct effect. These surveys occurred in offshore waters under Texas and Federal jurisdiction, pursuant to Texas Antiquities Permit #8601 issued by the THC, as well as anticipated permit requirements for a Federal undertaking under the NHPA—which would require offshore cultural resource investigations to identify historic properties within the offshore APE. The Applicant aligned the offshore cultural resource surveys in Federal waters with the specifications in NTL 2008-G05, 2005-G07, and 2011-JOINT-G01, published by the BOEM / Bureau of Safety and Environmental Enforcement, GoM Region.

The Applicant conducted a comprehensive desktop analysis to document all previously identified submerged archaeological resources within the proposed Project APE, and then performed offshore cultural resource geophysical surveys from October 1 through November 25, 2018 (SPOT 2019a, Application, Volume IIa, Section 7). The geophysical investigations were designed to identify seafloor and near-seafloor cultural resources within the Project's proposed offshore footprint (SPOT 2019a, Application, Volume IIa, Section 7).

The Applicant used a hull-mounted multi-beam echosounder, towed side-scan sonar, sub-bottom profiler, and magnetometer to conduct the geophysical survey. During the surveys closest to shore, the geophysical sensor suite included a hull-mounted interferometric sonar, which provided both side-scan sonar and swath bathymetry; a towed sub-bottom profiler; and magnetometer (SPOT 2019a, Application, Volume IIa, Section 7). Table 3.9-7 summarizes the survey results for each of these sections.

Table 3.9-7: Results of Offshore Cultural Resource Surveys

Sections	Survey Findings
Section 1: Pipeline Corridor	**SSS contacts:** 2 sonar contacts were identified in Texas waters as potential submerged archaeological sites. 2 sonar contacts were identified in Federal waters as potential submerged archaeological sites. Four contacts, contacts 1, 11, 15, and 16, were recommended for avoidance as potential archaeological resources. Contacts 1 and 11 were associated with large magnetometer targets. Contact 1 recommended avoidance zone is of 350 feet. Contact 11 recommended avoidance zone is of 165 feet. **Magnetic anomalies:** 65 unidentified anomalies were recorded in Texas waters. 3 anomalies in Texas waters were identified with characteristics that could indicate a potential shipwreck and 62 were identified as possible hazards and were recommended for avoidances. 35 unidentified magnetic anomalies were recorded within the pipeline corridor in Federal waters. Of these, 22 have been recommended for avoidance as hazards to operations, and 13 have been recommended for avoidance as potential archaeological resources. **Sub-bottom profiler features:** Channels indicative of submerged paleo-landforms were identified near the southern end of the survey area approximately 9 to 24 feet beneath the seafloor. Sea-level curve10 data indicate that these channels would pre-date the marine transgression across the seafloor around 8,400 to 10,400 years B.C.E., indicating that Paleoindians could have been present at the time when these channels were active. The margins of these channels were carefully scrutinized by Project archaeologists for evidence of preserved paleo-landforms. However, the channel margins appear to be systematically eroded with no evidence of intact landforms that would have been suitable for human occupation.
Section 2: Deepwater Port Site	**SSS contacts:** Three sonar contacts were identified within the footprint of the proposed SPOT DWP coverage area. None of the contacts were recorded in association with magnetic anomalies and are not considered to be archaeologically significant. **Magnetic anomalies:** Four magnetic anomalies were recorded. None of the anomalies were recommended for avoidance. **Sub-bottom profiler features:** A series of Pleistocene channels located from 4 to 10 feet below the seafloor were identified in the survey area, which could date to 10,400 years B.C.E. Thus, Paleoindians may have occupied this area when these channels were active. Although the margins of these channels were examined for preserved paleo-landforms, evidence shows that systematic erosion has removed the upper portions of these landforms that would have supported human occupation.

Sections	Survey Findings
Section 3: Crude Oil Pipelines	**SSS contacts:** No sonar contacts were identified as a result of the offshore geophysical survey. **Magnetic anomalies:** Two magnetic anomalies were recorded within the proposed tanker loading pipeline route corridor. Neither of these anomalies is located within 1,000 feet of the proposed routes. **Sub-bottom profiler features:** A series of complex, discontinuous, near horizontal sediment layers were observed. The upper margin of these channels begins around 6 to 10 feet below the seafloor, which is too deep to be affected by pipeline burial. The margins of these channels were carefully examined for preserved paleo-landforms; evidence indicates that systematic erosion has removed the upper portions of these landforms that would have supported human occupation.
Section 4: Tug Anchoring Area	**SSS contacts:** No sonar contacts are located within the footprint of the tug anchoring zones. **Magnetic anomalies:** No magnetic anomalies are located in the immediate vicinity of any of the three tug anchoring zones. **Sub-bottom profiler features:** A series of complex, discontinuous, near horizontal sediment layers were observed that in places are incised by Pleistocene channeling. The upper margin of these infilled channels begins around 5 to 15 feet below the seafloor, too deep to be affected by pipeline burial. The margins of these channels were carefully examined for preserved paleo-landforms; evidence indicates that systematic erosion has removed the upper portions of these landforms that would have supported human occupation.
Section 5: VLCC Anchoring Area	**SSS contacts:** No sonar contacts were identified as a result of the offshore geophysical survey. **Magnetic anomalies:** 15 magnetic anomalies were recorded within the survey area. All are indicative of small quantities of ferrous material and have not been recommended for avoidance as potential submerged cultural resources. **Sub-bottom profiler features:** A series of complex, discontinuous horizontal sediment layers were observed running east to west that are incised by Pleistocene channeling. The upper margin of these infilled channels begin around 2 to 3 feet. These channels exhibit gradual characteristics indicative of a low-energy environment interpreted as a possible estuary. The largest channel spans to 3,200 feet across and has been cut to a depth of 65 feet below the seafloor in some places. The margins of these channels were carefully examined for preserved paleo-landforms; evidence shows that systematic erosion has removed the upper portions of these landforms that would have supported human occupation.

Source: SPOT 2019a, Application, Volume IIa, Section 7

B.C.E. = Before Common Era; DWP = deepwater port; SPOT = Sea Port Oil Terminal; SSS = side-scan sonar; VLCC = very large crude carrier

Based on the survey findings, the Applicant determined that four side scan sonar targets (two in Texas waters and two in Federal waters) and 16 magnetometer contacts (3 in Texas waters and 13 potential archaeological resources in Federal waters) could represent the remains of submerged archaeological resources, such as a shipwreck. Eighty-four magnetometer contacts (62 in Texas waters and 22 in Federal waters) are recommended for avoidance as potential hazards to operations. The Applicant's cultural resources subcontractor recommended that the Project avoid all 100 of these targets by developing construction, operation, and decommissioning phase avoidance buffers around each target/anomaly.

The analysis of the sub-bottom profiler data indicated the presence of Pleistocene paleo-landforms around former river channels and an estuary within the Project's area of direct effect. The available data suggests these paleo-landforms may have been sub-aerially exposed during the Paleoindian Period, suggesting the potential for Indian archaeological sites at these locations. A detailed analysis of the paleo-landforms, however, suggested that marine transgression systematically eroded and removed the upper portions of the landforms, disturbing any archaeological resources that may have been present.

In a letter dated May 31, 2019, the THC concurred with the recommendations in the offshore cultural resource survey report to avoid magnetic anomalies 27, 101, and 797, and sonar targets 1 and 11. The THC stated that its interpretation of the recommended avoidance buffers is as follows (THC 2019b):

- The avoidance buffers commence at the outside edge of the magnetometer contours;
- A buffer of 107 meters around side scan sonar anomalies 27 and 10; and
- Anomaly buffer of 50 meters around side scan sonar anomaly 797.

In the May 31, 2019 recommendation letter, MARAD and the USCG stated that the offshore cultural resource investigations were sufficient in both scope and extent to identify historic properties within the offshore direct APE, and that no additional investigations were necessary (USCG 2019). In their June 14, 2019, response, the THC concurred with this recommendation (THC 2019a).

3.9.4. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore and offshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on cultural resources.

Cultural resources can be subject to direct and indirect impacts. Direct impacts occur when Project activities physically alter or damage cultural resources. All direct impacts on cultural resources are permanent and irreversible, since any physical change alters the scientific, historic, or cultural integrity[16] of the resource. The magnitude of these impacts varies based on the extent of the impact (i.e., amount or portion of the resource that is altered or damaged) and the significance of the resource.

Indirect impacts occur when Project activities alter the physical or cultural environment or setting of a resource. The duration of indirect impacts can be short-term, long-term, or permanent. Short-term indirect impacts on a cultural resource could include changes in the views and increased level of noise caused by temporary construction activities near a historic structure. Permanent indirect impacts on a cultural resource could include the construction of a large industrial facility next to a TCP that permanently changes the setting of the TCP, affecting the ability of Indian groups to use the resource. The magnitude of indirect impacts on cultural resources depends on the extent of the changes to resource setting and the perceptibility or intrusiveness of the change.

The study area within which potential impacts were assessed consists of the three APEs defined by the USCG, in consultation with the THC (onshore and offshore direct and onshore indirect).

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on cultural resources have been evaluated based on their potential to:

- Directly or indirectly affect submerged cultural resources;
- Cause irretrievable or irreversible damage to a prehistoric or historic property that is listed or eligible for listing on the NRHP;

[16] The National Park Service defines integrity in the context of cultural resources as "the ability of a property to convey its significance." The National Park Service recognizes seven aspects of integrity: location, design, setting, materials, workmanship, feeling, and association. Direct impacts on cultural resources can result in the loss of one or all seven aspects (NPS 2019b).

- Alter or impair a viewshed, scenic quality, or aesthetic value related to a historic property not consistent with applicable laws or regulations (minor to major depending on extent of alteration);
- Adversely affect a prehistoric or historic property that is listed or eligible for listing on the NRHP;
- Violate cultural resource standards by affecting resources that are of value to Indian culture and heritage; and/or
- Disturb human remains, including those interred outside of formal cemeteries.

The remainder of this section describes potential impacts from Project construction and operation on cultural resources from ground disturbance within the onshore direct APE, visual changes within the onshore indirect APE, seafloor disturbance within the offshore direct APE, and the unanticipated discovery of resources during construction both onshore and offshore.

3.9.4.1. Onshore Resources

Project construction would result in direct impacts on archaeological sites 41BO268, 41BO269, 41BO275, and 41BO283. The direct impacts on site 41BO268 would be adverse, long-term, and negligible, because non-Project related construction activities have substantially affected the portions of the site in the Project's area of direct effects. Project construction would also result in the removal of site 41BO283 and substantial portions of sites 41BO269 and 41BO275. The THC has determined, however, that site 41BO283 and the portions of sites 41BO269 and 21BO275 in the Project direct APE are not eligible for listing on the NRHP and therefore these resources are not historic properties as defined by the NHPA. As a result, site 41BO283 and the portions of sites 41BO269 and 41BO275 in the Project direct APE are not considered significant cultural resources and the removal of all or portions of the sites would result in direct, adverse, long-term, minor impacts on cultural resources. Project construction would have no impact on archaeological site 41BO70, because the site does not extend into the direct APE for the Project.

The Oyster Creek cemetery is located approximately 0.2 mile from the proposed Project onshore pipeline construction area. Due to the distance between the proposed Project and Oyster Creek Cemetery, any indirect visual or auditory impacts during construction would be adverse and negligible. The THC determined that because the Phair Cemetery, Resources 1a-e, Resource 2a-d, Resource 3a-3, Resource 4 and Resource 5 are not easily visible from the main road due to trees, it is highly unlikely that the Oyster Creek Terminal would be visible from the resources. The THC also determined that if the terminal is visible from any of the resources, the number of existing modern intrusions in their viewsheds reduces the potential for adverse effects from construction of the Oyster Creek Terminal. As a result, the THC has determined that construction of the terminal would have no adverse effects on the Phair Cemetery, Resource 1a-e, Resource 2a-d, Resource 3a-3, and Resource 4 cultural resources. Based on the THC findings, the Project would result in indirect, adverse, long-term, negligible impacts on these resources. Overall, onshore Project construction and operation would have adverse, long-term, negligible to minor impacts on cultural resources in both the direct and indirect APEs.

The Project could reduce the significance of potential direct impacts on undiscovered cultural resources by implementing the Project's Unanticipated Discoveries Plan for Cultural Resources and Human Remains (UDP) (Appendix U; BMP #29 in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures). The UDP requires all of the Applicant's EIs for the Project to monitor construction areas for potential archaeological materials uncovered during earth disturbance. If an EI encounters a potential cultural resource during construction, the EI is responsible for stopping work, protecting the potential find, notifying the THC, and working with the THC to develop a treatment plan for the resource.

3.9.4.2. Offshore Resources

The Applicant's offshore cultural resource investigations determined that four side scan sonar targets (two in Texas waters and two in Federal waters) and 16 magnetometer contacts (3 in Texas waters and 13 potential archaeological resources in Federal waters) could represent the remains of submerged archaeological resources, such as a shipwreck. Eighty-four magnetometer contacts (62 in Texas waters and 22 in Federal waters) are recommended for avoidance as potential hazards to operations. The geophysical surveys also identified buried, formerly subaerial Pleistocene paleo-landforms within the Project's offshore APE, but a detailed analysis suggests that the upper portions of these landforms have been systematically eroded and removed, disturbing any archaeological resources that may have been present.

Following its review of the Draft EIS, BOEM identified four additional magnetic anomalies that would fall within the offshore direct APE, based on previous surveys conducted by the oil and gas industry and reviewed by BOEM. In addition, BOEM recommended increasing the avoidance distances for the two sonar targets and six of the magnetic anomalies identified by the Applicant by an additional 50 feet (15 meters) for each target and avoiding magnetic anomalies by a minimum of 100 feet (30 meters) or half the duration of the anomaly, whichever distance is greater, in order to account for uncertainty in the seafloor location of the potential archaeological material creating the anomaly (BMP #36 in Appendix N). The Applicant would avoid all 21 of the identified side scan sonar and magnetometer targets by developing construction, operation, and decommissioning phase avoidance buffers around each target/anomaly in accordance with BOEM's recommendations; therefore, the Project would have no impact on known offshore cultural resources.

The Project could reduce the significance of potential direct impacts on undiscovered cultural resources through implementation of the Project's UDP (Appendix U; BMP #29 in Appendix N). The Project would implement the offshore UDP if previously unidentified, submerged archaeological resources or human remains were encountered during Project construction. If the Project encountered a potential cultural resource during offshore construction, the Project would stop work, protect the potential find, notifying the THC, and work with the THC to develop a treatment plan for the resource.

3.9.4.3. Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground or seafloor disturbing activities and impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction BMPs (Appendix M; BMP #1 in Appendix N), industry standard upland construction plans (BMP #26), and the onshore UDP (BMP #29). No cultural resources are anticipated to be encountered offshore. Therefore, impacts on cultural resources associated with planned or unplanned maintenance would be adverse, long-term, and negligible to minor in both the direct and indirect APEs.

3.10. Land Use, Recreation, Visual Resources, and Ocean Use

The following section analyzes potential impacts on land use, recreation resources (including onshore recreation resources, recreational fishing and boating, artificial reefs and scuba diving, and cruise ships), onshore and offshore visual resources, and ocean uses (including offshore oil and gas activity, non-energy mineral resources, and military uses).

3.10.1. Definition of the Resource

Land use refers to the existing and future ways that onshore areas are utilized or managed. Existing land use patterns can be indicated by land cover, which may be agricultural, natural vegetation, or developed to varying degrees of intensity. Land uses can be influenced by local zoning, subdivision, or other land management regulations, by land use plans developed by the governing municipality or county, or by management plans prepared by responsible state or Federal agencies. The study area for land use includes areas directly affected by Project construction or operation and areas directly adjacent to Project components. Lands within 1 mile of Project components are discussed generally, in terms of predominant land uses and patterns (i.e., rural, developed, or industrial in nature), to provide context for Project impacts.

Recreation resources include natural resources and constructed facilities that offer opportunities for leisure activities. Onshore recreational activities may include visiting parks, beaches or designated conservation areas for bird or wildlife viewing, hunting, biking, hiking, or fishing inland waters. Offshore recreation activities addressed in this EIS include recreational boating, recreational fishing, watersport activities such as scuba diving, and multi-day commercial cruises. The study area for recreation resources includes areas directly affected by Project construction or operation; lands and waters adjacent to Project components; regional coastal waters offshore Freeport; and OCS waters surrounding Project components. For recreational boating and fishing, the analysis also includes regionally important recreational resources such as artificial reefs and cruise ship terminals.

Visual resources refer to the components of the landscape that compose its visual character or scenery, as determined by natural features such as waterbodies and shorelines, vegetative patterns provided by forests or grasslands, geological features or terrain, and manmade features such as farms, buildings, or utility infrastructure. Potentially sensitive viewers—people or groups of people who may be concerned about or affected by changes in scenery—may alter their behavior due to changes in scenery. Viewer sensitivity varies among different groups of viewers; for example, a resident may be more sensitive to changes to views from their home, compared to a motorist who experiences only transient views while driving. Sensitive viewers for the Project's onshore terminals would include residents, visitors to recreation sites, and travelers along nearby roadways. Potentially sensitive viewers for the offshore components and activities would primarily be recreational boaters either passing through or fishing near the Project area. The study area for visual resources includes all areas within the Project viewshed.

Ocean use in this context refers to the existing ways in which offshore areas in the GoM are utilized or developed, and the types of activities allowed other than recreation activities and maritime transportation. Uses of offshore areas include oil and gas activities, non-energy marine mineral extraction, and military use and training. The study area for ocean uses includes Galveston Area lease blocks A-59 and 463, as well as areas adjacent to Project components. This section also discusses other important ocean use activities within the larger GoM. Section 3.6, Estuarine and Marine Fisheries, discusses fisheries resources, and Section 3.11, Transportation, discusses navigation for commercial and recreational boating traffic.

3.10.2. Existing Threats

Threats to land use, recreation resources, visual resources, and ocean use include population growth, infrastructure development, extreme weather, and industrial accidents. Population growth (see Section 3.14, Socioeconomics), particularly in suburban Houston, could lead to development of previously undeveloped land. The oil and gas industry is a major driver of onshore and offshore development in the region, which has the potential to convert various existing land uses to industrial land uses. Population growth and growth in the oil and gas industry both have the potential to affect the quality and quantity of onshore and offshore recreation opportunities and visual resources. While accidents and spills are rare, these events have the potential to cause immediate and long-term impacts on recreational resources that are important to the tourism industry. Chapter 4, Safety, discusses these events and their impacts in detail. Extreme weather such as hurricanes can cause considerable damage to structures and infrastructure in the Project area, negatively affecting recreational and visual resources.

3.10.3. Land Use

3.10.3.1. Existing Conditions

The Project's proposed onshore infrastructure includes modifications at the existing ECHO Terminal, the new ECHO to Oyster Creek Pipeline, the Oyster Creek Terminal, the Oyster Creek to Shore Pipelines, and MLVs associated with the onshore pipelines. National Land Cover Database (NLCD) classes indicate land uses within the footprints of these facilities, including agricultural (hay/pasture and cultivated crops) and developed areas associated with residential, commercial, and industrial uses (MLRC 2019). The existing conditions of the various onshore Project components discussed in this section are based on the NLCD. Actual or observed land uses and conditions may differ, as noted.

Table 3.10.3-1 summarizes and Figure 3.10.3-1 illustrates NLCD land cover classes crossed by the onshore pipelines and at the onshore terminal sites. The proposed onshore pipeline routes generally follow existing linear features (e.g., pipelines, electric transmission lines, roads, railroads, and property lines), as described in Sections 2.2.1.2, ECHO to Oyster Creek Pipeline, and 2.2.1.4, Oyster Creek to Shore Pipelines. The pipeline route crosses numerous pipelines, as well as electric transmission lines rights-of-way, primarily located adjacent to roadways.

Table 3.10.3-1: Miles of NLCD Land Cover Classes Crossed by the Onshore Pipeline Segments

Land Cover Category [a]	ECHO to Oyster Creek Pipeline [b]	Oyster Creek to Shore Pipelines [b]	Total Miles Crossed [b]
Barren Land	0.1	<0.1	0.1
Cultivated Crops	12.2	0.0	12.2
Deciduous Forest	0.5	<0.1	0.5
Developed, Low Intensity	4.6	0.3	4.8
Developed, Medium Intensity	2.4	0.1	2.5
Developed, High Intensity	0.7	0.1	0.7
Developed, Open Space	5.9	0.3	6.1
Emergent Herbaceous Wetlands [c]	0.9	6.0	6.9
Evergreen Forest	0.4	0.1	0.5
Hay/Pasture	16.9	0.5	17.4
Grassland/Herbaceous	1.3	1.8	3.1
Mixed Forest	0.1	0.0	0.1
Open Water	0.1	0.6	0.7
Shrub/Scrub	1.2	0.8	2.0
Woody Wetlands [c]	2.9	1.7	4.6
Total [d]	**50.1**	**12.2**	**62.3**

Source: MLRC 2019

ECHO = Enterprise Crude Houston; NLCD = National Land Cover Database

[a] Full descriptions of NLCD classes are provided in SPOT 2019a, Application, Volume IIb, Section 8.

[b] Total miles crossed by the right-of-way centerline was estimated. Each of the parallel, collocated pipelines would cross slightly different lengths of land cover categories.

[c] NLCD estimates of wetland acreage are not accurate for purposes of evaluating wetland impacts. See Section 3.3, Water Resources, for a description of field surveyed wetlands and analysis of potential wetland impacts.

[d] Totals may not match due to rounding.

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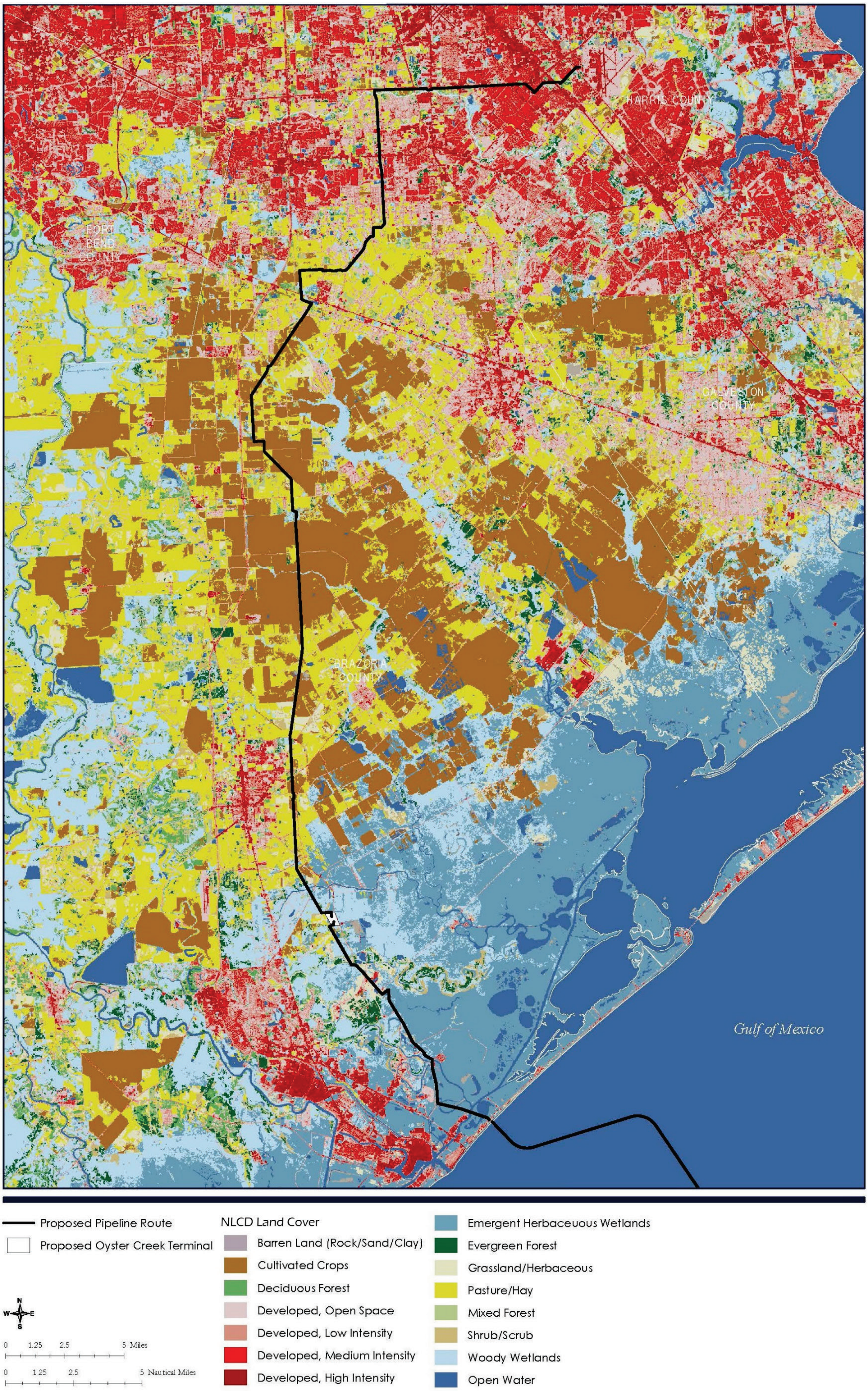

Source: MLRC 2019

Figure 3.10.3-1: NLCD Land Cover Classes, Onshore Pipeline Route

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ECHO Terminal

The ECHO Terminal is an existing facility, and modifications would be fully contained in an existing industrial area.

ECHO to Oyster Creek Pipeline

The ECHO to Oyster Creek Pipeline would cross areas of high to low (north to south) development intensity associated with southern suburban Houston and Pearland. South of MP 15, land cover becomes more agricultural or undeveloped (hay/pasture and scrub/shrub land covers), and land uses become more rural, with more widely dispersed residential, commercial, and industrial developments.

The ECHO to Oyster Creek Pipeline would cross through the incorporated municipalities of Houston, Brookside Village, Pearland, Manvel, Iowa Colony, and Angleton, as well unincorporated areas of Brazoria and Harris counties. Approximately 170 residential buildings would be located within 50 feet of construction workspaces for the ECHO to Oyster Creek Pipeline. In addition, the pipeline would cross the partially complete Meridiana housing/mixed-use development near Manvel (MPs 22.3 to 25.4), parallel to an existing pipeline. The pipeline right-of-way would cross the Meridiana development using open-cut installation from MPs 22.3 to 25.0, and HDD under a green space adjacent to a stormwater pond and a parking lot near the Alvin Heritage Center and Freedom Field from MPs 25.0 to 25.6 (outside of the Meridiana property).

Oyster Creek to Shore Pipelines

The Oyster Creek to Shore Pipelines would primarily cross rural, undeveloped areas. The NLCD and aerial photography show that natural land cover types, including wetland land covers, become more prominent towards the shoreline (Figure 3.10.3-1).[17] The Oyster Creek to Shore Pipelines would cross through the incorporated municipalities of Freeport and Surfside Beach, as well unincorporated areas of Brazoria County. Ten residential buildings would be located within 50 feet of construction workspaces for the Oyster Creek to Shore Pipelines.

Oyster Creek Terminal

The proposed Oyster Creek Terminal would be located in an approximately 140-acre area primarily characterized by NLCD as undeveloped pastureland and wetlands (see Figure 3.10.3-2 and Table 3.10.3-2). Despite the woody wetland and emergent herbaceous wetland designations, field verification conducted by the Applicant indicated that the extent of wetlands at the site is much more limited (see Section 3.3.5, Water Resources, Wetlands). The site is surrounded by low-density residential, commercial, and industrial developments. A high-voltage transmission corridor borders the site to the west. Two single-family residential buildings are located approximately 700 feet north-northeast of the site, and other agricultural buildings are located within 300 feet of the proposed site. The Seabreeze Environmental Landfill is directly across Farm to Market Road (FM) 523 from the Oyster Creek Terminal site.

[17] NLCD identification of "wetland" and "open water" are generalized, based on satellite imagery, and do not reflect the actual acreage of wetland or waterbodies affected by the Project. See Section 3.3, Water Resources, for a more detailed evaluation of wetland and waterbody impacts.

Table 3.10.3-2: NLCD Land Cover Classes within the Proposed Oyster Creek Terminal Site

Land Cover Category [a]	Acres [b]	Percent of Total
Developed, Low Intensity	2.3	1.6%
Developed, Medium Intensity	<0.01	<0.01%
Developed, Open Space	0.2	0.1%
Emergent Herbaceous Wetlands [c]	44.9	32.0%
Grassland/Herbaceous	1.4	1.0%
Hay/Pasture	4.5	3.2%
Shrub/Scrub	2.4	1.7%
Woody Wetlands [c]	84.5	60.3%
Total	**140.1**	**100.00%**

Source: MLRC 2019

[a] Full descriptions of NLCD classes are provided in SPOT 2019a, Application, Volume IIb, Section 8.

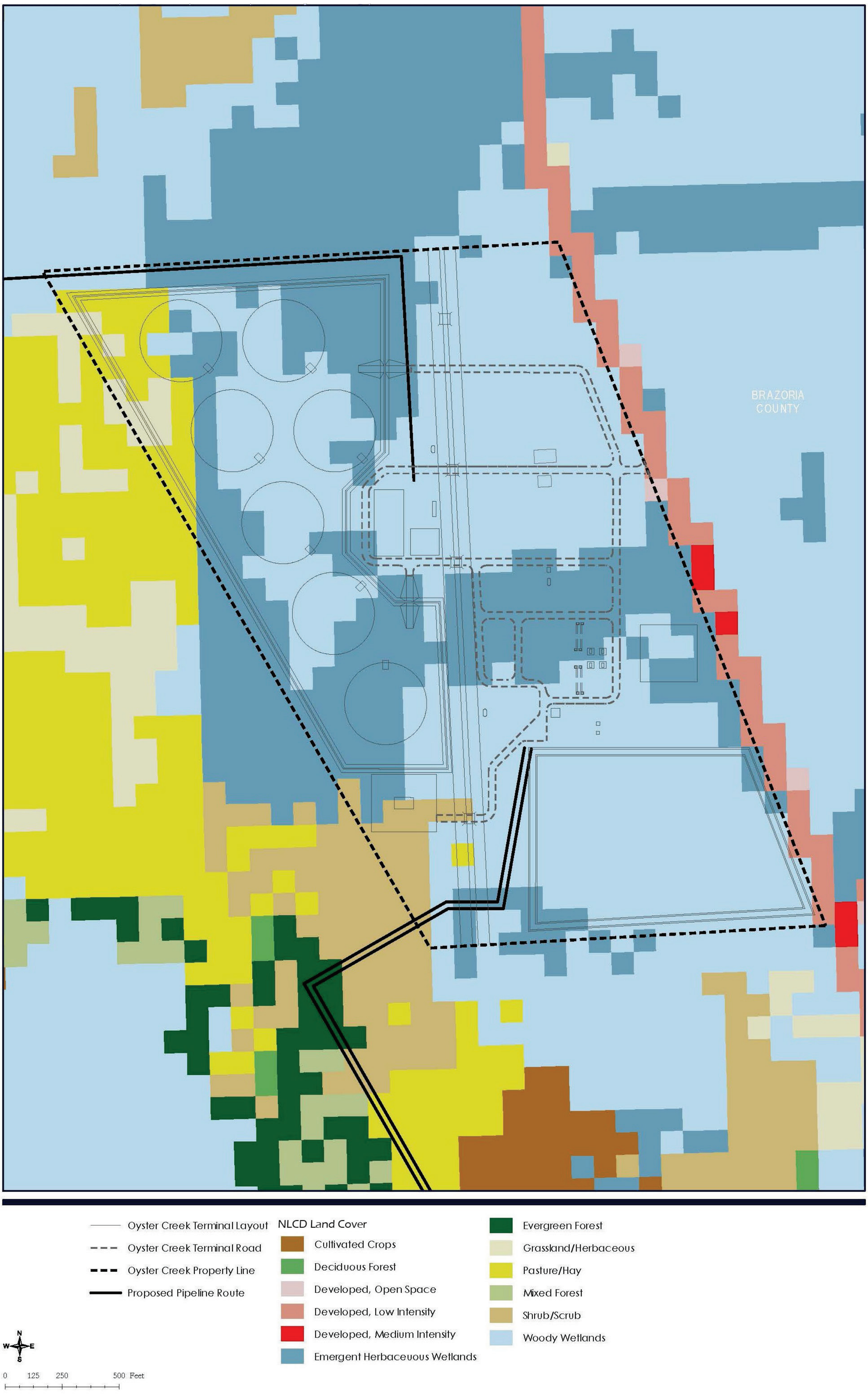
[b] Totals may not match due to rounding.

[c] NLCD estimates of wetland acreage are not accurate for purposes of evaluating wetland impacts. Based on wetland delineations at the Oyster Creek Terminal site, as described in Section 3.3, Water Resources, most of the areas identified by NLCD as wetlands are likely Grassland/Herbaceous or Hay/Pasture. See Section 3.3, Water Resources, for a description of field surveyed wetlands and analysis of potential wetland impacts.

Land Development Regulations

Some jurisdictions have zoning or land use regulations, or comprehensive land use plans that guide land use management. The City of Houston does not have a city-wide comprehensive zoning ordinance; however, the city does prohibit land uses that may adversely impact airport operations or safety within regulated airport zones, including but not limited to uses that produce vision-obscuring emissions (such as steam or smoke), uses that emit glaring light or utilize highly reflective surfaces, uses that have the potential to attract birds, and uses that create electrical or electromagnetic interference (City of Houston 2019; City of Houston Code of Ordinances, Sec. 9-360). Airport land use permits may be required for construction within the regulated zones.

The ECHO Terminal modifications and approximately 0.2 mile of the ECHO to Oyster Creek Pipeline would be located within the tier two regulated zone for the Ellington Airfield, and approximately 0.8 mile would be located in the tier three regulated zone for the Ellington Airfield (City of Houston n.d.). Approximately 9 miles of the ECHO to Oyster Creek Pipeline would be located within the tier three regulated zone for Houston Hobby Airport (City of Houston n.d.). Within these areas, most non-residential uses are allowed, but an airport land use permit would be required for new construction within the tier two regulated zone (City of Houston Code of Ordinances, Sec. 9-381(b) and Sec. 9-604(a)(3)). Nonresidential uses in tier three regulated zones are subject to building or development permits, but do not require an airport land use permit (City of Houston Code of Ordinances, Sec. 9-605(a)).



Source: MLRC 2019

Figure 3.10.3-2: NLCD Land Cover Classes, Oyster Creek Terminal Site

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The GLO administers the TCMP, which implements requirements of the Federal CZMA within the state's coastal zone. The Texas coastal zone includes all or part of 18 coastal counties, and extends approximately 9 nautical miles into the GoM (GLO n.d.a). The existing ECHO Terminal and new Oyster Creek Terminal, two portions of the ECHO to Oyster Creek Pipeline (MP 0.0 to 2.0 and 48.6 to 50.1), the entire route of the Oyster Creek to Shore Pipelines, and MPs 0.0 to 13.4 of the offshore pipelines are located within the Texas Coastal Zone (GLO n.d.b). The GLO, in coordination with the USACE and NOAA as appropriate, will review the Project to ensure consistency with Federal and state coastal zone management programs. Section 1.6.6, Coastal Zone Management Act, discusses the Project's compliance with the CZMA in detail (Chapter 6, Coastal Zone Consistency).

Brazoria County helps regulate the TCMP through its Beach Access and Dune Protection Program. Under this program, any development within 1,000 feet of mean high tide must obtain approval from the Brazoria County Commissioner's Court and GLO. Additionally, a Dune Protection Permit is required from the Brazoria County Commissioner's Court for alteration of elevation or vegetation of any sand dunes in the area 1,000 feet landward from the mean high tide line (Brazoria County n.d.).

3.10.3.2. Impacts and Mitigation

This section discusses the land use impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would employ to minimize such impacts. The study area within which potential impacts were assessed includes the Project workspace. As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on land use have been evaluated based on their potential to:

- Alter the functional use of an area already in use;
- Conflict with applicable planning and zoning;
- Conflict with the TCMP; or
- Affect residences or business.

The remainder of this section describes potential impacts from Project construction and operation on land use from ground disturbance and conversion of land cover and land use types to different types.

Publicly available land cover data were used to conduct a desktop analysis of potential changes in land uses (MLRC 2019). Table 3.10.3-3 lists acres of land use impact associated with Project construction and operation. Modifications at the ECHO Terminal would occur within an existing industrial property, and therefore would not constitute a change in land use or land cover. Construction and operation of the Oyster Creek Terminal would convert 140.1 acres of land to industrial use, except in surveyed wetland areas and marginal areas that would be maintained in an herbaceous state. The proposed Oyster Creek Terminal is located adjacent to the Seabreeze Environmental Landfill, an industrial land use site that generates frequent truck traffic, noise, and odor. Operation of the Oyster Creek Terminal would generate additional noise, traffic, and visual impacts (see Section 3.10.5, Land Use, Recreation, Visual Resources, and Ocean Use, Visual Resources); however, based on the extent of surrounding pasture and agricultural land, and the presence of an existing industrial activity, construction of the Oyster Creek Terminal would have direct, adverse, short-term, and minor impacts on land use. Operation of the Oyster Creek Terminal would have direct, adverse, long-term, and minor impacts.

Table 3.10.3-3: Construction and Operation Impacts on NLCD Land Cover Classes (Acres)

	Oyster Creek Terminal [a]		ECHO to Oyster Creek Pipeline		Oyster Creek to Shore Pipelines		Access Roads [b]	
Land Cover Category	**Construction**	**Operation**	**Construction [c, d]**	**Operation**	**Construction [c, d]**	**Operation**	**Temporary**	**Permanent**
Barren Land	0.0	0.0	0.9	0.0	0.6	0.0	0.0	0.0
Cultivated Crops	0.0	0.0	163.3	45.0	0.0	0.0	0.0	0.0
Deciduous Forest	0.0	0.0	7.4	1.8	<0.1	0.0	0.0	0.0
Developed, Low Intensity	2.3	2.3	74.2	4.9	3.6	1.4	0.1	0.0
Developed, Medium Intensity	<0.1	<0.1	35.2	3.9	0.8	0.8	<0.1	<0.1
Developed, High Intensity	0.0	0.0	9.0	1.0	0.2	0.2	0.0	0.0
Developed, Open Space	0.2	0.2	111.6	11.4	6.0	1.8	<0.1	0.0
Emergent Herbaceous Wetlands	44.9	44.9	6.0	1.8	129.6	35.7	0.3	0.1
Evergreen Forest	0.0	0.0	6.8	1.4	1.7	0.6	<0.1	<0.1
Hay/Pasture	4.5	4.5	253.1	54.4	7.9	2.8	1.5	0.0
Grassland/ Herbaceous	1.4	1.4	19.8	4.5	33.2	10.9	2.6	2.5
Mixed Forest	0.0	0.0	2.9	0.3	0.4	<0.1	1.7	1.7
Open Water	0.0	0.0	0.8	0.2	6.4	3.8	0.0	0.0
Shrub/Scrub	2.4	2.4	17.9	4.4	14.2	4.0	1.6	1.6
Woody Wetlands	84.5	84.5	35.7	10.1	33.0	10.6	0.1	0.0
Totals [e]	**140.1**	**140.1**	**745.0**	**145.1**	**237.7**	**72.6**	**8.0**	**5.9**

Source: MLRC 2019

ECHO = Enterprise Crude Houston; EOP = ECHO to Oyster Creek Pipeline; NLCD = National Land Cover Database

[a] Construction and operation of the Oyster Creek Terminal would occur within the same 140.1-acre area.

[b] Impact acres for access roads were classified based on the most recent information provided by the Applicant for impacts on vegetation (SPOT 2019mm).

[c] Construction impact acreages are based on the Project right-of-way; however, land within the right-of-way over sections of pipeline constructed using horizontal directional drilling would not be disturbed during construction. Therefore, actual disturbance would be less than the acreage shown here.

[d] Construction acreage includes construction workspace and additional temporary workspace.

[e] Totals may not match, due to rounding. Modifications to the ECHO Terminal would affect 3.2 acres of developed-high intensity (industrial) land, but would not result in a change in land cover type.

As described above and in Sections 2.2.1.2, ECHO to Oyster Creek Pipeline, and 2.2.1.4, Oyster Creek to Shore Pipelines, the proposed onshore pipelines would be collocated with other existing pipeline rights-of-way and other linear features for approximately 49.6 out of the total 62.3 miles of onshore pipelines (80 percent of total length), and would be installed underground.

Approximately 767.1 acres (construction only) used as part of temporary construction workspace, ATWS, or access roads not within the permanent right-of-way—as well as approximately 179.8 acres (cultivated crops, emergent herb wetlands, hay/pasture, grassland/herb, open water, woody wetlands) permanent impact only for onshore pipelines within the permanent right-of-way—would be restored and/or allowed to revert to preconstruction conditions and uses. The Applicant would use industry standard safe crossing practices during construction of the onshore pipelines where the proposed right-of-way overlaps or crosses rights-of-way associated with other pipelines and electric transmission lines.

This analysis assumes that the Project would comply with applicable zoning or other land development ordinances or other land use conditions imposed by municipal or county authorities, and that the Project would be designed to comply with state and Federal CZMA requirements. Because the proposed facilities within areas regulated for airport operations are either underground or at an existing industrial site, the Project would comply with the City of Houston's land use regulations for airport areas. The Applicant is preparing site-specific residential construction plans for all residences within 50 feet of all workspaces, with a goal of avoiding obstruction of access, and will submit these plans in a future supplemental filing. With implementation of these plans and requirements, construction of the onshore pipelines would not prevent the use of residential or non-residential lands to the extent practicable, although some activities associated with those land uses (i.e., gardening or farming within the right-of-way, or activities that require low noise levels) could be diminished or prevented during construction. The Applicant would install the ECHO to Oyster Creek Pipeline through the Meridiana development parallel to an existing pipeline, and would use the HDD method near the Alvin Heritage Center and Freedom Field from MPs 25.0 to 25.6. Onshore pipeline installation would last up to several days in any single location. As a result, construction of onshore pipelines would have direct, adverse, short-term, and moderate impacts on land use.

The Applicant would maintain the permanent right-of-way in an herbaceous state. No structures would be allowed, and trees would not be allowed to grow within upland areas of the permanent right-of-way (Appendix M, Construction BMPs; BMP #1 in Appendix N). As a result, operation of the onshore pipelines would permanently convert forested land and forested wetlands to open land or non-forested wetlands. Most agricultural activities would be allowed to continue within the permanent right-of-way, as would uses in developed areas that do not require structures (i.e., lawns, landscaped areas, etc.). MLVs would be mostly within the permanent right-of-way, and would result in the permanent conversion of 0.8 acre of Developed-Open Space, Developed-Low Intensity, Developed-Medium Intensity, herbaceous, emergent herbaceous wetlands, and woody wetlands to industrial land uses. Because certain land uses such as agriculture and open space would still be allowed within the permanent right-of-way, operation of the onshore pipelines would have a direct, adverse, long-term, and minor impact on land use.

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the

Applicant would adhere to the Construction Spill Response Plan (BMP #3), Construction BMPs (BMP #1), and the SWPPP (BMP #14). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor to moderate, depending on the activity.

3.10.4. Recreation Resources

3.10.4.1. Existing Conditions

Recreation resources in the area include onshore parks, beaches, and recreation areas, and offshore recreation activities such as recreational boating and fishing, scuba diving, and marine cruising. Figure 3.10.4-1 shows the onshore and shoreline recreation resources described in this section.

Onshore Recreation Resources

The proposed onshore pipelines and Oyster Creek Terminal and existing ECHO Terminal would not intersect any local, state, or Federal parkland, conservation lands, or conservation easements (NCED 2019; USGS 2018e), although the existing ECHO Terminal is adjacent to the Pasadena Municipal Golf Course. Land uses adjacent to the golf course include the existing ECHO Terminal facilities and Ellington Field (a military airfield). The proposed Project facilities at the existing ECHO Terminal would be approximately 500 feet from the golf course at their closest point (the southwest corner of the golf course). The Oyster Creek to Shore Pipelines would also cross the shoreline via the HDD method (a trenchless technology) under a public beach in Surfside Beach.

The proposed onshore pipelines would be located directly adjacent to or within four established recreational sites (see Figure 3.10.4-1):

- El Franco Lee Park is a Harris County Park in Houston, south of and adjacent to SH 8 (the Sam Houston Tollway). The ECHO to Oyster Creek Pipeline right-of-way and construction workspace (from MPs 4.9 to 5.4) would be located between the park and SH 8. The park includes a community center, picnic and playground areas, soccer and baseball fields, volleyball courts, and a fishing pond (Harris County n.d.). It is accessed from the SH 8 access roads and Hall Road, and is open between 6 a.m. and 10 p.m.
- Rueben Welch Park is located on East Kiber Street, approximately 0.1 mile west of the ECHO to Oyster Creek Pipeline centerline, from MPs 45.0 to 45.2 (USGS 2018e). Athletic fields are visible on aerial photography, and the USGS Protected Areas Database of the United States identifies the park as being owned by the City of Angleton; however, the city does not list the park as a municipal recreation resource (City of Angleton n.d.). Therefore, Welch Park is assumed to be privately operated.
- A portion of the Brazoria NWR in southeast Brazoria County is approximately 0.1 mile northeast of the construction workspace near MPs 7.2 to 7.4 of the Oyster Creek to Shore Pipelines. The refuge provides visitor activities including bird and wildlife watching, nature trails, waterfowl hunting, and fishing (USFWS 2019a). No developed recreation sites were identified within 0.5 mile of the proposed pipeline right-of-way within the refuge. Visitor activities in the refuge, including hiking and driving trails, are not located in the vicinity of the onshore pipelines.

- The transition from the Oyster Creek to Shore Pipelines to the subsea pipelines at the shore crossing would cross under a public beach in Surfside Beach, Texas via the HDD method. Public access to Gulf Coast beaches is established by the Texas Open Beaches Act and implemented in Surfside Beach by the Village of Surfside Beach's Dune Protection and Beach Access Plan (Village of Surfside Beach 2015). The shore crossing location would be approximately 0.5 mile southwest of Stahlman Park Event Center, which is owned by the Village of Surfside Beach.

Project pipelines would be approximately 1.5 miles east of Quintana Beach (City of Quintana) and 2.5 miles west of Follett's Island Beach, both owned by Brazoria County. Project pipelines would be approximately 4 miles east of Bryan Beach, owned by the City of Freeport.

Recreational Boating and Boating

Recreational fishing occurs in both inland waterways and in the GoM near the Project area, and is an important economic activity in Texas. Recreational fishing sales in Texas totaled approximately $2 billion, the second largest national sales impact after west Florida (NMFS 2018b). Inland fishing and boating opportunities are concentrated at established recreation sites such as parks, near boat ramps on lakes and perennial streams, and along paddling trails.

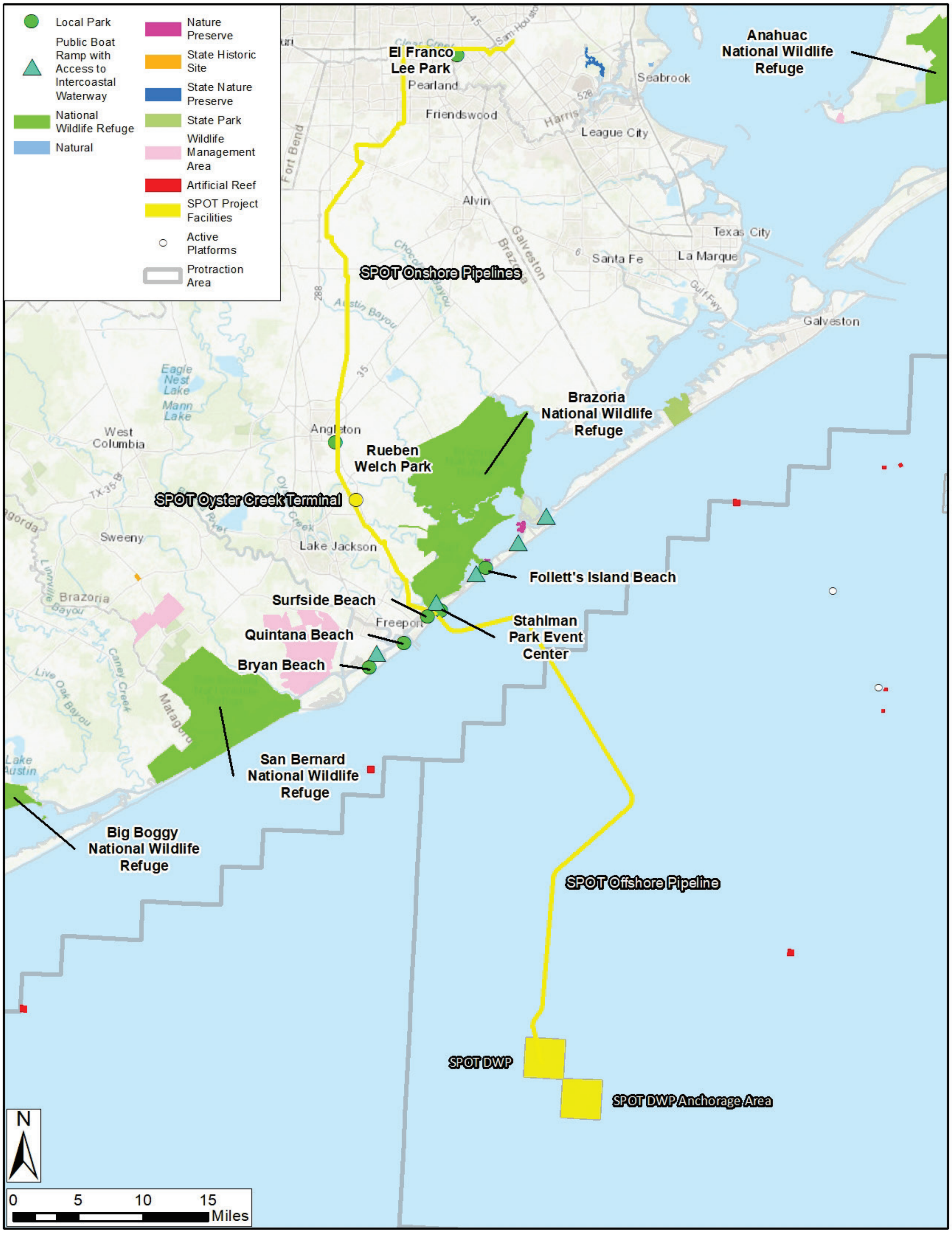
Offshore recreational boating and fishing activities occur in the vicinity of the proposed offshore pipelines and SPOT DWP. Recreational vessels that travel in the vicinity of the proposed offshore pipelines and SPOT DWP are typically launched from or based at public boat ramps, private boat ramps and marinas, or private residential docks in Brazoria County or neighboring Matagorda County. There are five public boat ramps in Brazoria County with access to the Gulf Intracoastal Waterway (GIWW) and the GoM (see Figure 3.10.4-1), including Swan Lake Ramp, Drum Bay-San Luis Beach Subdivision, Seidler's Boat Ramp, San Luis Boat Ramp, and Quintana Boat Ramp (Brazoria County 2019b). Several other public boat ramps are available in Matagorda County, while numerous private marinas, docks, and residential boat ramps are located in Brazoria and Matagorda counties.

No publicly available data show or list popular destinations for recreational boating and fishing trips from or near the study area; however, such locations likely include open waters within the GoM, proximate artificial reefs as shown on Figure 3.10.4-1, and reefs and banks in proximity of the FGBNMS, approximately 40 nautical miles southeast of the SPOT DWP (NOAA 2019a). Section 3.14.7.1, Socioeconomics, Recreation and Tourism, Existing Conditions, discusses the economic impacts associated with recreational fishing.

Subsistence fishing would occur in the same inland and offshore waters as recreational fishing. Surveys and observations have suggested that fish, shrimp, crabs, and oysters are important as a food source for Texas coastal communities, although no systematic surveys of subsistence practices are available (Industrial Economics, Inc 2014).

Artificial Reefs and Scuba Diving

Scuba diving is a popular activity at artificial reefs offshore Texas. The TPWD manages the Artificial Reef Program, which is guided by the Texas Artificial Reef Plan as a way to promote and enhance the artificial reef potential in waters off the Texas coast. TPWD has created 66 artificial reefs from decommissioned offshore platforms and wells as part of the Rigs-to-Reefs program, and 5 reef sites from the Ships-to-Reefs program (TPWD 2019j). The closest artificial reefs to the Project (see Figure 3.10.4-1) would be a converted platform reef 10.6 miles east-northeast of the SPOT DWP in Galveston Area lease block A-125, and the Freeport Liberty Ship Reef, 17.6 miles northwest of Galveston Area lease block A-59 (TPWD 2019j).



Source: USGS 2018e

Figure 3.10.4-1: Regional Recreation Resources

Cruise Ships

Cruise ships operate throughout the GoM, but multi-day cruises do not operate out of Freeport. The Port of Galveston, approximately 59 miles northeast of the proposed SPOT DWP and 33 miles northeast of the closest point on the offshore pipeline route, is the closest cruise terminal to the Project. Data on cruise vessel transits are not available; however, due to the absence of other nearby cruise ports or stopover locations, multi-day cruise vessels are unlikely to traverse Galveston Area lease blocks A-59 and 463 (SPOT 2019a, Application, Volume IIa, Section 10).

3.10.4.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on recreational resources. The study area within which potential impacts were assessed encompasses the shoreline from Brazoria County, Texas, to the proposed SPOT DWP, including the safety zones and ATBA/NAA around the platform and the SPM buoys and the safety zones around the support vessel moorings.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on recreational resources have been evaluated based on their potential to:

- Interfere with access to coastal recreational shorelines or waterways;
- Cause the loss or displacement of an important recreational resource, such as recreational fishing sites and other water-dependent recreational activities; and/or
- Degrade recreational value, as established in applicable public agency management plans or policies.

The remainder of this section describes potential impacts from Project construction and operation on the recreational resources from noise and other construction activities onshore, pipeline crossings of navigable waterways, safety zones and ATBA/NAA, and vessel traffic.

Onshore Recreation Resources

Construction at the ECHO Terminal would result in noise, dust, and fumes that would affect users of the Pasadena Municipal Golf Course. Based on other surrounding uses, including the existing ECHO Terminal facilities and Ellington Field (a military airfield), the distance from the golf course to the proposed Project facilities at the existing ECHO Terminal, and the vegetative buffer between the golf course and the ECHO Terminal, Project construction would have direct, adverse, short-term, and minor impacts on golf course users.

Construction of the onshore pipelines would last approximately 9 months. Work in any one location would therefore last an average of 4 to 5 days, although work at HDD or bore locations or wetland crossings would last for up to 40 days.

Pipeline construction would result in noise, dust, and fumes that would affect the users of El Franco Lee Park, Ruben Welch Park, the portion of Brazoria NWR near the pipeline workspace (although there are no recreation facilities within that part of the NWR), and the public beaches and parks near the landfall site (see Section 3.12, Air Quality, and Section 3.13, Noise). Construction would not hinder access to or use of park resources. Project construction would not affect other regional recreational resources identified on Figure 3.10.4-1 due to distance from the proposed Project components.

Since publication of the Draft EIS, the Applicant has changed the proposed location of the shoreline MLV from the south side to the north side of Bluewater Highway. The HDD entry/exit points closest to the public beach in Surfside would be on the north side of Bluewater Highway, near Swan Lake, which would reduce beach disruption but increase temporary noise disturbance for recreational boaters on the lake. Beach visitors would be separated from visual and noise impacts during HDD and MLV installation by a well-traveled road, the beach dunes, and existing structures. Beach access would not be affected by construction. Mitigation measures to control dust (see Section 3.12, Air Quality) and limit noise (see Section 3.13, Noise) would help to reduce impacts, but would not entirely eliminate them.

Because any disruptions would be temporary and limited in scope, as well as subject to the mitigation measures for noise, dust, and fumes, construction of the pipelines would have indirect, adverse, short-term, minor impacts on the use of park and beach resources.

Project operation would not affect recreation facilities, unless non-routine maintenance of the onshore pipelines is required at sites adjacent to park facilities. Chapter 4, Safety, discusses safety and non-routine maintenance (i.e., the need to repair a pipeline). Overall, Project operation would have an indirect, adverse long-term, and negligible impact on onshore recreation.

Recreational Boating and Fishing

The Applicant would implement BMPs, as described in Section 3.3, Water Resources, at stream crossings to minimize impacts on freshwater water quality and fish habitat. The onshore pipeline route and other onshore facilities would avoid established recreation sites, boat ramps, paddling trails, and lakes, and would cross major waterbodies such as the GIWW and Swan Lake via the HDD method. Recreational boaters on portions of Swan Lake and the GIWW would experience temporary construction noise impacts from HDD entry/exit points on the north and south sides of the lake, but access to the water would not be disrupted. Project construction would have indirect, adverse, short-term, and negligible impacts, and Project operation would have indirect, adverse, long-term, and negligible impacts on inland fisheries, fishing, and boating.

Project construction would temporarily restrict access to recreational fishing and boating activities within the offshore pipeline and SPOT DWP workspaces. Recreational fishing and boating vessels would be temporarily rerouted around construction safety zones, but would not be prevented from reaching their destinations (unless those destinations happen to be within a safety zone). The sizes, locations, and designation of proposed safety zones have not been fully evaluated by the USCG. Further discussion and determinations on the Project's proposed navigational safety measures will be conducted prior to licensing, and will require a regulatory amendment. Recreational fishing and boating occurs within the SPOT DWP workspaces, but more typically occurs closer to the coast than the SPOT DWP and would be affected more by the offshore pipeline installation than the DWP construction (RTI 2020).

The USCG would distribute a Local Notice to Mariners, identifying the location of SPOT DWP construction activity, and including a chartlet depicting the pertinent parameters of the actual affected site with latitude and longitude and coordinates for prescribed stand-off distances (i.e., 500 meters). Additionally, the USCG would work through the Freeport Subcommittee of the Lone Star Harbor Safety

Committee to advise all affected stakeholders of Project activities, including commercial vessel owners and operators of deep draft vessels, tugs and barges; supply vessels supporting OCS oil, gas, and mineral exploration; and commercial fishing interests. The USCG would also coordinate with the Applicant to conduct public outreach and distribute materials advising the offshore recreational boating community to avoid the area.

Project construction would not impact boat ramps or marinas. As stated in Sections 3.5.4, Wildlife and Aquatic Resources, Freshwater Fisheries, and 3.6, Estuarine and Marine Fisheries, Project construction would have direct, adverse, short-term, and negligible to minor impacts on fish species that may be targeted for recreational fishing, generally due to disturbance and habitat disruption. Because impacts would be temporary and limited to active construction areas, and because nearby open water areas provide alternative opportunities for fishing and boating, Project construction would have direct, adverse, short-term, and negligible impacts on recreational fishing and boating.

The impacts that affect recreational fishing would also affect those who rely on fishing as a food source, but effects on subsistence fishing could be greater for those who are displaced from their customary fishing areas by pipeline installation and who, therefore would incur greater fuel costs and time investment to achieve the same results in terms of food provision. Accordingly, local residents relying on subsistence fishing would experience direct, adverse, short-term, and minor impacts.

No popular fishing or boating destinations were identified within or adjacent to the Galveston Area lease blocks. Project operation would permanently restrict access for non-Project vessels within lease block 463, due to establishment of permanent safety zones, and would further discourage non-Project vessel activity in lease block 463, due to establishment of the ATBA/NAA. Areas above the offshore pipeline would have no restrictions. Noise and activity from support vessels and VLCCs or other crude oil carriers could cause displacement of or disturbance to fish, including species targeted by recreational fishing. Due to the transient nature of vessel activity and limited size of the lease blocks (18 square miles) compared to the surrounding waters, Project operation would have direct (displacement of vessels) and indirect (displacement of fish species targeted for recreational fishing), adverse, long-term, and negligible impacts on offshore recreational fishing and boating.

Artificial Reefs and Scuba Diving

The presence of Project vessels and offshore components could cause scuba vessels to use different routes to reach popular diving locations. Due to the distance between the two closest artificial reefs and the proposed offshore Project components (approximately 10.6 to 17.6 miles), Project construction and operation activities would have direct, adverse short-term to long-term, and negligible impacts on scuba diving at artificial reefs.

Cruise Ships

The presence of Project vessels and offshore components could cause cruise ships to use different routes. Due to the distance between the proposed Project components and cruise ship terminals (approximately 59 miles), as well as the absence of nearby cruise ship destinations, Project construction and operation would have direct, adverse, short-term to long-term, and negligible impacts on cruise ship operations.

Accidental Release of Hazardous Materials

Section 3.3.7.4, Water Resources, Coastal and Marine Environment and Marine Water Quality, Impacts and Mitigation, Section 3.5.4.2, Wildlife and Aquatic Resources, Freshwater Fisheries, Impacts and Mitigation, Section 3.5.3.3, Wildlife and Aquatic Resources, Wildlife, Impacts and Mitigation, Section 3.6.4.9, Estuarine and Marine Fisheries, Impacts and Mitigation, Accidental Releases of Hazardous Materials, and Section 3.7, Endangered Species, explain the potential impacts of an accidental release of hazardous materials on resources important to recreation and tourism, including beaches, birds, sea turtles, other wildlife, and freshwater and marine fisheries. An oil spill, onshore or offshore, would have the greatest impact on these biological resources, with impacts varying from minor to major depending upon the volume, location, and timing of the spill and the exposure of species to the release. Given the current technologies and safety features that the Applicant would employ, the potential of a spill occurring is relatively low (see Sections 3.5.3.3, Wildlife and Aquatic Resources, Impacts and Mitigation and 3.5.4.2, Wildlife and Aquatic Resources, Freshwater Fisheries, Impacts and Mitigation). Additionally, the third-party Spill Risk Analysis is included in Appendix H and the Oil Spill Modeling Report is included in Appendix X. In the event of a spill, the Applicant would implement its operational spill response plan. Impacts on beaches, birds, wildlife, marine life, and fish populations could result in direct or indirect, adverse, short-term or long-term, minor to major impacts on recreation and tourism activities and resources, depending on the size, location, and timing of the spill.

Planned and Unplanned Maintenance

Onshore Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (BMP #3), Construction BMPs (Appendix M; BMP #1 in Appendix N), and the industry standard upland construction plans (BMP #26). Therefore, impacts associated with planned or unplanned maintenance would be indirect, adverse, long-term, and negligible.

Offshore Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in transits for maintenance vessels. Maintenance impacts would be similar to those described for construction. Therefore, impacts associated with planned or unplanned maintenance would be direct and indirect, adverse, short-term, and negligible.

3.10.5. Visual Resources

3.10.5.1. Existing Conditions

The following section describes the existing visual character of offshore and onshore environments in the Project viewshed. Changes in scenery and resultant visual impacts can affect community character, tourism income, and property values.

Onshore, the baseline visual character includes some high-intensity suburban and industrial development near the existing ECHO Terminal, SH 8, and MPs 9 to 10 of the Oyster Creek to Shore Pipelines; however, most of the onshore pipeline routes pass through lower-intensity suburban, agricultural, and rural residential areas on flat coastal plains, interspersed with more heavily vegetated waterbodies and occasional oil and gas infrastructure such as MLV sites. The ECHO Terminal is an existing industrial facility that provides crude oil supply services. The visual character is industrial, and visible infrastructure includes storage tanks, piping, and metering equipment. The visual character of the Oyster Creek Terminal site is rural residential and undeveloped, surrounded by dispersed industrial, commercial, and residential developments. The Seabreeze Environmental Landfill is located directly across FM 523 from the Oyster Creek Terminal site. The visual character of the landfill area is light industrial, and visible components include a large white warehouse building, wetlands and retention ponds, and the landfill itself, which resembles a large hill. The visual character at the landing site for the offshore pipeline is a developed beachfront environment, with residences and rental properties, within sight of the GoM. Industrial development is common in this region of Texas, and oil and gas infrastructure and other energy infrastructure, such as transmission lines, are visible or close by in much of the existing viewshed for all proposed Project components.

Offshore, the baseline visual character of the Project area is beach shoreline and open ocean. Infrastructure including oil and gas platforms, drilling rigs, and aids to navigation (such as navigation buoys) are widely scattered offshore in the GoM. While few offshore oil and gas platforms are present near the offshore Project facilities, compared to other areas of the Gulf Coast (such as Louisiana), offshore oil and gas infrastructure is nonetheless a common sight in the regional landscape (SPOT 2019a, Application, Volume IIb, Section 8). Industrial and recreational vessel traffic is also visible from shore and from recreational boats traveling offshore.

3.10.5.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project. The study area within which potential impacts were assessed encompasses the viewshed for both the onshore and offshore components of the Project.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on visual resources have been evaluated based on their potential to:

- Alter or impair a viewshed, scenic quality, or aesthetic value not consistent with applicable laws or regulations; and/or
- Create a new source of substantial light or glare that would, over the long term, adversely affect nighttime views, especially from shoreline areas, adjacent water areas, and other locations where dark skies are an expected or protected value.

The remainder of this section describes potential impacts from Project construction and operation on the visual resources from the installation of visible infrastructure or other visible construction and operation activities.

Potential impacts on visual resources would result from visual changes or "contrast," such as the addition of infrastructure that may have a different appearance than previous conditions, and the way that visual contrast is perceived by viewers who are sensitive to visual changes. Direct impacts on visual resources would occur where new visible infrastructure or activities (such as the Oyster Creek Terminal, pipeline construction activities, and support vessel transit) would alter the landscape and change its visual character, as perceived by sensitive viewers (see Section 3.10.1, Land Use, Recreation, Visual Resources, and Ocean Use, Definition of the Resource). Indirect impacts would occur if these visual changes resulted in economic consequences, such as reduced property values and tourism, or changes in behaviors of sensitive viewers, such as avoidance of recreation areas adjacent to visible infrastructure. For example, direct impacts could occur if new industrial facilities change the visual character of the surrounding landscape from “rural and agricultural” to “developed or industrial” because of newly constructed, visually dominant industrial elements, such as large stacks or holding tanks. Indirect impacts could occur if recreationists avoid visiting a park with views of the new industrial elements, indicating a reduction of enjoyment associated with that resource. The Texas coastline in particular is valued for its scenery and ocean views, which are appreciated by short-term visitors, as well as seasonal and year-round residents. Local residents are likely to have a deeper appreciation of the aesthetic character and existing conditions of the coastal area, and may be sensitive to changes in views that are important to them.

It is unlikely that potentially sensitive viewers would perceive the proposed modifications at the ECHO Terminal as a noticeable contrast, due to the highly industrialized nature of the existing ECHO Terminal and intervening vegetation and infrastructure. Views from adjacent roadways, nearby residences, and the Pasadena Municipal Golf Course would be fully to partially obstructed by vegetation along roadways and parcel boundaries. The new proposed infrastructure would be constructed within the existing fence line of the ECHO Terminal, and would appear similar to existing infrastructure on site. As a result, infrastructure and activities associated with construction at and operation of the ECHO Terminal modifications would create negligible visual contrast, and would therefore have direct, adverse, short-term and long-term, and negligible impacts on visual resources.

The proposed Oyster Creek Terminal would be located in an area characterized by lower-density residential, commercial, and industrial developments interspersed with vegetated open space. During construction, the presence of construction vehicles, materials, crews, and traffic would create visual contrast at the site; however, operational lighting at the Oyster Creek Terminal near heavily trafficked areas would have external reflectors to minimize the glare. Construction of the facility would change the visual character of the area within and immediately surrounding the proposed Oyster Creek Terminal by inserting a dense industrial development in the midst of low-density rural and open space. As a result, the facility would contrast with immediately adjacent lands, though other industrial developments are common in the larger landscape.

During operation, the most prominent visual components of the operational Oyster Creek Terminal would be seven 100-foot-tall crude oil storage tanks. The Applicant’s study of the Project’s indirect cultural APE, which included storage tanks of similar size and design located within similar landscapes, indicates that views of the storage tanks would not be visible beyond a 2-mile radius (SPOT 2019u). Where not obstructed by topography, vegetation, and structures, the tanks may be visible from and create contrast at viewpoints within a 2-mile radius, due to height and color. Residences within 1 mile of the facility and travelers on FM 523 would likely experience the greatest visual impacts. Additional visual elements would include lighting, fencing, piping, retention levees or berms, and other aboveground infrastructure. Visitors to the Brazoria NWR would be unlikely to experience detrimental visual impacts, because visitor activities are located primarily on the east side of the refuge, outside of the viewshed of the Oyster Creek Terminal. As stated above, operational lighting at the Oyster Creek Terminal would be designed to minimize nighttime impacts. Scattered industrial development is common in the rural landscape in Brazoria County, and specifically near the proposed Oyster Creek Terminal. As a result, sensitive viewers in this area are likely limited to rural residences. Overall, construction of the Oyster Creek Terminal would have direct, adverse, short-term, and moderate visual impacts, while operation would have direct, adverse, long-term, and moderate impacts.

The proposed onshore pipelines would be collocated with existing linear features (i.e., exiting pipelines and electric transmission lines with cleared rights-of-way) for approximately 80 percent of the route (see Section 2.2.1.2, ECHO to Oyster Creek Pipeline, and 2.2.1.4, Oyster Creek to Shore Pipelines). Pipeline construction would remove existing vegetation and expose bare soils, creating a new cleared corridor that would be most notable at road crossings, where views down the axis of the pipeline route are created. During construction, the cleared corridor along with construction vehicles, materials, crews, and traffic would create visual contrast along the pipeline right-of-way. Onshore pipeline construction would therefore have direct, adverse, short-term, and moderate impacts on onshore visual resources.

After construction, the onshore pipeline right-of-way would be restored to its original contours, and disturbed areas would be revegetated, although trees would not be replanted or allowed to grow in the permanent right-of-way. Agricultural areas (including croplands and pasture/grazing areas) would be allowed to return to their previous vegetative cover, while grasses or other low vegetation would be replanted or allowed to grow in other areas. Pipeline markers and cleared corridors through forested areas would be the primary long-term visual evidence of the pipeline's presence.

MLVs would be the only pipeline infrastructure visible during operation. MLVs would each be approximately 0.1 acre in size, with aboveground piping and valves within a fenced gravel area. The MLVs would visually contrast with the herbaceous character of the right-of-way and surrounding vegetation. They would be visible to area residents and travelers. Comments on the Draft EIS expressed concern about the visual impact of the MLV in Surfside Beach. The proposed location of this MLV has been moved from the south side of Bluewater Highway to the north side. In this location, the MLV would still be visible from nearby residences, but would not likely be visible from Surfside Beach. Due to the small size of MLVs and because MLV sites and pipeline corridors are common in south Texas, after completion of revegetation, Project operation would have direct, adverse, long-term, negligible impacts on visual resources.

During offshore construction, lay barge/trench vessels, dive team vessels, and various supply vessels would be visible to residents and visitors in Surfside Beach and nearby beaches. Project construction beyond the horizon (from the perspective of coastal viewers) would only be visible to offshore boaters. Construction vessels would change position over time, and would be similar in appearance to existing offshore vessel traffic visible from the shoreline (see Section 3.11, Transportation). Due to the presence of existing commercial and industrial vessel traffic and the similarity of Project vessels to that existing traffic, Project activities would generate minimal visual contrast; therefore, offshore Project construction would have direct, adverse, short-term, and negligible offshore visual impacts.

During operation, the offshore subsea pipeline would not be visible. Due to the distance between the shoreline and Galveston Area lease blocks 463 and A-59 (31.3 and 35.4 statute miles, respectively), Project activities and structures at the SPOT DWP would be not visible or noticeable to the observers on beaches or shorelines. Offshore boaters could have views of Project facilities; however, no fishing or boating destinations were identified in the immediate area around the SPOT DWP. As a result, few sensitive viewers would see the SPOT DWP facilities, and any such views would only last while recreational boaters or fishers move through the area. Based on the analysis described for the proposed Oyster Creek Terminal, the offshore facilities would be visible from approximately 2 miles, depending on meteorological conditions. These offshore Project facilities and Project vessel activity would be similar in appearance to existing oil and gas activity in the Gulf Coast region. Based on the analysis above, the Project's offshore components would have direct, adverse, long-term, and negligible offshore visual impacts.

Impacts associated with an onshore or offshore oil spill could occur during the life of the Project. A small spill would likely not be noticeable, while a large oil spill could result in changes to vegetation communities, beaches, or be visible on the sea surface. However, visual disturbance from a spill would last only as long as it takes to clean up the oil. Therefore, impacts from an oil spill would be direct, adverse, short-term, and minor to moderate, depending on the size of the spill and the community impacted.

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vehicles or vessels and equipment both onshore and offshore. Impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.10.6. Ocean Use

3.10.6.1. Existing Conditions

The following sections describe ocean uses, excluding recreational uses. These uses include offshore oil and gas activity, non-energy marine minerals activity, marine shipping and commercial ports, and military use.

Offshore Oil and Gas Activity

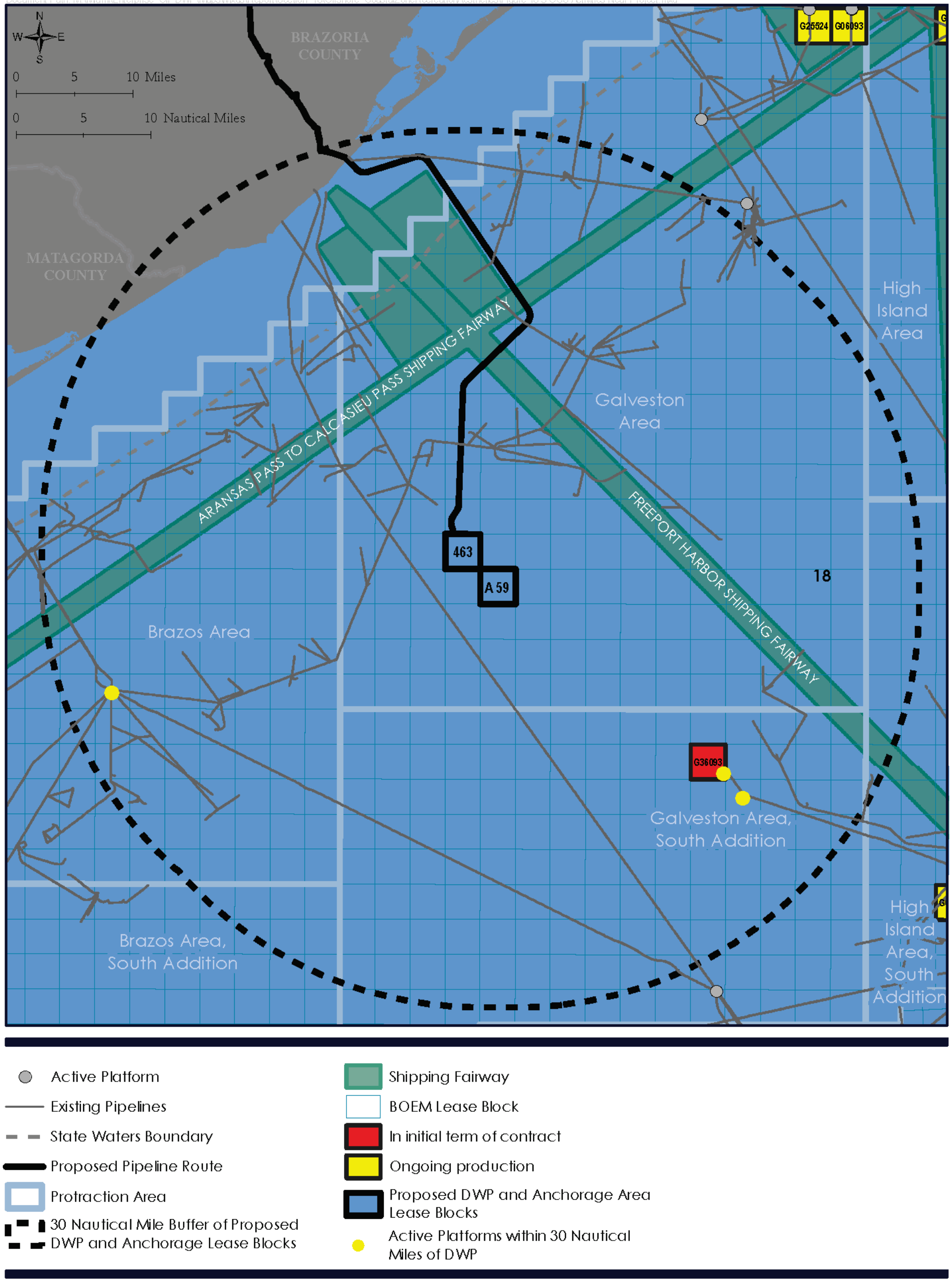
Approximately 17 percent of total U.S. crude oil production comes from the GoM (EIA 2019e), with the largest share of that production occurring in the central and western portions of the GoM. Texas was the highest oil-producing state in the country in 2018, accounting for 40 percent of U.S. crude oil production (EIA 2019b). As of January 2018, Texas's 29 petroleum refineries constituted 31 percent of the U.S. total refining capacity, and processed more than 5.7 million bbl of crude oil per day (EIA 2019f).

BOEM divides the GoM into the Western, Central, and Eastern Planning Areas. The offshore components of the proposed Project are located in the Western Planning Area, which includes the waters offshore of Texas, and has the second largest estimated volume of undiscovered and technically recoverable oil and gas resources among the GoM planning areas (BOEM 2016a). Each planning area includes numbered lease blocks, each of which generally comprises either 5,000 acres (Louisiana Shelf) or 5,760 acres (all other OCS areas) (Dupre 2014). Upon receiving required permits, leaseholders in these blocks can engage in exploration, development, or production activities. As of April 2019, 58 of the 310 active leases in the Western Planning Area were actively producing oil and/or gas, compared to 693 of 2,177 active leases in the Central Planning Area and 0 of 18 active leases in the Eastern Planning Area (BOEM 2019a). The majority of lease bids for Western Planning Area blocks submitted between 2012 and 2015 (inclusive), and all lease bids submitted in 2016 were in water depths greater than 1,312 feet (SPOT 2019a, Application, Volume IIa, Section 10).

No active lease blocks with ongoing production are located in the immediate vicinity of the SPOT DWP. Figure 3.10.6-1 shows the location of active lease blocks and offshore platforms and pipelines within 30 nautical miles of the proposed SPOT DWP location. These activities include one active lease block in the initial terms of its contract, three active platforms (located 18, 20, and 26 nautical miles from the SPOT DWP, respectively), and a network of active offshore pipelines connecting those platforms. The proposed SPOT offshore pipeline would cross 15 inactive lease blocks.

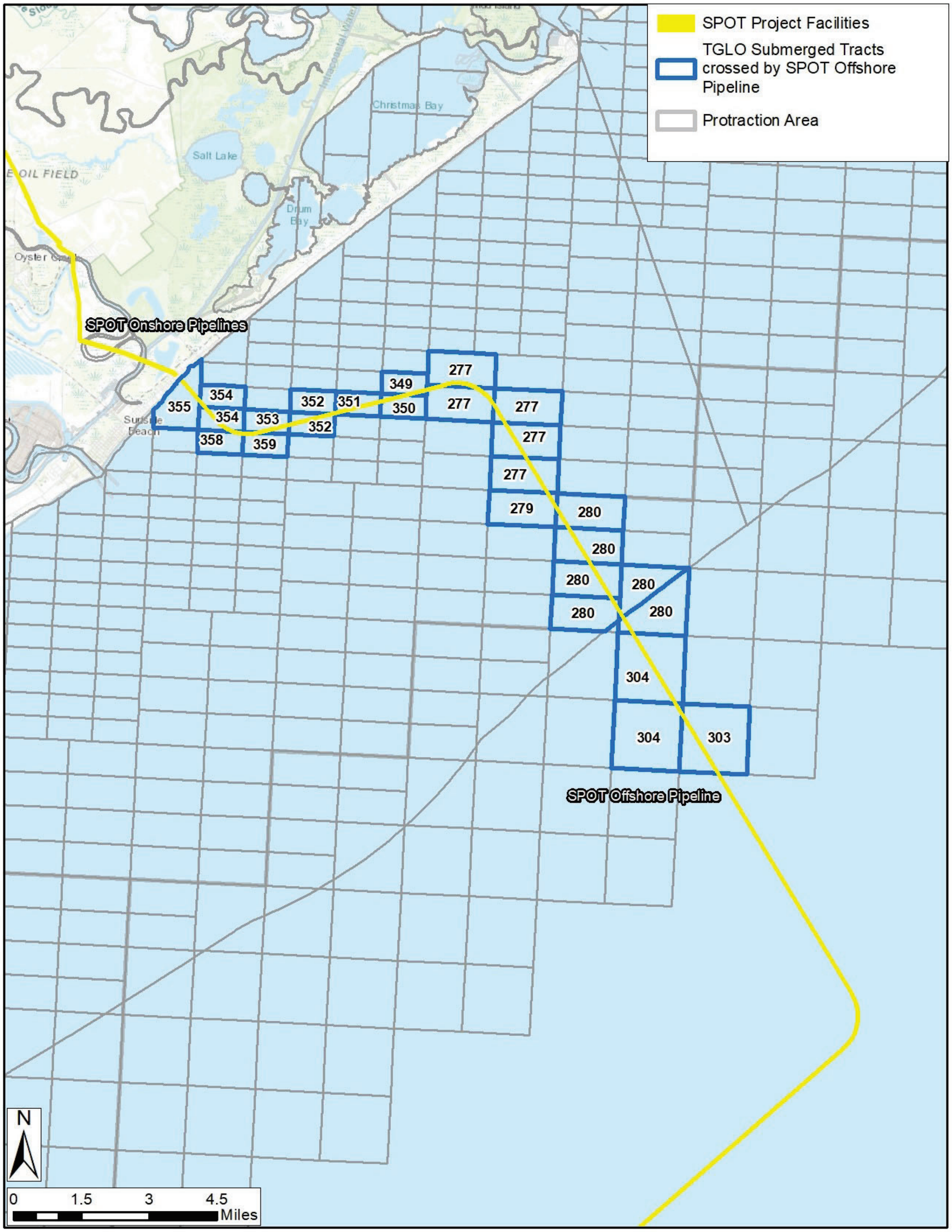
The proposed offshore pipelines would cross 14 state-owned offshore tracts in the GoM, located within approximately 14 nautical miles of the shoreline (Figure 3.10.6-2). State-owned tracts are organized in blocks similar to BOEM leases. The GLO assigns resource management codes (RMCs) to state-owned tracts to provide development guidelines, and to “enhance protection of sensitive natural resources by providing recommendations for minimizing adverse impacts from mineral exploration and development” (SPOT 2019a, Application, Volume IIa, Section 10). These RMCs include recommendations from the USFWS, TPWD, THC, and the USACE (GLO 2019). Table 3.10.6-1 lists the tracts crossed by the proposed offshore pipelines, along with associated RMCs.

An extensive network of subsea pipelines in the GoM gathers oil and natural gas from active platforms, and transports the products to onshore facilities (see Figure 3.10.6-1). The proposed offshore pipelines would cross two submarine cables in Galveston Area lease block 42, and seven pipelines that are either abandoned or proposed to be abandoned (see Table 3.10.6-2) (BOEM 2019b; SPOT 2019nn). Abandoned pipelines have been purged of their contents, are left buried under the seafloor, and may be isolated at each end or flushed and filled with inhibited seawater to mitigate internal pipeline corrosion and minimize residual hydrocarbon leakage (BOEM 2016b). Pipeline abandonment in-situ requires a permit from BOEM, and abandoned pipelines must not constitute a hazard or obstruction to navigation and commercial fishing operations, unduly interfere with other uses of the OCS, or have adverse environmental effects (30 CFR § 250.1750).



Source: SPOT 2019a, Application, Volume IIa, Section 10

Figure 3.10.6-1: Active Oil and Gas Activities in the Freeport, Texas Region



Source: GLO 2019

BOEM = Bureau of Ocean Energy Management; GLO = Texas General Land Office

Figure 3.10.6-2: GLO Tracts Crossed by the Proposed Offshore Pipeline

Table 3.10.6-1: GLO Tracts Crossed by the Proposed Offshore Pipelines

Tract Number [a]	Resource Management Code [b]
355	CC, CF, DA, ME, MK, MP, OA, TD, TE
354	CC, MA, MJ, TD
358	CC, DA, MA, MJ, MN, OA, TD
359	CC, DA, MA, MJ, MN, OA, TD
353	CC, MA, MJ, TD
352	CC, MA, MJ, TD
351	CC, DA, MA, MJ, OP, TD
350	CC, MA, MJ
349	CC, MA, MJ, TD
277 [c]	CC, MA, MJ, RW
279	CC, MA, MJ, RW
280 [c]	CC, MA, MJ, RW
304	CC, MA, MJ, RW
303	CC, RW

Source: GLO 2019

GLO = Texas General Land Office

[a] Listed in order of pipeline crossing from shore to open water.

[b] Resource Management Codes:

CC = Dredging of one channel may be authorized for development of this tract; CF = Limit vehicular access for development activities; DA = Dredging may not be allowed on this tract; MA = No special recommendations relating to sensitive areas, other than cultural resources; ME = Avoid impacts on coastal wetlands; MJ = Cultural resources may be present; MK = Avoid impacts on cultural resources; MN = Work on this tract is subject to state threatened or endangered species regulations; MP = Contains designated use areas; OA = Surface drilling may not be allowed; OP = High-velocity energy sources may be prohibited from performing geophysical surveys near reefs; TD = Geophysical surveying may be restricted from seaward base of sand dunes or vegetation line; TE = Dredging, oil and gas related activity or other development operations may be restricted within 1,000 feet of sea turtle nesting beach from March 15 to September 30; RW = Navigation concerns may exist

[c] Tracts are further subdivided, and RMCs may vary within subdivided sections

Table 3.10.6-2: Pipelines and Subsea Cables Crossed by the Proposed Offshore Pipelines

BOEM Segment ID	Facility Type	Intersecting Facility	Status
NA	Pipeline – Natural Gas	Houston Pipe Line [a]	Abandoned
NA	Pipeline – Natural Gas	Hall-Houston Expl. II [a]	Abandoned
NA	Pipeline – Natural Gas	Enterprise Products Operating LLC [a]	Abandoned
NA	Pipeline – Natural Gas	Enterprise Products Operating LLC [a]	Abandoned
9428	Pipeline – Gas/Condensate	Blue Dolphin Pipeline Company	Abandonment Approved April 18, 2017
10041	Pipeline – Bulk Gas	Devon Louisiana Corporation	Abandoned
11895	Pipeline – Gas/Condensate	Transcontinental Gas Pipeline	Abandoned
17364	Subsea Cables	BP Exploration & Production IN	Active
12717	Subsea Cables	Petrocom Communications Inc.	Active

Source: BOEM 2019b; BOEM and NOAA 2019; SPOT 2019nn

BOEM = Bureau of Ocean Energy Management; NA = not applicable

[a] These pipeline locations are not shown on Figure 3.10.6-1, but they are located within 6 miles of the shoreline.

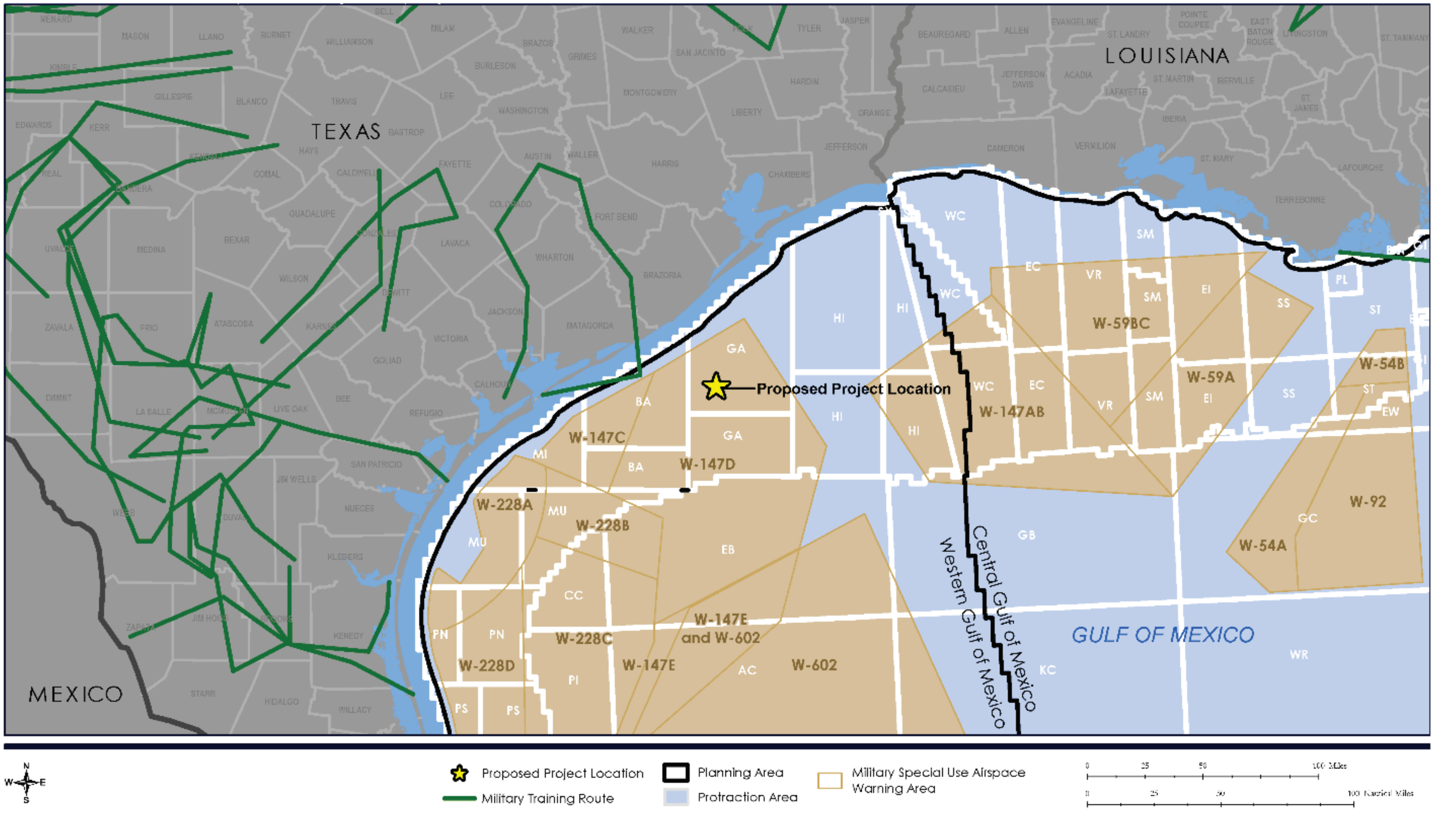
Non-Energy Mineral Resources

BOEM's Marine Minerals Program leases non-energy mineral resources from Federal waters on the OCS. The most common non-energy minerals leased are sand and gravel ("sediments"), which are used for shoreline erosion, beach nourishment, and wetlands restoration projects. BOEM identified OCS blocks with significant sand resources approximately 34 nautical miles northeast of the proposed offshore pipelines, and approximately 43 nautical miles northeast of the proposed SPOT DWP. No substantial sediment resources were identified in the Galveston Lease Area, and the nearest active marine minerals lease areas are located offshore Louisiana (BOEM 2019c). Other economically viable mineral resources are discussed in Section 3.8, Geologic and Soil Resources.

Military Use

Military uses within the GoM include military vessel and aircraft transit between onshore bases and offshore areas, aircraft carrier operations, rocket and missile research and testing, air-to-air gunnery, sonar buoy operations, and pilot training (SPOT 2019a, Application, Volume IIa, Section 10). The USCG conducts activities in state and Federal waters, including, but not limited to routine patrols, maintenance of aids to navigation, emergency spill response, and search and rescue missions.

Figure 3.10.6-3 shows the designated military warning areas and water testing areas in the vicinity of the proposed SPOT DWP. Warning areas are a type of special use airspace designated by the Federal Aviation Administration (FAA), with defined airspace dimensions (i.e., geographic extent and minimum and maximum altitudes) that contain activities that may be hazardous to non-participating aircraft (FAA 2019a). Military water testing areas are similarly defined locations that occupy water space. These areas are designated to warn non-military pilots or watercraft of potential danger of military activities.



Source: SPOT 2019a, Application, Volume IIa, Section 10

Figure 3.10.6-3: Military Warning Areas Offshore Texas

Other users of warning areas may include non-military companies that manufacture military aircraft and vessels, as well as the National Aeronautics and Space Administration during rocket launches or meteorological missions (i.e., hurricane investigation) (SPOT 2019a, Application, Volume IIa, Section 10). The SPOT DWP would be located within warning area W-147D, which encompasses approximately 9,300 square miles (FAA 2019b).

Restrictions in warning areas are only in place during periods of training activities (SPOT 2019a, Application, Volume IIa, Section 10), and may only include a portion of the warning area. The portion of the air or water space restricted depends on whether activities are air- or vessel-based, and if live fire is used, as follows:

- For aircraft drills, airspace is typically restricted from 5,000 feet above mean sea level to the highest altitude within the warning area;
- For aircraft drills using live fire, airspace is typically restricted from the surface to the highest altitude within the warning area; and
- For vessel live fire drills, airspace is typically restricted from the surface to 5,000 feet above mean sea level (SPOT 2019a, Application, Volume IIa, Section 10).

BOEM advises lessees and operators within warning areas and water testing areas to coordinate with the appropriate military representatives prior to conducting activities, and notes that warning areas and water testing areas are multiple use areas “where military operations and oil and gas operations have coexisted for many years” (BOEM 2014). Non-military flights over the GoM do not generally interfere with standard military aircraft drills involving airspace restrictions above 5,000 feet, and non-military helicopters moving from shore-based locations to DWPs generally fly below 2,000 feet. Vessel transit is typically not affected during military airport operations (SPOT 2019a, Application, Volume IIa, Section 10).

3.10.6.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project. The study area within which potential impacts were assessed encompasses shoreline from Brazoria County, Texas, to the proposed SPOT DWP, including the safety zones and ATBA/NAA around the platform and the SPM buoys and the safety zone around the support vessel moorings.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project’s effects on ocean resources have been evaluated based on their potential to:

- Alter the functional use of an area already in use;
- Conflict with applicable planning and zoning;
- Conflict with the Texas Coastal Zone Management Plan; and/or
- Affect existing business.

The remainder of this section describes potential impacts from Project construction and operation on ocean use from general construction activities, implementation of the safety zones and ATBA/NAA proposed for the Project, and operational activities, including vessel transit and helicopter flights.

Offshore Oil and Gas Activity

During construction of the offshore pipelines and SPOT DWP, the USCG would establish a temporary safety zone around the offshore Project area, allowing only Project-related vessels to access the construction area. The pipelines would cross only inactive Federal lease blocks, which would remain available for oil and gas exploration leasing after completion of Project construction. BOEM would alert potential bidders in advance of any limitations during Project construction. The Applicant would comply with any RMCs assigned to affected GLO lease blocks, and would use established and safe construction methods for crossing pipelines and submarine cables.

After construction and commissioning is completed, the USCG would remove the temporary safety zone and associated restrictions on non-Project vessel access to the pipeline workspaces. Assuming adherence to RMCs and appropriate construction methods for crossing pipelines and submarine cables, construction of the offshore pipelines would have direct, adverse, short-term, and negligible impacts on the offshore oil and gas industry.

The temporary safety zone around the SPOT DWP would limit oil and gas exploration and drilling activities during construction (although oil and gas resources would be available if accessed via the HDD method or similar techniques that do not disturb the ocean floor). The lease blocks that would be affected by construction of the SPOT DWP have no current or planned operations, and the closest active platforms or lease blocks are approximately 18 nautical miles away. The Applicant would coordinate with USCG Sector Houston-Galveston to issue a Broadcast to Mariners on a designated frequency and at periodic intervals to alert vessel and facility operators of active construction activities. Accordingly, construction of the SPOT DWP would have indirect, adverse, short-term, and negligible impacts on the offshore oil and gas industry.

During Project operation, the USGC would establish permanent safety zones at the SPOT DWP that would encompass the area around the SPOT DWP itself, each of the two SPM buoys, and the area around the support vessel moorings. These zones would prohibit oil and gas exploration, drilling equipment, and support vessels on the water surface for the life of the SPOT Project. In addition to the safety zone, an ATBA and NAA could be established at the request of the USCG (on behalf of the U.S. Department of State) to the IMO. Anchoring and other seafloor-disturbing activities would be prohibited in the ATBA/NAA, to prevent damage to the SPOT DWP and mooring system or damage to the proposed SPOT DWP's equipment from entanglement. Mineral resources inside the safety zones and ATBA/NAA would remain available for oil and gas exploration and extraction via the HDD method or similar technology that does not disturb the ocean floor. BOEM bidders would be advised of any restrictions, as well as safety zone and ATBA/NAA boundaries in lease sale notices. No lease blocks within or adjacent to the safety zones are actively leased, and the most recent leasing activity indicates more interest in locations farther offshore. Due to lack of current activity in the immediate vicinity of the SPOT DWP, as well as the availability of HDD technologies that would allow extraction from outside the safety zone, operation of the SPOT DWP would have direct, adverse, long-term, and minor impacts on oil and gas activity. The sizes, locations, and designation of proposed safety zones and ATBA/NAA have not been fully evaluated by the USCG. Further discussion and determinations on the Project's proposed navigational safety measures will be conducted prior to licensing, and will require both a regulatory amendment and an official notification to the IMO.

Non-Energy Mineral Resources

The proposed offshore Project components are approximately 34 nautical miles from the closest identified sediment resources, and approximately 80 nautical miles away from active mineral lease areas; therefore Project construction and operation would have direct, adverse, short-term and long-term, negligible impacts on non-energy mineral resources.

Military Use

During construction, the Applicant would communicate and coordinate its schedule and activities with port facilities, the USCG, and military branches. Because the pipeline construction work would be sequential, only a limited area around active installation or trenching would be inaccessible for non-Project vessels. Galveston Area lease blocks A-59 and 463 measure approximately 189 square miles, or 0.2 percent of the open ocean area of W-147D. Helicopter use during construction is not likely to interfere with military or commercial planes within W-147D or other warning areas because non-military helicopters moving between the shore and DWPs typically fly below 2,000 feet, whereas standard military flight training reservations typically occur above 5,000 feet. Construction could impact availability of W-147D for vessel-based or live-fire drills; however, impacts are anticipated to be rare due to availability of nearly all other areas in W-147D, as well as other warning areas for training activities. Therefore, construction of the SPOT Project would have direct, adverse, short-term, and negligible impacts on military uses.

Effects on military use during Project operation would be similar to those during construction. Project facilities would not introduce obstructions that would impede military aircraft. The Project’s safety zones (see Section 3.11, Transportation) would restrict surface activities in Galveston Area lease block 463, which constitutes less than 0.2 percent of the ocean surface area in W-147D. As a result, Project operation would have a direct, adverse, long-term, and negligible impact on military use.

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in transits for maintenance vessels. Maintenance impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible to minor.

3.11. TRANSPORTATION

This section describes existing onshore and offshore transportation conditions. It also evaluates the impacts of construction and operation of the Project’s onshore (onshore pipelines, terminals, and MLVs) and offshore (offshore pipelines, DWP platform) components on road traffic, offshore marine traffic and ports, and helicopter traffic.

3.11.1. Definition of the Resource

The onshore study area includes a well-developed road network that links the Freeport area and other smaller towns to the greater Houston region. The study area for onshore road transportation includes the road network in Brazoria and southern Harris counties from the Sam Houston Tollway to Freeport, and roads in Surfside Beach and Oyster Creek.

The offshore study area is traveled by commercial shipping and fishing vessels, tugboats, passenger and recreational vessels, and oil and gas exploration and production vessels. The study area for offshore transportation includes Port Freeport, the Freeport Harbor Channel, and the GoM approximately 90 nautical miles seaward from the coastline of Brazoria County and Galveston County, Texas. This offshore transportation study area includes designated navigation channels and fairways for Port Freeport and Galveston.

3.11.2. Existing Threats

Road congestion due to heavy peak hour traffic (primarily associated with Houston and surrounding areas) and road construction projects are the most common threat to efficient onshore transportation. The risk of traffic incidents (e.g., crashes) is a threat to road safety. These threats are elevated when trucks are involved, particularly trucks transporting hazardous materials.

Fixed structures in the GoM include active and inactive offshore oil platforms, as well as artificial reefs formed from inactive platforms or shipwrecks. Threats to marine transportation include collisions between vessels, allisions between vessels and fixed structures, weather-related hazards, and the need to avoid marine mammals such as whales.

3.11.3. Road Network and Traffic

3.11.3.1. Existing Conditions

The most heavily used roads in the vicinity of Project facilities are shown on Figure 3.11-1 and include:

- SH 8 (Sam Houston Tollway, "Beltway 8") is a limited-access, tolled freeway that forms a beltway around Houston, approximately 12 miles from the city center. The proposed pipeline would run parallel and adjacent to the southern portion of SH 8 for about 6.5 miles between SH 45 and SH 288. The highway in this vicinity has three lanes in each direction, in addition to continuous collector/distributor lanes (service roads).
- SH 288 links downtown Houston to Freeport via Manvel, Iowa Colony, Angleton, and Lake Jackson. Within Harris County, SH 288 is known as the South Freeway; within Brazoria County, it is known as the Nolan Ryan Expressway. The Texas Department of Transportation (TxDOT) will add new toll lanes and interchanges to a 10-mile segment of SH 288 from Interstate 69 in Houston to the Harris/Brazoria County border at Clear Creek, just south of SH 8 (TxDOT 2019c). South of Houston, SH 288 has varying characteristics, as described below.
  - From Beltway 8 south to Broadway Street in Pearland: Limited access highway with interchanges, six lanes plus turn lanes and shoulders with a center median, and northbound and southbound frontage roads;
  - From Broadway Street south to Croix Road (County Road [CR] 58): Limited access highway with interchanges, six lanes plus turn lanes and shoulders with a center median;
  - From Croix Road south to Highway 2004 in northern Lake Jackson: Limited access highway with interchanges, four lanes plus turn lanes and shoulders, center median, and frontage roads near interchanges and along some sections;

  - Within the City of Lake Jackson south of Highway 2004: Limited access highway with interchanges, four lanes plus turn lanes and shoulders, center median, and frontage roads on both sides;
  - Through the industrial area between Lake Jackson and Freeport: six to eight lanes plus turn lanes and shoulders, a center median and at-grade intersections with traffic signals; and
  - Within the city of Freeport: six lanes plus turn lanes and shoulders, a center median and at-grade intersections with traffic signals. Southeast of SH 36, the number of lanes decreases to four.

- Other heavily used roads in the vicinity of Project facilities include:
  - SH 35, which extends from southern Houston southwest to Corpus Christi, passing through Pearland, Alvin, and Angleton. From Houston to Pearland, this road primarily has four lanes, divided by a center turn lane, and paved shoulders. Between Pearland and Angleton, SH 35 has two undivided travel lanes with paved shoulders. West of Angleton, SH 35 has four lanes with a landscaped central median.
  - SH 332, which links Clute to Surfside City, where the onshore and offshore pipeline junction would be located. West of FM 523, SH 322 has four lanes, divided by a center turn lane, and paved shoulders, East of FM 523, SH 322 has two travel lanes and paved shoulders, within a 40-foot paved width.
  - FM 523, which connects Angleton and Freeport, traversing rural areas and the Town of Oyster Creek east of these municipalities. The proposed Oyster Creek Terminal would have frontage on FM 523, which has two undivided travel lanes and paved shoulders, within a 40-foot paved width.
  - FM 523, SH 332, and SH 288 (Brazoria Boulevard), which are important for accessing Port Freeport.
  - FM 1495, which links Freeport to Quintana Island.

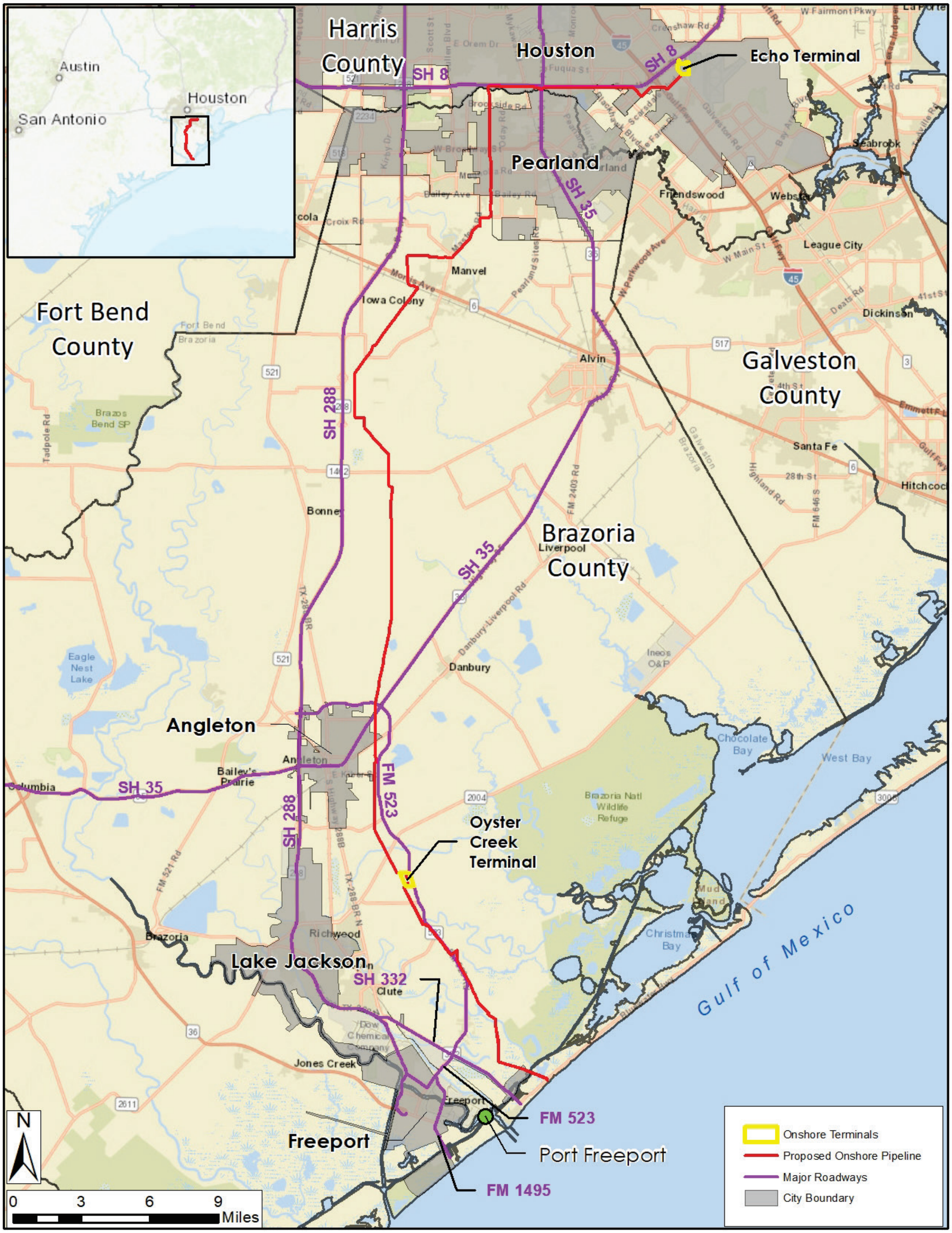


Figure 3.11-1: Transportation Study Area

Traffic Volume and Congestion

The south-central portion of Brazoria County is characterized by a mix of traffic associated with residential, industrial, construction, shipping, and recreational/tourism activities. Some local petrochemical and industrial complexes experience large daily inflows and outflows of vehicles during work-shift turnarounds and construction projects. Port Freeport experiences large increases in road traffic when vessels are being loaded and unloaded and commodities transported out of the area. Recreational and tourist traffic patterns vary seasonally, with most activity taking place on weekends and during special events, especially in summer months.

The southern portion of the Houston metropolitan area experiences heavy morning and evening peak hour traffic, with the heaviest morning flows directed northward (inbound toward central Houston) and the heaviest evening flows directed southward (outbound).

The Applicant's Traffic Impact Analysis (TIA) evaluated existing traffic operations based on Level of Service (LOS), a measurement of operating conditions on a road or intersection expressed in terms of capacity to handle traffic (road segments) and typical delay for drivers (intersections). LOS is expressed as one of six levels, designated by the letters A through F. Table 3.11-1 describes the LOS ratings applicable to existing conditions in the Project area.

Table 3.11-2 lists the morning and evening peak hour LOS at 27 intersections closest to the 18 temporary access driveways that would be used during construction of the onshore pipelines. Most of the intersections have little to no congestion (LOS A or B). Five intersections operate at a LOS C or D during the morning or afternoon peak hours: SH 8 at SH 35 (westbound and eastbound); CR 220 at FM 523 and SH 288 Business; and FM 523 at FM 2004.

Table 3.11-1: Intersection Level of Service Definitions

Level of Service	Description
A and B	No delay at intersection with continuous flow traffic. Uncongested operations; high frequency of long gaps available for all left and right-turning traffic; no observable queues.
C	Moderate delay at intersection with satisfactory to good traffic flow. Light congestion; infrequent backups on critical approaches.
D	Increased probability of delays along every approach. Substantial congestion on critical approaches, but intersection functional. No standing lines formed.
E	Heavy traffic flow condition. Heavy delays probable. No available gaps for cross street traffic or main street turning traffic. Limit of stable flow.
F	Unstable traffic flow. Heavy congestion. Traffic moves in forced flow condition. Average delays greater than 1 minute highly probable. Total breakdown.

Source: Transportation Research Board 2010

Table 3.11-2: Existing Intersection Level of Service

Intersection Name	Peak Hour LOS	
	Morning	Afternoon
1. Westbound SH 8 at SH 35	C	C
1. Eastbound SH 8 at SH 35	C	C
2. Flea Market Drive at SH 35	A	A
3. Knapp Road at SH35	A	A
4. CR 100 (McKeever Road) at FM 1128	A	A
5. CR 100 (McKeever Road) at CR 831	A	A
6. CR 786 (Pursley Road) at CR 64 (Airline Road No.3)/CR 67 (Manvel Sandy Point Road)	A	A
7. FM 1462 at SH 288 Southbound Frontage Road	A	B
8. FM 1462 at SH 288 Northbound Frontage Road	A	A
9. FM 1462 at CR 511	A	A
10. CR 601 at CR 45	A	A
11. CR 45 at CR 46	A	A
12. SH 35 at TX-Spur 28	A	A
13. SH 35 at FM 523	B	B
14. FM 543 (Downing Road) at Fig Lane	A	A
15. FM 543 (Downing Road) at CR 220 (Coale Road)	A	A
16. CR 220 (Coale Road) at FM 523	B	D
17. CR 220 (Coale Road) at SH 288 Business	B	C
18. FM 523 at FM 543 (Downing Road)	A	A
19. FM 523 at FM 2004	C	C
20. FM 2004 at CR 223 (Dixie Brown Road)	A	A
21. FM 523 at CR 595 (Fairway Drive)	A	B
22. FM 523 at CR 223 (Dixie Brown Road)	A	B
23. FM 523 at CR 226 (Stratton Ridge Road)	A	B
24. FM 523 at CR 227 (Hoskins Mound Road)	A	B
25. FM 523 at CR 792 (Suggs Road)	A	A
26. TX-Loop 332 at CR 690 (Levee Road)	A	B
27. TX-Loop 332 at CR 257 (Bluewater Highway)	A	A

Source: SPOT 2019kk

CR = County Road; FM = Farm to Market Road; LOS = Level of Service; SH = State Highway; TX = Texas

Note: Table lists only intersections, not road segments. The TIA that the studied roadway segments also operated at LOS D or better. See Table 3.11-1 for LOS definitions.

