DEEPWATER PORT LICENSE APPLICATION FOR THE BLUEWATER SPM PROJECT

VOLUME II – ENVIRONMENTAL EVALUATION

Section 2 – Alternatives Analysis

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ACRONYMS AND ABBREVIATIONS

Applicant	Bluewater Texas Terminal LLC.
Project	Bluewater SPM Project
bph	barrels per hour
BWTT	Bluewater Texas Terminal LLC
CFR	Code of Federal Regulations
DWP	Deepwater Port
DWPA	Deepwater Port Act of 1974
EFH	Essential fish habitat
EIA	Energy Information Administration
ft.	Feet
HDD	horizontal directional drilling
i.e.	Latin for in est, meaning "in other words"
MARAD	Maritime Administration
MHT	Mean high tide
MMbpd	Million barrels per day
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
PADD	Petroleum Administration for Defense Districts
PADD 1	East Coast Region
PADD 2	Midwest Region
PADD 3	Gulf Coast Region
PADD 4	Rocky Mountain Region
PADD 5	West Coast Region
PLEM	Pipeline end manifold
Project	Bluewater SPM Project
SPM	Single point mooring
T&E	Threatened and Endangered
U.S.	United States of America
VLCC	Very large crude oil carriers
WOUS	Waters of the United States

2 ALTERNATIVES ANALYSIS

2.1 Regulatory Requirements of the Alternatives Analysis

An analysis of alternatives was undertaken in compliance with the National Environmental Policy Act (NEPA). This section summarizes the process and outcome of the alternative analysis conducted for the proposed Bluewater single point mooring (SPM) Project (Project). The alternatives analysis is one of nine criteria used to determine a final decision under the Deepwater Port Act of 1974, as amended (DWPA) (33 Code of Federal Regulations [CFR] subchapter NN parts 148, 149, 150 and 33 U.S.C. 1503c). Pursuant to NEPA, governmental decision-makers must consider a range of reasonable and practicable alternatives to a proposed action that would result in a significant environmental effect. A reasonable alternative is defined by the below criteria:

- Satisfy the Project purpose and need as defined in Section 1 – Project Purpose and Need;
- Satisfy Project objectives discussed as defined in Section 1 – Project Purpose and Need;
- Technically and economically feasible; and,
- Would result in an acceptable return on the investment.

Under the DWPA and in accordance with the implementing regulations in 33 CFR subchapter NN (parts 148, 149, 150), the Maritime Administration (MARAD) may approve or deny an application for a license to construct, own, operate a Deepwater Port (DWP). Bluewater Texas Terminal LLC (BWTT; also referred to as Applicant) understands that a license approval may include enforceable conditions by MARAD as part of the license. MARAD may also consider alternative means to construct and operate the DWP that meet the criteria listed above. Identifying and evaluating alternatives ensures that decisions using the NEPA process regulated under the DWPA are in the best interest of the United States, and consistent with national security, energy policies, and environmental policies.

As described in Section 1.0 – Project Purpose and Need, the Applicant identified critical Project objectives required for the fulfillment of the purpose and need of the proposed Project, which is to provide a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins. These Project objectives serve as the basis for consideration throughout the alternatives analysis and are used to compare potential alternatives throughout a tiered analysis. The overall Project objectives are defined as follows:

Project Objectives

- Provide a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins and support economic growth in the U.S.
- Ability to safely and fully load a Very Large Crude Oil Carrier (VLCC).
- Ability of infrastructure to support the simultaneous full loading of up to two (2) VLCC vessels.
- Ability of infrastructure to support loading rates of approximately 80,000 barrels per hour (bph) for the full loading of up to 16 VLCC's per month in order to result in an acceptable return on investments.
- Minimize the required modifications to existing environmental conditions.
- Minimize potential interference with existing natural processes.
- Maximize offsite fabrication in a controlled setting thereby minimizing offshore impact as a result of on-site construction activities.
- Locate Project in proximity to existing and planned crude oil infrastructure in order to reduce footprint and environmental impacts.
- Minimize impact to waters of the U.S. (WOUS), including wetlands, coastal bend ecosystems, and special aquatic resources.
- Minimize impact to threatened and endangered (T&E) species and their associated habitats.
- Minimize impact to cultural resources.

