APPENDIX I

Summary of Hypothetical Oil Spill Response Actions

(SPOT Application, Vol IIa, Appendix R)

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Sea Port Oil Terminal Project
Offshore Brazoria County, Texas

VOLUME IIa
APPENDIX R

SUMMARY OF HYPOTHETICAL OIL SPILL RESPONSE ACTIONS

R SUMMARY OF HYPOTHETICAL OIL SPILL RESPONSE ACTIONS

1 INTRODUCTION

SPOT Terminal Services LLC (the Applicant), a subsidiary of Enterprise Products Operating LLC, a Texas limited liability company, is proposing to develop the Sea Port Oil Terminal (SPOT) Project in the Gulf of Mexico to provide U.S. crude oil loading services on very large crude carriers (VLCCs) and other crude oil carriers for export to the global market (Figure 1). The SPOT deepwater port (DWP) would be located in federal waters within the Outer Continental Shelf (OCS) in Galveston Area Lease Blocks 463 and A-59, approximately between 27.2 and 30.8 nautical miles (31.3 and 35.4 statute miles, or 50.4 and 57.0 kilometers), respectively, off the coast of Brazoria County, Texas, in water depths of approximately 115 feet (35.1 meters) (Figure 2).

The Applicant is filing this application for a license to construct, own, and operate the SPOT DWP pursuant to the Deepwater Port Act (DWPA) of 1974, as amended, and in accordance with United States Coast Guard (USCG) and U.S. Maritime Administration (MARAD) implementing regulations. The primary purpose of the SPOT Project would be to provide a safe and reliable long-term supply of crude oil for export to the global market. The Applicant has access, through its affiliates, to several crude oil pipelines from multiple sources that lead to numerous crude oil nearshore terminals owned and operated by the Applicant's affiliates along the Texas Gulf Coast.

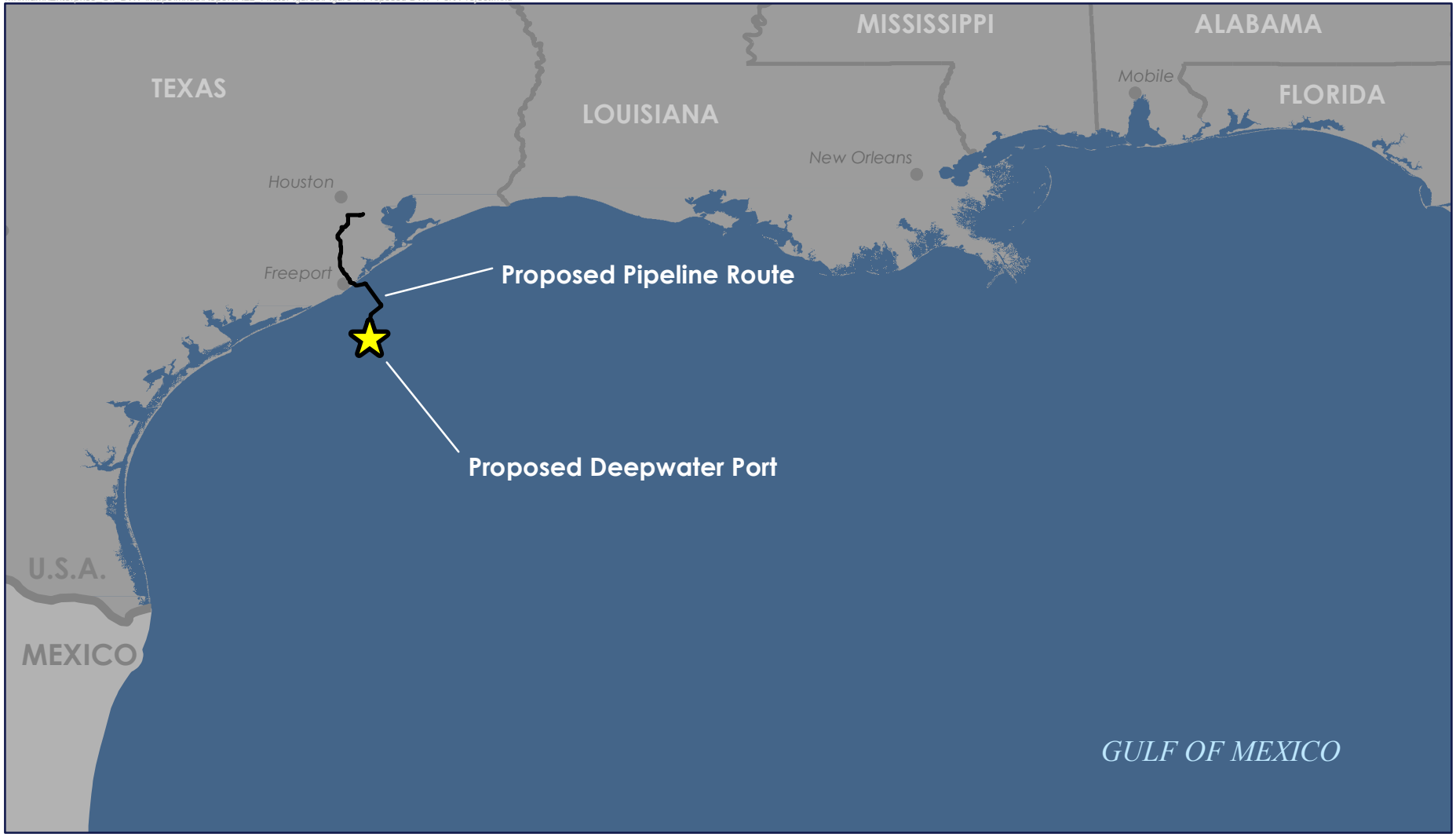
Based on its current design, the SPOT Project would have the capability of loading VLCCs and other crude oil carriers at a rate of up to 85,000 barrels per hour (bbl/h). The SPOT DWP would allow for up to two (2) VLCCs or other crude oil carriers to moor at single point mooring (SPM) buoys and connect with the DWP by floating connecting crude oil hoses and a floating vapor recovery hose. The maximum frequency of loading VLCCs or other crude oil carriers would be 2 million barrels per day, 365 days per year. The crude oils to be exported by the SPOT Project range from ultralight crude, such as processed condensate, to light crude, such as the West Texas Intermediate, to heavy grade crude oil, such as Western Canadian Select. The Applicant has integrated three (3) vapor combustor units at the DWP to minimize air emissions during loading.