3.11.3.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on the regional and local road network and traffic. The study area for onshore road transportation includes the road network in Brazoria and southern Harris counties from the Sam Houston Tollway to Freeport, and roads in Surfside Beach and Oyster Creek.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's road transportation effects have been evaluated based on their potential to:

- Interfere with access to transportation routes, over the long term;
- Cause permanent decreases in the LOS of key transportation arteries; and/or
- Cause a substantial increase in the risk of collisions or other road traffic incidents.

The remainder of this section describes potential impacts on the road network and traffic from construction and operation of the Project's onshore and offshore facilities, including the existing ECHO Terminal, proposed Oyster Creek Terminal, onshore and offshore pipelines, and the SPOT DWP, based on the criteria above.

Construction and Installation

Road Congestion

Construction and installation would generate road traffic for the following purposes:

- Delivery of components, construction materials, pipe, equipment, and consumable supplies to the existing ECHO Terminal, proposed Oyster Creek Terminal, and workspaces associated with onshore pipeline development;
- Delivery of components, construction materials, pipe, equipment, and consumable supplies to Port Freeport for transportation to offshore pipeline and the SPOT DWP sites; and
- Worker commuting:
  - For Oyster Creek Terminal, an average of approximately 350 workers daily for 22 months, with up to 520 workers during the peak construction month (March 2022).
  - For the ECHO Terminal, an average of 70 workers daily for 11 months, with up to 110 workers during the peak construction month (October 2021).
  - For onshore pipeline installation, an average of 300 workers daily for 9 months (February through October 2022), with up to 350 workers during a 2-month peak construction period (August to September 2021). These workers would report to worksites along the pipeline routes via public roads and the pipeline worksite access driveways.
  - Approximately 24 to 30 workers at the Surfside Beach site daily for about 2 months, to install the offshore HDD (January to February 2021).
  - For offshore construction, varying number of workers commuting to Port Freeport for transport to offshore locations or to operate the one to three daily supply vessel trips to offshore work areas (see Section 3.11.4.2, Transportation, Marine Navigation and Vessel Traffic, Impacts and Mitigation). These activities would generate approximately 260 workers during peak construction months (September and December 2021, January 2022, and June to July 2022). Up to 100 workers would report to work daily for portions of the construction period; other workers would remain offshore for work periods of approximately 30 days.

The temporary, construction-related increase in traffic volumes would be most noticeable in proximity to the proposed Oyster Creek Terminal, which is only accessible via FM 523.

For offshore construction, major components and bulk materials would be hauled to offshore job sites by barge, directly from ports near the equipment fabrication site or bulk materials source. The Applicant has not specified the location of these ports, which could be in the GoM region or beyond, depending on the component or material. Local supplies of construction consumables and smaller-volume freighted materials would be transported to Port Freeport by truck before being barged to the offshore job site.

The TIA assumed the following construction traffic volumes and distribution for onshore pipeline construction, occurring simultaneously at every proposed construction access driveway (SPOT 2019ii):

- An average of 24 employee vehicles during both the morning and afternoon peak hours (48 trips); and
- Ten construction trucks using each construction access driveway daily (20 trips), with no more than eight truck trips during the morning and afternoon peak traffic periods.

In addition, the TIA included the following assumptions about construction traffic for the existing ECHO Terminal and proposed Oyster Creek Terminal (SPOT 2019ii):

- All concrete, asphalt, dirt, sand and sodding would be delivered directly to the terminals; all other deliveries would be delivered to a staging yard first, then delivered to the terminal sites in three loads;
- Approximately 80 percent of all deliveries would take place between (not within) the morning and afternoon peak hours;
- Approximately 20 percent of construction workers at the terminals would carpool, while the remaining 80 percent would drive alone; and
- All worker commutes to and from the terminals would occur during morning and afternoon peak hours.

The TIA does not evaluate the impact of traffic generated by construction of the Oyster Creek Terminal, the expansion of the ECHO Terminal, or the offshore Project facilities.

Based on the average construction traffic, traffic counts taken in May 2019, and a 2 percent annual growth rate (consistent with Houston Galveston Area Council projections), onshore pipeline construction would not change the 2022 LOS at any of the intersections studied, compared to 2022 projected conditions without the Project (Table 3.11-3) (SPOT 2019kk).

For pipeline construction, the TIA assumes 48 daily employee trips at each construction driveway; however, sequential pipeline construction would likely concentrate traffic at a small number of access driveways (rather than the Applicant's assumption that all access driveways would be used every day). This would lead to greater traffic at each location for a short period. For example, if the pipeline workforce of 300 workers uses four to six construction access driveways (reflecting the actual location of pipeline construction activity) on a given day, then approximately 50 to 75 workers, generating up to 150 vehicle trips, would use each access driveway for the particular pipeline segment. The concentration of traffic could increase congestion at the studied intersections for a short period of time, but would also result in little to no impact on traffic at other driveway accesses for longer periods of time during construction.

Table 3.11-3: Intersection Level of Service during Onshore Pipeline Construction

Intersection	Peak LOS 2022 Project	Hour Without Construction	Peak LOS 2022 Project	Hour With Construction
Name	**Morning**	**Afternoon**	**Morning**	**Afternoon**
1. Westbound SH 8 at SH 35	D	D	D	D
1. Eastbound SH 8 at SH 35	C	C	C	C
2. Flea Market Drive at SH 35	A	A	A	A
3. Knapp Road at SH35	A	A	A	A
4. CR 100 (McKeever Road) at FM 1128	A	A	A	A
5. CR 100 (McKeever Road) at CR 831	A	A	A	A
6. CR 786 (Pursley Road) at CR 64 (Airline Road No.3)/CR 67 (Manvel Sandy Point Road)	A	A	A	A
7. FM 1462 at SH 288 Southbound Frontage Road	B	B	B	B
8. FM 1462 at SH 288 Northbound Frontage Road	A	A	A	A
9. FM 1462 at CR 511	A	A	A	A
10. CR 601 at CR 45	A	A	A	A
11. CR 45 at CR 46	A	A	A	A
12. SH 35 at TX-Spur 28	A	A	A	A
13. SH 35 at FM 523	B	C	B	C
14. FM 543 (Downing Road) at Fig Lane	A	A	A	A
15. FM 543 (Downing Road) at CR 220 (Coale Road)	A	A	A	A
16. CR 220 (Coale Road) at FM 523	A	B	A	B
17. CR 220 (Coale Road) at SH 288 Business	B	C	B	C
18. FM 523 at FM 543 (Downing Road)	A	A	A	A
19. FM 523 at FM 2004	C	C	C	C
20. FM 2004 at CR 223 (Dixie Brown Road)	A	A	A	A
21. FM 523 at CR 595 (Fairway Drive)	A	B	A	B
22. FM 523 at CR 223 (Dixie Brown Road)	A	B	A	B
23. FM 523 at CR 226 (Stratton Ridge Road)	A	C	A	C
24. FM 523 at CR 227 (Hoskins Mound Road)	A	B	A	B
25. FM 523 at CR 792 (Suggs Road)	A	A	A	B
26. TX-Loop 332 at CR 690 (Levee Road)	A	B	A	B
27. TX-Loop 332 at CR 257 (Bluewater Highway)	A	A	A	A

Source: SPOT 2019kk

CR = County Road; FM = Farm to Market Road; LOS = Level of Service; SH = State Highway; TX = Texas

Notes:

1. Table lists only intersections, not road segments. The traffic study found that affected roadway segments also operated at Level of Service D or better, and the pipeline construction traffic did not result in any change in the Level of Service.

2. The table reflects the results of a traffic study analyzing traffic from onshore pipeline construction. Intersections 16 through 25 above would also be affected by traffic from the construction of Oyster Creek Terminal.

Road Crossings

The proposed onshore pipeline would cross 1 interstate highway (Interstate 45), 7 Texas state highways, and approximately 56 county or municipal roads. A total of 51 crossings would use either HDD or bore methods that would not affect the road being crossed if the installation is successful (BMP #30). Tables 3.11-4 and 3.11-5 list these crossings. The Applicant's HDD Contingency Plan (Appendix L; BMP #6 in Appendix N) describes procedures that the installer would enact in the case of an unexpected geotechnical failure, in order to minimize the potential for an inadvertent release of drilling mud and to undertake effective cleanup.

Roads may need to be closed during hydrostatic testing prior to HDD or boring activities, or for other event-driven needs. Such closures would last less than 12 hours. County or municipal permitting for such closures would typically require coordination with county or municipal police departments to ensure that correct traffic control procedures are followed, and that appropriate detours are marked, if needed.

Table 3.11-4: ECHO to Oyster Creek Pipeline Road Crossings

Road	Type of Road	Crossing Method [a]	Milepost (start-end)	Length (feet)
CR 3 (Galveston Road) and railroad	County/municipal	HDD	0.1–0.5	2,000
CR 2553 (Scarsdale Boulevard)	County/municipal	Bore	1.1–1.1	220
Interstate 45	Interstate	HDD	1.2–1.6	1,820
Sageglen Drive	County/municipal	HDD	2.1–2.4	1,400
Sagedowne Lane	County/municipal	Bore	2.5–2.5	200
Hughes Road	County/municipal	HDD	2.6–2.9	1,250
Beamer Road and Kirkville Drive	County/municipal	HDD	3.3–4.0	3,850
Blackhawk Boulevard and Kingspoint Road	County/municipal	HDD	4.5–4.8	1,700
Hall Road	County/municipal	Bore	4.9–4.9	150
Nature View Circle	County/municipal	Bore	5.5–5.6	460
Pearland Parkway	County/municipal	HDD	5.6–5.9	1,600
SH 35 (Telephone Road)	State highway	Bore	7.0 –7.0	280
Mykawa Road and railroad	County/municipal	HDD	7.3–7.9	2,850
Brookside Drive	County/municipal	Bore	10.2–10.2	120
Sharon Drive	County/municipal	Bore	10.9–10.9	100
Summer Rain Drive	County/municipal	Bore	11.1–11.1	100
CR 518 (West Broadway Street)	County/municipal	Bore	12.2–12.2	200
CR 408 (Fite Road) and Old Oaks Boulevard	County/municipal	HDD	12.5-13.1	2,950
Magnolia Street	County/municipal	Bore	13.4–13.5	400
Bailey Road	County/municipal	Bore	14.1–14.2	260
CR 100 (McKeever Road)	County/municipal	Bore	15.2–15.2	160
Country Club Drive	County/municipal	Bore	15.3–15.3	100
Oil Field Road	County/municipal	Bore	16.0–16.0	150
Scopel Road	County/municipal	Bore	16.2–16.2	210
Easley Farm Road	County/municipal	Bore	16.6–16.7	120
Belcher Road	County/municipal	Bore	17.2–17.2	130
Texas County Road	County/municipal	Bore	17.2–17.3	100
Masters Road	County/municipal	Bore	17.9–17.9	180
SH 6 (Morris Avenue)	State highway	Bore	20.9–21.0	460
Alleluia Trail	County/municipal	Bore	21.9–21.9	150
CR 90 (Clark Road)	County/municipal	Bore	22.3-22.3	210
CR 64 and CR 65	County/municipal	HDD	25.0-25.5	2,800
CR 63 (Airline Road No.2 E)	County/municipal	Bore	26.6–26.7	500
CR 62 (Airline Road No.1 E)	County/municipal	Bore	26.9-26.9	150
CR 61 (Sandy Point Loop)	County/municipal	Bore	27.4-27.4	100
CR 60 (Schovajsa Road)	County/municipal	Bore	29.0-29.0	110
FM 1462	State highway	Bore	31.5-31.5	210
CR 51(Cannon Road) (unpaved)	County/municipal	Bore	33.9	249
CR 49 (Flores Bayou Bridge Road) (unpaved)	County/municipal	Open-cut	37.4	13
CR 601 (Field Road) (unpaved)	County/municipal	Open-cut	37.8	13
CR 45	County/municipal	Bore	38.5-38.5	200
FM 523	State highway	Bore	41.8–41.8	200
CR 35 (East Mulberry Street)	County/municipal	Bore	42.2–42.3	360
CR 341 East/Henderson Road	County/municipal	Bore	42.5–42.5	170

Road	Type of Road	Crossing Method [a]	Milepost (start-end)	Length (feet)
E. Hospital Drive and CR 171 and railroad	County/municipal	HDD	43.0–43.6	3,100
CR 210 (Cedar Road)	County/municipal	Bore	44.2–44.2	240
East Kiber Street	County/municipal	Bore	44.9–44.9	150
CR 233 (Fort Road)	County/municipal	Bore	45.8–45.8	180
Kings Drive	County/municipal	Bore	46.0-46.0	130
CR 543 (Downing Road)	County/municipal	Bore	46.8–46.9	410
CR 220 (Coale Road)	County/municipal	Bore	47.1–47.2	490
FM Road 2004	State highway	HDD	48.1-48.9	4,000

Source: SPOT 2019a, Application, Volume IIb, Section 1 and Appendix A1

CR = County Road; ECHO = Enterprise Crude Houston; HDD = horizontal directional drill; FM = Farm to Market Road; LOS = Level of Service; SH = State Highway
[a] The Applicant provided a list of HDD and bore crossings, and stated any other crossings would be accomplished via open-cut (SPOT 2019q). Mileposts are approximate.

Table 3.11-5: Oyster Creek to Shore Pipelines Road Crossings

Road	Type of Road	Crossing Method [a]	Milepost (start-end)	Length (feet)
CR 223 (Dixie Brown Road)	County/municipal	Bore	1.1–1.1	140
Phair Cemetery Road	County/municipal	HDD	1.7-2.0	1,600
Stratton Ridge Road	County/municipal	Bore	3.0–3.0	280
FM 523	State highway	Bore	4.0–4.0	220
CR 792 (Suggs Road)	County/municipal	Bore	7.6–7.6	240
CR 690A (Galleywax Way)	County/municipal	HDD	8.0-8.4	2,000
Cone Island Road	County/municipal	Open-cut	10.4	50
Marlin Avenue	County/municipal	HDD	11.0-12.1	5,800
Bluewater Highway	County/municipal	Bore	12.2-12.2	130

Source: SPOT 2019a, Application, Volume IIb, Section 1 and Appendix A1

CR = County Road; FM = Farm to Market Road

[a] The Applicant provided a list of HDD and bore crossings, and stated any other crossings would be accomplished via open-cut (SPOT 2019q). Mileposts are approximate.

Railroad Crossings

The onshore pipelines would cross active railroad lines at five locations, as listed in Table 3.11-6. Three are also road crossings listed in Table 3.11-4. All railroad crossings would be traversed via the HDD or conventional bore methods.

Table 3.11-6: Railroads Crossed by the Onshore Pipelines

Railroad Company and Line Number (Collocated Road Crossing)	County	Milepost	Crossing Method
Burlington Northern Santa Fe #15	Harris	0.2	HDD
Union Pacific #66 (Mykawa Road)	Harris	7.7	HDD
Union Pacific #66 Spur (Mykawa Road)	Harris	7.7	HDD
Burlington Northern Santa Fe #15	Brazoria	21.6	Bore
Union Pacific #66 (SH 171)	Brazoria	43.4	HDD

Source: SPOT 2019a, Application, Volume IIb, Section 1.

HDD = horizontal directional drill; SH = State Highway

Onshore Transportation Impacts during Construction

The temporary traffic increases associated with onshore pipeline construction and temporary road or lane closures for open-cut pipeline installation, hydrostatic testing, and other construction-related events would have a direct, adverse, short-term, and negligible impact on road transportation and traffic. Temporary traffic increases associated with construction of the other components have not been quantified, but are anticipated to have the following impacts:

- Offshore construction (transportation of employees and materials to Port Freeport): direct, adverse, short-term, and negligible;
- Oyster Creek Terminal: direct, adverse, short-term, minor to moderate; and
- Expansion of the ECHO Terminal: direct, adverse, short-term, and minor to moderate.

Operation

Road traffic generated during operation would consist of:

- Onshore employees commuting to job sites at ECHO Terminal and Oyster Creek Terminal;
- Routine inspection and maintenance of onshore facilities;
- Up to 20 offshore employees commuting approximately once every 2 weeks, either to a helicopter terminal in Galveston or Brazoria County, or to Port Freeport for vessel transport to the SPOT DWP; and
- Delivery of consumable supplies (e.g., food, water, first aid supplies) to Port Freeport for shipment to the SPOT DWP.

In total, Project operation would generate fewer than 45 employee daily vehicle round-trips, along with a smaller number of daily truck trips associated with inspection, maintenance, and supplies. These trips would have a direct, adverse, long-term, and negligible impact on road traffic.

An oil spill could occur during the life of the Project that would result in increased road traffic from response personnel. Response personnel may be local or may come from surrounding areas. The level of traffic generated from an oil spill is unpredictable, but would not be expected to cause substantial disruptions to road traffic. Impacts would likely be similar to those described for construction, but shorter in duration. Therefore, trips associated with an oil spill response would have a direct, adverse, short-term, and minor to moderate impact on road traffic, depending on the size of the spill and the resulting response.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vehicles and equipment. Impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible.

3.11.4. Marine Navigation and Vessel Traffic

3.11.4.1. Existing Conditions

Marine Navigation and Planned Improvements

Cargo vessels, container ships, barges, and tankers carrying crude oil or other liquid commodities form much of the vessel traffic in the heavily travelled GoM. Commercial fishing, as well as recreational and passenger vessels, also contribute substantial volumes of marine traffic. The most concentrated vessel activity occurs in Federally designated shipping safety fairways as described below. Galveston Area lease blocks A-59 and 463 have no existing safety or security zones, lightering areas,[18] navigation safety fairways, or anchorages (SPOT 2019a, Application, Volume III, Attachment 4).

Shipping Safety Fairways and Anchorages

Federal regulations establish shipping safety fairways and anchorage areas in the GoM for the purpose of providing "safe approaches through oil fields in the GoM to entrances to the major ports along the Gulf Coast" (33 CFR § 166.200). Figure 3.11-2 shows the location of safety fairways and anchorage areas near the SPOT DWP. No such areas are within or adjacent to Galveston Area lease blocks A-59 and 463, the location of the proposed Project. The designated shipping safety fairways guide large commercial vessels through the Gulf, serving as marine highways. The GoM shipping safety fairways are unmarked and their use is not mandatory; however, mariners—particularly large vessels—are encouraged to use these platform-free lanes (SPOT 2019a, Application, Volume III, Attachment 4).

Lightering Areas

The provisions of 33 CFR § 156.300 establish designated lightering zones within the GoM away from fairways or ports. These were originally established for ship-to-ship transfer involving single hulled cargo vessels, which were allowed to conduct ship-to-ship transfer of oil until January 1, 2015. Single hulled cargo vessels have been phased out of use, and double hull tankers can conduct ship-to-ship transfer anywhere, except for certain designated prohibited areas identified in 33 CFR § 156.310 (OCM 2019). Figure 3.11-3 shows these prohibited areas, along with other well-known, non-regulatory ship-to-ship transfer areas within the GoM (SPOT 2019a, Application, Volume III, Attachment 4). The SPOT DWP is located outside of all defined and prohibited lightering areas.

[18] Lightering areas or zones are designated locations at sea where ship-to-ship transfer of oil cargo is carried out from one tanker to another larger tanker.

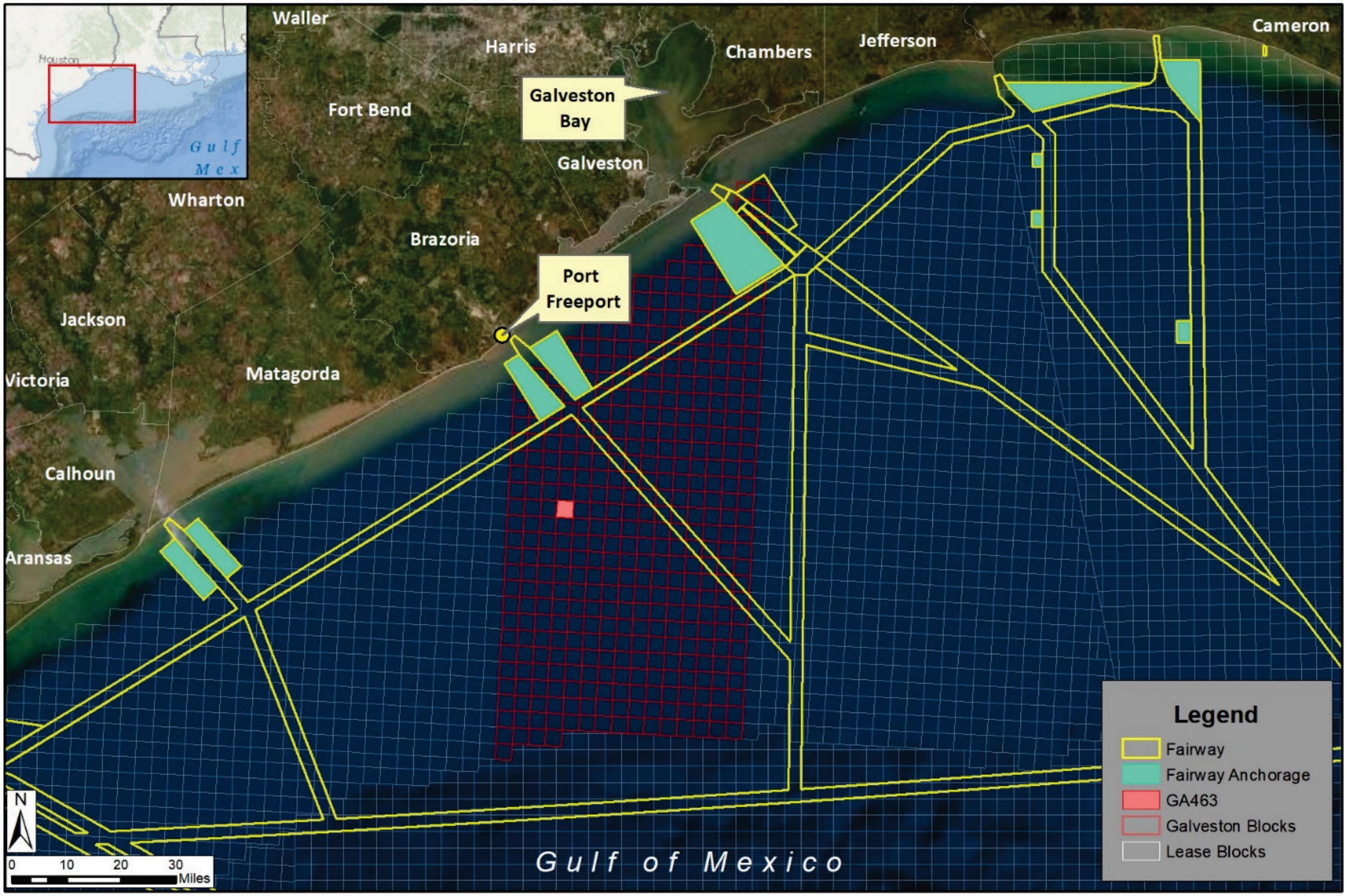


Figure 3.11-2: Navigation Fairways, Anchorages, and Lease Blocks

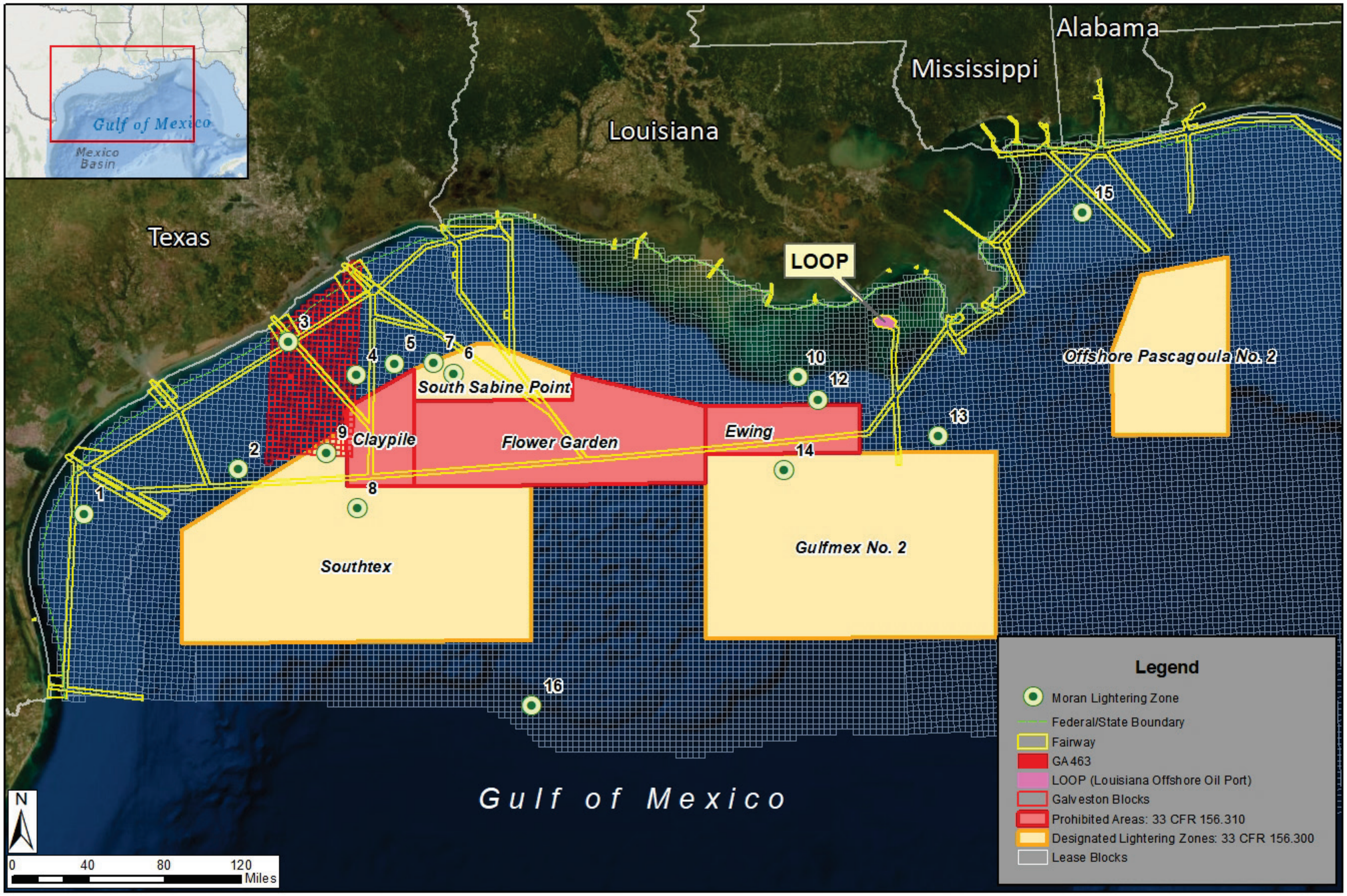


Figure 3.11-3: Restricted Navigation Areas

Federal Navigation Designations

Provisions of 33 CFR Parts 165 and 148 allow the authorization of safety zones, security zones, areas to be avoided, and no anchor zones to provide for safe navigation:

- Safety Zones: A safety zone is an area of water and/or shoreline where access "is limited to authorized persons, vehicles, or vessels" for safety or environmental purposes (33 CFR § 165.20). Safety zones can be stationary (i.e., a designated area around a fixed point such as a DWP) or mobile (i.e., surrounding a vessel in motion).
- Security Zones: Security zones are designated by the Captain of the Port or District Commander to prevent damage or injury to vessels and waterfront facilities so as to "safeguard ports, harbors, territories, or waters of the United States or to secure the observance of the rights and obligations of the United States" (33 CFR § 165.30).
- Areas to be Avoided: ATBAs include areas within defined limits in which either navigation is particularly hazardous, it is exceptionally important to avoid casualties, or the area should be avoided by all ships or certain classes of vessels (33 CFR § 148.5). ATBAs may be either recommended (i.e., where ships are advised to navigate with caution) or mandatory (i.e., where navigation is prohibited or subject to specific conditions).
- No Anchor Areas: NAAs are defined areas where anchoring is hazardous or could result in unacceptable damage to the marine environment (33 CFR § 148.5) and where anchoring is prohibited for all or certain classes of vessels, except in case of immediate danger.

The SPOT DWP would not be within any such designated areas (SPOT 2019a, Application, Volume III, Attachment 4). As described in Section 3.11.4.2, Transportation, Marine Navigation and Vessel Traffic, Impacts and Mitigation, the SPOT DWP would have its own safety zones and ATBA/NAA. The sizes, locations, and designation of proposed safety zones and ATBA/NAA have not been fully evaluated by the USCG. Further discussion and determinations on the Project's proposed navigational safety measures will be conducted prior to licensing, and will require both a regulatory amendment and an official notification to the IMO.

Navigation Designations around Deepwater Ports

Safety zones, NAAs, and ATBAs for DWPs are established in 33 CFR Part 150, Subpart J. The safety zone prohibits installations, structures, or activities incompatible with or that present an unacceptable risk to safety of the DWP's operations or activity. ATBAs for DWPs are recommended but not mandatory. The only existing DWP terminal in the GoM (Figure 3.11-3) is the LOOP, whose safety zones are approximately 267 nautical miles from the SPOT Project (SPOT 2019a, Application, Volume III, Attachment 4). At the time of this EIS, four DWPs are proposed in addition to the SPOT DWP: JupiterMLP, off the coast of Brownsville and approximately 180 nautical miles southwest of the proposed SPOT DWP; Bluewater, off the coast of Corpus Christi and approximately 100 nautical miles west of the proposed SPOT DWP; Texas Gulf Terminals, also off the coast of Corpus Christi and approximately 126 nautical miles west of the proposed SPOT DWP; and Texas GulfLink, approximately 28.3 nautical miles off the cost of Brazoria County and approximately 8 nautical miles east of the proposed SPOT DWP.

Oil and Gas Industry Activity

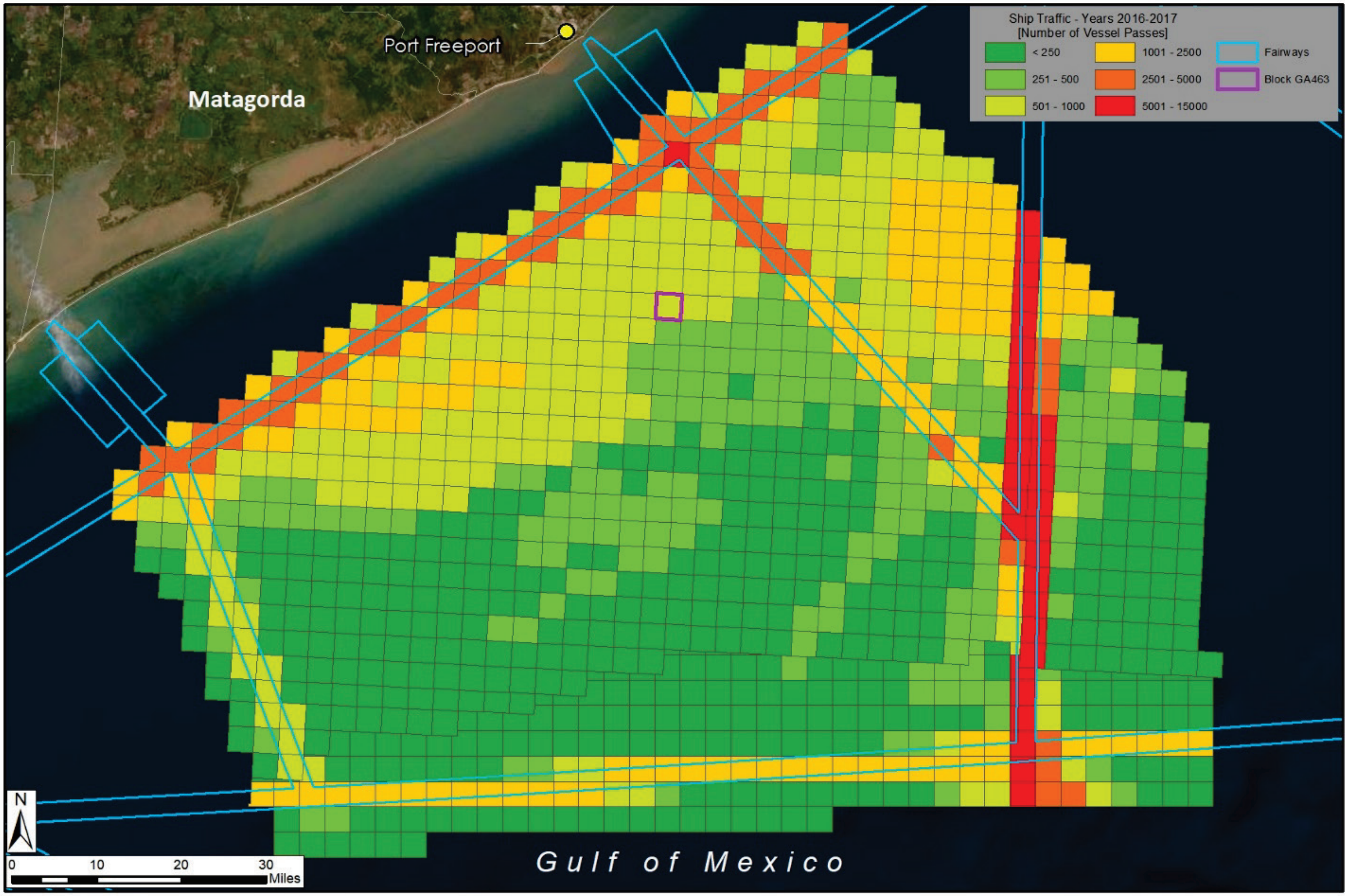
Oil and gas exploration and production in the GoM generates marine traffic from the movement of vessels carrying workers, supplies, and equipment. Vessel movement is more intensive when a new production area is being developed and production platforms are being installed. Navigation in the vicinity of oil and gas well platforms is controlled through the use of safety fairways, safety zones, anchorage areas, and aids to navigation. While hundreds of oil and gas platforms are present in the GoM, none are in any direct path of the proposed SPOT DWP. Many of these platforms are inactive, and some that appear on nautical charts may have been removed (SPOT 2019a, Application, Volume III, Attachment 4). As shown on Figure 3.10.6-1 (in Section 3.10, Land Use, Recreation, Visual Resources, and Ocean Use), oil production activities within 30 nautical miles of the proposed SPOT DWP location include one active lease block in the initial terms of its contract, three active production platforms, and a network of active offshore pipelines.

Vessel Traffic

The SPOT DWP Navigation Assessment compiled data for vessels carrying Automated Identification System (AIS) gear from January 2016 through December 2017 (SPOT 2019a, Application, Volume III, Attachment 4). The AIS gear must be carried by commercial vessels of 60 feet or more in length, passenger vessels approved to carry 150 or more passengers, and certain commercial tow or dredging vessels (33 CFR Part 164). Many recreational and smaller commercial vessels (such as small fishing vessels) do not carry AIS and are, therefore, not included in the vessel traffic counts. Figure 3.11-4 shows AIS data for 2016 and 2017.

The AIS data indicate that the northwest-southeast safety fairway that vessels would use to approach the SPOT DWP from the GoM is heavily travelled, with 2,500 to 6,000 vessel transits during the 2-year data collection period (i.e., an average of 3 to 7 total trips per day, in both directions). Vessel traffic is denser in the north-south safety fairway that provides direct access to Galveston, with 5,000 to 15,000 vessel transits during the 2-year period.

Galveston Area lease blocks 463, A-59, and other lease blocks near the SPOT DWP have relatively light traffic density, with 250 to 1,000 vessel transits in 2016 and 2017. A total of 751 vessels transited through lease block 463 in 2016 and 2017, with most vessel trips occurring from July through December (Table 3.11-7). One to three vessels per day transited through lease block 463 from July to December. Cargo, tanker, and tug/tow vessels made 55 total transits through lease block 463 during the 2-year period. All other identified vessels were fishing, passenger, or recreational vessels (Table 3.11-8); most (81 percent) were fishing boats.



Source: SPOT 2019a, Application, Volume III, Attachment 4

Figure 3.11-4: AIS Traffic Volumes, 2016–2017

Table 3.11-7: Vessel Transits through Galveston Area Lease Block 463

	Jan-June 2016	July-Dec 2016	Jan-June 2017	July-Dec 2017
Total Vessel Transits	48	381	73	249
Number of Fishing Vessel Transits	8	322	10	187

Source: SPOT 2019a, Application, Volume III, Attachment 4.

Table 3.11-8: Vessel Types Transiting Through Galveston Area Lease Block 463, January 2016–December 2017

Type of Vessel	Number of Transits
Cargo	21
Fishing	527
Passenger	68
Pleasure Craft/Sailing	44
Tanker	30
Tug/tow	4
Other or Not Available	57
Total	**751**

Source: SPOT 2019b

3.11.4.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on the marine navigation and vessel traffic. The study area for offshore transportation includes Port Freeport, the Freeport Harbor Channel, and the GoM approximately 90 nautical miles seaward from the coastline of Brazoria County and Galveston County, Texas.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's transportation effects have been evaluated based on their potential to:

- Interfere with access to transportation routes, over the long term;
- Cause a substantial increase in maritime traffic; and/or
- Cause a substantial increase in the risk of vessel collisions or other incidents (e.g., grounding).

The remainder of this section describes potential impacts on marine navigation and vessel traffic from construction and operation of Project facilities, including the SPOT DWP and offshore pipelines, based on the criteria above.

Construction and Installation

Offshore installation would occur using four construction spreads: (1) pipeline installation, (2) SPOT DWP installation, (3) SPM/PLEM installation and tie-in, and (4) SPOT DWP pre-commissioning. The vessel traffic associated with each spread is summarized below (SPOT 2019a, Application, Volume III, Attachment 4 and SPOT 2019f).

Pipeline Installation

Offshore pipeline laying and trenching would occur over an 18-month period from January 2021 through June 2022 and require the following vessel traffic:

- One pipelay barge and two supporting tugs would work along the pipeline corridor for an estimated 152 days, installing one pipeline from the HDD segment to the SPOT DWP, then repeating the installation process for the second pipeline; the crude oil loading pipelines at the SPOT DWP; and the vapor recovery pipelines. These vessels would likely be based at a Louisiana port.
- Four tugs would haul barges carrying the pipes from a Gulf Coast supply yard to the pipelay site during the 152-day pipelay period.
- Following pipelay, one trenching vessel and two support tugs would be on site for approximately 102 days, burying each pipeline, north to south.
- A supply vessel would make regular trips from Port Freeport to the pipelay sites during pipeline installation and trenching.
- A pipeline survey vessel would operate for approximately 30 days.

Vessels that would remain on site during installation (the pipelay barge, trenching vessel, and support tugs) may make trips to Port Freeport or another Texas-based port due to adverse weather conditions, unforeseen equipment failure, or maintenance that requires onshore facilities.

Supply vessel traffic associated with Project construction would travel to the SPOT DWP site from Port Freeport, while most other vessels would originate at other Gulf Coast ports.

Because the work would be sequential, only the limited area undergoing installation, including the anchor spread of the installation vessels, would be inaccessible for navigation by non-Project vessels.

Deepwater Port Installation

DWP components, including jacket, piles, deck sections, and living quarters, would be fabricated onshore and transported to the job site by barge. Installation of the SPOT DWP would occur from May through August 2022 and would require the following vessel traffic:

- One derrick barge and two anchor handling tugs on site for approximately 20 days;
- Three support tugs and barges on site for approximately 30 days, after transporting components and materials from fabrication facilities along the Texas-Louisiana Gulf Coast;
- One jack-up boat on site for approximately 45 days; and
- One supply vessel making continuous transits from Port Freeport to the SPOT DWP for approximately 65 days.

SPM and PLEM Installation

PLEM installation would occur between April and October 2022 (including a 2-month allowance for weather-related delays). Installation and tie-in spreads for the SPM and PLEM would require the following vessel traffic:

- One dynamically positioned dive support vessel on site for approximately 88 days;
- One construction barge with a supporting anchor handling tug on site for approximately 36 days, installing the PLEMs, foundation piling, and the anchors and anchor chains for the buoy mooring;
- Two support tug boats with cargo barges, making numerous transits between Gulf Coast fabrication yards and the Project site over approximately 88 days, transporting components and equipment;
- One four-point dive support vessel on site for approximately 32 days; and
- One supply vessel making continuous transits between Port Freeport and the Project site.

SPOT DWP Startup and Commissioning

SPOT DWP startup and commissioning would occur from August through October 2022, and would require a dive support vessel and jack-up vessel at the Project site, supported by regular supply vessel trips from Port Freeport.

Offshore Impacts during Construction

Offshore installation would take about 22 months (from January 2021 through October 2022) using construction spreads as described above. Each spread would generate regular supply vessel transits from Port Freeport. These vessels would travel to offshore construction areas via the safety fairway from Port Freeport and the safety fairway that parallels the Texas coast (see Figures 3.11-2 and 3.11-3). Vessels from Port Freeport would not need to cross a safety fairway except during the construction periods when the pipeline itself is laid and trenched across a fairway, as discussed below. Assuming that each of the spreads described above would require one supply vessel per day, and with the overlapping spreads described above, offshore installation could generate one to three daily supply vessel transits from Port Freeport.

The four spreads would require a total of about eight installation vessels with supporting tugs that would remain on site for the duration of the work. In addition, an unknown number of barges and tugs would transport pipes and components from GoM ports close to the fabrication yards. Barge trips to transport pipes would occur regularly during the pipeline laying throughout 2021. Component transport for the PLEM and SPOT DWP would require an unknown number of transports, primarily in spring 2022. The tug and cargo barge transits from fabrication yards to offshore job sites could also travel primarily within shipping fairways.

Due to the availability of shipping fairways, the limited amount of existing vessel traffic within the Project lease blocks and over the pipeline route, and the large area of the GoM available for alternative routes, Project construction vessel activity would have a direct, adverse, short-term, negligible impact on vessel traffic in the study area.

The offshore pipelines would cross shipping fairways at two locations. Both shipping fairways carried 2,500 to 5,000 vessels during the two-year period from 2016 to 2017, or 3 to 7 vessel passes per day. Based on the Applicant's proposed construction schedule, offshore pipeline installation and trenching across each fairway would take approximately 14 days during the 22-month offshore construction period. This includes separate 2- to 3-day periods to lay each pipeline, and separate 1- to 2-day periods to trench each pipeline. During these periods, non-Project vessels would need to exercise caution or even navigate outside of the fairway to avoid Project vessels (especially relatively immobile lay barges and assist tugs). As discussed in Section 3.11.4.1, Transportation, Marine Navigation and Vessel Traffic, Existing Conditions, vessel traffic in other portions of the offshore study area is relatively low. As a result, offshore pipeline construction would have a direct, adverse, short-term, and moderate impact on marine navigation.

Operation

Marine Traffic Volumes

VLCCs and other crude oil carriers would access the SPOT DWP from the northwest-southeast safety fairway, approximately 16 nautical miles from the SPOT DWP (see Section 2.2.6, Offshore Construction and Installation). Crew and supply vessels from Port Freeport would either follow the same fairway or take a direct route to the SPOT DWP, depending on vessel size and weather conditions.

Two VLCCs or other crude oil carriers could moor at the SPM buoys and be loaded concurrently. The Applicant anticipates that Project operation would generate an average of one tanker round-trip per day (i.e., one vessel trip inbound to the SPOT DWP, and one outbound from the SPOT DWP, each day) (SPOT 2019a, Application, Volume III, Attachment 4, Navigation Assessment Section 8). A maximum of 365 VLCCs and other crude oil carriers could be loaded per year. The Applicant would provide two support tugs for each tanker approach and departure. When not assisting VLCCs or other crude oil carriers, tugs (along with an emergency response vessel) would stand by at mooring buoys in Galveston Area lease block 463 (SPOT 2019a, Application, Volume III, Attachment 4).

Incoming VLCCs or other crude oil carriers would not typically anchor prior to mooring at an SPM buoy; however, Galveston Area lease block A-59 would be available for VLCC or other crude oil carrier anchorages if needed. Vessels at anchor would broadcast their navigation status, as defined by the International Regulations for Preventing Collisions at Sea, as "at anchor." In addition, Private Aids to Navigation are proposed for lease block A-59 as described below (SPOT 2019a, Application, Volume III, Attachment 4).

In addition to VLCCs and other crude oil carriers, as many as two vessel trips per week would carry workers, supplies, and equipment to the SPOT DWP. A maintenance vessel stationed near Freeport would make trips to the SPOT DWP on an "as needed" basis (SPOT 2019cc).

SPOT DWP Safety Zone and Aids to Navigation

The safety zone around the SPOT DWP platform would have a radius of 500 meters extending out from the platform. Based on current regulatory practice, the safety zone for each SPM buoy would likely extended 500 meters (the maximum allowed under 33 CFR §150.910) from the buoy itself (see Figure 2.2-8 in Section 2.2.8.5, Anchorage Areas, Safety Zones, and Limited Access Areas for the SPOT

Deepwater Port). In addition to the safety zone, an ATBA could be established at the request of the USCG (on behalf of the U.S. Department of State) to the IMO. Other DWPs have requested that the ATBA be a single, contiguous area; in the case of SPOT, the ATBA could be an area that extends up to 500 meters beyond the safety zones for the platform and SPM buoys, as depicted on Figure 2.2-8. As part of the request for ATBA establishment, the USCG would also request that the ATBA be designated a NAA. As shown on Figure 2.2-8, the USCG would also establish a safety zone for the support vessel mooring area. Based on the size of typical oil tanker and DWP support vessels, and the Applicant's proposed mooring design, this safety zone would likely extend 250 meters from the imaginary line connecting the three proposed support vessel moorings. The safety zones and ATBA/NAA would be completely within Galveston Area lease block 463.

Private aids to navigation would be required for each SPM system and the offshore platform to identify the SPOT DWP to other mariners, as described below (SPOT 2019a, Application, Volume III, Attachment 4).

Aids to navigation for the SPOT DWP platform required by Federal regulations would include:

- One marine lantern at each corner, at an elevation of approximately 68 feet. These would flash at night, 60 times per minute, in unison;
- One rotating beacon light at an elevation of approximately 150 feet;
- A fog horn that would activate when visibility is less than 5 miles; and
- A radar beacon.

The SPM buoys would each have a marine signal light, a foghorn, and a radar reflector, in accordance with International Association of Marine Aids and Lighthouse Authorities requirements. Lights would clearly mark floating hoses, in accordance with Federal regulations, as follows:

- On the mainline floating hoses, yellow lights, flashing 50 to 70 times per minute; and
- For the tail hoses, two red lights, flashing 50 to 70 times per minute.

Seven yellow lighted navigation buoys would mark the four corners of Galveston Area lease block 463, containing the SPOT DWP platform and SPM buoys, and the remaining three corners of the anchorage area (lease block 59-A). The navigation buoys would be equipped with solar-powered, battery-backup, GPS-linked lanterns to flash in unison at night (SPOT 2019a, Application, Volume IIa, Section 1.5.6.2).

Offshore Impacts during Operation

Operation would produce, on average, a single transit to and from the SPOT DWP each day, using the northwest-southeast safety fairway and the designated 16-nautical-mile route from the safety fairway to the SPOT DWP. Most vessels traveling to and from the SPOT DWP would be VLCCs, but Aframax and Suezmax vessels, which are 10 to 20 percent smaller than VLCCs in length and have one-half to two-thirds of the load capacity, could also be loaded at the SPOT DWP. Operation would also result in ongoing, frequent tug vessel travel within, to, and from Galveston Area lease blocks 463 and 59-A. The navigation aids to be installed on the SPOT DWP and around lease blocks 463 and 59-A would provide guidance for mariners and vessels.

The safety fairway is less heavily travelled than the nearby north-south fairway and could accommodate the additional traffic (two VLCC or other crude oil carrier transits per day) with only incremental delays or hazards. Project-related increases in marine traffic volume would therefore have direct, adverse, long-term, and minor impacts on vessel transportation.

Operation of the SPOT DWP would direct VLCCs or other crude oil carriers to this particular location in the GoM, rather than to lightering areas closer to major U.S. Gulf Coast ports; however, the Project would not increase the number of VLCCs traveling to or through the GoM. The SPOT DWP would reduce marine traffic in the general area by avoiding the need for smaller ship-to-ship transfer tankers to travel from ports to lightering areas to fill the VLCCs. MARAD and the USCG estimate that operation would eliminate the need for about 935 shuttle tanker round trips per year traveling from Galveston and other nearby ports to VLCCs in lightering areas (see Appendix Y). While the docks and wharves in Galveston formerly used for ship-to-ship transfer activities would be repurposed for other activities (SPOT 2019b), the reduction in shuttle tanker activity would nonetheless have a direct, beneficial, long-term, and moderate impact on vessel transportation.

As many as two support vessel round trips per week would travel between Port Freeport and the SPOT DWP for maintenance, resupply, and crew and vessel changes. These supply vessel transits would not be required to use designated fairways, and could thus take multiple different routes to reach the SPOT DWP. Supply vessel traffic would, therefore, have a direct, adverse, long-term, and negligible impact on overall vessel traffic in the study area.

An oil spill could occur during Project operation that may result in additional vessel traffic from response vessels. Any increase in vessel traffic would be commensurate with the size of the spill. While the number of vessel trips would vary depending on the scope of activities necessary for spill clean-up, impacts would be similar to those described for construction, but likely for a shorter duration. Therefore, impacts associated with the oil spill would be direct, adverse, short-term, and minor to moderate.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vessels and equipment. Impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.11.5. Air Traffic

3.11.5.1. Existing Conditions

Helicopters provide transportation between the GoM coast and offshore oil platforms for crews, supplies, and emergencies.

The FAA began satellite-based tracking of helicopters and oil platforms in 2009. Under this system, fixed and rotary-wing (i.e., helicopter) aircraft position data are relayed from the aircraft to ground receivers and then to the Houston Air Route Traffic Control Center, where controllers monitor helicopter positions. Prior to the advent of satellite-based tracking, departures from Gulf Coast heliports were often delayed due to separation requirements for airspace without radar guidance (such as the area offshore of Brazoria County) (FAA 2019c).

Numerous heliports exist in Brazoria County and nearby in Galveston County, including those at airports, hospitals, and private businesses.

3.11.5.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on air transportation. The study area for air transportation includes the Port Freeport area and the GoM approximately 90 nautical miles seaward from the coastline of Brazoria County and Galveston County, Texas.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's transportation effects have been evaluated based on their potential to cause a substantial increase in the risk of air traffic accidents. The remainder of this section describes potential impacts on air transportation from helicopter traffic required during construction and operation of the Project

Construction

Project construction would not include helicopter transportation; therefore, the Project would not have any impacts on air traffic.

Operation

The SPOT DWP would have a landing deck sized to accommodate either two Bell 407 helicopters (one parked and one taking off or landing), or one larger Sikorsky S-76 helicopter (SPOT 2019a, Application, Volume IIa, Section 1.3.2.8). Project operation would require approximately one helicopter trip per week to transport crewmembers between shore and the SPOT DWP. Helicopter operations would be based out of either the Freeport or Galveston areas (SPOT 2019a, Application, Volume IIa, Sections 8.3.2.2 and 8.3.5.2). Helicopter transport would also be used for medical emergencies (SPOT 2019t).

The addition of one weekly helicopter trip would have a direct, adverse long-term, and negligible impact on air travel in the GoM.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of helicopters. Impacts would be similar to those described for operation, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and negligible.

3.12. AIR QUALITY

This section discusses onshore and offshore regional climate conditions and ambient air quality, as well as activities associated with construction and operation of the Project that could result in emissions that affect air quality. In addition, this section discusses General Conformity requirements.

3.12.1. Definition of the Resource

In this document, air quality is defined as a measurement of pollutants in ambient air. Air pollution comes from many different sources, including stationary sources, mobile sources, and naturally occurring sources. The pollution sources can also emit a wide variety of pollutants. The USEPA has classified six criteria air pollutants, including ozone, CO, nitrogen dioxide (NO_2), SO_2, particulate matter, and lead (Pb), as NAAQS which are regulated standards set by the USEPA (see Section 1.6.9, Clean Air Act). GHGs such as CO_2, methane (CH_4), and nitrous oxide (N_2O) are also regulated air pollutants. In addition, state agencies have state-specific standards that regulate a variety of air pollutants that can harm public health and the environment. Air quality, as described here, may be affected by construction and operation of the proposed Project. Emissions of criteria and other types of pollutants are some of the potential hazards that can negatively impact air quality. Degradation of air quality can adversely impact human health and the environment, which would include effects on soil and water, crops and other vegetation, human-made materials (such as buildings and vehicles), wildlife, overall visibility, and the regional or local climate.

3.12.2. Existing Threats

Existing threats to onshore air quality include both commercial and private sources, such as industrial facilities and vehicle traffic. The Oyster Creek Terminal, the main onshore component of the proposed Project, would be located in a rural area with few industrial sources that adversely impact air quality. Private and commercial vehicle traffic may adversely impact air quality in the area.

Existing threats to offshore air quality in and near the proposed Project area include energy industry facilities and vessel traffic. Drilling platforms, drill rigs, derrick barges, and pipeline construction barges all contribute to emissions, adversely affecting air quality. Commercial and private vessels are also sources of emissions that adversely impact air quality.

3.12.2.1. Greenhouse Gases and Climate Change

Solar radiation is primarily responsible for the earth's climate system. Of the incoming solar shortwave radiation, about half is absorbed by the earth's surface. About 30 percent of this radiation is reflected back to space by gases and aerosols, clouds, and by the earth's surface, and about 20 percent is absorbed into the atmosphere. Based on the temperature of the earth's surface, the majority of the outgoing energy flux from the earth is in the infrared spectrum. The longwave radiation (also referred to as infrared radiation) emitted from the earth's surface is largely absorbed by certain atmospheric constituents—water vapor, CO_2, CH_4, N_2O, and other GHGs. The downward directed component of this longwave radiation adds heat to the lower layers of the atmosphere and to the earth's surface. This is what is known as the greenhouse effect.

The most important GHGs globally are CO_2, CH_4, and N_2O, and these are the key GHGs that would potentially be emitted by the activities during construction and operation of the SPOT Project, such as fuel combustion, loading of crude oil, and fugitive emissions from various activities. The increase in GHGs in the atmosphere from human-made or anthropogenic sources since the beginning of industrialization correlates with an increase in global average temperature.

The increasing trend in GHG concentrations and the potential effect of this change in atmospheric GHG concentrations on global climate has been studied extensively and is reported by the IPCC. The IPCC was organized in 1988 by the World Meteorological Organization and the United Nations Environment Programme to provide governments with a view of the state of knowledge about the science of climate change, potential impacts, and options for adaptation and mitigation through assessments of the most recent information published in the scientific, technical, and socioeconomic literature worldwide. The IPCC has released a series of reports over the past several decades, with the latest being the Sixth Assessment Report (IPCC 2021). The United States was a member country of the IPCC at the time the Sixth Assessment Report was published and is still a member at the time of the publication of this EIS. While the first IPCC assessment depended primarily on observed changes in surface temperature and climate model analyses, more recent assessments include multiple lines of evidence for climate change. Key observations from the Sixth Assessment Report are as follows:

- There is unequivocal evidence that atmospheric concentrations of GHGs such as CO_2, CH_4, and N_2O have increased substantially over the last 200 years due to human activities, and concentrations of these GHGs in the atmosphere have continued to rise as compared to concentrations reported in the Fifth Assessment Report.
- Observations show that global surface temperature was 1.09 degree Celsius higher from 2011 to 2020 than 1850 to 1900, with larger increases over land than over the ocean.
- Human influence is very likely the main driver in the global retreat of glaciers since the 1990s, as well as the decrease in Northern Hemisphere spring snow cover since 1950.
- Global mean sea level increased by 0.2 meter between 1901 and 2018, with human influence very likely the main driver of these increases since at least 1971.
- The report states that to limit human-induced global warming will require limiting cumulative CO_2 emissions and reaching at least net zero CO_2 emissions by 2050.

Climate change is a global issue with various regions contributing anthropogenic GHG emissions and being affected by climate change to various degrees. The IPCC has reported that a wide range of environmental effects could result from increasing concentrations of GHGs in the atmosphere. These may include increases in sea level and changes in weather patterns, resulting in changes in temperature and moisture availability on a regional basis. These weather changes can then cascade to changes in biological communities both on land and in the ocean. Additional research has also been conducted that supports the USEPA’s finding that GHGs may endanger public health and welfare, which resulted in the regulation of GHGs (Duffy et al. 2019; IPCC 2018; IPCC 2014; Jerrett et al. 2009).

Locally, the Southern Climate Impacts Planning Program reports that the following impacts of climate change have already been observed in Texas (SCIPP 2014):

- Air temperatures have increased in recent decades, but not as steadily as in the rest of the country. In the last 20 years, temperature increases have ranged from 0.5°F in the northeastern portion of the state to 1.5°F in the southwestern portion.
- Sea level rose 8 inches during the last century, inundating the Texas coastline, as a result of both sea level rise and subsidence. The Texas coastline is now eroding at an average rate of 2 to 10 feet per

year, depending on local subsidence. Freeport is experiencing a sea level rise rate of 17 inches per 100 years.

- Precipitation varies each year throughout the state, but is rising overall. Summer and winter rainfall has increased and extreme precipitation events are becoming more frequent. Overall, precipitation totals have increased 10 percent in the last century, mostly in eastern Texas.

Section 3.12.6 of this EIS includes an estimate of GHG emissions related to the proposed construction, operation, and decommissioning of the proposed SPOT Project. Section 5.3.7.3 analyzes the upstream and downstream effects from the export of crude oil, to the extent that these effects are reasonably foreseeable. Based on comments received on the Supplemental Draft EIS, Section 5.3.7.3 has been updated to include a quantitative estimate of potential GHG emissions associated with upstream production and transport and downstream use of crude oil that would be transported by the Project.

Since the issuance of the Draft EIS, there have been a series of administrative changes that may affect GHG emissions and efforts to mitigate climate change in the U.S. On January 20, 2021, President Biden issued the *Executive Order on Protecting Public Health and the Environment and Restoring Science to Tackle the Climate Crisis* (Executive Order 13990, 86 Fed. Reg. 14 [January 25, 2021]) and on January 27, 2021, the *Executive Order on Tackling the Climate Crisis at Home and Abroad* (Executive Order 14008, 86 Fed. Reg. 19 [February 1, 2021]). Among other objectives, the Executive Orders call for a net-zero emission economy and a carbon-free electricity sector. On January 20, 2021, President Biden announced that the United States would rejoin the Paris Climate Agreement (Agreement), enabling the United States to once again be a party to the Agreement on February 19, 2021. The Agreement is a binding international agreement to reduce GHG emissions and impacts on climate change that was adopted by 196 parties on December 12, 2015 and entered into force on November 4, 2016. The Agreement aims to limit global warming to well below 2 °C, and preferably to 1.5°C, compared to pre-industrial levels (UNFCCC 2015a). Prior to the U.S. withdrawal from the Agreement in November 2020, the United States initially proposed a 26 to 28 percent domestic reduction in GHG by 2025 compared to 2005 GHG emissions (UNFCCC 2015b). In April 2021, the United States set a target of 50 to 52 percent domestic reduction in GHG by 2030 compared to 2005 (The White House 2021).

The U.S. Department of State issued the document "The Long-Term Strategy of the United States: Pathways to Net-Zero Greenhouse Gas Emissions by 2050" in November 2021. This strategy outlined plans to decarbonize various sectors in the United States, including transportation fuels and industrial feedstocks, both of which may lower the domestic demand for crude oil (U.S. Executive Office 2021). The state of Texas has emission reduction programs aimed at incentivizing programs to reduce air emissions; however, at the time of publication of the Final EIS, a state-level climate action strategy was not yet available.

Onshore Greenhouse Gases and Climate Change

The Texas state air quality regulations and TCEQ air permitting programs are part of the USEPA-approved SIPs to implement, maintain, and enforce the NAAQS. For the onshore storage and supply components, the Applicant has applied for separate air permit authorizations under the Permit by Rule and Non-Rule Standard Permit programs with the TCEQ, which are minor NSR permits. Because the onshore components of the proposed Project qualify as a minor new source, the Applicant is not required to obtain a PSD air permit for the onshore components. Major PSD sources must apply best available control technology (BACT) to minimize their potential uncontrolled GHG emissions if such emissions would exceed 75,000 tons per year. As the onshore portion of the proposed Project would not be a major PSD source, the Applicant is not required to evaluate GHG BACT as part of its air permit applications with TCEQ. However, the onshore facilities would be subject to GHG reporting requirements under 40 CFR Part 98 if the potential GHG emissions are greater than 25,000 metric tons per year of carbon dioxide equivalent (CO_2e). CO_2e emissions are calculated by multiplying total mass emissions for each individual GHG by its global warming potential (GWP)[20] and adding the results. While there are multiple methodologies available for calculating CO_2e, the GWP used to calculate CO_2e for the Project is consistent with the method used to determine significance for GHG emissions under the CAA and as reported under the USEPA's Greenhouse Gas Reporting Program. For example, CH_4 and N_2O, which after CO_2 are the two most common GHGs emitted by a facility of this type, have GWP factors of 25 times and 298 times that of CO_2, respectively.

GHG emission estimates for aboveground facilities have been provided in Section 3.12.4.2, Onshore Air Quality, Impacts and Mitigation. The Applicant would calculate actual GHG emissions after commencing operation to determine whether the facilities would be subject to reporting under 40 CFR Part 98.

Offshore Greenhouse Gases and Climate Change

The proposed DWP would be a major source for emissions of criteria pollutants and would be required to apply for and receive a PSD air permit from the USEPA. The potential uncontrolled GHG emissions, measured as CO_2e, of the Project, would exceed the major PSD source threshold for GHG emissions of 75,000 tons per year. As a major PSD source, the proposed DWP must, therefore, apply BACT to its potential GHG emissions. The Applicant has included a GHG BACT analysis in its PSD air permit application. This analysis evaluates GHG control technologies for combustion emissions of CO_2, as well as for fugitive GHG emissions (primarily CH_4) from facility piping components. The GHG operation emissions presented in Section 3.12.5.2, Air Quality, Offshore Air Quality, Impacts and Mitigation, reflect the GHG BACT analysis and implementation of the Applicant's selected control technology. In addition to the BACT analysis provided by the Applicant in the PSD permit application, the USEPA requested the Applicant also look at carbon capture and sequestration technology. The Applicant's analysis determined carbon capture and sequestration would not be viable for the SPOT Project due to the additional space required on the platform, the additional infrastructure that would be required (e.g., a pipeline to transport the CO_2 to a sequestration location), the additional materials and fluids that would need to be stored on the platform, and the lack of available sequestration locations.

3.12.3. Regional Climate

This section summarizes the existing onshore and offshore conditions in the location of the proposed Project, including regional climatic conditions, ambient air quality, and GHGs and climate change.

[20] A "measure of how much energy the emissions of 1 ton of a gas will absorb over a given period of time, relative to the emissions of 1 ton of carbon dioxide (CO_2)" (USEPA 2017c)

3.12.3.1. Onshore Regional Climate

The onshore components of the proposed Project (existing ECHO Terminal, proposed Oyster Creek Terminal, and onshore pipelines) would be located in Harris County and Brazoria County, Texas. This area of Texas has a warm, humid climate with hot summers (Köppen-Geiger climate classification Cfa [humid subtropical climate]) (NOAA 2019c). The proposed terminal and pipelines would be located near the Houston and Galveston areas. For the Houston area, NOAA online weather data indicates a mean daily temperature ranging from 84.6°F in August to 53.1°F in January, with mean daily highs ranging up to 94.5°F in August, and mean daily lows ranging down to 43.2°F in January. Mean annual precipitation for the Houston area is 49.77 inches, distributed relatively evenly throughout the year (NOAA 2019g). For the Galveston area, NOAA online weather data indicates a mean daily temperature ranging from 85°F in August to 55.2°F in January, with mean daily highs ranging up to 90.3°F in August, and mean daily lows ranging down to 48.6°F in January. Mean annual precipitation for the Galveston area is 50.8 inches, distributed relatively evenly throughout the year (NOAA 2019g).

3.12.3.2. Offshore Regional Climate

The location for the proposed DWP is in the GoM, 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas near Galveston, Texas. Descriptions of regional climate do not typically include areas of open water; the nearest coastal climate in Brazoria County and the Galveston area is the one discussed above.

The entire GoM and its coastal areas are subject to tropical storms and hurricanes, which are most likely to occur between late May and early November. On average, the proposed Project area experiences a tropical storm (sustained winds of at least 39 miles per hour) every 1 to 2 years, while a hurricane (sustained winds of at least 74 miles per hour) can be expected to cross the proposed Project area once every 4 to 5 years. A major hurricane, rated as Category 3 or higher (sustained winds of at least 110 miles per hour), may occur about once every 25 years—the most recent was Hurricane Harvey, which came ashore north of Corpus Christi as a Category 4 storm on August 25, 2017 (NOAA 2017b). At the proposed DWP location, storms have the potential to produce substantial waves that present a hazard to ocean-going vessels. Along the coast, heavy rains and wind-driven storm surges may cause local or widespread flooding. Discussions on regional water temperature are included in Section 3.3, Water Resources.

3.12.4. Onshore Air Quality

The following sections discuss ambient air quality for the onshore portion of the Project and activities associated with construction and operation of the proposed Project that would impact onshore air quality.

3.12.4.1. Onshore Ambient Air Quality

The NAAQS were developed by the USEPA to protect public health (primary standards) and public welfare (secondary standards). The NAAQS were established in the 1970s and were last revised in 2015. Primary standards are based on observable human health responses and are set at levels that provide an adequate margin of safety for sensitive segments of the population. Secondary standards are intended to protect welfare interests, such as structures, vegetation, and livestock. Air dispersion modeling is used by proposed new sources to demonstrate compliance with the primary or secondary standards.

An air quality control region, as defined in Section 107 of the CAA, is a Federally designated area in which Federal ambient air quality standards must be met. An implementation plan, describing how ambient air quality standards will be achieved and maintained, is developed for each air quality control region. Areas meeting the NAAQS are termed attainment areas, and areas not meeting the NAAQS are termed nonattainment areas. Areas that have insufficient data to make a determination of attainment/nonattainment are termed unclassified or not designated but are treated as being attainment areas for permitting purposes. The designation of an area is made on a pollutant-specific basis by the USEPA. States use ambient air monitoring systems to evaluate compliance with the NAAQS and provide real-time monitoring of air pollution episodes, develop data for trend analysis, develop and implement air quality regulations, and provide information to the public.

The Houston-Galveston-Brazoria (HGB) area, which includes Harris and Brazoria counties, in which the onshore components of the Project would be located, is designated as serious nonattainment for the 2008 Eight-Hour Ozone NAAQS and marginal nonattainment for the 2015 Eight-Hour Ozone NAAQS (USEPA 2019b). Marginal is the lowest level of ozone nonattainment severity, and serious is the middle level of severity, below severe and extreme. The HGB area is designated as attainment or unclassifiable for the other NAAQS. Both the 2008 NAAQS and the 2015 NAAQS are currently in effect for the HGB area, as the 2008 NAAQS have not yet been revoked by the USEPA.

3.12.4.2. Impacts and Mitigation

This section includes a discussion of the impacts on air quality that would likely result from construction and operation of the onshore components of the SPOT Project. The study area within which potential impacts were assessed includes the onshore SPOT Project area and the airshed within which sensitive receptors could be affected.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on air quality have been evaluated based on their potential to:

- Cause or contribute to a violation of NAAQS;
- Cause or contribute to a violation of a Class I or Class II increment (the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant);
- Cause an adverse impact on air quality-related values in a Class I area;
- Expose sensitive receptors to substantially increased pollutant concentrations;
- Increase emissions of criteria pollutants beyond limits allowed under CAA regulations;
- Substantially increase the emissions of GHGs; and
- Create objectionable odors, resulting in adverse effects to a substantial number of people.

The remainder of this section describes potential impacts from Project construction and operation on air quality from construction equipment, road traffic associated with construction, and operation of the ECHO Terminal, the Oyster Creek Terminal, and the MLVs.

Construction Impacts and Mitigation

Construction activities would produce air emissions, predominantly combustion emissions from engines associated with non-road construction equipment and on-road vehicles. Non-road equipment would include compressors, skid loaders, forklifts, track hoes, front-end loaders, cranes, and pile driving hammers. On-road vehicles would include commuter vehicles, gasoline-engine pickup trucks, and diesel-engine passenger buses, flatbed trucks, and delivery trucks. Construction would occur at the existing ECHO Terminal, along the ECHO to Oyster Creek Pipeline route, at the Oyster Creek Terminal site, and along the Oyster Creek to Shore Pipelines route. There would be 18 HDDs along the ECHO to Oyster Creek Pipeline and 5 HDDs along the Oyster Creek to Shore Pipelines.

The construction emissions are based on a preliminary inventory of construction equipment and the expected duration of operation of the equipment. Emission factors for on-road and off-road equipment were obtained from the USEPA MOVES emission factor model for Brazoria County for years 2023 and 2024. The construction emission estimates are shown in Table 3.12-1.

Table 3.12-1: Proposed Onshore Construction Emissions for the SPOT Project

	Emissions (tons per year)						
Activity	**NO_x**	**CO**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2e**
2023							
Pipeline, valve stations	7.9	18.6	0.8	0.5	0.5	0.1	7,199
Pipeline, valve station fugitive dust	-	-	-	144.4	14.4	-	-
Oyster Creek Terminal	27.6	102.2	5.1	1.6	1.6	0.1	9,538
Oyster Creek Terminal fugitive dust	-	-	-	48.2	5.0	-	-
Total	**35.5**	**120.8**	**5.9**	**194.7**	**21.5**	**0.2**	**16,737**
2024							
Pipeline, valve stations	-	-	-	-	-	-	-
Pipeline, valve station fugitive dust	-	-	-	-	-	-	-
Oyster Creek Terminal	24.0	108.1	5.1	1.5	1.4	0.1	9,982
Oyster Creek Terminal fugitive dust	-	-	-	49.8	5.0	-	-
Total	**24.0**	**108.1**	**5.1**	**51.3**	**6.4**	**0.1**	**9,982**

Source: SPOT 2022c

- = source does not emit the pollutant; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

Notes:

1. Pipeline construction is expected to start and be completed in 2023; therefore, there would be no emissions related to pipeline and valve stations in 2024. Construction at the ECHO and Oyster Creek Terminals would occur from 2023 through 2024.
2. Emissions from pipeline and terminal construction would include emissions from non-road construction equipment (e.g. loaders, excavators, cranes, forklifts, tractors, generators), on-road equipment (e.g., trucks, vans), worker commutes by car, and truck deliveries.
3. Fugitive dust emissions are particulate matter that would be generated from general construction site work and earth moving activities.

Impacts associated with construction of the proposed Project would last for the duration of the construction period (2023 to 2024). Emissions from combustion would be intermittent and highly localized to construction sites. Other construction activities, such as welding, would generate emissions, but these would be negligible relative to the combustion emissions. Fugitive particulate matter emissions would also occur from vehicle travel on paved roads, and from soil disturbance at the construction sites. Overall, the impacts associated with construction of the onshore components of the Project would be direct and indirect, adverse, short-term, and minor. These construction emissions are not required to be authorized under TCEQ's Permit by Rule and Non-Rule Standard Permit.

Operation Impacts and Mitigation

Emissions generated from the onshore components of the proposed Project were evaluated based on data provided by the Applicant in its license application for the modifications to the existing ECHO Terminal and proposed MLVs (SPOT 2019a, Application, Volume IIb, Appendix K) and in the TCEQ Non-Rule Oil and Gas Standard Permit application submitted to the TCEQ in December 2018 for the proposed Oyster Creek Terminal (SPOT 2019a, Application, Volume I, Appendix G). The onshore components of the proposed Project would qualify for the TCEQ minor-source permitting program as a minor emission source.

Project operation would produce emissions from the ECHO Terminal modifications, proposed MLVs, and the proposed Oyster Creek Terminal. Emission sources would include storage tanks; maintenance, startup, and shutdown activities; vapor combustion units for controlling tank maintenance activities; and fugitive leaks from piping components such as pipe flanges, valves, pumps, and compressor seals. Tables 3.12-2 and 3.12-3 show the potential annual emissions.

Table 3.12-2: Proposed Operation Emissions Summary at ECHO Terminal and Mainline Valve Sites

	Emissions (tons per year)		
Pollutant	**Fugitive**	**Maintenance, Startup, and Shutdown**	**Total Emissions**
NO_x	-	-	-
CO	-	-	-
VOCs	0.57	1.71	2.28
PM	-	0.01	0.01
PM_{10}	-	<0.01	<0.01
$PM_{2.5}$	-	<0.01	<0.01
SO_2	-	-	-
CO_2e	-	-	-
H_2S	<0.01	<0.01	<0.01
HAPs	0.08	0.23	0.31

Source: SPOT 2019a, Application Volume IIb, Section 9

- = source does not emit the pollutant; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; HAPs = hazardous air pollutants; H_2S = hydrogen sulfide; NO_x = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

Table 3.12-3: Proposed Operation Emissions Summary at Oyster Creek Terminal

	Emissions (tons per year)				
Pollutant	**Tanks (7)**	**Fugitive**	**Maintenance, Startup, and Shutdown**	**VCUs**	**Total Emissions**
NO_x	-	-	-	9.06	9.06
CO	-	-	-	16.27	16.27
VOCs	61.44	0.23	1.96	4.36	67.99
PM_{10}	-	-	-	0.62	0.62
$PM_{2.5}$	-	-	-	0.62	0.62
SO_2	-	-	-	3.3	3.3
H_2S	<0.01	<0.01	<0.01	<0.01	0.01
Benzene	0.60	<0.01	<0.01	0.01	0.63
HAPs	8.32	0.03	0.09	0.16	8.6

Source: SPOT 2019a, Application, Volume IIb, Section 9

- = source does not emit the pollutant; CO = carbon monoxide; HAPs = hazardous air pollutants; H_2S = hydrogen sulfide; NO_x = nitrogen oxides; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide; VCU = vapor combustion unit; VOCs = volatile organic compounds

Notes: Assumed total particulate matter is equal to PM_{10} and $PM_{2.5}$. Maximum operating schedule is 8,760 hours/year. VCUs consist of two permanent and one portable VCU and can all operate in any one hour. Total annual emissions from the VCUs are the maximum between the three units.

The Non-Rule Standard Permit for the Oyster Creek Terminal would require an impact evaluation for NAAQS (NO_x and SO_2), State Property Line Standards (SO_2 and hydrogen sulfide [H_2S]), and State Health Effects Review (benzene). As shown in Table 3.12-4, NO_X, SO_2, H_2S, and benzene emissions are above the specified Non-Rule Standard Permit *de minimis* limits and further impact evaluation is required and presented below.

Table 3.12-4: *De Minimis* Thresholds and Site-Wide Emissions for the Oyster Creek Terminal Impact Evaluation

Pollutant	Threshold Emission Rate (lb/hr)	Site-Wide Total Emission Rate (lb/hr)
NO_x	2	88.08
SO_2	4	15.1
H_2S	0.025	0.474
Benzene	0.039	0.583

Source: SPOT 2019a, Application, Volume IIb, Section 9

H_2S = hydrogen sulfide; lb/hr = pounds per hour; NO_x = nitrogen oxides; SO_2 = sulfur dioxide

The Applicant performed an impact evaluation using the USEPA SCREEN3 model and demonstrated compliance with the NAAQS for annual and hourly NOx, annual SO2, the State Property Line Standards for H_2S, and the State Health Effects analysis for benzene, as shown in Table 3.12-5. However, the modeled concentration for hourly SO2 exceeded the Significant Impact Level (SIL), which the USEPA also considers when determining whether the source causes or cumulatively contributes to a violation of the corresponding NAAQS or PSD increments. Therefore, the Applicant conducted an additional evaluation for hourly SO2 based on a screening background concentration of 50 micrograms per cubic meter, per TCEQ guidance (TCEQ 2010).

Table 3.12-5: SCREEN3 Modeling Results

Pollutant	Averaging Period	Maximum Modeled Concentration ($\mu g/m^3$)	Air Quality Threshold ($\mu g/m^3$)
NO_x	Annual	0.0393	1 [a]
	1-Hour	2.72	7.5 [a]
SO_2	Annual	0.05	1 [a]
	1-Hour	78.35	196 [a]
H_2S	1-Hour	106.27	108 [b]
Benzene	Annual	0.11	4.5 [c]
	1-Hour	2.63	170 [c]
Crude Oil, benzene <1%	Annual	28.5	350 [c]
	1-Hour	696	3,500 [c]

Source: SPOT 2019a, Application, Volume I, Appendix G

$\mu g/m^3$ = micrograms per cubic meter; H_2S = hydrogen sulfide; NAAQS = National Ambient Air Quality Standards; NO_x = nitrogen oxides; SO2 = sulfur dioxide

[a] National Ambient Air Quality Standard.

[b] State Property Line Standard.

[c] State Health Effects Standard.

This additional modeling analysis demonstrates that operating impacts for the onshore component of the proposed Project would be in compliance with all Federal and state guidelines for acceptable ambient pollutant concentrations. As such, impacts associated with the operation of the onshore components of the proposed Project would be direct and indirect, adverse, long-term, and minor.

Greenhouse Gas Emissions

The Applicant has estimated potential GHG emissions from the proposed Oyster Creek Terminal, which are presented in Table 3.12-6. Because the ECHO Terminal and MLV sites would have electric-driven equipment, there would be no GHG emissions associated with the operation of these facilities.

Table 3.12-6: Proposed Onshore Operation GHG Emissions

Pollutant	Stationary Source Annual Emissions (tons per year)	Total Onshore Annual Emissions (tons per year of CO_2e)
CO_2	13,471	13,471
N_2O	0.11	32
CH_4	0.54	13
	Total	13,516

Source: SPOT 2021e

CH_4 = methane; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; N_2O = nitrous oxide

Based on the calculations, the onshore components of the Project would not likely be subject to GHG reporting requirements under 40 CFR Part 98, which applies to owners and operators of certain facilities emitting more than 25,000 metric tons per year of CO_2e. Impacts on air quality from GHG emissions during operation are further described in Section 3.12.6, Greenhouse Gas Impact Assessment.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vehicles and equipment. Impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct and indirect, adverse, short-term, and minor.

3.12.5. Offshore Air Quality

The Applicant conducted dispersion modeling in compliance with the USEPA Guidelines on Air Quality Models (USEPA 2017a) and BOEM's modeling guidance (BOEM 2019f) to evaluate emissions of criteria pollutants regulated under PSD regulations (40 CFR § 52.21). The analysis included an evaluation of the impact of emissions subject to the TCEQ Modeling and Effects Review (MERA) process and the emissions of SO_2 and H_2S subject to review under the TCEQ's State Property Line Standards (TCEQ 2018). In addition, although not required for compliance with the CAA, the Applicant conducted modeling for mobile emissions from VLCCs and other support vessels in assessing compliance with the NAAQS and PSD increments, which are not included in the PSD analysis (SPOT 2019a, Application, Volume IIa, Appendix Q). The following sections discuss activities associated with construction and operation of the proposed Project that would impact offshore air quality.

3.12.5.1. Offshore Ambient Air Quality

The USEPA and/or TCEQ have not assigned an air quality attainment status (i.e., attainment or nonattainment) for locations beyond the seaward state territorial boundary. Therefore, the NAAQS attainment status of the nearest adjacent onshore location should be considered for the offshore locations. Brazoria County, which is the nearest onshore location to the proposed DWP, is designated as serious nonattainment for the 2008 Eight-Hour Ozone NAAQS and marginal nonattainment for the 2015 Eight-Hour Ozone NAAQS (USEPA 2019b). Marginal is the lowest level of ozone nonattainment severity, and serious is the middle level of severity, below severe and extreme. Brazoria County is designated as attainment or unclassifiable for the other NAAQS.

To predict air quality impacts from a proposed source, air pollutant dispersion modeling must consider existing background concentrations. Table 3.12-7 presents monitoring data collected by nearby ambient monitoring stations during the 3-year period from 2015 through 2017.

For each pollutant, data were selected from the nearest available monitoring site to the proposed Project that is not also determined to be influenced by localized source impacts (i.e., monitoring stations that do not have similar ambient conditions to a project site for a particular pollutant were not selected). For example, a monitoring station located near a heavy industrial area may not be an appropriate comparison for a project located in a rural area not affected by heavy industrial use at the nearest monitoring site. The monitoring sites also offer conservative representations of the existing ambient air quality at the proposed DWP offshore location, as the existing background concentrations at the proposed DWP location are likely to be lower than the values shown, due to the scarcity of nearby emission sources relative to the onshore monitoring sites. The onshore monitoring sites are located in urban and industrial areas with more nearby emission source impacts; therefore, the onshore monitoring data would be higher than the actual background concentrations at the offshore location, and were selected as a more conservative representation.

Table 3.12-7: Background Ambient Air Quality and Ambient Air Quality Standards

Air Pollutant	Averaging Period	Statistic	Monitor Values [a]	Monitoring Site (Site Identifier) [b]	Primary NAAQS [c]
SO_2	1-hour	99th Percentile of daily 1-hour maximum averaged over 3 years	20.8 ppb	Texas City Ball Park (AQS #48-167-0005)	75 ppb
	3-hour	Not to be exceeded more than once per year	37.9 ppb		0.5 ppm
CO	1-hour	Not to be exceeded more than once per year	2.1 ppm	Houston Deer Park #2 (AQS #48-201-1039)	35 ppm
	8-hour		1.2 ppm		9 ppm
NO_2	1-hour	98th percentile averaged over 3 years	29.8 ppb	Galveston 99th Street (AQS #48-167-1034)	100 ppb
	Annual	Annual mean	3.26 ppb		53 ppb
O_3	8-hour	Annual fourth-highest daily maximum 8-hour concentration, averaged over 3 years	65 ppb	Lake Jackson (AQS #48-039-1016)	70 ppb
PM_{10}	24-hour	Not to be exceeded more than once per year on average over 3 years	70.3 µg/m^3	Houston Deer Park #2 (AQS #48-201-1039)	150 µg/m^3
$PM_{2.5}$	24-hour	98th percentile averaged over 3 years	21.7 µg/m^3	Galveston 99th Street (AQS #48-167-1034)	35 µg/m^3
	Annual	Annual mean averaged over 3 years	7.2 µg/m^3		12 µg/m^3
Pb	Rolling 3-month	Not to be exceeded	See note d	NA	0.15 µg/m^3

Source: SPOT 2019a, Application, Volume IIa, Appendix Q

µg/m^3 = micrograms per cubic meter; AQS = Air Quality System; CO = carbon monoxide; NA = not applicable; NAAQS = National Ambient Air Quality Standards; NO_2 = nitrogen dioxide; O_3 = ozone; Pb = lead; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; ppb = parts per billion; ppm = parts per million; SO_2 = sulfur dioxide

[a] Monitoring value shown matches the statistic of the NAAQS. Three-year averages are formed from 2015 to 2017 data.

[b] Locations of monitoring sites can be found in the SPOT Project Application, Volume IIa, Appendix Q.

[c] Secondary standards are promulgated for some pollutants and are generally the same as or less stringent than primary standards.

[d] In areas designated nonattainment for the Pb standards prior to the promulgation of the current (2008) standards, for which implementation plans to attain or maintain the current (2008) standards have not been submitted and approved, the previous standards (1.5 µg/m^3 as a calendar quarter average) also remain in effect.

There are several onshore air quality monitors within 62 miles of the proposed Project location that can be used to supply ambient monitoring data. The USEPA's Ambient Monitoring Guidelines (USEPA 1987) state that representative monitoring data should be based on three key criteria: monitor location, quality of the data, and timestamp of the data to the most current available date. The selected monitoring sites are located in the HGB area, and were evaluated in relation to the criteria provided in the guidelines as being representative of the proposed Project site.

3.12.5.2. Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project. The study area within which potential impacts were assessed includes the offshore SPOT Project area and the surrounding area out to 20,000 meters (65,617 feet) from the proposed safety zones, as determined through the dispersion modeling analysis.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's effects on air quality have been evaluated based on their potential to:

- Cause or contribute to a violation of NAAQs;
- Cause or contribute to a violation of a Class I or Class II increment (the maximum allowable increase in concentration that is allowed to occur above a baseline concentration for a pollutant);
- Cause an adverse impact on air quality-related values in a Class I area;
- Expose sensitive receptors to substantially increased pollutant concentrations;
- Increase emissions of criteria pollutants beyond limits allowed under CAA regulations;
- Substantially increase the emissions of GHGs; and
- Create objectionable odors, resulting in adverse effects to a substantial number of people.

The remainder of this section describes potential impacts from offshore Project construction and operation on air quality due to mobile emission sources and stationary emission sources. It also provides an analysis of GHG emissions and the dispersion modeling conducted by the Applicant to determine the potential impacts on air quality.

Construction Impacts and Mitigation

Construction activities would produce air emissions, predominantly from combustion emissions associated with marine vessel engines, compressors, generators, and cranes. Other construction activities, such as welding, would generate emissions, but these would be minor relative to the combustion emissions. Fugitive particulate matter emissions typically associated with construction projects, such as road dust, would not occur for construction of the offshore portions of the proposed Project.

Construction-related offshore equipment that would generate air emissions includes the following vessels during each construction task:

- Pipeline installation: pipelay vessel, two anchor handling tug (AHT) vessels, four support tugs, survey vessel (pre-lay survey), and supply boat;
- Pipeline trenching: trenching barge, two AHT vessels, and supply boat;
- Platform installation: heavy lift vessel, two AHT vessels, three support tugs, jack-up boat, and supply boat;
- SPM and PLEM installation and tie-ins: dynamically positioned dive support vessel, construction barge, AHT vessel, two support tugs, one 4-point dive support vessel, and supply boat; and
- Pre-commissioning, pipeline flooding, and testing: dive support vessel, jack-up boat, and supply boat.

Table 3.12-8 presents potential emissions from construction of the offshore Project components. Construction emission estimates were based on the duration of operation for each vessel, and the total rated horsepower for each vessel's engines. Total days and hours of operation for each vessel were based on the Project schedule. Vessel horsepower ratings were based on actual example vessels representative of those likely to be used for the Project. Emission factors were obtained from BOEM's 2014 Gulfwide Emission Inventory Study (BOEM 2017b).

Table 3.12-8: Proposed Offshore Construction Emissions

	Total Emissions (tons)						
Activity	**NO_x**	**CO**	**VOCs**	**PM_{10}**	**$PM_{2.5}$**	**SO_2**	**CO_2e**
Pipeline Installation	264.1	63.4	4.5	10.1	9.8	0.2	20,549
Pipeline Trenching	72.6	17.4	1.2	2.8	2.7	0.1	5,645
Platform Installation	172.0	22.0	6.5	5.5	5.2	33.8	8,269
SPM and PLEM Installation and Tie-Ins	439.2	50.8	17.3	13.9	13.1	93.0	20,168
Pre-commissioning, Flooding, and Testing	27.0	6.7	0.5	0.8	0.8	0.1	1,934
Total [a]	**974.9**	**160.3**	**30.0**	**33.1**	**31.6**	**127.2**	**56,565**

Source: SPOT 2022 c

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; NO_x = nitrogen oxides; PLEM = pipeline end manifold; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide; SPM = single point mooring; VOCs = volatile organic compounds

[a] SPOT estimates that 38 percent of offshore construction activities would occur in 2024, and 62 percent would occur in 2025. Therefore, approximately one-third of the total emissions would occur in 2024, and the remaining two-thirds would occur in 2025.

Impacts associated with construction of the proposed Project would be intermittent and would only last for the duration of the construction period. As such, impacts associated with construction of the offshore components of the Project would be direct and indirect, adverse, short-term, and minor. These construction emissions are not required to be authorized under the PSD permit.

The majority of the onshore and offshore construction activities would occur at a significant enough distance from each other that the onshore construction emissions and offshore construction emissions would not result in a cumulative impact associated with the two project components. In addition, most of the offshore construction would occur in a different construction year compared to the onshore components. Therefore, if both onshore and offshore construction activities are considered together, impacts on air quality from construction would be direct and indirect, adverse, short-term, and minor. Additional information regarding cumulative construction air quality impacts is included in Section 5.3.7.1, Cumulative Impacts of the Proposed Action on Air Quality.

Operation Impacts and Mitigation

Emissions generated from proposed Project operation were evaluated based on data included in the PSD permit application submitted to USEPA Region 6 in January 2019 (SPOT 2019a, Application, Volume I, Appendix F).

Operational emissions from the offshore portion of the Project would be produced by stationary sources onboard the platform and from mobile sources, including marine vessels and helicopter flights.

Stationary Sources

The platform would include the following stationary emission sources:

- Three marine loading vapor combustors;
- Two diesel generators for power generation;
- One emergency (backup) diesel generator;

- Two diesel firewater pumps;
- Two pedestal cranes;
- Three diesel storage tanks;
- One vent boom to discharge evaporative losses from draining of four crude oil pipelines during pigging activities;
- Uncaptured marine loading emissions; and
- Component fugitive emissions.

Mobile Sources

Mobile sources would include combustion emissions from the VLCC or other crude oil carrier engines, support vessels (tug boats, supply boats), and helicopter flights. The sources of emissions on the VLCCs or other crude oil carriers and support vessels would be primarily from diesel-fired internal combustion engines and boilers.

Table 3.12-9 presents potential emissions from stationary and mobile emission sources for offshore operations.

Table 3.12-9: Proposed Offshore Operation Emissions

Pollutant	Stationary Source Annual Emissions (tons per year)	Mobile Source Annual Emissions (tons per year)
NO_x	223.48	524.70
CO	290.95	87.11
VOCs	1,729.89	17.05
PM	8.11	14.63
PM_{10}	8.11	14.63
$PM_{2.5}$	8.11	13.89
SO_2	36.85	71.54
H_2S	1.19	-
HAPs	83.11	0.14
CO_2e	173,257	26,244

Source: SPOT 2019a, Application, Volume IIa, Section 11

- = source does not emit the pollutant; CO = carbon monoxide; CO_2e = carbon dioxide equivalent; H_2S = hydrogen sulfide; HAPs = hazardous air pollutants; NO_x = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

While the offshore portion of the Project would result in emissions from stationary and mobile sources, loading of VLCCs via an offshore platform rather than via reverse lightering (onshore loading to a smaller vessel and transfer to a VLCC at an offshore location) could result in fewer overall emissions associated with VLCC loading. Table 3.12-10 presents the estimated emissions associated with loading one VLCC via the Project versus loading of the same vessel via reverse lightering.

Table 3.12-10: VLCC Loading Emissions from SPOT versus Reverse Lightering

Pollutant	Units	SPOT Emissions	Reverse Lightering Emissions – Aframax	Reverse Lightering Emissions - Suezmax
NO_x	Tons	0.697	3.622	3.260
CO	Tons	0.844	2.046	1.899
PM_{10}	Tons	0.049	0.290	0.257
$PM_{2.5}$	Tons	0.047	0.268	0.238
VOC	Tons	4.517	80.141	80.067
SO_2	Tons	0.187	0.803	0.718
HAPs	Tons	0.215	3.820	3.811
CO_2e	Metric tons	529.2	1,425.9	1,315.0

Source: SPOT 2022b

CO = carbon monoxide; CO_2e = carbon dioxide equivalent; HAPs = hazardous air pollutants; NO_x = nitrogen oxides; PM = particulate matter; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide; VOCs = volatile organic compounds

Greenhouse Gas Emissions

Potential GHG emissions from the offshore Project components are presented in Table 3.12-11.

Table 3.12-11: Proposed Offshore Operation GHG Emissions

Pollutant	Stationary Source Annual Emissions (tons per year)	Mobile Source Annual Emissions (tons per year)	Total Offshore Annual Emissions (tons per year)	Total Offshore Annual Emissions (tons per year of CO_2e)
CO_2	171,420	25,109	196,529	196,529
N_2O	5.45	3.78	9.23	9.23
CH_4	8.57	0.39	8.96	8.96
			Total	196,547.19

Source: SPOT 2019a, Application, Volume IIa, Appendices O and P

CH_4 = methane; CO_2 = carbon dioxide; CO_2e = carbon dioxide equivalent; GHG = greenhouse gas; N_2O = nitrous oxide

The proposed Project would also be subject to GHG reporting requirements under 40 CFR Part 98, which applies to owners and operators of certain facilities emitting more than 25,000 metric tons per year of CO_2e. The proposed Project would be included in the petroleum and natural gas systems category specified in 40 CFR Part 98, Subpart W. Impacts on air quality from GHG emissions during operation are further described in Section 3.12.6, Air Quality, Greenhouse Gas Impact Assessment.

Dispersion Modeling Analysis

The Applicant performed an air quality dispersion modeling analysis to evaluate emissions of criteria pollutants regulated under the PSD permitting process. The criteria pollutant analysis provided an air quality impacts assessment in accordance with NEPA (SPOT 2019a, Application, Volume IIa, Appendix Q). The modeling used methodology outlined in a PSD modeling protocol submitted by the Applicant to USEPA Region 6 on October 5, 2018 as part of its PSD permit application (SPOT 2019, Application, Volume I, Appendix F). This analysis includes emissions from mobile VLCCs and other support vessels, to assess compliance with the NAAQS and PSD increments. This analysis also evaluated the ambient impact of emissions of the chemical species subject to the TCEQ MERA process and the emissions of SO_2 and H_2S subject to review under the TCEQ State Property Line Standards.

For NEPA purposes, the criteria pollutant air quality analysis was conducted in a single phase consisting of the refined phase, with nearby sources included in the modeling emission inventory. The analysis included an increment analysis and a NAAQS analysis, but did not include a significant impacts analysis in which the calculated maximum impacts due only to the proposed facility are determined for each pollutant with a net emissions increase that exceeds the PSD significant emission rate.

Analysis of Class I area impacts was unnecessary because there are no Class I areas located within 200 miles of the proposed Project; therefore, impacts on visibility or vistas, as regulated in the PSD permitting process, at any Class I areas are unlikely. The closest Class I area is Breton NWR, approximately 382 miles to the east.

Model Selection

The dispersion modeling analysis used a combination of the latest version of the American Meteorological Society/USEPA Regulatory Model (AERMOD-AERCOARE) using Version 18081 for AERMOD and Version D13108 for AERCOARE. AERCOARE estimates surface energy fluxes over water for use in the dispersion modeling conducted via AERMOD.

Source Characterization and Emissions

All emission sources at the facility that vent to stacks with a well-defined opening, as well as the VLCC and support vessels, were modeled as point sources. Fugitive emissions are those that are not emitted from a well-defined opening. Of the constituents subject to MERA, only benzene would be emitted as a fugitive. The fugitive benzene emissions were modeled as a volume source (i.e., a three-dimensional source of emissions).

Potential hourly emission rates were modeled for all stationary sources in assessing compliance with both short-term and annual standards. Vessels perform numerous activities, including transiting the safety zone and mooring. Maximum hourly emissions from each vessel activity were also used in assessing compliance with both short-term and annual standards for all pollutants except for NO_x. The transiting vessels were modeled using the annual average NO_x emission rate in assessing compliance with the 1-hour NO_2 standard. The annual NO_x emission from the transiting vessels used to assess compliance with the annual NO_2 standard conservatively included emissions from transiting vessels in both safety zones. As an additional conservative measure, transiting vessels were positioned in the model in only one safety zone. Concentrating the modeled vessel locations in a single safety zone would result in higher emissions concentrations than if the modeled vessel locations were more widely distributed. In addition, the NO_x annual average emissions for tugboats included emissions associated with non-transiting tug activities.

Selection of Background Monitoring Data

Several onshore air quality monitors within 62 miles of the proposed Project supply ambient monitoring data. Existing monitoring data were evaluated in relation to the criteria in USEPA's Ambient Monitoring Guidelines (USEPA 1987) as being representative of the Project site and proposed for use in both the Source Impact Analysis of 40 CFR § 52.21(k) and the Air Quality Analysis requirements of 40 CFR § 52.21(m). Pursuant to the guidelines, the representative monitoring data should be based on three key criteria, which include monitoring location, quality of the data, and timestamp of the data to the most current available date.

The 2015-2017 quality-assured ozone data from the Galveston 99th Street monitor (Air Quality System [AQS] # 48-167-1034 were used to establish representative background particulate matter equal to or less than 2.5 micrometers in diameter ($PM_{2.5}$), and NO_2 concentrations to fulfill the requirements of 40 CFR § 52.21(k) and (m). The Texas City Ball Park monitor (AQS # 48-167-0005) was used for SO_2, the Houston Deer Park No. 2 monitor (AQS # 48-201-1039) was used for CO and particulate matter equal to or less than 10 micrometers in diameter (PM_{10}), and the Lake Jackson monitor (AQS #48-039-1016) was used for ozone.

Receptor Locations

In accordance with 40 CFR § 50.1(e), the Applicant placed modeled receptors in areas considered as "ambient air" (see SPOT 2019a, Application, Volume IIa, Appendix Q for the receptor locations). Ambient air is defined as the atmosphere, external to buildings, to which the general public has access. For the SPOT Project, offshore public access was defined as the area outside the proposed safety zones around the SPM buoys. The Applicant has proposed two safety zones, one around each SPM buoy, each with a radius of 3,140 feet centered on the buoy, and an additional safety zone around the platform with a 1,640-foot radius.

The AERMOD analysis included approximately 17,300 receptors in three Cartesian grids. The three grids included: one 2,500 meters (8,202 feet) from the safety zone in all directions with receptors spaced 100 meters (328 feet) apart; one extending 2,500 to 7,500 meters (8,202 to 24,606 feet) from the safety zone in all directions with receptors spaced 250 meters (820 feet) apart; and one extending 7,500 to 20,000 meters (24,606 to 65,617 feet) from the safety zone in all directions with receptors spaced 500 meters (1,640 feet) apart. The purpose of the Cartesian grid design was to capture the maximum facility impacts within the nearest grid where receptors are spaced closest together and so that impacts for all pollutants were less than the SIL to demonstrate compliance with NAAQS at the receptor grid boundary. Each receptor was placed at sea level (i.e., elevation of 0 meters [0 feet]).

Selection of Meteorological Data

The Applicant used AERCOARE to compile the meteorological data and other estimates for input into AERMOD for dispersion modeling. Inputs needed for AERCOARE include wind speed, wind direction, air and sea temperature, atmospheric pressure, wave height, and wave period. Overwater hourly meteorological data between 2012 and 2017 from the NOAA National Data Buoy Center were used for input into AERCOARE (SPOT 2019a, Application, Volume IIa, Appendix Q). Buoy measurements of dew point temperature and dry bulb temperature from Buoy 42035, the nearest buoy with sufficient and current data, were used to calculate relative humidity values. Buoy 42035 is located 22.0 nautical miles east of Galveston, Texas, and 32.0 nautical miles northeast of the proposed Project site, and the data from this buoy met the 90 percent by quarter completeness criterion for all required meteorological parameters except for dew point temperature. Buoy 42035 was missing dew point temperatures for a 7-month period in 2015 and for the majority of 2016; as such, dew point temperatures from Buoy 42019 were used to supplement the data set and account for the missing dew point temperatures. Data from other nearby buoys were not used, as the buoys did not monitor all the required meteorological parameters, did not have historical measurements, or the data records did not meet the 90 percent by quarter completeness criterion of the USEPA's Meteorological Monitoring Guidance (USEPA 2000). However, all buoys near the Project site were missing dew point temperatures between June 16 and July 27, 2015. To fill in this missing month, the Applicant used the average of the dew point temperature data for that same month from Buoy 42035 for other calendar years (i.e., 2012, 2013, 2016, and 2017).

NO_2 Modeling Approach

The Applicant's model followed USEPA guidance to use a three-tiered screening approach for the AERMOD NO_2 modeling analyses. Tier 1 was used with the conservative assumption that 100 percent of the available NO_X would convert to NO_2. Tier 2 (Ambient Ratio Method) was then used with the USEPA's recommended minimum NO_2/NO_X ratio of 0.5 and maximum NO_2/NO_X ratio of 0.9. The Applicant did not use Tier 3 for NO_2 modeling.

Emissions from sources that emit intermittently (i.e., the emergency backup diesel generator and the two firewater pumps) were modeled in the 1-hour NO_2 analysis pursuant to guidance from the USEPA dated March 1, 2011 (USEPA 2011), which indicates that any source with emissions that does not have the potential to substantially contribute to the annual distribution of the daily maximum concentrations could either be excluded from the analysis or the emissions could be based on an average hourly rate, rather than the maximum hourly rate. For the SPOT Project, sources that would fit this description would include sources that operate intermittently, such as the emergency backup diesel generator and the firewater pumps. In addition, vessels in transit would fit this description, as they are not stationary and would not contribute to the annual distribution of daily maximum NO_2 concentrations. As such, the Applicant used the annual average emission rate for modeling emergency equipment and transiting vessels. For transiting vessels, the Applicant considered the annual NO_x emission rate for both safety zones, but assumed that rate would occur within a single safety zone.

Secondary $PM_{2.5}$ and Ozone Analysis Approach

Potential ozone and secondary $PM_{2.5}$ impacts were evaluated using the Modeled Emission Rate for Precursor (MERP) approach under the USEPA's MERP guidance (USEPA 2017b). Direct $PM_{2.5}$ emissions were modeled using USEPA-approved dispersion techniques based on its final Guidance for $PM_{2.5}$ Permit Modeling (USEPA 2014) and updated based on the USEPA Regional, State, and Local Modelers Workshop held on June 5, 2018. The MERP approach was used to estimate the secondary $PM_{2.5}$ contribution from both NO_X and SO_2 emissions. The Project's ozone precursor emissions were evaluated under the USEPA's MERP guidance to determine whether the Project would result in quantifiable ozone formation. The results of the $PM_{2.5}$ and ozone MERP analyses show that the total air quality impacts would be less than the $PM_{2.5}$ increment and the ozone SIL (SPOT 2019a, Application, Volume IIa, Appendix Q).

Summary of Modeling Results

Table 3.12-12 presents results of the NAAQS analysis. The modeling results show that total concentrations are below the standards for each constituent; therefore, the Project would comply with the NAAQS.

Table 3.12-12: NAAQS Analysis Results

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)	Background Concentration ($\mu g/m^3$)	Total Concentration ($\mu g/m^3$)	NAAQS ($\mu g/m^3$)
NO_2	1-Hour	110.24[1]	56.25	166.5	188
	Annual	14.9	6.16	21.1	100
SO_2	1-Hour	56.6[2]	55.5	112.1	196
	3-Hour	58.17	101.2	159.4	1,300
$PM_{2.5}$	24-Hour	3.12[3]	21.7	24.8	35
	Annual	1.22	7.2	8.4	12
PM_{10}	24-Hour	5.62[4]	70.3	75.9	150
CO	1-Hour	184	2,400	2,585	40,000
	8-Hour	87.1	1,372	1,459	10,000

Source: SPOT 2019a, Application, Volume IIa, Appendix Q

$\mu g/m^3$ = microgram per cubic meter; CO = carbon monoxide; NAAQS = National Ambient Air Quality Standards; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; SO_2 = sulfur dioxide

Notes:

1. Based on the 98th percentile of the annual distribution of maximum daily 1-hour concentrations, averaged across the 5 years of meteorological data modeled. Ambient Ratio Method was employed for the 1-hour and annual NO_x to NO_2 conversions.
2. Based on the 99th percentile of the annual distribution of daily concentrations, averaged across the 5 years of meteorological data modeled.
3. Direct $PM_{2.5}$ based on the 98th percentile of the annual distribution of daily concentrations, averaged across the 5 years of meteorological data modeled.
4. Based on the highest 6th high concentration across the five years of meteorological data modeled.
5. NO_2 concentration is approximately 88 percent of the NAAQS standard; approximately one-third of the total concentration can be attributed to the background concentration. Similarly, $PM_{2.5}$ concentration is approximately 70 percent of the NAAQS standard and greater than 85 percent of the total concentration can be attributed to background levels.

Evaluation of compliance with the short-term increment was based on the highest second-high value, which is the highest value of the second-highest concentration from the 5 years of meteorological data. The maximum annual concentrations were used to assess compliance with the annual increments. Table 3.12-13 presents the results of the increment analysis. The cumulative modeling results show that the Project would comply with the PSD increments.

Table 3.12-13: PSD Increment Analysis Results

Pollutant	Averaging Period	Modeled Concentration ($\mu g/m^3$)[1]	PSD Class II Increment ($\mu g/m^3$)
NO_x[2]	Annual	14.9	25
$PM_{2.5}$[2]	24-Hour	7.29	9.0
	Annual	1.42	4.0
PM_{10}	24-Hour	7.55	30
	Annual	1.49	17
SO_2	3-Hour	58.2	512
	24-Hour	27.8	91
	Annual	6.2	20

Source: SPOT 2019a, Application, Volume IIa, Appendix Q

$\mu g/m^3$ = micrograms per cubic meter; NO_x = nitrogen oxides; PM_{10} = particulate matter equal to or less than 10 micrometers in diameter; $PM_{2.5}$ = particulate matter equal to or less than 2.5 micrometers in diameter; PSD = Prevention of Significant Deterioration; SO_2 = sulfur dioxide

Notes:

1. Short-term compliance based on the maximum highest second-high value from the 5 years of meteorology. Annual compliance based upon maximum-modeled concentration from the 5 years of meteorological data modeled.
2. NO_x concentration is approximately 59 percent of the PSD increment. Similarly, secondary $PM_{2.5}$ concentration is approximately 81 percent of the PSD increment.

Table 3.12-14 presents the results of the TCEQ MERA and State Property Line modeling. The modeled impacts are below the standards; therefore, the Project's impacts would comply with the applicable state air quality standards.

Table 3.12-14: TCEQ MERA and State Property Line Analysis Results

Pollutant	Averaging Period	Maximum Modeled Impact ($\mu g/m^3$)	Standard ($\mu g/m^3$)	Analysis
SO_2	30-minute[1]	27.1	1,021	State Property Line
H_2S	30-minute[1]	1.27	108	
Benzene	1-Hour	2.63	170	MERA
	Annual	0.11	4.5	

Source: SPOT 2019a, Application, Volume IIa, Appendix Q

$\mu g/m^3$ = micrograms per cubic meter; H_2S = hydrogen sulfide; MERA = Modeling and Effects Review; SO_2 = sulfur dioxide

Notes:

1. 1-hour impacts were compared to the 30-minute standard.

Based on the air dispersion modeling analysis results described above, none of the emissions from the Project would exceed the NAAQS, PSD increments, TCEQ MERA standards, or State Property Line Standards. As such, Project operation would comply with relevant Federal and state regulations and guidance for air pollution, and impacts associated with the proposed Project operation would be direct and indirect, adverse, long-term, and minor.

The onshore and offshore components are separated by a significant enough distance from each other that the impacts from the respective components would not overlap. Therefore, if both onshore and offshore operational activities are considered together, impacts on air quality from operation would be direct and indirect, adverse, long-term, and minor to moderate, depending on the amount of GHGs emitted by the Oyster Creek Terminal. Additional information regarding cumulative operational air quality impacts is included in Section 5.3.7.1, Cumulative Impacts of the Proposed Action on Air Quality.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vessels and equipment, including a helicopter. Impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct and indirect, adverse, short-term, and minor.

3.12.6. Greenhouse Gas Impact Assessment

There has not been an appropriate methodology for use on the SPOT Project established to attribute discrete, quantifiable, physical effects on the environment to the Project's incremental contribution to GHGs. While global models exist, these models are not reasonable for project-level analysis, due to both scale and overwhelming complexity. It is not currently possible to determine localized or regional impacts from GHG emissions from the Project.

However, three tools that allow agencies to capture the full costs of GHG emissions by taking global damages into account are the social cost of carbon, social cost of nitrous oxide, and social cost of methane tools. These tools provide estimates of global monetary damages associated with GHG emissions by assessing climate change–related impacts such as agricultural productivity, human health, property damage from increased flood risk, increased demand for utilities, and the value of ecosystem services. Extreme weather conditions associated with climate change (e.g., flooding, droughts, and increased storms) would result in decreased agricultural productivity. Extreme temperature due to climate change and associated impacts on air and water quality would affect human health. Sea level rise, shoreline erosion, flooding, and wildfires associated with climate change would result in property damage, impacts to transportation infrastructure, as well as potential human health effects. Temperature extremes due to climate change would result in increased demands for electricity and other utilities for cooling and heating. Loss of biodiversity because of climate-driven stress could amplify impacts of climate change on agriculture (Executive Order 13990, 86 Fed. Reg. 14 [January 25, 2021]). All of these impacts would have a monetary cost.

As directed by Executive Order 13990 (86 Fed. Reg. 14 [January 25, 2021]), a U.S. Interagency Working Group issued interim technical guidance in February 2021 establishing social costs of carbon, nitrous oxide, and methane. Based on the social costs provided in this guidance, MARAD and the USCG calculated the aggregate social cost based on the GHG emissions associated with the construction of the Project. Table 3.12-15 provides the estimated social cost of carbon for aggregated offshore and onshore construction emissions by year based upon the current construction schedule. Table 3.12-16 provides the estimated social costs of carbon, nitrous oxide, and methane for aggregated offshore and onshore operational emissions per year in 5-year increments based on the estimated 25-year project lifespan. Both Tables 3.12-15 and 3.12-16 include discount rates ranging from 2.5 percent to 5 percent.[21] This range of discount rates reflects the current range of variability in research related to global social impacts of GHG emissions and captures a reasonable range of potential social costs (IWG 2021).

[21] The discount rate assesses the present value of future climate change damages. A higher discount rate results in a lower present value for future climate change damages, and a lower discount rate results in a higher present value for future climate change damages (USEPA 2016f).

Table 3.12-15: Estimated Social Cost of Construction GHG Emissions

Construction Year / Construction Emission Type	5% Average Discount Rate [a]	3% Average Discount Rate [a]	2.5% Average Discount Rate [a]
2023			
Carbon dioxide [b]	$239,900	$819,912	$1,217,721
2024			
Carbon dioxide [b]	$468,324	$1,570,600	$2,330,200
2025			
Carbon dioxide [b]	$540,885	$1,781,639	$2,640,643

[a] Calculated based on estimated construction emissions provided by the Applicant's Response to IR#331 (SPOT 2021d) and social cost of carbon, nitrogen, and methane for the calendar year during which the GHGs would be emitted (Executive Order 13990, 86 Fed. Reg. 14 [January 25, 2021]).

[b] Calculated based on CO_2e estimates for construction.