- Minimize impact to navigation and navigation safety.
- Minimize impact to commercial and recreational fisheries and essential fish habitat (EFH).
- Existing land use compatibility, availability, and suitability for the Project.

This alternatives analysis evaluates the reasonable and practicable alternatives in accordance with NEPA. A variety of practicable and reasonable alternatives were considered by the Applicant. Impracticable alternatives are defined as alternatives that are technically or economically unfeasible; therefore, were not considered as part of this alternative analysis.

The alternatives evaluated have been selected to determine the best means of satisfying the purpose and need of the Project and in accordance with NEPA requirements. As part of the alternative analysis process, the Applicant identified five tiers which were used to determine the proposed action and a reasonable alternative to the proposed action, both of which fulfill the purpose and need of the proposed Project. As a result of this alternatives analysis, the identified proposed action and reasonable alternative to the proposed action will be carried forward for further evaluation as part of the Environmental Evaluation conducted for the proposed Project to identify related environmental consequences and their level of impact to the environmental resources. An overview of the alternative analysis conducted for the proposed Project is shown in Table 2-1:

Table 2-1: Alternatives Analysis Overview

	Alternatives Analysis	Selection
Tier I Screening: No-Action Alternative		
No-Action Alternative	No-Action Alternative	Not considered for further review.
Tier II Screening: Location Alternatives		
U.S. Region Alternatives	East Coast (PADD 1)	Gulf Coast (PADD 3)
	Midwest (PADD 2)	
	Gulf Coast (PADD 3)	
	Rocky Mountain (PADD 4)	
	West Coast (PADD 5)	
Gulf Coast (PADD 3) State Alternatives	Alabama	Texas
	Arkansas	
	Louisiana	
	Mississippi	
	New Mexico	
	Texas	
Texas Coast Location Alternatives	Sabine/Beaumont Area	Corpus Christi Area
	Houston Area	
	Freeport Area	
	Matagorda Area	
	Corpus Christi Area	
	Brownsville Area	
Tier III Screening: Existing Infrastructure vs. New Infrastructure		
	Existing Pipeline and/or Platform Infrastructure	

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For each tier of the alternative analysis, a four-step process was used for the screening of potential alternatives to determine which best fulfilled the Project purpose and need and Project objectives. During this process, alternatives were eliminated to allow for the advancement of the most practicable alternatives for further consideration and analysis in subsequent tiers. The four-step process followed for each tier includes:

1. Identification and description of reasonable and practicable alternatives for analysis
2. Development of selection criteria for evaluating reasonable alternatives
3. Evaluation and comparison of reasonable alternatives based on selection criteria
4. Identification of most-suitable alternatives for advancement and evaluation in subsequent tiers

The development of selection criteria during step 2 for the evaluation of alternatives conducted during step 3 is based upon the Environmental and Project objectives described above. This alternatives locations for the siting of the necessary components associated with the Project were evaluated in accordance with 33 CFR Part §148.715(b) siting criteria, as applicable, including:

- (a) Optimizes location to prevent or minimize detrimental environmental effects
- (b) Minimizes space needed for safe and efficient operation
- (c) Locates offshore components in areas with stable sea bottom characteristics
- (d) locates onshore components where stable foundations can be developed
- (e) Minimizes the potential for interference with its safe operations from existing offshore structures and activities
- (f) Minimizes danger posed to safe navigation by surrounding water depths and currents
- (g) Avoids extensive dredging or removal of natural obstacles such as reefs
- (h) Minimizes the danger to the port, its components, and tankers calling at the port from storms, earthquakes, or other natural hazards
- (i) Maximizes the permitted use of existing work areas, facilities, and access routes
- (j) Minimizes the environmental impact of temporary work areas, facilities, and access routes
- (k) Maximizes the distance between the port, its components, and critical habitats including commercial and sport fisheries, threatened or endangered species habitats, wetlands, flood plains, coastal resources, marine management areas, and essential fish habitats
- (l) Minimizes the displacement of existing or potential mining, oil, or gas exploration and production or transportation uses
- (m) Takes advantage of areas already allocated for similar use, without overusing such areas
- (n) Avoids permanent interference with natural processes or features that are important to natural currents and wave patterns
- (o) Avoids dredging in areas where sediments contain high levels of heavy metals, biocides, oil or other pollutants or hazardous materials, and in areas designated wetlands or other protected coastal resources

Section 2.2 provides a summary of the alternatives analysis framework and details the basis on which the identified tiers used for analysis were developed.