The SPOT Project would consist of: (a) offshore/marine components; and (b) onshore storage/supply components, as described below. The "Project Fast Facts" table, presented previously, provides common measurements or metrics for the proposed Project.

OFFSHORE/MARINE COMPONENTS

The SPOT Project's offshore/marine components would consist of the SPOT DWP and subsea pipelines, as described below. Figure 3 provides an illustration of the offshore/marine components, and Section 1.3, "Description of Project Components," Volume IIa, provides a detailed description of the offshore marine components.

M:\Miami\Enterprise_Oil_DWP\Maps\Mxds\Report\ALL_First3Figures\Figure 1 Proposed DWP Port Project.mxd



Proposed Deepwater Port

Proposed Pipeline Route

N
W E
S

0 50 100 200 Miles

0 50 100 200 Nautical Miles

Figure 1
Proposed Deepwater Port Project

SPOT Terminal Services LLC

S P O T
Sea Port Oil Terminal

Source - ESRI

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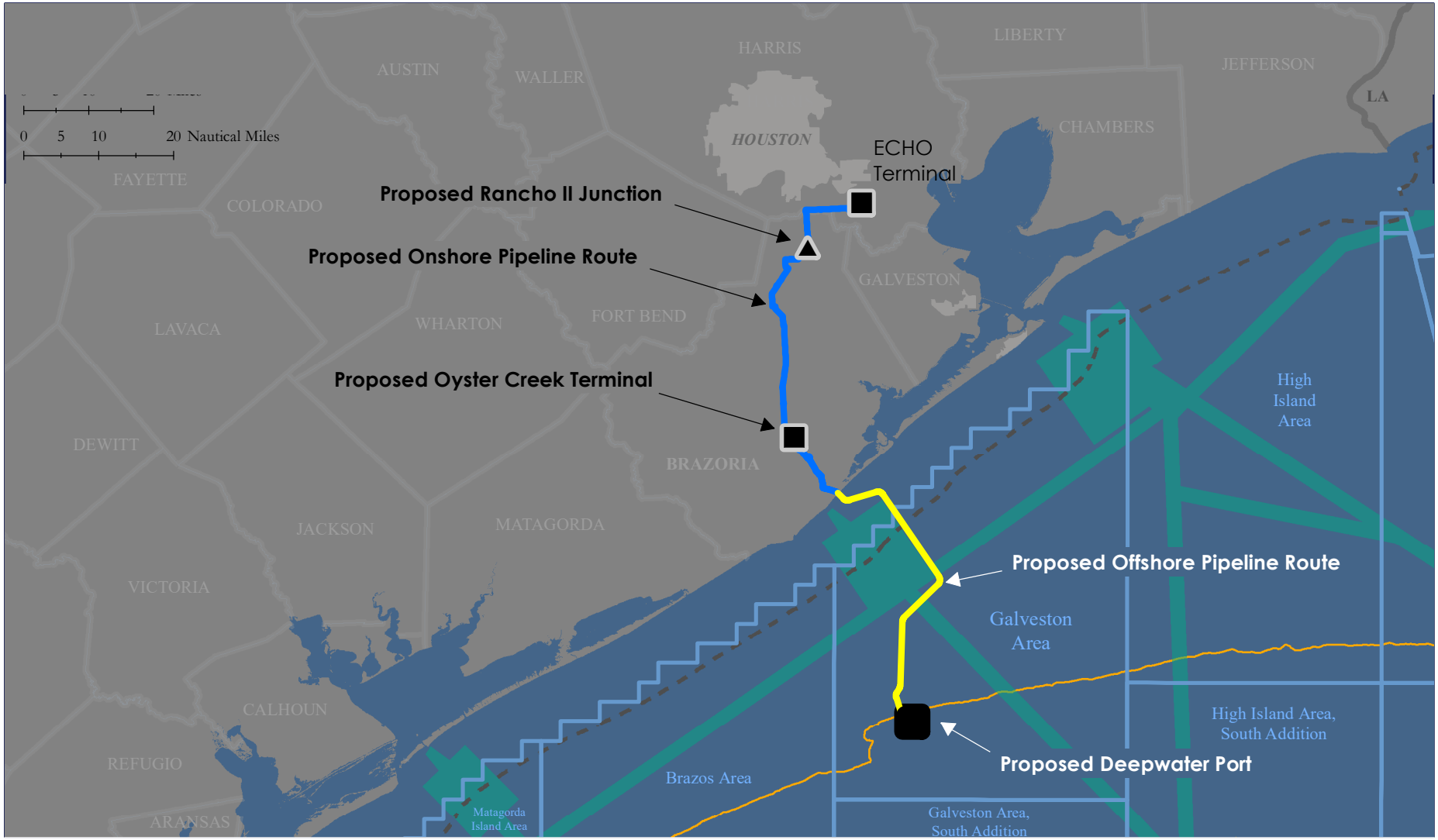

Proposed Onshore Pipeline Route
Proposed Offshore Pipeline Route
Depth Contour (115 ft)
State Waters Boundary