Table 3.12-16: Estimated Social Cost of Annual Operational GHG Emissions

Operational Year / Operational Emission Type	5% Average Discount Rate [a]	3% Average Discount Rate [a]	2.5% Average Discount Rate [a]
2025			
Carbon dioxide	$3,238,656	$10,668,513	$15,812,260
Nitrous oxide	$57,571	$177,792	$253,989
Methane	$6,886	$14,632	$18,935
Total	$3,303,112	$10,860,937	$16,085,184
2030			
Carbon dioxide	$3,619,674	$11,811,568	$16,955,315
Nitrous oxide	$66,037	$194,725	$279,388
Methane	$8,091	$17,214	$21,518
Total	$3,693,802	$12,023,506	$17,256,220
2035			
Carbon dioxide	$4,191,201	$12,764,114	$18,288,879
Nitrous oxide	$76,197	$211,657	$304,786
Methane	$9,468	$18,935	$24,100
Total	$4,276,866	$12,994,706	$18,617,765
2040			
Carbon dioxide	$4,762,729	$13,907,169	$19,622,443
Nitrous oxide	$84,663	$237,056	$330,185
Methane	$11,189	$21,518	$26,682
Total	$4,858,581	$14,165,742	$19,979,310
2045			
Carbon dioxide	$5,334,256	$15,050,224	$20,956,007
Nitrous oxide	$101,595	$253,989	$355,584
Methane	$12,911	$24,100	$30,125
Total	$5,448,762	$15,328,312	$21,341,716
2050			
Carbon dioxide	$6,096,293	$16,193,278	$22,099,062

Operational Year / Operational Emission Type	5% Average Discount Rate [a]	3% Average Discount Rate [a]	2.5% Average Discount Rate [a]
Nitrous oxide	$110,062	$279,388	$380,983
Methane	$14,632	$26,682	$32,707
Total	$6,220,987	$16,499,348	$22,512,752

[a] Calculated based on social cost of carbon, nitrogen, and methane for 2025, 2030, 2035, 2040, 2045, and 2050 (Executive Order 13990, 86 Fed. Reg. 14 [January 25, 2021]).

As shown in Table 3.12-15, the social costs of construction emissions associated with the Project for the year with the greatest emissions (2025) range from $540,855 to $2,640,643 depending on the discount rate chosen. As shown in Table 3.12-16, the social costs of annual operational emissions associated with the Project range from $3,303,112 to $16,085,184 in year 2025, the first proposed year of Project operation to $6,220,987 to $22,512,752 in 2050, depending on the discount rate chosen. As shown in Tables 3.12-15 and 3.12-16, there is a large variability of potential social costs of GHG emissions within the same year depending on the discount rate chosen.

Comparing the GHG emissions associated with the Project to state and national GHG emissions is a useful method to assess the overall scale of the GHG emissions associated with the Project. For construction year 2023, the construction-related GHG emissions associated with the Project (42,219 metric tons) would represent 0.0007 percent of the total GHG emissions of the United States[22] (5.788 billion metric tons) when compared to the GHG emissions for 2019 (USEPA 2021a), and would represent 0.0111 percent of the direct GHG emissions for all sectors reported for Texas[23] (0.380 billion metric tons) for 2019 (USEPA, 2021b). Annual operational GHG emission associated with the Project would represent 0.0033 percent of the total GHG emissions of the United States when compared to the GHG emissions for 2019, and would represent 0.0508 percent of the direct GHG emissions for all sectors reported for Texas for 2019.

Although the Project would result in ongoing operational GHG emissions, the transfer of oil via a deepwater port could eliminate the need for smaller ship-to-ship transfer tankers to travel from ports to lightering areas to fill the VLCCs. As discussed in Section 3.11.4.2, MARAD and the USCG estimated that this could result in the elimination of 935 shuttle tanker round trips per year traveling from Galveston and other nearby ports to VLCCs in lightering areas, which in turn would result in the lower air emissions (including GHG emissions) from lightering activities. As shown in Table 3.12-10, loading of a VLCC via the SPOT Project could result in 785.8 to 896.7 fewer tons of CO_2e compared to loading of a comparable VLCC via reverse lightering depending on the type of vessel used in the reverse lightering process. These reductions in emissions assume the current crude oil exports accomplished using shoreside ports and reverse lightering would instead be accomplished by using DWPs.

Potential reductions in emissions are important in the United States' effort to meet global climate goals. As part of the United States' commitment to implement the Paris Agreement under the United Nation's Framework Convention on Climate Change, the United States submitted a Nationally Determined

[22] Total U.S. GHG emissions for 2019 based on draft inventory of U.S. GHG emission sources and sinks.

[23] Total Texas GHG emissions for 2019 based on emissions reported under the Greenhouse Gas Reporting Program and do not include: 1) Petroleum and Natural Gas Systems Onshore Production and Gathering and Boosting segments, which are reported at the geologic basin level, which may cross state boundaries; and 2) emissions from electric distribution systems, which are reported at the corporate level and are not able to be allocated to individual states.

Contribution (NDC) on April 21, 2021 pledging to reduce economy-wide net greenhouse gas pollution by 50 to 52 percent from 2005 levels by 2030. The National Climate Advisor developed the NDC in consultation with the Special Presidential Envoy for Climate, and it was approved by President Biden. The NDC is based on an analysis of the electricity, transportation, buildings, industry, and land sectors of the economy (Office of Domestic Climate Policy 2021).

The construction-related GHG emissions associated with the Project would occur over a relatively short time period, would not require an air permit under the CAA, and would represent a very small percentage of Texas and U.S. GHG emissions during the construction year with the greatest potential emissions (2023). While there would be a social cost associated with construction-related GHG emissions, there would also be monetary benefits associated with Project construction. Based on these factors, the construction-related GHG emissions associated with the Project would have a direct, adverse, short-term, and negligible effect on climate change.

The operational GHG emissions associated with the Project would occur over the life of the Project. The DWP would be considered a major source for GHG emissions under the CAA. Depending on the discount rate, the DWP could result in social costs ranging from $3,303,112 in 2025 to up to $22,512,752 in 2050, and would represent a small percentage of Texas and U.S. GHG annual emissions. While there would be a social cost associated with operational GHG emissions, there would also be monetary benefits associated with Project operation. Based on these factors, the operational GHG emissions associated with the Project would have a direct, adverse, long-term, and minor effect on climate change.

3.12.7. General Conformity

Section 176 of the CAA establishes requirements to ensure that Federal actions or actions approved by Federal agencies do not adversely affect a state's ability to achieve and maintain attainment with the NAAQS for projects located in a nonattainment area for one or more criteria pollutants. These rules are known as the General Conformity Rule (40 CFR § 51.850–51.860, 40 CFR § 93.150–93.160). General Conformity requires Federal agencies to ensure their actions do not specifically cause or contribute to any new air quality standard violations, increase the frequency or severity of any existing standard violation, or delay the timely attainment of any standard, interim emission reduction, or other milestone. The General Conformity rule was amended by the USEPA in 2010 (see 75 Fed. Reg. 17,253 [April 5, 2010]) to exclude from a General Conformity analysis emissions regulated by any permit issued under minor and major NSR, rather than only major NSR emissions.

If General Conformity applies (i.e., a project requiring Federal action is located in a nonattainment area), a conformity determination is required for each pollutant for which the total direct and indirect emissions would equal or exceed *de minimis* levels, which are based on a calendar year (40 CFR § 93.153). The SPOT Project's onshore construction workspace would be within the HGB ozone nonattainment area (SPOT 2019h). In addition, the ozone nonattainment area extends 2.6 nautical miles offshore over state waters; therefore, a portion of the offshore pipeline construction workspace would be within the nonattainment area. During operation, activities that would contribute emissions that would fall under General Conformity would include helicopter trips between Freeport and the platform, and supply vessel transits between shore and the platform. Table 3.12-17 details the total construction emissions within the HGB ozone nonattainment zone (SPOT 2019h, 2021d).

Table 3.12-17: Total Construction Emissions within the HGB Ozone Nonattainment Area (Tons per Year)

Nonattainment Area	Emissions (tons/year)	
	NO_x	**VOC**
Onshore Construction	35.5	5.9
Offshore Construction	0.0	0.0
Total Project Year 1 (2023)	**35.5**	**5.9**
Onshore Construction	24.0	5.1
Offshore Construction	74.8	1.3
Total Project Year 2 (2024)	**98.8**	**6.4**
Onshore Construction	0.0	0.0
Offshore Construction	0.8	<0.1
Total Project Year 3 (2025)	**0.8**	**<0.1**

Source: SPOT 2022c

NO_x = nitrogen oxide; VOC = volatile organic compounds

The HGB area was most recently designated as nonattainment under the 2015 ozone NAAQS with a marginal classification (83 Fed. Reg. 25776, June 4, 2018), for which the General Conformity *de minimis* threshold is 100 tons per year of NOx or VOCs. However, because the USEPA has not taken action to revoke the 2008 ozone NAAQS, the HGB area is also currently subject to General Conformity requirements under the 2008 ozone NAAQS, due to its nonattainment status for that standard. Because the HGB area missed its 2008 ozone moderate nonattainment area attainment date of July 20, 2018 (as prescribed in 80 Fed. Reg. 12264, March 6, 2015), the USEPA issued a final rule on August 23, 2019 (84 Fed. Reg. 44238) reclassifying the HGB area to serious nonattainment of the 2018 ozone NAAQS, effective September 23, 2019. As such, the applicable General Conformity *de minimis* threshold for the HGB area is 50 tons per year of NOx or VOCs, and the General Conformity analysis for the SPOT Project will utilize this *de minimis* threshold value.

The total annual emissions of VOC from construction of onshore and offshore Project components would be less than the *de minimis* threshold of 50 tons per year. However, total annual emissions of NO_x would be greater than the *de minimis* threshold for one year of construction, which based on the final Project schedule is planned for 2024. MARAD and the USCG worked with the USEPA Region 6 and the TCEQ to evaluate the Project under General Conformity and compiled a draft determination, which was subject to a 30-day public comment period. A final General Conformity determination is included in Appendix V. In the event that the Project schedule is modified and the *de minimis* threshold is exceeded in a calendar year beyond 2024, the General Conformity determination would need to be reevaluated.

Emissions during operation would amount to 1.2 tons per year for NO_x and 0.1 ton per year for VOC, which are both well below the threshold of 50 tons per year (SPOT 2019a, Application, Volume IIa). Therefore, a General Conformity determination is not required for operational emissions, including NOx and VOC.

3.13. NOISE

This section defines noise and describes how it propagates through air and under water, identifies existing threats from noise in both mediums, describes the existing onshore and offshore noise conditions within the Project area, identifies potential noise impacts associated with construction and operation of the Project, and reviews proposed mitigation measures.

3.13.1. Definition of the Resource

The terms noise and sound are often used interchangeably. Sound is energy created by vibrations—when an object vibrates, it causes the surrounding air particles to vibrate, resulting in sound waves. An individual, human or animal, within range of the vibrations (i.e., sound waves) hears the sound. Sound is a normal and desirable part of life. Noise is a class of sounds that are considered unwanted, and in some situations, noise can adversely affect the health and well-being of individuals, both human and animal. Consequently, noise is defined as audible acoustic energy that adversely affects, or can affect, the physiological and psychological well-being of people (Berglund and Lindvall 1995).

The standard unit of sound measurement is the dB. The dB scale is a measure used to quantify sound power or sound pressure. A sound power level describes the acoustical energy of a sound and is independent of the medium in which the sound is traveling. Because sound consists of variations in pressure, the unit for measuring sound is referenced to a unit of pressure, the Pa. A dB is defined as the ratio between the measured SPL in µPa and a reference pressure. In air, the sound reference level is dB re 20 µPa, which relates to the amplitude of a sound wave's loudness with a pressure of 20 µPa. In water, the reference level is dB re 1 µPa. Table 3.13-1 provides examples of common sound levels in air for comparison purposes.

Table 3.13-1: Comparison of Typical A-Weighted Sound Levels in Air

Source of Sound	In Air (dB re 20 µPa at 1 meter)
Rock-n-roll band	136-146
Jet flyby by an altitude of 1,000 feet	126-136
Power mower [a]	116-126
Heavy truck at 40 miles/hour at 49 feet; blender [a]	106-116
Car at 62 miles/hour at 25 feet; clothes washer [a]	96-106
Ocean surf; vacuum cleaner; air conditioner at 20 feet [a]	86-96
Light traffic at 98 feet	76-86
Ocean offshore; quiet residential area, daytime	66-76
Quiet residential area, nighttime	56-66
Wilderness area	46-56

Source: Richardson et al. 1995

µPa = microPascal; dB re 20 µPa = decibels relative to 20 µPa

[a] Measured at operator's position

In air, sounds are often weighted to reflect higher hearing sensitivity at particular frequencies (i.e., to reflect how the human ear perceives sound). The most common weighting scale used is the A-weighted scale (dBA), which was developed to allow sound-level meters to simulate the frequency sensitivity of human hearing. Since noise levels can vary over a given time period, they are evaluated using various descriptors, such as the equivalent sound level (L_{eq}), which is an average of the time-varying sound energy for a specified period; day-night sound level (L_{dn}), which is an average of the time-varying sound energy for one 24-hour period, with a 10-dB addition to the sound energy for the time between 10 p.m.

and 7 a.m., to account for increased noise sensitivity during nighttime hours; and maximum sound level (L_{max}), which is the maximum sound level during a measurement period or noise event.

In water, sound travels as vibrations of the fluid particles in a series of pressure waves. The waves comprise a series of pressure variations and fluctuations. Three common descriptors used to describe underwater noise are Peak SPL (dB re 1 μPa), root mean square (RMS) SPL (dB re 1 μPa), and sound exposure level (SEL) (dB relative to 1 microPascal squared normalized to 1 second). The Peak SPL is the instantaneous maximum overpressure or underpressure observed during an acoustic event. The Peak SPL is unweighted and commonly quoted for impulsive sounds.[24] The RMS SPL is a measure of the average amplitude of the variations in pressure over the duration of an acoustic event. The SEL is a measure of the total acoustic energy of an event or a number of events (e.g., over the course of a day) and is normalized to 1 second. The cumulative SEL (SEL_{cum}) is used in underwater acoustics as it accounts for the accumulated exposure over the duration of an activity within a 24-hour period (NMFS 2016, 2018c).

3.13.2. Existing Threats

3.13.2.1. Onshore Threats

The onshore acoustic environment is currently affected by a variety of sources. Existing sources of airborne noise near the Project area include mobile sources, such as automobiles, buses, trucks, aircraft, and trains, or stationary sources, such as machinery or mechanical equipment associated with industrial and manufacturing operations or building heating, ventilating, and air conditioning systems.

There are no Federal regulatory limits for airborne noise beyond the environmental analysis required by the DWPA and NEPA; however, in 1974, the USEPA published *Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety* (USEPA 1974). This publication evaluates the effects of environmental noise with respect to health and safety, and provides information for state and local governments to use in developing their own ambient noise standards. To protect the public from activity interference and annoyance outdoors in residential areas, the USEPA has determined that noise levels should not exceed of 55 dBA L_{dn}. The USEPA considers an L_{dn} of 55 dBA to be the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas (USEPA 1974).

There are no state or local ambient noise regulations applicable to the onshore components of the proposed Project.

3.13.2.2. Offshore Threats

Sources of offshore anthropogenic sound are becoming more pervasive and more powerful, increasing oceanic background noise levels and peak sound intensity levels. Anthropogenic activities in the ocean have increased over the past 50 years, resulting in more low frequency (less than 1,000 Hz) and mid-frequency (1 to 20 kHz) noise. In general, sources of anthropogenic noise in the ocean include

[24] Impulsive sounds are typically transient, brief (less than 1 second), broadband, and consist of high peak sound pressure with rapid rise time and rapid decay. Non-impulsive sounds can be broadband, narrowband or tonal, brief or prolonged, continuous or intermittent, and typically do not have a high peak sound pressure with rapid rise/decay time.

commercial shipping, defense-related activities, research, recreation, underwater explosions (nuclear and otherwise), seismic exploration, and naval sonar operations (Hildebrand 2005; Weilgart 2007).

The marine soundscape in the GoM is composed of both natural and anthropogenic sources. Bird calls, interaction of wind and sea surface, precipitation (rain) falling on the water surface, and sounds produced by marine wildlife (marine mammals, fish, and invertebrates) are the dominating natural noise sources. Ship traffic and offshore energy industry operations are the most substantial source of noise generated by human activity in the GoM. Service vessels and helicopters, drilling rigs, derrick barges, and pipeline construction barges are all substantial noise sources. These sources can impact marine life, some of which are protected by the ESA and the MMPA, which prohibits the intentional harassment of marine mammals. The most relevant information to consider when assessing the impacts of underwater sound on marine mammals is the MMPA and the *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* recently revised by NMFS (NMFS 2016, 2018c). The following subsections describe these criteria for marine mammals, as well as guidance related to sea turtles and fish.

3.13.2.3. Underwater Noise Regulatory Criteria

Underwater noise associated with the proposed Project is assessed against criteria derived from U.S. policy and recent guidance concerning marine fauna hearing sensitivity. NMFS provided two types of criteria in the MMPA: Level A and B harassment criteria. Level A harassment is defined as any act of pursuit, torment, or annoyance that has the potential to injure a marine mammal or marine mammal stock in the wild. Level B harassment is defined as any act of pursuit, torment, or annoyance that has the potential to disturb a marine mammal or marine mammal stock in the wild by causing disruption of behavioral patterns, including, but not limited to, migration, breathing, nursing, breeding, feeding, or sheltering. The criteria are further separated for continuous and impulsive sounds.

3.13.2.4. National Marine Fisheries Service Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammals

NMFS released its *Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing* (NMFS 2016, 2018c) to assess the potential impacts of underwater sound sources on species-specific marine mammals. In the Technical Guidance, NMFS equates the onset of permanent threshold shift (PTS) with “Level A Harassment” as defined in the MMPA, and with “harm” as defined in the ESA. Therefore, PTS is considered equivalent to these two types of takes. NOAA equates temporary threshold shift (TTS) as “Level B Harassment” as defined in the MMPA and “harassment” as defined under the ESA. NOAA also considers behavioral changes to constitute “harassment” and “Level B Harassment.” PTS refers to a permanent increase in the threshold of audibility for an ear at a specified frequency above a previously established reference level, whereas a TTS is a temporary change in hearing sensitivity that is non-injurious and reversible.

NMFS specifies functional hearing groups based on different hearing ranges of different groups of marine mammals. Table 3.13-2 presents the estimated auditory bandwidth and species applicable to the associated functional hearing group. As further described in Section 3.5, Wildlife and Aquatic Resources, marine mammals potentially present in the area of the GoM in which the SPOT Project has been proposed include those from the following functional hearing groups: low-frequency cetaceans (i.e., Rice’s whale, fin whale, North Atlantic right whale) and mid-frequency cetaceans (i.e., sperm whale and various dolphin species). No marine mammals included in the high frequency, phocid pinniped, or otariid pinniped functional hearing groups would be present in the Project area.

Table 3.13-2: Marine Mammal Functional Hearing Groups from NMFS Guidance

Functional Hearing Group	Estimated Auditory Bandwidth	Relevant Species
Low-frequency cetaceans	7 Hz to 35 kHz	Baleen whales
Mid-frequency cetaceans	150 Hz to 160 kHz	Dolphins, toothed whales
High-frequency cetaceans	275 Hz to 160 kHz	Harbor porpoise
Phocid pinnipeds (underwater)	50 Hz to 86 kHz	True seals
Otariid pinnipeds (underwater)	60 Hz to 39 kHz	Sea lions, fur seals

Source: NMFS 2016, 2018c

Hz = Hertz; kHz = kilohertz

NMFS' Technical Guidance prescribes the applicable criteria for assessing underwater noise impacts on marine mammals. The Technical Guidance proposes criteria utilizing both Peak SPL and SEL_{cum}. The criteria depend on whether the underwater sound produced is on an impulsive or non-impulsive basis. Table 3.13-3 presents a summary of injury (PTS and TTS) and behavioral response criteria for marine mammals for impulsive and non-impulsive sounds.

Table 3.13-3: Underwater Noise Injury and Behavioral Response Criteria for Marine Mammals

Hearing Group	Permanent Injury onset, Peak SPL (dB re 1µPa)	Permanent Injury onset, SEL_{cum} (dB re 1 µPa²s)		Temporary Injury onset, Peak SPL (dB re 1µPa)	Temporary Injury onset, SEL_{cum} (dB re 1 µPa²s)		Behavioral Response, RMS SPL (dB re 1µPa)	
	Impulsive	Impulsive	Non-impulsive	Impulsive	Impulsive	Non-impulsive	Impulsive	Non-impulsive
Low-frequency cetaceans	219	183	199	213	168	179	160	120
Mid-frequency cetaceans	230	185	198	224	170	178	160	120
High-frequency cetaceans	203	155	173	196	140	153	160	120
Phocid pinnipeds (underwater)	218	185	201	212	170	181	160	120
Otariid pinnipeds (underwater)	232	203	219	226	188	199	160	120

Source: NMFS 2016, 2018c; 70 Fed. Reg. 7 (January 11, 2005)

µPa = microPascal; dB re 1µPa = decibels relative to 1 µPa; dB re 1 µPa²s = decibels at a reference pressure of 1 µPa squared normalized to 1 second; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level

Sound is a critical component in the natural history of marine mammals. Each species makes use of sound in different ways to forage, orient, detect, or respond to predators. Bottlenose dolphins produce sounds in the frequency range of 100 Hz to 35 kHz at a source level (dB re 1 µPa at 1 meter) of 137 to 236 dB and are considered able to hear sounds between 150 Hz to 160 kHz. Toothed whales (including mid-frequency cetaceans such as the bottlenose whale) typically produce sounds across the widest band of frequencies, with audiograms having a general U-shape and a functional hearing range between approximately 150 Hz and 160 kHz. Their social vocalizations range from a few hundreds of Hz to tens of kHz (Southall et al. 2007). They also generate specialized echolocation clicks at frequencies above 100 kHz that are used to detect, localize, and characterize underwater objects such as prey.

Ocean noise pollution is of particular concern to marine mammals because of their high dependency on sound as their primary sense for navigating, finding prey, avoiding predators, and communicating with other marine fauna. Marine mammals may have varying reactions to noise. Noise disturbances may cause marine mammals to leave a habitat, impair their ability to communicate, or cause stress (Hildebrand 2005). Noise can cause behavioral changes and mask other sounds including their own vocalizations. Marine mammals' behavioral responses to noise range from no response to panic and flight (Southall et al. 2007). Displacement (both short- and long-distance) has been observed for cetaceans in response to in-water noise and can cause marine animals to move into less suitable habitat or into high traffic areas where they may be at risk of vessel collision.

Increasing ship traffic affects the ability of whales and dolphins to communicate, search for prey, and avoid predators. Over the past decades, commercial shipping has become more prevalent, which in turn has led to an overall increase in underwater noise (Wright 2008). The sound frequency range within which whales communicate and echolocate overlaps with the frequency ranges of ship noise (Richardson et al. 1995). Reported whale responses to increased noise include habitat displacement, behavioral changes, and alterations in the intensity, frequency, and intervals of calls. However, it has been unclear whether exposure to increased noise results in responses that may lead to substantial consequences for individual whales or whale populations (Rolland et al. 2012).

Noise can also cause masking, which is the interference of a marine mammal's ability to send and receive acoustic signals due to the presence of another sound. Acoustic masking from anthropogenic noise is increasingly being considered as a threat to marine mammals, particularly low-frequency species such as baleen whales. Low-frequency ocean noise has increased in recent decades, often in habitats with seasonally resident populations of marine mammals, raising concerns that noise chronically influences life histories of individuals and populations. In contrast to physical harm from intense anthropogenic sources, which can have acute impacts on individuals, masking from chronic noise sources has been difficult to quantify at individual or population levels, and resulting effects have been even more difficult to assess (Clark et al. 2009).

Stress due to noise can lead to long-term health problems, and may pose increased health risks for populations by weakening the immune system and potentially affecting fertility, growth rates, and mortality (Romano et al. 2004). Stress-related responses from increased ambient and local noise levels can include rapid swimming away from ship(s), changes in surfacing, breathing, and diving patterns, changes in group composition; and changes in vocalizations (Richardson et al. 1995). Louder anthropogenic sounds may also lead to TTS or PTS, which in turn could interfere with foraging efforts or increase vulnerability to predators.

Ambient noise levels in the ocean within the auditory range critical for environmental, military, and economic interests are predicted to increase substantially with global climate change due to the combined effects of decreased absorption and increasing sources from anthropogenic activities (Hester et al. 2008). When GHGs react in the ocean, they lower pH, creating more acidic waters. The more acidic the water, the less sound waves are absorbed, thereby reducing the ability of surface seawater to absorb sound at frequencies important to marine mammals. A louder ocean would negatively affect cetaceans that rely on sound to navigate, communicate, find food, and avoid predators.

3.13.2.5. Noise Exposure Criteria for Sea Turtles and Fish

Little is known about how sea turtles make use of sound in both terrestrial and underwater environments. Currently, there are no NMFS established criteria for injury or behavioral disturbance or harassment for sea turtles (NMFS 2015). Physical examinations of green and loggerhead turtles indicate that sea turtles possess a typical reptilian ear with a few underwater modifications. This conclusion supports the theory that fish hearing, rather than marine mammal hearing, is the better model to use for sea turtles until there are sufficient data (Popper et al. 2014). For impulsive sources, Popper et al. (2014) estimate injury threshold levels of 210 dB re 1 microPascal squared normalized to 1 second SEL_{cum} and 207 dB re 1 µPa Peak SPL. NMFS, in a recent ESA Section 7 Biological Opinion, estimated sea turtle underwater acoustic injury threshold to occur at RMS SPL value of 207 dB re1 µPa (NMFS 2015).

Data are limited regarding sea turtle behavioral responses to sound levels below those expected to cause injury. However, sea turtles have been observed to modify their behavior in response to low frequency, impulsive sounds from seismic sources (McCauley at al. 2000). In August 1997, the Center for Marine Science and Technology of Curtis University in Western Australia conducted tests to determine sea turtle response to nearby air gun exposure. The tests showed that above an air gun level (approximately 166 dB re 1 µPa RMS SPL) the sea turtles noticeably increased their swimming activity compared to non-air gun operation periods. Further, it showed that above 175 dB re 1 µPa RMS SPL their behavior became more erratic, possibly indicating the sea turtles were in an agitated state (McCauley et al. 2000).

Based on the information above, sea turtle underwater acoustic injury and behavioral thresholds are believed to occur at 207 dB re 1 µPa RMS SPL and 166 dB re 1 µPa RMS SPL, respectively (Table 3.13-4). No distinction is made between impulsive and continuous sources for these thresholds.

Table 3.13-4: Underwater Noise Criteria for Sea Turtles

Hearing Group	Injury Criteria, RMS SPL (dB re 1 µPa)	Behavioral Response, RMS SPL (dB re 1 µPa)
Sea turtles	207	166

Source: NMFS 2015; McCauley et al. 2000

µPa = microPascal; dB re 1µPa = decibels relative to 1 µPa; RMS = root mean square; SPL = sound pressure level

The Fisheries Hydroacoustic Working Group (FHWG) was formed in 2004 and consists of biologists from NMFS, USFWS, the Federal Highway Administration, and the California, Washington, and Oregon Departments of Transportation, supported by national experts on sound propagation activities that affect fish and wildlife species of concern. In June 2008, the agencies reached agreement on the interim injury criteria for exposure to fish from impulsive noise sources (pile driving activities in particular). Behavioral impacts on fish were not addressed in the agreement; however, an RMS SPL in excess of 150 dB re 1 µPa is expected to cause temporary behavioral changes, such as elicitation of a startle response, disruption of feeding, or avoidance of an area (WSDOT 2019). Table 3.13-5 presents the current injury and behavioral thresholds for fish. The underwater sound exposure criteria for sea turtles (Table 3.13-4) and fish (Table 3.13-5) are based on the best available scientific data and are to be treated as interim until further research allows refinement and completion.

Table 3.13-5: Underwater Noise Criteria for Fish

Hearing Group	Injury Criteria, Peak SPL (dB re 1 µPa)	Injury Criteria, SELcum (dB re 1 µPa²s)	Behavioral Response, RMS SPL (dB re 1 µPa)
Fish (≥ 2 grams)	206	187	150
Fish (< 2 grams)	206	183	150

Source: FHWG 2008; WSDOT 2019

µPa = microPascal; dB re 1µPa = decibels relative to 1 µPa; dB re 1 µPa²s = decibels at a reference pressure of 1 µPa squared normalized to 1 second; RMS = root mean square; SELcum = cumulative sound exposure level; SPL = sound pressure level

3.13.3. Onshore Noise

3.13.3.1. Existing Conditions

GIS imagery was used to identify noise sensitive areas (NSAs) surrounding the ECHO Terminal, Oyster Creek Terminal, and HDD entry and exit locations along the onshore pipeline routes. NSAs include inhabited residences, schools, places of worship, parks, medical facilities, and nursing homes within 1 statute mile of the proposed facilities and/or activities.

Table 3.13-6 presents the locations of the nearest NSAs (all residences) and distances to the existing ECHO Terminal boundary. On November 1, 2018, L_{eq} levels were recorded adjacent to the existing ECHO Terminal. The average 24-hour L_{eq} for the measurement period was 66.9 dBA. Details of the ambient noise survey, including monitoring location and NSA map, instrumentation, methodology, and results are provided in Appendix R, SPOT Project Onshore Noise Impact Reports.

Table 3.13-6: ECHO Terminal Noise Sensitive Area Locations

NSA	NSA Type	Distance and Direction of Nearest NSA to Facility Boundary
NSA 1	Residence	1,000 feet southeast
NSA 2 [a]	Residence	840 feet southwest
NSA 3	Residence	1,175 feet west

Source: SPOT 2019i; Appendix R, SPOT Project Onshore Noise Impact Reports

ECHO = Enterprise Crude Houston; NSA = noise sensitive area

[a] The sound level meter was positioned near NSA 2. Due to the proximity of the NSAs, the ambient sound level recorded near NSA 2 was assumed representative of all three NSAs.

Table 3.13-7 presents the locations of the nearest NSAs (all residences) and distances to the proposed Oyster Creek Terminal. On November 28 and 29, 2018, 24-hour L_{eq} ambient levels were recorded adjacent to the proposed Oyster Creek Terminal. The measured hourly L_{eq} levels ranged between 56.9 and 76.7 dBA. The average 24-hour L_{eq} for the measurement period was 72.3 dBA, and the measured L_{dn} was 77.2 dBA. Details of the ambient noise survey, including monitoring location and NSA map and closest NSAs, instrumentation, methodology, and results are provided in Appendix R, SPOT Project Onshore Noise Impact Reports.

Table 3.13-7: Oyster Creek Terminal Noise Sensitive Area Locations

NSA	NSA Type	Distance and Direction of Nearest NSA to Facility Boundary
NSA 1 [a]	Residence	165 feet northeast
NSA 2	Residence	220 feet northeast
NSA 3	Residence	200 feet southeast
NSA 4	Residence	7,150 feet southwest
NSA 5	Residence	4,950 feet west

Source: SPOT 2019j; Appendix R, SPOT Project Onshore Noise Impact Reports

NSA = noise sensitive area

[a] The sound level meter was positioned near NSA 1. Due to the proximity of the NSAs, the ambient sound level recorded near NSA 1 was assumed representative of all five NSAs.

The onshore pipelines (ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines, collectively) would require a total of 23 HDD locations (18 single-line HDDs and 5 dual-line HDDs), each of which would require one entry and one exit site making a total of 46 entry or exit sites. From May 8 to 10, 2019, ambient noise surveys were conducted to document the existing noise levels near multiple HDD entry and exit locations along the proposed onshore pipeline routes. Table 3.13-8 presents the results of 24-hour L_{eq} ambient levels recorded at six representative locations (near residences and businesses) along the onshore pipeline routes. The measured 24-hour L_{eq} levels ranged between 53.4 and 62.6 dBA. As ambient sound level varies by location and local noise environment, the nearest measured ambient sound level to each HDD site was used as the representative ambient sound level for each site. Details of the ambient noise survey, including monitoring location and NSA maps, instrumentation, methodology, and results are provided in Appendix R, SPOT Project Onshore Noise Impact Reports.

Table 3.13-8: Measured 24-Hour Ambient Average Sound Levels for HDD Sites

Associated HDD Site	ECHO to Shoreline Ambient Sound Level (dBA Leq)
ECHO to Oyster Creek Pipeline (Single-Line HDDs)	
HDD #12: BO-0030	62.6
HDD #14: BO-0112	61.9
HDD #15: BO-0129	58.0
HDD #16: BO-0142	58.1
HDD #17: HWY 171	57.2
Oyster Creek to Shore Pipelines (Dual-Line HDDs)	
HDD #1: BO-0238	53.4

Source: SPOT 2019k; Appendix R, SPOT Project Onshore Noise Impact Reports

dBA = A-weighted decibels; HDD = horizontal directional drill; L_{eq} = average of the time-varying sound energy for a specified period

There are no known noise limits applicable to the onshore pipeline routes; therefore, the ambient noise levels measured at designated locations along the pipeline are used as a guideline noise limit for assessing potential impacts associated with the Project.

3.13.3.2. Onshore Noise Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the onshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on sensitive resources from noise. The study area within which potential impacts were assessed is a 1-mile radius around proposed construction workspaces. This is the farthest distance at which Project construction activities could produce intrusive sound levels when taking into account the ambient noise level in the Project area, based on the USEPA L_{dn} threshold of 55 dBA, compared with the typical pile hammer noise level of 36 dBA at 1 mile, which is the most conservative distance within which to determine potential impacts from onshore construction (see Table 3.13-12). However, to determine whether mitigation would be recommended, the noise levels at the NSA nearest the noise source were used.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's onshore noise effects have been evaluated based on their potential to:

- Cause a substantial change in existing ambient noise levels on land, which would affect humans and wildlife;
- Exceed USEPA recommended thresholds for noise levels at noise sensitive receptors (i.e., NSAs); and/or
- Violate state or local noise ordinances, limits, or standards, or applicable land use compatibility guidelines.

The remainder of this section describes potential impacts from onshore Project construction and operation on noise levels due to the use of heavy construction equipment, HDDs, and operational activities at the ECHO Terminal and Oyster Creek Terminal. There are no known noise limits applicable to the existing ECHO Terminal. Based on the measured ambient noise level, impacts on NSAs may require noise mitigation if the noise levels modeled at nearby NSAs exceed the measured 24-hour L_{eq} of 66.9 dBA.

In addition, there are no known noise limits applicable to the Oyster Creek Terminal site; therefore, the ambient L_{dn} and the lowest measured hourly L_{eq} are used for comparing construction and operational noise levels. Based on the measured ambient noise levels, impacts on NSAs would be considered significant and require noise mitigation if the noise levels modeled at nearby NSAs exceed either the measured ambient L_{dn} of 77.2 dBA or the lowest measured ambient 1-hour equivalent level of 56.9 dBA.

Airborne Construction Noise Impact

The primary sources of onshore airborne noise associated with the proposed Project would occur during the expansion of the ECHO Terminal and construction of the Oyster Creek Terminal, onshore pipelines, and MLVs from:

- Heavy construction equipment involving earth-moving, site preparation, and building/facility construction; and
- HDD operations during onshore pipeline construction.

Onshore pipeline and aboveground facility construction would cause temporary increases in ambient noise levels in the immediate vicinity of the proposed construction sites. During the expansion of the ECHO Terminal and construction of the proposed Oyster Creek Terminal, noise from construction activities would mainly occur from heavy construction equipment (e.g., trucks, backhoes, front-end loaders, and cranes). Heavy construction equipment would be used during different stages of construction (e.g., clearing, grading, paving, and construction traffic).

In general, pipeline construction in areas near residences would be limited to the shortest timeframe possible. Table 3.13-9 presents typical mobile and stationary pipeline construction equipment and corresponding noise emission levels. Noise from pipeline and aboveground facility construction activities that would occur near an NSA may be intermittent or continuous, but would be limited to short durations at any one location.

Table 3.13-9: Typical Pipeline and Aboveground Facility Construction Equipment Noise Levels

Construction Equipment [a]	Maximum Noise Level (Lmax) at 50 feet from Source (dBA)
Pump	81
Generator	81
Compressor (air)	78
Sandblasting Machine	96
Grader	89
Backhoe	78
Crane	81
Welding Machine	74
Excavator	81
Dozer	82
Front End Loader	79
Side Boom [b]	81
Motor Grader	89
Dump Truck	76

Source: WSDOT 2018

dBA = A-weighted decibels; Lmax = maximum sound level during a measurement period or a noise event

[a] Equipment shown is typical for pipeline construction. A specific construction equipment inventory for onshore component construction is currently not available.

[b] Assumed noise data for a crane.

Noise levels from onshore HDD operations are expected to temporarily increase above existing ambient levels at 23 HDD entry or exit locations. HDD operations would occur over the course of the 5-month construction schedule for the onshore pipelines. The majority of construction would take place during daytime hours; however, 24-hour construction would be used for HDDs. As discussed in Section 3.13.3.1, Noise, Onshore Noise, Existing Conditions, the nearest NSAs to the onshore HDD sites are mostly residences and businesses located within 0.5 mile of the entry and exit points. Predictive modeling was conducted by the Applicant to evaluate HDD noise levels at occupied structures adjacent to the proposed HDD entry and exit sites and determine which sites might require noise mitigation during HDD operations (Appendix R, SPOT Project Onshore Noise Impact Reports).

To reduce impacts from onshore HDDs on ambient background levels, the Applicant has committed to installing temporary acoustic panels around noise sources such as shakers and generators and/or perimeter sound walls around the HDD locations noted in Table 3.13-10 as requiring noise mitigation (Appendix R, SPOT Project Onshore Noise Impact Reports; BMP #31 in Appendix N). The model results show the use of these acoustic sound walls and sound panels would reduce the noise level at all NSAs to below the ambient noise level.

Table 3.13-10: Noise Modeling Results for Horizontal Directional Drills for the Onshore Pipelines

Location Identification	Nearest Receptors	Ambient Noise Level (dBA) [a]	Unmitigated Operational Noise Level (dBA)		Mitigated Operational Noise Level		Mitigation Type
			HDD Entry Noise Level	HDD Exit Noise Level	HDD Entry Noise Level	HDD Exit Noise Level	
ECHO to Oyster Creek Pipeline (Single-Line HDDs)							
HDD #1: Galveston Road	NSA 1 (entry) NSA 3 (exit)	66.9 66.9	42.8	57.2	NA	NA	None
HDD #2: Retention Pond	NSA 4 (entry) NSA 1 (exit)	69.2 69.2	44.1	57.1	NA	NA	None
HDD #3: I-45	NSA 1 (entry) NSA 3 (exit)	69.0 69.0	45.9	44.6	NA	NA	None
HDD #4: HCFCD A119	NSA 2 (entry) NSA 5 (exit)	59.3 59.3	72.6	62.3	54.9	57.4	• 16-foot-high sound wall (420 feet long) at entry • 12-foot-high sound wall (100 feet long) at entry • 16-foot-high sound wall (300 feet long) at exit
HDD #5: Sageglen Drive	NSA 5 (entry) NSA 2 (exit)	59.3 59.3	65.1	61.9	57.9	58.0	• 16-foot-high sound wall (260 feet long) at entry • 16-foot-high sound panels (32 feet long) at entry • 12-foot-high sound wall (240 feet long) at exit
HDD #6: Hughes Road	NSA 3 (entry) NSA 1 (exit)	69.8 (entry) 59.3 (exit)	50.9	62.3	NA	57.9	• 16-foot-high sound wall (300 feet long) at exit
HDD #7: HCFCD A120	NSA 1 (entry) NSA 3 (exit)	69.3	68.2	61.9	NA	NA	None
HDD #8: Blackhawk Boulevard	NSA 4 (entry) NSA 2 (exit)	69.0	54.4	65.3	NA	NA	None
HDD #9: Pearland Parkway	NSA 1 (entry) NSA 2 (exit)	60.7	52.9	54.7	NA	NA	None
HDD #10: Mykawa Road/BNSF Railroad	NSA 1 (entry) NSA 2 (exit)	68.8	49.9	36.5	NA	NA	None

Location Identification	Nearest Receptors	Ambient Noise Level (dBA) [a]	Unmitigated Operational Noise Level (dBA)		Mitigated Operational Noise Level		Mitigation Type
			HDD Entry Noise Level	HDD Exit Noise Level	HDD Entry Noise Level	HDD Exit Noise Level	
HDD #11: HCFCD A100	NSA 4 (entry) NSA 2 (exit)	62.9	43.6	58.9	NA	NA	None
HDD #12: Property Tract BO-0030	NSA 2 (entry) NSA 4 (exit)	62.9	68.1	60.8	59.4	NA	• 16-foot-high sound wall (300 feet long) at entry • 12-foot-high sound panels (300 feet long) at entry
HDD #13: Mary's Creek	NSA 4 (entry) NSA 2 (exit)	62.9	51.0	65.3	NA	59.7	• 12-foot-high sound wall (280 feet long) at exit
HDD #14: Property Tract BO-0112	NSA 1 (entry) NSA 3 (exit)	61.9	42.4	48.8	NA	NA	None
HDD #15: Property Tract BO-0129	NSA 2 (entry) NSA 2 (exit)	58.0	40.5	44.6	NA	NA	None
HDD #16: Property Tract BO-0142	NSA 1 (entry) NSA 1 (exit)	58.1	36.1	32.7	NA	NA	None
HDD #17: BNSF Railroad/Highway 71	NSA 2 (entry) NSA 1 (exit)	57.2	51.0	41.9	NA	NA	None
HDD #18: Bastrop Bayou	NSA 1 (entry) NSA 2 (exit)	61.0	41.3	36.8	NA	NA	None
Oyster Creek to Shore Pipelines (Dual-Line HDDs)							
HDD #1: Property Tract BO-0238	NSA 1 (entry) NSA 2 (exit)	53.4	51.5	57.5	NA	52.6	• 16-foot-high sound wall (320 feet long) at exit
HDD #2: Oyster Creek (OC) 1	NSA 1 (entry) NSA 4 (exit)	54.0 (entry) 52.5 (exit)	58.9	60.3	53.9	52.0	• 16-foot-high sound wall (620 feet long) at entry • 12-foot-high sound panels (64 feet long) at entry • 16-foot-high sound wall (340 feet long) at exit • 12-foot-high sound panels (48 feet long) at exit
HDD #3: Oyster Creek (OC) 2	NSA 1 (entry) NSA 1 (exit)	52.6	47.7	36.8	NA	NA	• None

Location Identification	Nearest Receptors	Ambient Noise Level (dBA) [a]	Unmitigated Operational Noise Level (dBA)		Mitigated Operational Noise Level		Mitigation Type
			HDD Entry Noise Level	HDD Exit Noise Level	HDD Entry Noise Level	HDD Exit Noise Level	
HDD #4: Oyster Creek (OC) 3	NSA 1 (entry) NSA 1 (exit)	50.5	46.5	38.5	NA	NA	• None
HDD #5: Gulf Intracoastal Waterway/Swan Lake	NSA 4 (entry) NSA 5 (exit)	60.7 (entry) 50.5 (exit)	64.4	48.2	57.2	NA	• 16-foot-high sound wall (200 feet long) at entry • 12-foot-high sound panels (180 feet long) at entry)

Source: SPOT 2019k; Appendix S, SPOT Project Onshore Noise Impact Reports

dBA = A-weighted decibels; HDD = horizontal directional drill; NA = not applicable; NSA = noise sensitive area

[a] Ambient noise levels provided in L_{eq}, which is an average of the time-varying sound energy for a specified period

In addition to installing temporary acoustic panels at certain HDD locations, the Applicant has also committed to implementing the following BMPs when construction noise exceeds background noise levels during HDD activities:

- Prohibit unnecessary idling of internal combustion engines (BMP #22 in Appendix N).
- Shut off all equipment when not in use (BMP #22).
- Keep all equipment in good repair, and replace all worn, loose, and unbalanced machines parts as soon as possible (BMP #22).
- Keep stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from neighboring houses (BMP #22).
- Designate a “disturbance coordinator” who would be responsible for responding to any complaints about facility noise. The “disturbance coordinator” would determine the cause of the noise complaint (e.g., bad muffler) and require that reasonable measures be implemented to correct the problem (BMP #22).
- Use mufflers on appropriate equipment during operation (BMP #22).

The average 24-hour L_{eq} for the measurement period at the existing ECHO Terminal is 66.9 dBA. The measured hourly L_{eq} levels at the Oyster Creek Terminal site ranges between 56.9 and 76.7 dBA and the measured L_{dn} is 77.2 dBA. No temporary acoustic panels and/or perimeter sound walls would be used around noise sources during construction at the existing ECHO or proposed Oyster Creek Terminals. Based on the results of a study completed by the Applicant (Appendix R, SPOT Project Onshore Noise Impact Reports), the noise generated during construction at the ECHO and Oyster Creek Terminals would be below the ambient noise levels at the nearest NSAs.

Based on the information provided above for the onshore facilities and the BMPs the Applicant would implement, construction of the proposed onshore components would have a direct, adverse, short-term, and minor impact on airborne noise.

Airborne Operation Noise Impact

The primary sources of airborne noise associated with operation of the Project would include equipment at the existing ECHO Terminal and the proposed Oyster Creek Terminal. At the existing ECHO Terminal, new equipment would include:

- Four main line crude oil pumps (10,000 hp each; electric-driven)
- Four booster crude oil pumps (2,500 hp each) working in parallel
- Four HVAC units
- Two transformers

At the proposed Oyster Creek Terminal, new equipment, which includes that proposed for initial operation and that proposed for expanded future operations, would include:

- 6 mainline crude oil pumps (9,000 hp each; electric-driven)
- 4 booster crude oil pumps (900 hp each; electric-driven)
- 3 vapor combustion units, 2 permanent and 1 portable
- 21 tank mixer motors
- 13 transformers
- 13 to 15 HVAC units

The Applicant conducted predictive modeling to evaluate the ECHO Terminal operational noise levels at nearby NSAs. The results of the unmitigated noise modeling analysis indicate the predicted noise levels at the three NSAs would be 41.8, 44.7, and 39.2 dBA, which would all be below the measured background noise level of 66.9 dBA. Therefore, additional noise mitigation would not be needed during operation of the ECHO Terminal (see Appendix R, SPOT Project Onshore Noise Impact Reports).

The Applicant also conducted predictive modeling to evaluate operational noise levels at nearby NSAs to the Oyster Creek Terminal site for both initial operation and expanded future operations (Table 3.13-11).

Table 3.13-11: Noise Modeling Results for Operation of the Oyster Creek Terminal

Receptor	Ambient Noise Level (dBA L_{eq})	Operation (dBA L_{eq})		Ambient Noise Level (dBA L_{dn})	Operation (dBA L_{dn})	
		Initial	Future		Initial	Future
NSA 1	56.9	51.2	51.2	77.2	57.6	57.6
NSA 2	56.9	52.4	52.5	77.2	58.8	58.9
NSA 3	56.9	48.6	48.6	77.2	55.0	55.0
NSA 4	56.9	41.9	41.9	77.2	48.3	48.3
NSA 5	56.9	43.3	43.3	77.2	49.7	49.7

Source: SPOT 2019j; Appendix R, SPOT Project Onshore Noise Impact Reports

dBA = A-weighted decibels; L_{dn} = average of the time-varying sound energy for one 24-hour period; L_{eq} = average of the time-varying sound energy for a specified period; NSA = noise sensitive area

The predicted noise levels from both initial and future operation of the Oyster Creek Terminal would be below the measured L_{eq} and L_{dn}; therefore, additional noise mitigation measures would not be needed during operation of the Oyster Creek Terminal in its initial stage or in the future.

While additional engineered noise mitigation measures would not be needed at the ECHO Terminal and Oyster Creek Terminal, the Applicant has committed to implementing the following BMPs to limit noise levels associated with operation of the ECHO Terminal and the Oyster Creek Terminal when construction noise exceeds background levels:

- Prohibit unnecessary idling of internal combustion engines (BMP #22 in Appendix N).
- Shut off all equipment when not in use (BMP #22).
- Keep all equipment in good repair, and replace all worn, loose, and unbalanced machines parts as soon as possible (BMP #22).
- Keep stationary noise-generating equipment, such as air compressors or portable power generators, as far as possible from neighboring houses (BMP #22).
- Designate a "disturbance coordinator" who would be responsible for responding to any complaints about facility noise. The "disturbance coordinator" would determine the cause of the noise complaint (e.g., bad muffler) and require that reasonable measures be implemented to correct the problem (BMP #22).
- Use mufflers on appropriate equipment during operation (BMP #22).

Operational noise from lower generating sources such as the MLVs were not modeled, due to their small contribution to overall operational noise. Operation of the onshore pipelines would not increase ambient noise levels, because the pipelines would be buried and any noise produced by the flow of crude oil and other products would be mitigated by at least 3 feet of soil and vegetation coverage. Based on the results of the quantitative analyses for the ECHO Terminal and Oyster Creek Terminal, and the Applicant's proposed BMPs, the operation of proposed Project onshore components would have direct, adverse, long-term, minor impacts on airborne noise.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vehicles and equipment. Impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, short-term, and minor.

3.13.4. Offshore Noise

3.13.4.1. Existing Conditions

Existing ambient noise conditions in the GoM are the result of naturally occurring sounds and sounds from anthropogenic sources. Examples of naturally occurring sound include wind, wave action, storms, and earth movements, as well as sounds created by marine wildlife. Examples of anthropogenic noise include commercial shipping, oil and gas exploration and production activities (e.g., seismic air guns), commercial and recreational fishing, recreational boating and whale watching activities, offshore power generation, research (e.g., sonar and telemetry), and military training and testing activities. Vessel noise in particular is a large contributor to noise in the marine environment and intensively used inland waters, as described in Section 3.13.2, Noise, Existing Threats.

In November 2018, the Applicant conducted acoustical monitoring to establish the baseline underwater noise conditions of the waters at the proposed SPOT DWP site prior to installation activities. A total of 42 hours of recordings were collected and of those, 36 hours were analyzed for their acoustic characteristics. The first 3 hours were excluded from the analysis due to the elevated noise levels caused by the deployment of the acoustic recorder used for the study. The average RMS SPL and maximum Peak SPL values recorded were 93 dB re 1 μPa and 109 re 1 μPa, respectively. The major noise sources observed during the survey were from snapping shrimp, weather, and anthropogenic sources (e.g., vessels and possible trawling activity). Details of the baseline acoustic monitoring, including survey location and methods, are provided in Appendix W, SPOT Water Quality Environmental Baseline Survey: Acoustic Monitoring Offshore Texas.

3.13.4.2. Offshore Noise Impacts and Mitigation

This section includes a discussion of the impacts that would likely result from construction and operation of the offshore components of the SPOT Project, as well as BMPs that the Applicant would employ to minimize impacts on sensitive resources from noise. The study area within which potential impacts were assessed includes designated navigation channels and fairways for the Port Freeport and Galveston area, as these are the most frequently used areas surrounding the SPOT DWP with the highest ambient underwater noise levels (Section 3.11, Transportation).

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's offshore noise effects have been evaluated based on their potential to cause a substantial change in existing ambient noise levels underwater, which would affect marine wildlife. The remainder of this section describes potential impacts from offshore Project construction and operation on noise levels due to the use of heavy construction equipment, pile driving, jet sledding, construction vessel transits, and helicopter flights and VLCC or other crude oil carrier transits during operation. Impacts on marine wildlife are discussed in detail in Section 3.5, Wildlife and Aquatic Resources, and Appendix E, Biological Assessment and Essential Fish Habitat Assessment.

Offshore Airborne Construction Noise Impacts

Given the distance from the SPOT DWP to the nearest NSAs onshore (30.7 nautical miles) and the distance from the seaward end of the shore crossing HDD (nearly 1 mile from the shore), there would be no airborne noise impact during construction of the offshore components of the Project at onshore NSAs. Construction noise impacts would vary based on the activity and distance from shore, but would be temporary at any given location as construction moves along the subsea pipeline route out to the SPOT DWP site. In addition, safety zones and an ATBA/NAA would be established to prevent vessels not related to the construction of the Project from coming within more than 1,000 meters of the SPM buoys or platform. Airborne noise associated with construction activities that are within hearing distance of onshore receptors would be similar to and consistent with the noise already generated by regional vessel traffic and standard construction noise. During construction, operating barges, tugs, and large diesel engine support vessels are expected to be the dominant noise sources; however, each of these sources would be temporary during construction only. Table 3.13-12 lists the offshore construction equipment and the corresponding SPLs that would be expected between 500 feet and 1 mile from the noise source. Noise impacts associated with construction of the offshore components would be temporary. In addition, all noise sources would fall below the USEPA-established threshold of 55 dBA at 1,000 feet from the source; therefore, noise impacts on NSAs onshore or on fishing or other vessels offshore would be direct, adverse, short-term, and negligible.

Table 3.13-12: Typical Noise Sources during Offshore Construction

Source	SPL (at 1 meter)	500 Feet Away (dBA)	1,000 Feet Away (dBA)	2,500 Feet Away (dBA)	1 Mile Away (dBA)
Derrick barge main engine	90	46.4	40.4	32.4	25.9
Material barge main engine	90	46.4	40.4	32.4	25.9
Quarters barge main engine	90	46.4	40.4	32.4	25.9
Work boat main engine	90	46.4	40.4	32.4	25.9
Crew boat main engine	90	46.4	40.4	32.4	25.9
Derrick barge crane engine	85	41.4	35.4	27.4	20.9
Derrick barge bow thrusters	85	41.4	35.4	27.4	20.9
Vessel generator engines (250 hp)	82	38.4	32.4	24.4	17.9
Pile hammer	100	56.4	50.4	42.4	35.9
Worst case, all equipment	102	58.4	52.4	44.4	37.9

Source: SPOT 2019a, Application, Volume IIa, Section 11.3.2.1; TORP 2006

dBA = A-weighted decibels; SPL = sound pressure level

Note: The dBA calculations are distance-based. The 0.4 and 0.9 results from the calculation methodology. In addition, because some equipment has the same SPL, the reduction over distance would be the same for these pieces of equipment.

Underwater Construction Noise Impact

The primary sources of underwater noise associated with the proposed Project during construction and installation of the SPOT DWP and subsea pipelines would be from:

- Impact pile driving during installation of the PLEMs and the platform;
- Offshore pipeline installation via HDD;
- Pipe-lay vessels, trenching vessel, support tugs, supply vessels, and remotely operated vehicle vessels used during sled trench installation of the offshore pipelines; and
- Cargo barges, supply vessels, dive support vessels, and installation vessels used during installation of the platform, SPMs, PLEMs, and associated pipelines and hoses.

Additional information regarding construction procedures for the offshore components of the SPOT Project can be found in Section 2.2.6, Offshore Construction and Installation.

Construction of the SPOT DWP would include the installation of 16, 30-inch-diameter steel piles for the PLEMs, driven to a depth of 60 feet below the seafloor, and 8, 72-inch-diameter jacket steel piles for the platform, driven to a depth of 380 feet below the seafloor. Platform piles would require 1,278 strikes per hour and operation would occur 24 hours per day. They would be installed using a conventional impact hammer, which would operate for 2 hours every 6 hours. There would then be a 12-hour welding and cool-down period. This cycle would be repeated eight times over the course of 10 days. This process would be repeated eight times and would result in a total of 10,224 strikes per pile. For the PLEM piles, the impact hammer would operate 24 hours a day, with one pile driven continuously approximately every 8 hours over 5.3 days. Strikes would occur every 40 minutes with an estimated maximum of 408 strikes per 30-inch pile.

Typical underwater SPLs produced by various construction and operation activities are summarized in Table 3.13-13. Source SPLs were not available for 30-inch- or 72-inch-diameter steel piles at water depths of approximately 115 feet; however, SPLs for 30-inch- and 96-inch-diameter steel piles at shallower water depths were available to include in the analysis.

Table 3.13-13: Typical Underwater Sound Pressure Levels for Various Construction and Operation Activities

Construction/Operation Activity	Project Component	Peak SPL (dB re 1 μPa)	SELcum (dB re 1 μPa²s)	RMS SPL (dB re 1 μPa)
30-inch steel piles by impact hammer [a]	PLEM	210	183	193
72-inch steel piles by impact hammer [a]	Jacket for platform	220	194	205
HDD [b]	Subsea pipelines	NA	NA	129.5
Clam shell bucket [c]	Jacket for platform, SPM buoys, PLEMs	156.6	NA	NA
Small vessels (dual 310-hp engines) [d]	General construction	NA	NA	160
Dive support vessel (thruster power of 5,032 bhp) [e]	General construction	NA	NA	177.9
Tug boat [f]	Anchor handling	NA	NA	170
Tug boat [g]	VLCC	175	NA	172
VLCC moving [g]	VLCC	NA	NA	186
VLCC moored [h]	VLCC	NA	NA	NA
Jet sledding [b, i]	Subsea pipelines	NA	NA	168

Sources: [a] Caltrans 2020; [b] Nedwell et al. 2012; [c] Dickerson et al. 2001; [d] Naval Surface Warfare Center 2003; [e] Neptune LNG 2016; [f] NMFS 2018d; [g] Richardson 1995

μPa = microPascal; bhp = brake horsepower; dB = decibels; dB re 1μPa = decibels relative to 1 μPa; dB re 1 μPa²s = decibels at a reference pressure of 1 μPa squared normalized to 1 second; HDD = horizontal directional drill; hp = horsepower; NA + not applicable; PLEM = pipeline end manifold; RMS = root mean square; SPM = single point mooring; SPL = sound pressure level; SELcum = cumulative sound exposure level; VLCC = very large crude carrier

[h] No suitable proxy available.

[I] Based on jet trenching, as no documented measurements are available for jet sledding.

Pile driving associated with construction of the proposed SPOT DWP has the potential to cause behavioral changes and physiological damage to marine mammals, sea turtles, and fish. The scale and nature of the pile driving activity associated with installation of the proposed Project, application of BMPs (Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures), and proximity of marine wildlife (marine mammal, sea turtle, or fish) to the sound source determines the level of potential impact of noise from pile driving.

The offshore pipelines would be installed using the jet sledding construction technique, which uses high-pressure water jets to break up the consolidated bottom of the seafloor and suctions the material to be placed to the side of the trench. In addition, the subsea pipelines would be installed via the HDD method from the shore crossing to approximately 5,500 feet offshore. Non-impulsive sound (continuous noise) from construction and supply vessel transits, including the use of thrusters for dynamically positioned vessels, would also contribute to the noise levels near the SPOT Project, but would be intermittent in nature and dependent on the construction activity.

Overall, underwater noise from construction of the Project would result in direct, adverse, short-term to long-term, and minor to major impacts on marine wildlife. See Section 3.5, Wildlife and Aquatic Resources, and Appendix E, Biological Assessment and Essential Fish Habitat Assessment for additional descriptions and determinations of noise impacts on marine species.

Offshore Operation Noise Impact

Operational activities would include VLCC and other crude oil carrier transits, support tug movements, supply vessel transits, and helicopter flights associated with maintenance activities and delivery of personnel and goods to the SPOT DWP. Specifically, VLCC and other crude oil carrier transits, support tug movements, and supply vessel transits would result in underwater noise.

Offshore Airborne Operation Noise Impact

Supply vessels and helicopters would be the primary modes for transporting personnel and supplies between onshore bases and the SPOT DWP. Sound generated from supply vessel traffic would be transient. The intensity and frequency of the noise levels would be highly variable, both between and among these sources. The SPOT DWP would require approximately one supply vessel twice weekly. In addition, loading operations would typically require two tugboats each time. Noise associated with supply vessels and tugboats offshore would be diminished over distance to any onshore NSAs. In addition, onshore ports are typically located in industrial areas where vessel and mechanical noises do not normally affect the community. Most high-speed vessel operations would occur far enough offshore to have little impact on noise levels at onshore locations.

One regular helicopter flight per week would be needed to deliver personnel and/or supplies. Sounds from helicopter use are typically associated with the rotors and are generally less than 500 Hz (Lowson and Ollerhead 1969). The altitude of the helicopter strongly influences noise levels at surface level and, because of noise concerns, the FAA regulates helicopter flight patterns and encourages pilots to maintain higher-than-minimum altitudes near NSAs (FAA Circular 91-36C).

Operation of the offshore platform would include the use of noise-producing equipment, such as vapor combustors with blowers, power-generating equipment (engines), pumps, and other rotating equipment. Noise levels for this equipment at various distances from the sound source are listed in Table 3.13-14.

Table 3.13-14: Typical Noise Sources during Offshore Platform Operation

Source	Sound Power (LwA)	1,000 Feet Away (dBA)	1 Statute Mile Away (dBA)	10 Statute Miles Away (dBA)
Vapor combustors (three) [a]	90	37.2	24.5	7.0
Diesel engine electric generators [b]	125	51.7	34.0	9.7

Source	Sound Power (LwA)	1,000 Feet Away (dBA)	1 Statute Mile Away (dBA)	10 Statute Miles Away (dBA)
Pedestal crane diesel engine (mechanical)	115	47.6	31.3	8.9
Pumps	102.4	42.4	27.9	7.9
Instrument air package	99.9	39.9	25.4	5.4

Source: SPOT 2019a, Application, Volume IIa, Section 11.3.2.2

dBA = a-weighted decibels, LwA = A-weighted sound power

[a] The primary noise source would be the electric motor-driven blower.

[b] Two units would be installed, but only one would operate at a time.

Based on the transient nature of supply vessel and helicopter trips, the distance of these operational activities from the shore, and the diminishing noise levels at a distance from the sound source, impacts from airborne noise on NSAs onshore or receptors in the vicinity of the offshore components during operation would be direct, adverse, and long-term, and minor.

Underwater Noise Impact

The highest energy source of underwater sound during operation of the Project would be from vessel transits near the proposed SPOT DWP and from mooring activities. Vessel sounds generated during operation would result from propeller cavitation and propulsion, as well as noise from water coming into contact with the hull and bubbles breaking in the wake of the vessels. The dominant sound source from VLCCs or other crude oil carriers would be from propeller cavitation, which would be dependent on the size and speed of the vessel. The SPOT DWP would allow for up to two VLCCs or other crude oil carriers to moor at the SPM buoys concurrently.

The maximum frequency of loading VLCCs or other crude oil carriers would be up to 365 per year, although other smaller crude oil transport vessels may be loaded. The Applicant has estimated that the vessels would travel at between 12 and 15 knots in open water, and approximately 3 knots in the SPOT DWP safety zone. Estimated underwater sound levels associated with VLCC traffic are provided in Table 3.13-13. Impacts from vessel noise during operation would be direct, adverse, short-term and long-term, and minor. Specific noise-related impact discussions for marine species are provided in Section 3.5, Wildlife and Aquatic Resources, and Appendix E, Biological Assessment and Essential Fish Habitat Assessment.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve the use of multiple vessels and equipment, including a helicopter. Impacts would be similar to those described for construction, but shorter in duration. Therefore, airborne impacts on NSAs onshore or on fishing or other vessels associated with planned or unplanned maintenance offshore would be direct, adverse, short-term, and negligible. Underwater impacts from vessel noise during operation would be direct, adverse, short-term, and minor.

3.14. Socioeconomics

This section discusses onshore and offshore socioeconomic impacts associated with Project construction and operation.

3.14.1. Definition of the Resource

Socioeconomic resources discussed in this section include population and demographics, housing, employment and income, public services, land- and marine-based tourism and recreation, commercial fisheries, marine commerce and shipping, and offshore mineral resources. The socioeconomic study area consists of Brazoria and Harris counties, Texas, which houses the Project's proposed onshore pipelines, proposed new terminal, and existing terminal, and which would experience the Project's direct and indirect economic impacts. In addition to county-level data, this section also provides data (where available) for selected cities and towns in Brazoria and Harris counties: Houston in Harris County, and Brookside Village, Angleton, Manvel, Pearland, Iowa Colony, Oyster Creek, and Surfside Beach in Brazoria County. These cities and towns would contain or be adjacent to Project facilities. Port Freeport, the Applicant's proposed base for offshore construction and operation, is in Brazoria County, in the City of Freeport; therefore, this section includes data on Freeport as well as the adjacent City of Lake Jackson.

3.14.2. Existing Threats

Brazoria and Harris counties are within the Gulf Coast Economic Development District (GCEDD), which consists of 13 Texas counties in the upper Gulf Coast area. The GCEDD's Regional Economic Resilience Plan concludes that the greatest risk to the region's economy is repetitive damage from hurricanes and tropical storms, citing the floods in 2015, 2016, and 2017 that created substantial economic losses (GCEDD 2018b). Droughts are also a threat, as indicated by the drought between 2010 and 2012 that caused statewide economic losses (GCEDD 2018b). Brazoria and Harris counties participate in regional planning efforts to improve drainage infrastructure, manage water supplies, and enhance the resilience of the region's economy (GCEDD 2018b).

Fluctuations in the oil and gas industry also constitute a threat to the Project's socioeconomic environment. In 2017, the oil and gas industry generated an estimated one-third of the GCEDD region's jobs, directly or indirectly, down from 50 percent of regional jobs in 2000. The energy industry drives business at the region's ports, accounting for an estimated 57 percent of freight (GCEDD 2018a). The region has experienced economic downturns when oil and gas prices decline sharply. The region's economic base has diversified, and the region's energy sector has become more resilient through diversified product lines and markets and new technologies (GCEDD 2018a).

Other priorities for sustaining the region's economic health include improving educational attainment and training to retain a competitive workforce, improving public transit and public recreation facilities, improving broadband access, and upgrading aging infrastructure (GCEDD 2018a and 2018b). The region's nonattainment status under the CAA (including Brazoria County) also constrains economic growth by limiting new or expanded industrial facilities that would exceed emission limits (GCEDD 2018b).

3.14.3. Population and Demographics

This section provides information on the current population in the study area, projected population increases, and potential Project impacts on population and demographic change.

3.14.3.1. Existing Conditions

Table 3.14-1 summarizes population data from 2010 and 2017. Harris County has the largest population among Texas counties and contains Houston, the most populous city in Texas. The largest municipalities in Brazoria County are Pearland, adjacent to Houston's southern boundary, and Lake Jackson near the Gulf Coast. The municipalities within Harris and Brazoria counties grew at varying rates from 2010 to 2017; Manvel and Pearland in northern Brazoria County experienced rapid population growth, while the central and southern Brazoria County municipalities—Angleton, Freeport, Lake Jackson, and Oyster Creek—had stable populations or slow growth. Regional projections anticipate that Harris County will grow at a similar rate through 2040 (about 1.6 percent annual growth, resulting in more than 72,000 new residents per year). The rate of population growth in Brazoria County is anticipated to increase to about 2.6 percent annually, resulting in nearly 9,000 new residents per year (Houston Galveston Area Council 2017a, 2017b).

Table 3.14-1: Population Change (2010–2017)

Jurisdiction	2010	2017	Average Annual Population Change (%)
Texas	25,145,565	27,419,612	1.3
Harris County	4,092,459	4,525,519	1.5
Houston	2,099,451	2,267,336	1.1
Brazoria County	313,166	345,995	1.5
Angleton	18,862	19,280	0.3
Brookside Village	1,523	2,005	4.5
Freeport	12,049	12,082	0
Iowa Colony	1,170	1,040	-1.6
Lake Jackson	26,849	27,317	0.3
Manvel	5,179	8,224	8.4
Oyster Creek	1,111	1,258	1.9
Pearland	91,252	113,693	3.5
Surfside Beach	482	633	4.5

Source: U.S. Census Bureau 2019a

3.14.3.2. Impacts and Mitigation

This section includes a discussion of the impacts of Project construction and operation on population and demographics. As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

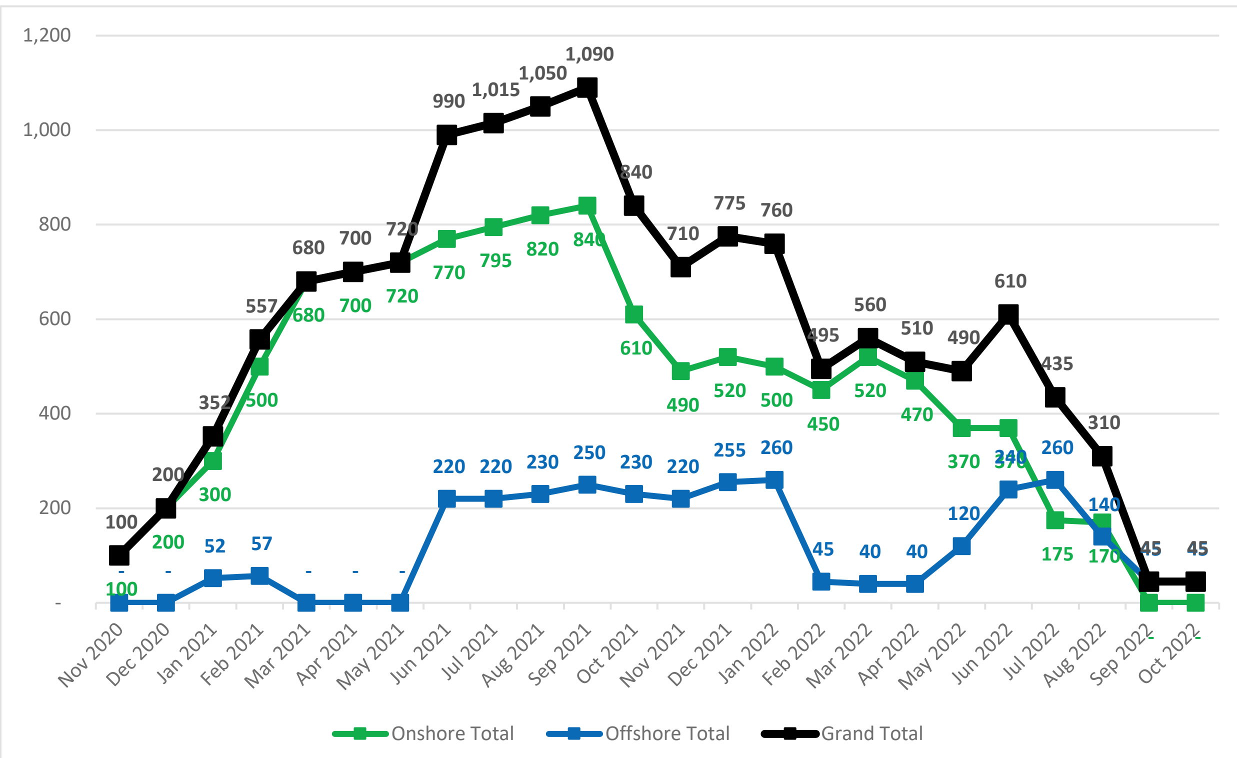
As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on population and demographics have been evaluated based on their potential to cause substantial change in population.

The remainder of this section describes potential population and demographic impacts of construction and operation of the Project's onshore and offshore facilities, including the ECHO Terminal, Oyster Creek Terminal, onshore and offshore pipelines, and the SPOT DWP, based on the criteria above.

Construction

Figure 3.14-1 summarizes the Project's workforce during the 2-year construction period. Project installation and construction would require as many as 1,100 workers during the peak construction period in 2021, including 260 offshore and 840 onshore workers (SPOT 2019a, Application, Volume IIa, Section 8). The Applicant estimates that 85 percent of the construction workforce would be hired from coastal Louisiana and Texas, but gives no projections of the workforce percentage that would be hired from within the socioeconomic study area, though the Applicant states that a "noticeable" percentage would be hired from Harris and Brazoria counties (SPOT 2019a, Application, Volume IIa, Section 8).

During the 22-month construction period, the onshore workforce would range from about 100 to 840 workers. The maximum workforce of 680 to 840 workers would occur during the second and third quarters of 2021, when the offshore pipelines and both terminals would be under construction simultaneously (SPOT 2019v).



Source: SPOT 2019v

Figure 3.14-1: Estimated SPOT Project Construction Workforce by Month

The offshore workforce would range from about 40 to 260 workers per month, with the largest workforce occurring between mid-2021 and mid-2022, during offshore pipelay activity and derrick barge work (SPOT 2019a, Application, Volume IIa, Section 1 and SPOT 2019v). No more than 100 offshore workers would return to shore daily; all others would be on a rotation with several weeks at the offshore jobsite, followed by several weeks of being off work (e.g., 30 days on/30 days off).

The substantial construction workforce already living in the socioeconomic study area would provide a pool of potential workers (see Section 3.14.5, Socioeconomics, Employment and Income), but some workers could relocate to the study area (see Section 3.14.4, Socioeconomics, Housing). In the unlikely scenario that all Project construction workers came from outside Harris and Brazoria counties and chose to permanently relocate to the socioeconomic study area (i.e., with the intent of seeking other work after the completion of the SPOT Project), the peak workforce of 1,100 workers would represent 0.3 percent of Brazoria County's population, and a far smaller percentage of the population of Harris County. Based on population growth trends discussed above, if these workers and their households moved to the area, they would be indistinguishable from background growth rates.

The Applicant has not specified which fabrication businesses would construct the Project's offshore components; however, the Applicant has stated that component fabrication would occur at multiple existing fabrication businesses, most within the Gulf Coast region, including some that may be within the study area. This fabrication would require up to 390 workers, primarily existing employees, for 16 months. The Applicant anticipates that the scale of the Project's work orders may cause some facilities to hire new workers to supplement existing workforces. Because these workers would be spread across multiple facilities in the multi-state Gulf Coast region, component fabrication would cause no perceptible population changes in the study area (SPOT 2019a, Application, Volume IIa, Section 1 and SPOT 2019v).

Based on the above analysis, Project construction would have a direct, short-term, negligible impact on socioeconomic study area population. Population change itself would be neither beneficial nor adverse. The remainder of this section discusses how Project-related population changes could impact other socioeconomic factors, such as employment and income, demand for housing, public services, and recreation.

Operation

Project operation would employ approximately 62 permanent workers, including 28 workers operating the SPOT DWP, and 34 workers operating the onshore facilities. The Applicant states that it would hire all permanent employees from labor pools in Texas or Louisiana. The Applicant would also regularly hire contractors during operation for maintenance, inspection, and supply services.

If all of the operational workforce was hired from outside the study area and moved to the study area, the addition of up to 62 households within the study area's population of 8,618,000, or even within Brazoria County's population of 346,000, would be indistinguishable from the background population growth rate. Operation-phase contractors would be existing businesses in the study area or the larger region. The location of these contractors and the number and work location of new contractor employees cannot be determined; however, contractor hiring is also not expected to have perceptible effects on the socioeconomic study area population. As a result, the operational workforce would have a direct, long-term, negligible impact on socioeconomic study area population. As with the construction phase, the impacts of population change on their own are neither beneficial nor adverse.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project; however, it is expected the workforce would be local. Therefore, impacts associated with planned or unplanned maintenance would be direct, short-term, and negligible, and would neither be beneficial nor adverse.

3.14.4. Housing

This section addresses Project impacts on the supply of housing and temporary lodging within and near the study area. As described in Table 3.2.1 in Section 3.2.2, Evaluation Criteria, the Project's effects have been evaluated based on their potential to cause substantial change in housing and lodging.

3.14.4.1. Existing Conditions

Potential Project workers would include the workforce residing within commuting distance of Project sites, workers from other areas who relocate to homes or temporary lodging within commuting distance, and offshore workers who live outside commuting distance, but who travel to and from the Project area only at the start and end of their multi-week offshore shifts. Project sites include the onshore sites and Port Freeport for offshore workers.

The average one-way commute for workers in Harris and Brazoria counties is nearly 30 minutes (U.S. Census Bureau 2019a), with 11 to 14 percent of commuters with a 45-60 minute commute and 10 to 11 percent with a commute longer than 60 minutes. Construction workers nationwide have longer average commuting times than other occupations (Kopf 2019). As a result, this EIS assumes that Project construction workers would be willing to travel approximately 60 minutes each way to work (roughly double the average commute in Harris and Brazoria counties). As shown on Figure 3.14-2, the area within an approximate 60-minute peak-hour commute includes an approximately 35-mile straight-line radius from Project facilities and workspaces (40 to 55-mile driving distance). For the existing ECHO Terminal and portions of the ECHO to Oyster Creek Pipeline north of Angleton, this includes most of Harris and Fort Bend counties and portions of Chambers County. For the proposed Oyster Creek Terminal site, this includes all of Brazoria County, most of Galveston County, southern Harris and Fort Bend counties, and eastern Matagorda County. For the Oyster Creek to Shore Pipelines and the onshore HDD site, this includes most of Brazoria and Galveston counties and eastern Matagorda County.

Figure 3.14-2: Estimated Commuting Area for Project Construction Workers

Housing Supply

Table 3.14-2 summarizes the housing supply and vacancy rates in the study area. These data include single-family homes, attached housing, mobile homes, apartment and condominium units, but do not include transient lodging (hotels, motels, guest cottages, and recreational vehicle [RV] parks). Vacancy rates in Harris and Brazoria counties are similar to the statewide rates. In 2017, there were more than 13,000 vacant housing units in Brazoria County and more than 47,000 vacant housing units in Harris County (excluding the City of Houston).

Table 3.14-2: Total Housing and Vacant Units (2017)

Jurisdiction	Total Housing Units	Total Vacant Units	Homeowner Vacancy Rate (%)	Rental Vacancy Rate (%)
Texas	10,611,386	1,180,967	1.6	7.6
Harris County	1,714,340	151,527	1.5	8.0
Houston	943,183	104,233	1.7	8.5
Brazoria County	130,392	13,304	1.4	7.3
Angleton	8,211	791	0	9.9
Brookside Village	692	60	0	3.7
Freeport	4,758	888	7.0	11.8
Iowa Colony	422	87	3.2	25.2
Lake Jackson	11,445	797	0.8	8.0
Manvel	3,069	391	1.1	3.8
Oyster Creek	523	77	0	0
Pearland	40,604	1,762	1.8	4.7
Surfside Beach	1,065	743	2.6	59.2

Source: U.S. Census Bureau 2019a

The high vacancy rate in Surfside Beach shown in Table 3.14-2 reflects the presence of vacation homes in this waterfront community (recorded in the census as seasonal vacant housing). While many of these dwellings are available for short-term rental, they are not used for year-round housing.

A 2019 study commissioned by the Brazoria Economic Development Alliance found that southern Brazoria County has unmet housing needs for entry level single family houses and affordable rental housing (CDS 2019). The highest need was found in affordable rental housing and affordable working class and lower income households. The study notes that a construction boom beginning in 2016 created a need for housing tailored to high-wage transient workers, and suggests that the housing shortfall can be partly attributed to a focus in the development industry on constructing short-term housing for the transient workforce. The study estimates that demand for affordable rental units would number in the high hundreds based on recent employment trends and is highest along the SH 288 corridor, especially in Angleton, Lake Jackson, and Freeport.

Short-Term Lodging

Short-term lodging in the study area includes hotels, motels, and RV parks or campgrounds. In addition, Brazoria County has several facilities that provide short-term cottage residences, catering specifically to temporary workers.

In 2016, there were 49 hotels or motels in Brazoria County, as well approximately 745 in Harris County, the large majority of which are in the City of Houston itself (U.S. Census Bureau 2018). Table 3.14-3 provides information on hotel and motel rooms in 2016 (the most recent year for which data were publicly available) for nine cities in Brazoria County that represent most of the county's hotel rooms, as well as cities in Harris, Galveston, and Fort Bend counties within the commuting radius that have a concentration of hotel/motel rooms.

Table 3.14-3: Hotel/Motel Rooms in the Socioeconomic Analysis Area

Jurisdiction	Hotel/Motel Rooms Q3 2016	Occupancy Q3 2016 (%)
Southern Harris County municipalities		
Houston	55,168	59
Nassau Bay	1,139	63
South Houston	172	57
Webster	1,868	68
Brazoria County municipalities		
Alvin	404	62
Angleton	183	66
Clute	656	68
Freeport	45	50
Lake Jackson	444	61
Manvel	70	62
Pearland	769	65
Surfside Beach	145	52
West Columbia	239	68
Selected Galveston County municipalities		
Galveston City	5,580	59
La Marque	228	57
League City	444	64
Texas City	795	64
Selected Fort Bend County municipalities		
Sugar Land	1,261	59
Missouri City	119	64
Total (excluding the City of Houston)	14,561	

Source: Source Strategies 2016

The third quarter of the calendar year (July 1 through September 30) is the busiest season for tourism in the Houston-Galveston-Brazoria Metropolitan Statistical Area (Houston Metropolitan Area), based on 2017 data describing spending on restaurants and lodging (University of West Florida 2018). Statewide, the hotel occupancy rate in the third quarter of 2016 was 65 percent. Assuming a 35 percent vacancy rate (as a conservative measure), the hotel or motels compiled in Table 3.14-3 would yield about 5,100 available rooms within the commuting radius of most project sites. The ECHO Terminal and the northern portion of the ECHO to Oyster Creek Pipeline (approximately north of Iowa Colony) would have a much greater number of hotels within commuting distance, due to the proximity to Houston.

In addition to the hotels and motels in Table 3.14-3, there are approximately 22 RV parks or campgrounds with RV spaces in Brazoria County, totaling at least 1,000 RV spaces, as well as 8 facilities offering short-term cottage residences that cater to temporary workers (Brazoria County EDA n.d.; various RV park websites). Many other RV parks and campgrounds are found within commuting distance in Galveston County and the greater Houston area. No occupancy data are available for RV parks, campgrounds, or short-term cottage residences.

3.14.4.2. Impacts and Mitigation

This section includes a discussion of the likely effects of Project construction and operation on housing. As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on housing have been evaluated based on their potential to cause substantial change in housing demand or affordability.

The remainder of this section describes potential housing impacts of construction and operation of the Project's onshore and offshore facilities, including the ECHO Terminal, Oyster Creek Terminal, onshore and offshore pipelines, and the SPOT DWP, based on the criteria above.

Construction

Peak Project construction would require up to 1,100 workers, including 840 onshore workers and 260 offshore workers (SPOT 2019a, Application, Volume IIa, Section 8). During the remainder of the 2-year project construction period, the workforce would range from 300 to 800 workers. Because construction is temporary (i.e., a total construction period of less than 2 years, with many workers performing tasks for a substantially shorter period of time), workers who do not live within commuting distance would probably seek temporary lodging within commuting distance of onshore jobsites or Port Freeport, rather than permanent residences.

Most offshore installation personnel would work multi-week shifts, separated by multi-week breaks (e.g., 30 days staying on a vessel followed by a 30-day onshore break). The Applicant anticipates that most of these workers would return to their permanent homes during onshore breaks and, therefore, would not seek temporary lodging in the socioeconomic study area. Fewer than 100 offshore construction workers would return to shore daily during their work periods of several months (SPOT 2019a, Application, Volume IIa, Section 8).

In the most extreme scenario, if all of the peak workforce were to temporarily relocate to the Project area, (substantially more than is likely to occur), these workers would require nearly 1,100 temporary lodging units (i.e., hotel/motel rooms, RV spaces, or short-term cottages). The socioeconomic study area and nearby areas within commuting distance have an adequate supply of lodging to accommodate this workforce. As noted above, there are over 14,500 hotel rooms and more than 1,000 RV spaces within commuting distance of Port Freeport, the proposed Oyster Creek Terminal, the southern portions of the ECHO to Oyster Creek Pipeline (i.e., approximately south of Iowa Colony), and the Oyster Creek to Shore Pipelines. Some vacation homes in Surfside Beach may be available for short-term rental to temporary workers. Additional RV sites are available in Galveston, Fort Bend, and southern Harris counties. An additional supply of hotel/motel rooms is available in Houston within a short distance of the northern Project worksites. If part of the construction workforce relocated permanently to Brazoria and Harris counties, the vacant housing stock shown in Table 3.14-2 (i.e., more than 13,000 vacant units in Brazoria County, excluding units in Harris County) would provide sufficient temporary housing.

Given the adequacy of short-term lodging within commuting distance of the Project, the use of short-term lodging within the socioeconomic study area by Project workforce would have positive impacts by increasing occupancy at hotels and other lodging businesses, while still leaving capacity available for tourists or other lodging users. Construction workers are unlikely to use permanent housing, although supplies of vacant housing are sufficient to accommodate some workers who choose to permanently relocate (i.e., to take advantage of other jobs in the region—see Chapter 5, Cumulative Impacts). The influx of workers seeking short-term housing for ongoing projects in the region may contribute to the insufficient supply of entry-level and rental housing in southern Brazoria County. The Project's short-term workforce would not necessarily be focused on the southern Brazoria County housing market, with the onshore job sites and reporting locations for offshore work located across a wider area. However, the workforce would make an incremental contribution to competition for housing development resources. Accordingly, Project construction would have a direct, beneficial, short-term, and minor impact on short-term lodging and an indirect, adverse, long-term and negligible to minor impact on the supply of permanent housing units in the socioeconomic study area.

Operation

Project operation would require a workforce of 62 permanent employees. If all 62 operational employees originated from other locations and permanently relocated to the socioeconomic study area, these new residents would provide income for owners of for-sale or for-rent vacant units without affecting the supply or cost of housing, due to the presence of more than 13,000 vacant dwelling units in Brazoria County, in addition to the larger supply of housing in southern Harris County and Houston. Accordingly, Project operation would have a direct, beneficial, long-term, and negligible impact on housing supply in the socioeconomic study area.

In the unlikely event of a large oil spill during Project operation, short-term housing in the Brazoria County area could temporarily experience higher occupancy rates due to the spill response workforce. As noted in Section 3.14.4.1 (Housing, Existing Conditions), hotel or motels within commuting distance of project facilities are likely to have at least 5,100 available rooms, based on average, peak season occupancy rates. The northern project facilities would have a greater number of hotels within commuting distance, due to the proximity to Houston. The previous subsection notes that the 1,100-worker construction workforce would increase occupancy rates, resulting in a beneficial impact on short-term housing. The number of spill response workers would depend upon the magnitude of the spill, and a very large workforce during a peak tourist season could conceivably put pressure on available short-term housing within a reasonable commuting distance. Accordingly, an operational onshore or inshore crude oil spill is most likely to have a direct, beneficial, short-term impact on short-term housing in the socioeconomic study area, but could possibly have a direct, adverse, short-term, minor impact depending on the number of response workers, spill location, timing (in relation to demand from tourists and other events) and length of response/remediation.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project; however, it is expected the workforce would be local. Therefore, impacts associated with planned or unplanned maintenance would be direct, short-term, and negligible, and would neither be beneficial nor adverse.

3.14.5. Employment and Income

This section examines potential Project impacts on employment and economic activity in the study area. As described in Table 3.2.1 in Section 3.2.2, Evaluation Criteria, the Project's effects have been evaluated based on their potential to cause substantial change in the local or regional economy or employment. Except where otherwise stated, monetary impacts are expressed in 2019 dollars.

3.14.5.1. Existing Conditions

Employment

Table 3.14-4 provides a summary of labor force statistics for socioeconomic study area counties and selected municipalities in 2017. Unemployment in Harris County was higher than the state as a whole. Brazoria County had lower unemployment and a higher median income than Harris County or the state. The cities and towns in northern Brazoria County, such as Iowa Colony, Pearland, and Manvel, had lower unemployment and higher household incomes than coastal communities such as Freeport, Oyster Creek, and Surfside Beach.

Table 3.14-5 displays the number of people unemployed by industry sector in Brazoria County based on October 2016 federal statistics (Emsi 2017). The category with the highest number of unemployed workers, 1,546 workers, is "No Previous Work Experience/Unspecified," a category for which reliable unemployment data are unavailable. The second highest number of unemployed workers is in the construction industry, with 1,383 workers, followed by the manufacturing industry, with 1,318 workers.

Table 3.14-4: Labor Force, Unemployment, and Income (2017)

Geographic Area	Civilian Labor Force	Unemployed Workers	Unemployment Rate (Percent)	Median Household Income
Texas	13,473,957	784,888	5.8	$57,051
Harris County	2,329,584	149,192	6.4	$57,791
Houston	1,188,008	78,707	6.6	$49,399
Brazoria County	170,709	8,439	4.9	$76,426
Angleton	9,462	390	4.1	$57,068
Brookside Village	1,032	83	8.0	$75,809
Freeport	5,629	616	10.9	$36,673
Iowa Colony	623	17	2.7	$92,679
Lake Jackson	14,511	728	5.0	$77,739
Manvel	4,188	135	3.3	$90,165
Oyster Creek	523	75	14.3	$42,188
Pearland	61,242	2,248	3.7	$102,124
Surfside Beach	322	13	4.0	$56,250

Source: U.S. Census Bureau 2019a

Table 3.14-5: Unemployed Workers in Brazoria County by Industry Sector (October 2016)

Industry Sector	Number of Unemployed	County Percent of Unemployed	National Percent of Unemployed
Agriculture, forestry, fishing and hunting	9	0%	1%
Mining, quarrying, and oil and gas extraction	157	2%	1%
Utilities	17	0%	0%
Construction	1,383	16%	5%
Manufacturing	1,318	15%	9%
Wholesale Trade	101	1%	2%
Retail Trade	1,026	12%	13%
Transportation and Warehousing	169	2%	3%
Information	14	0%	1%
Finance and Insurance	126	1%	2%
Real Estate, and Rental and Leasing	98	1%	1%
Professional, Scientific, and Technical Services	351	4%	5%
Management	1	0%	0%
Administrative and Support and Waste Management	314	4%	7%
Educational Services (private)	102	1%	3%
Health Care and Social Assistance	408	5%	8%
Arts, Entertainment and Recreation	62	1%	2%
Accommodation and Food Services	549	6%	10%
Other Services	373	4%	4%
Government	387	5%	7%
Unspecified or No Previous Work Experience	1,546	18%	16%

Source: Emsi 2017

Table 3.14-6 provides data on jobs located in Brazoria and Harris counties. The manufacturing and construction sectors are prominent employers, together providing 29 percent of the counties' jobs. The Brazoria County Economic Development Alliance's 2017 economic profile found that manufacturing and construction were also the largest sectors of the county's economy by value, especially in southern Brazoria County, contributing 79 percent of southern Brazoria County's gross regional product (Emsi 2017). Retail trade and accommodations and food service also provide substantial portions of the county's employment. Harris County's employment profile is similar to the state's, with lower proportions of manufacturing and construction employment than Brazoria County, and higher proportions in the health care, professional, and administrative sectors.

The oil and gas industry cluster—a term for the collection of individual industries and sub-industries that together support a common economic activity—include petroleum products manufacturing, chemical manufacturing, pipeline transportation, oil/gas extraction, support activities for mining, and heavy/civil engineering construction. In 2016, jobs in the oil and gas industry cluster composed 13 percent of jobs and at least 50 percent of the gross regional product (the total gross economic output) in both southern and northern Brazoria County (Emsi 2017). Other major sectors of Brazoria County's economy include government, health care and social assistance, and retail trade.

The Houston Metropolitan Area has historically been a global hub for the energy industry and home to oil and gas companies, refineries, and petrochemical plants. Energy-related businesses make up the largest industry cluster in Houston, directly employing 12 percent of the workforce. As of 2018, Houston had

21 Fortune 500 headquarters, 17 of which are related to oil and gas extraction and processing. Oilfield manufacturing and services companies that support the energy extraction firms support substantial clusters of machinery and fabricated metal manufacturers.

While the energy industry remains the dominant cluster, the metro area has diversified, as manufacturing unrelated to the oil and gas industry, chemicals, and healthcare have grown in importance (Federal Reserve Bank of Dallas 2018). Healthcare and social assistance contribute the largest number of jobs in Harris County, providing almost 13 percent of jobs located in the county. This sector is followed by retail trade and accommodations/food service, which each provide 10 percent of jobs.

Table 3.14-6: Jobs in Texas, Brazoria County, and Harris County, by Industry 2016

Industry	Brazoria County			Harris County			Texas
	Number of Establishments	Number of Employees	Percent of Employees	Number of Establishments	Number of Employees	Percent of Employees	Percent of Employees
Agriculture, forestry, fishing	9	50	0.1%	33	69	0.0%	0.1%
Mining, quarrying, oil and gas	40	681	0.8%	1,071	42,306	2.1%	1.9%
Utilities	9	151	0.2%	299	18,079	0.9%	0.5%
Construction	414	12,752	14.6%	6,508	160,568	7.9%	6.5%
Manufacturing	207	12,921	14.8%	4,021	151,272	7.4%	7.4%
Wholesale trade	263	2,872	3.3%	7,431	128,037	6.3%	5.0%
Retail trade	831	15,701	18.0%	13,217	213,643	10.4%	12.5%
Transportation and warehousing	193	2,014	2.3%	3,211	96,717	4.7%	4.3%
Information	60	1,101	1.3%	1,421	36,594	1.8%	2.3%
Finance and insurance	360	2,100	2.4%	6,681	79,522	3.9%	5.1%
Real estate	292	1,821	2.1%	5,549	40,799	2.0%	1.8%
Professional, scientific, technical services	526	3,316	3.8%	13,977	174,681	8.5%	6.8%
Management	19	296	0.3%	1,159	116,384	5.7%	3.1%
Administrative, business support, waste management	238	3,596	4.1%	5,290	151,762	7.4%	9.4%
Educational services	87	817	0.9%	1,205	49,445	2.4%	1.9%
Health care and social assistance	726	9,255	10.6%	11,528	262,449	12.8%	14.5%
Arts, entertainment, and recreation	75	1,069	1.2%	1,074	28,476	1.4%	1.4%
Accommodation and food services	576	11,681	13.4%	9,088	204,968	10.0%	11.3%
Other services (ex. public admin)	581	5,243	6.0%	7,943	89,413	4.4%	4.3%
Industries not classified	12	12	0.0%	178	251	0.0%	0.0%
Total for all sectors	**5,518**	**87,449**	**100.00%**	**100,884**	**2,045,435**	**100.0%**	**100.0%**

Source: U.S. Census Bureau 2018

Note: Data in this table represent those available when this report was created; data may not be available for all industries or geographies. Excludes most government employees, railroad employees, and self-employed persons.

Taxes

Major revenue sources for the State of Texas include the general sales tax; taxes on certain products and services such as motor fuels, motor vehicles utilities, hotel, insurance, and franchises; licenses and fees; and federal contributions. The largest revenue sources for Texas counties and municipalities are property and sales taxes. Sales taxes are applied to retail sales and many services. Property taxes collected in Brazoria and Harris counties are the sum of property tax rates assessed by numerous entities, including the county, municipalities, and public service districts for schools, drainage, hospitals, emergency services, and other services.

During fiscal year (FY) 2018, Brazoria County's general fund revenues exceeded expenditures by $10.7 million (Brazoria County Auditor's Office 2019). Tax revenues have increased each year since 2009, and in FY2018 increased by $5 million over FY2017. Property taxes yielded $122.4 million, which was 59.4 percent of the county's revenue. Sales taxes yielded $34.2 million, or 16.6 percent of the county's revenues.

Harris County received $1.96 billion in tax revenue in FY2018, approximately 52 percent of which was from property tax revenues (Harris County Auditor 2019).

The municipality of Surfside Beach received $1.6 million in general fund revenue in fiscal year 2020—approximately 52 percent was from property tax revenues. The largest revenue sources following property taxes were garbage collection fees (14 percent) and sales tax (6 percent) (Surfside Beach 2021). In addition, Surfside Beach funds recreation and tourism through its municipal hotel/motel tax and the municipal share of the state's hotel/motel tax. These taxes together formed 86 percent of the $523,000 revenue in Surfside Beach's "hotel fund," which is dedicated to beach maintenance (including erosion control), parks, and tourism (Surfside Beach 2021).

3.14.5.2. Impacts and Mitigation

This section includes a discussion of the likely results of Project construction and operation on employment and income. As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on employment and income have been evaluated based on their potential to cause substantial change in the local or regional economy, including employment levels and incomes.

The remainder of this section describes potential employment and income impacts of construction and operation of the Project's onshore and offshore facilities, including the ECHO Terminal, Oyster Creek Terminal, onshore and offshore pipelines, and the SPOT DWP, based on the criteria above.

Construction

Study Area Employment and Income Impacts

As described in Section 3.14.3 above, peak Project construction would require a workforce of up to 1,100, including 260 offshore and 840 onshore workers. Table 3.14-7 summarizes the estimated number of workers for different Project components. The Applicant states that about 85 percent of workers would be hired from Texas and Louisiana, including an unknown but "noticeable" percentage from Harris and Brazoria counties (SPOT 2019a, Application, Volume IIa, Section 8). Potential hiring within the study area would include construction and marine workers as summarized below:

- For the onshore construction (ECHO Terminal, Oyster Creek Terminal, onshore pipelines), the Applicant states that "employment opportunities that would result from the onshore construction would benefit the study area, where construction is a large industry and workers with matching labor skills reside" (SPOT 2019a, Application, Volume IIa, Section 8). The onshore payroll is estimated to be $77.3 million and the average annual salary for an onshore worker would be $100,000.
- The Applicant would contract with existing support vessels and crews at Port Freeport to assist with offshore construction and installation (SPOT 2019a, Application, Volume IIa, Sections 1 and 8; SPOT 2019f).

Table 3.14-7: Construction and Installation Workforce

Project Component	Average Monthly Workforce	Peak Workforce	Work Cycle	Duration [a]	Estimated Construction Period [b]	Average Annual Salary
Offshore		525			Jan. 2021–Oct. 2022	
HDD shore crossing (pipeline)	24	30	Continuous	60 days	Jan.–Mar. 2021	$75,000
Dive boat (pipeline)	30	40	Continuous	45 days	Jan.–Mar. 2021	$90,000
Pipelay vessel (pipeline)	230	250	30 days on/off	150 days	Feb. 2021–Apr. 2022	$100,000
Trenching barge (pipeline)	40	45	30 days on/off	120 days	Dec. 2021–May 2022	$100,000
Dive support vessel (SPOT DWP)	80	80	30 days on/off	90 days	Apr.–Oct. 2022	$100,000
Construction barge (PLEM installation)	45	45	Continuous	30 days	June–Oct. 2022	$100,000
Derrick barge (SPOT DWP platform/jacket)	120	120	45 days on/off	28 days	May–June 2022	$100,000
Hook-up spread	60	60	Continuous	45 days	July–Aug. 2022	$100,000
Onshore		840			Feb 2021–Sept 2022	
ECHO Terminal	70	110 (Oct 2021)	Continuous	12 months	Mar. 2021–Feb. 2022	$72,000
Oyster Creek Terminal	350	520 (Mar 2022)	Continuous	22 months	Nov. 2020–Sept. 2022	$72,000
Onshore Pipelines	300	350 (Aug.–Sep. 2021)	Continuous	9 months	Feb. 2021–Oct. 2021	$100,000

Source: SPOT 2019a, Application, Volume IIa, Sections 1.4 and 8; Volume IIb, Sections 1.3 and 1.4

[a] Estimated days of work, as opposed to the total period of construction.

[b] Includes period of construction/installation, commissioning, and start-up. Also includes allowance for weather-related delays. Dates are subject to change.

As indicated in Table 3.14-6, there were 12,752 construction jobs in Brazoria County and 160,568 in Harris County in 2016, indicating a large construction workforce living within or near the study area.

Construction jobs have frequent turnover, as jobs are finished and workers find new projects. Thus, the presence of a large construction workforce indicates that there is likely a sufficient, qualified workforce in the study area to support the Applicant's stated local-hiring intent. This is particularly true in the Houston Metropolitan Area, where construction is an important component of the oil and gas industry cluster.

If the Applicant is able to fulfil its local-hiring commitment, these new jobs would provide direct economic benefits to the study area through employment, wages for study area residents, and purchases of supplies and services from study area businesses to support onshore and offshore construction.

This direct economic activity would lead to indirect economic activity (i.e., taxes paid by Project employees who live in the study area), as well as induced economic activity, such as jobs supported by purchases made by Project employees who live in the study area, or sales and hotel taxes for the study area jurisdictions and the state.

Regional Employment and Income Impacts

Project expenditures outside of the study area would contribute to employment and income in the Gulf Coast region. The Applicant has not identified specific Gulf Coast facilities or communities. Based on the statement above that 85 percent of employees would be from Texas or Louisiana, it is assumed that most Gulf Coast region economic activity would also be in coastal areas of these states.

Specialized vessels and their crews contracted for offshore work (such as pipelay, dredging, construction and derrick barges, and dive support boats) would be based at Gulf Coast ports, primarily in Louisiana, and would have little impact on employment in the socioeconomic study area (SPOT 2019f). While, some of the offshore workforce could be hired from the study area, the application suggests that any such study area hiring would be limited. The crew for specialized vessels would most likely reside near the homeports of those vessels. The offshore workforce could include 525 workers, although the Applicant's timeline indicates that no more than 260 workers would be working at any one time, due to the work and break schedule described above. The offshore payroll is estimated to be $15.6 million, with an average salary of $85,000 (annualized) (SPOT 2019a, Application, Volume IIa, Sections 1 and 8; SPOT 2019f).

Existing fabrication yards in the Gulf Coast region would be contracted to manufacture most Project components. Fabrication would require an estimated 390 workers over a 16-month period, would cost $361.7 million, would require materials estimated to cost approximately $317.2 million, and would require $10.1 million in spending on shipping, warehousing, and logistics for offshore components (SPOT 2019a, Application, Volume IIa, Section 8). While not all such spending would occur in the Gulf Coast region, the Project's manufacturing and specialized vessel contracts would nonetheless support manufacturing businesses, existing and new jobs, and spending in the Gulf Coast region.

The Applicant would pay Texas state sales taxes estimated at $3.2 million for services to install pipelines in Texas state waters. Purchases of offshore platform component materials would generate additional sales taxes in Texas and Louisiana. Additional indirect and induced economic activity would result from the activity of contracted businesses as they purchase materials and services from other businesses, and from spending by employees within the Louisiana/Texas Gulf Coast region.

Summary and Impact Assessment

Construction and installation would support as many as 1,400 temporary jobs, including up to 1,100 at a time, during the 2-year construction period. The Applicant has not stated or committed to a percentage of workers to be hired from the study area. Project construction contractors would purchase supplies and services from study area businesses, and the spending by businesses and employees would support study area businesses and produce sales and hotel tax revenues. Although these impacts are not quantified, the employment and business activity could reasonably be expected to result in direct and indirect, beneficial, short-term, minor impacts on employment and income in the socioeconomic study area. If the Applicant coordinates with study area governments and business organizations to establish and achieve a numerical goal for hiring study area residents, the beneficial impact could be moderate rather than minor.

Operation

Project operation would generate 34 onshore jobs over the 30-year life of the SPOT DWP, with average salaries ranging from $110,000 to $125,000, and 28 offshore jobs with an average salary of $105,000 (Table 3.14-8). While these jobs would be a very small proportion of employment in the study area, they would provide a minor, long-term source of jobs with salaries higher than the 2017 median household incomes of $76,400 in Brazoria County and $57,800 in Harris County (Table 3.14-4).

Table 3.14-8: Operation Workforce

Project Component	Geographic location	Number of Workers	Work Cycle	Average Annual Salary
Offshore crew	Offshore	28	14 days on/off	$105,000
ECHO Terminal	Harris County	2	Continuous	$125,000
Oyster Creek Terminal	Brazoria County	12	Continuous	$110,000
Pipeline	Brazoria County and Harris County	20	Continuous	$120,000

Source: SPOT 2019a, Application, Volume IIa, Sections 1.5 and 8.3.5; Volume IIb, Section 1.4

In 2016, Brazoria County had 2,014 jobs in transportation and warehousing, a sector that includes pipeline transportation (Table 3.14-6). The 32 pipeline and Oyster Creek Terminal jobs would increase the jobs in this sector by 2 percent.

The SPOT DWP would also require regular use of stevedoring services (vessel loading and unloading) based in Freeport, vessel and offshore maintenance and inspection services, shore-based contractors for inspection and maintenance of the onshore components, and consumable supplies purchased from vendors within the study area. Supply and service vessels for the SPOT DWP would be based at Port Freeport, and would transport supplies purchased in the study area.

Workers residing in the study area would provide property and sales taxes to the study area jurisdictions. In addition, the Project's onshore components would be subject to property taxes collected by Brazoria County and the municipalities that the terminals or pipelines pass through: Houston, Brookside Village, Angleton, Manvel, Pearland, Iowa Colony, Oyster Creek, and Surfside Beach. The Applicant estimates a $92.9 million value for the onshore pipelines, Oyster Creek Terminal, and ECHO Terminal modifications (SPOT 2019a, Application, Volume IIa, Section 8). The Applicant would apply for Brazoria County tax abatements on eligible onshore facilities, which, if approved by the Brazoria County Commissioners' Court, would abate property taxes on the new improvements for up to 10 years (Brazoria County 2018).

The 2018 assessed value of all real property was $37 billion for Brazoria County and $486 billion for Harris County (Brazoria County Auditor's Office 2019, Harris County Auditor 2019). The $92.9 million estimated value of SPOT DWP onshore properties would add to the study area's assessed value and increase the base for property taxes. Most of the value would fall within Brazoria County (due to pipeline length in Brazoria County and the new Oyster Creek Terminal); if 80 percent of the $92.9 million is in Brazoria County, it would represent a 0.2 percent increase in the county properties' assessed value. Installation of pipeline segments within the municipalities listed in Table 3.14-1 would result in property tax payments to these municipal governments.

Based on the provision of approximately 62 long-term jobs with salaries higher than the study area's median household income, the regular use of inspection, maintenance, marine and transportation services based within the study area, and anticipated property tax revenues after the first 10 years, Project operation would have a direct and indirect, beneficial, long-term, and minor impact on socioeconomic study area employment and income.

A large accidental oil spill could result in a temporary increase in demand for local transportation and repair contractors, but could also result in temporary loss of work for workers directly associated with Project operation. Consequently, the impacts would negate each other and would neither be adverse nor beneficial. Overall, impacts would have a direct, short-term, and negligible impact on employment and income as the result of an oil spill.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project; however, it is expected the workforce would be local and impacts would be similar to, but smaller in magnitude than, construction. Therefore, impacts associated with planned or unplanned maintenance would be direct and indirect, beneficial, short-term, and minor.

3.14.6. Public Services

This section reviews public services within the study area, with a focus on schools and emergency services, and the ability of these services to meet needs that may arise from the proposed SPOT DWP. As described in Table 3.2.1 in Section 3.2.2, Evaluation Criteria, the Project's impacts have been evaluated based on their potential to cause substantial change in the availability of public services and infrastructure (e.g., schools, emergency services, medical services).

3.14.6.1. Existing Conditions

Public services that could be affected by Project activities would be in communities closest to the proposed onshore and offshore Project sites, including medical providers, public safety, and schools. Emergency service providers closest to the Project would respond to incidents associated with installation, operation, and accidents/upsets.

Hospitals

Brazoria County has four general hospitals with 291 total beds (Table 3.14-9). The largest and closest hospital to coastal areas of Brazoria County is CHI St. Luke's Health Hospital, a Level III Trauma Center with 154 beds. Level III Trauma Centers have "demonstrated an ability to provide prompt assessment, resuscitation, surgery, intensive care and stabilization of injured patients" in any emergency medical condition, provide back-up for rural and community hospitals, and have patient transfer agreements with Level I (Comprehensive) or Level II (Major) Trauma Centers in the region (American Trauma Society n.d.).

Table 3.14-9: General Hospitals in Brazoria County

Hospital Name [a]	Location	Beds	Trauma Level
HCA Houston Healthcare Pearland	Pearland	53	No trauma designation
Memorial Hermann Pearland Hospital	Pearland	64	Seeking designation as Level IV (Basic)
CHI St. Luke's Health Brazosport	Lake Jackson	154	Level III (Advanced)
Sweeney Community Hospital	Sweeney	20	Level IV (Basic)

Source: Texas DSHS 2019a, 2019b, 2019c

[a] Brazoria County also has one rehabilitation hospital: the 40-bed Encompass Health Rehabilitation Hospital of Pearland.

Harris County has 50 general hospitals with 12,288 total beds, 82 percent of which are in Houston. The closest hospital to the ECHO Terminal is Memorial Hermann Southeast Hospital, a 295-bed, Level III trauma hospital approximately 2 miles southeast of the ECHO Terminal (Texas DSHS 2019a, 2019b). Texas Medical Center in south-central Houston, about 14 miles from the ECHO Terminal, is the largest medical center in the world, with general and specialty services concentrated in a 1,345-acre district. Texas Medical Center has 59 member institutions (some located outside of Houston) that include 21 hospitals as well as support organizations, public health agencies, universities, and medical schools (TMC 2019). Three of the member institutions in Houston are Level I Trauma Centers capable of providing total care for every aspect of injury from prevention to rehabilitation (Texas DSHS 2019b).

Fire Protection and Emergency Medical Services

Brazoria and Harris counties are supported by a network of emergency service providers, including fire departments and emergency medical services (EMS).

Brazoria County has 37 fire departments and Harris County has 64 fire departments, most consisting of more than one fire station (Texas Department of Insurance 2018). The nationwide public protection classification system rates a community's local fire protection on a 10-point scale, established by the Insurance Services Office to assist the property and casualty insurance industry. The scale is based on factors such as water distribution, equipment, manpower, and fire alarm facilities. Larger cities tend to have class 1 (excellent) or class 2 ratings, while smaller towns typically have class 4 through 7 ratings (Texas Department of Insurance 2019). Public protection classification ratings for Brazoria County's municipalities vary by population size. The county's largest city, Pearland, has a class 2 rating. Freeport and Lake Jackson have class 5 and class 4 ratings, respectively, for properties within 5 road miles (8 road kilometers) of a fire station and within 1,000 feet (305 meters) of a water supply. Surfside Beach has a class 4 rating for all properties (Jesse Williams, State Fire Marshal's Office, Pers. Comm., September 20, 2018).

Twelve licensed EMS providers serve municipalities and communities in Brazoria County, in addition to seven private ambulance companies that are also state-licensed EMS providers (Texas DSHS 2019d). Six localized providers would serve the Project locations in Brazoria County: the Pearland Fire Department, Brazoria County Emergency Services District #3 (Manvel area), Angleton Area Emergency Medical Corps, Lake Jackson EMS Inc., Freeport Fire and EMS, and Surfside Beach EMS. Four emergency service districts collect tax revenue to support the local fire departments and emergency medical services (Brazoria County ESD #4 2019).

Police Protection

Police protection in the socioeconomic study area includes municipal police departments and county sheriff's departments. The Sheriff's Offices provide patrol for unincorporated areas, as well as backup support throughout the counties. The Harris County Sheriff's Office is the third largest sheriff's office in the country, with over 4,600 employees and 200 reservists (Harris County Sheriff's Office 2016). Table 3.14-10 summarizes information on police forces in each socioeconomic study area municipality. USCG Station Freeport in Surfside Beach provides search and rescue, law enforcement, and other missions along portions of the Texas Gulf Coast.

Many factors determine staffing levels for police departments, including crime levels, crime trends, and available budget. There are no national standards for officers per capita. In general, larger cities tend to employ more police officers per capita than mid-sized and smaller jurisdictions. In 2016, police departments serving cities with populations exceeding 25,000 had a median force of 16 officers per 10,000 population (Governing 2018). Most socioeconomic study area municipalities have staffing levels close to or exceeding this median, despite typically having populations lower than 25,000 (see Section 3.14.3, Socioeconomics, Populations and Demographics).