2.2 Framework of the Alternatives Analysis

As previously described, the alternatives analysis conducted for the proposed Project follows a tiered screening approach to identify and analyze potential alternatives and their ability to meet the Project purpose and need and Project objectives. As a result of the alternatives analysis, a total of six tiers were identified.

Tier I consisted of the evaluation of the no action alternative. Based on the results of Tier I, the need for action was determined. As such an analysis of potential location alternatives was conducted (Tier II), followed by existing infrastructure vs. new infrastructure alternatives (Tier III), siting analysis of required Project components (Tier IV), and evaluation of design alternatives (Tier V). The following sections detail the basis on which each of the identified tiers were developed based on preceding determinations.

2.2.1 Tier I – Evaluation of No Action Alternative

Tier I of the alternatives analysis process evaluated the no action alternative. The no action alternative refers to the continuation of existing conditions without implementation of the proposed Project. Based on the results of the Tier I screening, the overall need for the proposed Project was determined with respect to existing market conditions and future crude oil production.

2.2.2 Tier II – Location Alternatives

Based on the results of the Tier I screening analysis, a Tier II screening was conducted consisting of an evaluation of locations within the United States of America (U.S.) that is most suited for meeting the Project purpose and need. As part of Tier II of the alternatives analysis, forecast of crude oil production was analyzed to determine the most suitable setting for the Project. The most suitable setting is further refined through the analysis of navigation and navigational safety needs, existing land use and infrastructure, and presence of sensitive ecological resources. Completion of the Tier II screening resulted in the selection of a regional setting for the proposed Project.

2.2.3 Tier III – Existing Infrastructure vs. New Infrastructure Alternatives

Based on the regional location determined as a result of the Tier II screening analysis, Tier III screening was conducted to evaluate the technical feasibility for the utilization of existing offshore infrastructure to fulfill the Project purpose and need. The construction of new infrastructure as well as the utilization of existing infrastructure was investigated as part of the Tier III screening. The Tier III screening resulted in the determination of the most suitable conceptual project configuration and the required components. As such, the completion of the Tier III screening allows for a more specific siting analysis of the necessary components to be conducted during the Tier IV screening.

2.2.4 Tier IV – Siting Analysis of Required Project Components

The Tier III screening resulted in the development of a conceptual design and understanding of the required Project components which are required to fulfill the Project purpose and need. This understanding of the required infrastructure allows for a detailed siting analysis to be conducted for each of the necessary Project components to determine the preferred locations with regards to various siting criteria. As a result of the Tier IV analysis, two alternative Project configurations were carried forward for further analysis. The results of the Tier IV siting analysis allow for the further refinement of the conceptual project design and more detailed engineering of the various components associated with the proposed Project to be completed during the Tier V screening.

2.2.5 Tier V – Evaluation of Design Alternatives

The Tier V screening consisted of the analysis of the potential alternative project designs for the various components associated with the proposed Project. As part of this screening, each of the required components were analyzed to determine which allowed for the necessary throughput capacities and fulfillment of Project goals and objectives, while minimizing impacts and overall Project footprint to the maximum extent practicable. The selected design alternative was applied to both alternatives carried forward as a result of the Tier IV analysis.

2.2.6 Alternatives Analysis Screening Summary

Based on the results of the five-tiered screening process detailed above, two Project alternatives were identified as practicable alternatives to fulfill the Project purpose and need. This section of the alternatives analysis provides a comparative analysis of identified alternatives to define a "Proposed Project" and an "Alternative Project" based on previous screening criteria based on the ability to fulfill Project goals and objectives while minimizing environmental impacts to the maximum extent practicable. The Preferred Project and Alternative Project are both carried forward for further evaluation as part of the Environmental Evaluation conducted for the proposed Bluewater SPM Project to identify related environmental consequences and their level of impact to environmental resources as a result of the construction, operation, and decommissioning of the Project components.