Proposed Rancho II Junction
Crude Oil Tank Farm
Proposed Deepwater Port

Protraction Area
Shipping Fairway

SPOT
Sea Port Oil Terminal

Figure 2
Offshore/Marine Components and Onshore Storage/Supply Components

SPOT Terminal Services LLC

Source - ESRI, EP, ENE, BOEM, NOAA, TNRIS, NPMS

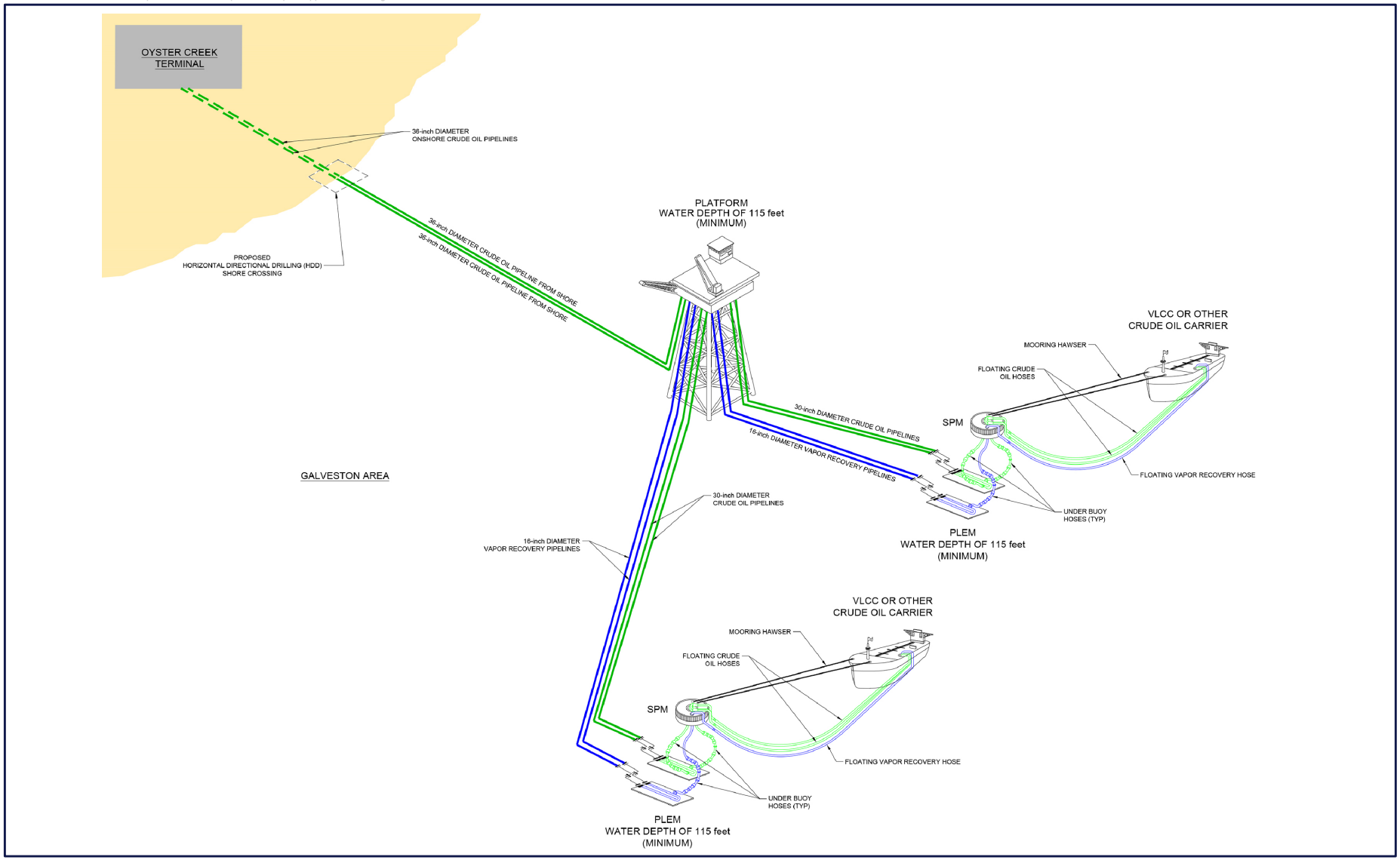

Figure 3
Proposed Deepwater Port Schematic

SPOT Terminal Services LLC

- One (1) fixed offshore platform with eight (8) piles. The fixed offshore platform would be comprised of four (4) decks:
    - A sump deck with boarding shut-down valves and open drain sump;
    - A cellar deck with departing pig launchers/receivers, generators, and the vapor combustion units;
    - A main deck with a lease automatic custody transfer (LACT) unit, prover loop, living quarters, electrical and instrument building, and other ancillary equipment; and
    - A laydown deck with a crane laydown area.
- Two (2) SPM buoys, each having underbuoy hoses for crude oil and VOC vapor recovery interconnecting with the crude oil and vapor recovery pipeline end manifolds (PLEMs) and floating crude oil and vapor recovery hoses, would connect to the moored VLCCs or other crude oil carriers for loading.
- Four (4) PLEMs (two per SPM buoy) would provide the interconnection between the pipelines and the SPM buoys. There would be two (2) PLEMs for crude oil and two (2) PLEMs for vapor recovery.
- Four (4) 30-inch (76.2-centimeter) outside diameter pipelines (two per PLEM) to deliver crude oil from the platform to the PLEMs.
- Four (4) 16-inch (40.6-centimeter) outside diameter vapor recovery pipelines (two per PLEM) to transfer recovered VOC vapors from the VLCC or other crude oil carrier to the three (3) vapor combustion units on the platform.
- Two (2) colocated 36-inch (91.4-centimeter) outside diameter crude oil pipelines from the shoreline crossing in Brazoria County, Texas, to the SPOT DWP for crude oil delivery. These pipelines would connect the onshore crude oil storage facility and pumping station for the SPOT Project (the Oyster Creek Terminal) to the SPOT DWP. The crude oil would be metered at the offshore platform. Pipelines would be bi-directional for the purposes of maintenance pigging and changing crude oil grades.