Table 3.14-10: Police Department Personnel

Jurisdiction	Population	Police Officers	Total Employees	Officers per 10,000 Population
Harris County				
Houston	2,267,336	5,182	6,632	22.9
Brazoria County				
Angleton	19,280	36	48	18.7
Brookside Village	2,005	4	4	20.0
Freeport [a]	12,082	31	45	25.7
Iowa Colony	1,040	ND	ND	ND
Lake Jackson	27,317	44	59	16.1
Manvel	8,224	14	20	17.0
Oyster Creek	1,258	7	11	55.6
Pearland	113,693	161	215	14.2
Surfside Beach	633	6	6	94.8

Source: Governing 2019, reporting information from the Federal Bureau of Investigation Uniform Crime Reporting program 2016

ND= No Data

[a] Only 2015 data are available for the City of Freeport.

According to the Brazoria County Criminal Justice Community Plan, developed with input from the County Sheriff's Office, municipal police departments, and other county and city agencies, Brazoria County needs increased recruitment, training, and retention of law enforcement personnel

(Brazoria County 2017). The county's population growth, the presence of large temporary construction workforces in the county, increased officer call loads, a shortage of officer recruits, and new demand for digitally recorded evidence have all increased the demand for law enforcement personnel. Specific needs include additional certified mental health deputies/officers, in-county mental health beds, upgraded emergency communications, additional traffic enforcement units, and specialized training in several areas.

Harris County's Criminal Justice Community Plan identifies needs for law enforcement training to address drug investigation, gang crimes, career criminals, the needs of crime victims, and the Breath Alcohol Training program (Harris County 2014). The plan notes that the need for interagency cooperation exceeds many agencies' resources in personnel and equipment.

Schools

Brazoria County is divided into eight independent school districts. The proposed pipelines would pass through the Pearland, Alvin, Angleton, and Brazosport Independent School Districts (ISDs), as well as the Houston ISD in Harris County. Table 3.14-11 summarizes information about these school districts.

Table 3.14-11: Public School Systems

School System	Number of Schools [a]	Enrollment (Oct. 2018) [a]	School Capacity	Percent of Capacity
Alvin ISD	30	25,945	29,397 [b]	88.3
Angleton ISD	11	6,767	8,754 [c]	77.3
Brazosport ISD	20	12,417	14,137 [d]	89.5
Pearland ISD	24	21,606	23,274 [e]	92.8
Houston ISD	279	209,772	ND	ND

ISD = Independent School District; ND = No data

[a] TEA 2019—Schools with students enrolled as of October 2018; includes charter, specialized and alternative schools.

[b] Templeton Demographics 2019.

[c] PBK Architects 2018.

[d] Brazosport ISD 2014a through 2014o; Brazosport ISD 2016.

[e] Pearland ISD 2016.

The Brazosport ISD encompasses coastal Brazoria County, including the cities of Lake Jackson, Freeport, Oyster Creek, and Surfside Beach. The District has had stable school enrollment and is in the midst of a multi-year school improvement program that includes replacement of three elementary schools, as well as facility upgrades (Brazosport ISD 2016). The Angleton and Pearland ISDs anticipate modest enrollment growth over the next 10 years. The Master Plans for these two districts propose facility upgrades and expansions, but no new schools. Alvin ISD predicts a higher rate of growth, and anticipates that the district as a whole will be over capacity by the 2022–2023 school year due to planned residential development (Templeton Demographics 2019). Houston ISD, the seventh-largest school district in the United States, is experiencing declining enrollments due in part to competition from charter schools that are not associated with any school district (Dulin 2019).

3.14.6.2. Impacts and Mitigation

This section includes a discussion of the likely impacts of Project construction and operation on public services. As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on public services have been evaluated based on their potential to cause substantial change in the availability or quality of public services.

The remainder of this section describes potential employment and income impacts of construction and operation of the Project's onshore and offshore facilities, including the ECHO Terminal, Oyster Creek Terminal, onshore and offshore pipelines, and the SPOT DWP, based on the criteria above.

Construction

Construction of the SPOT DWP onshore and offshore facilities could result in incidents that require police, fire, or emergency medical responders and hospital-based medical services from the agencies and facilities described above. The ECHO and Oyster Creek Terminal sites are accessible to emergency service responders via public roads. Vehicular access to pipeline construction areas would be via temporary construction access roads.

Hospitals with the capability of treating all emergency conditions are within a short driving distance of both onshore terminal sites and Port Freeport, as listed in Table 3.14-12. Pipeline sites could be closer to any of the four hospitals listed below, depending on the location.

Table 3.14-12: Driving Time to Hospitals

Site	Closest Hospital	Miles by Road	Estimated Driving Time (Non-Emergency)
ECHO Terminal	Memorial Hermann Southeast Hospital	3.0	9 minutes
Oyster Creek Terminal	CHI St Luke's Health Brazosport	9.7	16 minutes
Port Freeport	CHI St Luke's Health Brazosport	10.3	17 minutes
Surfside Beach HDD site	CHI St Luke's Health Brazosport	13.9	19 minutes

HDD = horizontal directional drill

Consistent with its statutory authorities and operational demands, the USCG would provide a response to aid the Applicant in the event of any emergency, using resources that are available at the time.

As described in Section 3.14.3.2, Socioeconomics, Population and Demographics, Impacts and Mitigations, the public service demands from the influx of temporary workers would be small compared to public services in the 4.9 million-person study area. The number of Project workers would not exceed 1,100 for the one to two-month peak period. Impact on schools are unlikely because Project construction workers are expected to either be socioeconomic study area residents or to relocate for short periods of time; thus, most would be unlikely to bring families with them. As shown in Table 3.14-11, study area school systems have capacity to accommodate longer-term workers that relocate with families.

The Brazoria County Criminal Justice Community Plan notes the presence of large, temporary workforces as one factor resulting in a need for additional law enforcement capacity (Brazoria County 2017). The Project would contribute to the presence of temporary workforces, along with other anticipated construction projects (see Chapter 5, Cumulative Impacts).

Based on the above, and particularly the need for additional law enforcement capacity in southern Brazoria County, Project construction would have an indirect, adverse, short-term, and minor impact on public services.

Operation

Project operation would require approximately 62 workers. If all workers were hired from outside the study area and moved to the study area, the addition of 62 households would generate an imperceptible incremental demand on public services in the 4.9 million-person study area. The offshore SPOT DWP would be equipped with a safety control system, fire and gas detection system, and firefighting system, and would not depend upon the services of local, land-based fire departments (SPOT 2019a, Application, Volume IIa, Section 12). As is common with other offshore facilities, the Project would be subject to Federal response authorities. Overall, Project operation would have a direct and indirect, adverse, long-term, and negligible impact on public services in the study area, except during accidental releases of hazardous materials. Depending on the size and duration of the spill, impacts on public services, including oil spill response resources of the USCG and other agencies or other entities, could be direct and indirect, adverse, short-term to long-term, and minor to major.

Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project; however, it is expected the workforce would be local. Therefore, impacts associated with planned or unplanned maintenance would be direct and indirect, short-term, and negligible, and would neither be beneficial nor adverse.

3.14.7. Recreation and Tourism

This section focuses on economic aspects of recreation and tourism. As described in Table 3.2.1 in Section 3.2.2, Evaluation Criteria, the Project's impacts have been evaluated based on their potential to cause substantial change to the local or regional recreation and tourism economy. See Section 3.10, Land Use, Recreation, Visual Resources, and Ocean Use, for a discussion of Project impacts on the availability or quality of, or access to recreation facilities and activities.

3.14.7.1. Existing Conditions

Recreation and tourism are minor economic drivers in Brazoria County and southern Harris County, generating jobs and encompassing a variety of onshore and offshore activities, as described below.

The arts, entertainment, and recreation sector as a whole generated 1,069 jobs in Brazoria County and 28,476 jobs in Harris County in 2016 (Table 3.14-6), equivalent to 1.2 percent and 1.4 percent of all jobs in Brazoria and Harris counties, respectively. The accommodation and food services sector provided a substantial portion of jobs, with 11,681 jobs in Brazoria County and 204,970 jobs in Harris County, representing 13 percent and 10 percent, respectively, of all county jobs. The only sectors providing a greater number of jobs were construction, manufacturing, and retail trade in Brazoria County and retail trade and healthcare/social assistance in Harris County. The accommodation and food services sector is related to recreation and tourism, but also supports business travel, temporary workforces, and other temporary housing needs.

Onshore Recreation and Tourism

Harris County has a wide range of tourism and recreation facilities, most of which are north of SH 8. Construction workspace for the ECHO to Oyster Creek Pipeline would be adjacent to the 361-acre El Franco Lee Park. The park, managed by Harris County, provides a community center, picnic and playground areas, nature trails, athletic fields, and a fishing pond (Houstonfirst 2019).

Popular recreation and tourism activities in Brazoria County include hunting, fishing, boating, wildlife viewing, and birdwatching. The county has 11 parks, including 7 inland parks and 4 parks on the coast. The county also maintains 21 public boat ramps that provide access to rivers, creeks, bayous, and the GIWW (Brazoria County 2019b). Three environmental preserves located in southern Brazoria County—the Brazoria NWR, the San Bernard NWR, and the Justin Hurst Wildlife Management Area—provide opportunities for bird and wildlife viewing, environmental education, hiking, hunting, and fishing (USFWS 2019a). Other visitor attractions in the county include numerous museums, historic sites, science and environmental exhibits, theaters, and municipal parks.

As described in Section 3.10.4, Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources, the onshore pipeline route through Brazoria County would be adjacent to a park in Angleton and the Brazoria NWR. Near the shore, the collocated pipelines would be 0.5 mile from the Stahlman Park Event Center in the Village of Surfside Beach. The HDD shore crossing would pass under CR 257 (the Bluewater Highway), which is used to access 40 miles of public beaches from Surfside Beach to Galveston. The HDD crossing would also extend beneath a public beach in Surfside Beach, a village with a high proportion of vacation homes and several hotels (Tables 3.14-2 and 3.14-3). The onshore pipelines would cross 129 waterbodies, including intermittent and perennial streams that provide spawning grounds or permanent habitat for freshwater fish, possibly including species popular for recreational fishing such as bass, catfish, crappie, alligator gar, paddlefish, saugeye, shad, sunfish, trout, and walleye (see Section 3.6, Estuarine and Marine Fisheries, for more detail).

The Oyster Creek Terminal would be approximately 4 miles west of the Brazoria NWR and 1 mile south of the Bastrop Bayou, which is used for boating and fishing. The Bastrop Bayou Public Boat Ramp has concrete boat ramps, a fishing pier, and parking, and is 1.2 miles from the Oyster Creek Terminal site.

Offshore Recreation and Tourism

Offshore recreation activities in the vicinity of the proposed offshore pipelines and SPOT DWP include boating and fishing, scuba diving at artificial reefs, and cruise ship operations, as described in Section 3.10.4, Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources. Business activities that support offshore recreation include hotels, motels, RV parks, vacation rentals, restaurants, recreation-oriented retailers, boat charters and tours, and equipment vendors. As noted in Section 3.10.4, cruise ships operate out of the Port of Galveston, not from the ports within the study area (Port Freeport and the Port of Houston).

Recreational fishing is an important economic activity in Texas. In 2016, an estimated 1.2 million recreational fishing trips occurred along the Texas Gulf Coast. Expenditures on recreational fishing supported an estimated 16,000 jobs and generated $2 billion in sales. Among the Gulf Coast states (Florida, Alabama, Louisiana, Mississippi, and Texas), Texas ranked third for the number of jobs and second for total recreational fishing-related sales and services (NMFS 2018b).

The National Ocean Watch "Ocean Economy" data, developed through a partnership between NOAA, the Bureau of Economic Analysis, and the Bureau of Labor Statistics, tracks businesses that are dependent upon a location on the coastline or use ocean resources. Ocean Economy industry sectors include marine transportation, commercial fishing, offshore mineral extraction, shipbuilding, marine construction, and tourism/recreation. For Gulf Coast counties, the Ocean Economy data on tourism and recreation include only businesses that rely upon proximity to the GoM, such as marinas, tour boats, boat sales and rentals, coastal sporting goods, coastal lodging, restaurants, amusement and recreation establishments, and businesses related to recreational fishing and boating in the GoM (NOAA 2017c).

Table 3.14-13 shows Ocean Economy data for Texas Gulf Coast counties from Jefferson County, which abuts Louisiana, to Nueces County, which contains the city of Corpus Christi. Coastal recreation and tourism is a source of jobs and income in the socioeconomic study area, but is not nearly as prominent in Brazoria and Harris counties as in most Texas Gulf Coast counties. Brazoria County's coastal recreation and tourism industry employment and Gross Domestic Product (GDP) are 20 to 25 times smaller than other counties with comparable population, and are comparable to counties with one-tenth of Brazoria County's population. Similarly, the coastal recreation and tourism industry in Harris County is smaller than in Galveston and Nueces counties, which have less than one-tenth the population of Harris County.

Table 3.14-13: Ocean Economy—Tourism and Recreation: Establishments and Self-Employment for Texas Coastal Counties (2016)

County	Population	Number of Establishments	Employment	GDP [a] ($1,000s)	Number of Self-Employed Individuals	Self-Employment: Gross Receipts ($1,000s)
Aransas	24,832	102	1,288	52,586	44	3,027
Brazoria	345,995	52	545	17,923	26	1,564
Calhoun	21,821	69	719	21,716	29	1,910
Chambers	39,283	29	433	15,218	22	1,259
Galveston	321,184	435	11,607	463,552	105	8,497
Harris	4,525,519	439	8,846	319,415	130	11,696
Jefferson	254,574	79	1,759	59,870	34	1,100
Matagorda	36,744	70	956	32,896	41	1,243
Nueces	358,484	546	13,668	591,927	105	7,816
Refugio	7,293	17	242	6,308	7	588
San Patricio	66,867	86	1,781	60,582	46	2,568
Victoria	91,518	8	63	2,135	0	0

Source: NOAA et al. 2019

[a] GDP is Gross Domestic Product. GDP and employment do not include self-employed individuals.

As another way of understanding the importance of ocean-based recreation and tourism, Brazoria County had about 87,450 total jobs in 2016, of which fewer than 600 jobs (approximately 0.6 percent of total jobs) were in ocean-based recreation and tourism. Harris County had 2 million total jobs in 2016, of which nearly 9,000 (approximately 0.5 percent of total jobs) were in ocean-based recreation and tourism.

3.14.7.2. Impacts and Mitigation

This section includes a discussion of the likely impacts of Project construction and operation on the economic outputs of the regional and local recreation and tourism industry. As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on recreation and tourism have been evaluated based on their potential to cause substantial change in the local and regional economic contributions of recreation and tourism. Section 3.10.4, Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources, describes the Project's effects on access to and use of recreation facilities.

The remainder of this section describes the Project's potential recreation and tourism impacts of construction and operation of the Project's onshore and offshore facilities, including the ECHO Terminal, Oyster Creek Terminal, onshore and offshore pipelines, and the SPOT DWP, based on the criteria above.

Onshore Recreation and Tourism

Construction

Pipeline construction would temporarily produce noise, dust, and fumes that would affect users of adjacent parks. As discussed in Section 3.10.4.2, Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources, Impacts and Mitigation, Project Construction would have negligible impacts on onshore recreational resources; therefore, Project construction would also not affect economic activity from onshore study area recreation and tourism. Construction impacts on freshwater fish due to pipeline stream crossings would be negligible, as discussed in Section 3.5.4.2, Wildlife and Aquatic Resources, Freshwater Fisheries, Impacts and Mitigation.

As noted in Section 3.10.4.2, pipeline installation under the public beach in Surfside could temporarily discourage visitors from using that portion of the beach due to noise and dust from the HDD installation, although beach access would not be affected. The HDD installation is planned to occur between January and March of 2023, although the HDD under the beach would not take the entirety of these 3 months. The second and third quarters of the calendar year (April 1 through September 30) are the busiest periods for tourism in the Houston-Galveston-Brazoria Metropolitan Statistical Area (University of West Florida 2018). Tourism-related spending is substantially lower in the first and fourth quarters, generally comprising less than one-third of the spending level in the third quarter. As a result, completing the HDD at the shore crossing during the first quarter as planned would minimize disruption to tourism. Since the publication of the Draft EIS, the Applicant has changed the proposed location of the shoreline MLV from the south side to the north side of Bluewater Highway. The proposed HDD entry/exit site would be on the north side of Bluewater Highway, near Swan Lake. As such, any beach visitors would be separated from visual and noise impacts during HDD and MLV installation by a well-traveled road, the beach dunes, and existing structures.

Project construction at the Oyster Creek Terminal would not affect the boat ramp and fishing pier at Bastrop Bayou, just over 1 mile away, as explained in Section 3.13.3.2, Noise, Onshore Noise, Impacts and Mitigation. Recreational boaters on portions of Swan Lake and the GIWW would experience temporary construction noise impacts from HDD entry/exit points on the north and south sides of the lake, but access to the water would not be disrupted.

Disruptions to parks and waterways during onshore construction would be temporary and limited in scope and the impact on inland fish would be negligible. In addition, the HDD entry site for pipeline installation near Surfside Beach would be located on the opposite side of Bluewater Highway than the beach, and the

HDD installation would not occur during the busiest season for tourism. Therefore, onshore Project construction would have a direct, adverse, short-term, and negligible to minor impact on economic activity related to onshore recreation and tourism.

Operation

As stated in Section 3.10.4.2, Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources, Impacts and Mitigation, Project Construction, operation would not affect recreation facilities unless non-routine maintenance of the onshore pipelines is required at sites adjacent to park facilities. Section 2.2, Detailed Description of the Proposed Action, discusses non-routine maintenance (i.e., the need to repair a pipeline).

The onshore to offshore pipeline connection would pass under the beach in the Village of Surfside Beach. Normal operation of the pipeline would not affect beach use, as the underground pipeline would be neither visible nor audible (see Section 3.12.3.2, Onshore Noise Impacts and Mitigation, Airborne Operation Noise Impact); however, if repairs were needed, beach access and use could be temporarily interrupted in the vicinity of the onshore to offshore crossing.

Section 3.13.3.2 Onshore Noise, Impacts and Mitigation describes the operational noise impacts from the Oyster Creek Terminal. Operational noise would be lower than ambient noise levels, including at NSA 5, which is a similar distance from the Bastrop Bayou public boat ramp (with similar intervening topography and land cover). As a result, operational noise from the Oyster Creek Terminal would not affect activity at the boat ramp.

Comments from Surfside Beach property owners received on the Draft EIS suggest that the pipeline location within Surfside Beach could lower vacation rental income and property values for adjacent and nearby properties. Currently available information does not support any firm conclusion with respect to pipeline effects on property value. Two available studies on the impact of natural gas pipelines on residential property sales do not address resort or vacation properties, and conclude that the data do not support a finding of any significant impact on property values (Diskin et al. 2011, INGAA Foundation 2016). Significant oil pipeline spills may result in temporary reductions in property value for affected and nearby land; the extent and duration of the reduction would depend on the severity of the spill and the specific impacts on properties (CRED 2013).

Repairs to pipelines, if needed, could temporarily impact recreation facilities; therefore, Project operation would have a direct, adverse, short-term, negligible impact on economic activity related to onshore recreation and tourism.

As explained in Section 3.10.4, an oil spill, although not anticipated, could have minor to major impacts on resources important to recreation and tourism, such as wildlife, freshwater fisheries, or beaches, resulting in indirect, adverse, long-term, minor to moderate impacts on economic activity and businesses related to onshore recreation and tourism.

Offshore Recreation and Tourism

The Project's impacts on the economic contribution of offshore recreation and tourism would be indirect, resulting from direct impacts on other resources that affect recreation and tourism, such as water quality, recreational fisheries, and noise.

Construction

Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigation, describes the Project's impacts on marine fisheries during construction, including fish targeted by offshore recreational fishing. These impacts could occur as a result of:

- Small accidental releases of gasoline, oil, hydraulic fluids, or diesel fuel from vessels during construction;
- Water intake and discharges activities during hydrostatic testing at the SPOT DWP;
- Inadvertent releases of drilling mud or other lubricants from the offshore HDD route;
- Pile driving noise; and
- Jet sledding noise.

These impacts would be direct, adverse, short-term, and minor to moderate for the fisheries. Specific areas near the proposed pipeline and SPOT DWP may be closed to fishing during Project construction due to safety concerns. These closures would typically consist of a small area for several days. SPOT DWP and pipeline installation would restrict access to Galveston Area lease block 463, and the area above the pipeline route (See Section 3.11.4, Transportation, Marine Navigation and Vessel Traffic).

As described in Section 3.6.4, the impacts on fish populations during construction would be short-term and minor. Cruise ship traffic and recreational vessels traveling for purposes of fishing, sightseeing, or scuba diving would be inconvenienced by safety zones established during construction, but would not be blocked from areas other than the actual construction locations. As a result, the impacts on the business establishments and employment supported by offshore recreation would be direct and indirect, adverse, short-term, and minor.

Operation

Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigation, describes the Project's impacts on marine fisheries during operation, including fish targeted by offshore recreational fishing. These impacts could occur as a result of the following procedures and events:

- Routine water intake and discharges from the SPOT DWP and VLCC or other crude oil carriers: long term, minor impacts;
- Vessel noise: short-term, minor impacts;
- Illumination of surface waters in the vicinity of the SPOT DWP: minor to moderate impacts; and
- Large oil spill: while the potential for a large spill to occur is small (see Chapter 4, Safety), a large oil spill during Project operation would have long-term, moderate to major impacts on fishes.

These impacts would be direct, adverse, short-term to long-term, and minor to major for the fisheries. The SPOT DWP safety zones and the ATBA/NAA would make large portions of Galveston Area lease block 463 permanently unavailable for marine traffic, including recreational fishing. As noted in Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigation, recreation and commercial hook-and-line fisheries may not be substantially affected by the safety zone due to the lack of hard-bottom habitat used by demersal species. People engaged in coastal pelagic recreational fishing may be affected due to restrictions on trolling activities within the safety zone.

Operation of the SPOT DWP would not affect cruise lines or scuba diving. Sightseeing and recreational boats have adequate space to travel through the GoM while avoiding the lease block that would be occupied by the SPOT DWP. People engaged in recreational fishing who regularly fish in the area and have customarily used the area to be occupied by the SPOT DWP would find different regular fishing locations.

Based upon the impacts on fish populations described in Section 3.6.4, operation of the SPOT DWP would have indirect, adverse, long-term, negligible to minor impacts on businesses that support offshore tourism and recreation, such as lodgings, marinas, and retail suppliers.

As explained in Sections 3.6.4.9 Estuarine and Marine Fisheries, Impacts and Mitigation, Accidental Releases of Hazardous Materials and 3.10.4.2 Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources, Impacts and Mitigation, Project Construction, an oil spill, although not anticipated, could have minor to major impacts on estuarine and marine fisheries, with corresponding impacts on economic activity related to recreational fishing, resulting in indirect, adverse, long-term, minor to moderate impacts on economic activity and businesses.

Planned and Unplanned Maintenance

Onshore Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project. Periodic maintenance could involve ground-disturbing activities or result in a release of hazardous material. Impacts would be similar to those described for construction. During maintenance activities, the Applicant would adhere to the Construction Spill Response Plan (BMP #3 in Appendix N), Construction BMPs (Appendix M; BMP #1), and the industry standard upland construction plans (BMP #26). Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse, long-term, and negligible.

Offshore Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in transits for maintenance vessels. Maintenance impacts would be similar to those described for construction. Therefore, impacts associated with planned or unplanned maintenance would be direct and indirect, adverse, short-term, and negligible.

3.14.8. Commercial Fisheries

This section focuses on the economic contribution of commercial fisheries within the study area, and potential economic impacts on commercial fisheries from the SPOT DWP. As described in Table 3.2.1 in Section 3.2.2, Evaluation Criteria, the Project's effects have been evaluated based on their potential to cause substantial change to the local or regional commercial fishery economy or employment.

3.14.8.1. Existing Conditions

In 2018, the GoM accounted for 16 percent of the weight and value of the U.S. commercial fishery landings (NMFS 2018d). On average, Texas contributed approximately 6 percent of the landings and 26 percent of the revenue in the GoM from 2008 to 2018 (see Table 3.6.3-2 in Section 3.6, Estuarine and Marine Fisheries). Total 2018 commercial fishing landings in Texas included more than 84.4 million pounds of seafood, valued at approximately $212 million (NMFS 2021b). The shrimp fishery is the largest commercial fishery in Texas. Oysters, red snapper, and blue crab also contribute a large portion of the commercial fish revenue (NMFS 2021b).

Ports within the Galveston Bay Complex ranked third among Texas ports in landings and second in value at 20 million pounds and $60 million, respectively, in 2018 (NMFS 2020a). Other Texas ports listed among the major U.S. ports for commercial fishery landings include Brownsville-Port Isabel (adjacent to the Mexico border), Palacios (in Matagorda County, adjacent to Brazoria County), and Port Arthur (on the Louisiana border). In 2019, commercial fishing activity in the portions of the GoM offshore of Freeport and Port Aransas accounted for approximately 14.2 million pounds of seafood, valued at approximately $35.8 million. Shrimp compose more than 90 percent of the total weight and value from these areas (TPWD 2020b).

Fishing vessels composed 70 percent of the marine traffic within Galveston Area lease block 463, where the proposed SPOT DWP would be located (see Section 3.11.3.2, Transportation, Road Network and Traffic, Impacts and Mitigation). About five fishing vessels per week passed through the lease block during 2016 and 2017, as shown in Table 3.11-8 in Section 3.11, Transportation.

Table 3.14-14 shows the Ocean Economy data for certain Texas Gulf Coast counties in the "living resources" category, which includes commercial fishing, aquaculture, and the supporting industries of seafood processing and seafood markets (NOAA 2019i). Data are not provided due to privacy concerns if a county has only one or two establishments in the given category. Because many commercial fishing businesses are sole proprietorships, it is still possible to compare the size of the industry in different counties using the self-employment data.

Harris County had the largest commercial fishing industry among the upper and mid-Gulf Coast counties, followed by Galveston, Jefferson, Matagorda, and Calhoun counties. Brazoria County had a relatively small commercial fishing industry compared to other Gulf Coast counties of comparable population (i.e., Jefferson, Nueces, and Galveston counties). Commercial fishing provides 1,358 jobs in the study area—nearly all of them in Harris County—excluding the suppressed job data for Brazoria County's one or two multi-employee businesses in the "living resources" sectors.

Table 3.14-14: Ocean Economy—Living Resources: Establishments and Self-Employment for Texas Coastal Counties (2016)

County	Population	Number of Establishments	Employment	GDP ($1,000s)	Number of Self-Employed Individuals	Self-Employment: Gross Receipts ($1,000s)
Aransas	24,832	Suppressed	Suppressed	Suppressed	122	3,957
Brazoria	345,995	Suppressed	Suppressed	Suppressed	124	6,310
Calhoun	21,821	11	63	3,902	181	10,453
Chambers	39,283	Suppressed			65	3,333
Galveston	321,184	24	306	27,008	470	34,318
Harris	4,525,519	80	688	71,724	546	28,764
Jefferson	254,574	28	75	4,893	404	24,079
Matagorda	36,744	33	32	4,052	267	17,696
Nueces	358,484	Suppressed	Suppressed	Suppressed	127	5,146
Refugio	7,293	Suppressed	Suppressed	Suppressed	5	131
San Patricio	66,867	0	0	0	58	1,778
Victoria	91,518	0	0	0	34	610

Source: NOAA 2019e

3.14.8.2. Impacts and Mitigation

This section includes a discussion of the likely impacts of Project on the economic output of commercial fisheries. As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on commercial fisheries have been evaluated based on their potential to cause substantial change in the economic output of commercial fisheries and for-hire and charter fishing businesses and related shore-based businesses such as seafood processing, seafood wholesalers, marine supply, and marine services. Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigations, describes the fisheries (i.e., the species targeted by commercial fishing).

The remainder of this section describes potential economic impacts on commercial fisheries from construction and operation of the Project's offshore facilities, including the offshore pipelines and the SPOT DWP, based on the criteria above.

Construction

SPOT DWP and offshore pipeline installation would restrict access to Galveston Area lease blocks A-59 and 463, and would restrict access to areas above the pipeline route for several days during pipeline laying and trenching (see Section 3.11.4, Transportation, Marine Navigation and Vessel Traffic). Based on the level of fishing vessel traffic within the SPOT DWP lease block, some commercial fishing operators would need to change their routes to avoid the Project lease blocks. While specific commercial fishing locations are not known, commercial fishing vessels that formerly fished in lease blocks A-59 and 463 would need to find other fishing locations.

Based on the potential route and location disruptions, the level of fishing vessel traffic within Galveston Area lease block 463, and the potential minor impacts on fish populations described above, offshore construction would have a direct, adverse, short-term, and moderate impact on the commercial fishing industry, for-hire and charter boating, and related businesses. These direct impacts would lead to indirect, adverse, short-term, minor impacts on shore-based establishments supported by commercial fishing.

Operation

In addition to the impacts summarized above from Section 3.6.4, Estuarine and Marine Fisheries, Impacts and Mitigation, Gulf menhaden are fished commercially, and bay anchovy are important as a prey fish for commercial species. These species are not a substantial component of recreational fisheries. As described in Section 3.6.4, Project operation would have direct, adverse, long-term, minor impacts on the Gulf menhaden fishery and bay anchovy as a prey species.

The SPOT DWP would establish safety zones and an ATBA/NAA, making large portions of Galveston Area lease block 463 permanently unavailable for marine traffic (Section 3.11.4, Transportation, Marine Navigation and Vessel Traffic). The safety zone would adversely impact commercial shrimp trawling by forcing shrimping vessels to avoid the safety zone. Section 3.6.4 concludes that impacts on commercial shrimp fisheries would be direct, adverse, long-term, and negligible.

As described in Section 3.11.4, 70 percent of the vessels that passed through Galveston Area lease block 463 in 2016 and 2017 were fishing vessels (SPOT 2019e). Although vessel traffic details are not available for other nearby lease blocks, the total vessel traffic levels are similar, and lease block 463 is a small portion of the available waters on the Texas Gulf Coast. As a result, it is expected that commercial fishing operators who have customarily fished within lease block 463 would adjust over the life of the SPOT DWP by finding other fishing locations.

Based on potential impacts on fish populations and the number of commercial fishing vessels that pass through the SPOT DWP area, Project operation would have a direct, adverse, long-term, minor impact on the commercial fishing industry, for-hire and charter boating, and an indirect, adverse, long-term, and minor impact on related onshore businesses such as wholesalers and processing.

As explained in Section 3.6.4.9 Estuarine and Marine Fisheries, Impacts and Mitigation, Accidental Releases of Hazardous Materials and Section 3.10.4.2 Land Use, Recreation, Visual Resources, and Ocean Use, Recreation Resources, Impacts and Mitigation, Project Construction, an oil spill, although not anticipated, could have minor to major impacts on estuarine and marine fisheries. The corresponding impacts on commercial fishing operations that rely on species or locations affected by the spill could result in direct, adverse, long-term, minor to moderate impacts on commercial fishing.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in transits for maintenance vessels. Maintenance impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be indirect, adverse, short-term, and minor.

3.14.9. Marine Commerce and Shipping

This section provides a brief overview of marine commerce and shipping in the study area, and potential impacts on this industry from the SPOT DWP. As described in Table 3.2.1 in Section 3.2.2, Evaluation

Criteria, the Project's effects have been evaluated based on their potential to cause substantial change to the local or regional marine commerce economy or employment.

3.14.9.1. Existing Conditions

Texas Gulf Coast ports handled more than 496 million tons of foreign and domestic cargo in 2016, more than 20 percent of all U.S. port tonnage (TxDOT 2019a,b). Six Texas ports rank in the top 50 ports in the U.S. in terms of annual tonnage, including the Port of Houston (ranked 2nd in the U.S.), Beaumont (8th), Corpus Christi (9th), Port Arthur (20th), Texas City (21st), and Freeport (34th) (USDOT 2019).

Within the study area, Port Freeport and the Port of Houston are focal points for the transportation and warehousing sectors of the county economy, which provided 2.3 and 4.7 percent of jobs in Brazoria and Harris counties, respectively (Table 3.14-6). Both ports are part of Federally designated Foreign Trade Zones, a designation that encourages import/export trade. In addition, both ports are on the GIWW, which supports marine commerce within and between the Gulf Coast states. Texas has the greatest volume of intrastate shipping of any state, with more than 75 million tons of cargo shipped between Texas ports in 2016 (TxDOT 2019a).

Port Freeport is the only DWP on the U.S. Gulf Coast currently able to receive large "post-Panamax" container ships now beginning to visit the GoM due to the 2016 expansion of the Panama Canal (TxDOT 2019a). Construction is underway on the Freeport LNG export facility, part of the new U.S. liquefied natural gas exporting industry, which can be accommodated due to depth of the channel access to Port Freeport and the Freeport LNG project. To further accommodate these ships, the port has embarked on a $30 million dredging project to widen its main channel, and has received Federal approval to deepen its harbor. Port Freeport includes 18 docks, warehouses, and cold storage facilities, and has access to a Union Pacific rail line.

Port Houston is one of the busiest ports in the nation, and handled "more than two-thirds of all containerized cargo on the United States Gulf Coast in 2016" (TxDOT 2019a). The Houston Ship Channel is the busiest waterway in the U.S. and is also the home of the largest petrochemical complex in the nation (NAI Partners 2019).

Other focal points of marine commerce close to the study area include the Port of Texas City and the Port of Galveston, both in Galveston County. The Port of Galveston is the 4th busiest cruise ship port in the United States and the only port in Texas that serves as the homeport for cruise ships (Texas Port Association 2019, NAI Partners 2019). In neighboring Matagorda County, south of Freeport, the Port of Palacios is a commercial fishing port focused on the shrimp industry (Texas Port Association 2019).

3.14.9.2. Impacts and Mitigation

This section includes a discussion of the likely impacts of Project construction and operation on marine commerce and shipping (other than commercial fisheries, for-hire charter fishing, and offshore recreational activity). As described above, the socioeconomic study area includes all of Brazoria and Harris counties.

As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's likely effects on the local or regional economic contributions of marine commerce and shipping have been evaluated based on their potential to cause substantial change in the economic outputs of marine commerce and shipping.

The remainder of this section describes potential impacts on marine commerce and shipping economic from construction and operation of the Project's offshore facilities, including the offshore pipelines and the SPOT DWP, based on the criteria above.

Construction

Offshore Project construction would generate temporary economic activity and vessel traffic at Port Freeport, as supply and crew vessels transport goods and personnel to offshore project sites. Increased vessel traffic within the harbor would require additional caution by Freeport Harbor pilots, but as stated in Section 3.11.4.2, Transportation, Marine Navigation and Vessel Traffic, Impacts and Mitigation, would not hinder marine commerce or shipping.

During construction of the offshore pipelines and SPOT DWP, the USCG would establish a temporary safety zone around the offshore Project area, allowing only Project-related vessels to access the construction area. Non-Project vessels would need to navigate around the safety zone. The offshore pipeline route would cross identified safety fairways—the most frequently traveled places in the offshore socioeconomic study area (see Section 3.11.3.2, Transportation, Road Network and Traffic, Impacts and Mitigation)—twice. Both shipping fairways carried 2,500 to 5,000 vessels during the 2-year period from 2016 to 2017, or 3 to 7 vessel trips per day (SPOT 2019e). Based on the Applicant's proposed construction schedule, offshore pipeline installation and trenching across each fairway would take approximately 14 days during the 22-month offshore construction period. This includes separate 2- to 3-day periods to lay each pipeline, and separate 1- to 2-day periods to trench each pipeline. During these periods, non-Project vessels would need to exercise caution or even navigate outside of the fairway to avoid Project vessels (especially relatively immobile lay barges and assist tugs).

As discussed in Section 3.11.3.2, vessel traffic in other portions of the offshore construction area is relatively low. Most vessels traveling near the proposed SPOT DWP location are fishing boats, as described in Section 3.14.8, Socioeconomics, Commercial Fisheries. Ships engaged in marine commerce would travel primarily within the shipping fairways and would not experience delays or need to alter routes except where the shipping fairways are affected.

Based on the above discussion, offshore Project construction would have a direct, beneficial, short-term, minor impact on economic activity at Port Freeport by providing increased revenue at the port, and a direct, adverse, short-term, minor impact on marine commerce and shipping, due to the need for ships to avoid pipeline construction across the safety fairways.

Operation

As described in Section 3.11.4.2, Transportation, Marine Navigation and Vessel Traffic, Impacts and Mitigation, Project operation would generate VLCC and other crude oil carrier trips to the SPOT DWP. These tankers would not be new traffic to the Texas Gulf Coast region, but would instead be tankers that might otherwise lighter near Galveston or Freeport. The SPOT DWP would also require up to twice-weekly supply boats as well as vessels carrying inspection and maintenance contractors traveling from Port Freeport to the SPOT DWP (SPOT 2019a, Application, Volume IIa, Section 1).

Use of the SPOT DWP by VLCCs and other crude oil carriers would avoid trips to lightering areas, and would also eliminate more than 900 shuttle tanker trips per year to and from the Ports of Galveston or Freeport (see Section 3.11.4, Transportation, Marine Navigation and Vessel Traffic). The elimination of large numbers of shuttle tanker trips from the Galveston area would free up space for other activities in the Houston-Galveston and Freeport areas.

Based on the above discussion, operation of the SPOT DWP would have a direct, beneficial, long-term, minor impact on marine commerce at Port Freeport by supporting supply boat and contract vessel operations, and an indirect, beneficial, long-term, moderate to major impact on marine commerce and shipping in the greater Texas Gulf Coast region by reducing shuttle tanker trips and enabling other productive uses of ports for marine commerce.

Planned and Unplanned Maintenance

Periodic maintenance of subsea pipelines and the platform would occur over the life of the Project. These activities could result in transits for maintenance vessels. Maintenance impacts would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be direct, adverse (marine commerce and shipping) and beneficial (economic activity at Port Freeport), short-term, and minor.

3.14.10. Offshore Mineral Resources, Including Oil and Gas

This section discusses possible impacts of the SPOT DWP on the offshore oil and gas industry in the study area. As described in Table 3.2.1 in Section 3.2.2, Evaluation Criteria, the Project's effects have been evaluated based on their potential to cause substantial change to local or regional economic activity or employment associated with offshore mineral resources.

3.14.10.1. Existing Conditions

Mineral extraction, including the oil and gas industries, is an important component of the Ocean Economy in the study area. The Offshore Mineral Resources sector, as compiled in the Ocean Economy data includes offshore sand and gravel mining, offshore oil and gas extraction, drilling of oil and gas wells, support operations for oil and gas operations, and exploration/mapping services (NOAA 2017c). For Harris County, this sector had a total GDP of $81.3 billion, and employed 81,790 persons in 2016 (NOAA 2019e). It accounted for 94 percent of Harris County's Ocean Economy, with the remaining 6 percent divided among commercial fishing, coastal recreation/tourism, shipbuilding, marine construction, and marine transportation. The Offshore Mineral Resources data for Brazoria County were suppressed, indicating that only one or two entities or businesses operated in this sector. Several large oil and gas and petrochemical companies (including Dow Chemical, Phillips 66, and Freeport LNG, among others) are present in southern Brazoria County. These companies rely on their coastal location and harbor access for transportation of products or supplies, but are not necessarily focused on offshore exploration or extraction in the region.

Oil and gas are key industries in the regional economy as a whole. The oil and gas industry along the Gulf Coast originated due to the availability of oil in the GoM, but current jobs are diverse and not limited to offshore oil exploration and extraction. About 10 percent of jobs in the 13-county GCEDD are in the energy industry, including research, transportation (pipeline, marine and other modes), administration, manufacturing and fabrication, processing and construction. Due to the high wages paid by the energy industry, these jobs account for approximately 20 percent of the region's wages and 30 percent of the regional GDP. The energy industry accounts for an estimated 57 percent of the total freight handled by the ports in the region (GCEDD 2018a). The industry cluster of oil and gas production and transportation is the fifth-largest industry cluster in Brazoria County, in terms of employment (GCEDD 2018b). In Harris County, oil and gas production/transportation is the third-largest industry cluster in terms of employment. Only business services and distribution and electronic commerce rank higher (GCEDD 2018b).

3.14.10.2. Impacts and Mitigation

Project construction and operation would cause some offshore extraction or oil exploration vessels in the GoM to navigate around the SPOT DWP and under-construction offshore pipelines, but would otherwise not affect offshore extraction or oil exploration (see Section 3.10.6, Land Use, Recreation, Visual Resources, and Ocean Use, Ocean Use). The SPOT DWP would contribute to the regional and national oil and gas industry by providing a more efficient and cost-effective means to export crude oil via VLCCs or other crude oil carriers (see Section 3.11.4, Transportation, Marine Navigation and Vessel Traffic) (U.S. EIA 2018).

Project construction would have an indirect, adverse, short-term, negligible impact on economic activity related to mineral extraction or oil exploration.

Due to its contribution to the national energy industry, thereby possibly contributing to the economic resources available to the industry, Project operation would have an indirect, beneficial, long-term, minor impact on economic activity related to mineral extraction or oil exploration.

Periodic maintenance of subsea pipelines and the offshore platform would occur over the life of the Project. These activities could result in transits for maintenance vessels, which would be similar to those described for construction, but shorter in duration. Therefore, impacts associated with planned or unplanned maintenance would be indirect, adverse, short-term, and negligible.

3.15. Environmental Justice

This section discusses onshore and offshore impacts associated with Project construction and operation that could affect environmental justice communities.

3.15.1. Definition of the Resource

3.15.1.1. Regulatory Background

Executive Order 12898, Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations, requires that "each Federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

Executive Order 12898 directs Federal agencies to actively scrutinize the following issues with respect to environmental justice as part of the NEPA process (CEQ 1997):

- The racial and economic composition of affected communities;
- Health-related issues that may amplify project effects to minority or low-income individuals; and
- Public participation strategies, including community or tribal participation in the NEPA process.

Environmental justice analyses must address minority populations (i.e., residents who identify as non-white, or who are white but have Hispanic ethnicity) when they compose over 50 percent of the population in an affected area (USEPA 2016c). Environmental justice analyses must also address affected areas where the share of minority populations is "meaningfully greater" than the minority percentage in the "reference population"—the population of a larger area of the general population, such as a county, region, or state (USEPA 2016c). Low-income populations must be identified in an environmental justice analysis whenever they are greater than the low-income population in the reference population (USEPA 2016c).

CEQ and USEPA guidance do not define the geographic extent of potential environmental justice communities, nor do they define "meaningfully greater" in terms of a specific percentage or other quantitative measure. Consistent with previous NEPA analyses, this EIS defines the "reference population" as the State of Texas, and identifies U.S. Census block groups, as defined by the U.S. Census Bureau (U.S. Census Bureau 2019b), as environmental justice communities if they meet any of the following criteria:

- A minority population that composes more than 50 percent of the block group's total population;
- A minority population at least 10 percentage points higher than that of the general population of Texas; or
- A poverty rate higher than that of the general population of Texas.

The State of Texas, Brazoria County, and Harris County all have minority populations that compose more than 50 percent of the total population. As a result, while the analysis identifies block groups within Brazoria and Harris counties with minority populations greater than 50 percent, greater emphasis is placed on affected areas where the minority population is meaningfully greater than in the State of Texas, as defined above.

3.15.1.2. Environmental Justice Study Area

Environmental justice populations are identified using the U.S. Census 2013-2017 American Community Survey. Block groups are the smallest geographic unit for which population and income data sufficient to complete the environmental justice analysis are available. The environmental justice study area (the "affected area" referred to in federal guidance documents) includes the block groups that meet the following criteria for proximity to the Project:

- All block groups that contain part of the onshore Project facilities: the ECHO Terminal, Oyster Creek Terminal, ECHO to Oyster Creek Pipeline, Oyster Creek to Shore Pipelines, and temporary workspaces along the pipeline routes; and

- All block groups partially or entirely within 1 mile of an onshore Project facility or workspace. Due to the size of block groups in southern Brazoria County, the full area covered by this criterion is up to 5 miles from the boundaries of Project facilities and workspaces.

Federal guidance does not specify a minimum study area for environmental justice. The 1-mile radius used in this analysis was selected to include the areas most likely to experience the Project impacts described in Section 3.15.4, Environmental Justice, Impacts and Mitigation. Most impacts that have the potential to reach beyond 1 mile from Project facility boundaries would be minor in magnitude. The 1-mile radius also allows meaningful analysis of whether pipeline and terminal locations would disproportionately affect minority or low-income populations. For certain socioeconomic project impacts, this environmental justice analysis refers to possible impacts on the minority and low-income populations in Brazoria and Harris counties as a whole.

3.15.2. Existing Threats

Low-income communities would be more vulnerable than other populations to socioeconomic fluctuations that result in declines in employment or income (see Section 3.14, Socioeconomics). These populations would also be more vulnerable to environmental threats due to limited financial resources for relocation.

Since the issuance of the Draft EIS, there have been a series of administrative changes that may affect efforts to mitigate climate change in the United States. On January 27, 2021, President Biden issued the Executive Order on Tackling the Climate Crisis at Home and Abroad (Executive Order 14008, 86 Fed. Reg. 19 [February 1, 2021]). Among other objectives, the Executive Order requires agencies to "make achieving environmental justice part of their missions developing programs, policies, and activities to address the disproportionately high and adverse human health, environmental, climate-related and other cumulative impacts on disadvantaged communities, as well as the accompanying economic challenges of such impacts."

Some communities with high proportions of low income and minority populations may face disproportionately high exposure to pollutants. A 2021 report on fossil fuels and environmental justice notes that much of the fossil fuel extracted from shale is transported to refineries, petrochemical plants, and export facilities along the Gulf Coast, and the pollutants from these facilities are likely to disproportionately affect environmental justice communities (Donaghy and Jiang 2021). The report cites a 2016 study comparing health risks from exposure to pollutants between two east Houston communities that are predominantly Hispanic and low income, and two primarily white and wealthier west Houston communities (White et al. 2016, cited in Donaghy and Jiang 2021). The east Texas communities had higher exposure to certain pollutants, with oil refineries and chemical manufacturing ranking among the top polluting sources in the east Houston areas. An analysis of 2018 USEPA data on Risk-Screening Environmental Indicators demonstrates that on a nationwide basis, refineries and petrochemical plants disproportionately impact low income and minority communities: 56 percent of refinery toxic burden is borne by minorities (who make up 39 percent of the population) and 19 percent by low income communities (who make up 14 percent of the population) (Donaghy and Jiang 2021). In the petrochemical sector, 66 percent of the toxic burden is borne by minorities and 18 percent by low income communities. The petroleum bulk stations and terminals needed for the fossil fuel transportation are much smaller emitters of air pollutants than refineries or petrochemical plants but are also disproportionately located in low income and minority communities (Donaghy and Jiang 2021).

3.15.3. Existing Conditions

Minority and Hispanic populations compose a majority of the populations of the State of Texas (57.1 percent), as well as Brazoria and Harris counties (50.9 and 69.4 percent, respectively). Low-income populations compose 16 percent of the state's population. Table 3.15-1 identifies minority and poverty data for Texas, Brazoria and Harris counties, and the 80 census block groups within 1 mile of Project facilities and workspaces. Bold numbers indicate values that meet one or both of the criteria listed in Section 3.15.1, Environmental Justice, Definition of the Resource. Block groups meeting one or both criteria for environmental justice populations are displayed on Figure 3.15-1.

Table 3.15-1: Minority and Low-Income Population Data

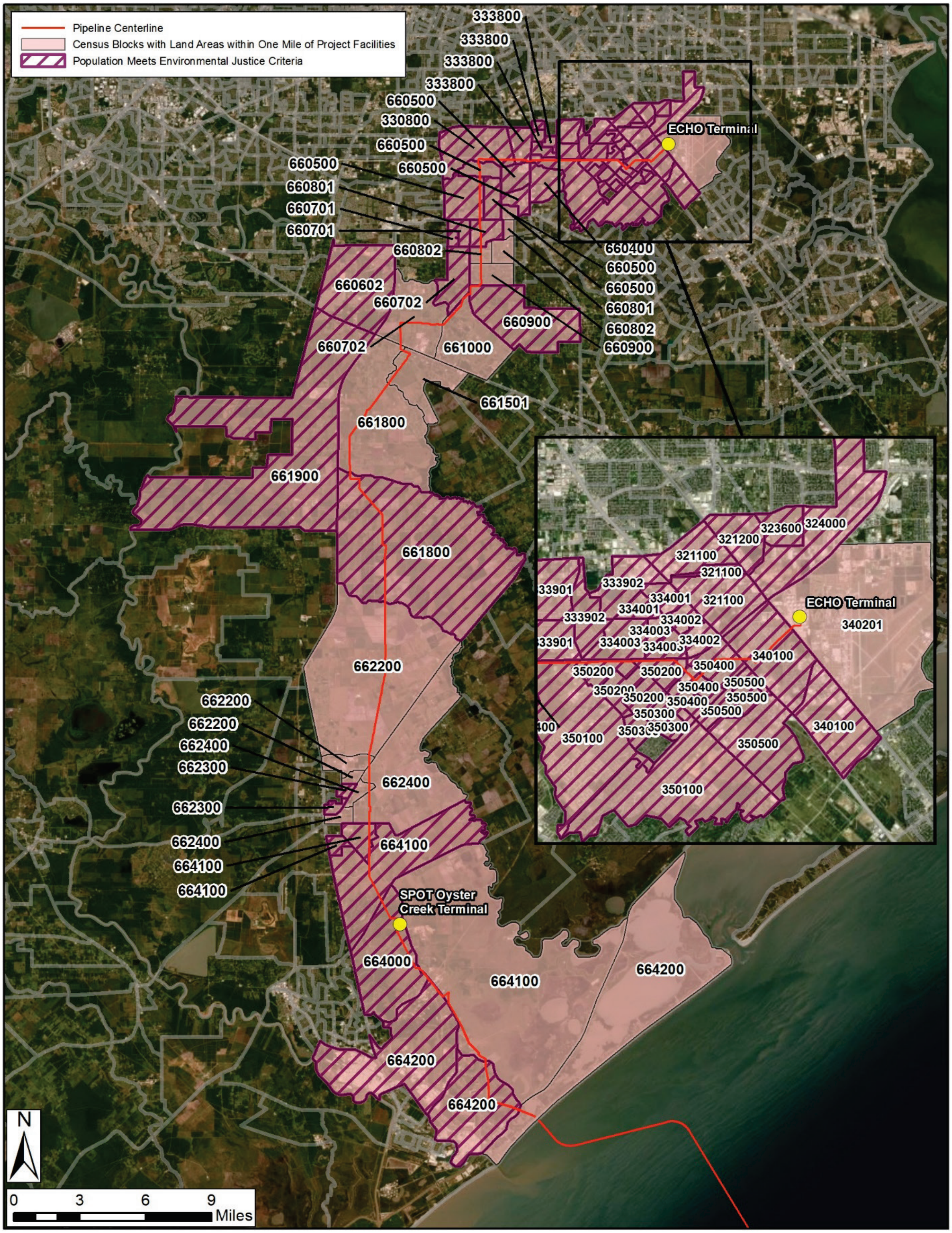
Geography	Census Tract	Block Group	Population	Percent Minority or Hispanic	Percent below Federal Poverty Level	Nearest Project Facility (distance in mile)
Texas	**Statewide**		27,419,612	**57.1%**	16.0	NA
Brazoria County	**Countywide**		345,995	**50.9%**	9.9%	NA
Brazoria County	660400	3	3,872	**55.8%**	**16.6%**	EOP (0.0)
Brazoria County	660500	1	995	33.2%	4.1%	EOP (0.0)
Brazoria County	660500	2	928	**66.3%**	**28.2%**	EOP (0.9)
Brazoria County	660500	3	1,349	**51.5%**	10.8%	EOP (0.9)
Brazoria County	660500	4	1,290	31.9%	0.0%	EOP (0.9)
Brazoria County	660500	5	2,497	**60.8%**	2.2%	EOP (0.1)
Brazoria County	660500	6	3,035	**57.6%**	3.3%	EOP (0.0)
Brazoria County	660602	1	15,610	**72.2%**	6.1%	EOP (0.7)
Brazoria County	660701	2	2,951	**86.4%**	5.1%	EOP (0.4)
Brazoria County	660701	4	2,879	**62.2%**	5.4%	EOP (1.0)
Brazoria County	660702	1	2,074	30.5%	2.0%	EOP (0.0)
Brazoria County	660702	3	1,962	**79.2%**	**31.5%**	EOP (0.0)
Brazoria County	660801	2	3,601	**60.6%**	4.8%	EOP (0.0)
Brazoria County	660801	3	2,681	39.1%	0.9%	EOP (1.0)
Brazoria County	660802	1	3,254	34.9%	0.6%	EOP (0.5)
Brazoria County	660802	3	1,901	49.3%	0.0%	EOP (0.0)
Brazoria County	660900	1	1,074	48.1%	9.7%	EOP (0.0)
Brazoria County	660900	3	2,018	**73.8%**	**17.3%**	EOP (0.0)
Brazoria County	661000	1	1,399	28.9%	1.5%	EOP (0.0)
Brazoria County	661501	2	1,582	39.1%	14.9%	EOP (0.0)
Brazoria County	661800	1	2,886	32.2%	10.5%	EOP (0.0)
Brazoria County	661800	2	2,815	**51.7%**	10.0%	EOP (0.0)
Brazoria County	661900	1	5,630	**77.1%**	12.0%	EOP (0.5)
Brazoria County	662200	1	1,686	46.1%	0.0%	EOP (0.0)

Geography	Census Tract	Block Group	Population	Percent Minority or Hispanic	Percent below Federal Poverty Level	Nearest Project Facility (distance in mile)
Brazoria County	662200	3	981	41.5%	5.8%	EOP (0.2)
Brazoria County	662200	4	2,153	28.0%	12.6%	EOP (0.0)
Brazoria County	662300	2	1,513	**58.8%**	**30.7%**	EOP (0.6)
Brazoria County	662300	4	1,509	38.0%	**26.1%**	EOP (1.0)
Brazoria County	662400	1	1,171	30.7%	7.2%	EOP (0.7)
Brazoria County	662400	2	1,325	45.1%	5.6%	EOP (0.0)
Brazoria County	662400	3	1,534	13.8%	12.2%	EOP (0.0)
Brazoria County	664000	2	1,902	**57.3%**	10.9%	Oyster Creek Terminal (0.0) EOP (0.0) OSP (0.0)
Brazoria County	664100	2	884	**51.4%**	**43.9%**	OSP (0.0)
Brazoria County	664100	3	473	**54.8%**	3.8%	EOP (0.8)
Brazoria County	664100	4	1,413	**57.6%**	**17.8%**	Oyster Creek Terminal (0.8) EOP (0.0)
Brazoria County	664100	5	1,746	45.5%	4.8%	Oyster Creek Terminal (0.0) EOP (0.4) OSP (0.3)
Brazoria County	664200	1	873	31.8%	**22.0%**	OSP (0.0)
Brazoria County	664200	2	561	28.5%	**30.4%**	OSP (0.0)
Brazoria County	664200	3	731	21.8%	10.5%	OSP (0.0)
Harris County	**Countywide**		4,525,519	**69.4%**	**16.8%**	NA
Harris County	321100	1	3,905	**81.5%**	**16.9%**	ECHO Terminal (0.3) EOP (0.6)
Harris County	321100	2	3,150	**87.3%**	7.4%	ECHO Terminal (1.0)
Harris County	321100	3	1,164	**91.5%**	**20.5%**	ECHO Terminal (0.8)
Harris County	321200	2	1,366	**80.8%**	**33.8%**	ECHO Terminal (0.7)
Harris County	323600	4	1,456	**77.3%**	**30.6%**	ECHO Terminal (0.7)
Harris County	324000	2	3,415	**51.7%**	4.0%	ECHO Terminal (0.1) EOP (0.7)
Harris County	330800	1	4,635	**88.8%**	14.4%	EOP (0.0)
Harris County	333800	1	2,198	**93.3%**	**30.8%**	EOP (0.0)
Harris County	333800	2	2,077	**92.9%**	8.7%	EOP (0.8)
Harris County	333800	3	1,890	**90.1%**	13.8%	EOP (0.1)
Harris County	333800	5	1,972	**90.3%**	8.1%	EOP (0.3)
Harris County	333901	1	5,461	**96.1%**	6.5%	EOP (0.1)
Harris County	333901	2	4,732	**86.4%**	8.1%	EOP (0.8)
Harris County	333902	1	3,547	**92.2%**	12.4%	EOP (0.8)
Harris County	333902	2	3,291	**83.1%**	10.4%	EOP (0.1)
Harris County	334001	1	1,765	**95.2%**	**26.7%**	EOP (0.8)

Geography	Census Tract	Block Group	Population	Percent Minority or Hispanic	Percent below Federal Poverty Level	Nearest Project Facility (distance in mile)
Harris County	334001	2	2,005	**77.8%**	7.3%	EOP (0.8)
Harris County	334002	1	652	**58.0%**	6.3%	EOP (0.5)
Harris County	334002	2	1,652	**80.6%**	8.7%	EOP (0.2)
Harris County	334003	1	2,179	**76.4%**	1.6%	EOP (0.1)
Harris County	334003	2	1,544	**90.4%**	**19.6%**	EOP (0.3)
Harris County	334003	3	2,694	**65.0%**	**17.5%**	EOP (0.1)
Harris County	340100	1	5,469	**82.0%**	6.2%	ECHO Terminal (0.1) EOP (0.0)
Harris County	340100	2	1,554	**71.2%**	**30.3%**	ECHO Terminal (0.6) EOP (0.7)
Harris County	340201	1	414	40.1%	0.0%	ECHO Terminal (0.0) EOP (0.0)
Harris County	350100	1	7,420	**63.9%**	7.4%	EOP (0.7)
Harris County	350100	2	8,644	**77.8%**	7.9%	EOP (0.0)
Harris County	350200	1	1,733	**74.9%**	**17.3%**	EOP (0.0)
Harris County	350200	2	2,359	**69.5%**	11.7%	EOP (0.1)
Harris County	350200	3	1,828	**86.2%**	7.2%	EOP (0.2)
Harris County	350200	4	2,704	**85.1%**	12.5%	EOP (0.0)
Harris County	350300	1	1,651	**76.7%**	11.3%	EOP (0.5)
Harris County	350300	2	973	**51.8%**	5.5%	EOP (0.6)
Harris County	350300	4	2,711	**52.9%**	2.6%	EOP (0.9)
Harris County	350400	1	1,825	**82.9%**	7.2%	EOP (0.0)
Harris County	350400	2	1,359	**80.7%**	14.4%	EOP (0.0)
Harris County	350400	3	3,281	**89.7%**	**18.4%**	EOP (0.6)
Harris County	350500	1	1,109	**79.7%**	12.2%	EOP (0.5)
Harris County	350500	2	1,892	**95.1%**	**24.6%**	EOP (0.1)
Harris County	350500	3	3,727	**84.3%**	**20.1%**	EOP (0.7)
Harris County	350500	4	1,601	**86.5%**	1.4%	EOP (0.4)

Source: U.S. Census Bureau 2019a

ECHO = Enterprise Crude Houston; EOP = ECHO to Oyster Creek Pipeline; NA = not applicable; OSP = Oyster Creek to Shore Pipeline



Source: U.S. Census Bureau 2019a

Figure 3.15-1: U.S. Census Block Groups and Environmental Justice Populations

As shown in Table 3.15-1 and on Figure 3.15-1, many of the block groups meet the thresholds requiring increased scrutiny for environmental justice concerns. Key findings for data on minority and low-income populations in the study area, moving generally from north to south, include the following.

3.15.3.1. ECHO Terminal

Nine block groups contain the terminal and areas within 1 mile of the terminal, including:

- Eight block groups with minority population shares exceeding 50 percent;
- Seven block groups with minority population shares exceeding the statewide value by more than 10 percentage points; and
- Five block groups with low-income population shares exceeding the statewide value.

3.15.3.2. ECHO to Oyster Creek Pipeline Route within Harris County

Thirty-seven block groups contain the pipeline route, temporary workspaces, and areas within 1 mile of the pipeline or workspaces, including:

- Thirty-six block groups with minority population shares exceeding 50 percent;
- Thirty block groups with minority population shares exceeding the statewide value by more than 10 percentage points; and
- Ten block groups with low-income population shares exceeding the statewide value.

3.15.3.3. Oyster Creek Terminal

Three block groups contain the proposed terminal site and areas within one mile of the site, including.

- Two block groups with minority population shares exceeding 50 percent; and
- One block group with a low-income population share exceeding the statewide value.

3.15.3.4. ECHO to Oyster Creek and Oyster Creek to Shore Pipeline Routes within Brazoria County

Thirty-nine block groups contain the pipeline route, temporary workspaces, and areas within 1 mile of the pipelines or workspaces, including:

- Nineteen block groups with minority population shares exceeding 50 percent;
- Five block groups with minority population shares exceeding the statewide value by more than 10 percentage points; and
- Ten block groups with a low-income population share exceeding the statewide value.

3.15.4. Impacts and Mitigation

This section discusses potential impacts of Project construction and operation on environmental justice communities, including the potential for impacts that would disproportionately and adversely affect minority or low-income populations, as well as BMPs that the Applicant would employ to minimize impacts on environmental justice. As described in Table 3.2-1 in Section 3.2.2, Evaluation Criteria, the Project's environmental justice effects have been evaluated based on their potential to:

- Cause adverse and disproportionate environmental, economic, social, or health impacts on minority or low-income populations (minor to major, depending on extent); or
- Cause adverse and disproportionate environmental health or safety risks to children (minor to major, depending on extent).

The remainder of this section describes the effects of Project construction and operation on environmental justice communities, based on the criteria above.

3.15.4.1. Cancer Cluster Studies

The Centers for Disease Control and Prevention and the Council of State and Territorial Epidemiologists define a cancer cluster as a greater than expected number of cancer cases that occur within a group of people in a geographic area over a defined period. The Texas Department of State Health Services has performed cancer cluster investigations throughout the state, including the Houston and Freeport areas, comparing the number of cancer cases in these areas against statewide data, based on the size and demographic characteristics of the population (Texas DSHS 2018).

The Freeport study was conducted due to community concern about emissions from a local catalyst recycling/reclamation facility. This study found that the certain types of cancer in six census tracts in and near Freeport occurred more frequently in 2000 through 2015 than the expected range based on statewide cancer rates (DSHS 2018). Three of these census tracts (6640, 6641, and 6642) have block groups included in the environmental justice study area, including six block groups with populations of environmental justice concern due to minority/Hispanic population or income levels (Table 3.15-1).

A 2019 study of the entire City of Houston, which looked only at biliary cancers, found a statistically significantly greater occurrence of certain cancers (at all ages) compared to statewide cancer rates. This includes the northernmost block groups in the environmental justice study area area—a total of 35 block groups, all with environmental justice populations due to their high proportions of minority/Hispanic or low income residents (Texas DSHS 2019e).

3.15.4.2. Locations with Potential Environmental Justice Impacts

As described above, many study area block groups have minority or low-income populations that meet one or more criteria for environmental justice analysis. The existing ECHO Terminal and the ECHO to Oyster Creek pipeline route in Harris County are within or near neighborhoods with a high proportion of minority residents. In addition, most block groups around the existing ECHO Terminal have a higher percentage of low-income residents than the state, while about one-third of the block groups along the pipeline route meet this criterion. The environmental justice analysis must therefore give heightened scrutiny to these facilities, because adverse impacts could disproportionately affect minority and low-income populations.

Block groups along the onshore pipeline routes in Brazoria County have varied demographic characteristics. Slightly less than half of the block groups have minority population percentages that exceed the statewide value, and 13 percent of the block groups have minority populations that exceed the statewide value by more than 10 percentage points. One-quarter of the block groups have a low-income population share that exceeds the statewide value. Taken as a whole, the onshore pipeline routes in Brazoria County pass through areas with a lower proportion of minority and low-income population than Texas as a whole.

The three block groups containing and within 1 mile of the proposed Oyster Creek Terminal have minority population shares lower than or close to the statewide share. The percentage of low-income population is generally lower than the state's.

Because some of the block groups within 1 mile of the pipeline routes in Brazoria County and the proposed Oyster Creek Terminal have minority population shares that exceed 50 percent, the environmental justice analysis must also give heightened scrutiny to these facilities.

Environmental justice impacts are, by definition, indirect, occurring as a result of direct or indirect impacts on other resources that create disproportionate and adverse impacts on the communities described in Section 3.15.4.1, Environmental Justice, Impacts and Mitigation, Locations with Potential Environmental Justice Impacts. Resources not discussed in this section would not generate foreseeable impacts on environmental justice communities. Section 3.15.4.5, Environmental Justice, Impacts and Mitigation, Other Resources Not Considered in Analysis, provides a summary of these resources not evaluated for environmental justice impacts.

3.15.4.3. Construction

The sections below describe the onshore construction impacts on resources applicable to environmental justice, followed by an environmental justice evaluation. Short-term impacts along the pipeline route would last several days in any particular location during the 9-month pipeline construction period. Impacts would continue for a longer time period during the 22-month Oyster Creek Terminal construction period and 12-month ECHO Terminal expansion construction period. The Project impact levels noted below assume that mitigation measures listed in Sections 3.3 through 3.13 are implemented. Impacts described as negligible are not listed.

For several of the resources addressed below, impacts on nearby residential properties are noted. The proximity of homes to onshore Project facilities affects the impact analysis for land use, visual impacts, and noise. The nearest residential properties are approximately 0.7 mile from the existing ECHO Terminal, 0.1 mile from the proposed Oyster Creek Terminal, and within 50 feet of the onshore pipeline construction workspaces.

Water Resources

The water resources impacts from onshore construction that could impact study area residents (as well as areas beyond the study area, where noted) are described below:

- Potential impacts on water wells within 150 feet of the construction workspace would be short-term and minor. Table 3.3.3-1 in Section 3.3.3, Water Resources, Groundwater lists 16 wells for public or domestic use within 150 feet of the pipeline centerline, and one near the Oyster Creek Terminal site, all in Brazoria County. Overall impacts would be indirect, adverse, short-term, and minor.

- Impacts on groundwater, surface water, or wetlands due to an inadvertent release of hazardous materials during construction would be direct, adverse, short-term, and minor.
- The onshore pipelines would cross 71 waterbodies, including perennial, intermittent, and ephemeral streams, and ponds, using the open-cut method. Impacts on waterbodies crossed would be direct, adverse, short-term, and moderate.
- Impacts on wetlands due to construction of the onshore pipelines and terminals would be direct, adverse, short-term, and minor.

Land Use, Recreation, Visual Resources, and Ocean Use

The land use, recreation, visual resources, and ocean use impacts from onshore construction that could impact study area residents (as well as areas beyond the study area, where noted) are described below:

- Based on the extent of surrounding pasture and agricultural land, and the presence of an existing industrial activity (a landfill), construction of the Oyster Creek Terminal would have direct, adverse, short-term, and minor impacts on land use.
- Onshore pipeline construction would not prevent the use of residential or non-residential lands, although some activities associated with those land uses (i.e., gardening or farming within the right-of-way, or activities that require low noise levels) could be diminished or prevented during construction. Onshore pipeline installation would last up to several days in any single location. As a result, construction of onshore pipelines would have direct, adverse, short-term, and moderate impacts on land use.
- Use of parks: Pipeline construction would have indirect, adverse, short-term, minor impacts on the recreational use of park and beach resources due to noise and fumes from nearby construction. Parks that would be affected by construction of the Project include El Franco Lee Park in Harris County, Ruben Welch Park in Angleton, a portion of Brazoria NWR near the pipeline workspace (but where no designated recreation facilities exist), and public beaches in Surfside Beach near the landfall site.
- Construction of the Oyster Creek Terminal would have direct, adverse, short-term, moderate visual impacts. Although the terminal would dominate and contrast with the immediate surrounding area, it would occur in a landscape with few sensitive visual receptors, and where scattered industrial development is common.
- Onshore pipeline construction would have direct, adverse, short-term, and moderate impacts on onshore visual resources.
- Project construction is anticipated to have negligible adverse impacts on recreational fishing and minor adverse impacts on subsistence fishing (Section 3.10.4.2). The short-term, minor impacts on subsistence fishing would affect members of environmental justice communities who rely on fishing and shellfishing as a food source (subsistence fishing).

Transportation

Section 3.11, Transportation, notes that Project construction would generate substantial traffic on study area roads. Prior to construction, the Applicant would analyze traffic impacts for Project construction sites in compliance with TxDOT requirements and would complete any entrance or intersection improvements required by TxDOT to ensure that Project traffic does not result in unacceptable levels of congestion (as defined by TxDOT).

The largest workforce would be required at the proposed Oyster Creek Terminal, which is accessed via CR 523, a regional collector from Freeport to Angleton. The existing ECHO Terminal is accessed via a service road parallel to SH 8. Neither location would draw traffic through or into a residential neighborhood. Pipeline workforce traffic would report to different worksites as construction proceeds. Onshore pipeline construction would have direct, adverse, short-term, minor impacts on any one location for environmental justice communities. Impacts due to traffic from onshore terminal construction would be direct, adverse, short-term, and minor to moderate.

Air Quality

Section 3.12, Air Quality, concludes that the air quality effects of Project construction would be adverse, but intermittent and highly localized to construction sites. Project construction would have direct and indirect, adverse, short-term, minor impacts on air quality.

Noise

During the expansion of the ECHO Terminal and construction of the proposed Oyster Creek Terminal, heavy construction equipment (e.g., trucks, backhoes, front-end loaders, and cranes) would generate noise that could be audible in nearby residences and communities. As stated in Section 3.13.3.2, Noise, Onshore Noise Impacts and Mitigation, noise generated during construction of the Oyster Creek Terminal would be below ambient noise levels, and would therefore have a direct, adverse, short-term, minor impact on airborne noise.

Onshore pipeline construction would also generate noise near residences, typically for a few days at any single location during the 9-month onshore pipeline construction process. Primary noise sources would include HDD installation (see Table 2.2-8 in Section 2.2.5.2, ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines). To address HDD noise, the Applicant has committed to installing sound walls and acoustic panels around HDD locations where noise levels would exceed the ambient sound levels (Appendix R, SPOT Project Onshore Noise Impact Reports; BMP #31 in Appendix N) (see Section 3.13.3, Noise, Onshore Noise). With these BMPs, construction would have direct, adverse, short-term, and minor noise impacts.

Socioeconomics

Project construction would provide jobs, income, tax revenue, and other economic benefits in Harris and Brazoria counties (see Section 3.14, Socioeconomics). This economic activity may benefit residents of environmental justice communities through the creation of jobs both directly (for Project construction) and indirectly, through the support for jobs and businesses that serve or provide goods and services for Project activities. Overall, construction would have direct and indirect, beneficial, short-term, minor impacts on employment and income in Harris and Brazoria counties; however, it is not possible to ensure that jobs and economic benefits specifically accrue to minority or low-income populations within the environmental justice study area.

Section 3.14 concludes that Project construction would have direct, adverse, short-term, and moderate impacts on commercial fishing in the GoM due to potential impacts on certain fish populations, and loss of a majority of the SPOT DWP lease block to commercial fishing boats. Low-income and minority residents of Brazoria and Harris counties who engage in subsistence fishing would experience indirect, adverse, short-term, and minor impacts (Section 3.10.4.2).

As noted in Section 3.14.4, southern Brazoria County has unmet housing needs for entry-level, single family houses and affordable rental housing, attributed in large part to the demand for short-term lodging tailored to high-wage transient workers (CDS 2019). A shortage of moderately priced rental housing within southern Brazoria County has a disproportionate and adverse impact on environmental justice populations who live and work in these communities. The incremental impact of Project construction on the presence of short-term construction workers would be small relative to the overall housing market and the existing supply of short-term lodging. Accordingly, Project construction would have an indirect, adverse, long-term, and minor impact on the supply of permanent, affordable housing units available to environmental justice populations.

Environmental Justice Evaluation

Environmental justice concerns are greatest in southern Harris County, in the block groups near the ECHO Terminal expansion and the northern portion of the ECHO to Oyster Creek Pipeline. The existing ECHO Terminal is separated from most residential neighborhoods by major roads, including SH 8 to the north, SH 3 (Galveston Road) and nonresidential land to the west, a golf course and Ellington Field Joint Reserve Base to the east, and nonresidential land to the south. These buffers would attenuate direct noise, dust, and traffic impacts on environmental justice (and other) populations.

A substantial portion of the ECHO to Oyster Creek Pipeline in Harris County would also be buffered from residential neighborhoods, and would be collocated with SH 8, existing pipelines, and/or electrical transmission lines. Approximately one-quarter of the pipeline in Harris County is adjacent to the rear of residential properties, particularly block groups south of SH 8 between the existing ECHO Terminal site and El Franco Lee Park, all of which meet one or more of the environmental justice criteria described in Section 3.15.1, Environmental Justice, Definition of Resource. As noted above, the air quality, noise, land use, as well as impacts on water resources and recreational use of parks, associated with Project construction would be short-term and minor; however, moderate, localized land use and visual impacts associated with the onshore pipelines and water quality impacts at open-cut waterbody crossings are possible. HDD boring would produce the most intense construction noise, but would be mitigated through the use of sound barriers to ensure that noise levels at nearby residences remain acceptable during construction.

Overall, environmental justice communities along the pipeline segments immediately adjacent to residential neighborhoods in southern Harris County would be disproportionately affected due to the proximity to construction without a buffer; however, pipeline construction impacts would be transient, lasting only a few days at each location, and thus would be unlikely to result in major impacts, as defined in Section 3.2.1.4, Negligible, Minor, Moderate, or Major.

The population within view of the proposed Oyster Creek Terminal would experience moderate adverse visual impacts, in addition to minor impacts on land use, air quality, and noise. Residents of the two environmental justice block groups within 1 mile of the proposed Oyster Creek Terminal could experience disproportionately adverse visual impacts. The extent of these potential impacts is limited by distance, topography, and vegetation. Views of the tallest terminal structures would extend approximately 2 miles from the terminal site, and only where there are no intervening trees or topography (see Section 3.9, Cultural Resources). As a result, only a limited number of residences (regardless of environmental justice status) would be able to view the terminal site.

Less than 10 percent of the ECHO to Oyster Creek Pipeline route in Brazoria County (primarily in northern Brazoria County), and virtually none of the Oyster Creek to Shore Pipelines (excluding HDD areas) are adjacent to residential properties in block groups that meet environmental justice criteria. These environmental justice communities would be disproportionately affected by air quality, noise, and visual impacts associated with Project construction due to the absence of a buffer between neighborhoods and the pipeline. As described above, pipeline construction impacts would be transient, lasting only a few days at each location, and thus would be unlikely to result in major impacts.

Some of the impacts discussed above would not be focused on the areas immediately adjacent to a Project construction site. For example, Project traffic congestion would inconvenience all travelers. While environmental justice communities would not necessarily experience more traffic than other communities would, the effects of traffic delays could be more substantial for these communities, particularly low-income residents who already face challenges finding and retaining employment. Construction noise adjacent to parks could temporarily inconvenience park users, an effect that could be disproportionate for minority or low-income residents who have fewer recreational choices and a reduced ability to access alternative recreation sites.

Impacts on fishing and shellfishing would affect low-income and minority residents who rely on subsistence fishing or whose livelihoods depend on the commercial or recreational fishing industry. Project construction would have moderate adverse impacts on commercial fishing (Section 3.14.8) and on the environmental justice populations who rely on commercial fishing for employment. Project construction would have minor adverse impacts on subsistence fishing, which would be similar to recreational fishing in that both typically occur on inland waters or closer to the coast than the SPOT DWP.

Based on the above, overall construction impacts on water quality, land use, visual quality, transportation, air quality, noise, and socioeconomics would not have a disproportionately high and adverse impact on minority or low-income populations in Brazoria County, although impacts on individual residences or neighborhoods that meet environmental justice criteria could be felt disproportionately. Even so, none of the impacts described above for environmental justice communities would be major or long-term impacts.

3.15.4.4. Operation

The sections below describe the onshore operational impacts on resources applicable to environmental justice, followed by an environmental justice evaluation. As with the discussion of construction impacts (Section 3.15.4.2), resources not discussed in this section would not generate foreseeable impacts on environmental justice communities, and impacts described as negligible are not listed.

Water Resources

Inadvertent releases of oil from onshore Project operation would affect groundwater, surface waters, or wetlands. These impacts would be direct and indirect, adverse, and could be short-term or long-term, and moderate to major, depending on the size of the spill. Impacts on flood zones and the risk of flooding would be direct, adverse, short-term, and negligible based on the design criteria of the Oyster Creek Terminal. As described in Section 3.3, Water Resources, impacts on wetlands due to typical operation of the onshore pipelines and terminals would be direct, adverse, short-term to long-term, and minor to moderate, depending on the type of wetland affected.

Land Use, Recreation, Visual Resources, and Ocean Use

The proposed Oyster Creek Terminal site is adjacent to a landfill that generates frequent truck traffic, noise, and odor. Based on the extent of surrounding pasture and agricultural land, and the presence of an existing industrial activity, operation of the Oyster Creek Terminal would have direct, adverse, long-term, and minor impacts on surrounding land uses.

Project operation would have an indirect, adverse long-term, and negligible impact on onshore recreation if non-routine maintenance of the onshore pipelines is required at sites adjacent to park facilities. Due to the transient nature of vessel activity and limited size of the lease blocks compared to the surrounding waters, Project operation would have direct and indirect, adverse, long-term, and negligible impacts on offshore recreational fishing and boating. A similar impact level would be experienced by those who rely on fishing and shellfishing as a food source (subsistence fishing). Project operation would also have direct, adverse short-term to long-term, and negligible impacts on scuba diving at artificial reefs and cruise ship operations.

Operation of the Oyster Creek Terminal would also have direct, adverse, long-term, moderate impacts on the visual character of the area within the terminal's viewshed. Although the terminal would dominate and contrast with the immediate surrounding area, it would occur in a landscape where scattered industrial development is common and would be within view of a limited number of residences regardless of environmental justice status. Pipeline operation would have direct, adverse, long-term, negligible visual impacts. Operation of the ECHO Terminal would have direct, adverse, long-term, negligible visual impacts, because the Project expansion would occur within an existing terminal.

Transportation

Project operation would generate a small amount of daily vehicle round-trips and daily truck trips associated with inspection, maintenance, and supplies, which would result in direct, adverse, long-term, and negligible impacts on road traffic

Air Quality

Project operation would comply with all Federal and state air quality regulations, and would have direct and indirect, adverse, long-term, and minor impacts on air quality (see Section 3.12, Air Quality).

Noise

As discussed in Section 3.13, Noise, operation of the onshore Project facilities would not exceed ambient noise levels. The predicted operational noise from the ECHO and Oyster Creek Terminals would be below ambient noise levels. While noise mitigation would not be required during operation of the terminals, the Applicant has committed to implementing certain BMPs to limit noise levels associated with operation of the ECHO Terminal and the Oyster Creek Terminal (see section 3.13.3.2, Noise, Onshore Noise, Onshore Noise Impacts and Mitigation). As a result, Project operation would have direct, adverse, long-term, and minor impacts on noise.

Socioeconomics

Operation would have direct and indirect, beneficial, long-term, minor impacts on employment and income in Harris and Brazoria counties (see Section 3.14.5, Socioeconomics, Employment and Income). Project operation would create a limited number of jobs and associated income and revenues, and there is no assurance that economic benefits would accrue to minority or low-income populations within the study area.

Section 3.14, Socioeconomics, concludes that Project operation would have direct and indirect, adverse, long-term, minor impacts on commercial fishing in the GoM, due to potential impacts on certain fish populations and loss of the SPOT DWP lease block for fishing. To the extent that residents of Brazoria and Harris counties depend upon employment in commercial fishing, they could also experience indirect, adverse, short-term, and minor impacts.

Oil Spills

The potential for an oil spill to occur is low. If a spill were to occur, it could have direct environmental justice impacts through effects on coastal environmental justice communities (as identified in Section 3.15.4.2), or indirect impacts through effects on the health or livelihood of residents of environmental justice communities (e.g., drinking water or species harvested for food or revenue). The magnitude of impacts of an oil spill on environmental justice communities would depend on the size and location of the spill, as well as conditions at the time of the spill; however, the magnitude of impacts for environmental justice communities would likely be larger than for the population as a whole.

Environmental Justice Evaluation

The primary impacts on residential communities during operation would be visual impact for homes within view of the Oyster Creek Terminal. Impacts on land use, air quality, noise, and socioeconomics would be minor. Impacts on flood zones, recreation, visual impacts associated with the onshore pipelines and existing ECHO Terminal, and road traffic would be negligible. Visual impacts associated with operation of the Oyster Creek Terminal would be moderate and impacts on water resources could be minor to moderate.

Impacts on fishing and shellfishing would affect low-income and minority residents who rely on subsistence fishing or whose livelihoods depend on the commercial or recreational fishing industry. Project operation would have direct, adverse, long-term, and minor impacts on commercial fishing (Section 3.14.8) and on the environmental justice populations who rely on commercial fishing for employment. Project operations would have direct, adverse, long-term, and negligible impacts on subsistence fishing, which would be similar to recreational fishing in that they typically occur on inland waters or closer to the coast than the SPOT DWP.

Generally, the operational impacts would not have disproportionate, adverse impacts on minority or low-income populations, except that the visual impacts of operation of the Oyster Creek Terminal could have a disproportionately adverse impact on the minority population residing in portions of the study area with views of the terminal.

3.15.4.5. Planned and Unplanned Maintenance

Impacts associated with planned and unplanned maintenance would occur during the life of the Project; however, it is expected the impacts would similar to construction impacts, although shorter in duration and smaller in magnitude. Therefore, impacts associated with planned or unplanned maintenance would not have disproportionate, adverse impacts on minority or low-income populations.

3.15.4.6. Other Resources Not Considered in Analysis

This section lists the resources not included in the environmental justice analysis, along with a brief explanation for their exclusion from the analysis. Offshore resources would affect all study area residents, and are thus excluded from analysis. In general, the Project's impacts on the onshore resources listed below were excluded because they would not foreseeably lead to "disproportionately high and adverse human health or environmental effects…on minority populations and low-income populations," as prescribed in Executive Order 12898.

- Habitats (Section 3.4): For onshore habitats, this resource is defined as vegetation within the onshore Project boundaries, which would not directly affect human populations.
- Wildlife and Aquatic Resources (Section 3.5). Onshore resources include wildlife and freshwater fisheries, none of which directly affect human populations. (Freshwater fishing for recreation and economic value are included in discussions of recreation and socioeconomics.)
- Estuarine and Marine Fisheries (Section 3.6). These resources, by definition, are offshore, and are thus excluded from evaluation in this section.
- Threatened and Endangered Species (Section 3.7). Any impacts would be to animal species, with no direct impacts on human populations.
- Geologic and Soil Resources (Section 3.8). Impacts on soils (compaction and erosion) would be limited to the Project sites and temporary construction workspaces; sediment and erosion control measures would prevent off-site impacts. No impacts were identified for geologic hazards or for geologic and paleontological resources.
- Cultural Resources (Section 3.9). The Applicant's cultural resources surveys identified direct, negligible impacts on cultural resources. Indirect impacts associated with the historic setting are addressed above as part of visual resources.

3.16. DECOMMISSIONING

3.16.1. Onshore Decommissioning Impacts

The Applicant would comply with the environmental regulations applicable at the time of decommissioning to minimize impacts on the natural and social environment, and would implement its spill response plans in the event of an accidental spill during decommissioning. The type and severity of impacts would need to be reevaluated at the time of decommissioning to account for changes between the time the EIS is published and the time the Project is decommissioned that would affect the natural or social environment. For the purposes of this EIS, potential impacts from decommissioning of the Project are compared to anticipated construction conditions.

The onshore pipelines would be abandoned in place and maintenance of the right-of-way would stop, which would allow vegetation to regrow undisturbed. The GLO typically requires pipelines installed on state-owned submerged land to be removed at end of life unless installed via the HDD method. If pipelines are installed via the HDD method, GLO may, at its discretion, authorize abandonment in place if specific requirements are met. The pipeline segments that cross state-owned submerged land for the SPOT Project would all be installed via the HDD method and may be abandoned in place if approved by the GLO. The Oyster Creek Terminal and MLV sites would be restored to preconstruction condition. The Applicant would be required to seek separate USACE approval for the proposed abandonment of pipelines under Section 10 of the RHA. All terminal components and impervious surfaces would be removed and the impacts involved with removal of the facility would be similar to those described for construction. After impervious surfaces are removed, the areas would be seeded with approved seed mixes and allowed to revegetate to a vegetation community similar to adjacent communities. The conversion of impervious surfaces back to pervious would increase percolation to the surficial and the Gulf Coast aquifers, and there would be no direct impacts on waterbodies or wetlands due to decommissioning activities. In addition, decommissioning activities would take place largely within the permanent right-of-way and would not change the land use. Project decommissioning would also generate similar types of, but less traffic than, the construction phase; this traffic would result in air emissions and noise.

Impacts on groundwater would be indirect, beneficial, long-term, and minor. Direct impacts on surface water, wetlands, the local geology, soils, land use, road traffic, air quality, and noise levels associated with decommissioning would be adverse, short-term, and negligible. However, restoration of natural vegetation would slow water movement across the land and improve the filtering of water before it reaches nearby surface waters. These changes would lead to beneficial impacts on surface waters and wetlands that would be long-term and negligible. In addition, the removal of the Project would allow for other land uses on the site and would eliminate visual impacts; therefore, decommissioning would result in direct, beneficial, and negligible impacts on land use and visual resources over the long-term. Only the MLV at the shore crossing location would be near a public recreation facility. Impacts at this location would be similar to those experienced during construction, such as temporary reductions in enjoyment of the nearby public beach, resulting in indirect, adverse, short-term, and minor impacts on recreation. All other indirect, adverse impacts on onshore recreation during decommissioning would be short-term and negligible.

Decommissioning would require a smaller workforce over a shorter timeframe than the construction period, primarily because the Applicant would abandon the pipelines in place. Impacts on employment, income, public services, and environmental justice would be similar to construction, but of smaller magnitude. Most workers would work multi-week shifts, and would not permanently move to the socioeconomic study area. Decommissioning would also result in additional spending in the area and sales tax revenues.

The decommissioning workforce needs would have a direct, short-term, negligible impact on the socioeconomic study area population. Similar to the construction phase, the impacts of population change on their own are neither beneficial nor adverse. Decommissioning would have a direct, beneficial, short-term, and negligible impact on lodging in the area, and would have a direct and indirect, beneficial, short-term, and minor impact on employment and income. Decommissioning would have a direct and indirect, adverse, short-term, and negligible impact on public services. Based on the present population, while decommissioning would affect a broad range of communities, including some environmental justice populations, none of the impacts would have more than a minor impact; therefore, decommissioning would not have a disproportionately high and adverse effect on environmental justice populations.

3.16.2. Offshore Decommissioning Impacts

The Applicant would comply with the environmental regulations applicable at the time of decommissioning to minimize impacts on the natural and social environment, and would implement its spill response plans in the event of an accidental spill during decommissioning. The type and severity of impacts would need to be reevaluated at the time of decommissioning to account for changes between the time the EIS is published and the time the Project is decommissioned that would affect the natural or social environment. However, it is reasonable to indicate that decommissioning would result in impacts similar to those described for construction in Sections 3.3 through 3.7.

Decommissioning would involve removal of the SPOT DWP platform to approximately 15 feet below the seafloor. After removal, the jacket would be used as an artificial reef through the Rigs-to-Reef program. The placement of this additional, permanent underwater structure would result in a temporary increase in turbidity in the local area; however, it would provide a long-term benefit to fish and other marine life by creating artificial reef habitat in the region. Local currents would be restored with removal of the SPOT DWP platform, and no effects would occur on tides, wave action, or winds. Removal of the SPOT DWP platform would temporarily disturb the seafloor and turbidity would increase during removal of the structures above the seafloor and during burial of the pipeline headers. However, over time, the tides, waves, and currents would return the seafloor to a similar bathymetry as before installation of the Project and turbidity would subside. Most of the offshore pipelines would be abandoned in place, and all other offshore components (i.e., SPM buoys, PLEMs, tie-in spools, piles) would be removed and transported to shore for reuse or disposal. Pipeline segments located between the offshore HDD exit pit and the boundary of state-owned submerged lands would be removed as described in Section 2.2.9, Detailed Description of the Proposed Action, Decommissioning.

There would be four support vessels used during decommissioning of the SPOT DWP. Accidental releases of hazardous materials could occur during these activities and affect water quality, and the use of the vessels would result in air emissions and underwater noise. Effects from accidental releases, air emission, and noise would be similar to, but less than, those described for construction. Specifically, construction-phase emissions are described in Section 3.12.4, Onshore Air Quality, and 3.12.5, Offshore Air Quality. Analysis of the air quality impacts of decommissioning with respect to the SIP would be required at the time of decommissioning. Overall, decommissioning activities would involve localized temporary offshore disturbance that would prevent the use of the area for other purposes, such as fishing and boating, and could temporarily impact the military's ability to traverse the Project area. Project decommissioning would generate similar types of, but less, marine traffic than the construction phase.

Decommissioning would cause direct, adverse, short-term, negligible to minor impacts on physical oceanography, turbidity, the local geology, sediments, recreation, ocean use, military use, marine traffic, air quality, underwater noise levels, commercial fishing, and marine commerce and shipping. However, conditions similar to those prior to installation of the Project would be restored over time, with the exception of the jacket adding underwater structure for marine life, which would create a direct, beneficial, long-term, minor impact to the marine environment and for recreational activities, such as fishing.

In addition, the removal of the Project would result in direct, beneficial, long-term, and negligible impacts on visual resources. Over time, without the SPOT DWP in operation and the resulting scour and water discharges, turbidity would lessen, resulting in direct, beneficial, long-term, minor impacts on the surrounding marine environment. The impacts of decommissioning on offshore mineral resources are assumed to be indirect, short-term, and negligible, but would depend on the needs of the regional crude oil industry at the time of decommissioning, and could have a higher adverse impact if the industry depends on the SPOT DWP.

3.17. Evaluation of Alternatives

The following sections analyze the reasonable alternatives to the Proposed Action (or proposed Project) identified in Chapter 2, Description of the Proposed Action and Alternatives. Sections 3.3 through 3.15 provide a detailed analysis of the Proposed Action for each environmental resource.

3.17.1. Alternative Onshore Pipeline Routes

Alternative routes were evaluated from the existing ECHO Terminal in Harris County to the shoreline of the GoM in Brazoria County. The locations of route alternatives evaluated are depicted on Figure 3.17-1 and discussed below.

Onshore pipeline routes must originate at the existing ECHO Terminal in Harris County, which connects to existing crude oil supplies. For alternative onshore pipeline routes that met this first criterion, MARAD and the USCG then considered the following environmental factors:

- Collocation with existing linear rights-of-way (to minimize fragmentation and effects on previously undisturbed areas);
- Proximity of state and Federal lands;
- Proximity of highly populated areas and industrial development;
- Proximity of threatened and endangered species habitat; and
- Crossings of waters of the United States.

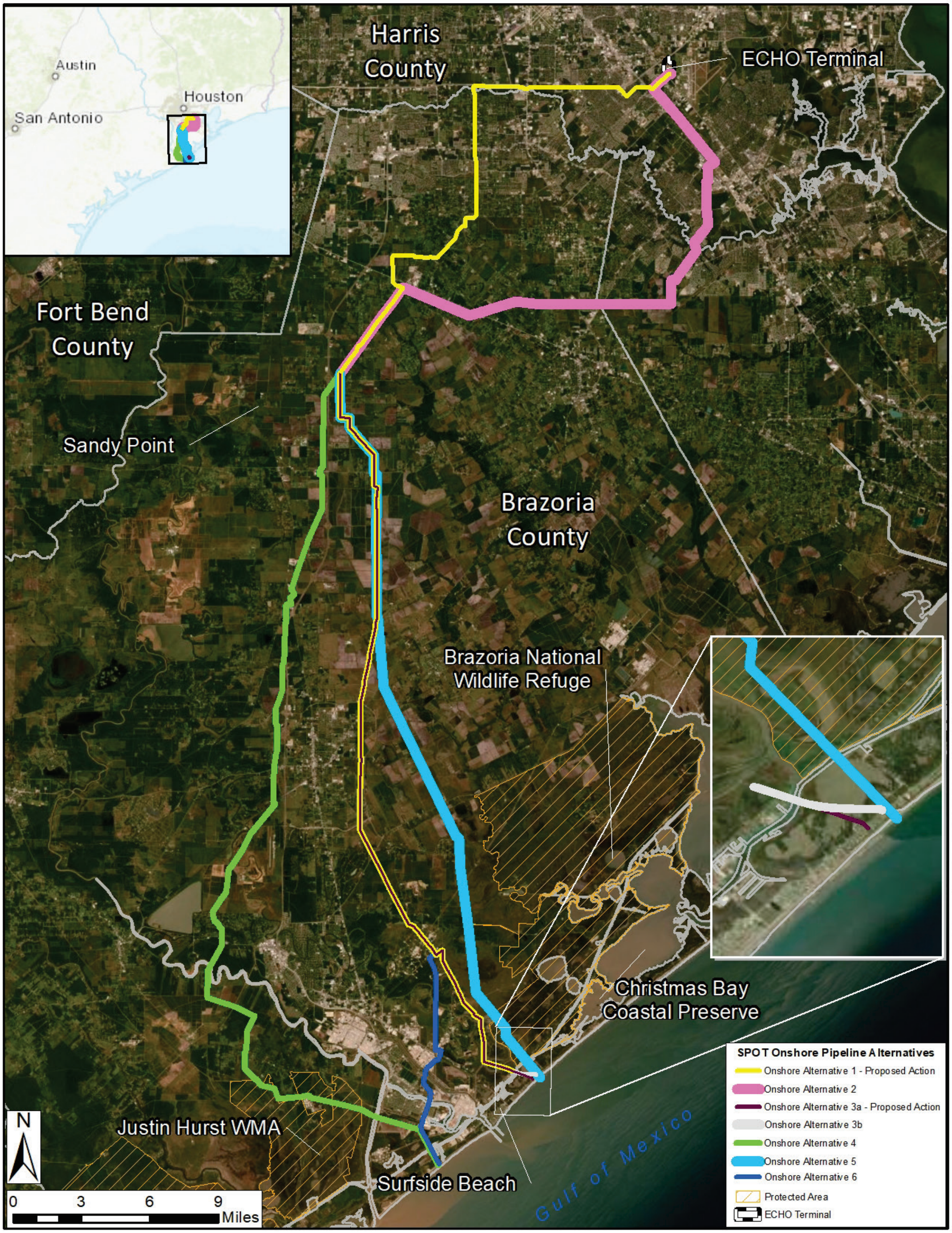
The area from Harris County, where the existing ECHO Terminal is located, into Brazoria County south of SH 6, is densely populated with residential and industrial/commercial areas, thus limiting routing options. Therefore, this area was reviewed independently from the pipeline route between the area near Sandy Point, Texas south of SH 6 and the shoreline. Within Harris County and northern Brazoria County, existing linear rights-of-way were identified with which the proposed onshore pipeline route could be collocated to minimize impacts. Two alternatives were considered for this portion of the pipeline route. Table 3.17-1 provides a summary of two onshore pipeline routes based on a desktop analysis of several publicly available databases:

- Onshore Pipeline Alternative 1 from the ECHO Terminal to Sandy Point, Texas
- Onshore Pipeline Alternative 2 from the ECHO Terminal to Sandy Point, Texas

From the terminus of Onshore Pipeline Alternatives 1 and 2, areas within Brazoria County were analyzed for route alternatives northeast of Sandy Point, Texas to the shoreline of the GoM. This included the area west of Christmas Bay Coastal Preserve to avoid impacts on the sensitive estuary. Within this area, existing linear rights-of-way were identified with which the proposed onshore pipeline route could be collocated to minimize impacts. As such, four alternatives were analyzed for this portion of the pipeline route:

- Onshore Pipeline Alternative 3a from Sandy Point, Texas to Shore
- Onshore Pipeline Alternative 3b from Sandy Point, Texas to Shore
- Onshore Pipeline Alternative 4 from Sandy Point, Texas to Shore
- Onshore Pipeline Alternative 5 from Sandy Point, Texas to Shore

During the public comment period for the Draft EIS, Onshore Pipeline Alternative 3b was proposed by a representative of the Village of Surfside to avoid the proposed shore-crossing location for the two offshore pipelines under Onshore Pipeline Alternative 3a, as shown on Figure 3.17-2.



WMA = Wildlife Management Area

Figure 3.17-1: Alternative Onshore Pipeline Routes Evaluated

Figure 3.17-2: Alternative Onshore Pipeline Routes 3a and 3b

Table 3.17-1: Summary of Onshore Pipeline Alternatives 1 and 2

Parameter [a]	Alternative 1	Alternative 2
Total length	26.2	29.2
Collocation [b] with other pipelines, electrical lines, roadways (miles/percent [%])	25.0/94%	23.3/80%
Land Cover and Land Use		
Cultivated crops	3.0	7.0
Forest [c]	0.5	2.0
Developed [d]	12.8	8.5
Hay/pasture	7.9	7.6
Herbaceous	0.3	1.7
Open water [e]	< 0.1	0.1
Scrub/shrub	0.4	0.8
Prime farmland soils	25.0	27.8
National Wetlands Inventory		
Freshwater emergent wetlands	0.2	0.4
Freshwater forested/shrub wetlands	0.1	0.3
Riverine wetlands	0.1	0.2
Waterbodies [f]		
Stream/river (number of crossings)	36	10
Other Resources		
Floodplain (100-year)	13.4	11.2
Other Infrastructure		
Pipelines (number of crossings)	85	156
Electrical transmission lines (number of crossings)	15	25
Roads (number of crossings)	32	23

Sources: FEMA 2020a; HIFLD 2019; NRCS 2019; RRC 2019b; TPWD 2014a; TXDOT 2018; USFWS 2019f; USFWS 2018a; USGS 2019b; USGS 2016; USGS 2010

[a] All parameters are measured in miles unless otherwise noted.

[b] Collocation includes linear infrastructure within 200 feet of the route based on centerline-to-centerline measurement (SPOT 2019y).

[c] Forest land includes evergreen, deciduous, and mixed forest land cover.

[d] Developed includes low, medium, and high intensity land cover, as well as developed, open space (e.g., parks).

[e] Open water includes ponds and lakes.

[f] Waterbodies were identified by review of high-resolution mapping for water features that are 30 feet wide with visible water. Features that are 30 feet wide with extensive tree cover are assumed to have water and are also included in the total count.

Table 3.17-2 provides a summary of the three onshore pipeline routes identified and analyzed from the terminus of Onshore Pipeline Alternatives 1 and 2 through Brazoria County to the GoM shoreline.

Table 3.17-2: Summary of Onshore Pipeline Alternatives 3 Through 5

Parameter [a]	Alternative 3a	Alternative 3b	Alternative 4	Alternative 5
Total length	35.9	36.0	44.7	33.6
Collocation [b] with other pipelines and electrical lines (miles/percent [%])	24.2/67%	24.7/69%	16.5/37%	5.9/18%
Federal, State, and Locally Owned Property				
Brazoria National Wildlife Refuge	0.0	0.0	0.0	3.4
Justin Hurst Wildlife Management Area	0.0	0.0	2.7	0.0
Land Cover and Land Use				
Cultivated crops	9.3	9.3	10.1	10.4
Forest [c]	0.7	0.7	0.7	0.2
Developed [d]	1.3	1.3	0.7	0.2
Hay/pasture	9.5	9.5	12.1	6.4
Herbaceous	2.8	2.8	1.0	1.2
Open water [e]	0.7	0.9	0.5	0.7
Scrub/shrub	1.6	1.6	1.3	0.6
Prime farmland soils	25.1	25.1	36.0	19.8
National Wetlands Inventory Wetlands				
Estuarine and marine deepwater wetlands	0.4	0.4	0.2	0.4
Estuarine and marine wetlands	2.3	2.5	0.4	1.7
Freshwater emergent wetlands	0.5	0.4	4.7	4.2
Freshwater forested/shrub wetlands	0.3	0.3	2.8	0.2
Riverine wetlands	0.2	0.2	0.3	0.2
Waterbodies [f]				
Stream/river (number of crossings)	33	33	23	227
Other Resources				
Floodplain (100-year)	19.9	19.9	25.5	19.7
Other Infrastructure				
Pipelines (number of crossings)	98	98	106	75
Electrical transmission lines (number of crossings)	6	6	10	3
Roads (number of crossings)	26	26	17	8

Sources: FEMA 2020a; HIFLD 2019; NRCS 2019; RRC 2019b; TPWD 2014a; TXDOT 2018; USFWS 2019f; USFWS 2018a; USGS 2019b; USGS 2016; USGS 2010

[a] All parameters are measured in miles unless otherwise noted.

[b] Collocation includes linear infrastructure within 200 feet of the route based on centerline to centerline measurement (SPOT 2019y).

[c] Forest land includes evergreen, deciduous, and mixed forest land cover.

[d] Developed includes low, medium, and high intensity land cover, as well as developed, open space (e.g., parks).

[e] Open water includes ponds and lakes.

[f] Waterbodies were identified by review of high-resolution mapping for water features that are 30 feet wide with visible water. Features that are that are 30 feet wide with extensive tree cover are assumed to have water and are also included in the total count.

3.17.1.1. Onshore Pipeline Alternative 1 from ECHO Terminal to Sandy Point, Texas (Proposed Action)

Onshore Pipeline Alternative 1 could be collocated (94 percent) with the EPO Rancho II Pipeline right-of-way through heavily populated and developed areas. Onshore Pipeline Alternative 1 crosses 85 pipelines and 36 waterbodies.

Onshore Pipeline Alternative 1 is shorter and crosses fewer pipelines as compared to Onshore Pipeline Alternative 2, which would minimize workspaces and environmental impacts. Although Onshore Pipeline Alternative 1 route crosses 100-year floodplains, underground infrastructure is typically buried and contours would be restored to preconstruction conditions. As a result, drainage patterns would not be negatively affected by flooding. Onshore Pipeline Alternative 1 is the Proposed Action for the SPOT Project and is evaluated in more detail for each environmental resource in Sections 3.3 through 3.15.

3.17.1.2. Onshore Pipeline Alternative 2 from ECHO Terminal to Sandy Point, Texas

Approximately 80 percent of Onshore Pipeline Alternative 2, or 23.3 miles of the route, is collocated with other linear infrastructure. Onshore Pipeline Alternative 2 crosses 156 pipelines and 10 waterbodies.

Onshore Pipeline Alternative 2 is about 3 miles longer and 14 percent less collocated as compared to Onshore Pipeline Alternative 1. It also crosses 71 more pipelines. Crossing pipelines requires additional workspace during construction and increases potential safety hazards while working on or near active pipelines. Onshore Pipeline Alternative 2 would have a greater impact than Alternative 1 due to its length and workspace required during construction and operation as compare to the other alternative.

3.17.1.3. Onshore Pipeline Alternative 3a from Sandy Point, Texas to Shore (Proposed Action)

Approximately 67 percent of Onshore Pipeline Alternative 3a, or 24.2 miles of the route, is collocated with other linear infrastructure. Onshore Pipeline Alternative 3 crosses 98 pipelines and 33 waterbodies.

Onshore Pipeline Alternative 3a does not cross Federal or state lands. It crosses the least amount of wetlands and waterbodies as compared to Alternatives 4 and 5. The parcel of land at which Onshore Pipeline Alternative 3a would cross the shoreline, and house an MLV, is undeveloped and available for sale. Onshore Pipeline Alternative 3a is the Proposed Action for the SPOT Project and is evaluated in more detail for each environmental resource in Sections 3.3 through 3.15.

3.17.1.4. Onshore Pipeline Alternative 3b from Sandy Point, Texas to Shore

Onshore Pipeline Alternative 3b follows the same route as Onshore Pipeline Alternative 3a until the Oyster Creek to Shore HDD #5 exit pit, at which point it deviates from Onshore Pipeline Alternative 3a to parallel the existing Blue Dolphin Pipeline for 1.4 miles south to the shore crossing. Onshore Pipeline Alternative 3b would cross 98 pipelines and 33 waterbodies.

Onshore Pipeline Alternative 3b would be approximately 0.1 mile longer than Onshore Pipeline Alternative 3a, and would affect 0.2 additional acre of open water and 0.2 additional acre of estuarine and marine wetlands. The parcel of land at which Onshore Pipeline Alternative 3b would cross the shoreline, and house an MLV, contains a natural gas pipeline, and is not known to be available for sale. Onshore

Pipeline Alternative 3b would require a bend in the HDD for the crossing of Swan Lake and the length of the HDD for Onshore Pipeline Alternative 3b would be 0.1 mile longer than the straight-line HDD that would be used for Onshore Pipeline Alternative 3a. HDDs with horizontal bends are more complex than straight-line HDDs; therefore, Onshore Pipeline Alternative 3b would take longer to construct and could have a higher risk of drill failure and inadvertent releases.

3.17.1.5. Onshore Pipeline Alternative 4 from Sandy Point, Texas to Shore

Approximately 37 percent of Onshore Pipeline Alternative 4, or 16.5 miles of the route, are collocated with other linear infrastructure. Onshore Pipeline Alternative 4 crosses 106 pipelines and 23 waterbodies. This alternative also crosses 2.7 miles of the Justin Hurst Wildlife Management Area. It is also immediately adjacent to, but does not cross, USFWS-designated critical habitat for the Piping Plover.

Onshore Pipeline Alternative 4 is the longest by at least 8.8 miles as compared to Onshore Pipeline Alternative 3 and Onshore Pipeline Alternatives 5. It also crosses the Justin Hurst Wildlife Management and at least eight more pipelines. Onshore Pipeline Alternative 4 would have the most land impact as compared to Onshore Pipeline Alternatives 3 and 5, due to its length and workspace required during construction and operation. In addition, it would have greater impacts on wildlife and recreational uses because it crosses the Justin Hurst Wildlife Management Area.

3.17.1.6. Onshore Pipeline Alternative 5 from Sandy Point, Texas to Shore

Approximately 18 percent of Onshore Pipeline Alternative 5, or 5.9 miles of the route, are collocated with other linear infrastructure. Onshore Pipeline Alternative 5 crosses 75 pipelines and 227 waterbodies. This alternative also crosses 3.4 miles of the Brazoria NWR.

Onshore Pipeline Alternative 5 is the shortest route as compared to Onshore Pipeline Alternative 3 and Onshore Pipeline Alternatives 4. However, it crosses 3.4 miles of the Brazoria NWR and is the least collocated route. In addition, it crosses at least 194 more waterbodies as compared to the other alternatives. Onshore Pipeline Alternative 5 would have the most impact on Federal land and crosses a substantial number of waterbodies that would be affected during construction and operation as compared to Onshore Pipeline Alternatives 3 and 4. Impacts on wildlife could be greater due to the proximity to the Brazoria NWR; however, impacts would likely be limited to noise impacts during construction.

3.17.2. Alternative Onshore Terminal Sites

As discussed in Chapter 2, Description of the Proposed Action and Alternatives, the Applicant determined that approximately 100 acres would be required to house the storage and pumping facilities needed for the SPOT Project. There was no available land greater to or equal than 100 acres adjacent to the existing ECHO Terminal; therefore, expansion of the ECHO Terminal is not viable. A new onshore storage and pumping facility would be necessary to support the SPOT Project.

The environmental and technical factors evaluated to identify and compare potential alternative sites for an onshore terminal included:

- Available parcels with at least 100 acres for development;
- Location of NSAs;

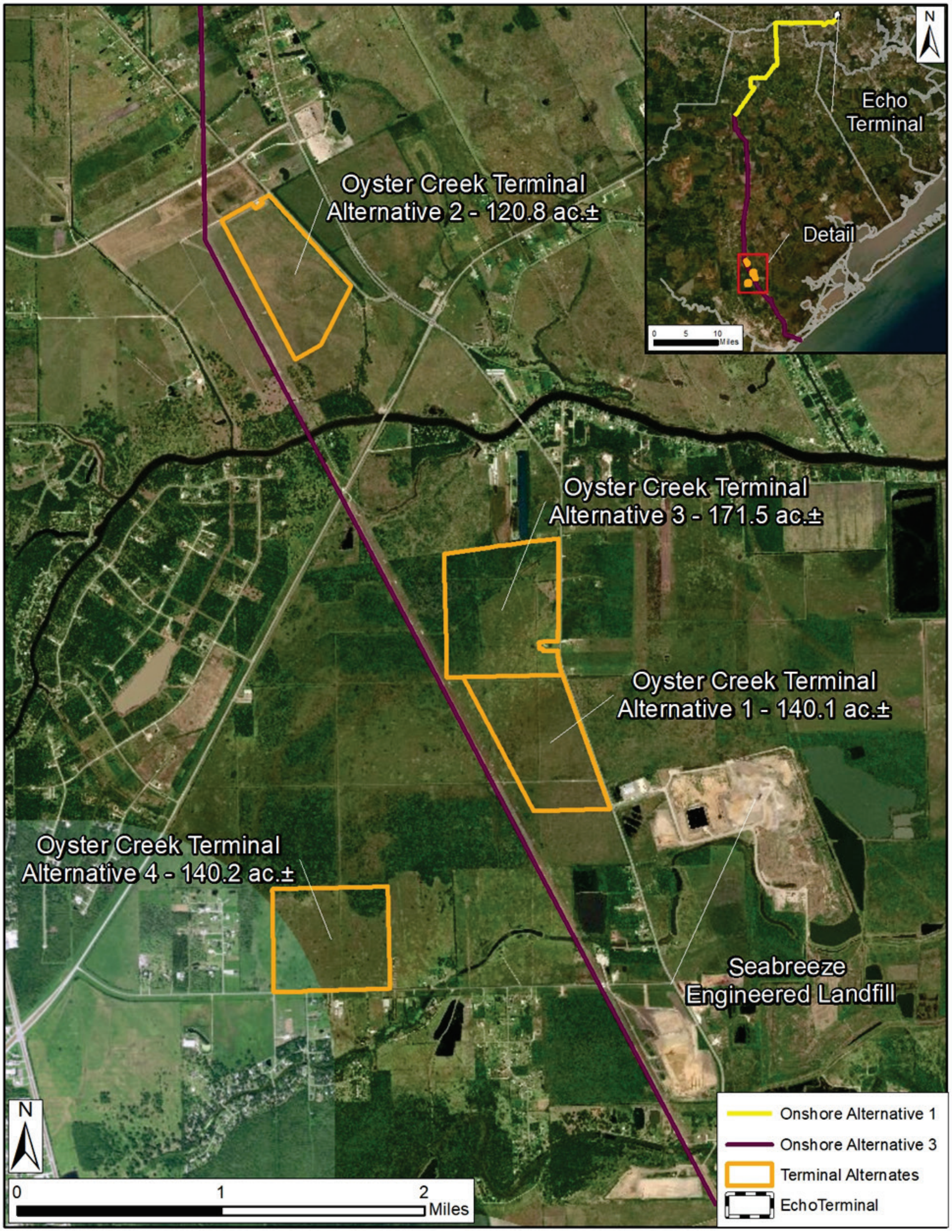
- Location of waters of the United States;
- Floodplains (which are not desirable locations for aboveground facilities, as impervious surfaces could affect drainage);
- Location relative to the onshore pipeline route(s) that would minimize pipeline lengths and workspaces; and
- Location of a mainline pumping unit within 16 miles of the shoreline, which is maximum distance required to transfer oil to the SPOT DWP without adding additional pumping unit(s) along the along the collocated Oyster Creek to Shore Pipelines.