2.3 Tier I – Evaluation of No-Action Alternative

The no action alternative refers to the continuation of existing conditions without implementation of the proposed Project. According to the U.S. Energy Information Administration (EIA) 2019 Annual Energy Outlook, total U.S. crude oil production reached an average of 10.8 million barrels per day (MMbpd) in 2018. By 2030, U.S. crude oil production is expected to increase by 3.7 MMbpd. The primary projected increase is that of crude oil classified as light crude oil which is defined as consisting of a density measured in American Petroleum Institute (API) gravity of greater than 35 degrees API. Light crude oil is projected to account for almost 81% (3.7 MMbpd) of the increase. Most of the light oil production growth is projected to occur within the Southwest region (Texas and New Mexico) at additional volumes of 2.2 MMbpd by 2030.

Current U.S. refineries are configured to process heavy and high sulfur crude oil supplies which are generally derived from international producers such as Canada, South America, and the Middle East. Running U.S. refineries solely on domestic light crude oil or reconfiguring the capabilities of any refinery is generally uneconomical.

Current and projected crude oil production indicate that the U.S. will become a net exporter of crude oil by 2020. Additionally, the U.S. has more sweet crude oil than it can refine domestically and therefore is needing an efficient export solution to international markets that have the necessary refining infrastructure and growing demand. Current U.S. crude oil export logistics are constrained and rely upon inefficient means resulting in significant economic disadvantages, potential navigational concerns, and exposure to workforce hazards.

Under the no-action alternative, the export of crude oil from the U.S. would be limited to existing operations and constraints. The no-action alternative would limit current and future crude oil production and opportunity for the U.S. capitalization on international market demands and economic growth. Table 2-2 presents the analysis of Tier I evaluation.

Table 2-2: Evaluation of the No Action Alternative Decision Matrix

Objective Type	Objectives	No Action Alternative	Action
Project Objectives	Provide a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins and support economic growth in the U.S.	X	✓
	Ability to safely and fully load a VLCC.	X	✓
	Ability of infrastructure to support the simultaneous full loading up to two (2) VLCC vessels.	X	✓
	Ability of infrastructure to support loading rates of approximately 80,000 bph for the full loading of up to 16 VLCC's per month.	X	✓
TOTAL		**0**	**4**

<u>Tier I – No Action Alternatives Analysis Conclusion</u>

Based on the results of the Tier I analysis, as presented in Table 2-2, the no-action alternative was not considered feasible and not considered for further review.

2.4 Tier II – Location Alternatives

As determined by the result of the Tier I screening analysis, the Applicant determined the need for the development of a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins and support economic growth in the U.S.

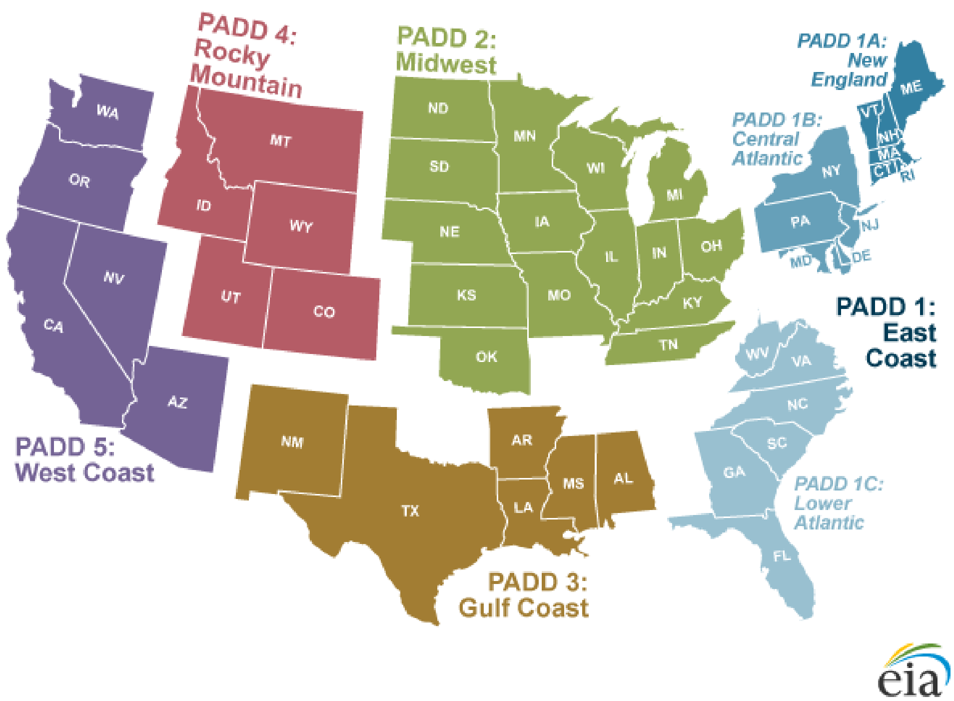
Tier II of the alternatives analysis evaluates locations within the U.S. most suited for meeting the Project purpose and need. Tier II analyzes location alternatives at the U.S. Regional level, state level, and local area level. The following sections describe the alternatives analyzed and the respective results of the Tier II screening analysis.