ONSHORE STORAGE/SUPPLY COMPONENTS

The onshore storage/supply components would provide the crude oil supply and interconnection for the proposed Project and would consist of the following components, as described below. Figure 2 provides the location of these components, and Section 1.3, “Description of Onshore Storage/Supply Components,” Volume IIb, provides a detailed description of the onshore components.

- Modifications to the existing Enterprise Crude Houston (ECHO) Terminal, to include measurement skids and electric-driven pumps to supply crude oil to the proposed Oyster Creek Terminal.
- One (1) 36-inch (91.4-centimeter) outside diameter pipeline from the existing ECHO Terminal to the proposed Oyster Creek Terminal.

- One (1) connection from the existing Rancho II 36-inch (91.4-centimeter) outside diameter pipeline to the ECHO to Oyster Creek 36-inch (91.4-centimeter) outside diameter pipeline, to include measurement skid (collectively referred to as the "Rancho II Junction").

- Seven (7) aboveground storage tanks at the proposed Oyster Creek Terminal, each with a total storage capacity of 685,000 barrels (600,000 barrels working storage capacity), for a total onshore storage capacity of approximately 4.8 million barrels (4.2 million barrels working storage) of crude oil. Measurement skids, pumps, and other appurtenant equipment would also be present to supply crude oil to the SPOT DWP.

- Two (2) colocated 36-inch (91.4-centimeter) diameter crude oil pipelines from the Oyster Creek Terminal to the shore crossing where these become the subsea pipelines supplying the SPOT DWP.

- Ten (10) mainline valves (MLVs)—six (6) MLVs within the permanent right-of-way (ROW) of the ECHO to Oyster Creek pipeline and four (4) MLVs within the permanent ROW of the Oyster Creek to Shore Crossing pipeline.

APPENDIX CONTENT

This report provides a summary of expected response actions that may be included as part of the tactical response to the hypothetical spills modeled in Appendix L, "Oil Spill Trajectory and Fate Modeling Report," Volume IIa.

2 METHODS

Appendix L , "Oil Spill Trajectory and Fate Modeling Report," Volume IIa, provides a modeling approach for assessing the potential oiling of coastal environments resulting from the unmitigated, hypothetical releases of three oil types: Western Canadian Select (WCS); West Texas Intermediate (WTI); and Ultralight crude oil (Condensate [C]), from the proposed SPOT DWP location. The spill volume for all modeled scenarios at the SPOT DWP platform was 2,200 bbl. The oil spill model uses a definition of the shoreline type in its calculations of oil-shore interactions. The digital shoreline used to create the habitat grid used in the spill risk assessment was developed using the most current National Oceanic and Atmospheric Administration (NOAA) Environmental Sensitivity Index (ESI) hydrography data layers for applicable states (NOAA Office of Response and Restoration 2012). Figure 4 provides an example of habitats identified using NOAA's ESI database for an area within the spill model boundaries.

Response actions for the various habitats addressed by this report are based on information provided in the NOAA National Ocean Service's 2010 document, *Characteristic Coastal Habitats – Choosing Spill Response Alternatives* (Reprinted in March 2017). The *Characteristic Coastal Habitats* collection was originally designed as a companion to *Environmental Considerations for Marine Oil Spill Response*, published in 2001 by the American Petroleum Institute, the National Oceanic and Atmospheric Administration, the U.S. Coast Guard, and the U.S. Environmental Protection Agency. The response method table for each habitat was based on information contained in the *NOAA Shoreline Assessment Manual* (NOAA 2013a) and the job aid entitled *Characteristics of Response Strategies – A Guide for Spill Response Planning in Marine Environments* (NOAA 2013b).