Alternative onshore terminal sites were evaluated in Brazoria County because it provides options for both available land meeting the size criteria of 100 acres or more, and locations within 16 miles of the proposed shoreline. The locations of onshore terminal site alternatives are depicted on Figure 3.17-3 and discussed below.

Four sites were evaluated that met the land size and mainline pumping unit location criteria, and are in proximity to Onshore Pipeline Alternative 3 from Sandy Point, Texas to shore (Proposed Action):

- Oyster Creek Terminal Alternative 1
- Oyster Creek Terminal Alternative 2
- Oyster Creek Terminal Alternative 3
- Oyster Creek Terminal Alternative 4

Table 3.17-3 provides a summary of the four alternative onshore storage and pumping terminal sites identified and analyzed in Brazoria County.



ac = acres

Figure 3.17-3: Alternative Onshore Storage Terminal Sites Evaluated

Table 3.17-3: Summary of Onshore Storage Terminal Alternatives 1 Through 4

Parameter [a]	Alternative 1	Alternative 2	Alternative 3	Alternative 4
Total area	140.1	120.8	171.5	140.3
Distance to ECHO Terminal (miles)	37.1	35.5	36.5	38.1
Distance to shore crossing (miles) [b]	10.3	12.7	10.9	10.7
Distance to Onshore Pipeline Alternative 3 from Sandy Point, Texas to Shore (miles)	< 0.1	< 0.1	< 0.1	0.6
Distance to existing electric transmission lines (miles)	0.0	0.0	0.0	1.0
Federal or state lands	0.0	0.0	0.0	0.0
NSAs within 0.5 mile (number of NSAs)	4	12	16	50
Floodplain (100-year)	140.1	118.0	171.5	140.3
Land Cover and Land Use				
Cultivated crops	0.0	83.1	0.0	2.6
Forest [c]	0.0	0.0	0.0	14.6
Developed [d]	2.5	1.6	3.2	2.9
Hay/pasture	4.5	4.3	0.0	24.9
Grassland/herbaceous	1.4	21.6	0.0	2.8
Open water [e]	0.0	0.0	0.0	0.0
Scrub/shrub	2.4	1.1	18.7	22.8
Prime farmland soils	64.9	60.4	154.1	140.2
National Wetlands Inventory Wetlands				
Freshwater emergent wetlands	0.0	0.0	0.0	0.1
Freshwater forested/shrub wetlands	0.0	0.0	20.4	0.0
Riverine wetlands	2.1	0.3	3.0	0.9
National Hydrography Dataset Waterbodies				
Canal/ditch (miles)	0.9	0.2	1.4	0.4
Intermittent stream/river (number of crossings)	0.0	0.0	0.0	0.0
Perennial stream/river (number of crossings)	0.0	0.0	0.0	0.0
Other Infrastructure				
Pipelines (number of crossings)	0	0	0	0
Electrical transmission lines (number of crossings)	0	0	0	0
Roads (number of crossings)	0	0	0	0

Sources: SPOT 2019a, Application, Volume IIb; USGS 2016; FEMA 2020a

ECHO = Enterprise Crude Houston; NSA = noise sensitive area; SPOT DWP = Sea Port Oil Terminal Deepwater Port

[a] All parameters are measured in acres unless otherwise noted.

[b] Onshore storage terminal site limited to area at least 100 acres in size within 16 miles of the shore crossing.

[c] Forest land includes evergreen and deciduous land cover.

[d] Developed includes low and medium intensity land cover, as well as developed, open space (e.g., parks).

[e] Open water includes ponds and lakes.

3.17.2.1. Oyster Creek Terminal Alternative 1 (Proposed Action)

Oyster Creek Terminal Alternative 1 is 140.1 acres and located outside of the 100-year floodplain. In total, 64.9 acres of the site are located on prime farmland soils; however, none of the site is located within actively cultivated crop lands. In addition, 2.1 acres of wetlands would be affected. It is located adjacent to an existing electric transmission line. It is also located within 0.5 mile of four NSAs, the fewest of any alternative evaluated. In addition, this alternative is located across FM 523 from the Seabreeze Environmental Landfill and would, therefore, be located adjacent to existing industrial infrastructure. Oyster Creek Terminal Alternative 1 is the Proposed Action for the SPOT Project and is evaluated in more detail for each environmental resource Sections 3.3 through 3.15.

3.17.2.2. Oyster Creek Terminal Alternative 2

Oyster Creek Terminal Alternative 2 is 120.8 acres and located outside of the 100-year floodplain. The site is composed of 83.1 acres of cultivated crop lands, of which 60.4 acres (73 percent) consist of prime farmland soils, and 0.3 acre of wetlands would be affected. This alternative would be in proximity to Onshore Pipeline Alternative 3 from Sandy Point, Texas, and would be located within 0.5 mile of 12 NSAs.

3.17.2.3. Oyster Creek Terminal Alternative 3

Oyster Creek Terminal Alternative 3 is 171.5 acres. In total, 14.6 acres of the site are located within the 100-year floodplain. Although 154.1 acres of the site are considered prime farmland soils, none of the site is considered actively cultivated crop lands. Oyster Creek Terminal Alternative 3 is composed of 20.4 acres of freshwater forested/shrub wetlands and 3.0 acres of riverine wetlands and is partially located within the 100-year floodplain; therefore, this site would be at the most risk for flooding and could affect drainage patterns in the area. Flooding could result in unintended facility shutdowns, an increase in safety hazards, or adverse environmental effects on surrounding areas. Furthermore, it would be located within 0.5 mile of 16 NSAs.

3.17.2.4. Oyster Creek Terminal Alternative 4

Oyster Creek Terminal Alternative 4 is 140.3 acres and is not located within the 100-year floodplain. In total, 140.2 acres of the site are considered prime farmland soils, of which only 2.6 acres are actively cultivated crop lands. In addition, 1 acre of wetlands would be affected. Oyster Creek Terminal Alternative 4 is located the farthest from Onshore Pipeline Alternative 3 from Sandy Point, Texas to shore; thus, it would require at least an additional 0.6 mile of new pipe to be constructed as compared to the other three alternatives. In addition, this alternative would require approximately 1 mile of new electric transmission line to connect with existing infrastructure for power. This alternative would also potentially affect 50 NSAs and would have the most impact during construction and operation as compared to the other alternatives.

3.17.3. Alternative Onshore Crude Oil Storage Terminal Design

Two different crude oil pump unit designs were evaluated for both the proposed expansion of the existing ECHO Terminal and the proposed new Oyster Creek Terminal.

3.17.3.1. Electric-Driven Pump Alternative Design (Proposed Action)

The Electric-Driven Pump Alternative Design uses electricity as the primary power source and includes the use of induction motors, which do not produce air emissions. Generally, electric engines generate less noise compared to other fuel-driven engines. Should electric power to the facilities be interrupted, the pumps would cease operating until power is restored. The Electric-Driven Pump Alternative Design is the Proposed Action for the SPOT Project and is evaluated in more detail for each applicable environmental resource in Sections 3.3 through 3.15.

3.17.3.2. Combustion-Driven Pump Alternative Design

The Combustion-Driven Pump Alternative Design includes an internal combustion engine with power sourced from fossil fuels (e.g., diesel, natural gas), which would result in air emissions. Combustion engines are relatively noisy compared to other drivers. This alternative may also require the installation of additional pipeline(s) or facilities for fuel delivery by truck to operate the equipment.

The Combustion-Driven Pump Alternative Design would have air emissions from the use and combustion of fossil fuels as compared to the Electric-Driven Pump Alternative Design, which would not produce emissions. It would also generate more noise during operation as compared to the Electric-Driven Pump Alternative Design.

3.17.4. Alternative Deepwater Port and Offshore Pipeline Locations

MARAD and the USCG conducted an analysis on six lease blocks and three offshore pipelines. The locations of these lease blocks, pipeline routes, and key criteria used to evaluate the sites are shown on Figure 3.17-4. As discussed in Chapter 2, Description of the Proposed Action and Alternatives, the identification process considered several factors, including:

- Lease blocks a minimum of 2 square miles in size;
- Lease blocks adjacent to another block that is not more than 1 mile from the SPOT DWP to accommodate VLCC or other crude oil carrier anchorage;
- Water depths of at least 75 feet or greater for the draft of a fully loaded VLCC in calm seas;
- An associated offshore pipeline route for each alternative, as the location of the SPOT DWP is dependent on location and proximity to the offshore pipeline route;
- Ability to connect the offshore pipeline routes to Onshore Pipeline Alternative 3 from Sandy Point, Texas at an unoccupied or undeveloped parcel of land (minimum of 150 feet wide by 250 feet long) for workspace associated with the Applicant-proposed HDD construction method; and
- Ability to terminate the offshore pipeline routes at the applicable Alternative DWP Site.

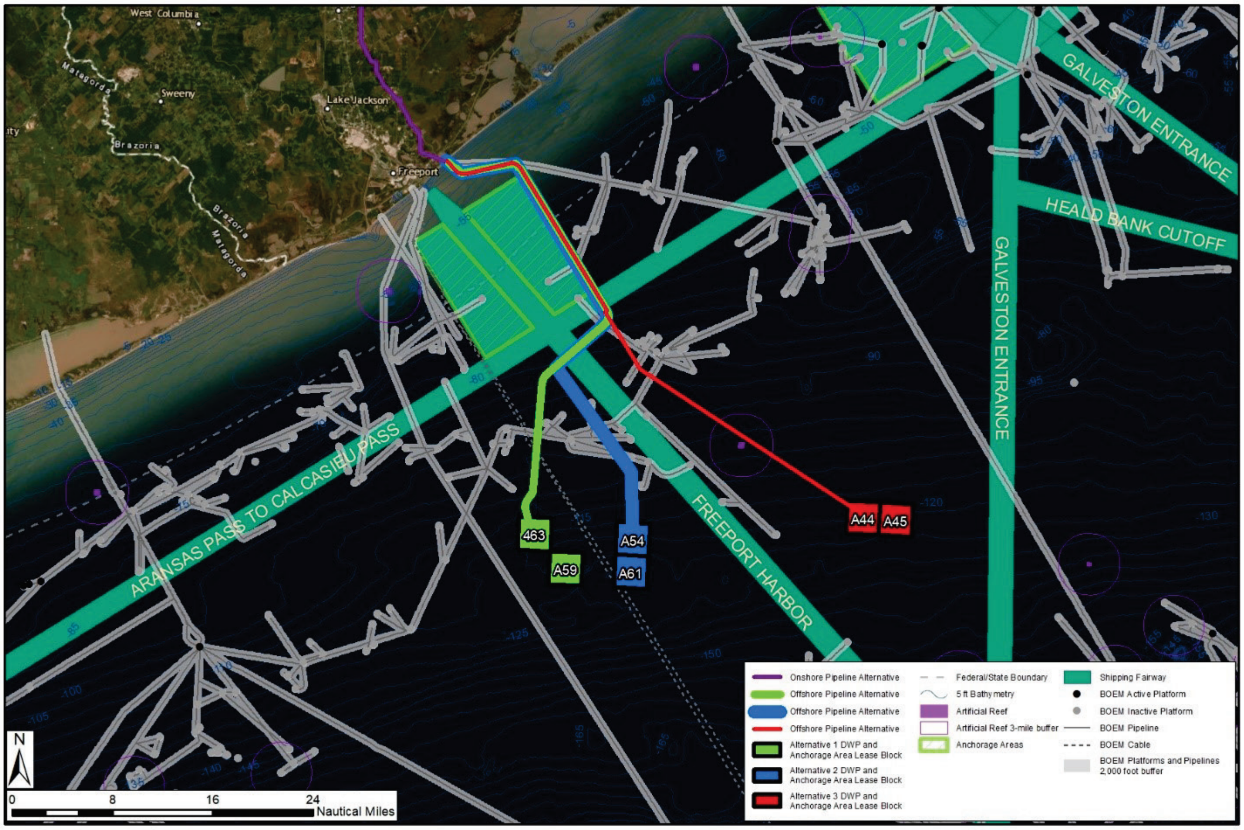


Figure 3.17-4: Alternative Deepwater Port Sites and Offshore Pipeline Routes Evaluated

Each lease block evaluated met the initial criteria; therefore, the primary factor used for a further analysis of the DWP and offshore pipeline location focused on the offshore pipeline alternative impacts.

Deepwater Port, Anchorage, and Offshore Pipeline Alternative 3 was qualitatively evaluated initially since the pipeline route is located within 3 miles of an artificial reef and is at least 7.1 miles longer as compared to the other two offshore pipeline alternatives. Therefore, Deepwater Port, Anchorage, and Offshore Pipeline Alternative 3 is not considered further in this EIS.

Two alternatives were further evaluated, as follows:

- Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1—Lease blocks 463, A-59, Offshore Pipeline Alternative 1
- Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2—Lease blocks A-54, A-61, and Offshore Pipeline Alternative 2

Table 3.17-4 provides an environmental evaluation summary for each of the alternative DWP, anchorage, and offshore pipeline locations based on specific environmental and technical considerations, including but not limited to:

- Avoidance of pipelines, cables, and plugged and abandoned wells, to the extent possible; and

- Avoidance of potential hazards and/or potentially significant cultural materials, as identified by the Applicant from its Geophysical Archaeological and Hazard Survey (SPOT 2019a, Application, Volume III, Attachment 21.

Table 3.17-4: Environmental Evaluation of the Deepwater Port Location Alternatives

Parameter [a]	Alternative 1	Alternative 2
Deepwater Port		
Lease blocks	463, A-59	A-54, A-61
Maximum depth (feet)	129	128
BOEM-identified cables (number)	0	1
BOEM-identified pipelines (number)	0	0
Distance to Freeport Harbor Shipping Lane (miles)	10.3	3.9
BOEM live bottom (pinnacle trend) stipulation blocks (number)	0	0
Offshore Pipelines		
Total length (miles)	46.9	47.7
Active platforms within 1 mile (number)	0	0
Abandoned platforms within 2,000 feet (number)	0	0
Artificial reefs within 3 miles (number)	0	0
BOEM pipelines and cables (number of crossings)	6	8
Plugged and abandoned wells (number) [a]	4	1
Potential hazards or significant cultural materials [a] (number)	100	95
Cultural sites / shipwrecks within 2,500 feet (number)	0	0
Designated shipping fairways (number of crossings)	2	2

BOEM = Bureau of Ocean Energy Management

[a] Provided and verified by the Applicant from the Geophysical Archaeological and Hazard Survey (SPOT 2019a, Application, Volume III, Attachment 2a).

3.17.4.1. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 (Proposed Action)

Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 includes Galveston Area lease blocks 463 and A-59, and an approximately 46.9-mile offshore pipeline route. The associated 46.9-mile offshore pipeline route crosses six pipelines/cables, four plugged and abandoned wells, and 100 potential hazards and/or potentially significant cultural materials.

This alternative has the shortest pipeline length; therefore, it would result in the shortest construction period, the least amount of total seafloor disturbance, and the least amount of associated potential impacts. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 is the Proposed Action for the SPOT Project and is evaluated in more detail for each environmental resource Sections 3.3 through 3.15.

3.17.4.2. Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2

Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2 includes Galveston Area lease blocks A-54 and A-61, and an approximately 47.7-mile offshore pipeline route. The associated 47.7-mile offshore pipeline route crosses 8 pipelines/cables, 1 plugged and abandoned well, and 95 potential hazards and/or potentially significant cultural materials.

This alternative includes an offshore pipeline route that is 0.8 mile longer than Deepwater Port, Anchorage, and Offshore Pipeline Alternative 1 and crosses two more pipelines/cables. This alternative would include more pipeline infrastructure and subsequently more seafloor disturbance and marine impacts.

3.17.5. Alternative Deepwater Port and Component Designs

Selection of the DWP design, as well as the design of specific components, depends on the consideration of multiple environmental, technical, and commercial factors as discussed in this section. Each design alternative was evaluated to determine whether it would be reasonable and environmentally preferable. Although each design has some flexibility, each also has some inherent features that are most compatible with certain technical conditions and that lend themselves to specific business models. Each alternative design was evaluated based on its suitability for use in the GoM, as well as its economic and operational feasibility.

3.17.5.1. Offshore Deepwater Port Design Alternatives

Two offshore DWP design alternatives were evaluated in regard to the DWP itself and VLCC or other crude oil carrier mooring. The DWP design alternatives were evaluated based on several factors, including the footprint of the infrastructure required, the maximum loading rate, the range of conditions during which VLCCs could moor and load, safety equipment, and operational considerations, such as custody transfer and maintenance.

Offshore Deepwater Port Design Alternative 1—Fixed Platform with SPM Buoy (Proposed Action)

Offshore Deepwater Port Design Alternative 1 includes a fixed-support platform with anchored SPM buoy(s) that integrate mooring capabilities and liquid product transfer systems directly from a pipeline.

This design requires a substantial amount of infrastructure and has the same operational capabilities as Offshore Deepwater Port Design Alternative 2, with the addition of the following capabilities:

- Allows for a wider range of acceptable mooring and loading conditions, as the VLCCs or other crude oil carriers have the flexibility to weathervane (i.e., swing) as necessary based on the conditions of the ocean; and
- Flexibility to install additional SPM buoy(s) with less impact than berth(s) to allow multiple and simultaneous VLCC or other crude oil carrier loadings.

Fixed Platform with SPM Buoy would provide for a wide range of conditions under which VLCC or other crude oil carrier mooring and loading operations could occur, as the VLCCs or other crude oil carriers would have the ability to weathervane. This design requires a large infrastructure footprint, but the proposed facilities associated with this alternative would have less impact than the installation of the Offshore Deepwater Port Design Alternative 2—Fixed Platform with Berth. Offshore Deepwater Port Design Alternative 1 is the Proposed Action for the SPOT Project and is evaluated in more detail for each environmental resource in Sections 3.3 through 3.15.

Offshore Deepwater Port Design Alternative 2—Fixed Platform with Berth

Offshore Deepwater Port Design Alternative 2 includes a fixed-support platform with mooring and berthing dolphins, crude oil loading arms at a marine berth, and interconnecting bridges between the support platform and marine berth. The mooring has a fixed orientation (i.e., vessels cannot weathervane with real-time sea states), which could limit VLCC or other crude oil carrier mooring/berthing and subsequent loading operations during less-than-optimal sea conditions. Fixed platforms with berths require the most amount of infrastructure of the alternatives considered.

Because this design includes a large infrastructure footprint, it can provide enough space for a number of systems required for safety and maintenance purposes.

Offshore Deepwater Port Design Alternative 2—Fixed Platform with Berth would require the most infrastructure, have the greatest seafloor disturbance, and would have limited capabilities for VLCC or other crude oil carrier mooring and loading due to the inability to weathervane as compared to Offshore Deepwater Port Design Alternative 1—Fixed Platform with SPM Buoy.

3.17.5.2. Alternative Volatile Organic Compound Control Technologies

A critical design criterion evaluated for the SPOT DWP is the ability for the Project to include a VOC recovery and removal system. Three alternatives were evaluated based on current industry standards and ability to support the magnitude of the Proposed Action, including removal of 90 percent or greater of the VOCs from the recovered vapors.

Vapor Combustor Alternative (Proposed Action)

The Vapor Combustor Alternative includes a vapor combustor unit fueled by propane that uses high combustion temperatures to achieve VOC removal via destruction. This technology provides the highest rate of VOC destruction/recovery and allows for the greatest flexibility in VOC composition. However, fuel is required to enrich the vapors, which requires shipment and storage at the DWP. The vapor combustor can be enclosed, minimizing visual and noise impacts from an open flare.

This design would require the smallest footprint on the platform (about 3,000 square feet) as compared to the other alternatives. The Vapor Combustor Alternative is the Proposed Action for the SPOT Project and is evaluated in more detail for each applicable environmental resource in Sections 3.3 through 3.15.

Adsorption with Absorption Alternative

The Adsorption with Absorption Alternative uses a combination of adsorption (i.e., holds molecules onto a solid surface) and absorption (i.e., takes up, or absorbs, the molecules) technologies to achieve VOC removal from the recovered vapors.

The space required for this design is greater (about 9,600 square feet) and may increase the size of the platform design as compared to the Vapor Combustor Alternative. It would also require an additional power generation of 3,875 kilowatts, resulting in additional emissions. In addition, this technology is not a common design for a project of similar size to the Proposed Action of the SPOT DWP. The Adsorption with Absorption Alternative is capable of removing 90 percent or more of VOCs from recovered vapors.

Adsorption with Vapor Combustion Alternative

The Adsorption with Vapor Combustion Alternative is similar to the adsorption with absorption alternative, except the VOC stream from the regeneration process would be sent to a vapor combustion unit rather than an absorption system.

The Adsorption with Vapor Combustion Alternative would require more space (about 12,480 square feet), which could increase the size of the platform design as compared to the Vapor Combustor Alternative. It would also require an additional power generation of 2,900 kilowatts, resulting in additional emissions. Furthermore, this technology is not a common design for a project of similar size to the Proposed Action of the SPOT DWP. The Adsorption with Vapor Combustion Alternative is capable of removing 90 percent or more of VOCs from recovered vapors.

3.17.6. Alternative Construction Methods

MARAD and the USCG evaluated construction alternatives for the SPOT Project to determine whether offshore environmental impacts could be reduced or mitigated by the use of alternative construction methods. This section includes a review of pipeline construction at the shoreline and platform foundation/pile driving alternatives. Each of these alternative methods is evaluated below.

3.17.6.1. Alternative Shoreline Pipeline Construction Methods

Two shoreline construction alternatives were identified for crossing the shoreline and beach at Surfside in Brazoria County.

Horizontal Directional Drill Alternative (Proposed Action)

The Horizontal Directional Drill Alternative would be used to install the two collocated subsea pipelines between the shore crossing and offshore segments of the subsea pipelines. This construction method would result in the pipelines being installed approximately 60 to 70 feet below the ground surface at the beach crossing.

The HDD method to install the pipeline at the shoreline and beach crossing would avoid impacts on beach access, onshore and nearshore habitats, and nearshore water quality due to turbidity and sedimentation. The pipeline would be installed at a depth of 100 feet below grade at the shoreline using the HDD method compared to a depth of at least 15 feet using the Open-Cut Trenching with Jet Sled Alternative. The additional depth of the HDD would increase the protection of the pipeline at the shoreline. The Horizontal Directional Drill Alternative is the Proposed Action for the SPOT Project and is evaluated for each applicable environmental resource in Sections 3.3 through 3.15.

Open-Cut Trenching with Jet Sled Alternative

This alternative includes several construction methods based on the location of the pipe and the land type (i.e., upland, beach, nearshore, offshore), including standard open-cut construction techniques for upland areas, open-cut construction using a dredge barge and pipe lay barge for nearshore and shallow water areas, and jet sledding for offshore areas.

As compared to the HDD Alternative, the Open-Cut Trenching with Jet Sled Alternative would result in direct impacts on the beach and would require the temporary closure of beach areas at Surfside. This alternative would also disturb beach and nearshore marine habitats, resulting in potential impacts on terrestrial and marine species. In addition, construction activities for the offshore segment would result in increased turbidity and sedimentation impacts in nearshore waters.

3.17.6.2. Alternative Offshore Construction Foundation/Pile Driving Methods

Four foundation/pile-driving methods were identified for the Proposed Action. These alternatives and rationale for consideration are discussed below.

Driven Pile Alternative (Proposed Action)

The driven pile method consists of a high-grade steel pile that is open-ended and driven into the seafloor by either conventional impact hammers or vibratory hammers. This method is generally used in conditions consisting of non-cohesive sediments, such as sand or silt, or in stratified soil conditions, but can be effective in most soil conditions. Driven pile installation is not sensitive to water depth because a hydraulic hammer would drive the pile down to the target depth. Driven piles are commonly installed in the GoM and are effective means of securing structures to the seafloor. Decommissioning of driven piles typically involves cutting the pile about 15 feet below the seafloor and leaving the remainder of the pile in place. The Driven Pile Alternative (conventional impact hammer or vibratory hammer) is the Proposed Action for the SPOT Project and is evaluated for each applicable environmental resource in Sections 3.3 through 3.15.

Suction Pile Alternative

The suction pile method includes a cylinder steel pile that is capped on one end and open at the other end. Suction piles are best used in clay and fine sediment conditions with few sediment layers, and have proven highly reliable. Installation of suction piles can be sensitive to water depth as the installation relies upon the suction pressure being built up within the anchor and the pressure of the given water column above to overcome the resistance in the sediment. As such, suction piles are best for water depths greater than the length of the pile. Additionally, the potential lack of soil penetration could result in limitations during installation. Suction piles are recoverable during decommissioning. To support the SPOT DWP platform, suction piles of 30 feet in diameter would be needed. These piles would also need to penetrate the seabed to a depth of 154 feet. As the SPOT DWP would be located in shallower waters of 115 feet, suction piles would not be a practical method for construction of the Proposed Action.

Jetted Piles Alternative

The jetted pile method consists of a steel pile, which has a pressurized water jet (or compressed air jet) at the end of it to allow the pile to penetrate the seafloor. This method is used in very dense soils and can be used in conjunction with, or separate from, pile-driving methods for pile installation. The location of the Proposed Action of the SPOT DWP is in soft sediments of the GoM; thus, the Jetted Pile Alternative is not anticipated to be a practical method during construction of the Proposed Action.

Grouted Drill Pile Alternative

The grouted drill pile method includes a steep pile and is similar to a driven pile, but is installed differently. If sediment condition consists of cemented soil layers and/or rock material, grouted drill piles may be required, as these materials limit the amount of penetration with driving hammers. Grouted pile anchors are not easily recovered during decommissioning and the general practice is similar to driven piles where they are cut 15 feet below the seafloor. This method is typically used onshore in bedrock or soils consisting of calcareous materials rather than soft sediments (i.e., clays, sands) where the drilled hole may collapse prior to installation of the pile. The location of the Proposed Action of the SPOT DWP is in soft sediments of the GoM, which is not suitable for this method; therefore, the Grouted Drill Pile Alternative is not anticipated to be a practical method during construction of the Proposed Action for the SPOT DWP.

3.17.7. Decommissioning Alternatives

Four alternatives for the removal of the proposed SPOT DWP facilities and offshore pipelines were identified including a request from BOEM.

3.17.7.1. Decommissioning Alternative 1 (Proposed Action)

Decommissioning Alternative 1 includes removal of the DWP, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. The crude oil export pipelines from shore to the DWP, crude oil loading pipelines, and the vapor recovery pipelines would be abandoned in place.

This alternative would have the least amount of impacts on the seafloor and marine resources as compared to the other alternatives and is common practice in the GoM for subsea pipelines. Decommissioning Alternative 1 is the Proposed Action for the SPOT Project and is evaluated for each applicable environmental resource in Sections 3.3 through 3.15.

3.17.7.2. Decommissioning Alternative 2

Decommissioning Alternative 2 includes removal of the DWP platform, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. It also includes the partial removal of the two crude oil export pipelines in state waters only, as requested by BOEM. The pipelines in Federal waters, including the two crude oil export segments, crude oil loading pipelines, and the vapor recovery pipelines, would be abandoned in place.

The HDD pipe segments beneath the beach at the shore crossing would not be removed.

Decommissioning Alternative 2 would include the removal of the two crude oil export pipelines from shore to the DWP in state waters and would increase impacts on the seafloor and marine resources as compared to Decommissioning Alternative 1.

3.17.7.3. Decommissioning Alternative 3

Decommissioning Alternative 3 includes removal of the DWP platform, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. It also includes the partial removal of the two crude oil export pipelines, crude oil loading pipelines, and the vapor recovery pipelines from Federal waters only to the SPOT DWP, as requested by BOEM. The pipelines in state waters would be abandoned in place.

Decommissioning Alternative 3 would include the removal of the two crude oil export pipelines, crude oil loading pipelines, and the vapor recovery pipelines in Federal waters and would increase impacts on the seafloor and marine resources as compared to Decommissioning Alternative 1 and Decommissioning Alternative 2.

3.17.7.4. Decommissioning Alternative 4

Decommissioning Alternative 4 includes removal of the DWP platform, SPMs, mooring facilities, PLEMs, and subsea tie-in spools. It also includes the full removal of the two offshore crude oil export pipelines, crude oil loading pipelines, and the vapor recovery pipelines from state and Federal waters to the SPOT DWP, as requested by BOEM.

The HDD pipe segment under the beach at the shore crossing would not be removed and would remain in place.

Decommissioning Alternative 4 includes the removal of the DWP platform, SPMs, mooring facilities, PLEMs, subsea tie-in spools, and full removal of the two offshore crude oil export pipelines, crude oil loading pipelines, and the vapor recovery pipelines from state and Federal waters, which would have the most impact on seafloor and marine resources as compared to the other alternatives.

4. SAFETY

4.1. INTRODUCTION

The transportation, handling, and storage of crude oil requires engineering controls to minimize potential health, safety, and environmental risks, and interruptions of supplies. This chapter provides an overview of issues associated with the proposed Project that could directly or indirectly affect public safety, with a focus on oil spill impacts, as well as the safe and reliable construction and operation of the SPOT DWP. This chapter is limited to design, engineering, and operational components of the proposed Project's infrastructure that could affect public safety. Reliability of overseas crude oil supplies and shipping is outside the scope of this EIS.

The safety of personnel working onboard the proposed SPOT DWP facilities, including process safety and vessel operations, is addressed in IMO conventions and U.S. regulations. These topics have been assessed preliminarily by the Applicant in its draft OPSMAN (SPOT 2019t) and would be fully addressed in the final OPSMAN, which requires approval from the USCG prior to commencement of operation if a license is granted. They are also beyond the scope of this EIS.

If the SPOT DWP is approved, the USCG would be responsible for review and approval of the design basis, fabrication, construction, installation, commissioning, operation, security, maintenance procedures, and inspection of the offshore Project components. PHMSA would be responsible for regulating and ensuring the safe and secure movement of crude oil via the onshore components of the SPOT Project. This would include a Management of Change process to review and approve any proposed substantive changes to DWP operation, equipment, or environmental impacts. Additionally, the USCG would coordinate with appropriate and responsible agencies as needed and required, such as MARAD, PHMSA, BOEM, Bureau of Safety and Environmental Enforcement (BSEE), and environmental resource agencies, for the life of the DWP and eventual decommissioning.

As part of the application, the Applicant's first-party contractors, RPS Group and Risknology, Inc., developed an Oil Spill Trajectory and Fate Modeling Report (SPOT 2019w), a Spill Risk Analysis (SPOT 2019a, Application, Volume IIa, Appendix M), and a Summary of Hypothetical Oil Spill Response Actions (Appendix I). The Applicant also provided additional information regarding offshore diesel fuel spills (SPOT 2019c), and spill modeling for the onshore pipelines (SPOT 2019d). Following filing of the application, the USCG requested its third-party contractor to review the information provided by the Applicant and conduct independent modeling and analyses. The information, figures, and tables associated with crude oil release and spill consequence analysis in this chapter are derived primarily from the work conducted by the third-party contractor for the USCG.

4.2. LAWS AND REGULATIONS

The SPOT Project would follow all onshore and offshore pipeline laws and regulations related to deepwater ports and pipelines, which are put in place to protect the safety of both the public and the environment. Section 1.6, Permits, Approvals, and Regulatory Requirements, offers a detailed discussion of applicable laws and regulations pertaining to the proposed Project.

The proposed Project would also need to conform to MARPOL, adopted in 1973 and modified by the Protocol of 1978, per the applicability of the Act to Prevent Pollution from Ships. All signatories of MARPOL must be compliant with the requirements that prevent and minimize pollution from ships, from both accidents and routine operations. The Project would need to comply with MARPOL Annexes I, II, III, V, and VI to which the United States is a signatory.

The laws and regulations relevant to deepwater ports and pipelines include requirements for operations, cleanup, public safety, transportation of crude oil, potential releases, and pipeline safety. They are designed to hold an applicant accountable to its integrity management programs and to using safe practices. These laws and regulations include design standards from ASME and API for various components and materials, an evaluation of which is beyond the scope of this EIS.

4.3. Crude Oil Hazards

4.3.1. Hazards

Petroleum is one of the most common pollutants released into the marine environment. Natural petroleum seeps, and leaks during extraction, transportation, and consumption are the main sources of crude oil released into the marine environment. Oil spills represent a small fraction of the total crude oil discharged into the sea. For example, the 1989 Exxon Valdez oil spill, which released more than 10 million gallons of crude oil into Prince William Sound, is small compared to the natural petroleum seeps off Santa Barbara, California where 20 to 25 tons of oil have leaked from the seafloor each day for the last several hundred thousand years (Live Science 2009). Crude oil often has acute and long-term impacts on marine ecosystems, including effects from physical damages (physical contamination and smothering) and toxicity of its chemical compounds. Crude oil is a complex mixture of both hydrocarbons (e.g., alkanes, cycloalkanes, and aromatic hydrocarbons) and non-hydrocarbon compounds. PAHs refer to any class of hydrocarbon molecules that have multiple carbon rings, and that include carcinogenic substance and environmental pollutants (Merriam-Webster 2019d). PAHs are considered the most acutely toxic components of crude oil, interfering with membrane fluidity. PAHs are also associated with potential carcinogenic, teratogenic, and mutagenic effects[1] in aquatic animals and humans.

Oil spills may affect marine organisms in a number of ways including physically, through behavior modifications known to produce carcinogenic and mutagenic effects, or through natural habitat modifications. Petroleum can kill marine organisms, reduce their fitness through sublethal effects, and disrupt the structure and function of marine communities and ecosystems (NRC 2003). The biological effects of oil pollution can be acute or chronic.

In the marine environment, oil can affect a variety of organisms including birds, mammals, pelagic and benthic organisms. Additional information on the potential effects of oil spills on biological resources can be found in Section 3.4, Habitats, through Section 3.7, Threatened and Endangered Species.

[1] Effects that "produce or tend to produce cancer," and are "related to or cause developmental malformations" and mutations (Merriam-Webster 2019a, b, c)

4.3.1.1. Birds

For birds, oil can cause feathers to mat and separate, impairing waterproofing and exposing the animal's skin to extremes in temperature, resulting in hypothermia or hyperthermia. The effects can be compounded, as birds try to get the oil off their feathers by preening, which results in the animal ingesting the oil, which can cause severe damage to its internal organs. Often, oil-soaked birds lose their buoyancy and beach themselves in their attempt to escape the cold water, resulting in an increased risk of predation.

4.3.1.2. Mammals

As with birds, oil can destroy the insulating ability of fur-bearing mammals, such as sea otters, thus exposing them to the harsh elements. Without the ability to repel water and insulate themselves from the cold water, mammals can die of hypothermia. Mammals also attempt to clean themselves and in doing so, ingest toxic levels of petroleum products, which can cause severe damage to their internal organs. Oil ingestion can disrupt the reproductive process, and animals that have survived oil spills may suffer the long-term effects of breeding problems and may produce deformed offspring.

4.3.1.3. Fish

Fish may not be exposed to oil immediately following a spill, but can come into contact with oil if it is mixed into the water column. When exposed to oil, adult fish may experience reduced growth, enlarged livers, changes in heart and respiration rates, fin erosion, and reproduction impairment. Oil also adversely affects eggs and larval survival.

4.3.1.4. Marine Invertebrates

After an oil spill, small crude oil droplets generated by waves and winds can be suspended in the water column. Plumes of small, stable dispersed oil droplets are also frequently found in subsurface waters after oil spills are treated with dispersants. The dispersants reduce the size of the oil droplets such that they are near neutrally buoyant. These dispersed oil droplets may be unlikely to resurface and re-coalesce with the slick. Potentially due to interactions with bacteria, these tiny droplets have been observed accumulating at the seafloor in mucus agglomerates (Payne and Beegle-Krause 2011). These crude oil droplets, which are often in the food size spectra of many zooplankters, can easily interact with planktonic organisms. For instance, small crude oil droplets can be ingested by zooplankton (protozoan and metazoans) when they are suspended in the water or attached to phytoplankton.

4.3.2. Physical Properties

The crude oil that would be exported via the SPOT DWP ranges from ultralight crude (API gravity of approximately 59.4, such as processed Condensate) to light crude (API gravity of approximately 41.3, such as WTI) to heavy grade crude oil (API gravity of approximately 20.1, such as WCS).

Physical properties of the three oil types were obtained from the Oil Trajectory and Fate Modeling Report (SPOT 2019a, Application, Volume IIa, Appendix L) and are described below. The three oil types, a light crude WTI, a heavy grade crude WCS, and processed Condensate, represent the range of potential oil densities (from ultralight to heavy crude oils) that might be transported offshore via the two collocated 36-inch crude oil pipelines.

4.3.2.1. West Texas Intermediate (WTI)

WTI is a light crude oil due to its low density, and is considered “sweet” because of its low sulfur content. The crude oil is refined in the Midwest and Gulf Coast regions in the United States and has an API gravity of 41. This API gravity is lower than crude oil from Montana, Manitoba, and North and South Dakota, which have an API gravity of about 43. WTI is bought by Mexico to mix with the heavy oil (API gravity of 20) that is produced from their country to help the export process. The properties, composition, and characteristics of WTI are presented in Table 4.3-1.

Table 4.3-1: Worldwide Crude Oil Physical and Chemical Properties

Parameter	Unit	Bakken Crude (North Dakota) [a,b]	Mixed Sweet Blend (Canada) [b,c]	Ekofisk (Norway) [b,d]	Qua Iboe (Nigeria) [a,b]	Azeri Light (Azerbaijan) [b,d]	Suncor Synthetic A (Canada) [b,c]	Iranian Heavy [a,b]	Arabian Heavy (Saudi Arabia) [a,b]	Lloyd Blend (Canada) [b,c]	Western Canadian Select [c,e]	Western Canadian Blend [b,c]	Fosterton (Canada) [b,c]	Maya (Mexico) [a,b]	Hondo Monterey (California) [a,b]	Boscan (Venezuela) [a,b]	West Texas Intermediate [e,f]	Condensate [e,f]
Gravity	API	42.1	39.5	38.42	35.8	34.8	33.1	30.0-31.0	27	20.8	20.6	20.6	20.5	20.2	18.3	10.9	41.3	63.2
Density	g/mL	-	0.83	0.832	-	0.85	0.86	0.89	0.89	0.93	0.93	0.93	0.93	0.93	0.94	1	0.8155	0.726
Sulfur	wt%	-	0.44	0.22	0.12	0.15	0.19	1.20-1.65	-	3.52	3.49	3.17	3.24	-	4.7	4.6	0.407	0.19
MCR	wt%	-	1.94	-	-	-	ND	-	-	9.57	9.61	8.59	9.66	-	-	-	1.62	0.14
Sediment	ppmw	-	-	-	-	-	-	-	-	333	360	299	207	-	-	-	-	78
TAN	mg KOH/g	-	-	0.13	-	0.26	-	-	0.1	0.81	0.93	0.73	0.2	-	-	-	0.15	-
Benzene	vol%	0.28	0.29	0.12	-	0.1	0.05	0.083	0.36	0.2	0.16	0.1	0.02	0.075	0.093	0.012	-	1.13
Toluene	vol%	0.92	0.85	0.64	-	0.33	0.24	0.25	1.89	0.35	0.29	0.18	0.11	0.278	0.21	0.018	-	3.58
Ethyl benzene	vol%	0.33	0.25	-	-	-	0.14	0.13	1.11	0.06	0.06	0.06	0.17	0.11	0.075	0.012	-	0.36
Xylenes	vol%	1.4	1.1	-	-	-	0.51	0.51	3.46	0.32	0.29	0.25	0.3	0.374	0.2323	0.03	-	3.99
Salt	vol%	-	-	-	-	-	-	-	-	56.8	49.1	74.3	13	-	-	-	-	-
Nickel	vol%	-	4.3	2.3	3.3	3	ND	22.6	-	58.5	57.4	45.5	47.8	45.5	-	117	-	-
Vanadium	vol%	-	2.1	2.1	0.3	0.7	ND	81	-	130.7	137.7	98.6	109	257	-	1320	-	-
Butanes	vol%	7.5	-	-	-	-	1.7	-	-	1.83	2.08	0.63	1.02	-	-	-	2.09	4.5
Pentanes	vol%	6.4	-	-	-	-	2.96	-	-	4.48	4.21	3.69	0.89	-	-	-	3.5	26.22
Hexanes	vol%	2.4	-	-	-	-	4.01	-	-	4.15	3.78	3.08	1.8	-	-	-	4.44	13.89
Heptanes	vol%	10	-	-	-	-	3.51	-	-	2.97	2.74	2.51	2.13	-	-	-	7.46	13.76
Octanes	vol%	8.9	-	-	-	-	4.47	-	-	2.12	2.13	2.16	3.05	-	-	-	7.35	14.67
Nonanes	vol%	3.7	-	-	-	-	3.8	-	-	1.48	1.52	1.85	3	-	-	-	3.26	8.46
Decanes	vol%	-	-	-	-	-	2.02	-	-	0.7	0.71	0.85	1.42	-	-	-	-	4.83

API = American Petroleum Institute; g/ml = grams per milliliter; MCR = micro carbon residue; mg KOH/g = milligrams of potassium hydroxide per gram; ND = measurement below instrument threshold; ppmw = parts per million weight; TAN = total acid number; vol% = percent volume; wt% = weight percent

Note: "-" indicates that the information is not available, either because the sensors will not pick anything up because the concentrations are so low, or because the crude oil does not have that parameter in it.

[a] Environment Canada 2020

[b] Some of the data represented were generated from U.S. Department of State 2014.

[c] Crude Quality Inc. 2019b

[d] Statoil 2020

[e] Western Canadian Select, West Texas Intermediate, and Condensate would be transported by the SPOT DWP Project.

[f] Crude Quality Inc. 2019c

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4.3.2.2. Western Canadian Select (WCS)

WCS is a heavy blended crude oil, composed of bitumen and blended with sweet synthetic and Condensate diluents. It is one of the largest heavy crude oil streams in North America with an API gravity of 21. This type of crude oil has a high total acid number (TAN) content with a value close to 1, and sometimes greater than 1. Table 4.3-1 has the characteristics of WCS and other crude oils from around the world. If a crude oil has a TAN value greater than 1, a refinery must be retrofitted to handle the difference. The retrofit includes a sulfur removal unit and upgraded construction materials to withstand the high acidity. The Applicant does not plan on taking in high TAN concentration of crude oil, but has the ability to do so and shall comply with the requirements of the National Association of Corrosion Engineers MR0175. A majority of WCS is mixed or blended with a Condensate or synthetic crude oil to lower the TAN content, thus allowing more refineries to be able to process it.

4.3.2.3. Condensate

Very light crude oil is a mixture of light liquid hydrocarbons resulting in a high API gravity of 45 to 70. Condensate is an example of this very light crude oil and is typically separated out of a natural gas stream in the production phase. It is usually blended with heavier crude oils or sent directly through pipelines to market. The commercial value is typically lower than other crude oils due to high light end content, which is difficult to process. Composition and other physical property data of condensate are summarized in Table 4.3-1.

4.3.2.4. Summary of Physical "Crude Oil" Properties

Definitions of the common physical properties are defined below:

- Specific gravity (i.e., API)—the ratio of the density of a substance to the density of a standard (water for liquids). This determines if the crude oil would sink or float—a substance with a specific gravity lower than 1 will float in water.
- Viscosity—a quantity expressing the magnitude of internal friction or a measure of how easily the oil would flow. The viscosity of crude oil generally increases as the temperature decreases and decreases as temperature increases. As such, the crude oil in the pipeline has more difficulty flowing if it becomes freezing or cold in the winter and requires more pressure to be pumped through the pipeline.
- Pour Point—the temperature below which the liquid loses its flow characteristics. If crude oil has a high pour point, it will be associated with a high paraffin content, which is associated with a large proportion of plant material.
- Interfacial Tension—the force that holds the surface of a particular phase together (liquid/liquid or gas/liquid).
- Density—the degree of compactness of a substance or the amount of matter of an object relative to its volume.
- Mousse water content—maximum percent of water in oil emulsion. Emulsion is the dispersion of droplets of one liquid in another in which it is not soluble.

- Toxicity—the degree to which a chemical substance or a particular mixture of substances can damage an organism.
- Flammability—the ability of a chemical to ignite or burn, causing combustion or fire.

The physical characteristics of the three types of crude oil representing the range of crude oils that are expected to be exported via the SPOT DWP are specified in Table 4.3-2.

Table 4.3-2: SPOT DWP Three Crude Oil Physical Properties

Characteristic	Western Canadian Select	West Texas Intermediate	Condensate
Density (kg/m^3)	933.4	818.9	741.2
API gravity	20.1	41.3	59.4
Viscosity (cP @ 20°C)	2.63	0.79	0.66
Flammability	Division 2 Flammable liquid	Division 2 Flammable liquid	Division 2 Flammable liquid
Flash point (°C)	< -30	< -30	< -30
Toxicity	Class D, Division 2, Subdivision A: Very Toxic Material	Class D, Division 2, Subdivision A: Very Toxic Material	Class D, Division 2, Subdivision A: Very Toxic Material
Solubility in water	Insoluble	Insoluble	Insoluble
Pour point (°C)	-50	-33	-55
Sulfur (wt%)	3.67	0.407	0.06-0.19
Interfacial Tension (mN/m)	16.6	16.6	18.4
Mousse water content	70%	60%	NA

Source: Crude Quality Inc. 2019c, 2019d; Canadian Centre for Occupational Health and Safety 2019; Anton Paar GmbH 2019

°C = degrees Celsius; API = American Petroleum Institute; cP = isobaric specific heat; kg/m^3 = kilograms per cubic meter; mN/m = millinewton per meter; NA = not applicable; wt% = weight percent

4.3.3. Chemical Properties

Chemical properties for the three crude oils associated with the SPOT DWP are defined herein to identify the hazards and risks associated with the Project and include the molecular weight, vapor pressure, solubility, and the octanol-water partition coefficient of each compound, as well as the fraction in oil, which relates to the constituents (compounds) within the oil. These characteristics help in defining how the crude oils behave under varying process conditions. Table 4.3-3 defines the general compositions of the crude oils that are expected to be exported by the SPOT DWP.

Table 4.3-3: Compositions of Crude Oils Exported by SPOT DWP

Composition (mass %)	Western Canadian Select	West Texas Intermediate	Condensate
n-Butane	1.7	2.08	2.7
n-Pentane	3.49	3.32	18.4
Hexanes	2.61	3.82	22.4
C7-C12	5.03	20.68	56.5
C13-C30+	87.17	70	0

Source: Crude Quality Inc. 2019a

The chemical properties of the three crude oils are further broken down by their hydrocarbon pseudo-components to provide a more comprehensive view of the three crude oils. Table 4.3-4, Table 4.3-5, and Table 4.3-6 define the average WTI, WCS, and Condensate hydrocarbon pseudo-components, respectively.

Table 4.3-4: West Texas Intermediate Crude Oil Chemical Properties

Hydrocarbon Pseudo-Component	Fraction in Oil (g/g oil)	Molecular Weight (g/mol)	Vapor Pressure (atm, 25ºC)	Solubility (mg/L)	log (Kow) (Unitless)
BTEX substituted benzenes	0.0189	108	1.78E-02	275	3.24
2-ring PAHs	0.0090	144	8.46E-04	13	4.29
3-ring PAHs	0.0065	197	2.07E-06	1	5.25
Aliphatics: BP < 180	0.2985	99	9.73E-02	NA	3.46
Aliphatics: BP 180-280	0.1788	169	1.68E-03	NA	6.47
Aliphatics: BP 280-380	0.1814	262	7.22E-07	NA	9.91

Source: SPOT 2019a, Application, Volume IIa, Appendix L

ºC = degrees Celsius; atm = atmosphere; BP = boiling point; BTEX = benzene, toluene, ethylbenzene, and xylenes; g/g = gram per gram; g/mol = gram molecule; log = logarithm; Kow = Octanol-water partition coefficient; mg/L = milligram per liters; NA = not applicable; PAH = polycyclic aromatic hydrocarbon

Table 4.3-5: Western Canadian Select Crude Oil Chemical Properties

Hydrocarbon Pseudo-Component	Fraction in Oil (g/g oil)	Molecular Weight (g/mol)	Vapor Pressure (atm, 25ºC)	Solubility (mg/L)	log(Kow) (Unitless)
BTEX substituted benzenes	0.0134	109	2.16E-02	324	3.28
2-ring PAHs	0.0090	144	8.46E-04	13	4.29
3-ring PAHs	0.0065	197	2.07E-06	1	5.25
Aliphatics: BP < 180	0.1206	99	9.73E-02	NA	3.46
Aliphatics: BP 180-280	0.1200	169	1.68E-03	NA	6.47
Aliphatics: BP 280-380	0.1223	262	7.22E-07	NA	9.91

Source: SPOT 2019a, Application, Volume IIa, Appendix L

ºC = degrees Celsius; atm = atmosphere; BP = boiling point; BTEX = benzene, toluene, ethylbenzene, and xylenes; g/g = gram per gram; g/mol = gram molecule; log = logarithm; Kow = Octanol-water partition coefficient; mg/L = milligram per liters; NA = not applicable; PAH = polycyclic aromatic hydrocarbon

Table 4.3-6: Condensate Crude Oil Chemical Properties

Hydrocarbon Pseudo-Component	Fraction in Oil (g/g oil)	Molecular Weight (g/mol)	Vapor Pressure (atm, 25ºC)	Solubility (mg/L)	log(Kow) (Unitless)
BTEX substituted benzenes	0.072300	98	3.35E-02	487	2.88
2-ring PAHs	0.006745	140	9.07E-05	23	9.81
3-ring PAHs	0.002161	179	4.42E-06	2	5.10
Aliphatics: BP < 180	0.358499	99	9.73E-02	NA	3.46
Aliphatics: BP 180-280	0.253386	169	1.68E-03	NA	6.47
Aliphatics: BP 280-380	0.257970	262	7.22E-07	NA	9.91

Source: SPOT 2019a, Application, Volume IIa, Appendix L

ºC = degrees Celsius; atm = atmosphere; BP = boiling point; BTEX = benzene, toluene, ethylbenzene, and xylenes; g/g = gram per gram; g/mol = gram molecule; log = logarithm; Kow = Octanol-water partition coefficient; mg/L = milligram per liters; NA = not applicable; PAH = polycyclic aromatic hydrocarbon

Table 4.3-1 provides a comparison of the three crude oils that are expected to be exported by the SPOT DWP to other worldwide crude oils. The composition and physical properties of crude oil affect how the crude oil behaves inside the pipeline, and different types of crude oil have different hazards and risks, which are discussed in the following sections.

4.3.3.1. Flammability and Explosion Potential

Title 16 CFR § 1500.3 defines crude oil as flammable when it has a flash point lower than 100°F. Flash point is determined by the lowest boiling point components of the substance. Medium to heavy crude oils are not considered flammable if they have been exposed to a short weathering period, which causes the oils to lose the majority of their volatile components. Consequently, the flash point temperatures of conventional crude oils increase substantially after weathering, and flammability and explosion potential decrease due to weathering. However, an ignition can still occur if certain conditions of crude oil are met:

- Sufficient oxygen supply is present;
- Lower flammability limit of vapors produced from the crude oil has been reached; and
- Heat or an ignition source is present.

If an ignition source is not present in the enclosed pipeline, fires and explosions are not possible. If crude oil is released, it can ignite if the three conditions above are met. If the crude oil has undergone weathering, the flammability and potential to ignite would be reduced.

4.3.3.2. Acidity and Corrosivity Potential

Another risk associated with crude oil pipelines that could result in a release is pipeline corrosion. Naphthenic acids are compounds in crude oil, and cause corrosion at high temperatures. This is normally not a risk in crude oil pipelines due to the typically low operating temperatures. The parameter used to define the corrosion potential of a particular crude oil is the TAN. A majority of Canadian crude oils have high TAN levels, which cause corrosion, and require mixing or blending to allow refineries to process without retrofitting. TAN levels less than 1 milligram of potassium hydroxide per gram are considered safe or adequate for transport, and the Applicant would operate the pipelines at low temperatures, minimizing the potential for corrosion due to high TAN levels.

Hydrogen sulfide is a corrosive compound commonly found in crude oil that also affects pipeline corrosion. Sulfur compounds tend to form iron sulfides, which can threaten the integrity of the steel walls of the pipeline and cause corrosion over time. Sulfur levels in the crude oils being transported by the Applicant would need to be monitored to maintain the integrity of the pipeline.

4.4. Threats from a Crude Oil Spill

4.4.1. Pipeline and Component Integrity Threats

There are numerous threats that could cause a LOC or release throughout the Applicant's proposed pipelines. A threat is defined as a mechanism that could lead to a pipeline LOC or failure. Cause is defined as an action or lack of action that leads to a pipeline spill. Causes create the release, while threats create the potential for a LOC.

The component integrity threats for release, leak, and spill are defined as follows:

- Release is defined as a failure of pipeline integrity that causes the oil to escape.
- Leak is defined as crude oil escaping the pipeline over a period of time.

Spill is defined as the crude oil volume of a leak that enters the environment by not being contained in the pipeline system.

Component integrity and potential pipeline threats were related to API 1160 Managing System Integrity for Hazardous Liquid Pipelines (API 2001). Some threats to the Applicant's proposed pipelines are defined as:

- External corrosion (e.g., environmental factors such as heavy rains or winds reacting with the metal of the pipeline causing corrosion);
- Internal corrosion (e.g., crude oil components such as iron sulfide or H_2S reacting with the inside of the pipeline);
- Stress corrosion cracking (SCC) (e.g., abnormal temperature or pressure changes that can cause expansion or contraction of the epoxy coating on the pipelines);
- Fatigue, or structural degradation caused by fluctuations/strain/cyclic stress (cyclic stress is the distribution of forces that change over time in a repetitive fashion);
- Manufacturing (e.g., defects in the material properties, such as steel not having the correct composition to handle the pressure in the pipeline);
- Construction (e.g., defects when installing the pipeline, such as welds and flanges);
- Equipment (e.g., pumps, valves, or pig launchers causing unusual quick failures or wear and tear);
- Third-party damage (e.g., contractors or landowners striking the pipeline);
- Incorrect operations; and
- Natural forces (e.g., flooding or erosion from other forces that expose the pipelines).

ASME B31.8S was used to categorize the Applicant's proposed pipeline threats into three time-related categories:

- Time-dependent: Primary threats that can be addressed by ongoing and periodic assessments that include external corrosion, internal corrosion, and SCC.
- Stable: Threats activated by a change in operations or surrounding environment such as equipment, manufacturing, and construction defects.
- Time-independent: All other threats that are not covered by stable and time-dependent categories (i.e., third-party damage, incorrect operations, and natural forces and weather-related events).

Pipeline-related incidents are reported to PHMSA; Table 4.8-1 provides a summary of these incidents over the past 10 years.

4.4.1.1. Time-Dependent Threats

All types of corrosion and SCC are time-dependent threats. Corrosion is defined as the deterioration of a material by a chemical reaction with its environment. The environment also governs the rate at which corrosion of the metal occurs. Corrosion requires the presence of an oxidizing agent, which, in pipelines, is typically water present in the crude oil inside the pipe and soil moisture present outside the pipe (API 2001). The following methods can be used to control or mitigate the corrosion of crude oil pipelines:

- Controlling accumulation in the pipeline
- External epoxy or other coatings applied to the pipeline
- Chemicals that are used to treat corrosion
- Insulation and cathodic protection
- In-line inspection tools
- Proper material selection for the pipeline (e.g., carbon steel)

SPOT DWP is equipped with the following methods to control or mitigate the corrosion of the proposed crude oil pipelines:

- External coating protection (15 to 16 mm of fusion bonded epoxy and an additional 2 to 4 mm of fusion bonded epoxy "rough coat")
- Cathodic protection (in accordance with DNVGL RP F103)
- Sour service applicability (complies with requirements of National Association of Corrosion Engineers MR0175/ISO 15156)

Further details on the three time-dependent corrosion threats mentioned above (external corrosion, internal corrosion, and SCC) are discussed in further detail below.

External Corrosion

Pipeline walls and welds are susceptible to external corrosion through contact with moist soil and water. Microbial activity can also accelerate external corrosion (ASME 2010). The most common hole size due to external corrosion is a pinhead, or very small hole that has a low leak rate, which typically results in a long-duration spill. Some factors that affect external corrosion rates are:

- Exposure time: Exposure to corrosive conditions over a long length of time weakens the strength and integrity of the pipe. This loss of integrity can result in a failure of a weld and/or breach of a wall, which would result in a spill or leak.
- Coating: All new pipelines, including Project pipelines, are required to be coated with fusion-bonded epoxy that creates a barrier between the soil and the pipeline. This reduces the development of rust and decreases the corrosion potential.
- Cathodic protection: Cathodic protection negates the effect of corrosion by supplying an electrical current to the pipe where the external environment comes into contact with the pipeline. The Applicant would install cathodic protection for the onshore pipelines in five locations to prevent corrosion.
- Pitting: Pitting is due to a surface defect in the metal or a scratch in the coating. It causes the same water or moisture connection between the steel, thus resulting in corrosion and the formation of pinholes. Proper pipeline installation during construction can lower the chances of pitting.
- Stray currents: Electric lines and piping can distribute stray electrical currents that cause external corrosion. These electrical currents can cause rapid hole formation due to the high rate of corrosion under these circumstances.
- Microbial activity: Bacteria found in the soil and water can contribute to pipeline corrosion. Two types of bacteria (aerobic and anaerobic) cause corrosion, and both can be present in the same environment depending on climatic conditions. The bacteria can cause both internal and external corrosion; therefore, preventative measures may be needed to mitigate bacterial activity.

Internal Corrosion

Internal corrosion could occur in the SPOT Project components due to contaminants being transferred between components. These contaminants include oxygen, water, CO_2, and chlorides that can form acids. The SPOT Project would not continuously pump oil from the Oyster Creek Terminal to the platform because VLCCs or other crude oil carriers would not be present at all times. Therefore, the potential for internal corrosion would be greater because localized water and/or crude oil would remain in the pipeline for a period of time. The likelihood for internal corrosion to occur is higher with WCS than the other two crude oils evaluated due to its higher density/viscosity and because it normally carries sediment. To mitigate the potential damage from internal corrosion, a number of mitigation measures can be used. Key recommendations of mitigation measures for the proposed SPOT Project include:

- Maintaining the operating temperatures of the pipeline lower than 140°F;
- Reducing the number of elbows, drastic reductions in pipe diameter, and other areas that impede the flow;
- Testing the composition of WCS for TAN and sulfur content to confirm that the levels are below the levels at which corrosion would occur; and
- Continuously pumping or removing localized water/crude oil from areas where these materials tend to gather when no VLCC or other crude oil carrier is moored at the SPM buoy.

Stress Corrosion Cracking

The combined action of corrosion and applied stress produces material cracking or SCC. The crack expands, resulting in a LOC or breach of the pipeline, which in turn releases crude oil. Pipelines expand and contract when there are temperature and pressure fluctuations, which can cause stress cracks; however, based on review of the Applicant's design basis, the potential of these crack form in the SPOT Project components is low. If the operating temperature or pressure fluctuates outside the design range of the pipelines, SCC could occur. SCC progresses through the following four stages:

1. Initiation of SCC at the pipe surface
2. Pitting due to the coating detaching or rust developing
3. Continued growth and crack coalescences
4. Large crack coalescence and pipeline failure, resulting in a leak

To minimize the potential for SCC to occur, regular maintenance protocols and inspections should be conducted, as proposed by the Applicant.

Fatigue

Stresses or strains affect the internal pipe structure, causing fatigue over time. The stress or strain accumulates on structural discontinuities such as geometric notches, surface irregularities, defects, or metallurgical nonhomogeneities. Fatigue occurs in three sequential stages:

1. Initiation: the formation of the crack. This occurs at inclusions, pores, or soft-rained regions of the pipe.
2. Propagation: the stable incremental enlargement of the crack or pore in service.
3. Failure: rapid unstable fracture of the pipe, which results in the pipe's LOC.

These three stages arise from accumulated cycles of stress or repetitive loading conditions due to changes in pressure or to crude oil pipeline fluctuations from a VLCC or other crude oil carrier loading and the interruption of crude oil pipeline flow. A steady state or one time loading effect does not cause fatigue. Following PHMSA guidelines on pipeline integrity management would help reduce fatigue.

4.4.1.2. Stable Threats

Stable threats can be divided into three categories: manufacturing, construction, and equipment.

Manufacturing

This category comprises defects occurring in the manufacturing of the pipeline. Some common examples are lower steel grade than specified, imperfections in the steel, and deformed joints or parts. Anyone of these manufacturing defects can cause a decrease in mechanical strength resulting in a breach or LOC of the pipeline. PHMSA has identified manufacturing integrity issues that do not meet the requirements of API, Specification for Line Pipe-5L and specified pipe grade (74 Fed. Reg. 97 [May 21, 2009]). During the manufacturing process, the SPOT Project would take into account the manufacturing integrity issues involved with the pipeline and the specifications for the range of operating conditions.

Construction

Many threats to the pipeline can occur during construction. Some of the common threats include:

- Weld defect or fabrication error
- Pipe buckle, weld or bend
- Broken pipe, coupling failure, or stripped threads
- Dents that affect welds or pipe body integrity (ASME 2010)

Any of the listed threats can cause weakening in the integrity of the pipeline and a LOC event, resulting in a leak. To minimize the risks, PHMSA requires startup and commissioning quality inspection, including detection of construction defects.

Equipment

The potential for equipment to not meet its intended design, or accomplish its operational or functional purpose constitutes an equipment threat. All components that assist in monitoring and controlling the pipeline system are an equipment threat. Some of the root causes of these threats are failure in design, operation, or manufacturing (not traceable to the construction phase). Some common examples of threats to equipment are:

- Temperature/pressure sensor not working properly
- Pumps not operating at the specified pressure or output
- Blackouts, false alarms, or glitches in software for operation of the SPOT DWP occurring
- SPM buoy malfunctioning
- Pig launchers/receives malfunctioning or incorrectly cleaning the pipeline

The Applicant would be responsible for following maintenance procedures and ensuring that equipment is working according to design specifications.

4.4.1.3. Time-Independent Threats

Time-independent threats can be divided into three categories: third-party damage, incorrect operations, and other natural forces and weather-related threats.

Third-party Damage

There are three primary third-party damage threats:

- Unintentional damage inflicted by pipeline contractors, third parties, or operators;
- Intentional damage or sabotage including vandalism; and
- Damaged pipe, such as dents created during the manufacturing or construction phase that were not previously identified.

For example, a farmer or third-party contractor could accidently hit or excavate an onshore pipeline, which could result in a spill, and an operator error, such as incorrect filling of a VLCC or other crude oil carrier, could result in an offshore pipeline incident. The Applicant has stated they would use the Transportation Security Administration Pipeline Security Guidelines to decrease the chances of terrorism and sabotage.

Incorrect Operations

The pipelines would be equipped with automated features to minimize incorrect operations, but personnel still play a primary role in mooring the VLCCs or other crude oil carriers and operating the platform according to the OPSMAN. Examples of incorrect operations include not operating the valve properly while connecting a VLCC or other crude oil carrier, or while on the platform. Safety devices on the platform such as the HIPPS help prevent or mitigate transient pipeline hydraulic events. Frequent occurrence of transient pipeline hydraulic events may result in other equipment failures, and possibly even rupture, due to fatigue.

Other Natural Forces and Weather-Related Threats

Natural hazards can cause substantial damage to the pipeline system. Heavy rain, high winds, and floods all have the potential to affect the SPOT DWP pipeline. Long-term exposure of the aboveground facilities at the Oyster Creek Terminal and the offshore platform to these weather-related incidents would increase wear and tear, weathering, and cause corrosion on the equipment. Earthquake and hurricanes occur less often but the having the proper procedures and safety mechanisms in place, such as an operational spill response plan, can help mitigate impacts in case of a pipeline rupture or leak. Other natural or weather-related hazards include mudslides, lightning, fires, and extreme ambient conditions. The Applicant would have safety plans or risk mitigation measures for natural forces and/or weather-related incidents that could occur to the platform and onshore components included in the OPSMAN.

4.4.2. First-Party Oil Spill Risk Analysis

As part of its DWP license application, the Applicant commissioned an oil spill risk analysis from Risknology, Inc. for the proposed SPOT DWP in the GoM (SPOT 2019a, Application, Volume IIa, Appendix M). The framework and methodology for the risk analysis followed international best practice (IPIECA 2013; ARPEL 2017). The analysis developed risk profiles for oil spill frequency and spill size for all components of the proposed SPOT DWP Project.

Oil spill risk assessments are regularly conducted to support Federal permitting purposes. While the technical approaches vary to some degree, researchers generally strive to quantify or at least qualify the likelihood of a spill occurring given the presence of a hypothetical set of circumstances (e.g., development of a new oil facility or transport pattern); and, if that spill were to occur, what volume, and types and degrees of environmental, health and safety, and socioeconomic effects might be expected. In some cases, the assessments consider the potential efficacy of measures that may reduce the probability of spills (i.e., prevent spills) or their consequences (i.e., mitigate consequences by response). The Risknology, Inc. report (SPOT 2019a, Application, Volume IIa, Appendix M) presents oil spill probability, expressed as an annualized frequency, for all system components of the proposed SPOT Project. The frequency of oil spills of a given size were compiled into various spill risk profiles, which were used to produce dimensioning accident spill sizes. The dimensioning accident spill sizes are useful for comparing internally among system components and for comparing externally with other existing and proposed projects. In addition to the first-party risk analysis conducted by the Applicant, a third-party oil spill risk analysis was conducted under the direction of the USCG. The third-party assessment is discussed in Section 4.6, Third-Party Spill Risk Analysis.

4.4.2.1. Oil Spill Risks

Oil spill dimensions were developed for 100-year and 500-year return periods (RP). A 100-year RP event is an event that has a 1 percent probability of occurring in any given year. The frequency is expressed as 0.01/year. Similarly, the 500-year RP event is an event that has a 0.2 percent probability of occurring in any given year. The frequency is expressed as 0.002/year. For the proposed project, there is a 0.029/year to 0.006/year chance of a spill with an approximate size of 15,500 bbl or greater occurring. The frequency of 0.01 (i.e., a 100-year RP event) lies between the minimum and maximum probabilities of a spill of 15,550 bbl occurring. As such, the 100-year RP spill event was conservatively considered to be 15,500 bbl. The spill scenario that would cause a spill of that size is a Full-Bore Rupture from the Export Metering and Pumps section of the Oyster Creek Terminal.

The expected spill size at approximately the 0.002/year frequency (500-year RP) is 48,500 bbl or greater. These spill sizes (15,500 bbl and 48,500 bbl) were used as the dimensioning spills for the proposed Project. The data defined in 4.4.2.1 were derived from the Risknology, Inc. spill risk analysis (SPOT 2019a, Application, Volume IIa, Appendix M).

4.4.2.2. Onshore Oil Spill Risk

The onshore spill risk profile for the proposed SPOT Project was developed based on the locations from which leaks from specific equipment components dominate the risk. For the proposed Project, at very low spill sizes, the risk is dominated by small releases from storage tank piping. As potential spill size increases, the risk is dominated by contributions from piping, Oyster Creek Terminal equipment, and, at the largest spill size, catastrophic storage tank rupture.

The distribution of risks to individual component locations and causes indicated that only 150 mm and full-bore rupture breaches result in a 15,000 bbl spill size. The risk of this spill is evenly distributed among the pipeline segments, with the Oyster Creek Terminal being a greater contributor than any one of the segments.

4.4.2.3. Offshore Oil Spill Risks

The offshore spill risk profile for the proposed SPOT Project indicates that at very low spill sizes, the risk is dominated by small releases from the SPM buoys. As potential spill size increases, the risk is dominated by contributions from the SPOT DWP platform topsides, subsea pipelines, subsea flow lines, PLEMs, and, at the largest spill size, marine vessel collisions and strikes.

4.4.2.4. Vapor Dispersion and Flash Fire Hazard Distances

The USCG has developed extensive guidance for hazard evaluation of offshore liquefied natural gas (LNG) spills from both accidental and intentional threats (Sandia 2004). Although the guidance specifically addresses LNG, modeling capabilities for the physical processes of discharge, dispersion, and thermal radiation from fire are principally applicable to spills of any hydrocarbon liquid containing lighter components.

The USCG uses validated models to evaluate these hazards, such as computational fluid dynamics or an equivalent model. The Applicant may consult with Commandant (CG-5) to ensure that appropriate assessment procedures are used. These models are a part of the EIS process and are defined in the Risknology, Inc. report (SPOT 2019a, Application, Volume IIa, Appendix M).

The vapor dispersion zones from the dimensioning spills were determined using the Phast modeling suite, which is approved by the PHMSA. For the 100-year RP, the distance to the lower flammability limit (LFL) and to 12.5 kilowatts per square meter (kW/m^2) radiation flux were both 0.48 mile. For the 500-year RP, the distance to LFL and to 12.5 kW/m^2 radiation flux was 1.96 miles. A radiation flux of 12.5 kW/m^2 is significant because this is the threshold at which extreme pain to an individual can occur within 20 seconds. It is also the level at which a significant chance of fatality occurs for medium duration exposure (IOGP 2010). For the 100-year RP and 500-year RP, a release from the platform facility would represent the dimensioning spill quantity. Hence, the hazard zones are centered upon the platform and not the SPM buoys.

4.4.2.5. Onshore Condensate Spill

The onshore Condensate spill risk profile for the proposed SPOT Project identifies locations from which leaks from specific equipment components dominate the risk. At very low spill volumes, the risk is dominated by small releases from storage tank piping. As potential spill size increases, the risk is dominated by contributions from piping, Oyster Creek Terminal equipment, and, at the largest spill size, catastrophic storage tank rupture. The behavior of Condensate is similar to that of WTI and WCS. The primary difference is that the Condensate, having a lower density, creates larger release quantities for similar breach sizes.

4.4.2.6. Offshore Condensate Spill

The offshore spill risk profile for the proposed SPOT Project identifies regions in which leaks from specific equipment components dominate the risk. At very low spill sizes, the risk is dominated by small releases from the SPM buoys. As potential spill size increases, the risk is dominated by contributions from the SPOT DWP platform topsides, subsea pipelines, subsea flow lines, PLEMs, and, at the largest spill size, marine vessel collisions and strikes. The data provided below are from the Risknology, Inc. report (SPOT 2019a, Application, Volume IIa, Appendix M).

The dimensioning spill of 194,700 bbl of Condensate is best represented by a release from the subsea pipelines delivering Condensate to the proposed SPOT DWP. This release was modeled using the worst-case discharge (WCD) gas model (S.L. Ross et al. 2009). Phast software (DNVGL 2017) was used to simulate pool formation and spreading, vapor dispersion, and flash fire and pool fire radiation distances. For the 100-year RP, the distance to the LFL was 0.08 mile and the distance to the 12.5 kW/m^2 radiation flux from a pool fire was 0.16 mile, which is substantially less than the distances for the dimensioning oil spill. This is due to the absorption and dilution of the Condensate mass in the water column prior to reaching the surface where it could serve as the fuel for a fire. In addition, the lighter components of Condensate vaporize at the surface before they can ignite.

Based on the above analysis, it is recommended that the operational planning basis for the proposed SPOT DWP acknowledge a flammable hazard zone of 0.48 mile, derived from the 100-year dimensioning oil spill. This distance is based on dispersion modelling conducted using the DNV GL Phast 8.2.2 modeling tool.

4.4.3. First-Party Oil Spill Modeling

4.4.3.1. Offshore Oil Spill Modeling

Pursuant to the DWPA, as amended, and in accordance with the USCG's implementing regulations, the Applicant conducted oil spill modeling for unmitigated, hypothetical releases of three oil types (WTI, WCS, and Condensate) from the SPOT DWP platform in Galveston Area lease block 463 (SPOT 2019a, Volume III, Attachment 15) based on BOEM's Final EIS for Gulf of Mexico OCS Oil and Gas Lease Sales: 2012-2017 (BOEM 2012b). In the oil spill modeling report conducted by RPS (SPOT 2019a, Application, Volume IIa, Appendix L), the median size of large spills (defined as those equal or greater than 1,000 bbl) is identified as 2,240 bbl based on spill occurrences between 1996 and 2010. Based on this median size, BOEM estimated that the most likely size of a spill equal or greater than 1,000 bbl from a proposed action on the OCS would be 2,200 bbl. Therefore, the Applicant used a spill volume of 2,200 bbl for the modeled scenarios at the offshore platform.

Although the spill was modeled as an unmitigated release, the Applicant would be required to prepare a Facility Response Plan for the SPOT DWP as an annex to the OPSMAN, if a license is granted. The OPSMAN would be developed based on a WCD, as discussed in Section 4.6, Third-Party Crude Oil Spill Analysis, and would contain spill response, containment, and clean-up measures to address WCD scenarios. The USCG must approve this plan before operation could begin. The proposed DWP would also have a leak detection system incorporated in the design, which would reduce likely spill sizes, and, in the event of a spill, a spill response would be initiated immediately to mitigate the size of the spill. However, best practice by government agencies and regulatory bodies such as BOEM and BSEE is to model unmitigated spills for environmental risk analyses, such as NEPA assessments.

Three stochastic (randomly determined) scenarios were modeled assuming the spill location at the platform and three oil types. For all three oil types, the volume of oil released was assumed to be 2,200 bbl over 1 hour, and its fate and transport were modeled for 60 days. Once the stochastic scenarios were complete, the results were examined to determine which scenario resulted in the maximum amount of shoreline being oiled. The chosen simulation with a specific start date represents the worst-case meteorological and oceanographic (metocean) condition for oil contamination of the shoreline.

The 2,200 bbl unmitigated release of WCS crude oil had a predicted surface oil exposure footprint that was more extensive than that of the 2,200 bbl release of WTI. This is due both to the high viscosity of WCS (which inhibits its ability to entrain into the water column) and the high volatile content of WTI (which enables much of it to evaporate quickly). As such, WCS is a persistent oil; even highly weathered oil residuals and tar balls can be transported long distances on the water surface. The surface oil exposure footprint exceeding 50 percent (above the 0.1 g/m^2 threshold) is located primarily within 50 kilometers (31 miles) of the release location for the WCS scenario as compared to within 13 kilometers (8 miles) of the release location for the WTI scenario. In both cases, surface oil exceeding 0.1 g/m^2 is estimated to take between 1.3 to 2 days to reach the coast. For the unmitigated release of WTI, surface oil above this threshold is predicted to stay within U.S. waters off the coast of Texas. For the unmitigated release of WCS, surface oiling above the threshold could occur anywhere along the Texas coast shoreline and could reach beyond the U.S. EEZ boundary into Mexican waters.

For the 2,200 bbl unmitigated release of Condensate, the surface oil exposure footprint was predicted to be small in comparison to the WTI and the WCS spills due to the properties (i.e., low viscosity) of the Condensate and its tendency to evaporate quickly from the water surface. The surface oil exposure footprint above 1 percent (above the 0.1 g/m^2 threshold) is located within 50 kilometers (31 miles) of the release location. As such, surface oil was predicted to stay within the immediate vicinity of the spill location because of the rapid evaporation. There was also a low (less than 5 percent) probability of surface oil exceeding 0.1 g/m^2 reaching the shoreline within a minimum of 1.3 days.

For the individual simulations representing the 99th percentile ranked by degree of shoreline oiling, the trajectory of each spill is a product of the environmental conditions on the selected date of the spill as well as the weathering properties of the oil. For instance, for the WTI representative simulation, while oil was on the water surface, the floating oil was entrained into the water during windy periods and then some of it resurfaced when winds became light. On the other hand, for the WCS representative simulation, much of the oil surfaced immediately and remained on the water surface until it either evaporated, went ashore, or degraded. However, in both cases, at any point in time throughout the 60-day simulation, the maximum surface oil exposure concentration was between 5 and 10 g/m^2 (a thickness that appears as a metallic sheen) either within the immediate vicinity of the spill site for the WTI simulation or within 100 kilometers (62 miles) to the west of the spill site for the WCS simulation. Most of the shoreline contaminated by more than1 g/m^2 of oil for the crude oil simulations was gravel or sand beach or artificial shoreline. Twenty miles and 10 miles of wetland and mudflat edge were oiled during the WTI and WCS simulations, respectively.

For the simulation representing the worst-case oil exposure to the shoreline following a 1-hour release of 2,200 bbl of Condensate, oil disappeared from the water surface within 7 days after release. The maximum surface oil exposure concentration at any point in time through the 60-day simulation was between 1 and 3 g/m^2 (a thickness that appears as rainbow sheen) within the immediate vicinity of the spill location. Most of the oiled shoreline, which by the end of the 60-day simulation was 6.6 miles immediately to the west-northwest of the spill site, was gravel or cobble beach. No wetlands were affected by this scenario.

4.4.3.2. Onshore Oil Spill Modeling

To assess onshore impacts of the proposed pipeline Project, pursuant to the DWPA, as amended, and in accordance with MARAD's and the USCG's implementing regulations, oil spill modeling was conducted for unmitigated hypothetical releases of two types of crude oil (WTI and WCS) from the onshore portion of the pipeline. In addition, a companion report was compiled containing oil spill modeling conducted for releases into coastal tidal waters. The analyses were performed using RPS' model OILMAPLAND or land releases and SIMAP for oil releases into waterbodies.

The onshore spill scenarios were modeled as unmitigated releases to provide a conservative worst-case scenario in analyzing the environmental risks posed by the pipeline. The Applicant has proposed the use of a leak detection system, spill response plans, and industry-standard valve placement to minimize the potential for a spill to occur and minimize impacts if a release were to occur. As mentioned above, government agencies and regulatory bodies such as BOEM and BSEE encourage environmental risk analyses to be conducted using unmitigated spill models.

Hypothetical releases from the ECHO to Oyster Creek Pipeline and Oyster Creek to Shore Pipelines into coastal tidal waters and the GoM were simulated by the Applicant to determine the transport and fate of the discharged product. For both oil types, local meteorological and substrate data obtained from NOAA were used to determine the flow and dispersion characteristics of oil released into the environment. The hypothetical spills from an operating pipeline are assumed to be due to full-bore ruptures. The spill volume or the modeled scenarios varies depending on the rupture location; the volume was calculated at equally spaced points along the pipeline using pipe diameter, flow rate, valve location, leak detection and valve shutdown times, and land elevation profile along the pipeline (SPOT 2019a, Volume IIa, Appendix M; SPOT 2019ww).

The volume of liquid released was calculated in two parts. In the first phase, liquid flows were calculated from the point of rupture at the operating flow rate until the leak is detected (approximately 3 minutes) and action is taken to shut off the pumps (at which point the release rate would begin to taper off over the course of 1 minute) and isolate the ruptured section of piping via valve closures (approximately 1 minute). Valve closure time isolates sections of the pipeline quickly, minimizing the differences in release volumes between the two oil types to less than 1 bbl.

In the second phase, the product drains were calculated from the break under the force of gravity before valves are closed until the oil release comes to a full stop. Product drains vary based on the location and elevation of the rupture. Once the valves are closed, gravity flow is restricted to the liquid contained in the pipeline segment between closed valves that are hydraulically above the break point, both up- and down-stream from the break. During this phase, the oil types' physical properties play a larger role in the overall release volume calculation. Due to the high viscosity of WCS, a release of this oil would have more restricted flow relative to WTI.

The total spill volume is the sum of pressurized flow volume (2,479 bbl) plus the gravity drain down volume. Release volumes from the ECHO to Oyster Creek Pipeline range from 2,745 to 29,704 bbl for WCS and 2,745 to 29,810 bbl for WTI. Release volumes from the eastern Oyster Creek to Shore Pipeline range from 2,586 to 15,677 bbl for WCS and 2,586 to 15,890 bbl for WTI. The operating conditions (pressure, temperature, pumped flow rate) are the same for the two collocated pipelines; therefore, this would also apply to the western Oyster Creek to Shore Pipeline.

Release durations from the ECHO to Oyster Creek Pipeline range from 0.1 to 2.6 hours for WCS, and 0.1 to 2.1 hours for WTI. Release durations from the eastern Oyster Creek to Shore Pipeline range from 0.1 to 1.1 hours for WCS, and 0.1 to 0.9 hour for WTI. The operating conditions (pressure, temperature, pumped flow rate) are the same for the two collocated pipelines; therefore, this would also apply to the western Oyster Creek to Shore Pipeline.

Once the spill scenario and characteristics were defined, the fate of the oil was determined using simulation software such as OILMAPLAND and SIMAP. Hydrology data used for such modeling was derived from the publicly available USGS high resolution National Hydrography Dataset.

Onshore Land Release Modeling Results

Release plume simulations were performed for 620 locations along the ECHO to Oyster Creek Pipeline, and 142 locations along the Oyster Creek to Shore Pipelines for both the WCS and WTI products.

For the ECHO to Oyster Creek Pipeline, using the WCS product, 522 of these releases are expected to reach a watercourse before the end date of the simulation used for modeling purposes. Twenty-eight of these are predicted to reach the GIWW. The remaining 98 releases are predicted to terminate on land after the entire product is either pooled on the ground, adhered to the land cover, or evaporated into the air. At the end of all 620 release simulations, an average of 1,097.0 bbl are predicted to remain on the land, 842.2 bbl are predicted to evaporate, 5,045.2 bbl are predicted to adhere to the shores of streams or remain on the stream surface, 906.3 bbl are predicted to remain on the surface of a lake, and 37.8 bbl are predicted to reach open waters of the Galveston Bay system, i.e., Clear Lake and Lost Lake off of Christmas Bay.

For the ECHO to Oyster Creek Pipeline, using the WTI product, 525 releases are expected to reach a watercourse before the end date of the simulation used for modeling purposes. One hundred and fifty-one of these are predicted to reach the GIWW. The remaining 95 releases are predicted to terminate on land after the entire product is either pooled on the ground, adhered to the land cover, or evaporated into the air. At the end of all 620 release simulations, an average of 817.2 bbl are predicted to remain on the land, 2,976.5 bbl are predicted to evaporate, 2,259.3 bbl are predicted to adhere to the shores of streams or remain on the stream surface, 335.6 bbl are predicted to remain on the surface of a lake, and 352.4 bbl are predicted to reach open waters of the Galveston Bay system.

For the Oyster Creek to Shore Pipelines, using the WCS product, seven of these release locations were located directly in Oyster Creek, the GIWW, or Swan Lake and were thus excluded from further OILMAPLAND analysis (SPOT 2019d). For the remaining 135 locations, 101 of these releases are expected to reach a watercourse before the end date of the simulation used for modeling purposes. Thirty-six of these are predicted to reach Oyster Creek, 6 to reach the GIWW, and 6 to reach Swan Lake. The remaining 34 releases are predicted to terminate on land after the entire product is either pooled on the ground, adhered to the land cover, or evaporated to the air. At the end of 135 release simulations, an average of 3,811.6 bbl are predicted to remain on the land, 211.6 bbl are predicted to evaporate, 929.2 bbl are predicted to adhere to the shores of streams or remain on the stream surface, and 1,484.8 bbl are predicted to remain on the surface of a lake.

For the Oyster Creek to Shore Pipelines, using the WTI product, 130 releases are expected to reach a watercourse before the end date of the simulation used for modeling purposes. Forty-nine of these are predicted to reach Oyster Creek, 57 to reach the GIWW, and 6 to reach Swan Lake. The remaining five releases are predicted to terminate on land after the entire product is either pooled on the ground, adhered to the land cover, or evaporated to the air. At the end of 135 release simulations, an average of 1,062.4 bbl are predicted to remain on the land, 2,246.7 bbl are predicted to evaporate, 243.2 bbl are predicted to adhere to the shores of streams or remain on the stream surface, and 1,167.8 bbl are predicted to remain on the surface of a lake.

Coastal Tidal Waters Release Modeling Results

Oil spill fate and trajectory analyses were conducted for six stochastic scenarios modeled at three spill locations (the GIWW, Oyster Creek, and Swan Lake), using two oil types (WTI and WCS). For both oil types, the volume of oil released was assumed to be 2,200 bbl over one hour, and its fate and transport were modeled for 30 days. Once the stochastic scenarios were complete, the results were examined to determine the scenario in which the maximum amount of shoreline was oiled. The chosen simulation with a specific start date represents the worst-case metocean condition for oil contamination of the shoreline.

As reported in the previous modeling of offshore oil spills, the 2,200 bbl unmitigated release of WCS had a predicted surface oil exposure footprint that was more extensive than that for the release of the same volume of WTI. The surface oil exposure footprint exceeding 50 percent probability for the unmitigated release of WCS into the GIWW is primarily located within 6 miles of the release location, compared to 3 miles for the WTI scenario. Shoreline oiling is predicted to spread along the GoM coast mostly to the southwest of the FHC but staying within 24 miles for the WTI scenario, while the WCS scenario is predicted to see shoreline oiling outside of the GIWW into Drum Harbor and Christmas Harbor up to about 9 miles to the northeast and south through the FHC to the southwest.

For the unmitigated release of both WTI and WCS into Oyster Creek, the surface oil exposure footprint exceeding 50 percent probability is located within 1.2 miles of the release. The shoreline oiling footprint above 1 g/m^2 is mostly confined to Oyster Creek for WTI, while for WCS it extends mostly downstream into Oyster Creek, along the GIWW, outside of the GIWW into Drum Harbor and Christmas Harbor up to about 9 miles to the northeast, and out through the FHC to the southwest.

For the unmitigated release of both WTI and WCS into Swan Lake, the surface oil exposure footprint exceeding 50 percent probability is located within 1.2 miles of the release location. The WTI is predicted to stay mostly within intracoastal waters with less than 10 percent of simulated scenarios entering the GoM. For WCS simulations, surface oil exposure footprint above 1 percent probability is predicted to extend 9 miles from the release site and is transported along the GIWW in the northeast direction and to the southwest through the FHC, traveling up to 7.5 miles offshore. There is low potential for shore oiling along the GoM coast for both oil types and oiling is predicted to stay in intracoastal waters.

Individual simulations representing the 99th percentile ranked by shoreline oiling were identified for the unmitigated release of both WTI and WCS into the three spill areas. These results represent the worst credible discharge that is dependent on the transient conditions of the surface water. For both oils, much of the spill either evaporates or washes ashore within the first day of release. In the spill scenarios for WTI, the majority of the oil evaporates before reaching a shoreline due to its high volatility. WCS, however, shows a tendency to surface quickly and linger until it reaches a shoreline rather than evaporate. The main concentrations of concern in the simulation are over 100 g/m^2 of oil, which would appear as the dark true color of the oil, and less than 1 g/m^2 of oil, which would appear as a light sheen (NOAA 2016; Bonn 2009, 2011). These concentrations of concerns are associated with a characteristic observable difference and not an observed biota effect.

The worst-case scenario for WTI released into the GIWW had a maximum surface oil exposure concentration of over 100g/m^2 along the GIWW that extended out into the GoM for a few miles. At the end of this 30-day simulation, 19.5 miles of shoreline were contaminated by more than 1 g/m^2 of oil, most of which was artificial/manmade shoreline or sand beach.

The worst-case scenario for WTI released into Oyster Creek had a maximum surface oil exposure concentration of over 100g/m^2 located within 1 mile of the release site, and did not spread into the GoM. At the end of this 30-day simulation, 7.6 miles of shoreline was contaminated by more than 1 g/m^2 of oil.

Most of this oiled shoreline was artificial/manmade shoreline, with the majority being within the nearby marina rather than the Oyster Creek shoreline.

The worst-case scenario for WTI released into Swan Lake had a maximum surface oil exposure concentration of over 100g/m^2 located in the northeast corner of Swan Lake near the spill site and along the GIWW and just past the FHC into the GoM. Lower concentrations were predicted to be transported to the northeast along the GIWW into Drum Bay. At the end of this 30-day simulation, 11.7 miles of shoreline was contaminated by more than 1 g/m^2 of oil, which consisted of artificial/ manmade shoreline, mudflats, rocky shore, and wetland.

The worst-case scenario for WCS released into the GIWW had maximum surface oil concentrations greater than 100 g/m^2 located along the GIWW, which traveled out into the GoM for up to 2.5 miles offshore and 5 miles along the shoreline. At the end of the 30-day simulation, 18 miles of artificial/manmade shoreline or sandy beach was found to be contaminated by more than 1 g/m^2 of oil.

The worst-case scenario for WCS released into Oyster Creek had a maximum surface oil exposure concentration greater than 100g/m^2 located within 1.2 mile of the release site, and was not found to spread into the GoM. By then end of the 30-day simulation, 7.6 miles of shoreline consisting of artificial/ manmade shoreline in and around the marina near the spill site was contaminated by more than 1 g/m^2 of oil, with the majority of contaminated shoreline being within the marina itself.

The worst-case scenario for WCS released into Swan Lake had a maximum surface oil exposure concentration greater than 100g/m^2 located in the northeast half of Swan Lake near the release site and along the GIWW about 4 miles to the southwest. By the end of the 30-day simulation, 6 miles of shoreline was contaminated by more than1 g/m^2 of oil, most of which consisted of artificial/manmade shoreline and gravel beach.

4.5. EVALUATION OF PUBLIC SAFETY

For the purposes of this section, the public is defined as non-Project-related people. The Applicant is required to address the safety of Project personnel by complying with the regulations of the DWPA and other applicable laws and regulations. The DWPA regulations require Project personnel to be educated on the hazards involved in the proposed Project’s operation, trained in proper emergency and evacuation procedures, outfitted with appropriate personal protective equipment, and to comply with other contingency plans and safety measures. Many of the detailed contingency plans and safety protocols have not been developed at this phase of the DWPA licensing process. Such details are required to be included in the Applicant’s OPSMAN, which must be approved by the USCG prior to commencement of DWP operation. Therefore, this section considers hazard scenarios based on their potential to affect the public.

4.5.1. Safety Review Criteria

An accidental or intentional release of the DWP crude oils ranging from ultralight crude to heavy crude has the potential to impact the safety of the public. The release of crude oils would generate a pool of unignited oil, a flammable vapor dispersion cloud, and if ignited, a pool fire.

4.5.1.1. *Credible Range of Release Scenarios*

The extent of fire and vapor dispersion is based on varying breach sizes and the number of tanks affected, as well as pipeline and other releases from intentional and accidental scenarios, and site-specific meteorology data. Meteorology data for the offshore component was gathered from NOAA. A spill consequence analysis (SPOT 2019a, Application, Volume IIa, Appendix M) was performed to accurately predict the hazards associated from the various breach sizes onshore and offshore.

Onshore Scenarios

A release of crude oil along the onshore pipeline could have substantial impact on high consequence areas (HCA) and the environment. Section 4.6.4, Summary of the Oil Spill Findings, details the potential onshore impacts and the relative range of release scenarios. The detailed potential HCA and environmental impacts can be found in Section 4.9.

Offshore Scenarios

The range of release scenarios for offshore portions of the pipeline includes a pipeline rupture due to an anchor drag, platform riser rupture, and VLCC leak. Section 4.6.3, Potential Impacts from Oil Spills Onshore and Offshore details release scenarios and the potential risks associated with them.

4.5.2. Site-Specific Input Data

Site-specific input data were used to complete the risk analysis associated with the Applicant's DWP. The risk analysis incorporates design information, size of storage tanks, VLCC, passing/visiting vessel, operations, and metocean data. The ECHO to Oyster Creek Pipeline is approximately 50.1 miles long. The Oyster Creek to Shore Pipelines consists of 12.2 miles of piping for each of the two collocated pipelines. Additionally, various metering equipment, valves, and storage tanks onshore are taken into account. The offshore portion of the SPOT Project consists of the shore crossing subsea pipeline, loading pipeline, and hoses that connect to VLCCs or other crude oil carriers. Further equipment is also used to connect these components of the offshore platform, and is identified and evaluated in the risk analysis. The shoreline crossing point in Brazoria County, Texas would consist of approximately 46.9 miles of subsea pipeline, to deliver crude oil to the DWP platform. The platform consists of another approximately 3.3 miles of loading pipeline with an additional 1,000 feet of hoses to transport the oil to the VLCCs or other crude oil carriers.

4.5.3. Direct Impact on Public Safety and Property

The purpose of the public safety evaluation is to review the proposed Project's potential safety and security impacts on the public and property from the proposed Port facilities. The crude oil spill consequences analysis considers potential direct impacts on humans and property from a potential WCD of crude oil from the proposed Project facilities. Indirect impacts on the public and property (e.g., economic impacts resulting from a crude oil release) are not considered in the public safety evaluation because there is a high level of uncertainty associated indirect impacts from an oil spill, such as economic impacts, real estate price impacts, long-term health impacts, opportunity costs, and business hindrance.

4.5.4. Bounding Case (Worst Credible Impact)

There are two worst credible impact (WCI) spill scenarios involving SPOT DWP pipelines. The onshore pipeline WCI would be due to one pipeline rupture along the pipeline route. It would involve a full-bore rupture and a total spill volume of 82,208 bbl. This could be caused by intentional sabotage or another similar pipeline impact scenario. This onshore WCI scenario would have the greatest impact in the HCAs because of the overall impact on marine life, wildlife, and/or people. More information on the onshore portion of the WCI can be found in Section 4.6.4, Summary of Oil Spill Findings. The offshore WCI scenario would be caused by a subsea pipeline release. The full-bore subsea pipeline WCI from an accidental or intentional anchor drop and drag scenario over the pipeline from a VLCC or any other crude oil carrier or public vessel, though low likelihood, could result in a spill volume of 687,272 bbl of crude oil. The crude oil could reach the shoreline of Galveston County and any neighboring county, affecting the shoreline environment. Section 4.6.3, Potential Impacts from Oil Spills Onshore and Offshore, discusses the other worst-case scenarios involving the offshore components of the SPOT Project.

4.5.5. Deepwater Crude Oil Ports

The SPOT DWP could transport crude oil, import and export oil, and fully load VLCCs or other crude oil carriers. Pipelines would be constructed from the shoreline of Brazoria County, Texas to the SPOT DWP and would cross HCAs. If a spill occurred, it could be due to manufacturing or installation defects, mechanical or structural damage from external forces, or vessel-induced damage (e.g., anchor drags). Twenty-six percent of large spills come from vessel-induced damage such as anchor drags in offshore pipelines (BSEE 2016). There are no recorded incidents of impacts on public safety and property from DWP facilities. From 1974 to 2013, there have been a total of 61 U.S. crude tanker spills (BSEE 2016). For land-based crude oil facilities, there have been seven documented incidents with one or more fatalities (worker and/or public) directly associated with operations (PHMSA 2010): (1) Clearwater, Minnesota, November 2007; (2) Saint James, Louisiana, March 2009; (3) White, Arkansas, May 2009; (4) Freestone, Texas, February 2013; (5) Gregg, Texas, August 2013; (6) Brazoria, Texas, September 2013; and (7) Jefferson, Texas, August 2016. All seven incidents were related to crude oil facility operations.

4.5.6. Very Large and Other Crude Oil Carriers

The SPOT DWP is designed to receive carriers from the worldwide fleet of available VLCCs and other crude oil carriers (Suezmax and Aframax). VLCCs are the second largest operating cargo vessels in the world with capacities of over 250,000 deadweight tons. Crude oil carriers are an integral part of the GoM economy and transportation system. The SPOT DWP would have the capability of loading VLCCs and other crude oil carriers at a rate of 85,000 bph, 2 million bpd, 365 days a year. Table 4.5-1 defines the three visiting vessels' general characteristics.

Table 4.5-1: Visiting SPOT DWP Crude Oil Carrier General Characteristics

Characteristic	Unit	Aframax	Suezmax	VLCC
Draft (Maximum Load)	ft	49	66	71
Overall Length	ft	820	900	1,092
Deadweight	U.S. ton	132,277	242,508	352,740
Beam	ft	105	164	197

Source: SPOT 2019a, Application, Volume IIa, Section 1; EIA 2014; Maritime Connection Connector 2019.

DWP = deepwater port; ft = foot; SPOT = Sea Port Oil Terminal; VLCC = very large crude carrier

All visiting vessels need to meet accepted industry norms for safety, environmental protection, and operating conditions. A substantial number of oil tankers operate worldwide. In 2018, oil tankers took up 15 percent of the world merchant fleet with vessels up to 4 years old (UNCTAD 2019). This is substantial given the impacts on vessel traffic and associated hazards. Oil tankers make up a total of 29.2 percent of the world's total deadweight tonnage (TDWT) (UNCTAD 2019). TDWT represents the total deadweight tonnage that all commercial vessels worldwide can collectively hold. Oil tankers hold 560 million deadweight tons of the 1.92 billion TDWT. The average vessel age is 10.1 years old with ships built in the last 10 years being on average seven times larger than the ones that were built two decades or more ago (UNCTAD 2019). Even with the deadweight tonnage increasing, incidents involving crude oil spills from tankers have been declining substantially since 1992. The highest cause of crude oil tanker spills is allision/collision, with 36 percent of the total number of spills from 1992 to 2011 resulting from such incidents (ITOPF 2019).

4.5.7. Port Security

Under the CGMTA of 2002 and International Ship and Port Facility Security (ISPS) regulations, shipping companies, vessels, and facilities are required to have a security office and a comprehensive security plan to conduct their operations. If approved, the Applicant would be required, as part of the OPSMAN, to submit a Deepwater Port Security Plan (DWPSP) (33 CFR § 150.15(x)), which would have to be approved by the USCG in accordance with Federal regulations. The DWPSP would need to be approved 60 days prior to operating the facility. The purpose of the DWPSP is to provide the Applicant's personnel who have security response responsibilities with a systematic approach to securing the DWP, and protect personnel working at the proposed Project from human threats such as theft, vandalism, or terrorism. The DWPSP would be included as an integrated component of the OPSMAN.

In December 2002, at the urging of the USCG, the United Nation's IMO Maritime Safety Committee developed amendments to the 1974 International Convention for Safety of Life at Sea to enhance maritime security. The new ISPS Code was also adopted to provide a standardized, consistent framework for evaluating risk, enabling governments to offset changes in threat with changes in vulnerability for ship and port facilities. The International Convention for Safety of Life at Sea amendments and the ISPS Code both came into effect on July 1, 2004.

On a national front, the U.S. Congress enacted the CGMTA in November 2002, which was designed to protect U.S. ports and waterways from terrorist attacks by requiring area maritime security committees and security plans for facilities and vessels that might be involved in a transportation security incident.

Accordingly, the USCG developed maritime security rules (33 CFR Chapter 1, Subchapter H Maritime Security) that require owners and operators of certain facilities in U.S. ports, and certain vessels operating in U.S. waters, to conduct a Facility/Vessel Security Assessment, name a Facility/Vessel Security Officer, and develop and implement a Facility/Vessel Security Plan. If a license is issued, a DWPSP consistent with 33 CFR § 150.15(x) would be drafted and implemented by the Applicant, and reviewed by the USCG. The validity of the ISPS plans for the VLCCs and other crude oil carriers would be verified by the Applicant and the USCG.

In addition to the general risk prevention and minimization strategies discussed below, detailed prevention and mitigation strategies for both accidental and intentional release scenarios would be incorporated into both the Security Plan and the operational spill response plan, in compliance with OPA 90, which would be included as annexes to the OPSMAN. Process design and operational reviews and approvals would also increase safety by further preventing or minimizing potential risks. Although ongoing, much of this activity would be completed in the post-licensing phase of the Project.

The safe and secure operation of any DWP is a result of the layered implementation of numerous risk mitigation measures. The mitigation measures identified during the risk assessments are incorporated into the OPSMAN. In accordance with 33 CFR Part 150, the proposed DWP cannot operate without prior USCG approval of the OPSMAN. The OPSMAN must provide detailed specifications and procedures for all aspects of DWP operation to include prevention and mitigation strategies for both accidental and intentional spill release scenarios. Furthermore, the final sizes, locations, and designation of proposed safety zones require both a regulatory amendment and official notification to the IMO in accordance with 33 CFR § 150.915.

In accordance with 33 CFR § 148.105(x), the Applicant submitted a draft OPSMAN as part of their DWP license application and the USCG is satisfied that it meets the regulatory requirements of 33 CFR Subchapter NN. The USCG issues final approval of a DWP Operations Manual only after supporting federal and state agencies provide substantive input in ensuring the OPSMAN addresses the requirements for safe operation in accordance with (1) all Federal regulatory requirements; and (2) the conditions of the DWP license issued by MARAD.

Safety and security criteria for vessel and port operations were used in evaluating the proposed SPOT DWP's location, and these criteria would be critical components of the DWP's design and operating procedures. The offshore location for the proposed DWP must minimize potential safety risks (e.g., extensive vessel traffic), while simultaneously allowing for adequate security (e.g., relatively easy access for emergency responders). The specific latitude and longitude of the DWP would need to be verified by USCG for the purpose of establishing vessel transit routes.

Federal regulations require all bulk-carrying vessels to provide a 96-hour advanced notice of arrival to the USCG prior to entering any U.S. port. Information about the vessel and its voyage, including its port of origin, cargo on board, crewmembers, passengers, status of essential equipment, and special security information, must be provided with the notice of arrival. All persons would be screened by the National Vessel Movement Center prior to the vessel's entry. Complete details concerning the USCG's notice of arrival requirements can be found in 33 CFR Part 160.

The USCG may routinely complete facility inspections, shipboard safety and security examinations, vessel escorts, and cargo monitors while a vessel is in U.S. waters or at a U.S. port. A detailed Emergency Response Plan would be part of the OPSMAN and DWPSP, which would require the approval of the USCG before operation could begin.

The DWPSP and vessel security plans would address security issues, including, but not limited to, access control for people, goods, and materials; monitoring and alerting vessels that approach or enter the proposed SPOT DWP safety zone and ATBAs/NAAs; identifying risks and measures to deter terrorist activity; internal and external notification requirements and response in the event of a perceived threat or attack on the proposed Project; designating a Port Security Officer; providing identification means for personnel; security training requirements; actions and procedures that are scalable to the threat; emergency procedures, such as evacuation; special operations procedures; and recordkeeping for periodic training, drills, and exercises. Additional requirements for the security plans include, but are not limited to, radar monitoring of the safety zone and any non-enforceable, self-monitored zones that the Applicant may incorporate into the DWPSP for situational awareness of vessel traffic in the general vicinity, maritime security levels, ship security plans, ship security alarm systems, AIS, and declarations of security between the proposed SPOT DWP facilities and visiting vessels.

The USCG has a number of measures available to enforce security requirements and otherwise enhance security for vessels subject to U.S. Port State jurisdiction and port facilities in the United States. These measures include conducting random and targeted patrols and vessel boarding; reviewing information contained in vessel arrival notification; conducting escorts and targeted boarding of vessels identified as high risk; conducting background intelligence checks; reviewing, approving, and exercising vessel and facility security plans; and other appropriate actions designed to improve maritime security.

The Applicant would work with local USCG units to ensure the proposed SPOT DWP meets the requirements of the USCG Maritime Security and Response Operations Manual and that the SPOT DWP security procedures are integrated and coordinated with the local USCG units.

4.6. THIRD-PARTY CRUDE OIL SPILL ANALYSIS

As stated above, the USCG independently conducted a crude oil spill modeling and risk assessment to support the SPOT DWP license application process.

The tables and figures that present the predicted hazardous distances/zones around the DWP release sources (i.e., VLCCs, risers, and subsea pipelines) in this section represent the maximum distance scenario in all metocean conditions.

The consequence modeling included potential crude oil and diesel spills. The SPOT DWP would handle other chemicals that, if spilled, could pollute the GoM (e.g., lube oil and engine coolant). However, the volume of these chemicals would be low, and the impact on the natural and human environment would be considered low risk relative to the other Project components. Therefore, these chemicals were excluded from the consequence modeling. The volumes of particular materials that would be stored on the platform can be found in Table 2.2-5. The consequence modeling assumed the following key inputs.

For crude oil loading:

- Crude types: WCS, WTI, Condensate

- Crude loading capacity: 85,000 bph for two VLCC loadings
- Isolation and shutdown time: 0.5 hour[2]

For subsea pipelines from shore to the SPOT platform:

- Pipeline length: 46.9 miles
- Pipeline diameter: 36 inches
- Number of pipelines: 2
- Operating pressure and temperature: 300 psi, 80 °F

For oil tanker loading/unloading:

- Oil tanker: VLCC similar to Arcturus Voyager
- Largest cargo tank volume: 8.6 million gallons
- Maximum loading hose diameter: 24 inches
- Loading hose length: 780 feet

4.6.1. Purpose and Objectives

The purpose of the SPOT Project crude oil spill consequence analysis prepared by the USCG was to model and evaluate the potential impact of oil spill incidents on the marine ecosystem. A series of large-scale, credible oil spill scenarios were modeled, which include accidental and intentional VLCC cargo tank breaches, riser rupture due to supply vessels colliding on the platform, and subsea pipeline rupture caused by dropped or dragged anchor.

4.6.2. Technical Approach

The USCG used the following methodology to conduct the analysis:

- Project Description: The USCG gathered and reviewed site-specific information about the SPOT Project, which including location of the Project, offshore infrastructure, crude oil types, process design basis, heat and material balance, metocean data, and basic attending VLCC characteristics.
- Hazard Identification (HAZID): The USCG identified major hazards from the SPOT DWP through a HAZID workshop on October 15, 2019 with the USCG, other agencies and stakeholders, and the Applicant. A VLCC cargo tank breach from an accidental or intentional impact, dual 36-inch crude oil export pipeline rupture from dropped or dragged anchor, and riser rupture caused by supply vessel collision with the platform were identified as the worst credible scenarios and have been evaluated in this analysis. Additional information about the HAZID can be found in Appendix H, Spill Risk Analysis.
- Scenarios Development: The USCG developed an overview of the scenarios included in the consequence analysis, with a focus on large-scale oil spills based on the output from the HAZID workshop and the guidelines published by Sandia (Sandia 2004, 2008). Assumptions were made for the consequence modeling of each identified large-scale spill scenario (Appendix H, Spill Risk Analysis).

[2] This reasonable estimate was made by the USCG and confirmed by the Applicant, which would allow the Applicant to detect a drop in pressure, shut down the affected pipeline, and shut in the affected isolatable section.

- Modeling and Presenting Results: The USCG predicted pool fire hazard zones from the ignited large-scale oil spill cases, and simulated spread and migration of the oil slick that would occur following a worst credible discharge scenario.
- Impact Thresholds: 5 kW/m^2 – maximum thermal intensity in areas where emergency actions lasting 2 minutes to 3 minutes can be required by personnel with appropriate clothing (API 521, 2014). It is commonly used to establish the fire safety zone (restricted access within this area) for personnel in open areas; 12.5 kW/m2 – extreme pain within 20 seconds, significant chance of fatality for medium duration exposure (IOGP 2010); 37.5 kW/m2 – cause immediate fatality and damage to process equipment (Mannan 2012).

4.6.3. Potential Impacts from Oil Spills Onshore and Offshore

The USCG report evaluated the consequences of the worst-case oil spill scenarios caused by accidental events (ship-to-ship collisions, collisions between supply vessel and the platform, pipeline rupture due to dropped or dragged anchor) and intentional threats. The proposed dual 36-inch crude oil export pipelines would be located within 0.5 mile of the nearshore public anchorage zone. The U.S. OCS pipeline large spills data for the years 1964 to 2015 (BOEM 2016d) indicate that the majority of these pipeline failures (approximately 50 percent of all the spill incidents) were caused completely or partially by anchor damage. However, impacts to pipelines from anchors are low-frequency events, when considering the total underwater pipeline mileage and volume of oil production. The spill rate for releases resulting in less than 1,000 bbl released is 0.89 spill per billion barrels produced, while the spill rate for larger releases is 0.17 spill per billion barrels released over 40 years of data (BOEM 2016d). While the overall frequency of impact from anchors is low, the Project pipelines routed near the anchorage zone would be exposed to a slightly higher likelihood of impact from a dropped or dragged anchor.

The subsea pipelines would avoid shipping fairways, with the exception of the two fairway crossings (see Section 3.11.4.2, Marine Navigation and Planned Improvements Impacts and Mitigation). Any ships anchored within the anchorage areas adjacent to the fairways would likely be pushed by the Gulf current away from the subsea pipelines. The pipelines would also be buried up to 10 feet below the ocean floor at the fairway crossings, which would protect them from external impact.

Vessels maneuvering near offshore crude oil transfer areas near the offshore platform would be directed away from the pipelines to avoid crossing over the pipelines, which would reduce the potential for pipeline damage. The Applicant has also proposed the following mitigation strategies related to vessel navigation:

- A vessel traffic controller
- A collision/allision avoidance system
- Designated safety zones, ATBAs, and NAAs around the SPOT DWP and SPM buoys
- A radar surveillance system
- Navigational aids
- Safety fairways designated for vessel movement
- Navigational practices established by the International Regulations for Preventing Collisions at Sea 1972 (72 COLREGS)
- AIS and Electronic Protection Zones

The proposed safeguards and mitigation strategies would be implemented for the subsea pipelines. Considering the safeguards and navigation controls that would be implemented, as well as the low frequency of general anchor impact events, a spill resulting from an anchor impacting one or both of the pipelines is expected to be very low probability.

Ship collision incidents in which a VLCC cargo tank is damaged and leaks oil is another main cause of large oil spills. Sandia has conducted a sophisticated finite element modeling of collisions of a series of ships with a double-hulled oil tanker and provided estimates of the level of damage and hole sizes expected for different accident scenarios (Sandia 2004). Though the Sandia analysis (Sandia 2004) analyzed vessel collision with an LNG tanker vessel, which is constructed differently than a VLCC, there were no available analyses for vessels colliding with a VLCC. However, the size of the breach due to vessel collisions is expected to be similar for an LNG tanker vessel and a VLCC. Therefore, the Sandia reports were used to determine VLCC breach size due to vessel collisions. The Sandia reports also report the potential consequences associated with LNG spills. However, LNG consequence was not used as a stand-in for the oil spill consequence. Oil spill consequence modeling was performed based on the chemical properties of the crude oil that would be exported through the SPOT DWP.

Sandia also analyzed cargo tank breaches due to a range of possible intentional threats, including sabotage, insider threats, and external attacks. Documented attacks against ships include hijackings, attacks with small missiles and rockets, and attacks with bulk explosives (IMO 2020). There have been 83 documented attacks from January through April 2020, with most attacks located off the coast of Africa and Asia. The 2019 IMO annual report shows 193 total worldwide piracy incidents, and the 2018 IMO annual report shows 223 total worldwide piracy incidents (IMO 2020). Recent GoM attacks for 2019 have been off the coast of Mexico and involved transporting petroleum for Pemex (Business Insider 2019). The relevant piracy attacks in the GoM have not had any cargo tank breaches, and were related to stolen inventories or robberies. In addition, any attacks off the coast of Mexico would not likely elevate to a serious nature, as the Applicant would implement its facility response plan, which would be part of the OPSMAN.

Spilled oil can coat everything it touches, such as birds, fish, marine mammals, beaches, coastal marshes, and marshlands, thus resulting in immediate and a long-term (up to several decades) damage to the marine ecosystem. The oil spill consequence analysis performed by the USCG simulated the oil spread over the ocean surface under the influence of hydro meteorological conditions (e.g., waves, winds, currents, solar radiation, etc.) and predicted the oil slick's migration path. The oil slick migration was obtained from the computational simulation.