2.4.1 U.S. Region Alternatives

The U.S. is divided into five regions called Petroleum Administration for Defense Districts (PADDs) as shown in Figure 2-1. PADDs are geographic aggregations which were established during World War II to help organize and ration petroleum products being used as fuel such as gasoline and diesel. PADDs are used today to analyze patterns of crude oil and petroleum product movements throughout the U.S. (EIA 2019c). The five PADDs are:

- East Coast (PADD 1)
- Midwest (PADD 2)
- Gulf Coast (PADD 3)
- Rocky Mountain (PADD 4)
- West Coast (PADD 5)

Figure 2-1: Petroleum Administration for Defense Districts



Source: EIA 2019

The analysis of U.S. Regional location alternatives was based upon three screening criteria consisting of the following:

1. High Crude Oil Production: Establishment of a crude oil export solution within the regional location of the highest crude oil production.
2. Amount of Existing Crude Oil Transport Infrastructure: Establishment of a crude oil export solution within the regional location with existing crude oil transport infrastructure (i.e. pipelines) allows for connectivity and utilization of existing infrastructure. This, consequently, is cost-effective, promotes operational efficiencies, and minimizes the need for additional infrastructure.
3. Regional Coastal Boundary: The most efficient form of export of crude oil from the U.S. is conducted via waterborne commerce. As such, access to coastal waters is required for the loading of vessels for export.

The following sections detail the analysis conducted for the U.S. Regional location alternatives.