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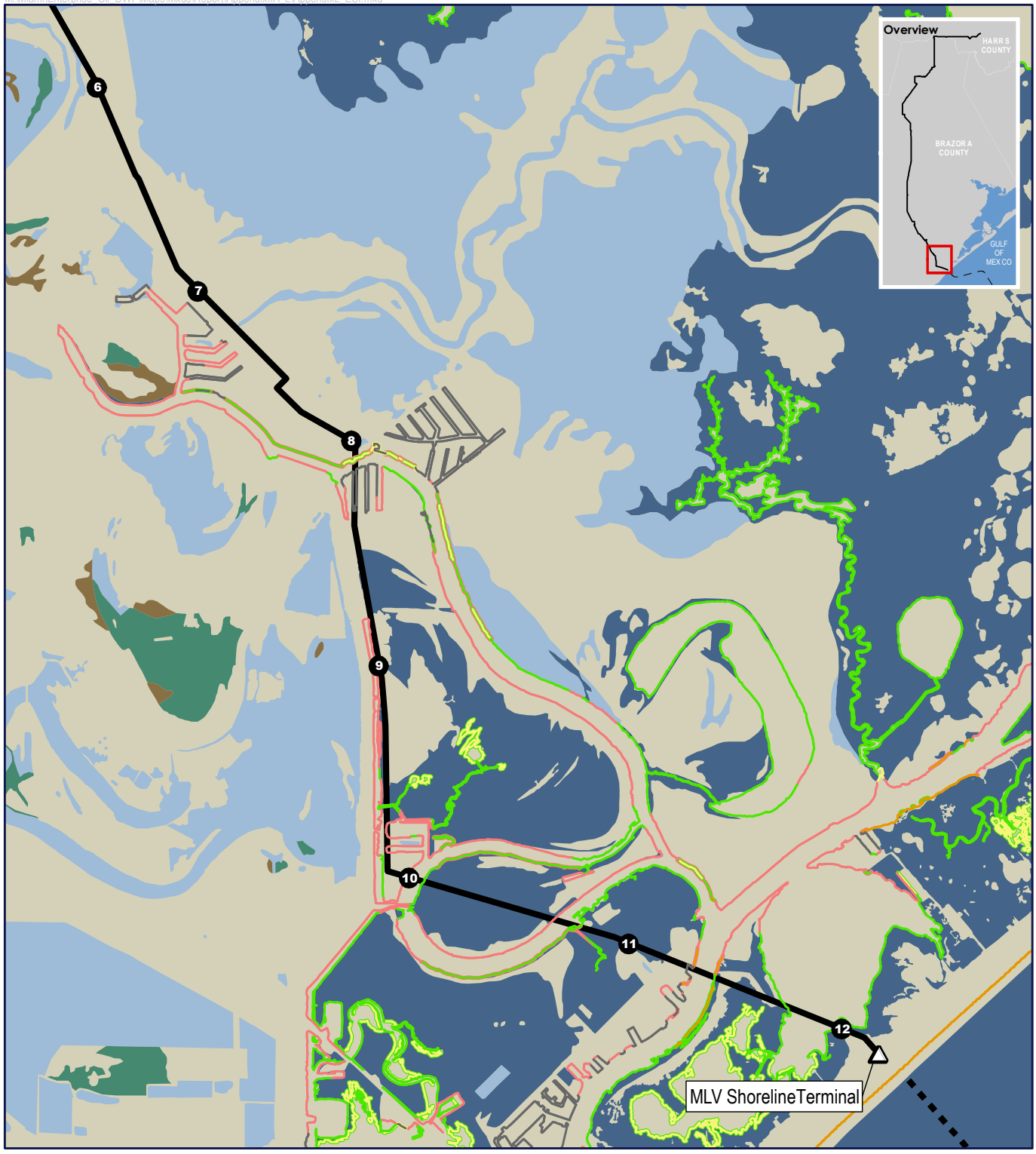

- Milepost
- Mainline Valve Site
- Proposed Onshore Pipeline Route
- Proposed Offshore Pipeline Route
- Armored
- Beaches (sand or gravel)
- Flats (mud or sand)
- Rocky and steep shorelines (rock, sand or clay)
- Vegetated (grass/marsh/mangroves/ scrub-shrub)
- Salt- and brackish-water marshes
- Freshwater marshes
- Swamps
- Scrub-shrub wetlands

0 0.25 0.5 Miles

N W E S

Figure 4
ESI Shoreline Types
SPOT Terminal Services LLC

SPOT
Sea Port Oil Terminal

Source - ESRI, TX ESI

NOAA (2010) summarizes the technical rationale for selecting response methods for four categories of oil in specific habitats, including: I – gasoline products; II – diesel-like products and light crudes; III – medium grade crudes and intermediate products; and IV – heavy crudes and residual products. For the analysis developed in this document, WCS is considered a category IV oil, WTI is considered a category III oil, and C is considered as a category II oil.