In the event of an oil spill reaching an ignition source, the thermal radiation generated from a pool fire would have immediate impacts on the nearby offshore infrastructure and any marine species in the vicinity. The thermal hazard zones were presented as graphical overlays on the nautical charts using the maximum heat hazardous distance calculated from a pool fire modeling for the proposed Project location.

All of the potential impact zones presented in this section represent conservative estimates from the credible large-scale spill scenarios. They do not account for any control or safety measures that could be implemented to reduce the likelihood of such an event or to mitigate its consequences. Such control or safety measures have been proposed and evaluated during the HAZID workshop in a coordinated effort with the Applicant, and in consultation with the USCG. For marine safety reasons, this information will not be made public.

4.6.3.1. Worst-Case Discharge for Onshore Project Components

The SPOT Project would construct new onshore pipelines from the existing ECHO Terminal to the proposed Oyster Creek Terminal, on the Gulf Coast. One 50.1-mile, 36-inch crude oil line would connect the existing ECHO Terminal and proposed Oyster Creek Terminal, and two collocated 12.2-mile, 36-inch crude oil pipelines would run from the proposed Oyster Creek Terminal to the shore (see Figure 4.6-1). The design capacity of the ECHO to Oyster Creek Pipeline is 42,500 bph with a maximum of 63,025 bph with drag reducing agent. The two collocated Oyster Creek to Shore Pipelines each have a design capacity of 42,500 bph, for a combined total capacity of 85,000 bph. The SPOT DWP would be capable of loading 85,000 bph onto VLCCs or other crude oil carriers through the onshore and offshore pipelines.

In accordance with the definition in 49 CFR § 194.105(b), the WCD from the onshore components was defined and calculated by taking the following into consideration:

- Rupture of one of the 36-inch onshore crude pipelines leading to an on-land 82,208 bbl spill;
- Maximum time to isolation (assumed to be 0.5 hour): pipeline's maximum release time and maximum shutdown response time;
- Maximum flow rate: 42,500 bph based on the pipeline's design capacity;
- Largest line drainage volume after shutdown: 60,958 bbl for the Oyster Creek to Shore Pipelines between MLV500 to MLV600, as shown on Figure 4.6-2;
- Total discharge volume of 82,208 bbl considering the above facts and from calculations based on 49 CFR § 194.105 (b)(1); and
- Total discharge volume of 600,000 bbl, which is identified from the working storage capacity of a single largest tank at the Oyster Creek Terminal, from calculations based on 49 CFR § 194.105 (b)(3).

Based on 49 CFR § 194.105 the WCD (the largest discharge volume) for the Project onshore components is 600,000 bbl, which is the capacity of a single tank within a single secondary containment system at the Oyster Creek Terminal. However, rupture of an onshore pipeline could result in more serious safety and environmental impacts, especially if the failed pipeline section is located inside an HCA because there is typically less surveillance along a pipeline corridor than at a terminal. More preventive and mitigation measures can also be implemented inside a terminal to reduce the likelihood of release incidents and mitigate potential outcomes. Section 4.5, Evaluation of Public Safety, discusses the safety of pipeline operation in the HCAs.

The analysis of environmental impacts due to the WCD did not account for mitigation efforts to minimize the spread of oil and impacts on sensitive receptors, or the frequency that this scenario may occur. Though the WCD is expected to occur at a very low frequency, the USCG would require the Applicant to implement proper planning and response actions to mitigate this scenario. The most likely spill scenario is expected to be significantly lower in volume than the WCD. Additional details about the onshore WCD scenario and frequency can be found in Appendix H, Spill Risk Analysis. The Prevention, Monitoring, and Mitigation Plan would be developed as part of the OPSMAN, which is required to address oil spill response, containment, and clean-up measures that consider the WCD.

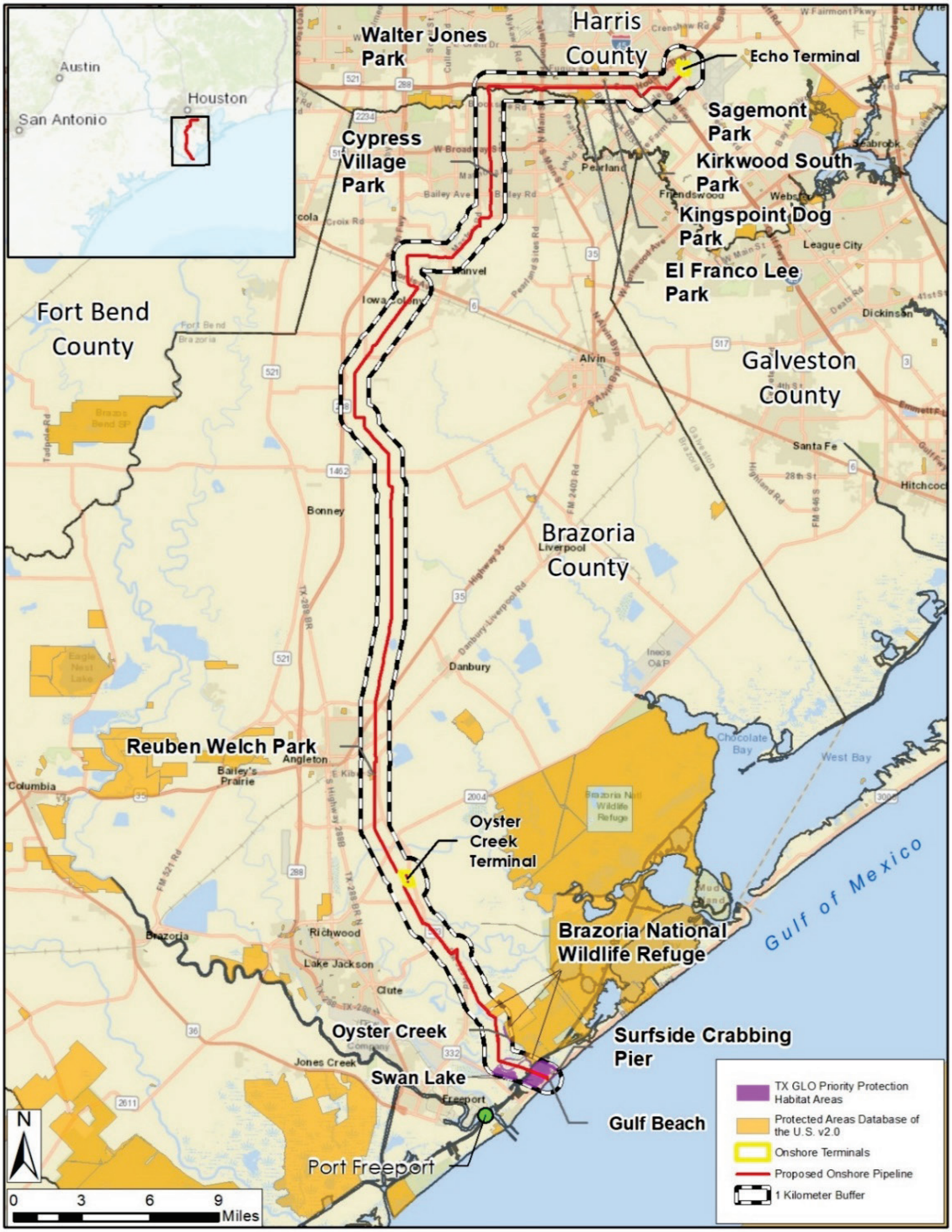


Figure 4.6-1: Proposed Onshore Pipeline Route for the SPOT Project

Figure 4.6-2: Longest Line Section for the SPOT Project Onshore Pipelines

Table 4.6-1 presents the Phast-calculated maximum distances to three thermal radiation levels of interest from an ignited pipeline rupture event, assuming the discharge rate reaches the maximum flow rate of 42,500 bph. The thermal hazard zones were not plotted as graphical overlays on the pipeline route map as the scale of potential impact may vary depending on the characteristics of each locations.

Table 4.6-1: Distances to Thermal Radiation Levels—Onshore Pipeline Rupture

Crude Type	Number of Ruptured Pipeline	Line Size	Pool Diameter	Distance (m)		
		(inch)	(m)	to 5 kW/m^2	to 12.5 kW/m^2	to 37.5 kW/m^2
WCS	1	36	66	145	107	74
WTI	1	36	115	150	106	82
Condensate	1	36	125	154	109	85

kW/m^2 = kilowatts per square meter; m= meters; WCS = Western Canadian Select; WTI = West Texas Intermediate

4.6.3.2. Worst-Case Discharge for Offshore Project Components

In accordance with the definition in 49 CFR § 194.105(b), the WCD from the SPOT DWP offshore components is defined and calculated by taking the following into consideration:

- Rupture of two 36-inch offshore crude pipelines due to anchor drag leading to an on-water 687,602 bbl[3] spill;
- Maximum time to isolation (assumed to be 0.5 hour)[2]: pipeline's maximum release time and maximum shutdown response time;
- Maximum flow rate: 42,500 bph per pipeline based on the pipeline's design capacity;
- Largest line drainage volume after shutdown: 623,192 bbl for the offshore pipelines from MLV700 to the SPOT DWP shut-down valves, as shown on Figure 4.6-3; and
- Total discharge volume of 687,602 bbl considering the information above and from calculations based on 49 CFR § 194.105 (b)(1).

The discharge of the total volume of the pipeline would occur in two phases: early and late phase. Early phase losses would occur when crude oil would be continuously pumped through the ruptured orifice before pumps could be shut down and isolation valves could be closed. In addition to this pumped flow, there would be losses due to contraction/expansion and head losses. Late phase losses would follow as sea water intrusion occurs. Crude oil would be replaced by the surrounding sea water, evacuating the remaining volume of crude within the pipeline over an estimated period of 36 hours.

[3] The change in total discharge volume evaluated for the worst-case spill scenario was the result of the Applicant moving MLV 7 to the north side of Bluewater Highway. That change affected the isolatable section volumes for the MLV7 to Shore Crossing section and the Subsea Pipeline section, resulting in the volume changing from 687,237 to 687,602 bbl.

The analysis of this WCD scenario did not account for mitigation efforts to limit the size of the spill. Similar to the analysis of the onshore WCD scenario, the frequency of the offshore WCD scenario is low and more likely scenarios are expected to have significantly lower spill volumes. Additional details about the offshore WCD scenario and frequency can be found in Appendix H, Spill Risk Analysis. The Prevention, Monitoring, and Mitigation Plan would be developed as part of the OPSMAN, which is required to address oil spill response, containment, and clean-up measures that consider the WCD.

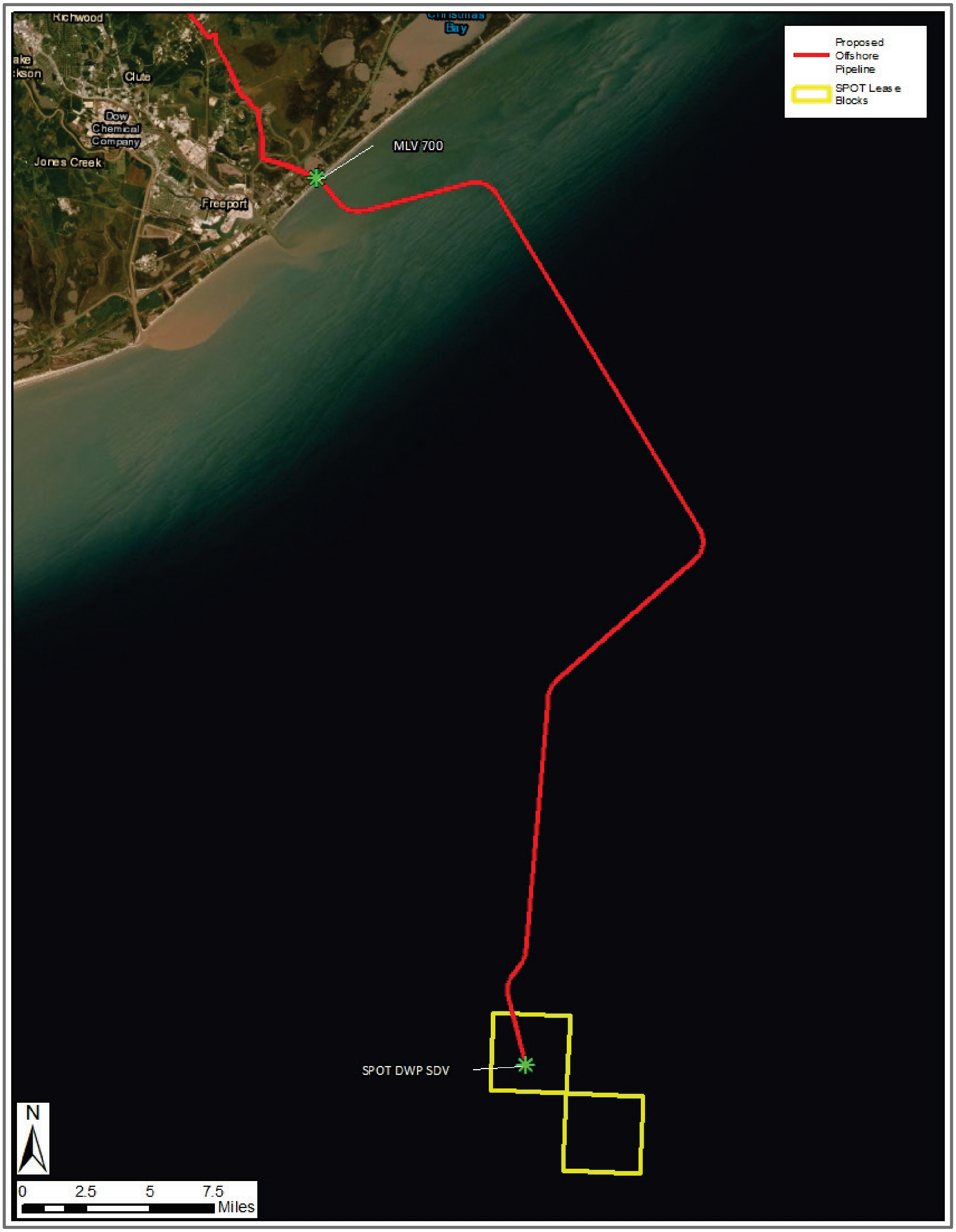


Figure 4.6-3: Proposed SPOT Offshore Crude Pipeline Route

4.6.3.3. Crude Oil Spill Thermal Radiation Zones from Pool Fires

The analysis considered two possible types of LOC scenarios, accidental and intentional, involving one to three oil cargo tanks, and a simultaneous rupture of the 36-inch risers caused by supply vessel collision with the platform. Although Sandia's 2004 and 2008 publications focused on LNG carriers' cargo tank breach and safety analysis, the approaches and sources are based on a previously conducted study for oil tankers (Sandia 2004). The conclusions for the potential breach sizes are, therefore, considered applicable and applied in this study.

The oil spill resulting from any of the accidental and intentional events would form a pool floating on the ocean surface. Upon ignition, a pool fire would occur and impose hazardous heat on the nearby species, offshore personnel, and infrastructure.

Accidental Scenarios Results – Thermal Radiation from Pool Fires

Hazard distances to the thermal radiation levels for the following accidental oil spill scenarios were calculated using Phast:

- Accidental ship collision causing one cargo tank breach with a spill area of approximately 1 square meter (10.8 square feet);
- Accidental ship collision causing one cargo tank breach with a spill area of approximately 2 square meters (21.5 square feet); and
- Simultaneous rupture of the 36-inch dual crude oil risers caused by supply vessel collision with the platform.

Calculations have been performed for the three types of crude oil selected in the design basis (WCS, WTI, and Condensate). Tables 4.6-2 and 4.6-3 summarize the distances to the three thermal radiation levels.

Table 4.6-2: Distances to Thermal Radiation Levels—Accidental Ship Collision

Crude Type	Tank Breached	Breach Size (m^2)	Pool Diameter (m)	Distance (m)		
				to 5 kW/m^2	to 12.5 kW/m^2	to 37.5 kW/m^2
WCS	1	1	85	193	152	117
WCS	1	2	125	247	193	149
WTI	1	1	151	209	154	126
WTI	1	2	218	280	203	166
Condensate	1	1	160	208	151	125
Condensate	1	2	228	278	200	165

kW/m^2 = kilowatts per square meter; m= meters; m^2 = square meters; WCS = Western Canadian Select; WTI = West Texas Intermediate

Table 4.6-3: Distances to Thermal Radiation Levels—Platform Riser Rupture

Crude Type	Number of Ruptured Risers	Line Size (inch)	Pool Diameter (m)	Distance (m)		
				to 5 kW/m²	to 12.5 kW/m²	to 37.5 kW/m²
WCS	2	36	129	229	168	123
WTI	2	36	204	239	169	131
Condensate	2	36	221	247	174	137

kW/m^2 = kilowatts per square meter; m= meters; WCS = Western Canadian Select; WTI = West Texas Intermediate

Intentional VLCC Tank Breach Results—Thermal Radiation from Pool Fires

Sandia's 2008 report specifies that where there is less waterway control and surveillance of ship operations, credible intentional threats can cause a larger breach size ranging from 5 to 16 square meters (53.8 to 172.2 square feet). According to Sandia 2008, this range of breach sizes should be considered for facilities or operations about 5 or more miles offshore.

Hazard distances to the thermal radiation levels for the following accidental oil spill scenarios were calculated using Phast:

- Intentional act leading to a 5-square-meter (53.8-square-foot) breach in three tanks of a VLCC
- Intentional act leading to a 12-square-meter (129.2-square-foot) breach in a single tank of a VLCC
- Intentional act leading to a 16-square-meter (172.2-square-foot) breach in a single tank of a VLCC

Table 4.6-4 summarizes distances to the three thermal radiation levels.

Table 4.6-4: Distances to Thermal Radiation Levels—Intentional Threats

Crude Type	Tank Breached	Breach Size (m²)	Pool Diameter (m)	Distance (m)		
				to 5 kW/m²	to 12.5 kW/m²	to 37.5 kW/m²
WCS	1	12	322	487	370	284
WCS	1	16	373	544	411	315
WCS	3	5	203	346	268	206
WTI	1	12	547	589	421	351
WTI	1	16	634	663	476	398
WTI	3	5	349	412	295	243
Condensate	1	12	568	584	418	352
Condensate	1	16	657	656	472	399
Condensate	3	5	364	407	291	242

kW/m^2 = kilowatts per square meter; m= meters; m^2 = square meters; WCS = Western Canadian Select; WTI = West Texas Intermediate

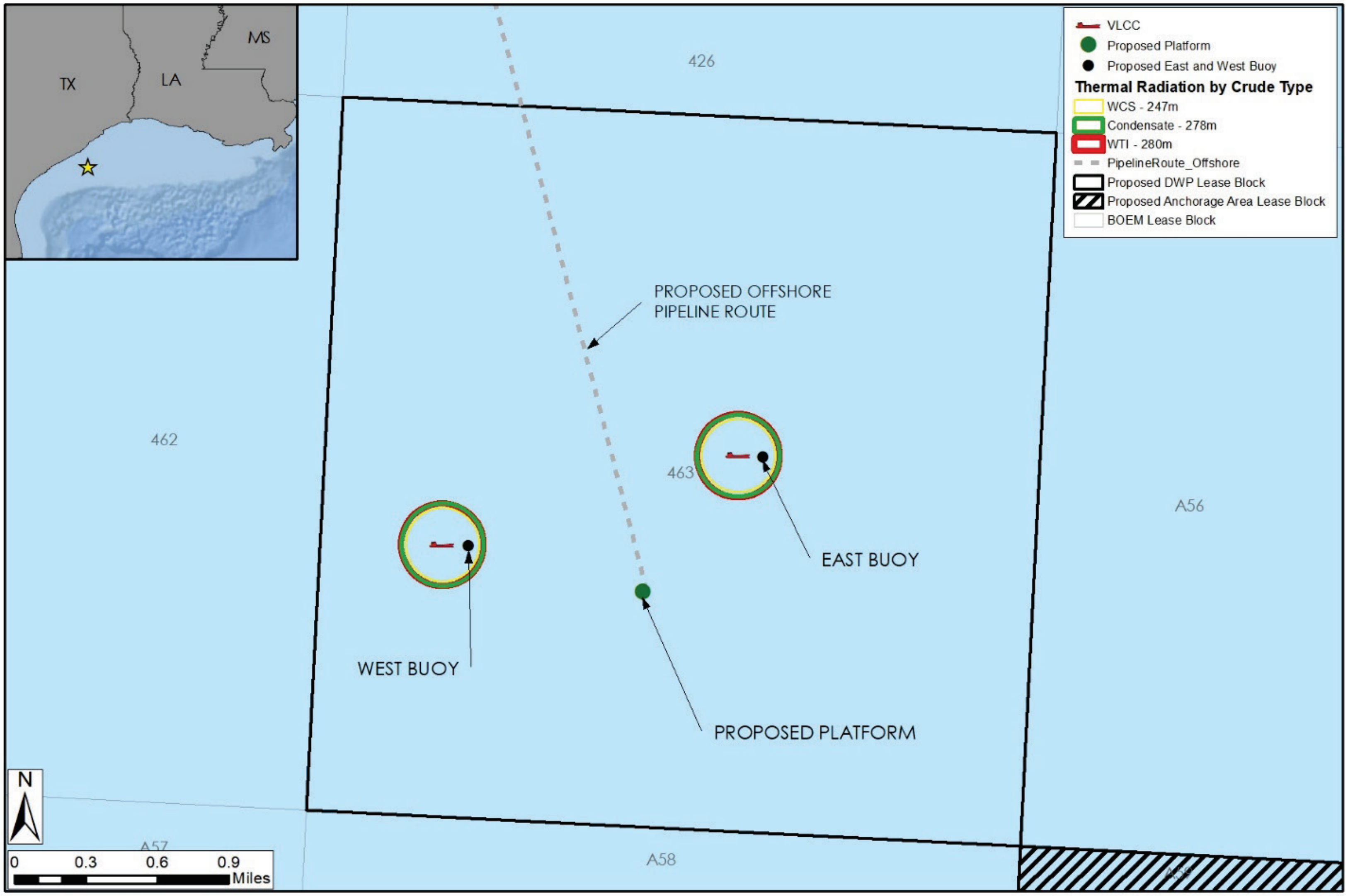
Thermal radiation hazard zones (Figure 4.6-4, Figure 4.6-5, and Figure 4.6-6) are created in the form of a circular area, with the radius equal to the distances to the thermal radiation level of interest (5 kW/m^2 for the following figures). The 5 kW/m^2 thermal radiation level is commonly used to establish the restricted access area to protect personnel from exposure to a fire hazard. In a real spill incident, not all spilled volume would contribute to the pool fire as the wave and turbulence at the sea surface can cause all or part of a lick to break up. The following figures are intended to provide a conservative estimate of the potential thermal hazard impact region.

Figure 4.6-4 shows the 5 kW/m^2 thermal radiation contours generated from a pool fire resulting from an accidental breach case (with spill area of 2 square meters [21.5 square feet] in a single tank) for the three types of crude oil.

Figure 4.6-5 shows the 5 kW/m^2 thermal radiation contour generated from a riser rupture incident caused by vessel collision with the platform. It was assumed that both 36-inch risers would rupture at the same time in the event of a vessel collision because of their close proximity.

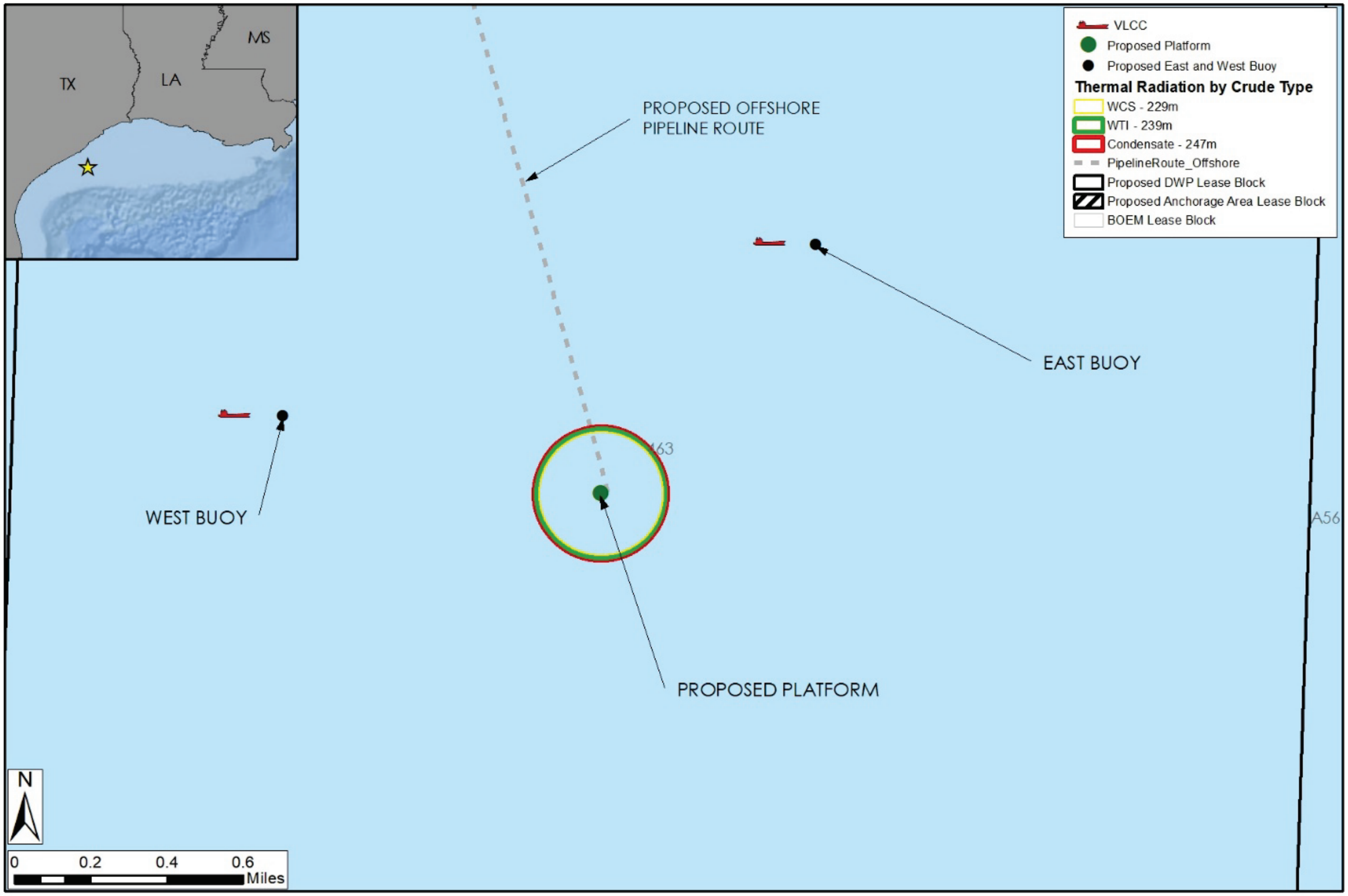
Figure 4.6-6 shows the 5 kW/m^2 thermal radiation contours resulting from an intentional breach case (with the spill area of 16 square meters [172.2 square feet] in a single tank) for the three types of crude oil. Although a 16-square-meter (172.2-square-foot) tank breach scenario is not considered likely according to Sandia, the consequence is evaluated to provide a conservative estimate of the possible worst outcome.

None of the pool fire hazard scenarios evaluated reached another VLCC, neighboring platform, or the shipping fairway; therefore, the analysis suggests that there would be minimal impacts on public safety from even a large spill from the VLCCs.



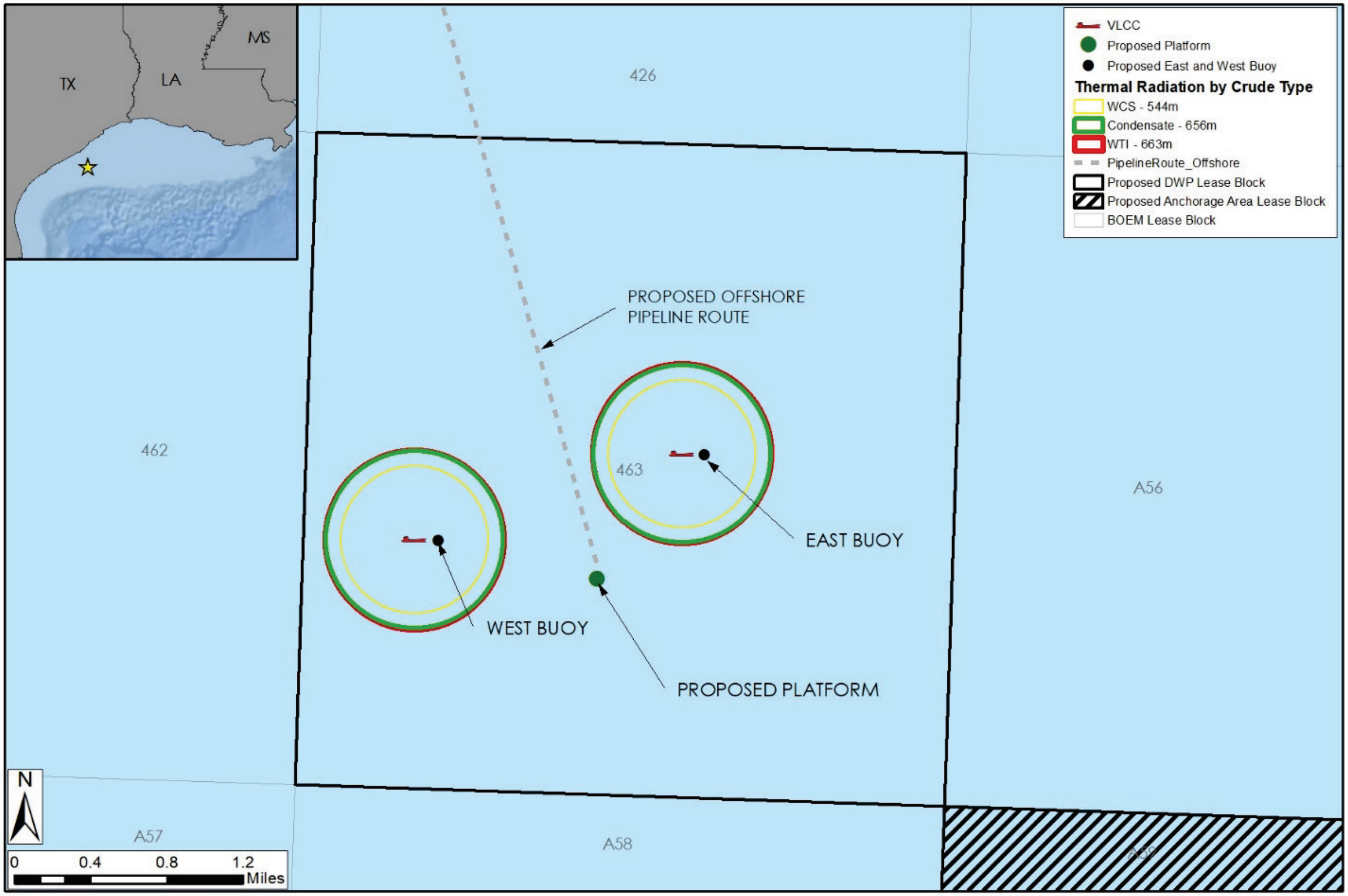
BOEM = Bureau of Ocean Energy Management; DWP = deepwater port; kW/m^2 = kilowatts per square meter; m = meters; m^2 = square meters; VLCC = very large crude carrier; WCS = Western Canadian Select; WTI = West Texas Intermediate

Figure 4.6-4: 5-kW/m^2 Thermal Hazard Zone from Accidental Cargo Tank Breach—Ship Collision with 2-m^2 Spill Area for WCS, WTI, and Condensate



BOEM = Bureau of Ocean Energy Management; DWP = deepwater port; kW/m^2 = kilowatts per square meter; m = meters; VLCC = very large crude carrier; WCS = Western Canadian Select; WTI = West Texas Intermediate

Figure 4.6-5: 5-kW/m^2 Thermal Hazard Zone from 36-inch Dual Riser Rupture—Ship Collision with the Platform for WCS, WTI, and Condensate



BOEM = Bureau of Ocean Energy Management; DWP = deepwater port; kW/m^2 = kilowatts per square meter; m = meters; m^2 = square meter; VLCC = very large crude carrier; WCS = Western Canadian Select; WTI = West Texas Intermediate

Figure 4.6-6: 5-kW/m^2 Thermal Hazard Zone from Intentional Threats—Cargo Tank Breach with 16-m^2 Spill Area for WCS, WTI, and Condensate

4.6.3.4. Crude Oil Spread and Slick Migration Modeling

Spill Fate and Trajectory Modeling of Oil Spill

The USCG used a commercial software capable of simulating a full suite of fate and transport processes of oil in water—COSIM (Chemical/Oil Spill Impact Module) within Generalized Environmental Modeling System for Surfacewaters—to model the spill fate and trajectory of potential oil spills. COSIM is a state-of –the-art 3-dimensional oil spill model used around the world for real-time spill events, investigative damage assessments, and environmental impact assessment studies such as this EIS. The software allows for probabilistic analyses by running a spill scenario over multiple iterations (120 iterations in this study) to examine the pathways a spill may travel over a range of hydrodynamic and meteorological conditions. COSIM estimates the fate of a spill into various phases and forms, taking into account the surface slick, shoreline, atmosphere, water column (dissolved or entrained), sediments, or removal via cleanup activities. The fate calculation includes the following processes (see Figure 4.6-7): advection, dispersion, spreading, evaporation, volatilization, dissolution, emulsification, photo-oxidation, dense oil sinking, sedimentation, biodegradation, and encapsulation (when ice is present).

Worst Credible Oil Spill Discharge at the SPOT DWP

In accordance with the definition in 33 CFR § 154.1029(b)(2), the WCD from the SPOT DWP Project is defined and calculated taking into account the following:

- Rupture of both crude oil export pipelines leading to subsea oil spill, caused by dropped or dragged anchor;
- Maximum time to isolation: the maximum time to discover the release from the pipeline plus the maximum time to shut down flow from the pipeline;
- Maximum flow rate: estimate based on the maximum system pressure, assumed to be one and a half times the design maximum flow rate of 85,000 bph; and
- Discharge volume: maximum time to isolation × maximum flow rate + total line drainage volume.

The worst credible discharge scenario selected for oil fate and trajectory modeling is an underwater crude oil release from a simultaneous rupture of both 36-inch crude export pipelines at a nearshore location and close to the SPOT DWP (Figure 4.6-8). The modeled release would occur in two phases: early phase and late phase. An early loss would occur over 0.5 hour, resulting in a discharge volume of 63,750 bbl before shutdown took place. This would be followed late phase discharges (assumed to last 36 hours) after shutdown kicked in, involving a release volume of 623,852 bbl from the line drainage. The total volume modeled was 687,602 bbl. For a worst-case scenario, it was assumed that no response efforts took place to mitigate the impacts of the spill. In an actual emergency, response efforts can mitigate a spill to protect shorelines, impede the transport of oil, and remove oil from the affected environment.

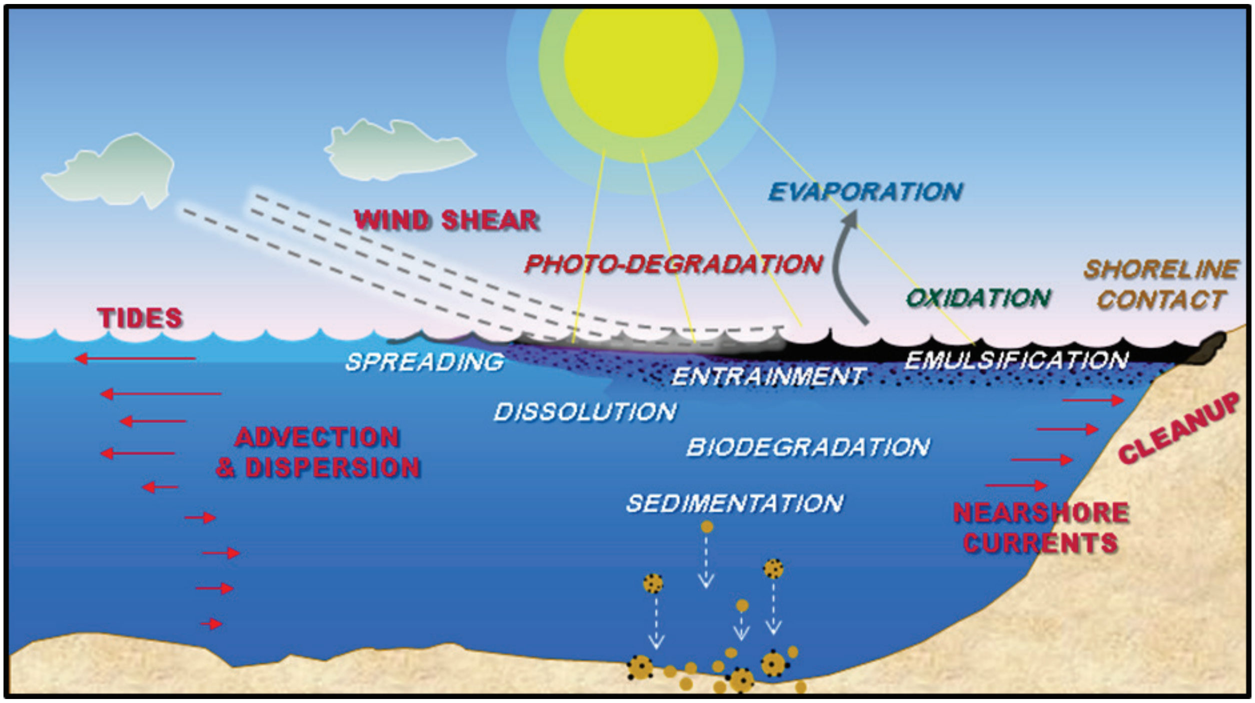


Figure 4.6-7: COSIM Oil Fate and Trajectory Modeling Overview

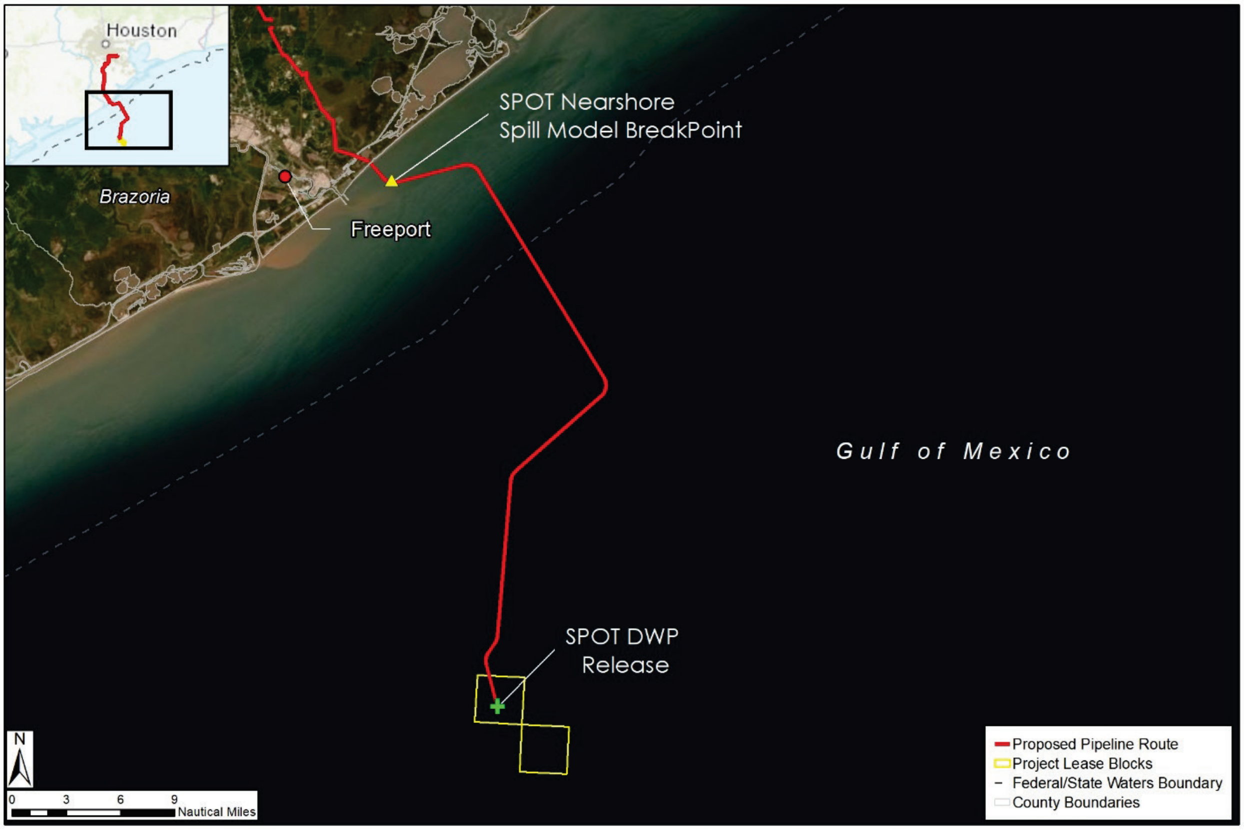


Figure 4.6-8: Selected Spill Locations: Nearshore and at the Deepwater Port

Spill Fate and Trajectory Results

Potential impacts were examined regarding:

- The probability and locations of shorelines which could contact oil above a 100 g/m² threshold for environment impacts and 1 g/m² for socioeconomic impacts; and
- The probability and locations of water surface areas where oil may float at or above 0.1 micrometer, the defined thickness threshold levels indicating oil may be visible.

Probabilistic results are presented as a composite of the range of possible locations to which oil may travel under the various conditions. Individual worst cases are then examined among the range of possible trajectories.

In Scenario 1, the release was simulated to occur from a break at the SPOT DWP (Figure 4.6-9). In Scenario 2, the release occurred 2 miles off the coastline at pipeline first bends direction after running perpendicular to the coast Figure 4.6-9). In Scenario 3, the release was simulated to occur to the VLCC moored at the SPM buoy because of another vessel colliding with it (Figure 4.6-9).

In the modeled oil spill events that were close to shore and the SPOT DWP, two different simulations were ran: how the potential oil spill impact propagation would affect the shoreline, and how the oil would move with oceanic currents around the GoM and the total potential oiling impact on those areas. Figure 4.6-10, Figure 4.6-11, and Figure 4.6-12 show the results of the scenarios for shoreline oiling for a Condensate oil spill. In 40 percent of the Scenario 2 events close to shore, the oil missed the shoreline, turned and went out to sea for the next 14 days while for the other 60 percent of the cases reached Freeport.

Shoreline oiling (above a 5 percent probability) may occur primarily 250 miles between Port Aransas and Port Arthur in SPOT DWP Scenario 1 and 122 miles between Port O'Connor and Galveston Island in Scenario 2. Shorelines most likely to contact oil range from the region between Port O'Connor to Freeport, Texas. Figure 4.6-13 and Figure 4.6-14 show the GoM potential oil spill impacts of a spill in both locations. The SPOT DWP has a greater potential oiling spill impact on more of the shoreline area and GoM because ocean currents carry the oil farther and currents close to shore are less strong and therefore do not have as great an effect as they do further offshore. A majority of the oil would go directly to the shoreline or stay in the same area when released close to shore. The scenarios for the spill fate and trajectory modeling were simulated using the three crude oil types (Condensate, WTI, and WCS) that are proposed to be exported by the SPOT DWP.

Scenario 3, VLCC collision resulting in an oil spill, was simulated near the SPOT DWP SPM buoys in the fate and trajectory modeling due to high traffic volumes in the area. The energy due to the collision causes a breach in the double hull of the tankers resulting in an oil spill in the GoM. Figure 4.6-12 depicts the shoreline oiling impact from a VLCC collision near SPOT DWP. The VLCC oil spill highest probability of surface oiling to the shoreline was near Freeport, but a small 5 percent surface oiling ranged from Port Aransas to Galveston Island. The ocean currents took the oil spill towards the northwest, resulting in a 5 percent probability of surface oiling impact on Freeport and Galveston Island. Figure 4.6-15 shows the surface oil due to oceanic currents in the GoM.

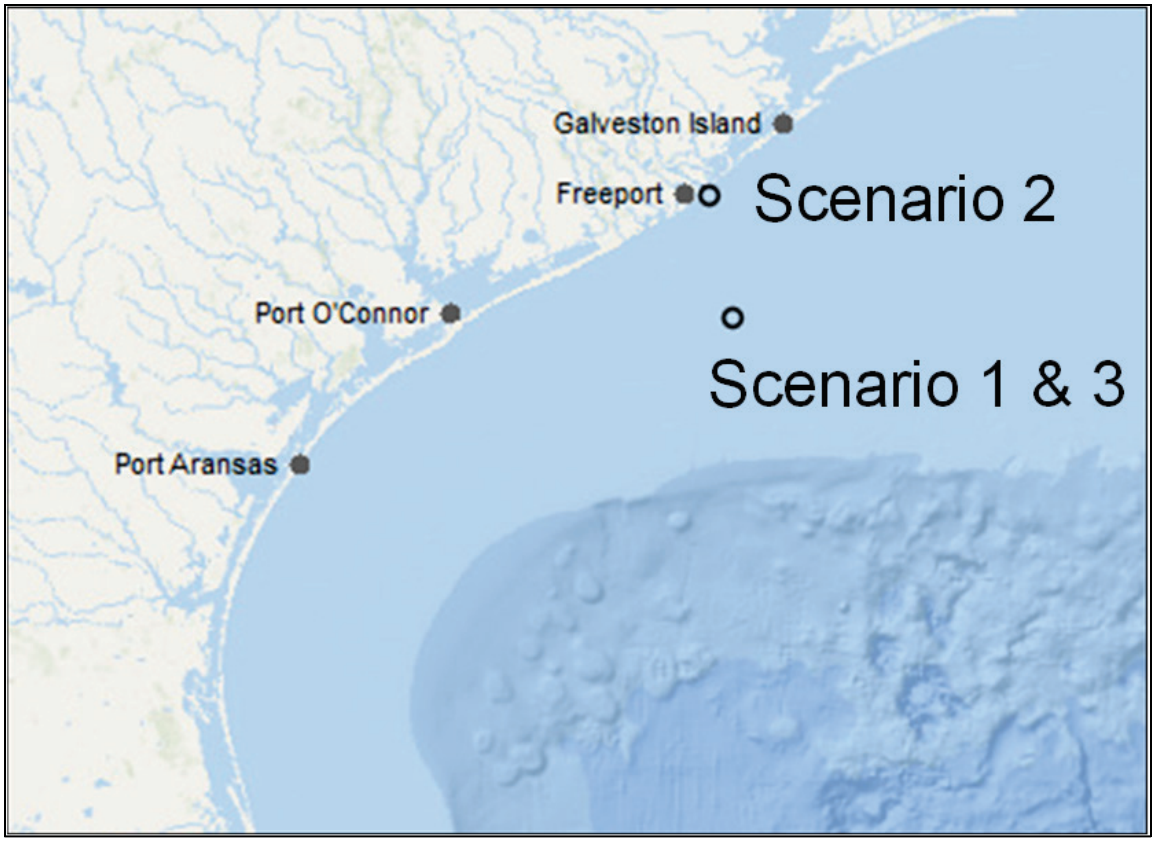


Figure 4.6-9: SPOT DWP and Close to Shoreline Oil Spill Scenarios near Texas Gulf Coast

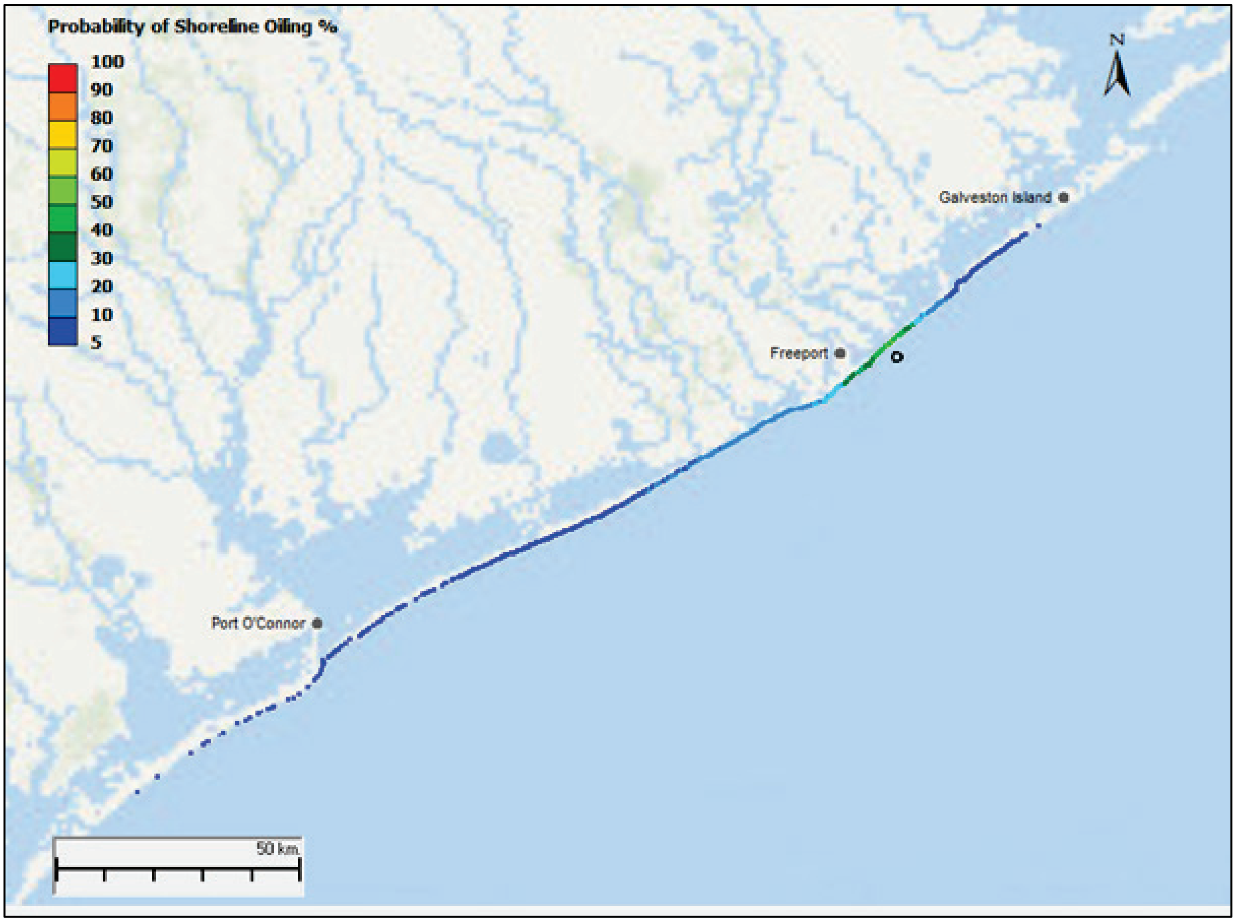


Figure 4.6-10: Close to Shore Scenario (Scenario 2) of Potential Oil Spill Effect on Shoreline

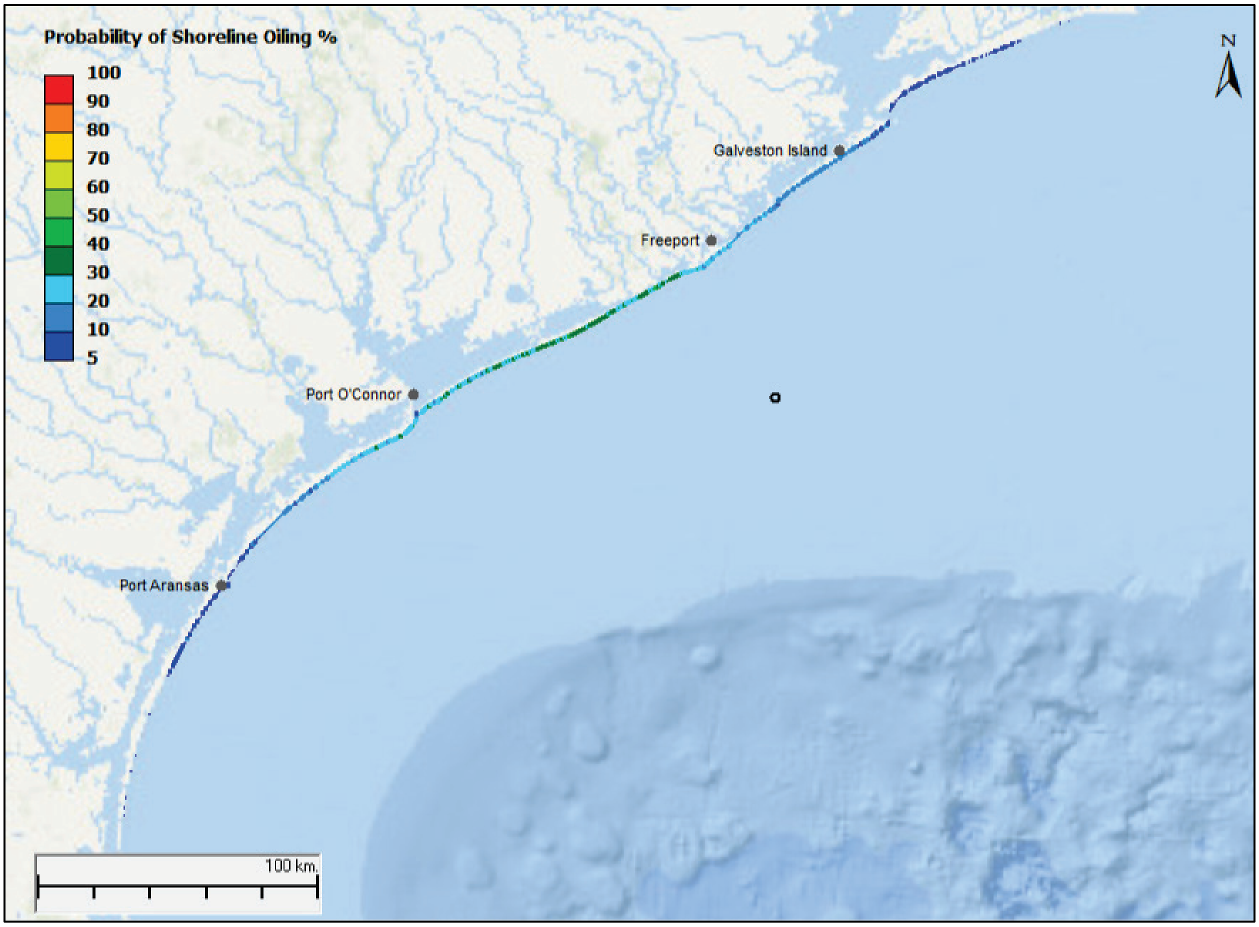


Figure 4.6-11: SPOT DWP Scenario (Scenario 1) of Potential Oil Spill Effect on Shoreline

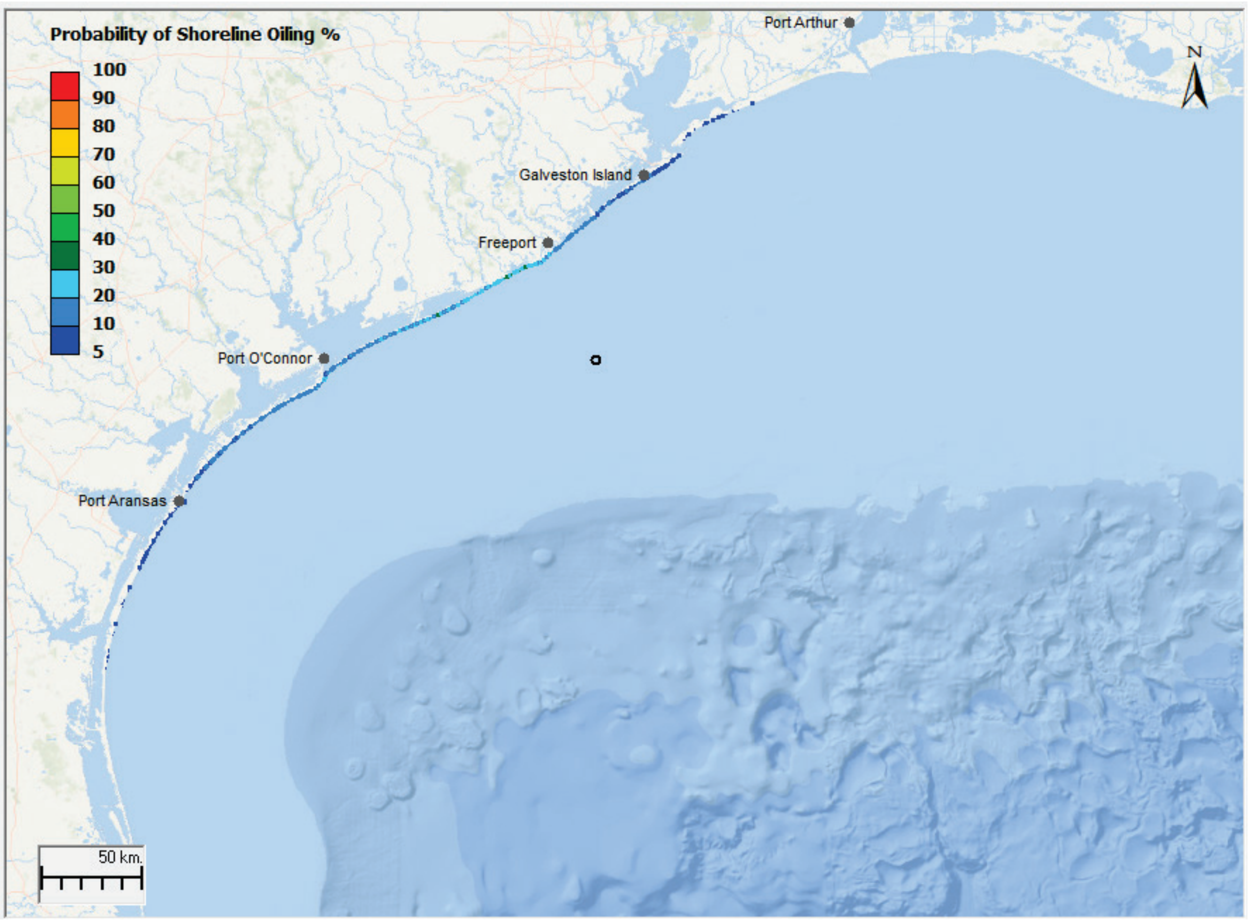


Figure 4.6-12: VLCC Scenario (Scenario 3) of Potential Oil Spill Effect on Shoreline

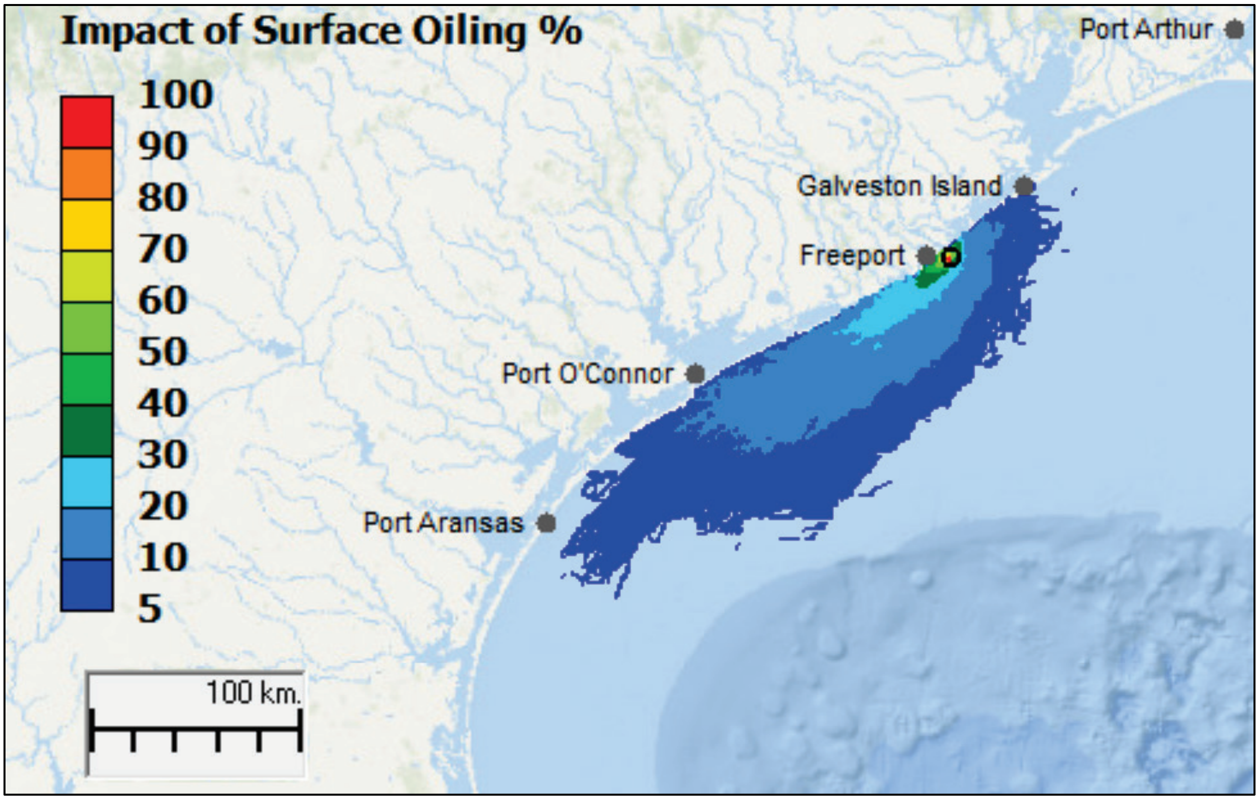


Figure 4.6-13: Close to Shoreline Scenario (Scenario 2) of Gulf of Mexico Potential Oil Spill Impact

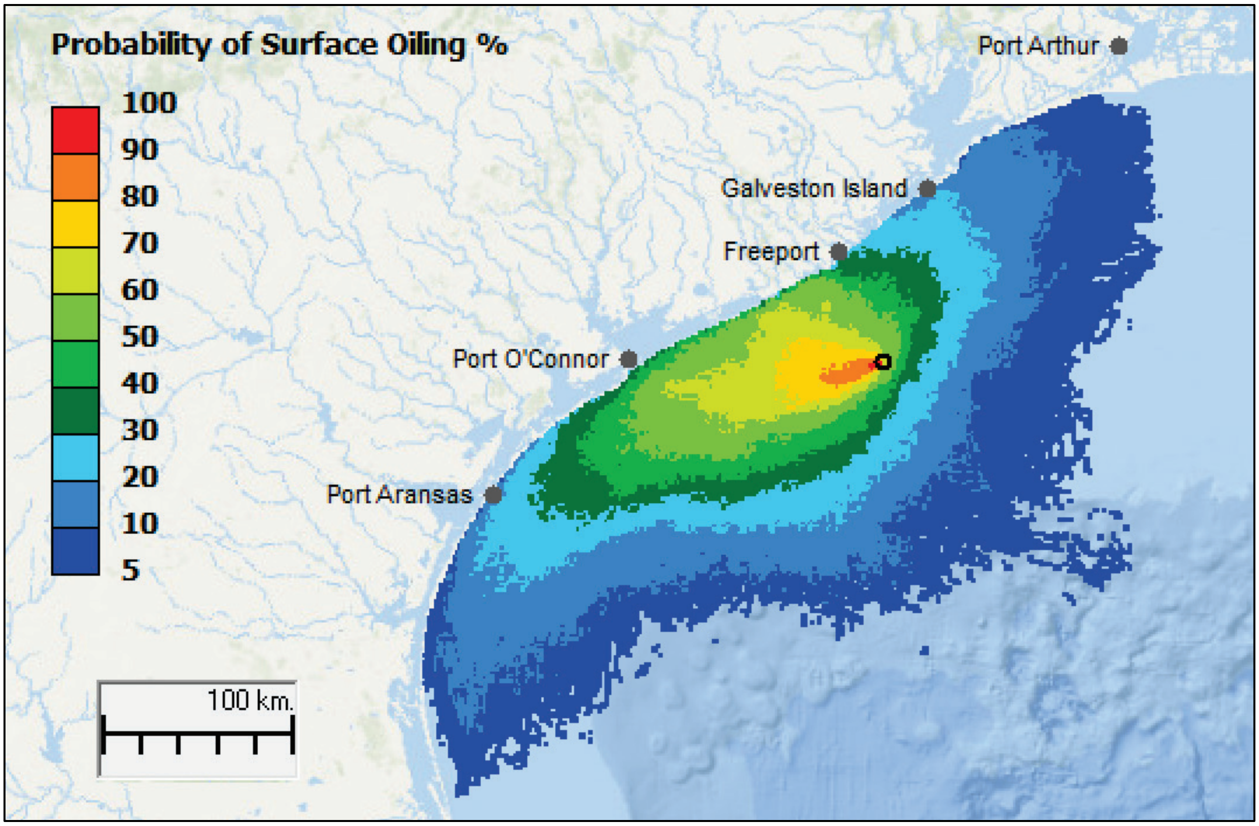


Figure 4.6-14: SPOT DWP Scenario (Scenario 1) of Gulf of Mexico Potential Oil Spill Impact

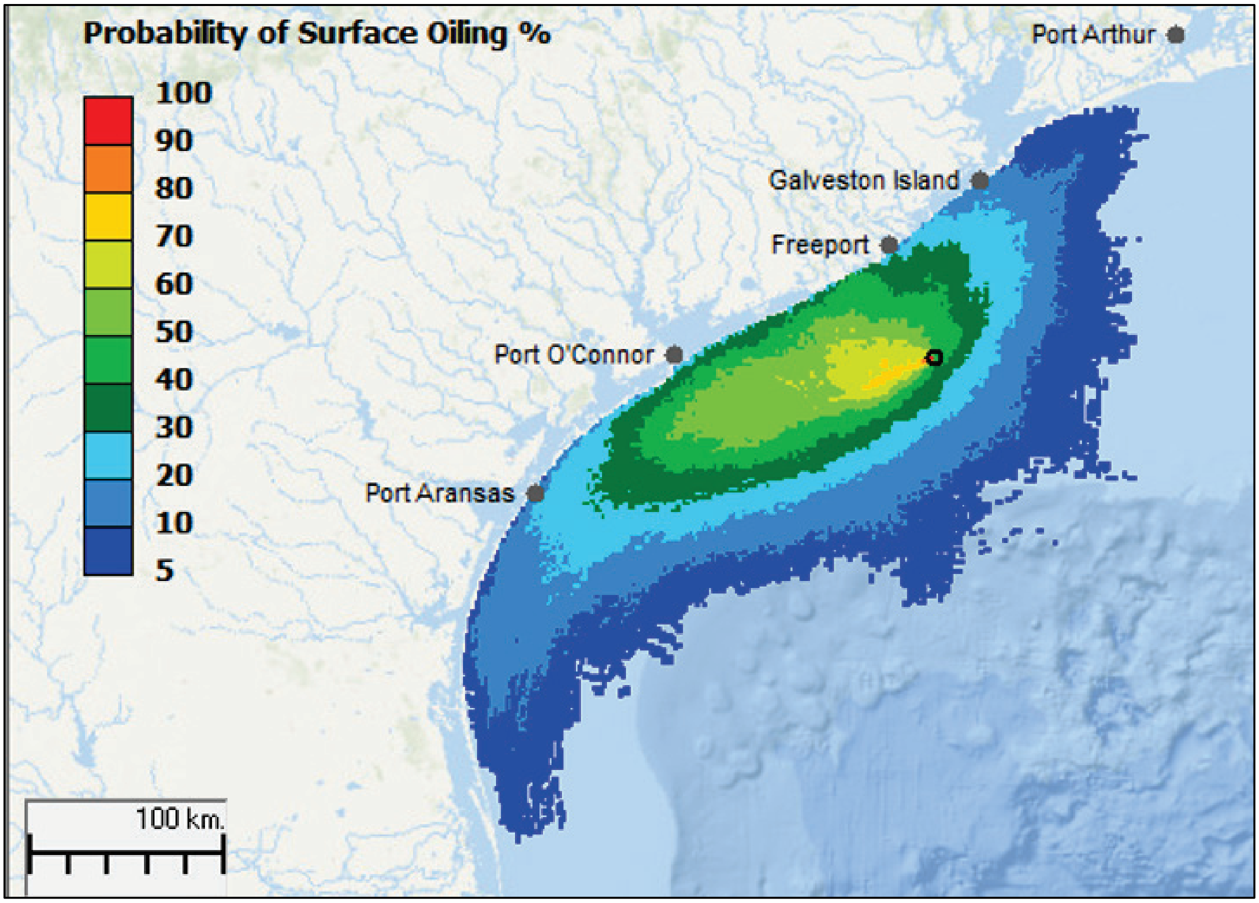


Figure 4.6-15: VLCC Scenario (Scenario 3) of Gulf of Mexico Potential Oil Spill Impact

4.6.4. Summary of the Oil Spill Findings

Table 4.6-5 presents the maximum hazard distance estimated from major oil spill hazards, including offshore and onshore events. Based on the results, an oil spill from a subsea pipeline rupture from a dropped or dragged anchor could result in vast areas of the GoM being covered in oil. An oil spill near or inside any of the HCAs along the pipeline route may harm communities, contaminate the water source, and destroy or damage sensitive breeding grounds and important species.

Regarding the offshore oil release ignited events, none of the pool fire hazard scenarios evaluated reached another VLCC, neighboring platform, or the shipping fairway; therefore, the analysis suggests that there would be a minimal impact on public safety from even a large spill from the VLCCs.

Table 4.6-5: Maximum Distances for the Major Onshore and Offshore Hazards

Hazard Type	Outcome	Impact Distance (m)
Offshore Hazard		
Dropped and Dragged Anchor	Oil slick migration (potential shoreline oiling between Port Aransas and Port Arthur)	402,336
Accidental Ship Collison	Distance to 5 kW/m^2 thermal radiation	280
	Distance to 37.5 kW/m^2 thermal radiation	166

Hazard Type	Outcome	Impact Distance (m)
Intentional Act, Pool Fire	Distance to 5 kW/m^2 thermal radiation	663
	Distance to 37.5 kW/m^2 thermal radiation	399
Onshore Hazard		
Pipeline Rupture, Pool Fire	Distance to 5 kW/m^2 thermal radiation	154
	Distance to 37.5 kW/m^2 thermal radiation	85

kW/m^2 = kilowatts per square meter; m = meters

4.6.5. Third-Party Spill Risk Analysis

A third-party spill risk analysis of the SPOT Project was requested by the USCG to support the review of the Applicant's deepwater port license application. The analysis employed international best practice for the framework and methodology.

This analysis developed the risk profiles for oil spill frequency and spill size for all onshore and offshore components of the proposed SPOT Project. The analysis considers failure of all components associated with the SPOT Project, which includes the terminals, offshore platforms, pipelines, pipeline pumps, storage tanks, valves, and valve stations. The probability that an emergency shutdown could fail to close was also considered.

The pipelines would operate below their maximum allowable working pressure and temperature. The pipelines would be designed to handle varieties of crude. Therefore, it is not expected that switching crude blends would result in a spill or increase the risk of spills. However, the crude blends are expected to behave differently after release. Therefore, three representative crude blends were considered for the analysis.

Oil spill sizes considered in the analysis range from 17.5 bbl to 687,602 bbl. This oil spill size range and the associated oil spill frequency per spill scenario were used to develop the 100-year RP and 500-year RP oil spill.

Consequence hazard zones for safety and planning purposes were determined for the range of spill sizes defined above. Flammable vapor cloud dispersion hazard zones to LFL and distance to the planning threshold thermal radiation flux limit are shown in Table 4.6-6. The 100-year RP hazard distances shown do not reach other platforms, shipping lanes, or VLCCs not associated with SPOT crude oil transfer operations that may be in transit or in the anchoring area.

Table 4.6-6: Flammable and Dispersion Distances for Oil Spill Scenarios

Scenario	Distance to LFL (meters)	Distance to 12.5 kW/m^2 (meters)
West Texas Intermediate		
100-year return period (16,271 bbl)	1,964	291
500-year return period (434,612 bbl)	9,753	1,178
Western Canadian Select		
100-year return period (17,174 bbl)	2,007	398
500-year return period (547,278 bbl)	10,863	1,579
Condensate		
100-year return period (15,936 bbl)	1,442	284
500-year return period (434,612 bbl)	7,912	1,195

bbl = barrels; kW/m^2 = kilowatts per square meter; LFL = lower flammability limit

It is recommended that the Applicant incorporate safety and emergency response considerations for the flammable hazard zone, which was determined to have a radius of 2,007 meters (1.2 miles), derived from the 100-year dimensioning oil spill results, into the OPSMAN. The distance was calculated based on dispersion modeling conducted using validated software and models, and following relevant USCG guidelines applicable to the DWP. The full third-party spill risk analysis is presented in Appendix H, Spill Risk Analysis.

4.7. MARINE SAFETY

Marine safety for vessels, DWPs, and offshore structures is regulated through a framework of overlapping international treaties and standards, national laws and regulations, and Federal and state port or area-specific rules. The agency with primary responsibility for vessels and DWPs in the area of the proposed Project is the USCG. The USCG currently boards foreign-flagged vessels under the Port State Control program, and may board, inspect, and search any vessel entering a U.S. port. The USCG is also responsible for reviewing and approving operations and security plans, as well as periodic inspecting of the facilities (once constructed) to enforce compliance with safety and security requirements.

4.7.1. Marine Safety Standards

In accordance with 33 CFR Part 150, the licensee of the DWP could not operate the proposed SPOT DWP without prior USCG approval of the OPSMAN, which must address the requirements of the DWPA and provide detailed specifications and procedures for all aspects of DWP operation and infrastructure. The OPSMAN would address security, emergency response, public and personal safety, protection of the environment, navigation, vessel movement, materials handling, and personnel qualifications. The OPSMAN would also be required to address DWP requirements for calling vessels, approaches, safety zone, DWP infrastructure, and pipelines.

If the proposed Project is approved and commences operation, the USCG would conduct regular inspections to ensure that the OPSMAN is being properly implemented. In addition, the USCG would periodically review the OPSMAN, and propose or require amendments as necessary to meet the intentions of the appropriate regulations and address potential changes in conditions.

Marine safety would be enhanced, in part, by navigation aid systems, fire and gas detection systems, emergency shutdown systems, and communication systems.

During the construction phase of the Project, the USCG would be responsible for approval and oversight of design, fabrication, installation and construction, and commissioning of the Project. Any substantive changes that would affect the OPSMAN and equipment would have to be reviewed and approved. The USCG would also coordinate with PHMSA as the technical and approval authority of pipeline design, construction, operation, and maintenance.

The Applicant would be required to comply with applicable codes and standards for the VLCC and other crude oil carrier safety systems and equipment onboard the vessels. These systems and equipment include detection, emergency shutdown, spill containment, fire protection, flooding control, crew escape and safety shelters, and all other such equipment as required by applicable Federal and international regulations and standards.

4.7.1.1. Navigation Aid Systems

The USCG has requirements for indicating the location of fixed structures on nautical charts, and the USCG 8th District's Local Notice to Mariners (monthly editions and weekly supplements) informs local mariners about locations of aids to navigation. Additionally, Marine Safety Information Broadcasts would be issued whenever DWP-related activities (e.g., construction, marine mammal monitoring, general deepwater port operation) are occurring.

The SPOT DWP would be located offshore Brazoria County, Texas in approximately 115 feet of water and approximately 27.2 to 30.8 nautical miles off the coast. The proposed location for the SPOT DWP experiences relatively low vessel traffic, as discussed in Section 3.11, Transportation, of this EIS, Transportation, and naturally deep water to allow fully loaded VLCCs and other crude oil carriers to transit without the need to establish additional channel or navigation hazard markers for transit between the SPOT DWP and the closest fairway (SPOT 2019a, Volume III, Attachment 4).

The VLCCs or other crude oil carriers, while connected to the SPM buoys or in the designated anchorage areas, would be required to display lighting, and produce sound signals in accordance with the 72 COLREGS. Lighting systems appropriate for moored vessels would be visible during appropriate times of the day and during periods of reduced visibility. The 72 COLREGS governs the color, placement, and range of visibility on all seagoing vessels operating on U.S. waters outside inland demarcation lines. AIS beacons on the VLCCs and other crude oil carriers would transmit the name and position of each vessel at all times.

The Applicant would establish private aids to navigation to mark the corners of Galveston Area lease block 463, where the SPOT DWP is proposed, as well as Galveston Area lease block A-59, where the anchorage area is proposed. These aids would serve to identify the SPOT DWP and anchorage area to other mariners. The private aids to navigation would consist of seven yellow buoys, outfitted with radar reflecting towers and yellow marine lanterns.

The SPOT DWP would fall within the USCG's Eighth District Office of Waterways Management and Aids to Navigation. If the application were approved, the USCG would need to review proposed lighting and marking schemes for the platform. The SPOT DWP would be located in a Class A area and must meet the requirements of 33 CFR § 67.20.

Marine lanterns would be installed at the four corners of the platform at an elevation of 68 feet, and no lower than 20 feet above mean high water. Lanterns would be white in color and flash at a rate of approximately 60 flashes per minute and be automatically activated from sunset to sunrise. The foghorn would provide a sound output in accordance with International Association of Marine Aids and Lighthouse Authorities recommendations in order to warn vessels of the platform during periods of reduced visibility. The foghorn would provide a 2-second blast every 20 seconds with a maximum intensity at a frequency between 100 and 1,100 Hz. The foghorn would be located at an elevation of 100 feet at the cellar deck, would have a range of at least 2 miles, and be equipped with a fog detector that would automatically activate the foghorn when visibility drops below 5 miles in all directions.

A rotating beacon would be installed to distinguish the SPOT DWP from other offshore structures; the beacon would be placed at the top of the communications tower at approximately 150 feet. The radar beacon would be installed to aid identification of the platform to vessels equipped with marine radars. The radar beacon would also be located at the top of the communications tower at approximately 140 feet and operate 24-hours daily.

A radar navigation system would be installed on the SPOT DWP platform to detect aircraft or marine vessels in the vicinity. The radar antenna would be located on deck of the platform and the signal processor and computer would be located in the communications room. The system would include an automatic radar plotting aid in compliance with the performance requirements of 33 CFR § 164.38.

The navigation aids for each SPM buoys would consist of a marine signal light, a foghorn, and a radar reflector, all in accordance with International Association of Marine Aids and Lighthouse Authorities requirements.

4.7.1.2. Fire and Gas Detection System

Fire and gas detection systems would be placed strategically around the SPOT DWP and have the ability to detect fires from flame, smoke, or heat. Each motor, tank, and generator would have a fusible plug installed, which, in the event of a fire, would melt and activate the fire alarm, start the diesel firewater pump, and deluge the area. The gas detection system would detect gas leaks and accumulation. Gas detectors would also be placed in the propane area on the platform, which would trigger gas alarms, start the diesel firewater pump, and deluge the area.

The fire and gas detection system would be interfaced to a distributed control system that would monitor the detection loop and control the fire pumps. The operator in the control room could access the deck plans and indicate the exact location of each detector. The system would be computerized with a backup-battery, operating panel, and power supply in the control room. All fire and gas detection systems on the SPOT DWP platform would comply with National Fire Protection Association (NFPA) 72 Section 17.5 and NFPA 72 Section 17.10 requirements (NFPA 2016).

4.7.1.3. Emergency Shutdown System

The SPOT DWP platform would include a separate safety and process control system that would be monitored in the control room on the platform. The safety and control system would be independent of the process control system and would manage all of the SPOT DWP platform safety systems. An emergency shutdown valve actuated by an electric motor and an emergency shutdown valve controller would, when activated, shut down all systems on the SPOT DWP.

A HIPPS would be installed on the platform to protect the system from over pressure and designed to close within a period determined by analysis to prevent downstream overpressure. The vendor would design the HIPPS system according to the IEC 61511/508 and API RP 14C, 8th edition requirements. The HIPPS system would consist of a dedicated control panel, two axial flow shutdown valves, and pressure transmitters. All components of the HIPPS system would be Safety Integrity Level 3 rated. Safety Integrity Level 3 is the second highest safety integrity level given and has a risk reduction factor of 10,000 to 1,000.

4.7.1.4. Communications System

Arrivals and departures of vessels to and from the SPOT DWP would be directed by the Applicant via communications with arriving and departing vessels.

The Applicant has stated that all moorings and departures by VLCCs or other crude oil carriers to or from the proposed DWP facilities would be carried out at the Applicant's discretion, as set forth in the Applicant's OPSMAN. All vessels nominated and accepted to load at the SPOT DWP would communicate their vessel and cargo information to the SPOT Scheduler as provided in the SPOT Vessel Questionnaire. If the SPOT Vessel Questionnaire is incomplete or not returned to the Applicant at least 15 days prior to the first day of the confirmed laydays and cancelling date (laycan) window for the vessel, then the Applicant may, in its sole discretion, refuse to receive the vessel at the SPOT DWP.

Communications between the SPOT DWP platform and marine traffic, including VLCCs and other crude oil carriers would occur via very high frequency (VHF)-FM marine radios. Prior to arrival or departure, the VLCC master would make a broadcast via VHF radio to warn any vessels in the area that the VLCC would soon arrive or depart. As the VLCC prepares to arrive or exit the proposed SPOT DWP facilities, the VLCC master would evaluate weather conditions and determine the safest procedures and route for arriving or departing. The proposed Project facilities would not be made available to provide bunkers (fuel and diesel oil) or fresh water to moored VLCCs or other crude oil carriers.

Constant monitoring of the marine international hailing and distress channel (CH-16) would be on an exclusive VHF-FM marine radio. Remote handset radios would also be included in the marine radios system for operators on the SPOT DWP platform. Telephone or internet communications between the Applicant and vessels outside of marine VHF range would be conducted via satellite communications directed to MarineSPOT@eprod.com or 713-381-SPOT. Communications would have to be established and maintained between the SPOT personnel and vessel personnel during all moorings and departures to an SPM. A failure in communications may result in a shutdown of vessel loading operations and operation would not be allowed to continue until communications between SPOT DWP and the vessel were reestablished.

Radio communications with the SPOT DWP would be established on the International Calling Frequency when a vessel calling on the SPOT DWP is 20 nautical miles from the boundary of the SPOT DWP safety zone. The vessel traffic controller would assign a working frequency and pass instructions to the vessel.

4.7.2. Navigational Safety Measures

The navigational safety measures within the safety zone, NAA, and the ATBAs discussed below would be incorporated into the OPSMAN with final dimensions and mandatory or recommended restrictions yet to be assessed for safety and security.

Limited access areas, such as safety zones, ATBAs, and NAAs are established with varying degrees of vessel restrictions and notification requirements. Pursuant to the regulations of the DWPA, the USCG is authorized to establish mandatory safety zones around the DWP. In addition to the safety zone, an ATBA could be established at the request of the USCG (on behalf of the U.S. Department of State) to the IMO. As part of the request for ATBA establishment, the USCG would also request that the ATBA be designated an NAA. The intent of the NAA would be to prevent damage to the SPOT DWP and mooring system or damage to the proposed SPOT DWP's equipment from entanglement. The intent of the ATBA would be to discourage vessel traffic, and to help prevent other vessels not associated with the SPOT Project from interfering with the SPOT DWP's operation. However, there is no applicable authority for the creation of an anchorage area on the high seas.

4.7.2.1. Safety Zones

The DWPA requires the establishment of a zone of appropriate size around and including any DWP for the purpose of navigational safety. In such a zone, no installations, structures, or uses are permitted that would be incompatible with the operation of a DWP.

The USCG has promulgated regulations that provide requirements for the establishment and location of, and restrictions within, safety zones, ATBAs, and NAAs around deepwater ports (33 CFR Part 150 Subpart J). These areas are established with the purpose of promoting the safeguarding of life and property, protecting the marine environment, and navigational safety at deepwater ports and in adjacent waters. Safety zone enforcement would fall under the Secretary of Homeland Security (i.e., the USCG as establishing agency). The design and layout of the SPOT DWP, including its proposed safety zone and placement of the SPM buoys meets the requirements of 33 CFR § 150.910 and 33 CFR § 148.5. Per 33 CFR § 148.5, new DWP safety zones are limited to 500 meters around the facility. In addition to the protections established by this safety zone, additional operational risk mitigation measures were identified as part of the Risk Analysis for the SPOT DWP. These mitigations include, but are not limited to:

- Vessel traffic controls;
- Operational weather restrictions;
- Collision/allision avoidance systems;
- Weather forecasting and monitoring technologies; and
- Platform impact protections.

If established, all unauthorized vessels would be prohibited from entering the proposed safety zone at any time. The safety zones associated with the SPOT DWP would not interfere with the use of designated shipping safety fairways or other DWP operations. In accordance with 33 CFR § 150.910, the Applicant would request a safety zone be established around the SPOT DWP and each SPM buoy. The USCG is authorized to establish mandatory safety zones around the DWP, which would have a radius of 500 meters (1,640 feet) extending out from the centroid of the platform. Based on current regulatory practices, the safety zone for each SPM buoy would likely extend 500 meters (1,640 feet) from the buoy itself. In addition to a safety zone, an ATBA could be established at the request of the USCG (on behalf of the U.S. Department of State) to the IMO, as described in Section 4.7.2.2, Areas to be Avoided. Figure 4.7-1 depicts the proposed safety zones around the SPOT DWP and the SPM buoys. In addition to the safety zones around the DWP and SPM buoys, the USCG would also establish a safety zone for the support vessel mooring area. Based on the size of a typical oil tanker and DWP support vessels, as well as the Applicant's proposed mooring design, this safety zone would likely extend 250 meters (820.2 feet).

The safety zone would only be open to entry for VLCCs or other crude oil carriers prepared for connection for loading crude oil, and the necessary service vessels supporting that process. The USCG would regulate activities within the safety zone; however, it would be the Applicant's responsibility to ensure the safety and security of the SPOT DWP, personnel, vessels, and the environment. No security zones are proposed for the SPOT DWP, as the safety zone would be adequate for restricting any operations outside of VLCC or other crude oil carrier activity. The USCG, as well as other state and local law enforcement and emergency response organizations, would provide assistance in the event of a credible security threat to the SPOT DWP.

If approved and constructed, the SPOT DWP would be placed on nautical charts printed by NOAA's Office of Navigation and Charting. Included in the accompanying notes would be an explanation of the safety zone with references to the applicable Federal regulations and Coast Pilot for the geographic region. The NOAA Office of Navigation and Charting reviews charts annually for updates and reprinting. In the interim, NOAA and USCG distribute updates as monthly notices to mariners and weekly local notices to mariners, respectively. Commercial vessels regulated by the USCG must carry the latest version of paper charts, or at least currently corrected copies, and must be the appropriate scale for safe navigation in the areas transited. The NOAA website provides paper charts available for ordering, electronic or "raster" charts available for downloading, and Coast Pilots[4] available for ordering or downloading.

[4] A series of nautical books that cover a variety of information important to navigators of coastal and intracoastal waters and the Great Lakes. Issued in nine volumes, they contain supplemental information that is difficult to portray on a nautical chart.

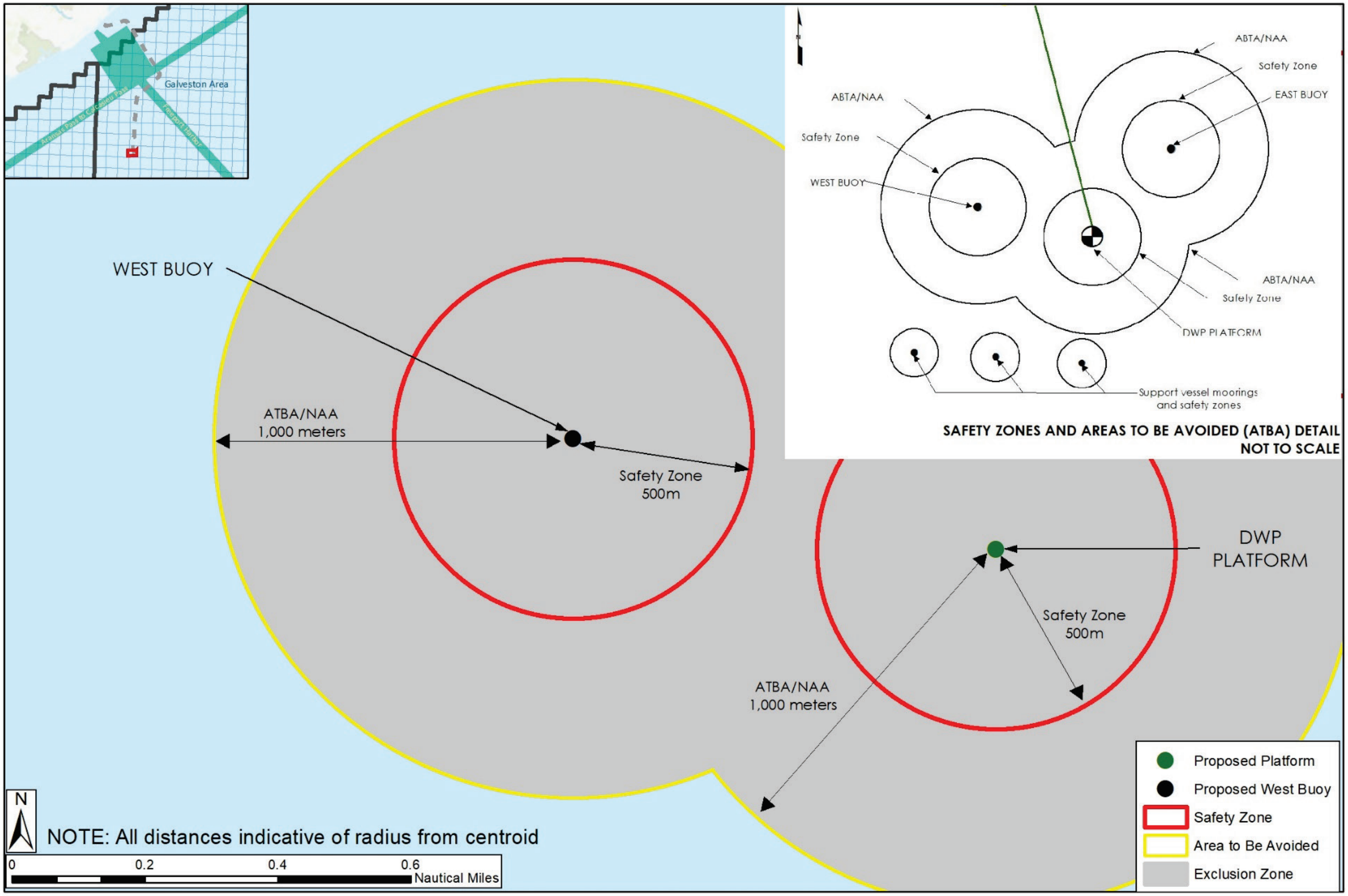


Figure 4.7-1: Depiction of Potential Safety Zones and Areas to be Avoided

4.7.2.2. Areas to be Avoided

In addition to safety zones, the Applicant has also proposed the establishment of an ATBA to further reduce vessel traffic around the SPOT DWP and SPM buoys, and to prevent damage or entanglement of the SPM buoy anchor system and pipelines. The Applicant can propose an ATBA extending 500 meters (1,640 feet) beyond the safety zones of the platform and SPM buoys. The 500 meters (1,640 feet) would allow moored vessels to move with the currents as necessary and to navigate to and from the SPM buoys. Other DWPs have requested that the ATBA be a single, continuous area; the Applicant could request the same for the SPOT DWP. As part of the request for an ATBA establishment, the USCG would also request that the ATBA be designated an NAA.

The ATBA would appear on subsequent editions of local and regional nautical charts. The ATBA is meant to discourage vessel traffic. It would help ensure that other vessels do not interfere with SPOT DWP’s operations, including the maneuvering of the VLCCs and other crude oil carriers and their support vessels.

The sizes, locations, and designations of the proposed safety zones and ATBAs/NAAs have not been fully evaluated by the USCG. Further discussion and determinations on the Project’s proposed navigational safety measures would be conducted prior to licensing and would require both a regulatory amendment and an official notification to the IMO.

4.7.2.3. Designated Anchorage Areas

The Applicant has proposed an anchorage area in Galveston Area lease block A-59 adjacent to the southeast corner of Galveston Area lease block 463, which would contain the SPOT DWP and SPM buoys. The proposed anchorage area and Galveston Area lease block 463 are depicted on Figure 4.7-2. The proposed dedicated anchorage area could be used by VLCCs or other crude oil carriers to wait for access to an SPM buoy or to stand by if they must temporarily disconnect from the SPM buoy. The anchorage area would be 3 square miles and would not contain any Project infrastructure. White lighted buoys would be placed at the northeast, southeast, and southwest corners of the anchorage area. The northwest corner would be marked with a lighted yellow buoy, as described in Section 2.2.8.2, Offshore Facilities, as it is the southeast corner of the lease block containing the SPOT DWP.

In addition to the full lease block anchorage area for VLCCs or other carriers, three dedicated support vessel-mooring buoys for support tugs and vessels would be located in the southwest corner of Galveston Area lease block 463, to the southwest of the platform. The USCG would establish a safety zone for the support vessel mooring area. Based on the size of a typical oil tanker and DWP support vessels, and the Applicant’s proposed mooring design, this safety zone would likely extend 250 meters (820.2 feet) from the imaginary line connecting the three proposed support vessel moorings. The buoys would have markings to meet 33 CFR Part 149, Subpart E and be anchored to the seafloor using a chain and anchor system. The Eighth Coast Guard District is the authority charged with making the determination if mooring buoys can be placed in the water in Galveston Area lease block 463.

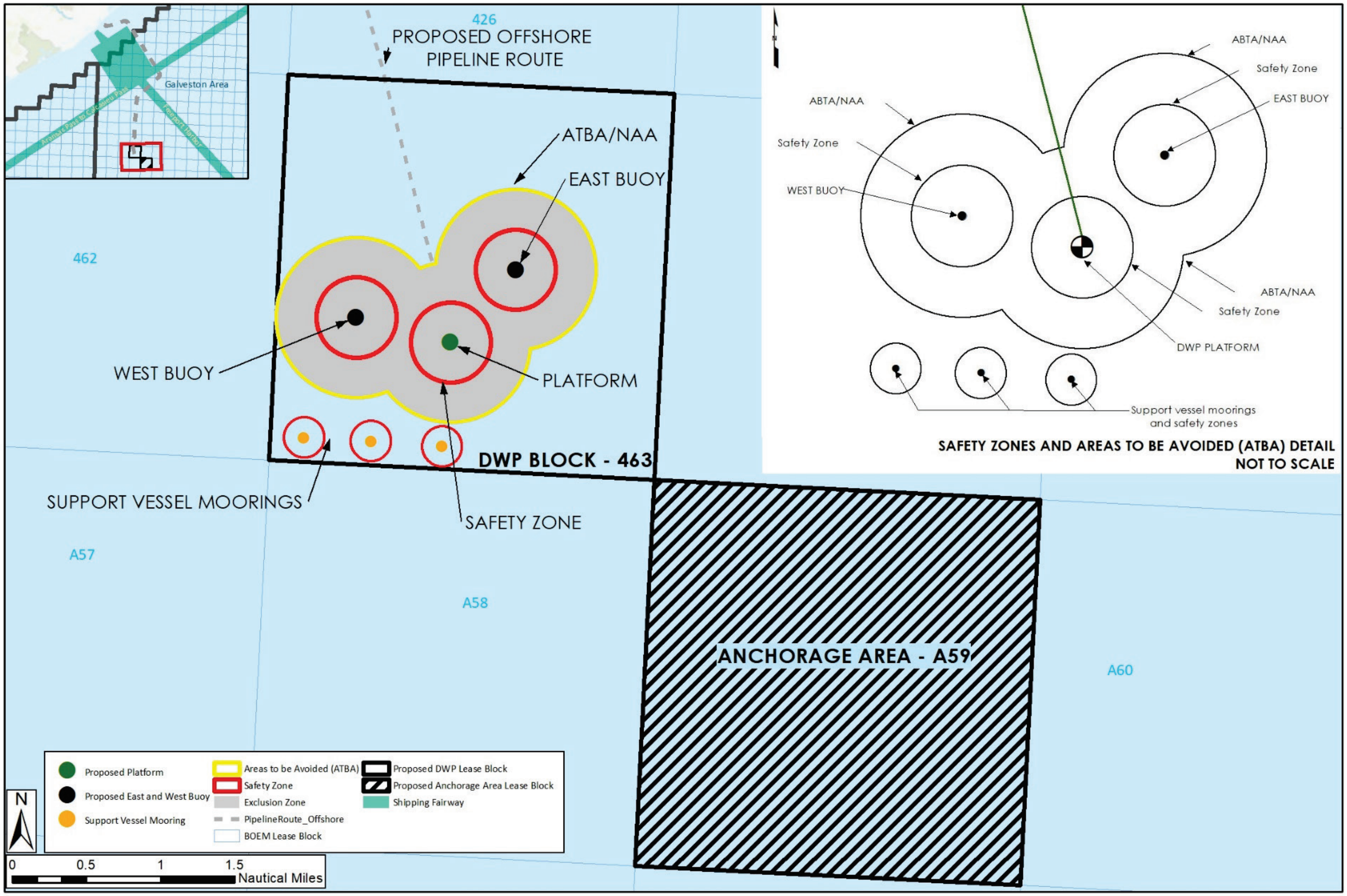


Figure 4.7-2: Approximate Safety Zones with Designated Anchorage Area

4.7.3. Very Large Crude Oil Carrier Support

The Applicant has stated that all arrivals, moorings, and departures by VLCCs or other crude oil carriers would be carried out at the SPOT DWP mooring master's discretion, as set forth in the Applicant's draft OPSMAN. Communication would occur directly between the vessel's crew and the mooring master for all mooring procedures and for scheduling arrival and departure times, according to procedures outlined in the OPSMAN. Dedicated support vessels would provide direct assistance to VLCCs and other crude oil carriers when approaching and departing the SPM buoys.

4.7.3.1. Vessel Safety and Collision

Site-specific ship collision analysis has been conducted for the SPOT DWP (Appendix H, Attachment E, Vessel Trend Analysis). If all vessels transiting in the vicinity of the SPOT DWP follow the 72 COLREGS, also referred to as "Rules of the Road," a majority of vessel-on-vessel collision risks could be mitigated. In the case of a vessel collision, all SPOT personnel and crew must inform the control room of where what happened and who is informing, by using the radio. If the SPOT DWP ultra high frequency radio is not responding, the telephone line to the control room is 713-381-SPOT. After the Applicant is informed of the initial collision incident, they would consult the proper regulatory agency that handles marine emergencies for further instructions.

The Applicant's draft OPSMAN addresses navigational safety concerning vessel safety. When approaching the SPOT DWP, the recommended NOAA charts to follow are 11300 (U.S. Gulf Coast – Galveston to Rio Grande) and 11330 (U.S. Gulf Coast-Mermentau River to Freeport). All vessels would be directed to utilize the proposed designated anchorage areas in Galveston Area lease block A-59 adjacent to the southeast corner of Galveston Area lease block 463 unless directed to moor upon arrival. Vessel routing measures around the SPOT DWP and closest fairway would be coordinated with the USCG and outlined in the OPSMAN.

BSEE requires that vessel collisions that are related to oil and gas exploration and production activities be reported to the agency within scope of 30 CFR § 250.188 (BSEE 2019). Collisions that result in property or equipment damage greater than $25,000 are considered major, while those resulting in damage less than $25,000 are considered minor. A collision is defined by BSEE as a moving vessel (including aircraft) striking another moving vessel, stationary vessel, or object (e.g., a boat striking a drilling rig or platform).

As noted above, BSEE collision statistics are focused on incidents that are related to oil and gas exploration and production activities on the OCS; therefore, the database may not include all vessel collisions and allisions that are not related to offshore oil and gas operations. Vessel collisions reported to BSEE regarding fixed leg platforms between 2013 and 2017 are shown in Table 4.7-1.

Table 4.7-1: Gulf of Mexico Vessel Collisions with Fixed Leg Platforms (2013–2017)

Collisions	2013	2014	2015	2016	2017	2013-2017 Totals
Minor (under $25,000 damage)	3	3	0	2	2	10
Major (over $25,000 damage)	6	7	4	0	6	23
Collision Total per Year	9	10	4	2	8	33

Source: BSEE 2018

BSEE data indicate that from 2013 to 2017 (complete 2018 data not available at the time of preparation of this EIS), there were 33 OCS collisions in the GoM with fixed leg platforms. These collision statistics suggest there is some risk of vessels operating in close proximity to fixed and floating structures on the OCS and that occasional accidents occur.

Mitigation measures to reduce the risk associated with a crude oil release caused by both accidental and intentional scenarios will be proposed and evaluated in a coordinated effort with the Applicant, in consultation with the USCG and local stakeholders, and included in the OPSMAN. For maritime security reasons, this information will not be made public.

4.7.3.2. Mooring

Approaching and departing VLCCs and other crude oil carriers would be under the direction of the SPOT DWP mooring master. The VLCCs or other crude oil carriers would establish communications with the SPOT DWP when the vessel is 20 nautical miles from the safety zone. This would ensure support vessels would be available to assist the VLCCs and other crude oil carriers with arrival and departures. If a license is granted, specific requirements for pilots and support vessels (e.g., tugboats) would be described in the Applicant's OPSMAN. The support vessels would also assist with embarking the mooring master onto the VLCCs or other crude oil carriers. The embarked mooring master, along with the ship's navigation crew, would maintain visual lookout and use visual cues to assist with the approach and departure from the SPM buoy. The anticipated safest trade carrier route to the SPM buoy is shown on Figure 4.7-3.

The OPSMAN would specify minimum visibility, maximum wave height, maximum winds, currents, or any combination of these conditions, and wind states and other environmental criteria that would need to be met for vessels to arrive at and depart from the SPOT DWP. No mooring would be carried out during extreme weather conditions. Section 4.7.3.3, Extreme Weather, contains more information on the weather criteria and operational limits for mooring at the SPOT DWP.

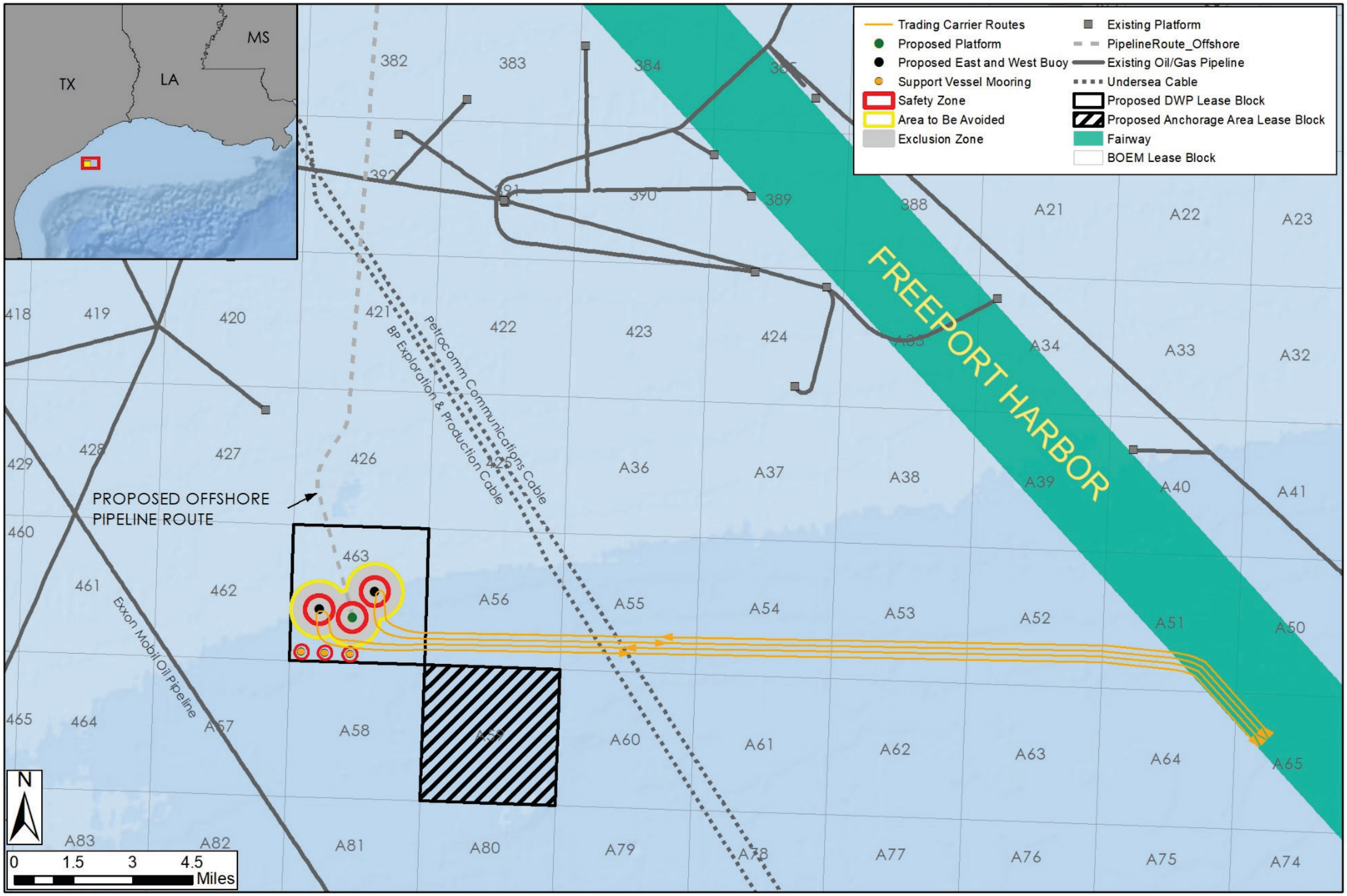


Figure 4.7-3: Anticipated Trade Carrier Routes to SPM Buoy

4.7.3.3. Extreme Weather

The Applicant would install a weather monitoring system on the platform that would monitor and transmit current and predicted weather forecasts and data, including wind speed and direction, precipitation, relative humidity, temperature, and other critical information to helicopters and vessels operating in the area and to crane operators and support vessels associated with the SPOT DWP. The Applicant would assign dedicated personnel to regularly monitor official forecasts from the National Weather Service and the National Hurricane Center. The Applicant would also subscribe to professional meteorology consulting firms that specialize in providing weather forecast information to the offshore oil and gas industry. Table 4.7-2 shows the Applicant's maximum allowed weather criteria for operations at the SPOT DWP.

Table 4.7-2: Proposed Weather Criteria and Operational Limits for SPOT DWP

Criteria	Operational Limit Specification
Current Speed	< 1.51 ft/s
Wave Period	< 8.7 seconds
Visibility	> 1 mile
Wave Height	< 9.9 feet
Wind Speed	< 28 knots

Source: SPOT 2019t

DWP = deepwater port; ft/s = feet per second; SPOT = Sea Port Oil Terminal

The VLCCs or other crude oil carriers would also monitor current and forecasted weather conditions through each vessel's equipment, as well as National Weather Service internet and VHF voice broadcasts of marine conditions, real-time weather satellite imagery via internet, and mass media weather broadcasts available by satellite on each vessel's audio/visual system.

When wind, wave, and ocean current conditions are predicted to exceed the thresholds for mooring, the VLCCs or other crude oil carriers would disconnect from the SPM buoys and proceed to the anchorage area or other location to wait out or avoid the hazardous weather. No VLCCs or other crude oil carrier would be present at the SPOT DWP during extreme weather events, tropical storms, or hurricanes.

At the first sign of hazardous weather, the port superintendent or mooring master would determine the needs and plans for storm evasion and safely and quickly complete an evacuation to avoid the storm. Hurricane season in the GoM is generally between June 1 and November 30. In the event of an approaching tropical storm or hurricane, the Applicant would follow the OPSMAN guidelines. When feasible, the Applicant would issue a 72-hour notice and incoming vessels would not be allowed to moor. Already moored vessels would complete loading operations at the Applicant's sole discretion, allowing time for disconnection and departure of the VLCC or other crude oil carrier. If the SPOT DWP becomes threatened by a tropical storm or hurricane, a complete shutdown and evacuation of the SPOT DWP may be ordered by EPO prior to tropical storm force winds.

4.8. OFFSHORE PIPELINE SAFETY

The proposed pipelines in Galveston Area lease block 463 are subject to the pipeline safety laws and regulations administered by the PHMSA, Office of Pipeline Safety (49 CFR Parts 190-199), including safety standards for design, construction, testing, operation, maintenance, and reporting. Pipe wall thickness, shutoff valve spacing, external pipe protective coating, cathodic protection, underground clearance, and depth of cover would comply with the pipeline safety regulations. Inspection of pipeline welds, materials and external protective pipe coating and hydrostatic testing would be performed prior to placing the pipelines in service. The Applicant would periodically inspect the pipelines to ensure protection from any changes in operating and maintenance conditions including inspection of pipeline after significant events (e.g., earthquakes or hurricanes). The proposed pipeline components would be designed to accommodate in-line inspection tools (smart pigs) for integrity inspections. Smart pigs have a variety of sensors (e.g., magnetic and ultrasound) to measure the wall thickness of the pipe around the circumference as it travels internally. The use of smart pigs would provide a reliable record of changes in pipeline conditions to ensure that pipeline integrity is maintained. The frequency of pipeline inspection by pigging and other surveillance measures to confirm integrity would meet or exceed the requirements of all applicable regulations and guidelines. Regulations require an OPSMAN that includes a discussion of operation, maintenance, and emergency activities, that is in compliance with the following:

- Training and qualifications of unsupervised employees and contractor personnel to operate and maintain the pipeline system would be in accordance with all applicable regulations and guidance;
- Operating procedures would address routine and emergency tasks;
- Periodic in-house training classes would be required for operation and maintenance personnel to maintain qualifications, refresh their understanding of abnormal operating conditions, and review safety, maintenance, operation, and emergency procedures;
- Annual testing and inspection of pressure-limiting devices and emergency shutdown systems would be conducted;
- Patrolling pipeline routes would be conducted at specified time intervals in accordance with the applicable regulations and guidance;
- Measures to ensure that corrosion would be controlled to prevent pipeline leakage and failure; and
- Measures to ensure that pipeline integrity would be managed to protect public safety and the environment.

4.8.1. Offshore Pipeline Safety Standards

Offshore pipelines must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards under the PHMSA. The regulations are intended to ensure adequate protection for the public and to prevent crude oil facility accidents and failures. The regulations also specify material selection and qualification; integrity management; operator qualification; and pipeline protection from internal, external, and atmospheric corrosion. BOEM, through delegation from the Secretary of the Interior, has authority to promulgate and enforce regulations for the promotion of safe operations, to protect the environment and conserve natural resources of the OCS, including pipeline transportation of mineral production, and to approve rights-of-way for the construction of pipelines and associated facilities on the OCS. Proposed offshore pipelines affecting a fairway or anchorage area must be covered by a right-of-way permit obtained from BOEM. If the Project is approved, the USCG is responsible for the overall review and approval of the port components, construction, and operation. The USCG would coordinate with the PHMSA, BOEM/BSEE, and others as needed for their technical authorities and approval responsibilities.

4.8.2. Offshore Pipeline Incident Data

The data in Table 4.8-1 represent crude oil offshore pipeline incident summary reported by PHMSA under the criteria of 49 CFR § 195.50 (PHMSA 2019b). Table 4.8-1 is specific to offshore pipeline incidents that do not include refined petroleum products obtained by distillation and processing.

Table 4.8-1: Crude Oil Offshore Pipeline Incident Summary

Cause	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018
Corrosion, External	0	2	0	0	1	1	2	1	0	0	0
Corrosion, Internal	0	0	0	0	0	0	0	1	0	0	0
Excavation Damage	0	0	0	1	0	0	0	0	0	0	0
Incorrect Operation	0	2	1	0	0	0	0	0	0	1	0
Construction/Material Failure	1	1	2	1	1	0	0	1	0	1	3
Damage by Natural Force	5	1	1	0	0	0	0	1	0	1	0
Damage by Outside Force	0	0	0	0	1	0	0	0	0	0	0
Other Causes	1	0	0	1	0	0	1	0	0	0	0
Total	**7**	**6**	**4**	**3**	**3**	**1**	**3**	**4**	**0**	**3**	**3**

Source: PHMSA 2019b

Crude oil offshore pipelines are most susceptible to damages by natural force and construction/material failures. The construction/material failure incidents are normally related to pumps or non-threaded connection failures, which can be reduced through fabrication/construction quality control, asset integrity programs for pumps, and by minimizing the use of non-threaded connections.

4.8.3. Offshore Hazards from Outside Forces

Damage from outside forces poses the greatest threat to pipeline safety. BOEM and PHMSA require subsea pipelines to be constructed and operated with specifications that minimize these outside forces, which are outlined in 49 CFR § 192.317. It is unlikely that subsea pipelines would pose a major hazard to public safety or crude oil supply reliability. The Applicant proposes no extraordinary measures beyond regular inspections and maintenance of the proposed offshore pipelines.

Anchor hooking of a pipeline could displace the pipeline to a point where it distorts and structurally fails, and could possibly puncture the line, leading to a crude oil spill. The worst credible case for an offshore pipeline rupture would result in the loss of all crude oil within the largest isolatable section of the offshore pipelines. Crude oil has a substantial impact on the environment. The impact of the WCD scenario is specified in Section 4.6.3, Potential Impacts from Oil Spills Onshore and Offshore. The volume of a release would be determined by the release rate and time to isolation of the inventory. As soon as an isolatable section has been isolated or shut-in, it would begin to depressurize, decreasing the release rate until the entire volume of the isolatable section has been released. Therefore, a larger hole size would result in the release of any number of barrels of crude oil faster than a smaller hole size. The maximum potential volume that could be released would be the same, regardless of the size of the hole.

Collisions between the VLCCs or other crude oil carriers and the SPOT DWP or SPM buoys could also occur; however, the safety zones, ATBAs, and implementation of practices within the OPSMAN would minimize the risk of collisions. The Applicant modeled a WCD scenario in Galveston Area lease block 463 2 to 3 meters (6.6 to 9.8 feet) below the water surface with a potential 70,980-gallon diesel spill from a VLCC collision (SPOT 2019c). This amount of diesel fuel represents a total loss of all the fuel carried on a VLCC or platform. Diesel tends to evaporate quickly due to it being light, which limits the amount of surface oiling. This results in a maximum surface oil concentration of 50 to 100 g/m^2 (transitional dark appearance) (SPOT 2019c). The surface oil was primarily less than 5 g/m^2 and only spread within 35 kilometers (21.7 miles) northwest of the release location. No wetlands were affected by the WCD scenario of a diesel spill and the shoreline affected was contaminated by more than 1 g/m^2 of oil and was all artificial shoreline along Galveston Island.

4.9. Reliability and Safety of Onshore Facilities and Pipelines

The transportation of crude oil by pipeline involves some incremental risk to the public due to the potential for accidental release of crude oil. The greatest hazard is contamination of the environment following an oil spill and/or a major pipeline rupture. Crude oil is a dark, oily liquid that is toxic if inhaled, ingested, or if it comes into contact with skin. Inhaling fumes from crude oil can cause difficulty in breathing, headaches, and dizziness. Ingesting crude oil can cause an upset stomach, vomiting, and diarrhea. Contact of crude oil with the skin or eyes can cause irritation, swelling, and burning. Crude oil is a highly flammable liquid and the vapors may create a concentration within an enclosed space in the presence of an ignition source that can explode (National Library of Medicine 2019). The USCG acknowledges that some of the below discussion refers to third-party damage and pipeline-specific circumstances that do not apply directly to the proposed Project; however, the USCG is including comprehensive information to better address all safety-related comments received for this Project, and for the public’s benefit.

4.9.1. Safety Standards

Under Title 49, U.S.C. Chapter 601, the DOT is mandated to prescribe minimum safety standards to protect against risks posed by pipeline facilities. The DOT pipeline standards are published in 49 CFR Parts 190–199. The DOT’s PHMSA administers the national regulatory program to ensure the safe transportation of hazardous materials, including crude oil, by pipeline. It develops safety regulations and other approaches to risk management that ensure safety in the design, construction, testing, operation, maintenance, and emergency response of pipeline facilities. Many of the regulations are written as performance standards that set the level of safety to be attained, and that allow the pipeline operator to use various technologies to achieve safety. PHMSA’s safety mission is to ensure that people and the environment are protected from the risk of pipeline incidents. This work is shared with state agency partners and others at the Federal, state, and local level. Title 49, U.S.C. Chapter 601 requires a state agency to assume all aspects of the safety program for intrastate facilities by adopting and enforcing the

Federal standards. A state may also act as DOT's agent to inspect interstate facilities within its boundaries; however, the DOT is responsible for enforcement actions.

For the proposed Project, the State of Texas' delegated authority to inspect interstate pipeline facilities is the RRC. The RRC is responsible for the safety standards used in the transportation of hazardous liquids, including crude oil, and works in compliance with Federal and state regulations. To construct and operate a pipeline, an Applicant must certify that it has been granted a waiver of the requirements of the safety standards by the DOT in accordance with Texas Administration Code Title 16 Chapter 8, Federal Energy Regulatory Commission (FERC) regulations, and the Hazardous Liquid Pipeline Safety Act of 1979.

FERC is responsible for regulating rates and practices of oil pipeline companies engaged in interstate transportation, establishing equal service conditions to provide shippers with equal access to pipeline transportation, and establishing reasonable rates for transporting petroleum and petroleum products by pipeline. FERC is also a member of the DOT's Technical Pipeline Safety Standards Committee, which determines if proposed safety regulations are reasonable, feasible, and practicable. Once oil projects become operational, safety is regulated, monitored, and enforced by the DOT. FERC has no jurisdiction over construction or maintenance of production wells, oil pipelines, refineries, or storage facilities. The USEPA has jurisdiction over oil spills.

The pipeline and aboveground facilities associated with the Project must be designed, constructed, operated, and maintained in accordance with the DOT Minimum Federal Safety Standards in 49 CFR Part 195. The regulations are intended to ensure adequate protection for the public and to prevent hazardous liquid facility accidents and failures. The DOT specifies material selection and qualification; minimum design requirements; and protection from internal, external, and atmospheric corrosion.

Title 49 CFR § 195.452 specifically explains the management of pipeline integrity for hazardous liquid pipelines that could affect an HCA. This includes any pipeline located in a high consequence area unless the operator can definitively show by risk assessment that the pipeline could not affect the area. DOT-defined HCAs are present in the vicinity of the proposed onshore facilities and pipeline rights-of-way and further discussed in Section 4.9.1.3, High Consequence Areas near Onshore Facilities and Pipeline. Covered pipelines are categorized as Category 1, 2, or 3. The pipelines constructed by the Applicant would fall under Category 3- pipelines that are constructed or converted after May 29, 2001. In order to manage the integrity of the pipeline the operator must follow the regulations and guidelines set forth under 49 CFR § 195.452. This section addresses guidelines on the integrity management program that is set by the operator of the pipeline, including but not limited to safety assessments of pipeline segments, high consequence areas, and what actions an operator must take to address any pipeline integrity issues.

Further, 49 CFR § 195.100–195.134 specifically addresses design criteria for compressor stations, including emergency shutdowns and safety equipment. It requires a pipeline operator to establish a written emergency plan that includes procedures to minimize hazards in an emergency. The operator must also establish a continuing education program to enable the public, government officials, and others to recognize an emergency at the facility and report it to appropriate public officials. The Applicant would provide the appropriate training to local emergency service personnel before the new facilities are placed in service.

The DOT prescribes the minimum standards for operating and maintaining pipeline facilities, including the requirement to establish a written plan governing these activities. Each pipeline operator is required to establish an emergency plan that includes procedures to minimize the hazards of a hazardous liquid pipeline emergency. Key elements of the plan include procedures for:

- Emergency system shutdown and safe restoration of service;
- Receiving, identifying, and classifying emergency events, gas leakage, fires, explosions, and natural disasters;
- Establishing and maintaining communications with local fire, police, and public officials, and coordinating emergency response;
- Making personnel, equipment, tools, and materials available at the scene of an emergency; and
- Protecting people first and then property and making them safe from actual or potential hazards.

The DOT requires that each operator establish and maintain liaison with appropriate fire, police, and public officials to learn the resources and responsibilities of each organization that may respond to a hazardous liquid pipeline emergency, and to coordinate mutual assistance.

HCAs are defined in 49 CFR Part 195, Subpart F for pipeline integrity management. An HCA is defined as a high population area (HPA), other populated area, commercially navigable waterway (CNW), or Unusually Sensitive Area, including a sole-source drinking water supply (see Chapter 3, Environmental Analysis of the Proposed Action, for a discussion of impacts on Unusually Sensitive Areas.

4.9.1.1. High Population Areas and Other Populated Areas

In the event of a spill, the effects on populated areas would depend on the size of the spill and the size of the population in the affected area. For this reason, populated areas are divided into two categories by the DOT: HPAs and other populated areas. HPAs contain 50,000 or more people and have a population density of at least 1,000 people per square mile. These areas are defined and delineated by the Census Bureau as urbanized areas. Other populated areas contain concentrations of people and include incorporated or unincorporated cities, towns, villages, or other designated residential or commercial areas, with population densities less than 1,000 people per square mile. The population data used in this report have been updated to include the results of the 2010 Census. The figures in Section 4.9.1.3, High Consequence Areas near Onshore Facilities and Pipeline, show the HPA throughout the onshore portion of the SPOT DWP platform.

Long-term exposure effects of crude oil have not been researched as rigorously as exposure to the discreet constituents of crude oil. Most research indicates that the long-term effects of exposure to crude oil would be similar to the long-term effects of the chemicals that make up crude oil including, but not limited to, benzene, toluene, ethylbenzene, xylene, H_2S, and PAHs (CDC 2010). Similar to short-term effects, exposure to these chemicals can occur through ingestion, inhalation of vapors, dermal exposure, and ocular exposure. According to the Centers for Disease Control and Prevention (CDC 2010), the long-term exposure effects due to each of the chemicals listed above are as follows:

- Benzene is a known carcinogen and long-term exposure can adversely affect bone marrow and cause anemia, leukemia, and possibly death.
- Long-term exposure to toluene may affect the nervous system or kidneys.
- Long-term exposure to ethylbenzene has been observed in animal studies to cause damage to the kidneys, inner ear, and hearing.
- Long-term exposure to xylene may cause impaired reaction time, impaired concentration and memory, and changes in the liver and kidneys.
- Long-term exposure to H_2S may cause permanent or long-term effects including headaches, impaired attention span, impaired memory, or impaired motor function.
- Symptoms of long-term exposure to PAHs may include chronic bronchitis, chronic cough irritation, bronchogenic cancer, and dermatitis.

These constituents are more toxic but present in lower percentages compared to other constituents, such as petroleum products in gasoline. Crude oils contain a high percentage of heavier hydrocarbons, which do not pose substantial toxicological threats but raise concerns that are more aesthetic in nature. Although there is the potential for long-term exposure by the public, long-term exposure effects would likely only be seen in people who were directly interacting with crude oil for multiple hours a day for an extensive period of time (i.e., spill cleanup professionals). These individuals should be trained in appropriate personal protective equipment for the task, exposure limits, work/rest schedule, and other ways to minimize the risk of crude oil interaction.

A human health risk could result from the inhalation of elevated levels of H_2S emitted into the air in the vicinity of an oil spill. Human health effects of exposure to H_2S, an irritant and an asphyxiant, depend on the concentration of the gas and the length of exposure. Background ambient levels of H_2S in urban areas range from 0.11 to 0.33 ppb, while in undeveloped areas concentrations can be as low as 0.02 to 0.07 ppb (Skrtic 2006). Olfactory perception of H_2S occurs for most people at concentrations in the air ranging from 0.005 to 0.3 parts per million (ATSDR 2016).

Professionals such as first responders or others that may be at the spill site are at the greatest risk of exposure to H_2S within the first 4 minutes of a spill. The level of H_2S decreases to non-toxic levels after that assuming there is no further release of oil. However, H_2S concentrations can pose a health risk to those in the immediate area of the oil release during an ongoing release or source (ATSDR 2016).

In the event of a pipeline spill, the Applicant has identified and prepared written procedures to address a response action. These activities are provided in the Applicant's Onshore Construction Spill Response Plan (Appendix F).

4.9.1.2. Commercially Navigable Waterways

CNWs are waterways where a substantial likelihood of commercial navigation exists (19 CFR § 195.452). These waterways are included as HCAs because they are a major means of commercial transportation, are critical to interstate and foreign commerce, supply vital resources to many U.S. communities, and are part of a national defense system.

The proposed SPOT DWP onshore pipeline connects or is near many CNWs. Two of the main waterways are the Bastrop Bayou and GIWW. The proposed SPOT pipeline route is shown on Figure 4.9-1 with the corresponding waterways. Bastrop Bayou is an HCA due to the effect of a pipeline oil spill would have on the environment, which is discussed in detail in Chapter 3, Environmental Analysis of the Proposed Action. The main impact from a spill from the onshore pipeline would be on waterway traffic and shipping/transport. The GIWW is the main route for barges and other deep-draft vessel transportation routes. If it were affected by a pipeline spill, a majority of the traffic would have to be stopped or routed to a different area. This would affect any industry involved with the waterway traffic and the potential loss could affect certain businesses.

Figure 4.9-1: High Consequence Areas Along Proposed Onshore Pipeline

4.9.1.3. High Consequence Areas near Onshore Facilities and Pipeline

This section identifies and summarizes HCAs within a 1-kilometer (0.6-mile) buffer zone from the onshore pipeline. The 1-kilometer (0.6-mile) buffer zone was chosen to represent areas that could be affected by a release from the proposed onshore pipeline. These HCA data are compiled from a variety of data sources, including Federal and state agencies such as PHMSA and TCEQ.

Unusually sensitive areas (USAs) located along the proposed pipeline are shown on Figure 4.9-2 and Figure 4.9-3. These USAs include drinking water sources and particularly sensitive ecological communities.

Figure 4.9-3 presents HPAs, other populated areas, and CNWs that are located within the 1-kilometer (0.6-mile) buffer zone of the pipeline. Table 4.9-1 and Table 4.9-2 tabulate the identified HPAs and other populated areas, respectively, and show the length of pipeline crossing each HCA. The mileage of pipeline along HPAs is 16.4 miles and 27.3 miles along other populated areas, totaling 43.7 miles along PHMSA-defined populated areas. Table 4.9-3 shows the two CNWs that could be potentially affected by a pipeline spill. All HPA, other populated area, and CNW data are obtained from the publicly available online PHMSA database.

Table 4.9-1: Mileage of High Population Areas Along Proposed Onshore Pipeline

High Population Areas	Miles of Pipeline
Houston	13.6
Lake Jackson-Angleton	2.8
Total	**16.4**

Table 4.9-2: Mileage of Other Populated Areas Along Proposed Onshore Pipeline

Other Populated Areas	Miles of Pipeline
Alvin City	3.2
Angleton City	1.5
Brookside Village City	0.7
Clute City	1.4
Freeport City	0.4
Houston City	2.3
Iowa Colony Village	4.3
Manvel City	8.8
Oyster Creek City	2.4
Pearland City	1.2
Richwood City	0.9
Surfside Beach City	0.2
Total	**27.3**

Table 4.9-3: Mileage of Commercially Navigable Waterways Along Proposed Onshore Pipeline

Commercially Navigable Waterways	Miles of Pipeline
Gulf Intracoastal Waterway	0.2
Bastrop Bayou	0.1
Total	**0.3**

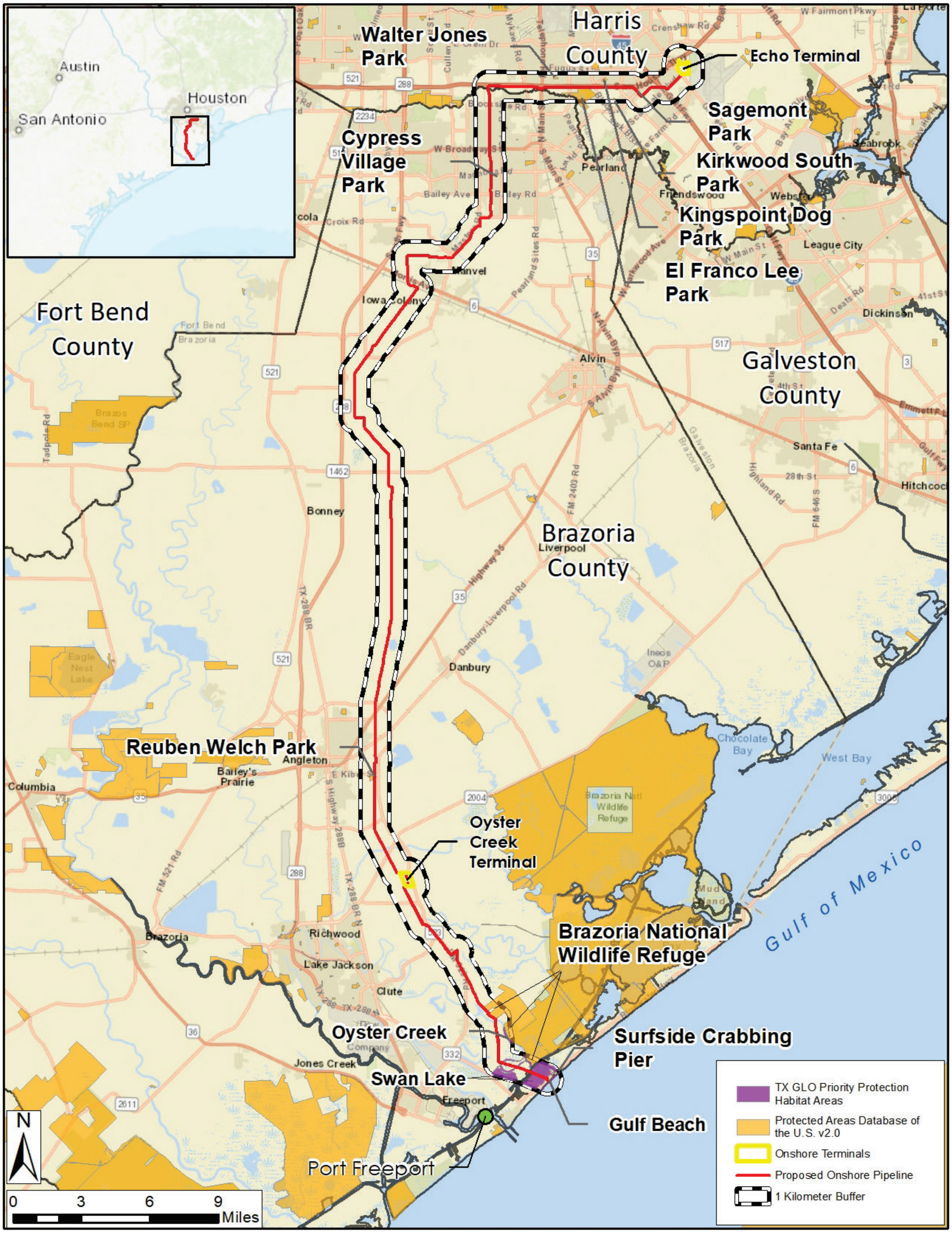
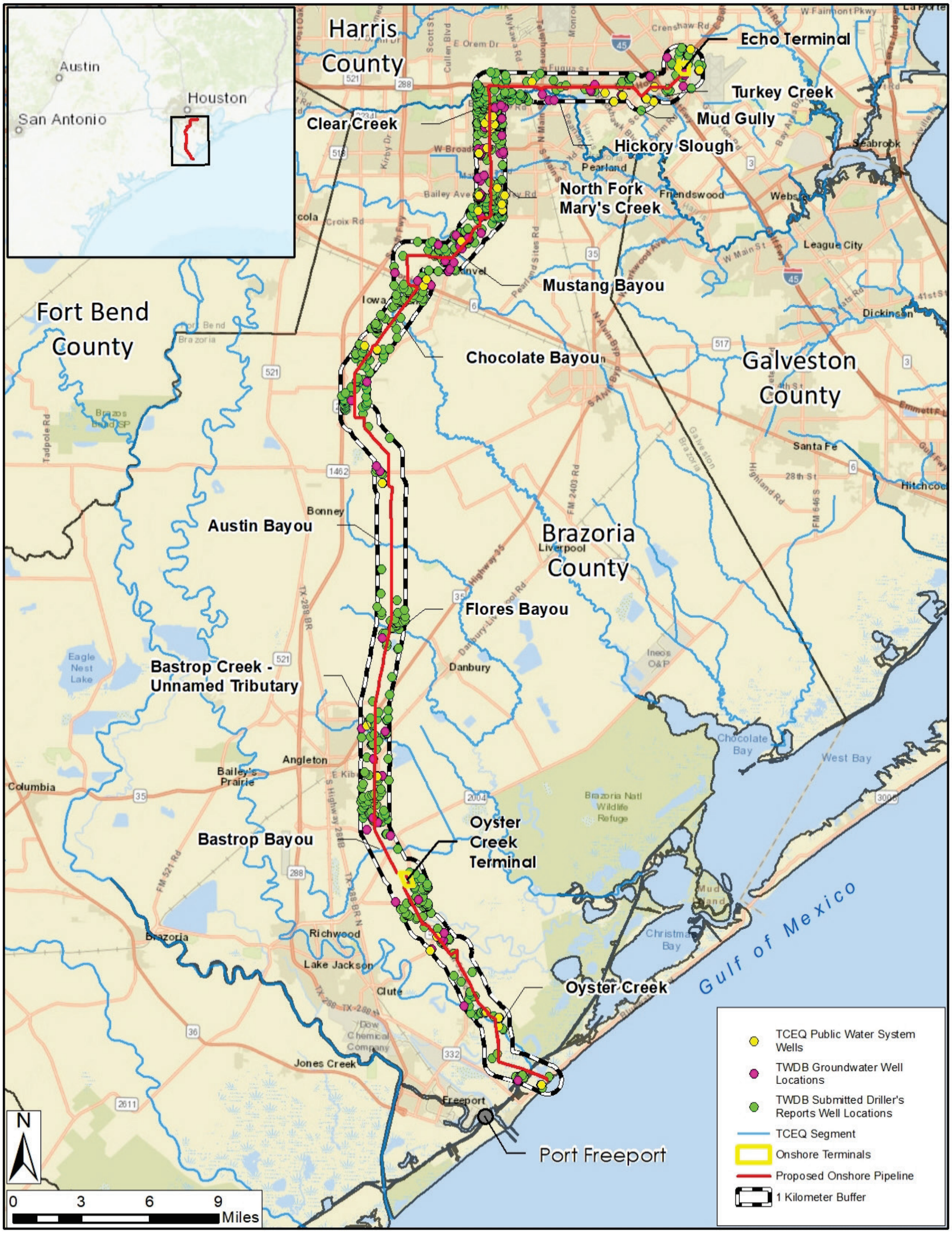


Figure 4.9-2: Protected High Consequence Areas Along Proposed Onshore Pipeline



TCEQ = Texas Commission on Environmental Quality; TWDB = Texas Water Development Board

Figure 4.9-3: Public Water System High Consequence Areas Along Proposed Onshore Pipeline

Table 4.9-4 identifies the miles of pipeline located along protected areas which were obtained from the TCEQ database. Table 4.9-5 shows the miles of pipeline located along priority habitat protection areas identified by the GLO. Table 4.9-6 presents the miles of pipeline located along USAs that have been identified by the USGS Gap Analysis Project and stored in the Protected Areas Database of the United States. A total of 23.2 miles of pipeline cross USAs.

Table 4.9-4: Mileage of Protected Areas Along Proposed Onshore Pipeline

Protected Areas	**Miles of Pipeline**
Brazoria National Wildlife Refuge	2.6
Cypress Village Park	0.1
El Franco Lee Park	1.5
Kingspoint Dog Park	0.2
Kirkwood South Park	0.1
Rueben Welch Park	0.3
Sagemont Park	0.2
Surfside Crabbing Pier	0.1
Walter Jones Park	0.2
Total	**5.3**

Table 4.9-5: Mileage of Priority Habitat Protection Areas Along Proposed Onshore Pipeline

Priority Habitat Protection Areas	**Miles of Pipeline**
Swan Lake	2.0
Oyster Creek	2.1
Gulf Beach	0.1
Total	**4.2**

Table 4.9-6: Mileage of Unusually Sensitive Areas Along Proposed Onshore Pipeline

Unusually Sensitive Areas	**Miles of Pipeline**
Austin Bayou Above Tidal	0.2
Bastrop Bayou Tidal	0.1
Chocolate Bayou Above Tidal	1.8
Clear Creek Above Tidal	3.9
Flores Bayou	0.3
Hickory Slough	0.7
Mary’s Creek	0.4
Mud Gully	0.1
Mustang Bayou	0.7
Oyster Creek Tidal	3.5
Turkey Creek	1.1
Unnamed Tributary of Bastrop Creek	0.9
Total	**13.7**

A number of wells are located within the 1-kilometer (0.6-mile) pipeline buffer zone around the proposed centerline, as shown on Figure 4.9-3. Included in this figure are public water systems, groundwater wells, and wells from the Submitted Driller’s Report Database (SDRDB).

Table 4.9-7 shows the number of public water system wells from the TCEQ database located within the pipeline buffer zone, grouped by public water system. Table 4.9-8 summarizes the groundwater wells identified by the Texas Water Development Board located within the pipeline buffer zone, grouped by the intended use of the well. Table 4.9-9 also shows SDRDB wells located along the pipeline, also grouped by the intended use of the well. A total of 710 active wells reside in the path of the proposed onshore pipeline.

Table 4.9-7: Count of Public Water System Wells in Proposed Onshore Pipeline Buffer Zone

Public Water System Name	Number of Wells within Pipeline Buffer Zone
Almeda Water Well Service	1
Angle Acres Water System	2
Bayou Colony Subdivision	1
Bill Holley Centre	1
Brazoria County Mud 55	1
BW Grayson Business Park	1
City Of Angleton	1
City Of Houston	4
City Of Pearland	1
Clear Brook City Mud	2
Comcast - Old Galveston Road	1
Commodore Cove Improvement District	3
Cooter Browns Place	1
Dow Salt Dome 1	1
Dow Texas Freeport Salt Dome 9	1
Flora 7	1
Frontier Water	1
Hey Bobs	1
Johns Countryette	1
Kirkmont Mud	1
La Morena Flea Market	1
Manvel Bible Chapel	1
Manvel High School	1
Meadowlark Subdivision	2
Oyster Creek Estates	3
Raintree Estates	2
Robin Cove Water Subdivision	2
Sagemeadow Utility District	1
Sandy Meadow Estates Subdivision	3
Sharondale Subdivision	1
Suburban Garden Trailer Park	3
Turtle Cove Lot Owners Association	2
Village Of Surfside Beach	3
Total	**52**

Table 4.9-8: Count of Groundwater Wells in Proposed Onshore Pipeline Buffer Zone

Groundwater Well Usage	Number of Wells in Pipeline Buffer Zone
Public Supply	47
Domestic	11
Industrial	10
Irrigation	8
Other	2
Total	**78**

Table 4.9-9: Count of SDRDB Wells located in Proposed Onshore Pipeline Buffer Zone

SDRDB Well Usage	Number of Wells in Pipeline Buffer Zone
Domestic	413
Monitor	184
Environmental Soil Boring	37
Industrial	22
Public Supply	13
Irrigation	13
Stock	11
Rig Supply	8
Other	7
Test Well	2
Total	**710**

4.9.2. Pipeline Accident Data

An accident report is required for each failure in a pipeline system in which there is a release of a hazardous liquid or transportation of carbon dioxide resulting in accidents defined in 49 CFR § 195.50(b). PHMSA requires all operators of crude oil transmission pipelines to notify PHMSA of any significant incident and to submit a report within 30 days. Significant incidents are defined as any release of hazardous liquid that:

- Caused a death or personal injury requiring hospitalization; or
- Caused an estimated property damage of more than $50,000.

During a 10-year period from 2009 to 2018, 643 significant incidents were reported on crude oil transmission pipelines nationwide. Additional insight on the service incidents by cause may be found in Table 4.9-10.

The most likely cause of a significant incident involving crude oil is corrosion. Corrosion incidents are time-dependent due to stress/strain on the pipeline over a period of time. Newer pipelines are coated with a fusion-bonded epoxy, which helps reduce corrosion. The SPOT DWP platform would be more susceptible to a material, weld, or equipment failure incident instead of a corrosion incident because these have a higher rate of occurrence than corrosion in new pipelines.

Table 4.9-11 provides additional data on excavation, natural forces, and other outside force damage.

Table 4.9-10: Crude Oil Pipeline Significant Incidents by Cause (2009–2018)

Cause	Number of Incidents[a]	Percentage
Material, Weld, or Equipment Failure	203	32%
Corrosion	224	35%
Excavation	53	8%
Natural Forces[b]	38	6%
Outside Forces[c]	21	3%
Incorrect Operation	84	13%
All Other Causes[d]	20	3%
Total	**643**	**100%**

Notes:
[a] All data were gathered from the Oracle BI Interactive Dashboard website for Significant Pipeline Incidents (PHMSA 2019a).
[b] Natural force damage includes heavy rains/foods, earth movement, high winds, lightning, temperature, landslides, mudslides, and other natural force damage.
[c] Outside force damage includes electrical arcing from other equipment, fire/explosion, intentional damage, maritime equipment or vessel drift, vehicle not engaged in excavation, and other outside force damages.
[d] All other causes include miscellaneous, unspecified, or unknown causes.

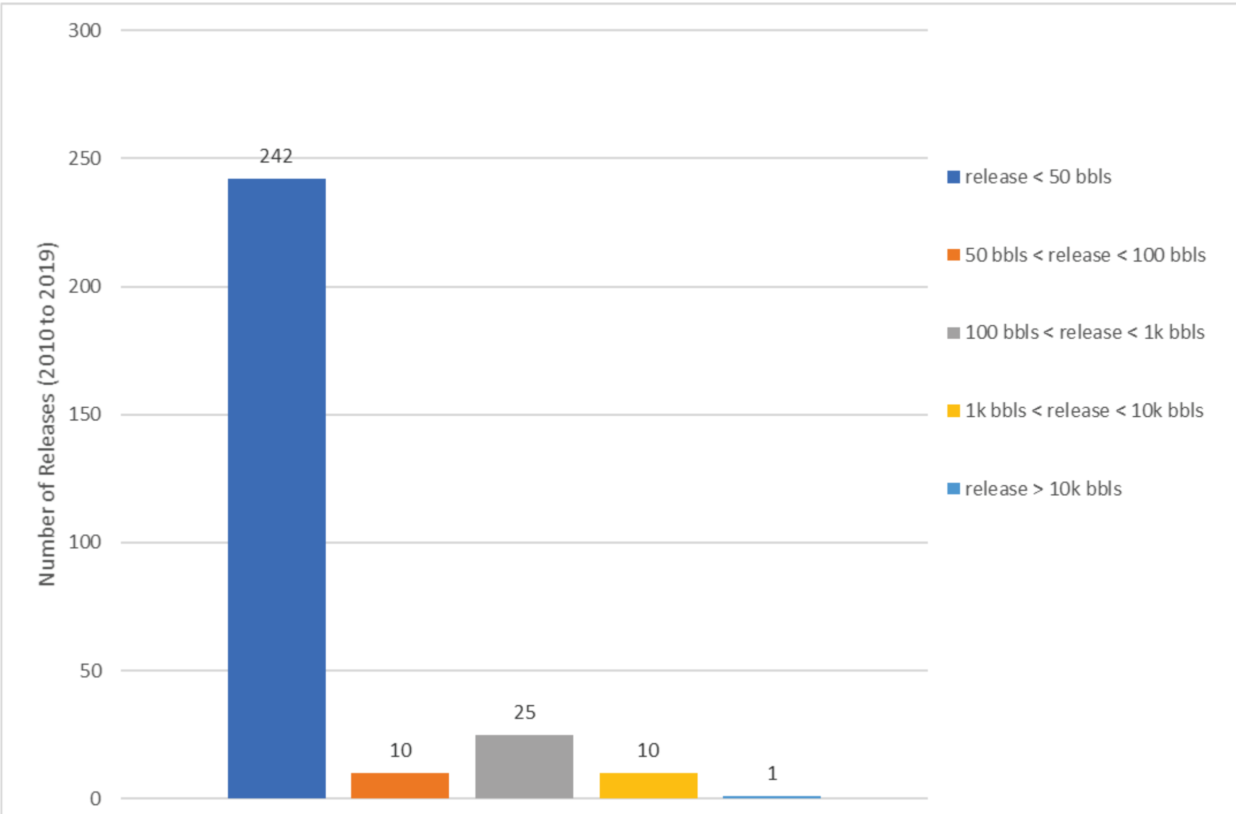
Table 4.9-11: Excavation, Natural Forces, and Outside Force Incidents by Cause (2009–2018)

Cause	Number of Excavation, Natural Forces, and Outside Force Incidents[a]	Percentage of all Incidents[b]
Third-party excavation damage	43	7%
Heavy rain, floods, mudslides, landslides	23	4%
Vehicle (not engaged with excavation)	13	2%
Earth movement, earthquakes, subsidence	5	1%
Lightning, temperature, high winds	46	7%
Operator/contractor excavation damage	25	4%
Unspecified excavation damage/previous damage	3	0%
Other or unspecified natural forces	2	0%
Fire/explosion	1	0%
Fishing or maritime activity	8	1%
Other outside force	5	1%
Previous mechanical damage	3	0%
Electrical arcing from other equipment/facility	3	0%
Intentional damage	4	1%
Total	**184**	**29%**

Notes:
[a] All data gathered from the Oracle BI Interactive Dashboard website for Significant Transmission Pipeline Incidents (PHMSA 2019a)
[b] Percentage of all incidents was calculated as a percentage of the total number of crude oil significant incidents (i.e., all causes) presented in Table 4.9-10. Outside force, excavation, and natural forces caused a total of 29 percent of the significant pipeline incidents in the U.S. from 2009 to 2018. The pipeline should be clearly marked where it is buried in the ground, so the excavation incidents occurrence can decrease. Oyster Creek Terminal storage tanks would be the other accident area due to flooding and/or high winds. Flooding and high winds is an active hazard for the state of Texas and a proper mitigation technique to reduce this risk should be investigated.

4.9.3. Applicant Accident Data

According to pipeline incident data acquired from PHMSA, from 2009 to 2019 there were a total of 509 pipeline incidents involving EPO and its subsidiaries. Of these 509 events, 288 of them were related to crude oil operations. Figure 4.9-4 illustrates the distribution of release sizes versus the number of releases.



Source: PHMSA 2021

Figure 4.9-4: Number of EPO and Subsidiary Oil Spills by Size

Approximately 84 percent of these incidents resulted in less than 50 barrels of crude oil released and approximately 9 percent resulted in 50 to 100 barrels released. The remaining 7 percent of incidents were either between 50 and 100 barrels or more than 1,000 barrels of released material. The large majority of these incidents were detected and reported in a timely manner by EPO and/or its subsidiaries and subsequently cleaned up (PHMSA 2021).

In 2020, there were no release incidents associated with EPO or its subsidiaries in Brazoria County and one release associated with EPO or its subsidiaries in Harris County. The incident in Harris County was reported to PHMSA and involved a small release from an out of service storage tank.

4.9.4. Impact on Public Safety

Table 4.9-12 summarizes all service incidents involved with crude oil on onshore and offshore pipelines with annual injuries from 2010 to 2018. The injuries and fatalities due to the pipeline incidents are split into two categories, consisting of the public and employees. Fatalities among the public were low with two fatalities over a 10-year period.

Table 4.9-12: Fatalities and Injuries of Crude Oil Transmission Pipelines (2010–2018)

Year	Injuries		Fatalities	
	Employees	Public	Employees	Public
2010	0	0	0	0
2011	0	0	0	0
2012	1	3	1	2
2013	6	0	0	0
2014	0	0	0	0
2015	0	0	0	0
2016	4	0	0	0
2017	0	0	0	0
2018	0	0	0	0

Source: PHMSA 2019b

Pipelines are relatively safe for the public compared to employees. Of the 17 incidents, 12 were employee-related. There is a higher chance of a fatality or injury due to a natural hazard such as an earthquake, tornado, or hurricane than there is due to an accident or release from a crude oil pipeline. Some of the dangers associated with a crude oil pipeline incident for the public include explosions, pool fires, and jet fires. The highest risk to the public would be the portion of the onshore pipeline route that crosses through HCAs.

Under the ignition conditions of crude oil in the HCAs around the public, the spilled crude oil or leak from the pipeline could cause an explosion, pool fire, and/or jet fire. This explosion, pool fire, and/or jet fire could destroy the pipeline and other structures in the vicinity. The spilled oil could also burn and, if people are within certain thermal radiation level thresholds, the ignited spill could cause injuries and fatalities in the vicinity.

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5. CUMULATIVE IMPACTS

Cumulative impacts are the collective result of the incremental impacts of an action that, when added to the impacts of other past, present, and reasonably foreseeable future actions, would affect the same resources, regardless of what agency or person undertakes those actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time (40 CFR § 1508.7); although the impacts of individual actions taken separately might be minor, the impact of those same actions taken together may be substantial for one or multiple resources.

5.1. CUMULATIVE IMPACT ASSESSMENT METHODOLOGY

A cumulative impacts analysis focuses on the resources rather than the planned action, and considers impacts that take place on both spatial and temporal scales. On a spatial basis, impacts must be considered both within and outside the proposed Project area. Time scales for a cumulative impacts analysis are generally longer than project-specific analysis of impacts. This cumulative impacts analysis considers the following types of cumulative impacts (adapted from NRC 1986; CEQ 1997b), encompassing impacts on both spatial and temporal scales:

- **Time-lagging:** Frequent and repetitive actions on an environmental system may result in cumulative impacts when the system does not have time to recover from the impacts of one action before the next action occurs (e.g., overgrazing of pastureland in arid regions).
- **Time-lapse:** Impacts of actions on environmental systems may not appear until an extensive amount of time has elapsed, such as exposure to carcinogens.
- **Space-crowding perturbations:** Cumulative impacts on the environment arise from high spatial density of actions (e.g., decreased water quality in a river into which several factories discharge contaminated water).
- **Cross-boundary impacts:** The impacts of an action are spatially removed from the location of the action (e.g., groundwater contamination that migrates away from the source).
- **Fragmentation:** An action results in a change in the landscape pattern (e.g., construction of an overhead power line through a forest or construction of a highway that would separate a neighborhood community).
- **Compounding impacts:** Synergistic or collaborative impacts may result from multiple sources or pathways, such as adverse health impacts resulting from the combination of several pesticides in surface water runoff.
- **Indirect impacts:** Secondary impacts may result from a primary action, such as the development of commerce after a roadway is constructed.
- **Triggers and thresholds:** Fundamental changes in system behavior or structure can occur when a threshold is reached (as in climate change) or when an action becomes a trigger for system change.

The general approach taken for the cumulative impacts analysis in this EIS is to:

- Define other activities that could impact resources within the vicinity of the proposed SPOT Project, including vessel transit routes.
- Assess whether impacts from the proposed Project overlap or are adjacent to impacts (in time or space) from other activities, potentially creating any of the types of cumulative impacts listed above.
- Total the impacts from the proposed Project with other similar impacts, if impacts are additive and if quantitative information is available, or make a qualitative assessment of total impacts.
- Estimate the proposed Project's incremental contribution to total (cumulative) impacts, as a percentage of total, if quantitative, or make a qualitative assessment of the share of total impacts. The proposed Project's contributions incorporate BMPs and agency-recommended mitigation measures that the Applicant has agreed to implement, as described throughout Chapter 3, Environmental Analysis of the Proposed Action, and as listed in Appendix N, List of Applicant's Best Management Practices and Agency Recommended Mitigation Measures.
- Assign an impact duration (short- or long-term) and an impact descriptor (negligible, minor, moderate, or major) to the proposed Project's contribution to cumulative impacts, and discuss whether an impact is adverse or beneficial to the resource and direct or indirect, where possible.
- Evaluate whether incorporation of specific alternatives into the proposed Project would change the proposed Project's incremental contribution to cumulative impacts.

The cumulative impacts analysis focuses only on those impacts that are similar to impacts that would result from the proposed Project. If the proposed Project would not impact a certain resource, specific habitat, or activity (based on the analysis in Chapter 3, Environmental Analysis of the Proposed Action), those particular resources, habitats, and activities are not addressed in this cumulative impacts analysis; however, this cumulative impacts analysis did not exclude any resources.

Proposed, recommended, or required mitigation measures may or may not change the incremental contribution of the proposed Project to cumulative impacts. Avoidance measures that effectively eliminate the impact before the impact occurs, such as minor reroutes of a pipeline to avoid a cultural resource or adjustment of the construction schedule to avoid a species' breeding season, would eliminate the incremental contribution. Mitigation measures that would reduce the impact or the extent of the impact as the impact occurs, such as the use of turbidity curtains or rip-rap, would reduce the incremental contribution. Compensatory and other mitigation measures that occur after the impact occurs, such as primary restoration efforts or buying credits to offset the impact, would not reduce or eliminate the incremental contribution to cumulative impacts.

To determine which other actions could create a cumulative impact with the proposed SPOT Project, this cumulative impacts analysis identified the geographic extent of potential cumulative impacts for each resource type. Beyond these geographic extents, the Project's capacity to affect each resource would become negligible. Within these areas, or regions of influence (ROIs), other planned or proposed developments or actions could cumulatively affect the environment in addition to the Proposed Action. Defining the ROI requires balance; the ROI must not be so narrow that it ignores the real possibility of cumulative harm, nor can it be so broad that it makes the analysis "unwieldy" (CEQ 1997). Tables 5.1-1 and 5.1-2 describe the geographic ROI for onshore and offshore Project components, respectively, where cumulative impacts from past, present, and reasonably foreseeable future actions could affect each relevant resource. In most cases, the effects of past and present actions are reflected in baseline conditions. Accordingly, past and current projects are only specifically considered if their future operations would meaningfully change over time.

5.2. Past, Present, and Reasonably Foreseeable Future Actions

To identify potential cumulative impacts, information on projects, developments, or activities that might overlap temporally or geographically with the Proposed Action was collected from regulatory agency databases, developer and agency press releases, chambers of commerce and other regional and local business organizations and publications, industry news sites, and other publicly available sources in addition to what was provided in the DWPA Application in January 2019 (SPOT 2019a, Volume I, Chapter 5). Past, present, or reasonably foreseeable future actions (also referred to as cumulative projects) identified by the Applicant in its application (SPOT 2019a, Application, Volume IIa, Appendix B) were also considered. The following screening criteria were used to select potential cumulative actions within the ROIs described in Tables 5.1-1 and 5.1-2:

- Projects that have submitted a site plan or preliminary document for review by a local planning agency or government agency;
- Projects with a valid permit issued from a regulatory agency; and
- Projects with approved or ongoing activities, as identified on a regularly maintained government website.

Table 5.2-1 lists 45 cumulative projects considered in this analysis. These projects include 11 onshore major industrial projects, 2 major onshore infrastructure projects, 1 onshore warehousing and distribution project, 1 utility project, 6 Federal, state, and municipal activities, 2 transportation projects, 5 commercial and residential developments, 3 pipeline projects, 8 major offshore industrial projects, and 6 waterway transportation projects. The information in Table 5.2-1 is based on publicly available data. Figures 5.2-1 through 5.2-3 show the locations of the projects included in the cumulative impacts analysis. The remainder of Section 5.2, Past, Present, and Reasonably Foreseeable Future Actions, describes the types of cumulative projects included in this analysis. Some of the actions have cumulative impacts with both onshore and offshore Project components.

Table 5.1-1: Regions of Influence by Onshore Resource Type

Resource Type	Region of Influence [a]	Rationale
Water Quality and Use	Surface waters and aquifers crossed by and downstream (but still onshore) of the Project's onshore components, within a reasonable distance within which pollutants could migrate	A conservative estimate of the distance runoff, spills, discharges, and eroded sediment from the Proposed Action could drain into downstream waterbodies.
Land Cover and Vegetation	Within 1 mile of the pipelines and 5 miles of the Oyster Creek Terminal	The pipeline ROI reflects the potential presence of existing or other proposed pipelines within the same corridor and the distance where simultaneous activities could impact land cover and vegetation. The ROI for Oyster Creek Terminal reflects the typical extent of visual impacts (see Section 5.3.5, Land Use, Recreation, Visual Resources, and Ocean Use). The ECHO Terminal is an existing use, and is, therefore, excluded from consideration for this resource.
Fisheries	Surface waters and aquifers crossed by and downstream of the Project's onshore components (but still onshore), within a reasonable distance within which pollutants could migrate	Primary impacts to fisheries would be through impacts to water quality and use (runoff spills, discharges, and erosion); therefore, the ROI is the same as the water quality and use ROI.
Wildlife and Protected Species	Within 1 mile of the pipelines and 5 miles of the Oyster Creek Terminal	Impacts on wildlife and species are most closely tied to changes in land use and land cover; therefore, the ROI is consistent with land cover and vegetation.
Cultural Resources	Area of Potential Effect	The cultural resources ROI includes the onshore direct and indirect APE, as defined by MARAD and USCG with concurrence from the Texas Historical Commission: direct APE includes the Project workspace, indirect APE includes resources visible within approximately 3 miles of Project facilities.
Geological Resources and Soils	Project workspace (Geology) Brazoria County (Soils)	Geologic impacts would not extend beyond the area of the Project's direct disturbance. Impacts on prime farmland or other sensitive soil types (if any) could extend countywide.
Land Use, Recreation, Aesthetics	Within 1 mile of the pipelines and 5 miles of the Oyster Creek Terminal (Land Use and Recreation) Within 5 miles of all Project facilities (Visual)	The ROI for land use and recreation is consistent with the ROI for land cover and vegetation, reflecting a reasonable travel distance to access comparable recreation resources. The ROI for visual impacts reflects the distance at which visual changes are typically considered to be part of the "background" view, and are thus less apparent to the viewer.
Socioeconomics	Brazoria County, Southern Harris County, Texas	Housing and labor supply, public service impacts, and other economic impacts would extend through the adjacent communities, but would be indistinguishable in central Harris County (i.e., the City of Houston) or areas further north.

Resource Type	Region of Influence [a]	Rationale
Environmental Justice	Environmental justice populations identified in Section 3.15.3. For certain socioeconomic project impacts, the ROI could extend to minority and low-income populations in Brazoria and Harris counties as a whole.	The ROI is consistent with the environmental justice populations identified in Section 3.15.3 and is based on the potential for effects to: cause adverse and disproportionate environmental, economic, social, or health impacts on minority or low-income populations; or, cause adverse and disproportionate environmental health or safety risks to children.
Roadway Traffic	The major roads evaluated in Section 3.11, Transportation, roads crossed by onshore pipelines, and other roads within 1 mile of onshore Project components	Traffic impacts from construction workers and delivery vehicles would concentrate on major roads that access the Project area. Cumulative impacts could also occur on minor roads directly affected by Project construction.
Air Quality and Meteorology		
Construction	Concurrently constructed projects within 0.25 mile of the Project	Vehicle, vessel, and equipment emissions and dust generated during construction would not travel farther than 0.25 mile.
Operation	31.1-mile (50-km) radius around Oyster Creek Terminal	Consistent with USEPA major source modeling guidance for the distance within which the cumulative air emissions model is predictive.
Noise [b]		
Construction	Concurrently constructed projects within 0.25 mile of the Project and within 0.5 mile of HDD entry and exit points and pile driving activities	The ROI represents the farthest distance at which construction noise could adversely affect noise sensitive areas, due to the temporary nature of construction activities.
Operation	1-mile radius around the Oyster Creek Terminal	The ROI represents the farthest distance that operation noise could adversely affect noise sensitive areas, based on operation activities at the Oyster Creek Terminal.
Safety and Security	10-mile radius around the ECHO Terminal and Oyster Creek Terminal	An event that affects public safety or the security of the facilities could also affect other facilities within 10 miles. This is a reasonable range for potential impacts to diminish and would typically encompass the areas issued shelter-in-place orders by city officials.

Source: BLM 1986; USEPA 1974

APE = area of potential effect; ECHO = Enterprise Crude Houston; HDD = horizontal directional drill; km = kilometer; MARAD = Maritime Administration; ROI = region of influence; USCG = U.S. Coast Guard; USEPA = U.S. Environmental Protection Agency

[a] ROI is the radius distance measured from the centerline of individual and collocated onshore pipelines and the boundary of the Oyster Creek Terminal.

[b] As described in Section 3.13, Noise, the USEPA considers 55 dBA to be the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas (USEPA 1974). Typical pile hammer noise level is rated 36 dBA at 1 mile.

Table 5.1-2: Regions of Influence by Offshore Resource Type

Resource Type	Region of Influence [a]	Rationale
Marine Water Quality and Use	5 miles from the Project's offshore components (but still offshore)	Project in-water construction activities, including disturbing the seabed (e.g., pile installation, pipeline burial) and accidental introductions of chemicals into the water column (e.g., fuel and lubricants) could alter the water quality. The ROI reflects a conservative consideration of increased turbidity and total suspended solids, liquid discharges, and introductions of chemical contaminants from the SPOT Project and any actions within the ROI. It is also consistent with the ROI for marine environment.
Sediments	1 mile from the Project's offshore components (but still offshore)	Project in-water construction activities, including disturbing the seabed (e.g., pile installation, pipeline burial) and accidental introductions of chemicals into the sediment (e.g., fuel and lubricants) would occur at and near the Project, which could affect sediment distribution and introduce contaminants. This is consistent with the ROI for geological resources.
Marine Environment	5 miles	Project in-water construction activities, including disturbing the seabed (e.g., pile installation, pipeline burial) and from accidental introductions of chemicals into the water column (e.g., fuel and lubricants) would occur within the vicinity of construction and operation activities and potentially up to 5 miles away, affecting elements of the marine environment (e.g., bottom substrate, wave and tidal action, wetlands, deepwater environment).
Commercial and Recreational Fisheries	ATBA and Safety Zones	Impacts would occur where fishing is restricted, specifically the restricted area within the proposed safety zone and ATBAs around the SPOT DWP and ATBAs around each SPM buoy.
Wildlife and Protected Species	GoM out to the EEZ	This ROI is based on the farthest distance at which underwater noise from pile driving and vessel transits could create greater than negligible impacts on marine wildlife.
Cultural Resources	Area of Potential Effect	The offshore direct APE, as defined by MARAD and USCG with concurrence from the Texas Historical Commission.
Socioeconomics	Brazoria County, southern Harris County, Texas	Socioeconomics is addressed in Table 5.1-1.
Environmental Justice	Environmental justice populations identified in Section 3.15.3. For certain socioeconomic project impacts, the ROI could extend to minority and low-income populations in Brazoria and Harris counties as a whole.	Environmental Justice is addressed in Table 5.1-1.

Resource Type	Region of Influence [a]	Rationale
Geological Resources	1 mile	Impacts on geological resources would occur at and near Project construction sites during in-water construction activities that disturb the seabed (e.g., pile installation, pipeline burial). This ROI is consistent with the ROI for sediment.
Marine Zone Uses and Aesthetics	5 miles	The maximum distance at which pile installation and pipeline burial, as well as operational activities, could conflict with other ocean uses. This ROI is consistent with the typical definition of the visual "background" (BLM 1986).
Air Quality	31.1 miles (50 km) from the SPOT DWP	Consistent with USEPA major source modeling guidance for the distance within which the cumulative air emissions model is predictive.
Noise (excluding underwater noise)	1 mile	The farthest distance at which Project construction activities could produce intrusive sound levels, when coupled with similar levels of construction noise from another project. [b]
Safety and Security	Within the safety zones and ATBAs for the SPOT DWP and the SPM buoys	An event affecting public safety or the security of the DWP could also affect vessels within the safety zones or ATBAs.

Source: BLM 1986; USEPA 1974

APE = area of potential effect; ATBA = area to be avoided; DWP = deepwater port; km = kilometer; MARAD = Maritime Administration; ROI = region of influence; SPM = single point mooring; SPOT = Sea Port Oil Terminal; USCG = U.S. Coast Guard; USEPA = U.S. Environmental Protection Agency

[a] ROI is the radius distance measured from the boundaries of Galveston Area lease blocks 463 and A-59 and the centerline of the collocated offshore pipelines.

[b] As described in Section 3.13, Noise, the USEPA considers 55 dBA to be the maximum sound level that will not adversely affect public health and welfare by interfering with speech or other activities in outdoor areas (USEPA 1974). Typical pile hammer noise level is rated 36 dBA at 1 mile.

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Table 5.2-1: Offshore and Onshore Cumulative Projects Identified for Consideration in the Cumulative Impacts Analysis

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
Onshore Major Industrial					
Freeport LNG Phase II Modification, Liquefaction, and Train 4 Projects (Freeport LNG Development, L.P.)	• $13 billion, four-train natural gas liquefaction and LNG export terminal on Quintana Island, Texas, with two LNG carrier berths and total capacity of 20 MMtpy • Four-unit pretreatment plant (Pretreatment Facility) • 11.0-mile feed gas pipeline between Stratton Ridge, the Pretreatment Facility, and the Quintana Island Terminal • LNG train in-service dates from 2019 through 2023 • 1,200 to 1,400 construction jobs, 223 direct permanent jobs, and 1,040 indirect jobs	Quintana Island, Freeport, and Stratton Ridge, Texas (collocated with Oyster Creek to Shore Pipelines from MPs 4.9 to shore terminus)	Construction: underway since 2014 and ongoing Operation: 2019 (Train 1) through 2023 (Train 4)	• Water resources (water and sediment quality, turbidity, habitats, groundwater and municipal water) • Biological resources (benthic) • Cultural resources (direct APE) • Noise (dredging and placement) • Air quality (major air emission source) • Socioeconomics (workforce, housing) • Environmental justice (minority populations and low-income populations)	• Freeport LNG 2018 • DiSavino 2018 • Brazoria County EDA 2018 • FERC 2014 • FERC 2018
Dow Chemical Co. Freeport: Polyolefin Elastomers Plant (Dow Chemical Company)	• $846 million facility to make polymers that bridge the gap between plastics and rubber • 1,200 construction jobs, 50 direct jobs, 235 indirect jobs	Freeport, Texas (2.2 miles from Oyster Creek to Shore Pipelines MP 10.0)	Construction: complete Operational since 2018	• Water resources (water quality) • Commercial and recreational fisheries • Air quality (emissions) source during operation • Socioeconomics (workforce requirements) • Environmental justice (minority populations and low-income populations)	• Blum 2017 • Brazoria County EDA 2021a
MEGlobal Ethylene Glycol Plant (MEGlobal at Oyster Creek)	• $1 billion MEG manufacturing facility, dependent on Dow's on-site ethylene cracker • 1,400 construction jobs, 35–50 direct jobs, and 172 indirect jobs	Oyster Creek, Texas (2.0 miles from Oyster Creek to Shore Pipelines MP 9.5)	Construction: complete Operational since 2019	• Water resources (water quality) • Commercial and recreational fisheries • Air quality (emissions) source during operation • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Dow 2016 • Brazoria County EDA 2021a
INEOS Linear Alpha Olefins Plant (INEOS Oligomers- Chocolate Bayou)	• New linear alpha olefins production plant • $550 million facility under construction at the existing INEOS site • 3,200 construction jobs; 80 direct, permanent jobs; 376 indirect, permanent jobs	Chocolate Bayou, Texas (11.1 miles from ECHO to Oyster Creek Pipeline MP 39.0)	Construction: complete Operational since 2019	• Air quality (emissions) source during operation • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• INEOS Oligomers 2017 • Brazoria County EDA 2021a
Praxair Air Separation Unit and Carbon Dioxide Purification facility (Praxair- Freeport)	• $104 million facility to produce nitrogen and argon to supply customers and provide oxygen to MEGlobal's new ethylene glycol plant, Yara Freeport, LLC's ammonia plant, and Praxair's industrial gas pipeline system. Includes a new carbon dioxide purification and liquefaction facility. • 70 construction jobs; 15 direct, permanent jobs; 70 indirect, permanent jobs	Freeport, Texas (2.0 miles from Oyster Creek to Shore Pipelines MP 9.5)	Construction: complete Operational since 2019	• Water resources (water quality) • Commercial and recreational fisheries • Biological resources (wildlife and protected species) • Air quality (emissions) source during operation • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Praxair 2016 • Brazoria County EDA 2021a
INEOS Polyalphaolefin Plant (INEOS Oligomers- Chocolate Bayou)	• $145 million facility with a capacity of 120 thousand metric tons per year of low viscosity polyalphaolefin. Feedstock for the polyalphaolefin unit will originate at the INEOS linear alpha olefins plant (see above). • 200 construction jobs; 15 direct, permanent jobs; 37 indirect, permanent jobs	Chocolate Bayou, Texas (11.1 miles from ECHO to Oyster Creek Pipeline MP 39.0)	Construction: underway since 2018 and ongoing Operational since 2019	• Air quality (emissions) source during operation • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• INEOS Oligomers 2017 • Brazoria County EDA 2018
Shintech/ K-Bin PVC Compounding Facility (Shintech Inc./K-Bin)	• $17 million facility expansion of existing Shintech-Freeport facility • 25 peak construction jobs; 10 direct, permanent jobs; 17 indirect, permanent jobs	Clute, Texas (2.8 miles from Oyster Creek to Shore Pipelines MP 8.4)	Construction: complete Operational since 2019	• Air quality (emissions) source during operation • Socioeconomics (workforce) • Vessel traffic • Water resources (water quality) • Environmental justice (minority populations and low-income populations)	• Shintech Inc. 2006 • Brazoria County EDA 2021a
Phillips 66 Fractionation of NGL (Phillips 66 Old Ocean)	• $1.3 billion expansion of Phillips 66 Sweeny HubNGL fractionator for two new fractionators (100,000 bpd to 400,000 bpd increase) • 1,300 peak construction jobs; 12 direct, permanent jobs; 22 indirect, permanent jobs	Sweeney, Texas (23.2 miles from Oyster Creek Terminal)	Construction: underway since 2019 and ongoing Operational since 2020	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Phillips 66 2018 • Brazoria County EDA 2021a • Brelsford 2020

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
Phillips 66 NGL Fractionator 4 (Phillips 66 Old Ocean)	• $500 million expansion of Phillips 66 Old Ocean facility • 500 peak construction jobs; 10 direct, permanent jobs; 23 indirect jobs	Sweeney, Texas (23.2 miles from Oyster Creek Terminal)	Construction: 2021 Operational: 2023	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Brazoria County EDA 2021b
Phillips 66 Freeport LPG Export Terminal (Phillips 66)	• Terminal's initial export capacity of 4.4 million barrels per month is the equivalent of loading eight very large gas carriers per month. The terminal can load two ships simultaneously with refrigerated propane and butane. • Some portion of a $3 billion investment that included the LPG terminal and the Sweeny Fractionator One project, a 100,000 bpd NGL fractionator completed in 2015 in Sweeny, Texas	Freeport, Texas (3.5 miles from Oyster Creek to Shore Pipelines MP 9.9)	Operational since 2016	• Water resources (water quality, habitat) • Commercial and recreational fisheries • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Gas Processing and LNG n.d. • Phillips 66 2016
Third Coast Terminals Prepolymer Toll Manufacturing Unit	Unit designed to produce 6,000 to 32,000 pounds of prepolymer per batch	Clute, Texas (1.7 miles from ECHO to Oyster Creek Pipeline MP 7.5)	Operational since 2016	• Water resources (water and sediment quality, habitat) • Commercial and recreational fisheries • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Everchem 2017 • Third Coast Terminals 2017
Onshore Major Infrastructure					
Oil and Gas Exploration and Production Activities – Onshore (RRC, Oil and Gas Industry)	Includes installation and operation of onshore wells, oil and gas pipelines, and support facilities.	Brazoria and Harris counties	Ongoing	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	ShaleXP 2019
Seabreeze Environmental Landfill (Waste Connections of Texas)	Type 1 solid waste facility. In addition to the landfill operations, the site has full service recycling facilities that are available to all Brazoria County residents.	Angleton, Texas (0.9 miles from Oyster Creek Terminal)	Operational	• Air quality (emissions) • Noise (operation) • Water resources (water quality and use) • Cultural resources (indirect APE) • Socioeconomics (workforce) • Road Transportation • Land Use and Visual • Environmental justice (minority populations and low-income populations)	Seabreeze Environmental Landfill 2019
Onshore Warehousing and Transportation					
Port Freeport Parcel 14 Rail Development (Port Freeport)	Development of a 250-acre site for rail warehousing, distribution, and approximately 21,000 linear feet of rail track spurring from the Union Pacific mainline	Freeport, Texas (3.7 miles from ECHO to Oyster Creek Pipeline MP 9.9)	Construction: underway since 2017 and ongoing Operational since 2018	• Water resources (water quality and use) • Commercial and recreational fisheries • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Port Freeport 2017a
Utilities					
Chocolate Bayou Wind I LLC	145 MW onshore wind farm	Chocolate Bayou (Approximately 16 miles from Oyster Creek Terminal)	Construction: 2020 Operation: 2022	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Buckley 2016

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
Federal, State, and Municipal Activities					
U.S. Navy Military Readiness Training Activities (U.S. Navy)	Military readiness training activities and research, development, testing, and evaluation, which include the use of active sonar and explosives within the in-water areas of the western Atlantic Ocean along the eastern coast of North America, in portions of the Caribbean Sea and GoM, at select Navy pierside locations, within port transit channels, near select civilian ports, and in bays, harbors, and inshore waterways (e.g., lower Chesapeake Bay).	GoM range complexes, including Naval Surface Warfare Center Panama City Division Testing Range and the following existing ranges and operating areas (OPAREAs): Pensacola, Panama City, Corpus Christi, New Orleans, and Key West (The closest OPAREA is Corpus Christi, which is approximately 130 nautical miles west of the SPOT DWP)	Ongoing	• Biological resources (wildlife and protected species) • Commercial and recreational fisheries • Noise (underwater noise)	U.S. Navy 2018
Master Drainage Plan City of Manvel	Drainage improvements to address the City's existing and future needs	Manvel, Texas (ECHO to Oyster Creek Pipeline passes through Manvel)	None available	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Klotz Associates 2014
Mustang Bayou Trail Plan	Proposed pedestrian and equestrian connections along major drainage corridors such as Mustang Bayou	Manvel, Texas (ECHO to Oyster Creek Pipeline passes through Manvel)	None available	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Burditt Consultants LLC 2017
Brazosport ISD	Bond-funded program for school improvements: • Ogg Elementary Replacement Elementary School • O.M. Roberts Elementary School • Brannen Elementary • Polk Elementary • Ney Elementary • Griffith Elementary • Austin Elementary • Lanier Middle School • Lake Jackson Intermediate School • Clute Intermediate School • Brazoswood High School • Brazosport High School • Hopper Field	Brazoria County (2.75 to 9 miles from onshore pipelines)	• 2019-2020 • 2019-2021 • 2021-2022 • 2016-2019 • 2020 • 2018-2019 • 2019 • 2018-2020 • 2018-2019 • 2017-2019 • 2017-2019 • 2017-2019 • 2020-2020	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Brazosport ISD 2014p • Brazosport ISD 2019 • VLK Architects 2018
Alvin ISD	Planned school improvements: • Alvin ISD Heritage Complex (athletic facilities) • EC Mason Replacement Campus • Meridiana High School - Junior High School #8	Manvel, Texas (ECHO to Oyster Creek Pipeline passes through Heritage Complex via HDD)	• Complete in 2018 • 2019-2020 • 2019-2020	• Water resources (water quality and use) • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Alvin ISD 2019a • Alvin ISD 2019b • Lodhia 2018
Galveston East End Lagoon (Galveston Park Board of Trustees)	Improvements within the 684-acre East End Lagoon would include an educational pavilion, observation pier, additional walking trails, an RV park, and a paid offshore fishing facility.	Galveston, Texas (12.5 miles from Oyster Creek Terminal)	None available	Air quality (emissions)	Pros Consulting LLC 2019
Transportation Projects					
City of Manvel Thoroughfare Plan	• At least three local roadways (two lanes) and two parkways (four lanes, median, and multipurpose paths) would cross the ECHO to Oyster Creek Pipeline route. • Proposed collector streets (two-lane undivided roadways) within 80 feet of the ECHO to Oyster Creek right-of-way	Manvel, Texas (ECHO to Oyster Creek Pipeline would intersect proposed thoroughfares)	Construction: within 10 years Operation: within 10 years	• Cultural resources (direct APE) • Road transportation • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Freese and Nichols 2015

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
TXDOT Highway Construction	• SH 288: Install equipment and infrastructure (Project IDs: 059802120) • FM 2004: Planning, pavement repair, seal coat, and markings (Project ID: 252302069; 252302068) • SH 35: Surfacing/roadway restoration; pavement repair, seal coat, and markings (Project ID: 017803158; 017802090) • SH 523: Install intersection flashing beacon, install advanced warning signals and signs (intersection) (Project ID: 100301095)	Brazoria County, Texas (within 1 mile of proposed onshore pipelines)	All listed as updated May 24, 2019, with TBD as estimated completion date	• Road transportation • Air quality (emissions) • Socioeconomics (workforce) • Water resources (water quality) • Biological resources • Environmental justice (minority populations and low-income populations)	TXDOT 2019d
Commercial and Residential Developments					
Sierra Vista Community	Housing development consisting of 685 single-family homes	Iowa Colony, Texas (1.5 miles from ECHO to Oyster Creek Pipeline MP 25.7)	Under construction	• Road transportation • Air quality (emissions) • Socioeconomics (workforce) • Water Resources (water quality and use) • Environmental justice (minority populations and low-income populations)	• Sierra Vista 2019 • Realty News Report 2018
The Meridiana	Housing development consisting of over 950 single-family homes in West Meridiana as well as parks and community centers. The layouts for Central and East Meridiana, which will contain additional homes, are not yet available.	Manvel and Iowa Colony, Texas (ECHO to Oyster Creek Pipeline crosses Meridiana)	Under construction	• Water resources (water quality and use) • Cultural resources (direct APE) • Land use • Road transportation • Air quality (emissions) • Socioeconomics (workforce) • Noise (construction) • Environmental justice (minority populations and low-income populations)	Meridiana 2019
The Presidio Manvel	Proposed 333-acre mixed-use development with 77 acres planned for single-family homes, 40 acres for multi-family homes, 1 million square feet on 180 acres for retail, 10 acres for hotel, and 20 acres of restaurant pads.	Manvel, Texas (ECHO to Oyster Creek Pipeline crosses Presidio)	Preconstruction, no set timeline	• Road transportation • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Tharaldson Investments 2017
Pomona	Housing development consisting of 1,004 single-family homes, parks, and community centers	Manvel, Texas (2.4 miles from ECHO to Oyster Creek Pipeline MP 20.0)	Under construction	• Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Pomona 2019
Liberty Pointe	Planned 153-acre multi-phased single-family residential development with 700 units to the east of Angleton High School (Parrish 2018).	Angleton, Texas (ECHO to Oyster Creek Pipeline would cross Liberty Pointe	Preconstruction, no set timeline	• Road transportation • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	City of Angleton 2018
Pipeline Projects					
Coastal Bend Header Pipeline (Gulf South Pipeline Company, LP)	• 66-mile, 36-inch-diameter pipeline header in Brazoria and Wharton counties, Texas • Will provide firm subscription for the Freeport LNG Export Terminal	Brazoria and Wharton counties, Texas (parallel to and 0.1 mile west of the onshore pipelines [MP 47.6 of the ECHO to Oyster Creek Pipeline through MP 3.8 of the Oyster Creek to Shore Pipelines] and Oyster Creek Terminal)	In service since 2018	• Water resources (water table, quality, and use, wetland hydrology) • Biological resources (vegetation) • Geological resources and soils • Cultural resources (direct APE) • Land use, recreation, aesthetics • Road traffic • Air quality (emissions) • Noise (construction and operation) • Socioeconomics (workforce, housing) • Environmental justice (minority populations and low-income populations)	Gulf South Pipeline 2018
Gray Oak Pipeline (Gray Oak Pipeline LLC)	Crude oil pipeline from the Permian Basin and Eagle Ford Shale to several destinations along the Texas Gulf Coast	Brazoria County, Texas (8.7 miles southwest of Oyster Creek to Shore Pipelines MP 6.8)	Operational: end of 2019	• Air emission source during operation • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Chapa 2018

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
Stratton Ridge Expansion Project (Enbridge)	• Expansion of the Texas Eastern Transmission Pipeline system to deliver up to 400,000 dekatherms per day of natural gas to Stratton Ridge, Texas • Includes existing 30.5-mile, 42-inch Brazoria Interconnector Gas Pipeline between Stratton Ridge and Iowa Colony in Brazoria County • Expected capital expenditure of approximately $200 million • Includes modifications to a pig launcher/receiver at Freeport LNG's existing meter station in Stratton Ridge	Stratton Ridge, Texas (5 miles from ECHO to Oyster Creek Pipeline)	Operational since June 2019	• Water resources (sedimentation, turbidity, hydrological profile) • Biological resources (vegetation, wildlife habitat) • Soils • Commercial and recreational fisheries • Air quality (emissions) • Socioeconomics (workforce requirements during construction) • Environmental justice (minority populations and low-income populations)	• Enbridge Inc. 2019 • FERC 2017b • FERC 2019b
Offshore Major Industrial					
Oil and Gas Exploration and Production Activities – Western, Central, and Eastern Planning Areas (BOEM and Oil and Gas Industry)	• Activities may occur up to 40 to 50 years on leased blocks in the Western, Central, and Eastern Planning Areas. • Seismic surveys, well drilling, installation and operation of offshore platforms, pipelines, and support facilities, and transporting oil and gas using ships or pipelines	Gulf of Mexico (18 nautical miles from closest active platform to the SPOT DWP)	Ongoing	• Water resources (water and sediment quality, accidental releases) • Marine biological resources (habitat, wildlife, protected species) • Commercial and recreational fisheries • Cultural resources (submerged) • Air quality (emissions)	• BOEM 2017c
Texas GulfLink Project (Texas GulfLink, LLC)	• Offshore crude export terminal similar to the SPOT Project • Two fixed offshore platforms approximately 28.3 nautical miles off the coast of Brazoria County, designed to serve VLCCs • Approximately 32 miles of offshore pipeline • Onshore storage and supply components: onshore storage terminal in Brazoria County, pump station, and two onshore crude oil pipelines totaling 12.3 miles	Fixed offshore platform (Offshore pipelines intersect; Closest platform is 7 nautical miles east of the SPOT DWP)	Draft EIS Published November 2020 Construction: Unknown Operation: Unknown	• Water resources (water quality and circulation, sediment quality) • Benthic resources • Commercial and recreational fisheries • Cultural Resources (submerged) • Noise • Air quality (emissions)	• Texas GulfLink LLC 2019a • Texas GulfLink LLC 2019b • Texas GulfLink LLC 2019c
Blue Marlin Offshore Port Project (Blue Marlin Offshore Port, LLC)	• Offshore crude export terminal similar to the SPOT Project • Existing WC 509 Platform complex approximately 87 nautical miles off the coast of Cameron Parish, designed to serve VLCCs, would be converted to a dual-purpose crude oil and natural gas use • Offshore pipelines from existing offshore platform complex in WC 509 to two new offloading buoys for oil deliveries • Conversion of the Stingray pipeline from natural gas to crude oil service for delivery to the existing offshore platform complex, the WC 509 Platform Complex • Onshore supply components: pump stations, mainline valves, and one approximately 37-mile-long onshore crude oil pipeline	Fixed offshore platform (approximately 73 nautical miles east of the SPOT DWP)	Construction: Unknown Operation: Unknown (Currently in permitting and design stage) Application submitted October 1, 2020	• Water resources (water quality and circulation, sediment quality) • Commercial and recreational fisheries • Cultural Resources (submerged) • Noise • Air quality (emissions)	MARAD and USCG 2020a
Bluewater Texas (Bluewater Texas Terminal LLC)	• Offshore crude export terminal similar to the SPOT Project • Two offshore SPM buoys in Outer Continental Shelf Matagorda Island Area TX4 lease blocks 698 and 699, approximately 15 nautical miles off the coast of San Patricio County, Texas, and located approximately 21 nautical miles east of the entrance to the Port of Corpus Christi • Approximately 27 miles of offshore pipeline • Onshore components: operations facility at Harbor Island and two onshore crude oil pipelines totaling 56.18 miles	Offshore SPM buoys (Approximately 104 nautical miles west of the SPOT DWP)	Draft EIS Published October 2021 Construction: Unknown Operation: Unknown	• Water resources (water quality and circulation, sediment quality) • Commercial and recreational fisheries • Cultural Resources (submerged) • Biological Resources • Noise • Air quality (emissions)	Bluewater Texas Terminal LLC 2020 MARAD 2020

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
New Fortress Energy Louisiana FLNG Deepwater Port (New Fortress Energy Louisiana FLNG LLC)	• Offshore self-elevating platform and fixed platform LNG production facility • Two nominal 1.4 MMtpy liquefaction systems (FLNG1 and FLNG2) on seven offshore platforms (3 for FLNG1, 3 for FLNG2, and 1 for the Compression Rig) in Outer Continental Shelf West Delta Lease Blocks 38 and 39, approximately 16 nautical miles off the coast of Plaquemines Parish, Louisiana • One floating storage unit with a total capacity of 160,683 cubic meters of LNG for off-loading to LNG carriers • The Project would receive natural gas through the existing Kinetica pipeline system. Dual buried pipeline laterals (3,036 feet and 2,972 feet long) would connect the existing pipeline to FLNG1	Self-elevating offshore platform and fixed offshore platform (Approximately 280 nautical miles east of the SPOT DWP)	Construction: 2023 Operation: 2023 Application submitted March 31, 2022	• Water resources (water quality and circulation, sediment quality) • Commercial and recreational fisheries • Cultural Resources (submerged) • Biological Resources • Noise • Air quality (emissions)	MARAD and USCG 2022
Port Delfin LNG (Delfin LNG LLC)	• Offshore moored FLNG production facility and onshore facilities • Four FLNG vessels producing up to 13 MMtpy of LNG in Outer Continental Shelf West Cameron Blocks 314, 318, 319, 327, 328, 334, and 335, approximately 37 to 41 nautical miles off the coast of Cameron Parish, Louisiana • Would reuse and repurpose two existing offshore natural gas pipelines: the former UTOS pipeline and the HIOS pipeline • A 700-foot new pipeline would be constructed to bypass a platform at WC 167 and connect the UTOS and HIOS pipelines • Received a positive Record of Decision from MARAD in 2017 and approval from the DOE for long-term exports of LNG	Moored offshore FLNG vessels (Approximately 90 nautical miles east of the SPOT DWP)	Construction: Unknown Operation: Unknown Received ROD June 2017	• Water resources (water quality and circulation, sediment quality) • Commercial and recreational fisheries • Cultural Resources (submerged) • Biological Resources • Noise • Air quality (emissions)	MARAD 2022 MARAD and USCG 2016
Louisiana Offshore Oil Port (LOOP) (LOOP LLC)	• Offshore crude export terminal similar to the SPOT Project • Receives and temporarily stores crude oil from overseas sources, providing the single largest U.S. point of entry for waterborne crude oil. In February 2018, facility modifications were completed enabling crude oil exports • Three offshore SPM buoys used for the offloading of crude tankers and a marine terminal in Outer Continental Shelf West Delta Lease Block 59, approximately 15 nautical miles off the coast of Plaquemines Parish, Louisiana • Connected via pipeline to onshore storage facility, Clovelly Hub, which is capable of storing approximately 9.54 million cubic meters of crude oil, and above-ground tank facility with an additional 1.91 cubic meters of capacity • Currently the only port in the U.S. capable of offloading a wide range of vessels including ULCC and VLCC down to MR Tankers • LOOP was solely an import terminal until February 2018, when it began processing crude oil exports in addition to imports.	Offshore SPM buoys (Approximately 268 nautical miles east of the SPOT DWP)	Operation: 1981	• Water resources (water quality and circulation, sediment quality) • Commercial and recreational fisheries • Cultural Resources (submerged) • Biological Resources • Noise • Air quality (emissions)	LOOP LLC 2022 Calcuttawala 2018
West Delta LNG Export Deepwater Port (West Delta LNG, LLC)	• Offshore fixed-platform LNG production facility • Thirteen fixed bridge connected platforms with piles in Outer Continental Shelf West Delta Lease Block 44, approximately 10.5 nautical miles off the coast of Plaquemines Parish, Louisiana • Production platform will accommodate six modular natural gas liquefaction trains, each with a nameplate capacity of 0.83 MMtpy • Five storage tanks will have a total storage capacity of 300,000 cubic meters of LNG for off-loading to LNG carriers • Onshore components: Venice Pretreatment Plant for the pre-treatment and processing of sourced natural gas and approximately 4 miles of connector pipeline to subsea pipeline • Approximately 16 miles of offshore pipeline	Fixed offshore platform (Approximately 291 nautical miles east of the SPOT DWP)	The Application is in process of being amended; construction and operation dates to be determined.	• Water resources (water quality and circulation, sediment quality) • Commercial and recreational fisheries • Cultural Resources • Biological Resources • Noise • Air quality (emissions)	MARAD 2019

Project (Owner)	Project Description	Location (Closest Distance to Project Facility)	Estimated Timeframe (Status)	Resources Affected	References
Waterway Transportation					
Freeport Harbor Channel Improvement Project (Port Freeport)	• $295 million project to widen and deepen the channel from 45 feet to authorized depths of 51 to 55 feet • Enhancements to upper turning basin and widening the narrowest section of the channel to improve inner channel navigation safety for larger ships	Freeport Harbor Channel (3.4 miles from Oyster Creek to Shore Pipelines)	Construction: 2020 Operation: 2025 (In permitting and design stage currently)	• Water resources (water and sediment quality) • Marine biological resources (habitat) • Marine zone uses and aesthetics • Transportation (vessel navigation) • Underwater noise (dredging/placement) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• American Journal of Transportation 2018 • Port Freeport 2017b • Port Freeport 2018 • USACE 2018b
Hoegh Autoliners Vessel Fleet Expansion (Hoegh Autoliners)	• Fleet size will increase to six post-Panamax vessels. • Conversion of more than 25 acres at Port Freeport to terminal space, parking for shipped automobiles, and new warehousing	Freeport Harbor Channel (3.4 miles from Oyster Creek to Shore Pipelines)	Operational since 2016	• Water quality • Marine biological resources and fisheries • Marine Zone Uses and Aesthetics • Air quality (emissions) • Underwater noise (vessel noise) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• American Journal of Transportation 2018 • World Maritime News 2016
Clear Creek Flood Risk Management Project (USACE and Harris County Flood Control District)	• Improvements to approximately 15 miles of channel conveyance along Clear Creek, more than 5 miles along three tributaries of Clear Creek, and to a previously constructed second outlet channel with a gated structure between Clear Lake and Galveston Bay • Creation of 500 acre-feet of inline detention along Clear Creek	Harris/Brazoria County border (9.9 miles from Oyster Creek Terminal)	Construction: ongoing Operation: 2025	• Water resources (water and sediment quality) • Air quality (emissions) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Dredging Today 2019
Marine Highway Designation -"M-69" (MARAD)	• Designation includes the GIWW between Bayport and Barbour's Cut in Houston and Velasco Terminal in Freeport. • Designation allows TXDOT and Texas ports to develop projects along the GIWW to help relieve roadway congestion in the Gulf Coast region by allowing more freight to be waterborne. • Weekly barge service will move containers for shippers and consignees, and containers that were moved on trucks.	GIWW (Intersects the Oyster Creek to Shore Pipelines at MP 11.3)	Operational since 2017	• Water resources (water and sediment quality) • Marine biological resources (habitat, wildlife, protected species) • Commercial and recreational fisheries • Geological resources • Cultural resources (direct APE) • Marine zone uses and aesthetics • Air quality (emissions) • Noise (operational) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	Port Freeport 2017c
Port Freeport Velasco Terminal Development (Port Freeport)	• 2,400-foot dock and two future vessel berths • 22 acres interim/90 acres ultimate container and general cargo storage facilities • 2,000-foot rail spur • Annual throughput of 600,000 to 700,000 TEUs	Freeport, Texas (4 miles from Oyster Creek to Shore Pipelines)	Operational	• Air quality (emissions) • Socioeconomics (workforce and housing) • Environmental justice (minority populations and low-income populations)	• Lockwood, Andrews & Newnam, Inc. 2019 • Port Freeport 2017b
Project 11—Houston Ship Channel Expansion (Port Houston)	• $1 billion project to widen and deepen the 52-mile channel along the Galveston Bay reach from 530 feet to an authorized width of 700 feet, and also deepen some upstream segments to a depth of 46.5 feet. • Enhancements include safety and efficiency improvements and crafting of new environmental features.	Houston Ship Channel, Galveston Bay Reach (47 miles from mouth of Houston Ship Channel to Shore Pipelines)	Construction: ongoing Operation: 2025	• Water resources (water and sediment quality) • Marine biological resources (habitat) • Marine zone uses and aesthetics • Transportation (vessel navigation) • Air quality (emissions) • Underwater noise (dredging/placement) • Socioeconomics (workforce) • Environmental justice (minority populations and low-income populations)	• Port Houston 2022 • Schuler, M. 2022.

APE = area of potential effect; BOEM = Bureau of Ocean Energy Management; bpd = barrels per day; DOE = Department of Energy; DWP = deepwater port; ECHO = Enterprise Crude Houston; FM = Farm to Market; GIWW = Gulf Intracoastal Waterway; GoM = Gulf of Mexico; HDD = horizontal directional drilling; HIOS = High Island Operating System; ID = identification; ISD = Independent School District; LLC = limited liability company; LNG = liquefied natural gas; LP = limited partnership; LPG = liquefied petroleum gas; MARAD = Maritime Administration; MEG = monoethylene glycol; MMtpy = million metric tonnes per year; MP = milepost; MR = Medium Range; MW = megawatt; NGL = natural gas liquids; OCS = outer continental shelf; PVC = polyvinyl chloride; RRC = Texas Railroad Commission; RV = recreational vehicle; SH = State Highway; SPM = single point mooring; SPOT = Sea Port Oil Terminal, LLC; TBD = to be determined; TEU = twenty-foot equivalent unit; TXDOT = Texas Department of Transportation; ULCC = Ultra Large Crude Carriers; USACE = U.S. Army Corps of Engineers; UTOS = U-T Operating System; VLCC = very large crude carrier

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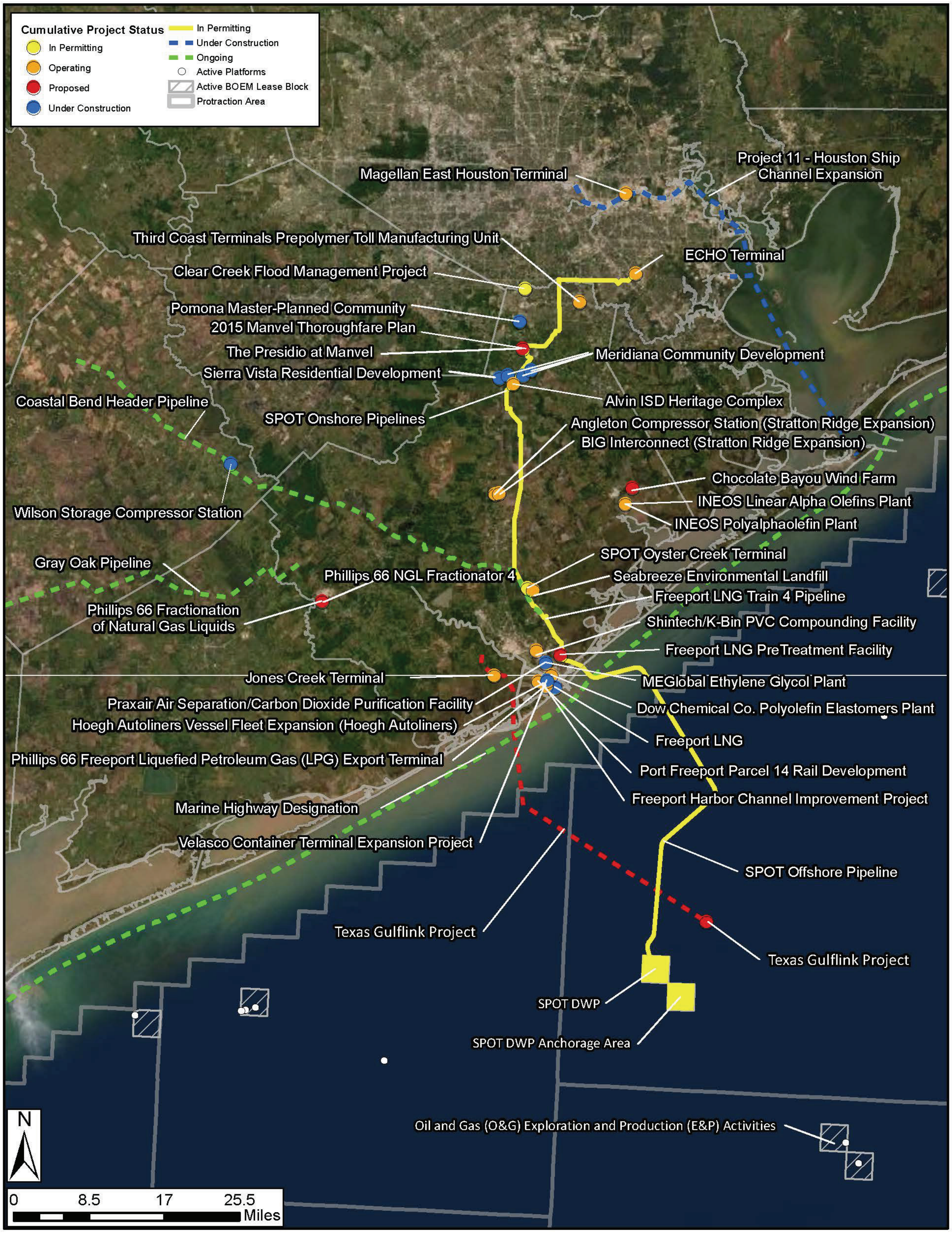


Figure 5.2-1: Cumulative Projects—Overview

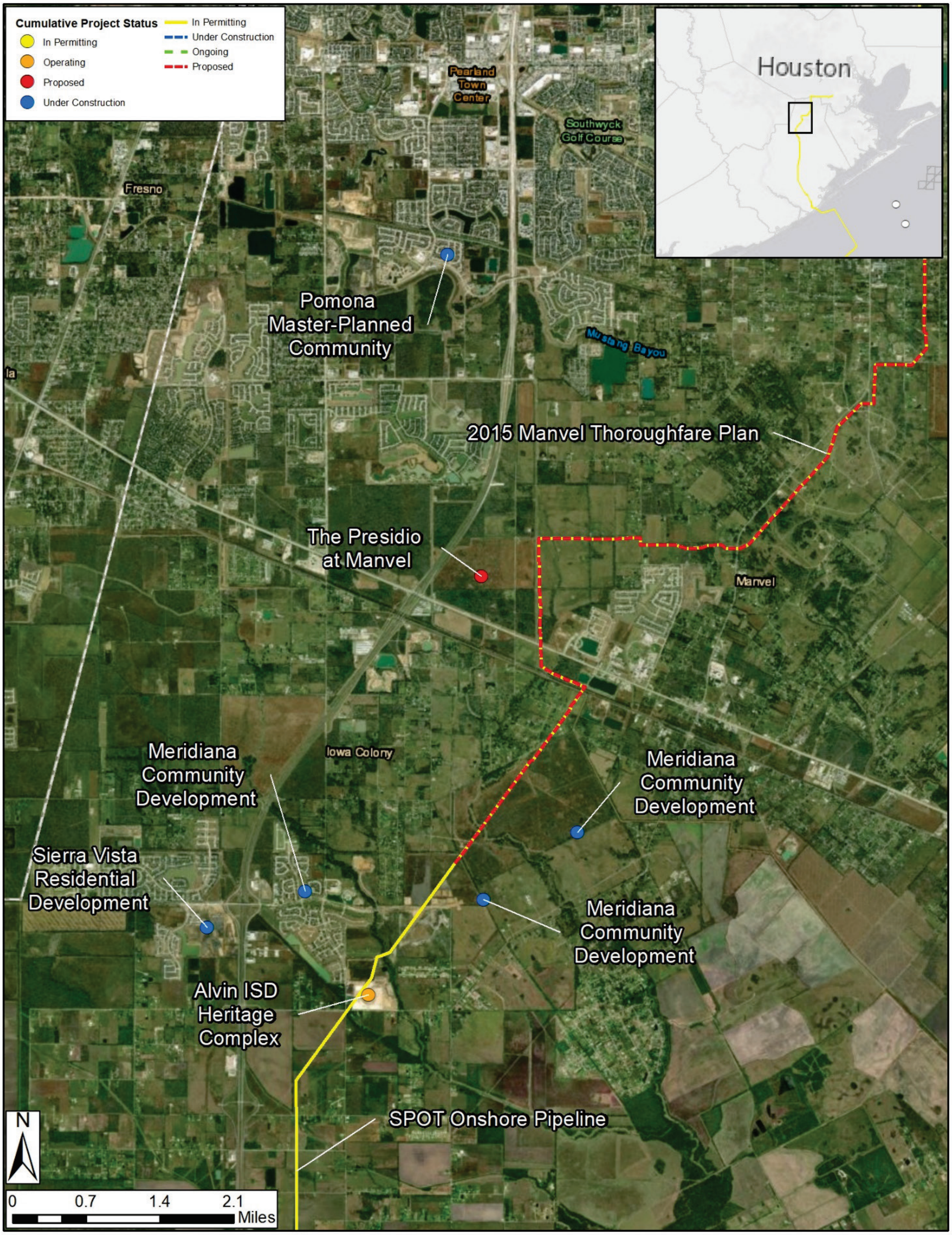


Figure 5.2-2: Cumulative Projects—Northern Brazoria County

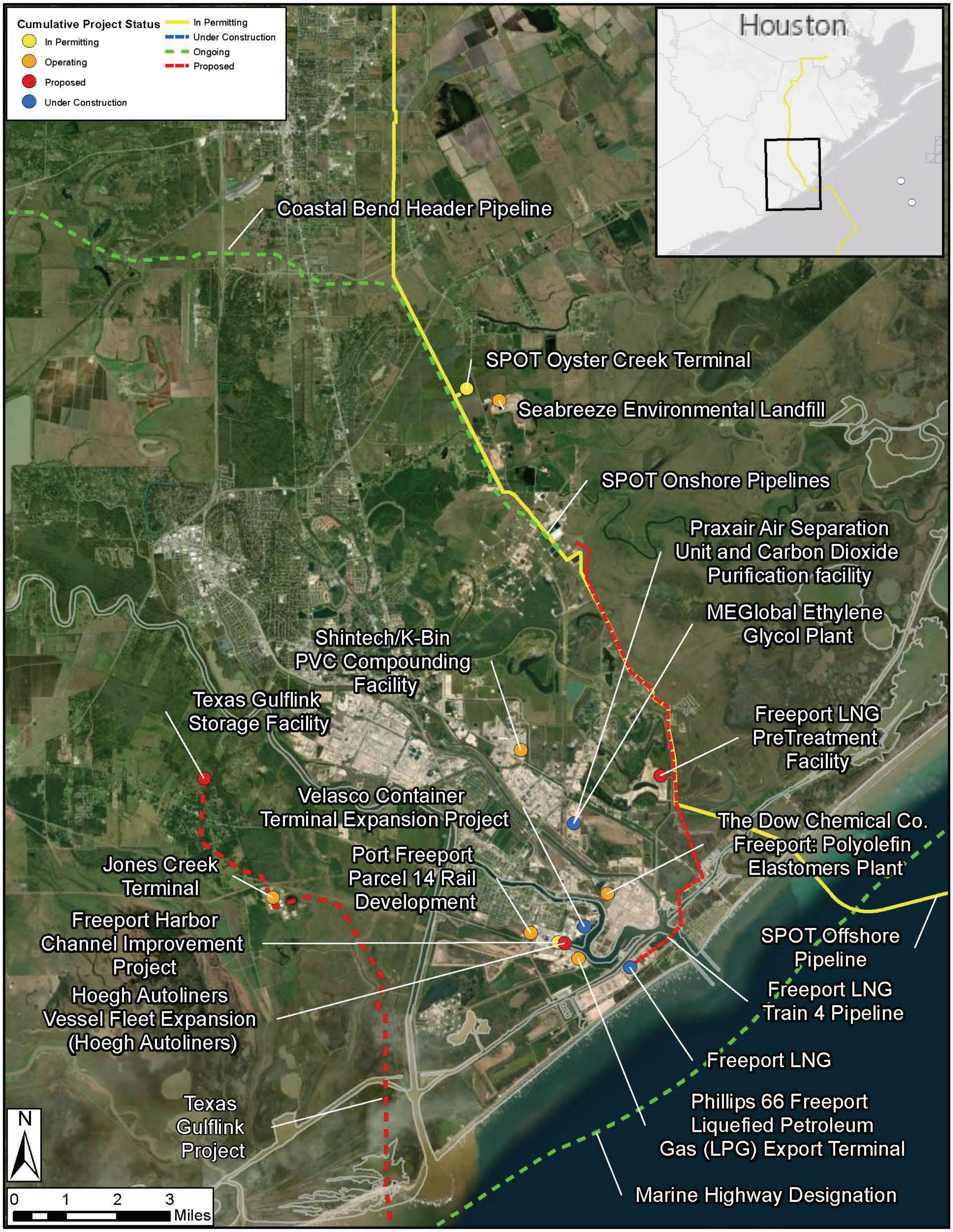


Figure 5.2-3: Cumulative Projects—Southern Brazoria County

5.2.1. Deepwater Ports

Since the amendment of the DWPA in 2002 to include DWPs for natural gas, MARAD and the USCG have received dozens of DWPA license applications for the GoM; however, many applications have been withdrawn prior to construction. LOOP off the Louisiana coast near Port Fourchon, is the closest operational DWP to the Project area. It receives and temporarily stores crude oil from overseas sources, providing the single largest U.S. point of entry for waterborne crude oil. This project is 268 nautical miles from the SPOT Project area. LOOP made facility modifications to enable crude oil exports beginning in February 2018 (Calcuttawala 2018).

An application for the Texas GulfLink Project was submitted to MARAD in May 2019. This project would be an offshore oil export DWP that would be located approximately 28.3 nautical miles off the coast of Brazoria County and approximately 7 nautical miles east of the proposed SPOT DWP. The Texas GulfLink Project would be similar in purpose to the SPOT Project, and would serve VLCCs and other crude oil carriers via two fixed offshore platforms with piles. The Texas GulfLink Project would include 32 miles of offshore pipeline, 12.3 miles of onshore pipeline, and an onshore terminal in Brazoria County (see Section 5.2.2, Onshore Terminals). Part of the proposed Texas GulfLink Project offshore pipeline would intersect the SPOT Project's proposed route (see Figure 5.2-1).

An application for the Blue Marlin Offshore Port (BMOP) Project was submitted to MARAD and the USCG on October 1, 2020. This project would be located off the coast of Cameron Parish, Louisiana, about 112 nautical miles from the SPOT DWP. The BMOP Project would be similar in purpose to the SPOT Project, and would serve VLCCs and other crude oil carriers via two fixed offshore platforms with piles. The platforms are existing and would be converted for use as a DWP. The BMOP Project would include 37 miles of new onshore pipeline, one pump station in Nederland, Texas, modifications to existing onshore facilities, conversion of 104 miles of existing offshore pipeline, and installation of two loading pipelines 4,700 and 6,100 feet in length, respectively.

An application for the Bluewater Texas Project was submitted to MARAD in June 2019. This project would be an offshore oil export DWP that would be located approximately 15 nautical miles off the coast of San Patricio County, Texas, and approximately 104 nautical miles west of the proposed SPOT DWP. The Bluewater Texas Project would be similar in purpose to the SPOT Project and would serve VLCCs and other crude oil carriers via two SPM buoys. The Bluewater Texas Project would include an operations facility at Harbor Island and approximately 27 miles of offshore pipeline and 56 miles of onshore pipeline (see Section 5.2.4, Pipeline System Projects).

An application for the Delfin LNG Project was submitted to MARAD on May 8, 2015. This project would be an offshore LNG export DWP approximately 38 nautical miles off the coast of Cameron Parish, Louisiana, and approximately 90 nautical miles northeast of the proposed SPOT DWP. The Delfin LNG Project would consist of four semi-permanently moored floating liquefied natural gas vessels and would reuse and repurpose two existing offshore natural gas pipelines: the former U-T Operating System (UTOS) pipeline and the High Island Operating System (HIOS) pipeline. In addition, a new pipeline would be constructed to connect the UTOS and HIOS pipelines (see Section 5.2.4, Pipeline System Projects). The Delfin LNG Project would provide a safe and reliable facility to export domestically produced LNG, and would serve LNG carriers with nominal cargo capacities between 125,000 and

177,000 cubic meters. On March 13, 2017, MARAD issued its Record of Decision approving the project with certain technical, financial, and environmental conditions.

An application for the West Delta LNG Export Deepwater Port Project was submitted to MARAD in August 2019. This project would be an offshore fixed-platform LNG production facility that would be located approximately 10.5 nautical miles off the coast of Plaquemines Parish, Louisiana, and approximately 291 nautical miles east of the SPOT DWP. The West Delta LNG Export Deepwater Port would provide a safe and reliable facility to export domestically produced LNG, and would serve LNG carriers with nominal cargo capacities between 30,000 and 180,000 cubic meters. The West Delta LNG Export Deepwater Port Project would include a pretreatment plant and approximately 4 miles of connector pipeline to the subsea pipeline, which would be approximately 16 miles long (see Section 5.2.4, Pipeline System Projects).

An application for the New Fortress Energy Louisiana FLNG Project was submitted to MARAD in March 2022. This project would be an offshore self-elevating platform and fixed platform LNG production facility that would be located approximately 16 nautical miles off the coast of Plaquemines Parish, Louisiana and approximately 280 nautical miles east of the SPOT Project. The New Fortress Energy Louisiana FLNG Project would provide a safe and reliable facility to export domestically produced LNG, and would serve one LNG carrier at a time, which would have a nominal cargo capacity between 125,000 and 160,000 cubic meters. Other than temporary construction staging areas, there are no onshore facilities associated with the New Fortress Energy Louisiana FLNG Project, which would receive natural gas through the existing Kinetica pipeline system. Dual buried pipeline laterals (3,036 feet and 2,972 feet long) would connect the existing pipeline to the FLNG.

As stated in Section 1.3, Purpose and Need, the United States already exports domestically produced crude oil. Table 5.2.1-1 shows the maximum export volume for each proposed deepwater port project as a percentage of U.S. crude oil production and U.S. exports, both as individual projects and cumulatively. Current export capacity in the GoM is 13.8 million barrels per day (Argus 2021), which is well above the current crude oil export volumes. Cumulatively, if all four proposed deepwater port projects (SPOT, GulfLink, Bluewater, and Blue Marlin) are licensed, built, and operate at maximum capacity, they could export crude oil representing about 54 percent of U.S. crude oil production and 203 percent of U.S. crude oil exports based on 2021 production and export data (EIA 2022a; EIA 2022b). However, it is highly unlikely that any of the proposed projects would operate at maximum capacity due to downtime for planned and unplanned maintenance, severe weather shutdowns, and market conditions, among other factors. Additionally, it is unknown whether any of these proposed deepwater port projects will be licensed and built.

Table 5.2.1-1: Maximum Crude Oil Exports as a Percentage of U.S. Crude Oil Production and Exports

Project	Maximum Number of Vessels Loaded	Maximum Annual Export Capacity (bbl) [a]	Percent of 2021 U.S. Crude Oil Production [b, g]	Percent of 2021 U.S. Crude Oil Exports [c, g]	Percent of 2021 GoM Export Capacity
Sea Port Oil Terminal [d]	365 per year	730,000,000	18	67	14
Texas GulfLink [e]	180 per year	360,000,000	9	33	7
Bluewater Texas Terminal [e]	192 per year	384,000,000	9	35	8

Project	Maximum Number of Vessels Loaded	Maximum Annual Export Capacity (bbl) [a]	Percent of 2021 U.S. Crude Oil Production [b, g]	Percent of 2021 U.S. Crude Oil Exports [c, g]	Percent of 2021 GoM Export Capacity
Blue Marlin Oil Port [e]	365 per year	730,000,000	18	67	14
LOOP [f]	146 per year	292,000,000	7	27	6
Cumulative Totals [h]	1,102 per year	2,496,000,000	62	229	50

[a] Maximum annual export capacity assumes vessels are fully loaded VLCCs with a capacity of 2 million barrels.

[b] Based on 2021 annual crude oil production of 4,083,494,000 barrels (EIA 2022a).

[c] Based on 2021 annual crude oil exports of 1,087,638,000 barrels (EIA 2022b).

[d] Source: SPOT 2019a

[e] Source: MARAD 2022a; reported as 15 per month for Texas GulfLink, and 16 per month for Bluewater.

[f] Source: LOOP, LLC 2022.

[g] As discussed in Section 5.3.7.3, crude oil production and exports are driven by complex market forces, and new export capacity is likely to have a minimal effect on export volumes, and a marginal effect on production.

[h] Numbers may not add up due to rounding.

5.2.2. Onshore Terminals

The existing ECHO Terminal in Harris County, Texas, would provide the crude oil supply for the SPOT Project. Other crude oil terminals in the Texas Gulf Coast region include the Jones Creek Terminal in Brazoria County, the Magellan East Houston Terminal, and the Nederland Terminal near Beaumont, Texas. All three of these terminals are more than 31.1 miles[1] from the proposed SPOT DWP; however, the Jones Creek and Magellan East Houston terminals are within 10 miles of the proposed onshore pipelines and the Jones Creek terminal is approximately 10 miles southwest of the Oyster Creek Terminal.

The Phillips 66 Freeport Liquefied Petroleum Gas (LPG) Export Terminal has been in operation since 2016. In addition, six existing LNG terminals and several liquefaction and export projects are near the Project area, as well as 14 LNG export facilities proposed, planned, or under construction in the Gulf Coast region. Of those 14 proposed facilities, 2 terminals in Louisiana and Texas are under construction. Freeport LNG's Quintana Island Terminal, Cameron LNG near Hackberry, Louisiana, Cheniere's Corpus Christi LNG, and Sabine Pass LNG near Port Arthur, Texas, are currently operating as export terminals. Freeport LNG's first export was completed in September 2019, Cameron LNG's first export was completed in May 2019, Corpus Christi LNG's first export was completed in December 2018, and Sabine Pass LNG's first export was completed in February 2016 (Chapa 2019; FERC 2021a, 2021b, and 2019c; Offshore Energy Biz 2018).

As shown on Figures 5.2-1 through 5.2-3, three onshore oil and gas terminals are operational and are within 31.1 miles of the Project area. In addition, Port Freeport is expanding the Velasco Container Terminal. This ongoing expansion project includes increasing the harbor depth to 51 feet, adding two berths to accommodate Panamax and Post-Panamax class vessels, and developing land-to-store cargo from the berths. Construction activities are expected to be completed in 2026.

[1] Distance is consistent with USEPA's major source modeling guidance, which states that the cumulative air emissions model is predictive within 50 kilometers (31.1 miles).

5.2.3. Oil and Gas Activity

The SPOT DWP is located in BOEM's Western Gulf of Mexico Planning Area for offshore oil and gas activity. This area, which includes the offshore waters adjacent to Texas, has the third largest volume of untapped oil and gas resources among all OCS regions, and the second highest volume among the three areas of the Gulf of Mexico OCS Regions, behind the Central GoM Planning Area (BOEM 2016a). The Central GoM Planning Area includes the offshore waters adjacent to Louisiana, Mississippi, and Alabama. The Eastern GoM Planning Area includes the offshore waters adjacent to Florida and within the GoM. For leasing purposes, the OCS is divided into protraction areas, which are further divided into numbered lease blocks. Oil and gas activities may occur on OCS leases after a lease sale, and may occur over a period of 40 to 50 years. According to BOEM's 2017 to 2022 Outer Continental Shelf Oil and Gas Leasing Proposed Final Program, 10 of the 11 lease sales included in the 2017 to 2022 Proposed Final Program are in the Gulf of Mexico OCS Region. As of May 1, 2019, 1,415,042 acres of the 12,110,149 acres actively leased in the Gulf of Mexico OCS Region (12 percent) are in the Western Planning Area, 10,591,427 acres (87 percent) are in the Central Planning Area, and 103,680 acres (approximately 1 percent) are in the Eastern Planning Area (BOEM 2016c, 2021).

Onshore oil and gas activity in the Project area includes development, construction, and operation of oil fields, oil refineries, and gas/natural gas liquids processing plants in Brazoria County and Harris County, Texas.

5.2.4. Pipeline System Projects

Numerous existing or proposed pipeline systems cross the Project area. The Gulf South Coastal Bend Header is a 66-mile, 36-inch LNG pipeline between Brazoria and Wharton counties, Texas. In 2018, the Praxair Texas City Plant began supplying industrial gas to the Yara Freeport ammonia plant through its recently extended Gulf Coast pipeline system. In addition, an extensive network of subsea pipelines in the GoM gathers oil and natural gas from active platforms, and transports the products to onshore facilities (see Figure 3.10.6-1).

The approved (license issuance pending) Delfin LNG Project would reuse and repurpose two existing offshore natural gas pipelines: the former UTOS pipeline and the HIOS pipeline. In addition, a 700-foot new pipeline would be constructed to bypass a platform at West Cameron Block 167 and connect the UTOS and HIOS pipelines.

Several proposed projects near the Project area would have associated pipeline systems. The Texas GulfLink Project would include 32 miles of offshore pipeline to the DWP and an additional 12.3 miles of onshore pipeline. As noted in Section 5.2.1, Deepwater Ports, part of the proposed Texas GulfLink Project offshore pipeline would intersect the SPOT Project's proposed route (see Figure 5.2-1). Subsea pipelines would be installed for oil and gas developments in offshore lease blocks. The authorized Freeport LNG Train 4 Project would include 10.6 miles of 42-inch-diameter pipeline between the Freeport LNG Terminal, Pretreatment Facility, and Stratton Ridge Meter Station. Part of the proposed Train 4 Pipeline right-of-way overlaps the SPOT Project's proposed route (see Figure 5.2-3). The Stratton Ridge Expansion Project, the start-up of which was approved by FERC in March 2019, includes the construction of a new 12,500 hp compressor station in Brazoria County and 0.5 mile of pipeline from the new compressor station to the Brazoria Interconnector Gas Pipeline (Gonzales 2019; FERC 2019a). The

BMOP Project would include 37 miles of onshore crude oil pipeline between Nederland, Texas, and Cameron Parish, Louisiana. The onshore portions of the other DWP projects are outside of the onshore ROIs for the SPOT Project and are, therefore, not considered further.

5.2.5. Utilities

The proposed Chocolate Bayou Wind I LLC Project, approximately 16 miles east of the Oyster Creek Terminal, is an 80 to 150 megawatt wind energy development in Chocolate Bayou, Texas, consisting of 17 to 60 turbines. Construction is anticipated to begin in 2020 (Brazoria County Commissioner's Court 2018; USEPA 2016d).

5.2.6. Other Industrial Facilities

The Project area is surrounded by several operating and planned manufacturing plants, including chemical manufacturing and processing plants with associated laboratories and testing facilities, and the Praxair Air Separation Unit and Carbon Dioxide Purification facility in Brazoria County, Texas. With the exception of the Phillips 66 NGL Fractionator 4 Project, which is proposed to begin construction in 2021 (Brazoria County EDA 2021b), other industrial facilities included in this cumulative impact analysis are operational.

5.2.7. Commercial and Residential Developments

Several residential development projects are under construction within 1.0 mile of the Project area in Brazoria County, Texas. In 2018, construction started in the Sierra Vista community, an 850-acre residential development that will also include commercial development in Iowa Colony near SH 288 (Land Tejas 2019). Construction is also ongoing at Pomona, a master-planned community in Manvel, which includes a new elementary school as well as an area zoned for commercial development (Pomona 2019).

The Meridiana community, located east of SH 288, would have three community hubs, each with housing and commercial space, as well as the Alvin ISD Heritage Complex, a sports, extracurricular, and event complex that opened in 2018. The Proposed Action would cross directly through the Alvin ISD Heritage Complex via HDD approximately 140 feet from the recently opened 10,000-seat Freedom Field stadium. Three new schools are also planned for the Meridiana development: an elementary school, a middle school scheduled to open in 2020, and a high school adjacent to the junior high school scheduled to open in 2021. Two hubs of this community, West Meridiana and Central Meridiana, are already under construction, while construction has not yet begun on East Meridiana. The ECHO to Oyster Creek Pipeline would cross East and Central Meridiana generally in planned green space adjacent to an existing utility right-of-way.

The Project would cross through the planned Liberty Pointe subdivision, a 700-unit development along FM 523 surrounding and west of the intersection with SH 35 (City of Angleton 2018; Parrish 2018). The ECHO to Oyster Creek Pipeline would cross the development, but would be adjacent to an existing utility right-of-way.

The Project area would also be adjacent to the planned Presidio Manvel Town Center community, which would include retail space, restaurants, a hotel, and multi-family and single-family housing. Construction of the Presidio Project will not begin until at least 2020 (Steve Williamson, Transwestern, Pers. Comm., May 9, 2019).

5.2.8. Federal, State, and/or Municipal Government Activities

Future Federal, state, and/or municipal government activities include military readiness training activities, channel management, improvements, and dredging, as well as local roadway improvement and development projects. The four projects evaluated in this cumulative impact analysis include the Freeport Harbor Channel Improvement Project, the Manvel Thoroughfare Plan, and U.S. Navy military readiness training activities.

U.S. Navy military readiness training activities and research, development, testing, and evaluation include the use of active sonar and explosives within the in-water areas in portions of the Caribbean Sea and the GoM, at select Navy pierside locations, within port transit channels, near select civilian ports, and in bays and harbors. These activities are ongoing, and within the GoM range complex, occur within the Naval Surface Warfare Center Panama City Division Testing Range and the following existing ranges and operating areas (OPAREAs): Pensacola, Panama City, Corpus Christi, New Orleans, and Key West. The nearest OPAREA is Corpus Christi, which is approximately 130 nautical miles west of the SPOT Project.