3 RESPONSE ASSESSMENT

To develop a basis for response to the various oil types, it was first important to understand the habitat types that would be at risk from a 2,200 bbl potential spill originating from the proposed SPOT DWP. Appendix L, "Oil Spill Trajectory and Fate Modeling Report," Volume IIa, provides this information in Tables 3-3 and 3-4 for WTI and WCS, respectively, and in text (see Appendix L, Section 3) where a worst-case condensate spill would "affect 6.6 miles (11 km) of gravel or cobble beach immediately to the west-northwest of the spill site (no wetland would be affected)." Next, the modeled affected habitats were considered in relation to specific response methods for various habitats as provided in NOAA 2010. Therefore, for example, if 20 miles (33 kilometers) of sand beach was potentially impacted per the model, then response methods such as natural recovery, berms, manual cleaning or other techniques, were noted and their likelihood for 'adverse impact,' considering the cleanup method, was determined. This process was repeated for all of the coastal habitats identified by the 'worst-case' model run for each of the three crude oil types considered. The outcome of this process revealed the most applicable response method(s) that should be considered, which would result in the least damage to the habitat under consideration. Tables 1 and 2 provide a summary of the preceding approach for shoreline habitats. Table 3 provides a similar analysis for methods that are applicable to the offshore environment.

For condensate, per the model, since only one coastal habitat would be affected (e.g., gravel or cobble beach), it was determined that the least adverse habitat affect would be associated with methods including natural recovery, sorbents, debris removal, flooding and low-pressure, ambient water flushing and nutrient enrichment. The greatest adverse effect would be associated with methods including barriers/berms, manual oil removal/cleaning, mechanical oil removal and vegetative cutting/removal.

Table 1
Evaluation of Response Methods for Shoreline Habitats Potentially Affected by a 2,200 bbl Spill of West Texas Intermediate Crude Oil from the SPOT Deepwater Port

Response Method [1]	Habitat Type					
	Rocky Shoreline (1 statute mile [1.6 kilometers (km)] long)	Gravel/Cobble Beach (43 statute miles [70 km] long)	Sand Beach (61 statute miles [98 km] long)	Mudflat (7 statute miles [12 km] long)	Wetland (13 statute miles [21 km] long)	Artificial/ Manmade Shoreline (20 statute miles [33 km] long)
Natural Recovery	A	B	B	B	B	A
Barriers/Berms		C	B	C	B	
Manual Oil Removal/Cleanup	B	B	A	C	C	B
Mechanical Oil Removal		B	B		D	
Sorbents	A	A	A	A	A	A
Vacuum	A	B	B	B	B	
Debris Removal	A	A	A	B	B	
Sediment Reworking/Tilling			B		D	
Vegetation Cutting/Removal	C	C	C	D	C	B
Flooding			A	B	B	
Low-pressure, Ambient Water Flushing	A	A	B	C	B	A
High-pressure, Ambient Water Flushing	B	C				B
Low-pressure, Hot Water Flushing	C	C	C			C
High-pressure, Hot Water Flushing	CB	D				C
Steam Cleaning	D	D				D
Sand Blasting	DB					D
Solidifiers		B	B	C	C	
Shoreline Cleaning Agents	C	C	C		B	B
Nutrient Enrichment		A	A	I	B	
Natural Microbe Seeding		I	I	I	I	
In-situ Burning		C	C		B	

Notes:

[1] Categories are used to compare the relative environmental impact of each method in the specific environment and habitat: A = Least adverse impact; B = some adverse impact; C = Significant adverse impact; D = The most adverse impact; I = Insufficient information for evaluation; Blank means the method was not applicable.