5.3. Potential Cumulative Impacts by Resource Area

Potential cumulative impacts are described by resource and ROI in the following subsections.

5.3.1. Water Resources

5.3.1.1. Cumulative Impacts of the Proposed Action on Water Resources

Cumulative projects that could affect onshore water resources within the proposed Project vicinity include construction of onshore pipelines, construction and operation of onshore terminals, construction and opening of new community developments, changes to drainage management, and road construction projects. Activities that could affect offshore water resources near the Project area include offshore pipelines, DWPs, construction and operation of onshore terminals and associated vessel traffic, marine traffic associated with the offshore oil and gas industry, and channel management and improvements. These activities could affect water quality, marine currents, water temperature, turbidity and sediments, DO, and contaminated sediments, and could generate marine debris, inadvertent spills, hazardous materials releases, and testing and maintenance discharges.

Onshore, trenching and backfilling would temporarily increase the amount of sediments released downstream or in nearby waterbodies or wetlands. This could be exacerbated by other projects under construction in the ROI, particularly Meridiana, where the pipeline would cross near several drainage ditches, small waterbodies, and wetlands. In this area, the Proposed Action would use the HDD method from MPs 25.0 to 25.6 near the Alvin ISD Heritage Complex. The HDD entry point is near a drainage ditch and three small wetlands. As discussed in Section 3.3.5, Wetlands, the Applicant would protect wetland hydrology during construction, and would restore preconstruction contours following construction. In addition, the Applicant would mitigate unavoidable wetland impacts by implementing measures in its Compensatory Wetland Mitigation Plan (Appendix P). The SPOT Project, in combination with other cumulative projects listed in Table 5.2.1-1, would have direct, adverse, short-term or long-term, and negligible to minor cumulative impacts on onshore water quality.

There could be overlap of offshore water quality impacts during construction if the GulfLink offshore pipeline were constructed at the same time as the SPOT Project. The GulfLink offshore pipeline would cross the SPOT pipelines at about 9 miles from the SPOT platform. Within that area, water quality would be affected by construction activities (primarily pipeline burial), resulting in increased turbidity and/or a longer timescale of disturbance, depending on timing. The SPOT Project estimated a total of 25,261 acres of turbidity impacts while the GulfLink Project estimated 132,000 acres of turbidity impacts. Cumulatively, these impacts would affect water quality over a larger area and some areas could become more turbid if construction occurs simultaneously and turbidity plumes overlap. If construction occurs consecutively, the duration of water quality impacts in the region would last longer. Any offshore turbidity impacts resulting from construction would be short-term, with restoration to ambient conditions expected within 24 hours from either project at any one location. As construction moves from either project, pelagic species would be more prone to exposure to water quality impacts as they swim in and out of the construction zone. Conversely, benthic species would only be exposed to construction impacts for the limited time that construction would occur in a specific area. No other overlap in turbidity levels would be expected from installation of piles given that water quality impacts would likely be restricted to up to 866 feet from the piles for the SPOT Project (see Section 3.3.7.4, Coastal and Marine Environment and Marine Water Quality, Impacts and Mitigation), even if the two projects have concurrent construction schedules. The nearest oil and gas exploration and production activity would be approximately 24 nautical miles southeast of the proposed SPOT DWP (see Figure 5.2-1).

There is some potential for overlap of water quality impacts with other projects as the pipeline approaches the shoreline. Offshore construction impacts would be localized and are not expected to meaningfully overlap with similar impacts from other facilities. Vessels used for installation of the offshore SPOT Project components would be equipped with spill containment and cleanup equipment to respond to small, accidental releases. These measures would minimize the extent of impacts from a spill in marine waters. Construction of the SPOT Project, in combination with other past, present, and reasonably foreseeable projects, would have direct, adverse, short-term, minor cumulative impacts on offshore water resources.

Onshore operation impacts on water quality could result from unplanned maintenance or repairs in or near water resources along the onshore pipeline routes, and from an onshore or offshore oil spill. The unplanned maintenance and repairs would not likely overlap with cumulative projects, with the exception of those roadway or pipeline projects that intersect the SPOT onshore pipeline route. Offshore operation impacts would be associated with intermittent and operational water discharges from the platform and VLCCs or other crude oil carriers calling on the port. The plume size of discharges from the port would be relatively small (several hundred feet) and would quickly mix with surrounding seawater. Cooling water discharges from VLCCs or other crude oil carriers would result in small plumes of warmer water that could co-mingle with platform discharges, but those effects would be highly localized (see Section 3.3, Water Resources). Due to the highly localized impacts associated with discharges, impacts are not expected to overlap with similar impacts from other facilities. For large offshore spill events, the Applicant would mobilize a shore-based emergency response team. Impacts on both onshore and offshore water resources during operation would vary based on the cause and extent of water quality impacts, such as the size of a spill or release. Depending on the cause, cumulative impacts during operation could be direct, adverse, and short-term or long-term, and could range from negligible to major on both onshore and offshore water resources.

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. As a result, decommissioning of the SPOT Project, in combination with other cumulative projects, would have direct, adverse, short-term or long-term, and negligible cumulative impacts. See Section 3.3, Water Resources, for a more detailed description.

5.3.1.2. Cumulative Impacts of the Alternatives on Water Resources

Table 5.3.1-1 summarizes the impacts of onshore and offshore alternatives on water resources, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.1-1 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.1-1: Summary of Cumulative Impacts of Alternatives on Water Resources

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternative 2	Fewer waterbody crossings than the Proposed Action, but more pipeline crossings and resultant workspace. Overall, similar impacts on water resources due to sedimentation and turbidity.
Onshore Pipeline Alternative 5	Increased cumulative impacts due to greater number of waterbody crossings than the Proposed Action.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts on nearshore water resources due to disturbance of beach, nearshore, and offshore marine habitats and resultant increased turbidity and sedimentation.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts due to more pipeline infrastructure and greater associated seafloor and marine disturbance.
Offshore Deepwater Port Design Alternative 1	Increased cumulative impacts on water resources, due to greater seafloor disturbance.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts due to greater seafloor disturbance, as well as increased turbidity.

5.3.2. Biological Resources

5.3.2.1. Cumulative Impacts of the Proposed Action on Biological Resources

Biological resources include terrestrial and marine habitats, terrestrial non-threatened and non-endangered species, freshwater fisheries, benthic resources, plankton, marine mammals, estuarine and marine fisheries resources, and threatened and endangered species. The SPOT Project would not generate cumulative impacts on protected marine environments, such as MPAs, because the Project would not change implementation of fishing restrictions associated with MPAs, and the FGBNMS MPA is too far away to be affected by proposed Project activities.

Cumulative activities that could affect biological resources include the following:

- Current and recently proposed onshore oil and gas processing facilities;
- Construction and operation activities associated with the offshore oil and gas industry, including DWPs;
- Additions and modifications to land-based chemical plants; harbor expansion projects; and
- Channel management and improvements.

These activities could generate onshore cumulative impacts through vegetation removal and habitat alteration, wildlife displacement, introduction of invasive plant species, and could generate offshore cumulative impacts through degradation of water quality and marine habitats, increased vessel traffic and vessel strikes, increased noise, inadvertent spills of hazardous materials, and marine debris.

Onshore Project construction is not likely to be cumulatively substantial when combined with other ongoing and future onshore activities, unless the construction activities are near each other and occur simultaneously. In particular, the proposed Project pipeline would cross the Meridiana community (currently under construction) and overlap the Freeport LNG Train 4 Project Pipeline right-of-way; therefore, cumulative impacts are likely with these ongoing activities. The Applicant would employ a number of BMPs to minimize impacts on freshwater fisheries and terrestrial wildlife resources (see Section 3.5, Wildlife and Aquatic Resources). As a result, the proposed SPOT Project, in combination with other past, present, and reasonably foreseeable projects, would have short-term to long-term, direct or indirect, negligible to major, adverse cumulative impacts on onshore biological resources.

Operation of the onshore Project components would have fewer impacts on biological resources, due to less ground disturbance, fewer vehicles, and lower noise levels, and would not be cumulatively substantial when combined with other ongoing and future onshore activities. Similarly, offshore Project operation would have lower impacts on biological resources than construction.

Offshore construction and operation would likely result in cumulative effects on benthic habitat; marine fish, including ichthyoplankton; marine mammals; and protected species, depending on the resource and type of activity. A description of cumulative impacts is described for each resource below.

Benthic Resources

Offshore pipelines for the SPOT Project and the GulfLink Project would cross about 9 miles from the location of the SPOT DWP platform. Both projects would use jet sledding for pipeline burial, which would result in increased sediment depth over a portion of the seafloor beyond what modeling predicted for each individual project. As noted in Section 3.5.5, Benthic Resources, the SPOT Project would impact 1,212 acres of benthic habitat due to pipeline burial and anchoring during pipeline installation. The GulfLink Project would disturb the seafloor over a 75-foot-wide construction corridor and additional areas for anchor handling. Impacts in the area where the two project’s pipelines cross could extend the normal recovery period for benthic resources from 6 months to 2 years if the timing between the two projects is offset by weeks or months, but would not prevent the recolonization of soft bottom habitats by benthic species once construction is complete.

Cumulatively, operation of the two DWPs would result in a combined long-term disturbance to benthic habitat caused by anchor chains dragging on the seafloor, which would prevent recolonization of the areas. However, the impacts for the combined projects would be over a small area compared to the available soft bottom habitats in the northern GoM. Therefore, the cumulative adverse impacts on benthic habitat from the two projects would be minor.

Plankton

In addition to the SPOT Project, there is one approved (license issuance pending) DWP, five other proposed DWPs, and one operational DWP in the GoM ranging from Texas to Louisiana. GulfLink is the closest (7 nautical miles), and the others range from 90 nautical miles to 291 nautical miles from the SPOT Project. Each DWP would include water withdrawals during operation. Seasonality and timing of withdrawals would affect the density of plankton in the GoM and thus, the numbers entrained.

The SPOT and GulfLink projects would both withdraw seawater for hydrostatic testing during the construction phase. The combined loss of fish larvae and eggs for the two projects would result in 100 percent mortality for any entrained organisms. During operation, the SPOT Project anticipates loading 365 vessels annually while the GulfLink Project anticipates that 180 vessels would be loaded annually (MARAD and USCG 2020b). VLCCs or other crude oil carriers calling on the ports would use seawater for engine cooling while in the safety zones of the respective projects. The combined DWP and VLCC and other crude oil carrier annual seawater withdrawals for the SPOT Project would total about 4.6 billion gallons, with the majority used as vessel cooling water (i.e., 46,032,000 gallons per year for the DWP and 4,628,293,440 based on 12,680,256 gpd for 365 days). The GulfLink Project would have potable water shipped, thus limiting water intake at the DWP. However, VLCCs and other crude oil carriers calling on the GulfLink DWP would require a total of about 821 million gallons annually, based on 2.25 million gpd for 365 days (MARAD and USCG 2020b). Average annual entrainment of eggs and larvae, and age-1 equivalent losses based on base larval mortality for the two projects are provided in Table 5.3.2-1.

Table 5.3.2-1: Average Annual Entrainment using Base-Mortality for the SPOT and GulfLink Projects

Parameter	SPOT Project [a]	GulfLink Project [b]	Cumulative Totals
Fish Eggs			
Anchovies	25,265,533	7,276,327	26,846,596
Gulf menhaden	1,021,093	260,392	7,948,823
Red snapper	1,101,099	51,000	1,148,837
Red drum	905,587	163,248	1,010,667
Fish Larvae			
Anchovies	53,432,597	9,701,770	55,540,681
Gulf menhaden	13,676,510	347,189	22,913,483
Red snapper	2,268,942	68,001	2,332,592
Red drum	5,822,128	217,664	5,962,235
Age-1 equivalents			
Anchovies	29,681	5,642	30,907
Gulf menhaden	12,095	334	20,972
Red snapper	947	31	976
Red drum	4,856	188	4,977

[a] Source for SPOT Project is the Response to IR #334 (SPOT 2021f).

[b] Source for the GulfLink Project is CSA Ocean Sciences Inc. (2021) (see Docket No. MARAD-2019-0093)

Most of the DWP projects are spread across hundreds of miles, which would limit plankton entrainment at any particular location. The northern GoM is highly productive, so even the combined estimated plankton losses due to water withdrawals for the two projects within 7 nautical miles of each other would be within one standard deviation of 12 years of available Texas landings data (red snapper). Texas does not collect landings data for anchovy, gulf menhaden, or red drum, but it is reasonable to assume the same is true for these species given the productivity in the GoM. Therefore, the SPOT Project and other projects in the GoM (e.g., manned oil and gas platforms, other DWPs) would produce direct, adverse, long-term, and minor cumulative impacts on plankton populations (including phytoplankton, zooplankton, and ichthyoplankton).

Marine Mammals

Most marine mammals in the GoM (including Federally listed whales) occur in the deeper oceanic waters, but several dolphins inhabit the shallower waters of the continental shelf (e.g., Atlantic spotted dolphins, common bottlenose dolphins). Marine mammals Gulf-wide would be affected by the construction and operation of DWPs, ongoing oil and gas activities, and military activities that occur throughout the GoM. The new DWPs would cause a small reduction in benthic and plankton resources that marine mammals or their prey species rely on for food, which would result in direct and indirect, adverse, long-term, and minor impacts on marine mammals.

The main categories of potential impacts from activities in the GoM are vessel strikes, underwater noise, entanglement, marine debris, and oil spills.

Vessel Strikes

Vessel strikes pose a threat to any marine mammal in the GoM and may result in severe injury or mortality due to blunt force trauma from being struck by the ship bow or by lethal wounding from propeller cuts. Collisions with large whales are more common, but smaller marine mammals may also be affected. Severe and lethal whale collisions are usually associated with large vessels greater than 80 meters (262 feet) long (BOEM 2017c); Vanderlaan and Taggart (2007) report that vessel speed is the primary factor in the probability of a vessel strike being lethal. While vessel strikes can occur anywhere, collisions between ships and whales are more likely to occur in areas with heavy commercial shipping traffic (NMFS 2017f). Eight of the top 10 busiest U.S. ports all occur in the GoM, including Houston, Texas City, Galveston, Freeport, and Corpus Christi, Texas; New Orleans, Louisiana; Mobile, Alabama; and Pascagoula, Mississippi (MARAD 2013) and Figure 5.3-1 shows the level tanker traffic in the GoM in 2017.

Based on data from the International Whaling Commission Vessel Strike database (IWC 2014) and from Soldevilla et al. (2017), there have been four confirmed ship strikes in the GoM. Additionally, NMFS (2020m) reports possible collisions with sperm whales in the GoM from 1990 (lethal) and 2005 (non-lethal), and one from the Navy in 2001 (fate unknown), and indicates the possibility that sperm whales may not hear approaching vessels or have become habituated to the high level of traffic. The low incidence of confirmed strikes does not indicate that vessel strikes are not occurring. It is likely that many more strikes go undetected or unreported, perhaps because they occurred in remote areas or because the animals never washed up on shore (Jensen and Silber 2004). As more DWPs become operational, large vessel traffic would continue to increase. The deep draft of VLCCs places any animals in the upper

75 feet of the water column at risk. Though VLCCs would move slowly in DWP safety zones, speed would increase as they exit the safety zone and travel through the GoM.

Oil and gas exploration involves vessel traffic associated with geological and geophysical surveys in the GoM out to the EEZ. BOEM (2017c) states that survey vessels move at higher speeds over shelf waters while traversing to the survey location, and move relatively slowly once on the survey site. BOEM (2017c) estimates 19,689 vessel transits associated with geological and geophysical activities would occur over a 10-year period. Survey vessel crews would also function as visual observers and would adhere to vessel strike avoidance measures for all vessels operating in the GoM OCS (BOEM 2017c). Even with these mitigation measures in place, NMFS (2020m) found that there is the potential for both non-lethal and lethal vessel strikes due to oil and gas activities.

Vessel traffic associated with military activities occurs throughout the GoM, but certain activities are restricted to designated OPAREAs around Corpus Christi, Texas; New Orleans, Louisiana; and Pensacola, Panama City, and Key West, Florida. Naval exercises are episodic within the designated OPAREAs, but small naval vessels regularly move about in nearshore waters at high speeds. Offshore, submarine speeds average 8 to 13 knots. Navy ships travel at average speeds of 10 to 15 knots (U.S. Navy 2018), which is similar to the vessel speeds assumed for fully loaded VLCCs and other crude oil carriers. While operating, Navy procedures require that personnel maintain constant watch (day and night) and use proper scanning and notification procedures, which would help reduce the risk of collision between vessels and marine mammals.

In addition to vessel traffic associated with oil and gas activities, naval activities, and commercial shipping, the increasing number of DWPs in the GoM would also increase vessel traffic. Figure 5.3-2 shows the annual average vessel traffic from all vessels. Some nearshore traffic may be reduced as lightering vessels would not be required for VLCC and other crude oil carrier loading, but overall vessel traffic would likely increase. It is difficult to predict how vessel traffic associated with oil and gas exploration and naval activities would change over time, but it is clear that overall vessel traffic in the GoM would continue to increase, which could increase the potential for vessel strikes. While increased vessel traffic from operation of the SPOT Project would be relatively small, the Project would contribute to the overall increase in vessel traffic in the GoM. Table 5.3.2-2 provides the number of vessels that could call on any of the other DWPs in the GoM annually. However, it is unclear how many vessels would consist of new tanker traffic and how many would be the same tankers previously loaded via reverse lightering. When considered with potential increases from the other DWPs and other projects, the overall vessel traffic in the region would continue to increase and the potential for vessel strikes would also increase. Although it is known that reducing vessel speeds can reduce the potential risk of a vessel strike or the severity of that strike, neither MARAD nor the USCG have the authority to regulate vessel speeds outside the safety zone and seaward of 12 nautical miles from the coastline. Given that reported vessel strikes are likely a fraction of actual vessel strikes, when considered cumulatively, the impacts on marine mammals associated with the risk of vessel strikes would increase incrementally with the increase in vessel traffic. Overall impacts from vessel strikes would be direct, adverse, long-term, and minor to moderate, but could be lethal (major).

Table 5.3.2-2: Maximum Annual Vessel Calls at Deepwater Ports in the Gulf of Mexico

	LOOP [a]	BMOP [b]	Texas GulfLink [c]	SPOT [d]	Bluewater [e]	Louisiana FLNG DWP [e]	West Delta LNG DWP [e]	Port Delfin LNG [f]
Vessel calls for exports	146	365	180	365	192	40	TBD	160
Vessel calls for imports	Unknown[g]	NA	NA	NA	NA	NA	TBD	NA

NA = not applicable; BMOP = Blue Marlin Offshore Port; FLNG = Fast Liquefied Natural Gas; DWP = Deepwater Port; TBD = to be determined

[a] Source: LOOP 2022

[b] Source: BMOP 2020

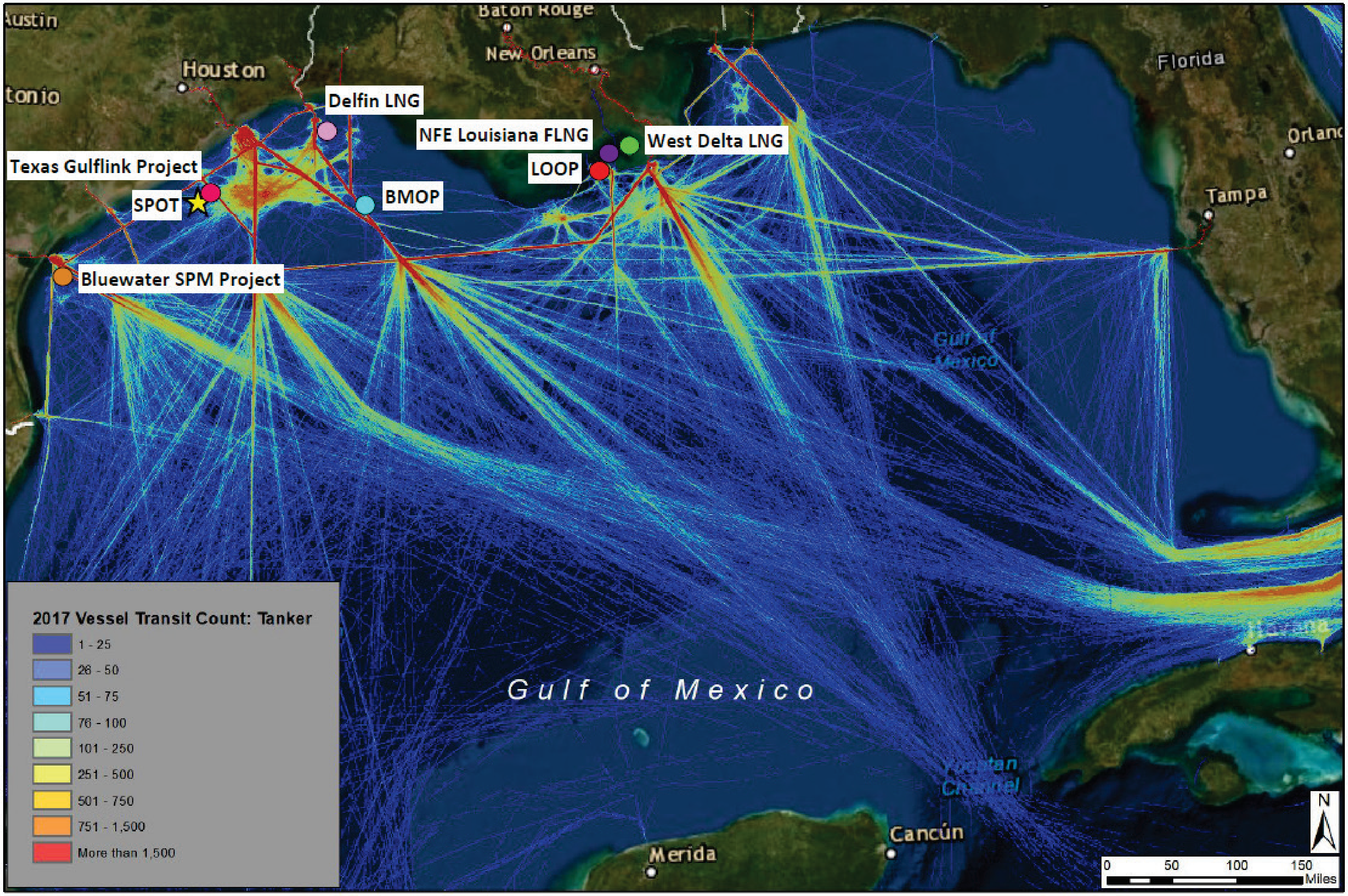
[c] Source: MARAD and USCG 2020b

[d] Source: SPOT 2019a

[e] Source: MARAD 2022a

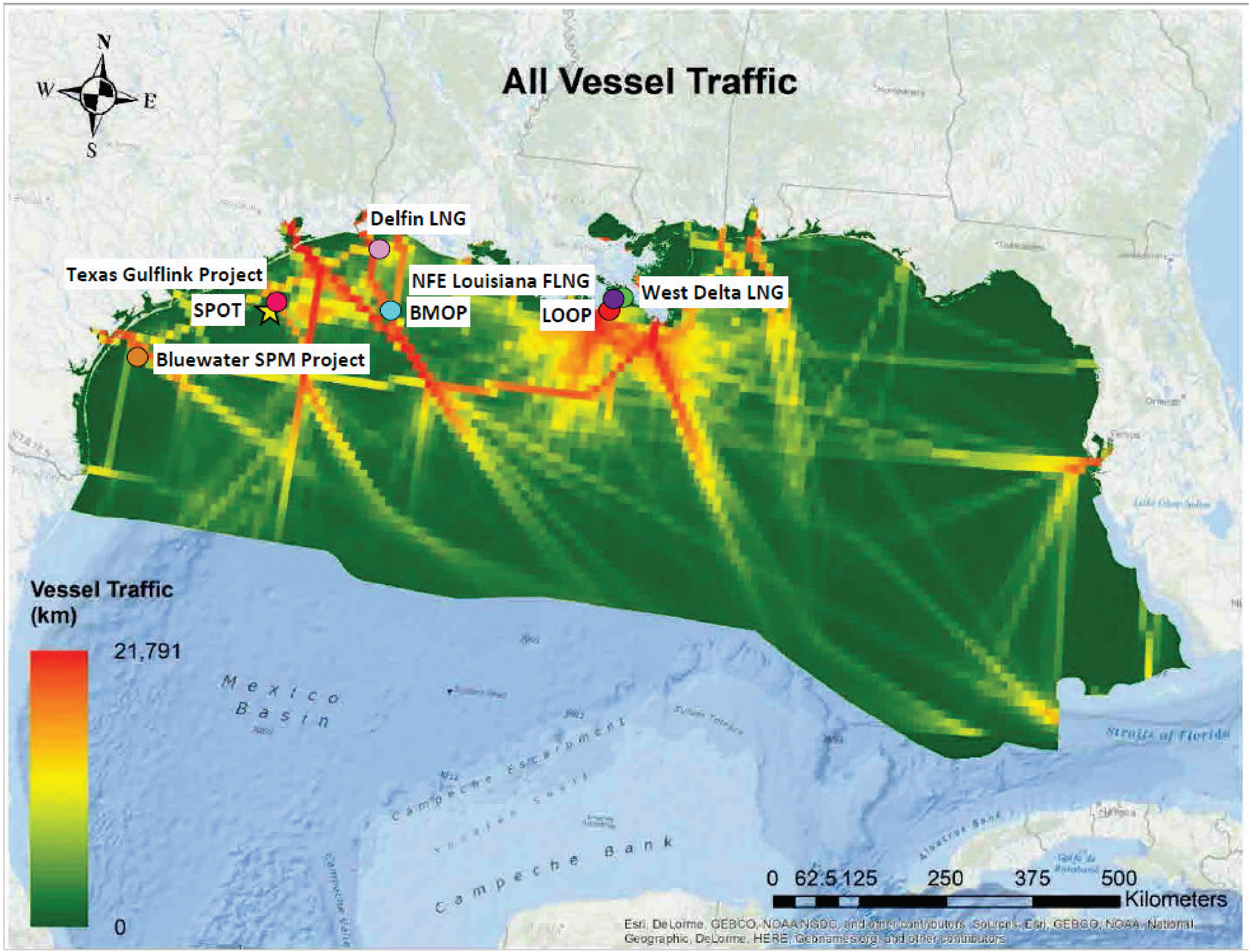
[f] Source: MARAD and USCG 2016

[g] The offloading capacity at the LOOP Marine Terminal is 100,000 bbl per hour (LOOP 2022). The total number of vessel calls for imports would vary based on the size of the vessel. The estimated capacity of crude oil carriers ranges from 750,000 bbl to 2,000,000 bbl.



Source: NOAA OCM 2019l

Figure 5.3-1: Large Vessel Traffic (Tankers) in the Gulf of Mexico in 2017



Source: NMFS 2020m

Figure 5.3-2: Average Annual Kilometers of Vessel Traffic from all Vessels in the Gulf of Mexico Based on 2014-2018 AIS Data

Underwater Noise

Noise pollution is an increasing concern throughout the world's oceans, and monitoring of disturbance to marine mammals due to anthropogenic underwater noise is increasing (Thomas et al. 2015). Noise can cause injury or disturbance to marine animals, which in some cases could be lethal. Marine mammals would be affected by all the noise sources in the GoM, and could face multiple exposures if activities from various sources occur simultaneously or if animals exposed to one noise are then exposed to another in close succession. There are two main types of noise—impulsive noise (e.g., pile driving) and non-impulsive noise (e.g., drilling). Underwater noise generated by pile driving activities for the SPOT and GulfLink projects could be audible at both project sites. Details associated with pile driving for the two projects are included in Table 5.3.2-3.

The two dolphin species (mid-frequency cetaceans) most likely to occupy the shelf waters associated with the DWPs and be affected by construction noise are the Atlantic spotted dolphin and common bottlenose dolphin. Pile driving would be the loudest underwater activity, but noise would also be generated by construction vessels, trenching, and anchor handling. The effects from pile driving would depend on the use of mitigation measures such as bubble curtains. Any dolphins present in the area during these activities could be injured or disturbed. Pile driving noise for both projects would be short-term, lasting a combined total of about 1 month. The proximity of the two projects could also make a larger area unavailable for dolphins due to construction activities and noise, potentially reducing suitable foraging or calving habitat.

In addition to construction noise, VLCC or other crude oil carrier transits would generate noise and cause behavioral responses to any marine mammals in proximity of the vessel. There is a corresponding increase in underwater noise associated with increases in vessel traffic (Wright 2008). Noise can lead to long-term health problems, and may pose increased health risks for populations by weakening the immune system and potentially affecting fertility and growth rates, and can cause mortality (Romano et al. 2004). Noise can interfere with acoustic signals and affect the ability of whales and dolphins to communicate, search for prey, and avoid predators (Clark et al. 2009). Although scientists recognize the potential problems caused by increasing noise pollution in the marine environment, and that reducing vessel speeds could help reduce underwater noise pollution, neither MARAD nor the USCG have the authority to regulate vessel speeds outside the safety zone and seaward of 12 nautical miles from the coastline.

In addition to noise generated from construction and operation of the DWP projects, marine mammals would be exposed to noise generated from oil and gas activities and naval exercises that occur at unspecified locations throughout the GoM. Oil and gas activities generate noise from airguns, boomers, and sparkers (impulsive) and drilling (non-impulsive) (BOEM 2017c). Sound propagation varies based on conditions and can be affected by salinity, temperature, bathymetry, and substrate. The duration, frequency, and intensity are also important factors when considering the effects of underwater noise on the marine environment. Seismic airguns are used to explore the seafloor or locate oil and gas deposits and multiple airguns are typically used together (i.e., airgun array). The sound generated from airgun arrays is louder than a single airgun. The effects on marine mammals vary based on proximity to the sound source and the hearing sensitivity of the animal, but may include changes in dive patterns, call rates, movements, and vocalizations (DOSITS 2020).

Table 5.3.2-3: Pile Driving Parameters for the SPOT and GulfLink Projects

Parameter		SPOT Project [a]			GulfLink Project [b]			
		Offshore Platform	SPM Buoys	PLEMs	Offshore Platform		SPM Anchors	PLEMs
Pile type		Steel	none	Steel	Steel		Steel	Steel
Pile number		8	NA	8 per PLEM	4		6 per SPM	4 per PLEM
Pile diameter		72 inches	NA	30 inches	66 inches		54 inches [c]	24 inches
Pile driving method		Impact	NA	Impact	Impact		Impact	Vibratory
Number of strikes (impact) or seconds (vibratory) per pile		10,224 strikes (maximum); 5,365 strikes (minimum) [e]	NA	408 strikes (maximum); 194 strikes (minimum) [e]	1,000 strikes [d]		100 strikes [d]	1,200 seconds
Driving time per pile		8 hours (2 hour intervals every 6 hours)	NA	40 minutes	12 hours		1 hour	20 minutes
Number of piles per day		1	NA	3	1		2	4
Number of driving days		10	NA	5.5	4		6	2
Total number of piles		8	NA	16	4		12	8
Attenuation device		Bubble curtain	NA	Bubble curtain	None		None	None
Attenuation rate		7 dB [e]	NA	7 dB [e]	None		None	None
Sound Source Level [a]	SPL_{peak} (dB re 1µPa)	220 (213 attenuated)	NA	210 (203 attenuated)	212	197	210	
	SPL RMS (dB re 1µPa)	205 (198 attenuated)	NA	193 (186 attenuated)	197	182	195	Sound Source Level [a]
	SEL_{cum} (dB re 1µPa^{2}s)	194 (187 attenuated)	NA	183 (176 attenuated)	188	173	185	
Distance at which source level measured		10	NA	10	10 [f]	17 [f]	10	Distance at which source level measured

dB = decibels; dB re 1 µPa = decibels relative to 1 microPascal; dB re 1 µPa^{2}s = decibels relative to 1 microPascal squared normalized to 1 second; m = meters; ft = feet; NA = not applicable; peak = peak sound pressure, PLEM = pipeline end manifold; RMS = root mean square; SEL_{cum} = cumulative sound exposure level; SPL = sound pressure level; SPM = single point mooring; SPOT = Sea Port Oil Terminal

[a] Source sound levels for SPOT Project from Caltrans 2020 Pile Driving Underwater Noise Compendium

[b] Source sound levels for GulfLink Project from NMFS, Greater Atlantic Regional Fisheries Office (GARFO), Pile Driving Acoustic Tool (user spreadsheet comparison to NFMS 2018a) (MARAD and USCG 2020b)

[c] GARFO Pile Driving Acoustic Tool did not have measurements for a 54-inch pile; a 60-inch pile was used as a proxy (MARAD and USCG 2020b).

[d] It is unknown if the number of strikes per pile is based on a worst-case or most-likely pile driving scenario.

[e] New information based on SPOT 2021c.

[f] SPL measurements were provided for a 17-meter distance. A source level referenced to 10 meters was calculated using a practical spreading loss of 15(log r), where r = radius.

Seismic surveys produce noise in the same frequency as the vocalization frequencies used by baleen whales, suggesting the likelihood that seismic surveys may cause behavioral responses in baleen whales

(Thomas et al. 2015). In a recent Biological Opinion, NMFS (2020m) described the types of effects that would be expected from airgun/survey activities in the GoM on sperm whales (a mid-frequency cetacean) and GoM Bryde's whales (a low-frequency cetacean). Sperm whales would experience disturbance from these activities and GoM Bryde's whales would likely experience injury and disturbance (NMFS 2020m). The same effects would be experienced by the other cetaceans in the GoM. Military activities would include the use of sonar and explosives, which can result in injury (e.g., hearing loss, mortality), physiological stress, masking, and other behavior responses.

As noted above, marine mammals would be affected by all the noise sources in the GoM, and could face multiple exposures if activities from various sources occur simultaneously or if animals exposed to one noise are then exposed to another in close succession. The specific locations of seismic surveys or military exercises at specific times are unknown, but noise from the construction and operation of new DWPs, oil and gas activities, and military exercises will continue to affect marine mammals Gulf-wide. This noise would have a long-term impact on marine mammals, especially as more places in the GoM become ensonified,[2] which limits the areas that could be used as refugia. If construction of the SPOT and GulfLink projects occurred simultaneously, the ensonified area around the two projects would be larger than if construction occurred at different times. If the two projects are constructed consecutively, the timeframe for disturbance would be longer than if construction would be separated by a period of time. Further, ensonification will continue to increase incrementally with the increase in ship traffic in the GoM. The cumulative effects of noise on marine mammals from all activities in the GoM would be direct, adverse, long-term, and moderate.

Entanglement

Marine mammals could become entangled in anchor lines during construction or operation of any of the DWPs. However, it is assumed that the projects would avoid the use of rope and instead use chains or large-diameter lines under tension, which would reduce the potential for entanglement. When assessed cumulatively, the potential for entanglement from the SPOT and GulfLink projects would be incrementally greater than that of a single project, but the risk of entanglement would still be expected to be quite low. As such, cumulative risk of entanglement of marine mammals would be direct, adverse, long-term, and minor.

Marine Debris

Marine debris poses a threat to all marine species with 56 percent of cetaceans having ingested marine debris; attributing mortality is difficult but as much as 22 percent of stranding mortalities have been associated with ingestion of marine debris (Baulch and Perry 2014; Laist 1997). Ingestion of marine debris is not consistent across species, but injury or death of beaked whales and sperm whales, among others, has been attributed to ingestion of styrofoam and plastic lines and bags (Baulch and Perry 2014; Jacobsen et al. 2010). Even assuming that all DWPs would comply with the marine debris regulations, an incremental increase in debris from construction and operation of the SPOT and GulfLink projects, as well as other DWPs, would result in direct, adverse, long-term, and minor cumulative impacts on marine mammals.

[2] Ensonify means "to fill with sound" (Glosbe 2016).

Oil Spills

NMFS (2020n) reports the footprint of the DWH oil spill overlapped the habitat of at least 15 different species within 22 stocks of dolphins and whales. Many inshore and nearshore dolphins, as well as oceanic dolphins and whales were injured or killed. Bottlenose dolphins living in Barataria Bay and Mississippi Sound suffered injuries including a higher incidence of reproductive failure, lung disease, impaired stress response, and compromised immune function. These injuries may have also lead to increased infections and disease. Evidence also suggests that the spill contributed to the largest and longest cetacean mortality event in the northern GoM with a total of 1,141 dolphins killed from March 2010 through July 2014. Barataria Bay bottlenose dolphins studied from 2010 through 2015 had a 35 percent greater than expected mortality rate, 46 percent greater than expected failed pregnancies, and 37 percent greater than expected likelihood of adverse health effects. With no intervention (active restoration), it could take as long as a century for continental shelf and oceanic marine mammals to recover (NMFS 2020n).

An oil spill at one of the DWPs would not result in the magnitude of oil released during the DWH spill, which released millions of barrels of oil into the GoM for 87 days. As described in Section 4.6.3.2, Worst-Case Discharge for Offshore Project Components, the largest volume of oil under the worst-case scenario for the SPOT Project would be 687,272 bbl, while the worst-case scenario for the GulfLink Project was estimated to be a 565,000 bbl release. Even combined, the volume would be significantly less than what occurred during the DWH spill. As described in Section 4.9, Reliability and Safety of Onshore Facilities and Pipelines, the two primary causes of pipeline oil spills are material, weld, or equipment failure, and corrosion, which combined accounted for 427 of 643 total incidents between 2009 and 2018. Though the potential for a spill to occur is low, cumulatively, an oil spill from either or both DWP projects would result in adverse impacts on marine mammals, including Federally listed species, that would be direct, adverse, long-term, and moderate to major, depending on the size, location, and timing of the spill(s).

Sea Turtles

Five Federally listed sea turtles occur Gulf-wide, and nest on GoM beaches from Mexico to Florida. Kemp's ridley and loggerhead sea turtles are known to nest on Texas beaches near the SPOT and GulfLink projects (USFWS 2015c; Shaver 2021). Kemp's ridley sea turtles exhibit strong nest fidelity (USFWS 2015c) and recent research for this species found that the nearshore Gulf waters are a crucial part of their migratory habitat, particularly nearshore areas about 20 kilometers (12.4 miles) from the coast in average water depths of about 26 meters (85 feet) (Shaver et al. 2016). Satellite tracking of post-nesting Kemp's ridley sea turtles between 2010 and 2017 documented the use and importance of foraging grounds in the northern GoM by the majority of reproductively active females (Gredzens and Shaver 2020). Additionally, hatchling and juvenile sea turtles rely on *Sargassum* mats for protection and food. *Sargassum* lives about 1 year; it begins growing in the western GoM in March and expands as it moves east (Gower and King 2011). *Sargassum* mats are likely to be present at or near the SPOT and GulfLink projects, and both projects would be very close to or overlap with the migratory corridor described for Kemp's ridley sea turtles. Stranding data from 2020 and 2021 suggest that green sea turtles are also frequently present in inshore waters (NMFS 2021d). For green sea turtles in the northwestern GoM, a shift to a seagrass-dominated diet becomes important for turtles larger than 30 centimeters, making seagrass beds in the northwestern GoM important foraging areas (Howell and Shaver 2021). Furthermore, lighting and noise from the two projects could affect access to foraging areas or deter sea turtles from accessing nesting beaches in the area.

The same projects, areas, and activities considered in the cumulative analysis for marine mammals were considered in the cumulative analysis for sea turtles.

Vessel Strikes

Records from the Sea Turtle Stranding and Salvage Network for Zones 18 and 19 (where the SPOT and GulfLink projects would be located) reported a total of 118 strandings in 2020 (82 offshore and 36 inshore) and a total of 131 as of March 20, 2021 (11 offshore and 120 inshore), including some caused by vessel strikes (NMFS, 2021d). A recent study evaluated sea turtle strandings in Florida from 1986 through 2014 and found that 21.5 percent of all strandings were associated with a definitive vessel strike injury and an additional 9.1 percent resulted from a probable vessel strike injury. The study also found that about 12 percent of stranded sea turtles were found alive, but only 1.7 percent survived rehabilitation and were subsequently released (Foley et al. 2019). Hazel et al. (2007) studied the behavioral responses exhibited by green sea turtles to approaching vessels and found they were more likely to avoid vessels that approached them slowly (4 kilometers per hour, or 2.2 knots). When vessels made moderate (11 kilometers per hour, or 5.9 knots) or rapid (19 kilometers per hour, or 10.3 knots) approaches, the turtles moved a shorter distance away from the approaching vessel (Hazel et al. 2007).

As part of its Biological Opinion for the oil and gas regulated activities, NMFS (2020m) calculated the density of sea turtles greater than or equal to 30-centimeters diameter (11.8 inches) in the GoM out to the EEZ (Table 5.3.2-4) and estimated both lethal and non-lethal vessel strikes from all vessels and from oil and gas vessels (Table 5.3.2-5). A full explanation of the calculations can be found in NMFS' (2020m) Biological Opinion.

Table 5.3.2-4: Abundance of Sea Turtles Greater than or Equal to 30-Centimeters Diameter (11.8 Inches) in the Gulf of Mexico to the EEZ

	Green	Hawksbill	Kemp's Ridley	Loggerhead	Leatherback
Abundance estimate	83,195	138,185	458,241	321,084	10,475

Source: NMFS 2020m

Table 5.3.2-5: Estimated Annual Injuries or Mortality of Sea Turtles Greater than or Equal to 30-Centimeters Diameter (11.8 Inches) from Vessels in the Gulf of Mexico

	Green	Hawksbill	Kemp's Ridley	Loggerhead	Leatherback	Totals
Annual non-lethal vessel strike injuries resulting from all vessels	323	484	685	1,573	51	3,116
Annual non-lethal vessel strike injuries resulting from oil and gas vessels	196	297	381	891	28	1,793
Annual average vessel strike mortalities (corrected) [a]	643	12	363	590	17	1,625
Annual lethal vessel strike injuries resulting from oil and gas vessels	389	8	202	334	10	943

Source: NMFS 2020m
[a] Data presented uses a 17 percent correction factor of observed annual average vessel strike mortalities (see full explanation in NMFS 2020m).

As described above, vessel strikes could occur due to military exercises in the GoM. Additionally, the proximity of the two DWP projects to important sea turtle habitat would increase the chances for vessel strikes in the area. Although there would be an overall increase in VLCC or other crude oil carrier traffic in the area near the DWPs, there could be a decrease of nearshore vessel traffic due to the reduction in lightering vessel traffic. The potential for severe injury increases with increased vessel speed; however, as noted for marine mammals, neither MARAD nor the USCG have the authority to regulate vessel speeds outside the safety zone and seaward of 12 nautical miles from the coastline. Given that documented vessel strikes are likely a fraction of actual vessel strikes, when considered cumulatively, the impacts on sea turtles associated with the risk of vessel strikes would increase incrementally with the increase in vessel traffic. Overall impacts from vessel strikes would be direct, adverse, long-term, and minor to moderate.

Underwater Noise

Sea turtle hearing is not well studied and little is known about their hearing capabilities or their use of sound, but they may rely on sound during particular life stages or it may also be important for detecting threats (NMFS 2020m; Lavender et al. 2014). The potential activities already described in the cumulative impact to marine mammals would also apply to sea turtles. However, NMFS (2020m) indicates that juvenile sea turtles, who spend the majority of their time near the surface, may not be exposed to the loudest sound fields generated by airgun and boomer use associated with oil and gas activities, but may still be affected by pile driving noise from the two DWPs. Cumulatively, the impacts on sea turtles due to construction and operation of the DWPs and potential for overlapping or nearby noise generated from oil and gas activities and military activities would be direct, adverse, long-term, and minor.

Marine Debris and Entanglement

Marine debris poses a threat to sea turtles and has been linked to nutrient deficiency. Sea turtle behavior makes them prone to entanglement or ingestion of marine debris because young turtles in particular seek shelter or food under floating objects such as *Sargassum*, which increases the potential for them to become entangled in or to ingest marine debris that gets caught in *Sargassum*. The recent NMFS Biological Opinion for oil and gas activities found that sea turtles would be affected by marine debris resulting in both lethal and non-lethal interactions (NMFS 2020m). Reports of entanglement of sea turtles are primarily associated with fishing gear such as monofilament line, rope, and net, but entanglement in other marine debris is also common. In combined data from 1980 to 1992 for the GoM, southeast U.S., northeast U.S., and U.S. Caribbean, 6.8 percent of sea turtles were entangled in burlap bags, six-pack rings, steel cables, plastic bags, rubber gloves, and other material. Most sea turtle strandings reported in Texas and the northern GoM in the late 1980s were entangled in marine debris (NOAA Marine Debris Program 2014a, 2014b). Though entanglement is a significant issue for sea turtles, there are no reported entanglements associated with anchor chains. It is assumed that the DWP projects would avoid the use of rope and instead use chains or large-diameter lines under tension, which would reduce the potential for entanglement. When assessed cumulatively, the potential for impacts from marine debris and entanglement from the SPOT and GulfLink projects, and other activities in the GoM, would be incrementally greater than for a single project and would be direct, adverse, long-term, and minor.

Oil Spills

The DWH oil spill had a profound effect on marine species in the GoM. NMFS (2020n) estimated the spill killed as many as 7,600 large juvenile and adult sea turtles, 166,000 small juvenile sea turtles, and 35,000 hatchlings. It will take decades to recover from the loss because sea turtles mature slowly. Direct mortality from an oil spill is easier to identify than the long-term effects on sea turtle populations, partly because they are difficult to accurately count in surveys and because their migratory movements extend thousands of miles. They may live extended parts of their life in areas that are very far apart. Although population trends are often based on the number of nesting females, annual nesting fluctuations are influenced by multiple factors and may not reliably capture population trends or the effects of a single spill event. There have been large fluctuations in nesting in the years following the DWH; a record high number of nesting Kemp's ridley sea turtles occurred Gulf-wide in 2017 and the 2019 GoM nesting season was a 10-year low for the species. Closer to the DWPs, the 2020 nesting season included eight Kemp's ridley nests (six at Surfside Beach, one in Brazoria County north of Surfside, and one on Galveston Island) and one loggerhead nest in Brazoria County north of Surfside (NPS 2021). These numbers are similar to the numbers reported for 2017 and 2018 (Appendix E1, Biological Assessment and Essential Fish Habitat Assessment). Though the DWH had a clear adverse impact on Kemp's ridley and other sea turtles, other environmental and biological factors also influence reproduction (NMFS 2020n), making it impossible to point to one single event. Additional monitoring and studies are needed to understand the nesting trends observed for Kemp's ridley sea turtles (NMFS 2020n).

The SPOT and GulfLink projects would occur in an important migratory corridor for Kemp's ridley sea turtles and where *Sargassum*, important habitat for hatchling and juvenile sea turtles, typically grows in the GoM. An oil spill from one or both of the DWPs would adversely affect sea turtles and these important habitats. As described above for marine mammals, the potential for an oil spill to occur is quite low, but cumulatively, a spill from either or both of the DWP projects (from either the onshore or offshore components) would result in adverse impacts on sea turtles that would be direct, adverse, long-term, and minor to major, depending on the size, location, and timing of the spill(s).

Fish

The same projects, areas, and activities considered in the cumulative analysis for marine mammals were considered in the cumulative analysis for fish. Cumulatively, fish could be negatively affected by activities occurring in the GoM that result in underwater noise, marine debris, vessel traffic, and oil spills, but some species may receive a negligible benefit from the increased hard bottom habitat from construction of the SPOT and GulfLink projects. Overall, cumulative impacts on fish from normal operation would be direct, adverse, long-term, and minor. Impacts from an oil spill would be direct and indirect, adverse, long-term, and minor to major, depending on the timing, location, and size of the spill. The addition of hard bottom habitat would be direct, beneficial, long-term, and negligible.

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. As a result, the Project, in combination with other cumulative projects, would have short-term to long-term, direct or indirect, adverse, and negligible to minor cumulative impacts on biological resources. See Sections 3.4, Habitats, through 3.7, Threatened and Endangered Species, for a more detailed description.

5.3.2.2. Cumulative Impacts of the Alternatives on Biological Resources

Table 5.3.2-6 summarizes the impacts of onshore and offshore alternatives on biological resources, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.2-6 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.2-6: Summary of Cumulative Impacts of Alternatives on Biological Resources

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternative 2	Fewer waterbody crossings than the Proposed Action, but more pipeline crossings and resultant workspace. Potential increased cumulative impacts to due to additional habitat loss.
Onshore Pipeline Alternative 3	Potential increased impacts on habitat due to decreased collocation.
Onshore Pipeline Alternative 4	Increased cumulative impacts, due to crossing 2.7 miles of the Justin Hurst Wildlife Management Area and location immediately adjacent to (but not crossing), USFWS-designated critical habitat for the Piping Plover (*Charadrius melodus*). Overall, this alternative would have the most land habitat impact due to its length and workspace required during construction and operation as compare to the other alternatives.
Onshore Pipeline Alternative 5	Increased cumulative impacts, due to crossing 3.4 miles of the Brazoria National Wildlife Refuge as well as at least 194 more waterbodies as compared to the other alternatives.
Oyster Creek Terminal Alternative 3	Increased cumulative impacts, due to the site containing 20.4 acres of freshwater forested/shrub wetland habitat, which could be affected during construction.
Oyster Creek Terminal Alternative 4	Increased cumulative impacts, due to the need for at least an additional 0.6 mile of new pipeline and approximately 1 mile of new electric transmission line, which would lead to additional habitat loss and/or fragmentation.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts, due to more pipeline infrastructure and greater associated seafloor and marine disturbance, which would impact marine species.
Offshore Deepwater Port Design Alternative 1	Increased cumulative impacts on biological resources, due to greater seafloor disturbance, which would impact marine species.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts on biological resources due to disturbance of beach, nearshore, and offshore marine habitats.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts due to greater seafloor disturbance, as well as increased turbidity, which would impact marine species.

USFWS = U.S. Fish and Wildlife Service

5.3.3. Geologic and Soil Resources

5.3.3.1. Cumulative Impacts of the Proposed Action on Geologic and Soil Resources

Onshore activities that could impact geologic and soil resources within the vicinity of the proposed Project include current and recently proposed oil and gas facilities, harbor expansion projects, commercial and residential developments, and additions and modifications to land-based chemical plants. The primary offshore activities that could impact geologic and sediment resources within the vicinity of the proposed Project include nearshore oil and gas exploration and production activities and the Freeport Harbor Expansion Project.

Project construction is not likely to contribute substantially when combined with other ongoing and future onshore activities, unless the construction activities overlap each other or are within 1 mile. In particular, the proposed Project pipeline would cross the Meridiana community (currently under construction), and overlap the Freeport LNG Train 4 Project Pipeline right-of-way. Onshore, where feasible, ground disturbance would occur in areas previously disturbed by existing oil and gas activities. The Applicant would employ BMPs to minimize impacts on geologic resources (see Section 3.8, Geologic and Soil Resources). As a result, construction of the Project, in combination with other past, present, and reasonably foreseeable projects, would have direct or indirect, adverse, short-term to long-term, negligible to minor cumulative impacts on onshore geologic and soil resources.

Construction of the offshore components would overlap where the SPOT offshore pipelines and GulfLink offshore pipeline cross at about 9 miles from the SPOT DWP platform. Burial of the two pipelines would result in increased sediment deposition over some areas near the pipeline crossings. Over time, tides, wind, and currents would redistribute sediments. Increased sediment deposition would have direct, adverse, short-term, minor, cumulative impacts on geologic and sediment resources offshore.

During general operation activities, the SPOT Project would not contribute to cumulative impacts on geologic or soil resources. During unplanned maintenance or repair activities, the SPOT Project, in combination with other past, present, or reasonably foreseeable project, would have direct, short-term, adverse, negligible cumulative impacts on geologic and soil resources. During offshore Project operation, as discussed in Section 3.8.4.1, Geologic and Soil Resources, Soil and Sediment Characteristics, Existing Conditions, actions of tides and/or natural or vessel-induced currents may cause sediment scour where the Project components intersect the seafloor. Because the Project's impacts on sediments and geology would be confined to the proposed Project's footprint, the only potential offshore overlap would be the locations where Project pipelines cross existing pipelines. Therefore, Project operation would have direct or indirect, adverse, short-term to long-term, negligible to moderate impacts on geologic and sediment resources

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. Overall, Project decommissioning would have direct, adverse, short-term, negligible, cumulative impacts on geologic and soil resources, both onshore and offshore.

5.3.3.2. Cumulative Impacts of the Alternatives on Geological and Soil Resources

Table 5.3.3-1 summarizes the impacts of onshore and offshore alternatives on geological and soil resources, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.3-1 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.3-1: Summary of Cumulative Impacts of Alternatives on Geological and Soil Resources

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternative 2	Increased cumulative impacts due to the additional pipeline crossings and required workspace compared to the Proposed Action.
Onshore Pipeline Alternative 3	Less crossing of developed land, but increased cumulative impacts due to less collocation.
Onshore Pipeline Alternative 4	Overall, this alternative would have the most impact on geological and soil resources due to its length and workspace required during construction and operation as compare to the other alternatives.
Onshore Pipeline Alternative 5	Increased cumulative impacts, as this route is the least collocated route and would cross less developed land than the other alternatives.
Oyster Creek Terminal Alternative 2	Decreased cumulative impacts due to less prime farmland soils and developed land crossed.
Oyster Creek Terminal Alternatives 3 and 4	Increased cumulative impacts due to more prime farmland soils being crossed.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts, due to more pipeline infrastructure and greater associated seafloor disturbance as compared to the Proposed Action.
Offshore Deepwater Port Design Alternative 1	Increased cumulative impacts on geological and soil resources, due to greater seafloor disturbance as compared to the Proposed Action.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts on geological and soil resources due to greater disturbance of beach, nearshore, and offshore marine geological and soil resources as compared to the Proposed Action.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts due to greater seafloor disturbance and increased turbidity as compared to the Proposed Action.

5.3.4. Cultural Resources

5.3.4.1. Cumulative Impacts of the Proposed Action on Cultural Resources

Cumulative projects that could affect cultural resources include the Freeport LNG Train IV pipeline, the Seabreeze Environmental Landfill, the City of Manvel Thoroughfare, the Meridiana community, the marine highway designation for the GIWW, and Texas GulfLink. Activities that result in disturbance of the ground and seafloor could threaten historic and prehistoric archaeological resources onshore and offshore, and could result in visual impacts on historic structures onshore.

Project construction is not likely to be cumulatively substantial when combined with other ongoing and future onshore activities because, unless the construction activities occur simultaneously, no new cultural resources would be disturbed (i.e., cultural resources can only be disturbed once, before they are either protected or displaced). In particular, the proposed Project pipeline would cross the City of Manvel Thoroughfare route, the Meridiana community (currently under construction), and the marine highway designation for the GIWW, and would overlap the Freeport LNG Train 4 Project Pipeline right-of-way; however, it is not likely that construction of these projects would occur simultaneously with the SPOT Project. Unanticipated discoveries during construction could result in minor to major incremental impacts on cultural resources; however, the Applicant would implement its Unanticipated Discoveries Plan for Cultural Resources and Human Remains (see Appendix U) to minimize potential impacts. As a result, the SPOT Project, in combination with these cumulative projects, could result in minor incremental impacts on cultural resources. Therefore, cumulative impacts on cultural resources would be direct, adverse, long-term, and minor.

Offshore construction of the subsea pipelines for the SPOT Project would overlap with the route for the subsea pipelines for the Texas GulfLink Project. Construction of these projects could occur simultaneously; however, it is unlikely the portion of the pipelines that intersect would be constructed at the same time. Therefore, the SPOT Project, in combination with the Texas GulfLink, would not have cumulative impacts on cultural resources.

The proposed Oyster Creek Terminal would be constructed across FM 523 from the Seabreeze Environmental Landfill. However, it was determined that the onshore components of the SPOT Project would not have indirect (i.e., visual) adverse impacts on cultural resources. Similarly, there are no cumulative projects present in the offshore ROI for cultural resources; therefore, the SPOT Project would not contribute to cumulative impacts on cultural resources during operation of either the onshore or offshore components.

5.3.4.2. Cumulative Impacts of the Alternatives on Cultural Resources

Table 5.3.4-1 summarizes the impacts of onshore and offshore alternatives on cultural resources, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.4-1 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.4-1: Summary of Cumulative Impacts of Alternatives on Cultural Resources

Alternative	Discussion
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Decreased cumulative impacts, due to proximity to fewer potential cultural sites or shipwrecks.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts due to greater seafloor disturbance, which could impact cultural sites.

5.3.5. Land Use, Recreation, Visual Resources, and Ocean Use

5.3.5.1. Cumulative Impacts of the Proposed Action on Land Use, Recreation, Visual Resources, and Ocean Use

Activities that could impact land use, recreation, visual resources, and/or ocean use within the proposed Project vicinity include the Freeport Harbor Expansion Project, construction and operation of DWPs, onshore terminals, BOEM's Five Year OCS Oil and Gas Program, compressor stations and pipeline systems, and community developments, including the Alvin ISD Heritage Complex. The ECHO Terminal is an existing use, and is, therefore, excluded from consideration in the analysis for this resource.

As stated in Section 3.10.3.1, Land Use, Recreation, Visual Resources, and Ocean Use, Land Use, Existing Conditions, the proposed onshore pipeline route follows existing linear features (e.g., pipelines, electric transmission lines, roads, railroads) to the extent possible to minimize establishing new linear features across the landscape; however, several communities are planned or currently under construction (see Section 5.2.7, Commercial and Residential Developments). In particular, the proposed Project pipeline would cross a portion of the Meridiana community that is currently under construction or planned for construction during the SPOT Project's construction phase, and several planned or under construction roads, collocated with an existing pipeline right-of-way. In addition, the proposed pipeline would run adjacent to the site of a new middle school, and would cross directly through the Alvin ISD Heritage Complex via HDD approximately 140 feet from Freedom Field stadium. Using the HDD method in this location could limit access to people entering the complex parking lot, depending on where the construction vehicles are accessing the HDD entry site. The proposed Project pipeline would also run adjacent to the planned Presidio Manvel Town Center community and the planned Liberty Pointe subdivision. The Applicant is preparing a residential construction plan for all residences within 50 feet of workspaces to mitigate potential impacts to residents. In addition, a section of the authorized Freeport LNG Train 4 Project Pipeline right-of-way directly overlaps the Project's proposed route. As a result, construction of the SPOT Project, in combination with other past, present, and foreseeable projects, would have direct, adverse, short-term, minor cumulative impacts on land use and recreation.

Construction of the offshore portion of the Project would result in construction vessel traffic along the offshore pipeline route and at the site of the SPOT DWP, which would affect fishing access to various areas due to the presence of other vessels. Once construction is complete, fishing and other recreational activities that currently occur in this area would be allowed to resume with the exception of areas that would be prohibited during operation. The potential for offshore overlap of recreation, visual resources, and/or ocean use impacts with other projects would be unlikely given the lack of intersection between the Project and the cumulative activities listed in Table 5.2-1. As a result, construction of the Project, in combination with other past, present, and foreseeable projects, would have short-term, direct, minor, adverse cumulative impacts on offshore recreation, offshore visual resources, and ocean use.

The Seabreeze Environmental Landfill is located directly across FM 523 from the Oyster Creek Terminal site. The visual character of the landfill area is light industrial, and visible components include a large white warehouse building, wetlands and retention ponds, and the landfill itself, which resembles a large hill. Construction of the Oyster Creek Terminal would change the visual character of the area within and immediately surrounding the proposed site by inserting a dense industrial development in the midst of low-density rural and open space. As a result, the facility would contrast with immediately adjacent lands, though other industrial developments are common in the larger landscape. Therefore, operation of the onshore components of the Project, namely the Oyster Creek Terminal, in combination with other past, present, and foreseeable projects, would have direct and indirect, adverse, long-term, minor cumulative impacts on land use, recreation, and visual resources.

Once operation commences offshore, the Applicant is proposing a 3,173-foot radius for the safety zones and ATBAs from the center of each SPM buoy and a 500-meter (1,640-foot) safety zone around the platform. The actual size of the ATBA that would be requested of the IMO would be determined through the advice and consent of the USCG. The safety zones would limit access to only Project-related vessel traffic. Fishing and other recreational activities that currently occur in this area would not be permitted in these safety zones or ATBAs. The potential for offshore overlap of recreation, visual resources, and/or ocean use impacts with other projects would be unlikely given the lack of intersection between the Project and the cumulative activities listed in Table 5.2-1. As a result, the Project, in combination with other past, present, and foreseeable projects, would have direct, adverse, long-term, minor cumulative impacts on offshore recreation, offshore visual resources, and ocean use.

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. Overall, Project decommissioning would have direct and indirect, adverse, short-term, negligible cumulative impacts on land use, recreation, visual resources, and ocean use, both onshore and offshore.

5.3.5.2. Cumulative Impacts of the Alternatives on Land Use, Recreation, Visual Resources, and/or Ocean Use

Table 5.3.5-1 summarizes the impacts of onshore and offshore alternatives on land use, recreation, visual resources, and/or ocean use, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.5-1 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.5-1: Summary of Cumulative Impacts of Alternatives on Land Use, Recreation, Visual Resources, and/or Ocean Use

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternative 2	Increased cumulative impacts, due to less collocation, and more cultivated crops and farmland crossed.
Onshore Pipeline Alternative 3	Increased cumulative impacts, due to less collocation, and more cultivated crops and farmland crossed.
Onshore Pipeline Alternative 4	Increased cumulative impacts, due to less collocation, more cultivated crops and farmland crossed, and crossing of 2.7 miles of the Justin Hurst Wildlife Management Area. Overall, this alternative would have the most land impact due to its length and workspace required.
Onshore Pipeline Alternative 5	Increased cumulative impacts due to less collocation and crossing of 3.4 miles of the Brazoria National Wildlife Refuge as well as at least 194 more waterbodies than other alternatives.
Oyster Creek Terminal Alternative 2	Alternative crosses less developed land, but more cultivated crops.

Alternative	Discussion
Oyster Creek Terminal Alternative 3	Increased cumulative impacts due to crossing of more cultivated crops and farmland.
Oyster Creek Terminal Alternative 4	Increased cumulative impacts due to crossing of more cultivated crops and farmland, as well as the need for approximately 1 mile of new electric transmission line, which would increase cumulative impacts on visual resources.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts on recreation and ocean use, due to more pipeline infrastructure, which may result in additional restricted areas during construction activities.
Offshore Deepwater Port Design Alternative 1	Increased cumulative impacts on recreation and ocean use, due to a larger restricted area around the proposed SPOT DWP.
Alternative Volatile Organic Compound Control Technologies	Increased cumulative impacts on recreation and ocean use, due to a larger restricted area around the proposed SPOT DWP.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts on recreation, visual resources, and ocean use due to construction activities and the disturbance of beach, nearshore, and offshore marine habitats.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts on recreation and ocean use, due to cargo barge trips for transportation of joints to an onshore facility for disposal, as well as additional underwater decommissioning activities.

5.3.6. Transportation

5.3.6.1. Cumulative Impacts of the Proposed Action on Transportation

Activities that could create onshore cumulative impacts on road transportation include construction of onshore pipelines, construction and operation of onshore terminals, new community developments, operational traffic from the Seabreeze Environmental Landfill, and road construction projects. Onshore impact-producing activities would include increased traffic congestion and delays due to road construction. Activities that could contribute to offshore cumulative impacts on marine transportation include installation of offshore pipelines, construction (including improvement or expansion activities) and operation of onshore terminals and DWPs and associated vessel traffic, marine traffic associated with the offshore oil and gas industry, and channel management and improvements. Offshore impact-producing activities would include navigational restrictions and increased maritime traffic and congestion.

The offshore projects considered for the cumulative analysis would use Port Freeport and other Gulf Coast ports, as well as established shipping safety fairways. Offshore Project construction would temporarily increase marine traffic between Port Freeport and the DWP, while deliveries of components and materials from other ports would increase vessel traffic in the fairways and other waters near the SPOT DWP. Waterways in the coastal areas off the coast of Texas and Louisiana already experience heavy use. All vessels (whether related to the Project or cumulative projects) would be required to follow navigational safety laws, adhere to safe navigation practices established through the 1972 International Rules of the Road (72 COLREGS), observe safety zones and ATBAs, and coordinate with Federal and state agencies responsible for regulating marine traffic. Therefore, offshore construction of the Project, in combination with other past, present, and foreseeable projects, would have direct, adverse, short-term, minor cumulative impacts on offshore transportation.

Operation of both the onshore and offshore components of the SPOT Project would result in onshore traffic using the same major roads and offshore vessel traffic using the same fairways as cumulative projects identified in Table 5.2-1. All traffic and vessels would be required to adhere to the relevant traffic and safety laws and regulations. As a result, operation of the SPOT Project, in combination with other cumulative projects, would have direct, adverse, long-term, minor cumulative impacts on onshore transportation and on offshore transportation other than ship-to-ship transfers associated with the DWPs listed in Section 5.2.1, Deepwater Ports.

The proposed Project and three of the other DWPs described in Section 5.2.1 anticipate the future use of VLCCs for crude oil export. Appendix Y analyzes the number of ship-to-ship transfer trips (to load VLCCs waiting offshore because they are too large to fully load at shoreside terminals) that would be avoided by construction of the four DWPs. As shown in Appendix Y and Table 5.3.6-1, if none of the four DWP projects were constructed, and assuming use of VLCCs in place of smaller vessels for crude oil exports, the ship-to-ship transfer of crude oil to VLCCs otherwise intended for export through the four DWP projects would generate a 25 percent increase in tanker trips in and out of the four major ports likely to serve lightering activity, with as much as a 41 percent increase in the Sabine-Neches Waterway (which serves Port Arthur, Texas). Construction and operation of the DWPs would avoid these trips.

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. Overall, Project decommissioning would have direct, adverse, short-term, negligible, cumulative impacts on onshore and offshore transportation.

Table 5.3.6-1: Cumulative Ship-to-Ship Transfer Trips Potentially [a] Avoided

	Tanker Vessel Trips				
	2015 Trips [b]	**Cumulative Lightering Added [e]**	**VLCC Trips Added [c]**	**Non-VLCC Export Trips Replaced [d]**	**Net Change [e]**
Houston-Galveston-Texas City (SPOT, GulfLink)	10,682	4,669	1,460	4,314	17%
Corpus Christi (Bluewater)	2,278	1,472	384	1,092	34%
Sabine-Neches Waterway (BMOP)	3,528	2,799	730	2,076	41%
All DWP Projects	**16,488**	**8,940**	**2,574**	**7,482**	**25%**

BMOP = Blue Marlin Offshore Port; DWP = deepwater port; SPOT = Sea Port Oil Terminal; VLCC = very large crude carrier

[a] The analysis in this table reflects a scenario in which VLCC loading at deepwater ports replaces, rather than adds to, vessel activity necessary to reverse-lighter crude oil onto VLCCs in the absence of deepwater ports.

[b] Source: (MARAD 2015). Existing vessel activity reported as "calls"—i.e., inbound trips only. This report assumes that each existing inbound call is associated with an outbound trip; thus the figure in this column is double the number of calls. MARAD has not published more recent data.

[c] See Appendix Y, Table 3.

[d] Reflects the average size of Aframax and Suezmax tankers and the assumed ratios of Aframax to Suezmax tankers used for ship-to-ship transfers, as discussed in Appendix Y.

[e] Calculated as: (Cumulative Lightering Added, plus VLCC Trips Added, minus Non-VLCC Export Trips Replaced) divided by 2015 Trips

5.3.6.2. Cumulative Impacts of the Alternatives on Transportation

Table 5.3.6-2 summarizes the impacts of onshore and offshore alternatives on transportation, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.6-2 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.6-2: Summary of Cumulative Impacts of Alternatives on Transportation

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternatives 2, 4, and 5	Increased cumulative impacts due to longer pipeline length, which could require additional vehicle trips to deliver pipes.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts on transportation, due to more pipeline infrastructure and possibly more barge trips and additional restricted areas during construction.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts due to additional cargo barge trips for transportation of joints to an onshore facility for disposal.

5.3.7. Air Quality

5.3.7.1. Cumulative Impacts of the Proposed Action on Air Quality

Activities that could generate onshore cumulative impacts on air quality include oil and gas activities; waterway transportation projects, including channel improvement projects and terminal development projects; onshore and offshore pipeline projects; industrial facilities; the Seabreeze Environmental Landfill; the Port Freeport Parcel 14 Rail Development; the Chocolate Bayou Wind I Project; development of residential communities; school improvement projects; and roadway construction projects. Emissions from these sources would overlap with air quality impacts from operation of the Oyster Creek Terminal. Activities that could generate offshore cumulative impacts on air quality include offshore waterway transportation projects, including channel improvement projects, the Texas Gulflink Project, and offshore pipeline projects.

Table 5.3.7-1 provides a summary of the deepwater port projects in the GoM either under review or authorized for operation under the DWPA. These include crude oil import and export terminals and liquefied natural gas export terminals. Based on publicly available information, this table summarizes the air emissions (criteria pollutants, HAPs, and GHG emissions) associated with the operation of the offshore portions of these projects, from both stationary sources (e.g., platforms and associated equipment) and mobile sources (e.g., crude oil and LNG transport vessels, support vessels). Although this table does not include a comprehensive inventory of all offshore air emission sources in the GoM, this information provides an overview of the potential cumulative air emissions associated with the operation of these projects, assuming all are authorized under the DWPA.

Table 5.3.7-1: Air Emissions Associated with Deepwater Port Projects in the Gulf of Mexico

Project Type	**Crude Oil Terminals**					**Liquefied Natural Gas Terminals**		
Project Name	**LOOP (import/ export)**	**Bluewater (export)**	**SPOT (export)**	**Texas GulfLink (export)** [1]	**BMOP (export)**	**Delfin LNG (export)**	**West Delta LNG**	**Louisiana Fast LNG (export)**
Project Status	**Operation**	**Proposed**	**Proposed**	**Proposed**	**Proposed**	**License Pending**	**Proposed**	**Proposed**
Location	18 nm off Jefferson Parish, LA coast	15 nm off San Patricio Co., TX coast	27.2 to 30.8 nm off Brazoria Co., TX coast	28.3 nm off Brazoria Co., TX coast	86 nm off Cameron Parish, LA coast	37.4 to 40.8 nm off Cameron Parish, LA coast	10.5 nm off Plaquemines Parish, LA coast	16 nm off Jefferson Parish, LA coast
Max Daily Volume	1.2M barrels	1.92M barrels	2.0M barrels	1.0M barrels	1.92M barrels	657.5M standard cf	900M standard cf	397M standard cf
Max. Annual Vessel Calls	146 [2]	192	365	180	365	40	Unknown	40
Offshore Emissions During Operation (TPY) [3]								
NO_x	Unknown [4]	1120.4	748.2	961.7	764.3	4,810	925	842.4
CO	Unknown [4]	306.5	378.1	338.5	227.4	7,088	602	784.8
VOCs	Unknown [4]	22,276.2	1,746.9	9,721.9	21,903.4	134	21	653.4
PM_{10}	Unknown [4]	39	22.7	31.3	15	319	62	98.2
$PM_{2.5}$	Unknown [4]	39	22.0	30.0	14.9	319	62	98.2
SO_2	Unknown [4]	45.1	108.4	37.7	23.3	240	<0.1	111.3
H_2S	Unknown [4]	2.9	1.2	<0.1	9.5	--	--	--
HAPs	Unknown [4]	869.8	83.2	300.6	1,230.7	46.3	944	--
CO_2e (GHG)	Unknown [4]	63,588.8	199,501	64,783	51,477	4,885,491	1,041,670	1,506,900

Source: LOOP FEIS (USDOT and USCG 1976); Bluewater DEIS (MARAD and USCG 2021a) (Document ID MARAD-2019-0094-0446); SPOT SDEIS (MARAD and USCG 2021) (Document ID MARAD-2019-0011-1267); GulfLink DEIS (MARAD and USCG 2020b) (Document ID MARAD-2019-0093-0088); BMOP Application (Docket ID MARAD-2020-0127) (BMOP 2020) and Response to Information Request #82 (BMOP 2021); Delfin FEIS (MARAD and USCG 2016) (Document ID USCG-2015-0472-0105); West Delta application – PSD application (LNG21 2019) (Document ID MARAD-2019-0095-0001); NFE Louisiana FLNG application – PSD application (New Fortress Energy 2022) (Document ID MARAD-2022-0076-0002)

BMOP = Blue Marlin Offshore Port; cf = cubic feet; CO_2e = carbon dioxide equivalent; CO = carbon monoxide; GHG = greenhouse gas; HAPs = hazardous air pollutants; H_2S = hydrogen sulfide; LA = Louisiana; LOOP = Louisiana Offshore Oil Port; M = million; nm = nautical miles; NOx = nitrogen oxides; PM_{10} = particle matter of 10 microns; $PM_{2.5}$ = particle matter of 2.5 microns; PSD = prevention of significant deterioration; SO_2 = sulphur dioxide; SPOT = Sea Port Oil Terminal; TPY = tons per year; TX = Texas; VOCs = volatile organic compounds

[1] Texas Gulflink has proposed the use of a VOC control system, which would reduce the amount of VOCs and HAPs generated by marine vessel loading of crude oil; however, at the time of production of the FEIS, revised emissions estimates reflecting the VOC control system were not publicly available.

[2] Source: LOOP, LLC 2022. This is the total number of export vessel calls, the number of import vessel calls is unknown.

[3] Includes stationary and mobile source emissions.

[4] While some operational emissions data are reported in the LOOP FEIS, the current number of vessel calls and emissions data are considered unknown due to the age of the document.

Impacts associated with onshore and offshore construction of the proposed Project would last for the duration of the construction period, but would be intermittent and highly localized to construction sites (see Section 3.12, Air Quality). The SPOT Project's onshore construction workspace and a portion of the offshore pipeline construction workspace would fall within the HGB ozone nonattainment area; therefore, MARAD and the USCG conducted a General Conformity review. The applicable General Conformity *de minimis* threshold for the HGB area is 50 tons per year of NO_x or VOCs, and the total annual emissions of NO_x from construction of the SPOT Project would be greater than the *de minimis* threshold. As such, MARAD and the USCG have compiled a General Conformity Determination that assesses how the SPOT Project would conform to the SIP during the years of construction. Other projects would be required to adhere to the same process for reviewing and providing any necessary determinations under the General Conformity Rule and would be evaluated by the TCEQ for conformance with the SIP. While construction activities may overlap with other cumulative projects, the SPOT Project, in combination with other cumulative projects, would result in direct, adverse, short-term, negligible cumulative impacts on air quality both onshore and offshore.

The existing ECHO Terminal and proposed Oyster Creek Terminal would be approximately 37 miles apart. Mobile emissions associated with terminal construction would typically disperse and become indistinguishable from background air pollutant concentrations within about 10 miles. The two terminals are also farther apart than the USEPA-recommended 31.1-mile (50-km) range for cumulative air quality modeling. As a result, emissions from construction of the ECHO and Oyster Creek Terminals would not cumulatively overlap with one another. The Applicant's dispersion modeling cumulative impact analysis (SPOT 2019r), which included the emissions from existing stationary emission sources up to 31.1 miles from the proposed Oyster Creek Terminal, determined that the operational Project would remain in compliance with all applicable air quality standards. The Project's incremental contribution to onshore air quality impacts would be below the SILs established by the USEPA in its guidance for implementation of the NAAQS (USEPA 2019b). Based on this assessment, operation of the onshore components of the SPOT Project, in combination with other past, present, and reasonably foreseeable projects would result in direct, adverse, long-term, minor cumulative impacts on air quality onshore.

Operational emissions from the offshore portion of the Project would be produced by stationary sources onboard the platform and from mobile sources, which would include marine vessels and helicopter flights. The Applicant's dispersion modeling cumulative impact analysis (SPOT 2019s), which included the emissions from existing stationary emission sources up to 31.1 miles (26.9 nautical miles) from the proposed SPOT DWP, determined that the operational Project would remain in compliance with all applicable air quality standards. The Project's incremental contribution to onshore and offshore air quality impacts would be below the SILs established by the USEPA in its guidance for implementation of the NAAQS (USEPA 2019b). Accordingly, operation of the offshore portion of the Project, in combination with other past, present, and foreseeable projects, would have direct, adverse, long-term, minor cumulative impacts on air quality offshore.

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. Overall, Project decommissioning would have direct, adverse, short-term, negligible cumulative impacts on onshore and offshore air quality.

5.3.7.2. Cumulative Impacts of the Alternatives on Air Quality

Table 5.3.7-2 summarizes the impacts of onshore and offshore alternatives on air quality, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.7-2 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.7-2: Summary of Cumulative Impacts of Alternatives on Air Quality

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternatives 2, 4, and 5	Increased cumulative impacts due to longer pipeline length, which would require additional vehicle trips to deliver pipes and more construction emissions.
Combustion-Driven Pump Alternative Design	Increased cumulative impacts due to the use and combustion of fossil fuels as compared to the Proposed Action.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts, due to more pipeline infrastructure and possibly more barge trips, which would increase the cumulative impact on air quality as compared to the Proposed Action.
Adsorption with Absorption Alternative	Increased cumulative impacts due to less efficient VOC removal from recovered vapors.
Adsorption with Vapor Combustion Alternative	Increased cumulative impacts due to less efficient VOC removal from recovered vapors.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts, due to additional construction vehicles and dredge barge.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts, due to additional cargo barge trips for transportation of joints to an onshore facility for disposal.

5.3.7.3. Cumulative Impacts of the Proposed Action on Climate Change

Section 3.12.2, Air Quality, Existing Threats, discusses a series of administrative changes since the issuance of the Supplemental Draft EIS that may affect GHG emissions and efforts to mitigate climate change in the United States These include Executive Order 13990 (86 Fed. Reg. 14 [January 25, 2021]) and Executive Order 14008 (86 Fed. Reg. 19 [February 1, 2021]). Among other objectives, the Executive Orders call for a net zero emission economy and a carbon-free electricity sector. In 2021, the United States again became a signatory to the Paris Agreement (2015), an international agreement on climate change with the goal of limiting global warming to well below 2 degrees Celsius, preferably to 1.5 degrees Celsius, compared to pre-industrial levels (UNFCC 2022; U.S. Department of State and the U.S. Executive Office of the President 2021). As part of the Agreement, the United States has set a Nationally Determined Contribution (NDC) to reduce net greenhouse gas emissions by 50 to 52 percent by 2030 and has set a goal of net zero greenhouse gas emissions by no later than 2050 (U.S. Department of State and the U.S. Executive Office of the President 2021).

The current trajectory of growing global CO_2 emissions would cause global warming of 1.5 degrees Celsius and 2 degrees Celsius to be exceeded during the 21st century unless deep reductions in CO_2 and other greenhouse gas emissions occur in the coming decades (IPCC 2021; NIC 2021; IEA 2021c). To meet the Paris Agreement goal, global fossil fuel production would need to decrease by approximately

6 percent per year from 2020 to 2030. Instead, countries are projecting an average annual increase of 2 percent, which means by 2030 fossil fuel production would be more than double what is needed to meet the 1.5 degree Celsius limit (SEI et al. 2020). Impacts from climate change (e.g., excessive heat, flooding, and extreme storms) will be increasingly costly with more demands for humanitarian assistance and disaster relief operations, while also requiring militaries in flood prone areas to adapt operations (NIC 2021). The report "Climate Change 2021: The Physical Science Basis" released by the IPCC (2021) states "It is virtually certain that global surface temperature rise and associated changes can be limited through rapid and substantial reductions in global GHG emissions. Continued GHG emissions greatly increase the likelihood of potentially irreversible changes in the global climate system…, in particular with respect to the contribution of ice sheets to global sea level change (high confidence)."

It has been predicted that between 2018 and 2050, the United States could release 120 billion metric tons of CO_2 emissions from new oil and gas developments. Methane leakage from these developments could add an additional 16 to 39 billion metric tons of CO_2e emissions to that total (Trout and Stockman 2019). Approximately 60 percent of emissions from the coal and natural gas supply chains and 35 percent of emissions from the oil supply chain are methane. Under the Net-Zero Emissions by 2050 Scenario presented by the International Energy Agency (IEA), it is predicted that methane emissions from fossil fuels could be reduced by 75 percent between 2020 and 2030. While approximately one-third of this reduction is predicted to be from reducing fossil fuel consumption, the largest factor in the reduction of methane emissions would be from increased use of emissions reduction measures and technologies in the fossil fuel supply chains (IEA 2021c). In order for the United States to meet its net-zero GHG emissions goals by 2050, the United States will need to set stringent standards for oil and gas production to address methane emissions (U.S. Department of State and the U.S. Executive Office of the President 2021).

While not generated directly by the Project, the production of crude oil that would be transported by the Project produces GHG emissions. In addition, the refining and ultimate combustion of the refined products (e.g., gasoline) or the use of oil as a feedstock for other products (e.g., plastics) would also produce GHG emissions.

MARAD and the USCG received many comments claiming the proposed Project would induce production of crude oil. The potential for induced production depends on many things, including the limitations of production from U.S shale (Takahashi 2021b). In an attempt to further quantify and assess the portion of additional GHG emissions that may be attributable directly to induced production associated with the Project, an information request to the Applicant asked them to provide the reasonably foreseeable GHG emissions associated with the production and end use of the crude oil to be transported by the Project. In response to the information request, the Applicant stated that it was not possible to accurately predict oil production induced solely by the Project given a complex interaction of market forces and other factors, nor is it possible to attribute the crude oil to be exported by the Project to one or multiple oil production areas.

Based on comments received on the Supplemental Draft EIS, MARAD and the USCG worked with the USEPA to develop a methodology (see Appendix BB) for estimating GHG emissions associated with the production of the crude oil to be transported by the Project and the subsequent refining and end use of the crude oil. As noted below, the majority of these emissions already occur as part of the petroleum supply chain, and the Project would have only a minimal effect on downstream consumption and a marginal effect on upstream production. These calculations are based on the percentage of total U.S. 2019 crude oil exploration, production, transportation and refining GHG emission estimates attributable to SPOT's maximum capacity, as well as gasoline and diesel combustion GHG emission estimates attributable to the refining of SPOT's maximum capacity. The estimated GHG emissions associated with the maximum capacity of crude oil that could be transported by the Project are presented in Table 5.3.7-3. Detailed emission calculations are included in Appendix BB, which also includes the estimated social cost of carbon calculations associated with these GHG emissions.

Table 5.3.7-3: Estimated GHG Emissions from the Project including Crude Oil Production, Export, and End Use of Crude Oil That Would Be Exported by the Project

	Emission Estimates
Activity Category	**CO_2e (tons per year)**
Project Construction	
2023 Onshore [a]	16,737
2023 Offshore [a]	0
2023 Total Construction CO_2 Emissions	**16,737**
2024 Onshore [a]	9,982
2024 Offshore [a]	21,495
2024 Total Construction CO_2 Emissions	**31,477**
2025 Onshore [a]	0
2025 Offshore [a]	35,070
2025 Total Construction CO_2 Emissions	**35,070**
Project Operation	
Onshore Operational Sources [b]	13,516
Offshore Stationary Sources [c]	173,257
Offshore Mobile Sources [c]	26,244
Total of Annual Operational CO_2e Emissions	**213,017**
Upstream Exploration, Production and Transportation	
Crude Oil Exploration [d]	382,145
Crude Oil Production [d]	12,664,444
Crude Oil Transportation [d]	37,401
Total of Upstream CO_2e Emissions	**13,083,991**
Downstream Refining and Combustion	
Crude Oil Refining [d]	964,306
Gasoline Combustion [e]	129,750,200
Diesel Combustion [e]	89,176,800
Total of Downstream CO_2e Emissions	**219,891,306**

[a] Source: SPOT 2021d

[b] Source: SPOT 2021e

[c] Source: SPOT 2019a, Application, Volume IIa, Section 11

[d] Source: (USEPA 2022b). Greenhouse Gas Inventory Data Explorer, Petroleum Systems. See Appendix BB for calculation details.

[e] Source: (USEPA 2022c). Greenhouse Gas Emissions Typical Passenger Vehicle. See Appendix BB for calculation details.

As previously stated in Section 3.12.6, comparing the GHG emissions associated with crude oil potentially exported by the Project to state and national GHG emissions is a useful method to assess the overall scale of GHG emissions. Annual GHG emission associated with the production of the maximum amount of crude oil that could be exported by the Project could represent 0.2 percent of the total GHG emissions of the United States when compared to the GHG emissions for 2019, and could represent 3.4 percent of the direct GHG emissions for all sectors reported for Texas for 2019. Annual GHG emissions associated with the end use of the maximum amount of crude oil that could be exported by the Project could represent 3.8 percent of the total GHG emissions of the United States when compared to the GHG emissions for 2019, and could represent 57.8 percent of the direct GHG emissions for all sectors reported for Texas for 2019. As discussed further below, the GHG emissions associated with the upstream production and downstream end use of the crude oil that could be exported by the Project at maximum capacity represent a significant amount of GHG emissions (see Table 5.3.7-3), the majority of these emissions likely already occur as part of the U.S. crude oil supply chain, and the Project itself is likely to have very little effect on the amount of GHG emissions associated with the overall U.S. crude oil supply chain.

As presented in Appendix BB, the social costs of the production of the maximum amount of crude oil that could be exported by the Project range from $222,427,840 to $1,085,971,217 in year 2025, the first proposed year of Project operation to $418,687,698 to $1,517,742,906 in 2050, depending on the discount rate chosen. The social costs of the end use of the maximum amount of crude oil that could be exported by the Project range from $3,738,152,203 to $18,250,978,401 in year 2025, the first proposed year of Project operation to $7,036,521,793 to $25,507,391,501 in 2050, depending on the discount rate chosen. As shown in the calculations included in Appendix BB, there is a large variability of potential social costs of GHG emissions within the same year depending on the discount rate chosen (IWG 2021).

Although it may not be possible to attribute the oil to be exported by the Project to any particular production area, the production of oil generates GHG emissions. As such, the upstream exploration, production, and transportation emissions are based on 2019 emission estimates for the entire U.S. oil industry, which is the most recent year currently available. The percentage of these emissions attributed to the crude oil transported by the Project would be 16 percent, which is based on the loading of one VLCC per day as a percentage of the total crude oil produced in 2019.

In response to an information request, the Applicant stated that downstream GHG emissions and environmental impacts associated with the end use of oil transported by the Project are not reasonably foreseeable for many reasons, including that the final use of the oil, whether as a fuel or as a feedstock for the production of other products, cannot be reliably predicted and is likely to change over the 30-year life of the Project. Whether or not the end use of oil exported by the project can be predicted, it is nevertheless reasonable to expect this oil would be put to some use. Examples of potential end uses for crude oil include refining and combustion for fuel (e.g., vehicles, production of electricity, heating), use as a feedstock for plastics and other manufacturing, processing into fertilizer, and processing into lubricants and solvents. In an effort to quantify potential downstream emissions associated with crude oil exported by the Project, it was assumed that all of the crude oil would be refined into gasoline and diesel fuel and combusted in passenger vehicles, though this may over or understate the true emissions associated with the oil exported by the project. As discussed below, the majority of the annual upstream exploration, production, and transportation and downstream refining and combustion GHG emissions presented in Table 5.3.7-3 already occur as part of the petroleum supply chain.

Based on consultations with U.S. DOT economists, it is expected that the Project will have minimal impacts on downstream consumption for two reasons. First, exporters of U.S. crude are “price takers” rather than “price makers” (EIA 2022c). The standard definition of a price taker is a consumer or firm that must accept prevailing prices in a market, lacking the market share to influence market price on its own. Economic actors that sell an identical product in a market with many suppliers, such as oil, are normally considered price takers. The decision by U.S. oil producers to export oil depends upon the world price for oil, which in turn depends upon the consumption and production decisions of billions of consumers and thousands of producers in different nations. The major drivers of oil price movements, such as global oil demand, wars and civil unrest, technological innovation, and government policy are minimally influenced by U.S. exporter decisions and largely independent of U.S. exports. Thus, we expect the SPOT Deepwater Port would not impact world oil prices.

Second, market projections indicate that the future demand for oil is expected to decline, regardless of whether deepwater ports for U.S. oil exports are constructed. The IEA forecasts that world oil demand will peak soon after 2025 and decline by 20 million bpd by 2050 (IEA 2021a). IEA’s forecast is based upon policy decisions by countries to achieve their net zero carbon goals, which in turn significantly depend on their reducing the use of fossil fuels in ground transportation. Increasing the deployment of electric vehicles for passenger and freight movements, electrification of rail transportation, and phasing out fossil fuels in ocean-going trade will all play an important role in achieving those goals. The IEA forecasts that by 2030, 60 percent of all passenger cars sold globally will be electric vehicles, and no new internal combustion engine passenger cars will be sold anywhere after 2035 (IEA 2021b).

Similarly, upstream production is expected to be only marginally impacted by the Project. The Project is likely to reduce the cost of transportation of crude oil for export because filling VLCCs from pipelines is less expensive than reverse-lightering operations. At the margin, this reduced cost of transporting crude oil will increase the profits available to U.S. crude oil producers and resellers who choose to export their crude oil. However, because the world price, and thus global consumption, of oil is independent of U.S. oil export infrastructure, this increase in U.S. crude oil imports would be expected to largely displace production in other countries. Additionally, as noted in Section 5.2.1 current U.S. GoM crude oil export capacity is well above current export volumes.

Based on these analyses, although the GHG emissions associated with the upstream production and downstream end use of the crude oil to be exported by the Project at maximum capacity represent a significant amount of GHG emissions (see Table 5.3.7-3), the majority of these emissions likely already occur as part of the U.S. crude oil supply chain, and the Project itself is likely to have very little effect on the amount of GHG emissions associated with the overall U.S. crude oil supply chain. Additionally, as stated in Section 3.12.5, loading of VLCCs via an offshore platform rather than via reverse lightering (onshore loading to a smaller vessel and transfer to a VLCC at an offshore location) could result in fewer GHG emissions associated with VLCC loading.

5.3.8. Noise

5.3.8.1. Cumulative Impacts of the Proposed Action on Noise

Activities that could generate onshore cumulative noise impacts include waterway transportation projects, including channel improvement projects and terminal development projects; onshore and offshore pipeline projects; industrial facilities; the Seabreeze Environmental Landfill; the Port Freeport Parcel 14 Rail Development; the Chocolate Bayou Wind I Project; development of residential communities; school improvement projects; and roadway construction projects. Offshore, there would be little potential for overlap of noise impacts from the proposed Project and other activities considered in the cumulative impacts analysis (see Table 5.2-1) due to the distance between these projects and the attenuation of noise with distance.

To establish background noise levels, the Applicant conducted ambient noise surveys near various portions of the onshore Project components, including the terminals and HDD entry and exit locations. The Applicant would use the HDD method near several NSAs, including the Alvin ISD Heritage Complex and residential developments. The Applicant's noise modeling indicated that the predicted unmitigated noise levels for a number of HDD entry and exit points exceed ambient sound levels at adjacent NSAs. These NSAs are residential structures located more than 1 mile from other projects considered in the cumulative impacts analysis. To minimize the noise levels at the NSAs, the Applicant would use temporary noise acoustic panels around noise sources and/or perimeter sound walls around the HDD locations. The Applicant determined construction of the terminals would not result in noise levels greater than the ambient noise level and noise mitigation measures would not be implemented. Based on this assessment and the fact that the NSAs are located more than 1 mile from other cumulative projects, construction of the onshore components, in combination with past, present, or reasonably foreseeable projects, would result in direct, adverse, short-term, minor cumulative impacts on noise levels.

Offshore, there would be little potential for overlap of noise impacts from the proposed Project and other activities considered in the cumulative impacts analysis (see Table 5.2-1) due to the distance between these projects and the attenuation of noise with distance. The nearest oil and gas exploration and production activity would be approximately 24 nautical miles southeast of the proposed SPOT DWP (Figure 5.2-1). As a result, construction of the offshore components of the SPOT Project, in combination with other cumulative projects, would not result in cumulative impacts on noise levels.

Operation of the onshore Project components would result in noise, primarily from the ECHO Terminal and the Oyster Creek Terminal. The Seabreeze Environmental Landfill is located within the 1-mile ROI across FM 523 from the Oyster Creek Terminal; however, noise impacts from the Oyster Creek Terminal during operation would be minor in nature. As a result, operation of the onshore components of the Project, in combination with the Seabreeze Environmental Landfill, would have direct, adverse, long-term, negligible cumulative impacts on noise levels. There are no past, present, or reasonably foreseeable projects within the offshore ROI; therefore, operation of the offshore components of the SPOT Project, in combination with other cumulative projects, would not result in cumulative impacts on noise.

Airborne noise associated with onshore components would not result in cumulative impacts associated with offshore cumulative activities, and vice versa. Similarly, noise from onshore sources would not generate cumulative underwater noise impacts.

While both construction and decommissioning would have the same impact magnitude, the impacts during decommissioning would be less than during construction, due to the shorter timeframe. Overall, Project decommissioning would have direct, adverse, short-term, negligible cumulative impacts on onshore and offshore noise levels.

5.3.8.2. Cumulative Impacts of the Alternatives on Noise

Table 5.3.8-1 summarizes the impacts of onshore and offshore alternatives on noise, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.8-1 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.8-1: Summary of Cumulative Impacts of Alternatives on Noise

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternatives 2 through 5	Increased cumulative impacts, due to longer pipelines and an increased area exposed to construction noise.
Oyster Creek Terminal Alternatives 2 through 4	Increased cumulative impacts, due to a higher number of NSAs within 0.5 mile.
Combustion-Driven Pump Alternative Design	Increased cumulative impacts, due to generation of more noise during operation as compared to the Proposed Action.
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts, due to more pipeline infrastructure and greater associated seafloor and marine disturbance.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts due to noise from additional construction vehicles and dredge barge activities.
Decommissioning Alternatives	
Decommissioning Alternatives 2 through 4	Increased cumulative impacts due to additional cargo barge trips for transportation of joints to an onshore facility for disposal as well as greater seafloor disturbance.

5.3.9. Socioeconomics

5.3.9.1. Cumulative Impacts of the Proposed Action on Socioeconomics

Activities that could generate cumulative socioeconomic impacts on population, housing, employment, and tourism in the proposed Project vicinity would occur both onshore and offshore. These activities include waterway transportation projects, including channel improvement projects and terminal development projects; onshore and offshore pipeline projects; industrial facilities; the Seabreeze Environmental Landfill; the Port Freeport Parcel 14 Rail Development; the Chocolate Bayou Wind I Project; development of residential communities; school improvement projects; and roadway construction projects.

Onshore activities, including construction of new schools, communities, roads, and industrial developments would affect socioeconomic factors such as population, housing, employment, and tourism. Most of the offshore activities included in the cumulative impacts analysis are part of the continued development of the oil and gas and shipping industries in the vicinity of the Project, and would also affect the same socioeconomic factors.

Further reduction of currently unrestricted waters as a result of the proposed Project and other activities listed in Table 5.2-1 could adversely impact offshore recreation and tourism and commercial fishing, which are a component of the local economy; however, people engaged in fishing would likely be able to relocate to adjacent and comparable grounds with limited impact on these industries.

Ongoing development in the vicinity of the proposed Project would result in both beneficial and adverse socioeconomic impacts, including creation of new jobs and revenue for the local economy as well as increased demand for public services.

Based on the analysis above, the Project, in combination with other past, present, and reasonably foreseeable projects, would have direct, adverse, short-term to long-term, minor cumulative impacts on population, housing, public services, recreation and tourism, commercial fishing, and environmental justice populations, and would also have direct, beneficial, short-term, minor cumulative impacts on employment, marine commerce, and shipping.

5.3.9.2. Cumulative Impacts of the Alternatives on Socioeconomics

The alternatives may employ more or less personnel, and may result in a smaller or larger restricted workspace area during construction; however, the difference in contribution to cumulative socioeconomic impacts among the alternatives would likely be imperceptible, as compared to the Proposed Action.

5.3.10. Environmental Justice

5.3.10.1. Cumulative Impacts of the Proposed Action on Environmental Justice

This section examines impacts identified in Sections 5.3.1 through 5.3.9 to determine whether any of the cumulative impacts would have disproportionately high and adverse effects on the environmental justice populations identified in Section 3.15.3. Environmental justice populations have a greater vulnerability to certain impacts than other populations, due to factors such as limited transportation or residential options, challenges in finding and retaining employment, dependence on subsistence fishing or fishing-related livelihoods, and fewer recreational choices. Therefore, overlapping impacts from multiple projects could more severely affect environmental justice communities.

Sections 5.3.1 through 5.3.9 identify minor cumulative impacts on air and water quality, biological resources, recreational resources, noise, and onshore traffic resulting from overlap of Project impacts with impacts from projects listed in Section 5.2. Environmental justice populations would be affected by the overlapping or cumulative impacts on traffic, recreation resources, visual resources, and noise during construction. These cumulative impacts are anticipated to be minor and short-term, and would not be expected to have disproportionately high and adverse impacts on environmental justice populations. The negligible to minor cumulative impacts on water resources, soil, and cultural resources would not be expected to have impacts particular to environmental justice populations.

As noted in Section 3.12.4, the HGB area, which includes Harris and Brazoria counties, is designated as a serious nonattainment area for the 2008 Eight-Hour Ozone NAAQS and marginal nonattainment area for the 2015 Eight-Hour Ozone NAAQS (USEPA 2019b). Air quality would be affected by activities listed in Section 5.2. However, as discussed in Section 5.3.7.1, the incremental contribution of the Project to air emissions is such that the cumulative impact of the SPOT Project, in combination with other projects, would result in negligible cumulative impacts on air quality during construction and minor impacts during operations.

The impacts on socioeconomics identified in Section 5.3.9 include impacts on housing supply and fishing. As noted in Section 3.14.4.1, an existing short-term housing demand resulting from various large construction projects may contribute to a shortfall in the supply of affordable rental housing. Projects identified in Section 5.2 that require temporary workers during the same time period as Project construction would result in short-term, cumulative demand for housing, which could adversely affect environmental justice populations. Additionally, cumulative impacts on commercial and recreational fishing would contribute to minor impacts on environmental justice populations who rely upon commercial or subsistence fishing for their livelihood or sustenance. Other offshore projects would result in restrictions on fishing within additional, relatively small areas of the GoM.

Based on the analysis above, in comparison with other past, present, and reasonably foreseeable projects, the contribution of the Project to cumulative impacts on environmental justice communities would be both direct and indirect, adverse, short-term to long-term, and negligible to minor, due primarily to the impacts on air quality, fishing, and housing.

5.3.10.2. Cumulative Impacts of the Alternatives on Environmental Justice

The alternatives may employ more or less personnel, and may result in a smaller or larger restricted workspace area during construction; however, the difference in contribution to cumulative environmental justice impacts among the alternatives would likely be imperceptible, as compared to the Proposed Action.

5.3.11. Safety and Security

5.3.11.1. Cumulative Impacts of the Proposed Action on Safety and Security

The existing ECHO Terminal and the proposed Oyster Creek Terminal would be the primary facilities of concern from a safety and security standpoint onshore. The onshore pipelines would be buried and would, therefore, not be as vulnerable as the terminals. If an event were to occur that jeopardized the safety of the public or the security of the facilities, the same event could also affect nearby facilities. Activities that could result in onshore cumulative impacts on safety and security include the MEGlobal Ethylene Glycol Plant, the Praxair Air Separation Unit and Carbon Dioxide Purification facility, the Shintech/ K-Bin Polyvinyl Chloride Compounding facility, and the Third Coast Terminals Prepolymer Toll Manufacturing Unit, as these facilities are within 10 miles of the Oyster Creek or ECHO Terminals. The MEGlobal and Praxair facilities are approximately 9 miles from the Oyster Creek Terminal, the Shintech/K-Bin facility is approximately 7 miles from the Oyster Creek Terminal, and the Third Coast facility is approximately 7 miles from the ECHO Terminal. Several major incidents occurred in the general vicinity of the Project area at various petrochemical or other industrial facilities in 2019, including two in Baytown, one in Deer Park, one in Crosby, one in Port Neches, and one in Houston (Abrahams and Willey 2019; Carter and Willey 2019; Homer 2020; Kamath 2019; Mamdooh and Kennedy 2019; Sanchez and Baldacci 2019). None of these incidents occurred in Brazoria County; however, the addition of the Oyster Creek Terminal would incrementally increase the risk of an incident occurring and could result in cumulative impacts on public safety and security. If an event were large enough to affect multiple facilities, city officials, emergency responders, and representatives from the facilities would likely work together to minimize impacts on the public. Additional details on safety and security are included in Chapter 4, Safety.

Offshore, the Applicant is proposing a 3,173-foot radius for the safety zones and ATBAs from the center of each SPM buoy as well as a 500-meter (1,640-foot) safety zone around the platform. The safety zones would limit access to only Project-related vessel traffic. Other activities, such as fishing, that currently occur in this area would not be permitted in these safety zones or ATBAs. Therefore, the potential for overlap of safety and security impacts with other projects would not occur, given the lack of intersection between the Project and the cumulative activities listed in Table 5.2-1.

Based on the evaluation above, the Project, in combination with other past, present, and reasonably foreseeable projects, would have direct, adverse, short-term, negligible cumulative impacts on safety and security unless a major event were to occur. If a major event were to occur, cumulative impacts could be direct or indirect, adverse, long-term, and minor to major.

5.3.11.2. Cumulative Impacts of the Alternatives on Safety and Security

Table 5.3.10-1 summarizes the impacts of onshore and offshore alternatives on safety and security, as compared to the Proposed Action. Alternatives not specifically listed in Table 5.3.10-1 would have the same or equivalent cumulative impacts as the Proposed Action.

Table 5.3.10-1: Summary of Cumulative Impacts of Alternatives on Safety and Security

Alternative	Discussion
Onshore Alternatives	
Onshore Pipeline Alternative 2 through 4	Increased cumulative impacts, due to more pipeline crossings than the Proposed Action, which would increase potential safety hazards while working on or near active pipelines.
Onshore Pipeline Alternative 5	Decreased cumulative impacts, due to fewer pipeline crossings than the Proposed Action, which would decrease potential safety hazards while working on or near active pipelines.
Oyster Creek Terminal Alternative 3	Increased cumulative impacts, due to increased risk for flooding, which could result in unintended facility shutdowns and an increase in safety hazards.
Offshore Alternatives	
Deepwater Port, Anchorage, and Offshore Pipeline Alternative 2	Increased cumulative impacts, due to more pipeline infrastructure, which may result in additional restricted areas during construction activities.
Open-Cut Trenching and Jet Sled Alternative	Increased cumulative impacts, due to the temporary closure of the beach areas at Surfside, which would increase potential safety and security hazards.

6. COASTAL ZONE CONSISTENCY

Congress enacted the CZMA in 1972 (16 U.S.C. § 1451 et seq.) to encourage the preservation, protection, development, and, where possible, restoration or enhancement of valuable natural coastal resources such as wetlands, floodplains, estuaries, beaches, dunes, barrier islands, and coral reefs, as well as the fish and wildlife utilizing those habitats. The CZMA applies to activities within the defined coastal zone, as well as activities outside of the defined coastal zone if they have the potential to impact resources within the coastal zone. Under the CZMA, coastal states have the authority to implement comprehensive coastal management programs and to conduct a consistency review for a Federal action that may have a reasonable foreseeable effect on resources contained within the state's coastal zone (15 CFR Part 930, 15 CFR Part 923). Consistency determinations are also required for activities that are Federally funded, licensed, and/or permitted, including offshore infrastructure in U.S. navigable waters and waters in the EEZ, which might impact coastal waters.

The Texas Coastal Coordination Act of 1991 established a comprehensive coastal resource management program in Texas. The TCMP gives Texas the authority to review proposed Federal actions and activities that are located in or may affect the land and water resources in the Texas Coastal Zone through a Federal consistency review process. The Texas Coastal Zone includes all or portions of 18 counties along the GoM, including (from north to south), Orange, Jefferson, Chambers, Harris, Galveston, Brazoria, Matagorda, Jackson, Victoria, Calhoun, Refugio, Aransas, San Patricio, Nueces, Kleberg, Kenedy, Willacy, and Cameron counties, and extends approximately 10 miles into the GoM (TCMP 2017; GLO n.d.a.). The inland boundary of the CZMA in the vicinity of the Project mostly follows the Brazoria County and Harris County lines. Based on TCMP's coastal zone map, all of the Project's onshore storage/supply components would be located within the Texas Coastal Zone Management Area administered by the GLO.

As a condition of the DWPA license issuance, the proposed Project must demonstrate consistency with the TCMP (because Texas is the adjacent coastal state). Consistency determinations are processed by the GLO as part of the TCMP, as required under the Texas Coastal Coordination Act.

A consistency determination form is included in the USACE application as part of the CWA Section 404 process and would be reviewed by the RRC through the Section 401 Water Quality Certification process. The GLO is responsible for performing the consistency certification under the TCMP and providing the certification to the USACE and RRC, as well as the Applicant. Concurrent with its DWPA application, the Applicant submitted a draft application to the USACE under Section 404 of the CWA in December 2018. The Applicant filed a final application with the USACE on March 15, 2019. The application contains a consistency review form for the onshore components of the proposed Project. The Applicant provided a revised consistency review form to the GLO on October 24, 2019, and the GLO issued its conditional concurrence following its consistency review on June 21, 2021 (Appendix G, Federal Consistency Decision). The Section 404 permit from the USACE, the Section 401 Water Quality Certification from the RRC, and the GLO consistency determination must be received before the proposed Project can commence construction.

As part of the TCMP, the Beach Access and Dune Protection Program requires any development within 1,000 feet of mean high tide to obtain approval from the GLO (Agency Comment 111-017). Additionally, a Dune Protection Permit is required from the Village of Surfside Beach for any alteration (in elevation or vegetation) of nearby sand dunes from mean high tide landward for a distance of 1,000 feet (Agency Comment 111-014). Appendix D, Agency Correspondence, presents correspondence regarding the CZMA with these agencies.

7. IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES

An irreversible or irretrievable commitment of resources refers to impacts on or losses to resources that cannot be reversed or recovered, even after an activity has ended and facilities have been decommissioned. A commitment of resources is related to use or destruction of nonrenewable resources, and the impacts that loss would have on future generations. For example, if a species becomes extinct or minerals are extracted as a result of a proposed action, the loss would be permanent. Similarly, chronic, low-level pollution from a proposed project can injure and kill organisms at all trophic levels, leading to mortality of individual organisms, as well as possible reduction or elimination of small or isolated populations of some organisms.

The construction and operation of the SPOT Project would involve the irreversible or irretrievable commitment of material resources and energy, marine area resources, and biological resources, as discussed below. The impacts on these resources would be permanent. The impacts described below incorporate BMPs and mitigation measures that the Applicant has agreed to implement, as described throughout Chapter 3, Environmental Analysis of the Proposed Action, and as listed in Appendix N, List of Applicant's BMPs and Agency Recommended Mitigation Measures.

The work required to construct and operate the proposed Project would require the conversion of available fossil fuels to energy, an irreversible commitment of fossil fuels. The completed Project would also irretrievably commit finite raw materials, such as steel, although some steel used in the Project may be recyclable after decommissioning. No supplies committed to the Project are considered scarce, and the use of these supplies would not limit other unrelated construction activities in the region.

Project construction and operation would result in an irreversible or irretrievable loss of some biological resources. Irretrievable losses of seafloor habitat associated with the footprint of the jacketed platform, the PLEMs, and the mooring system for the SPM buoys would occur over the life of the proposed Project. Due to the removal of these features upon decommissioning, the seafloor habitat in the area would return to near-normal pre-Project conditions; however, permanent changes in the seafloor habitat at the site of the Project footprint would constitute irreversible impacts, though they would be minimal. Construction would also result in the entrainment of fish eggs and larvae due to water withdrawals during hydrostatic testing of the subsea pipeline. These losses would result in irreversible impacts.

Biological losses during Project operation would include the entrainment of fish eggs and larvae associated with cooling water, firewater, and ballast water intake. Associated loss of ecological services would occur during construction and operation of the proposed Project. These services, including any commercial or recreational ocean use in the area, would return after decommissioning of the proposed Project; however, the ecological services lost or unavailable during this period would not be recovered after completion of decommissioning. Therefore, these losses would be irreversible or irretrievable. Irreversible losses may also include the loss of biological resources in the event of an oil spill, and loss of sea turtles or marine mammals due to vessel strikes.

Although the impact on archaeological resources is expected to be minor, any interaction between an impact-producing factor (e.g., placement of new structures and installation of pipelines) and a significant historic shipwreck or prehistoric site could permanently affect information contained in archaeological site components and the spatial distribution of those components. This could cause a permanent loss of potentially unique archaeological data. The Applicant's site selection process and the alternatives analysis conducted in this EIS take into account the potential for the presence of archaeological resources in the area. The proposed location for the SPOT DWP was selected to minimize the potential to disturb archaeological artifacts, among other parameters.

Construction and operation activities authorized under the DWPA would be carried out under comprehensive, enforced regulatory procedures designed to protect public safety and the environment. Nonetheless, some loss of human and other biological life could result from unpredictable and unexpected natural or human occurrences (i.e., accidents, terrorism, human error and noncompliance, adverse weather conditions, etc.). Some normal and required operations, such as structure removal done in accordance with applicable laws and regulations, can result in the destruction of marine life. Although the possibility exists that individual marine mammals, sea turtles, birds, and fish could be injured or killed, these losses are unlikely to have a lasting impact on existing populations, and thus would not constitute irretrievable or irreversible impacts.

8. RELATIONSHIP BETWEEN SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

Short-term refers to the total duration of onshore and offshore construction of the proposed SPOT Project. Long-term refers to a prolonged period following decommissioning of the proposed Project. Short-term operational activities may result in persistent impacts over a longer period. Construction and the eventual removal of new structures would cause minor impacts in the short-term, which would be limited to the immediate vicinity of the activity; impacts of decommissioning may last longer because of minor elements that would be left in place. Short-term use may have long-term impacts on biologically sensitive offshore areas or archaeological resources. Upon completion of Project construction, the marine environment would generally be expected to remain at or return to its normal long-term productivity levels.

The proposed Project would be located in the GoM approximately 27.2 to 30.8 nautical miles off the coast of Brazoria County, Texas. This area is one of the most important energy producing areas in the United States. Approximately 17 percent of total U.S. crude oil production comes from the GoM and 45 percent of the total refining capacity in the United States is located along the Gulf Coast. Approximately 5 percent of offshore natural gas production occurs in the GoM, and 51 percent of the total natural gas processing capacity is located along the Gulf Coast (EIA 2019e). The area surrounding the proposed SPOT Project supports the oil and gas industry, marine commerce and shipping, commercial and recreational fishing, area ports, and other uses. Project construction is likely to have little impact on long-term productivity of the OCS, because this area already experiences heavy use and vessel traffic, and construction-related activity would constitute a short-term, incremental increase in existing activity.

Project operation would result in long-term impacts within Galveston Area lease blocks A-59 and 463, and would result in an incremental increase in ocean use and marine traffic between Freeport, Texas and the lease blocks. No available data or studies indicate that use of the Project area would cause long-term losses in productivity in the oil and gas, marine commerce and shipping, commercial and recreational fishing, or other related industries, although such losses are possible. Similarly, Project construction and operation would not generate long-term productivity or environmental gains. Benefits of the proposed Project are expected to be principally those associated with an increase in supplies of crude oil for export.

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