Table 2
Evaluation of Response Methods for Shoreline Habitats Potentially Affected by a 2,200 bbl Spill of Western Canadian Select Crude Oil from the SPOT Deepwater Port

Response Method[1]	Habitat Type					
	Rocky Shoreline (1 statute mile [1.6 kilometers (km)] long)	Gravel/Cobble Beach (71 statute miles [114 km] long)	Sand Beach (153 statute miles [246 km] long)	Mudflat (2 statute miles [4 km] long)	Wetland (8 statute miles [14 km] long)	Artificial/ Manmade Shoreline (7 statute miles [11.3 km] long)
Natural Recovery	A	C	C	B	B	A
Barriers/Berms		B	B	C	B	
Manual Oil Removal/Cleanup	B	B	A	C	C	B
Mechanical Oil Removal		B	B		D	
Sorbents	A	B	A	B	A	A
Vacuum	A	B	A	B	B	
Debris Removal	A	A	A	B	B	
Sediment Reworking/Tilling			B		D	
Vegetation Cutting/Removal	C	C	C	D	C	B
Flooding		C	B	B	B	
Low-pressure, Ambient Water Flushing	B	B	B	D	B	B
High-pressure, Ambient Water Flushing	B	D				B
Low-pressure, Hot Water Flushing	C	C	C			C
High-pressure, Hot Water Flushing	C B	D				C
Steam Cleaning	D	D				
Sand Blasting	D					D
Solidifiers						
Shoreline Cleaning Agents	C	C	C		B	B
Nutrient Enrichment		B	A	I	B	
Natural Microbe Seeding		I	I	I	I	
In-situ Burning		C	C		B D	

Notes:

[1] Categories are used to compare the relative environmental impact of each method in the specific environment and habitat: A = Least adverse impact; B = some adverse impact; C = Significant adverse impact; D = The most adverse impact; I = Insufficient information for evaluation; Blank means the method was not applicable.

Table 3
Evaluation of Response Methods for Offshore Habitat Potentially Affected by a 2,200 bbl Spill of Three Types of Crude Oil from the SPOT Deepwater Port

Response Method[1]	Offshore Environment		
	West Texas Intermediate	Western Canadian Select	Condensate
Natural Recovery	B	B	A
Booming-Containment	A	A	A
Booming-Deflection/Exclusion	A	A	A
Skimming	A	A	A
Physical Herding	B	B	B
Manual Oil Removal/Cleaning			
Sorbents	B	B	B
Debris Removal	A	A	A
Dispersants	A	A	A
Emulsion-treating Agents	B	B	B
Elasticity Modifiers	B		B
Herding Agents	B		B
Solidifiers	B		B
In-situ Burning	A	A	A

Notes:

[1] Categories are used to compare the relative environmental impact of each method in the specific environment and habitat: A = Least adverse impact; B = some adverse impact; C = Significant adverse impact; D = The most adverse impact; I = Insufficient information for evaluation; Blank means the method was not applicable.

4 SUMMARY

As previously noted, Appendix L, "Oil Spill Trajectory and Fate Modeling Report," Volume IIa, contains the methods, scenarios, and results of the oil spill modeling contracted by the Applicant. Both oil transport and fate modelling and probabilistic modeling were conducted for the three crude oils noted. This analysis provides an overview of the methods that should be considered for the various habitats present and susceptible to potential crude oil spills from the proposed Project. Each habitat is unique and requires careful planning prior to developing the specific methods needed for cleaning up an oil spill and restoring the habitat. Generally, the results of this analysis indicate that natural recovery, the use of sorbents, and the removal of debris can result in the least adverse impact to most shoreline resources for the range of crude oil grades considered. Although not specifically considered by this response analysis, oil spills can also affect socioeconomic factors that rely on the various ecological habitats identified, including use of offshore artificial reefs, commercial and recreational fishing opportunities, marine traffic, and beach and natural areas use. The application of the various response techniques provided in this analysis can be used to mitigate impacts to both ecological and human use services provided by coastal/marine habitats. In the event of a crude oil spill, the SPOT DWP Emergency Spill Response Plan will be implemented to ensure minimal potential impact in accordance with the Operation and Maintenance Philosophy (Attachment 18, "Offshore Operations and Maintenance Philosophy," Volume III [*Confidential*]).

5 REFERENCES

National Oceanic and Atmospheric Administration (NOAA). 2010. Characteristic Coastal Habitats: Choosing Spill Response Alternatives. U.S. Dept. of Commerce. Seattle, WA: Emergency Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 73 pp + appendices.

_____. 2013a. Shoreline Assessment Manual. 4th Edition. U.S. Dept. of Commerce. Seattle, WA: Emergency Response Division, Office of Response and Restoration, National Oceanic and Atmospheric Administration. 65 pp + appendices.

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