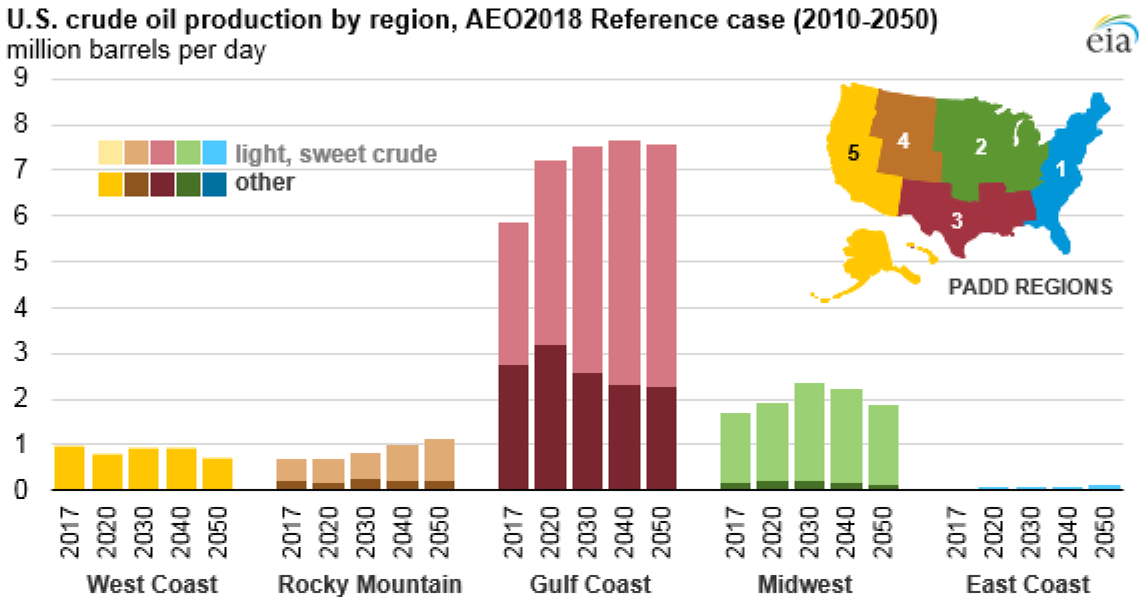
High Crude Oil Production

As shown in Table 2-3, 2018 crude oil production volume within the Gulf Coast region (PADD 3) was by far the highest when compared to all other PADDs. As shown in Figure 2-2, the Gulf Coast region (PADD 3), stands out as experiencing the highest projected surge in oil production over the next 40 years. Recent growth in U.S. crude oil production has been driven by the development of tight (shale) oil resources, primarily in the Permian Basin. Three major tight oil plays in the Permian Basin—the Spraberry, Bone Spring, and Wolfcamp—accounted for 36% of U.S. tight oil production in 2018. Production from these three plays is projected to increase and to account for 43% of cumulative tight oil production through 2050 in the Reference case (Figure 2-3).

Table 2-3: Crude oil production in the U.S. in 2018 by PADD

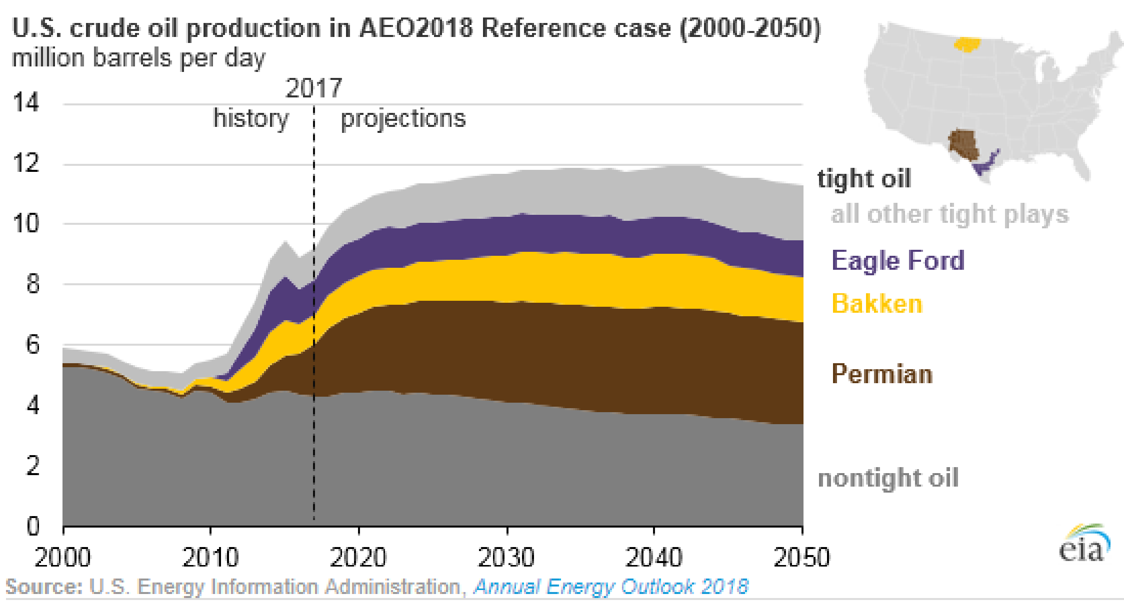
Crude oil production in the U.S. in 2018 by PADD	
East Coast (PADD 1)	18,156 thousand bpd
Midwest (PADD 2)	634,514 thousand bpd
Gulf Coast (PADD 3)	2,138,715 thousand bpd
Rocky Mountain (PADD 4)	261,404 thousand bpd
West Coast (PADD 5)	360,587 thousand bpd
Source: EIA.gov	

Figure 2-2: Forecasted Increase of U.S. Crude Production Sources Per PADD



Source: EIA 2019

Figure 2-3: Forecasted Increase of U.S. Crude Production Sources Per Source



Amount of Existing Crude Oil Transport Infrastructure

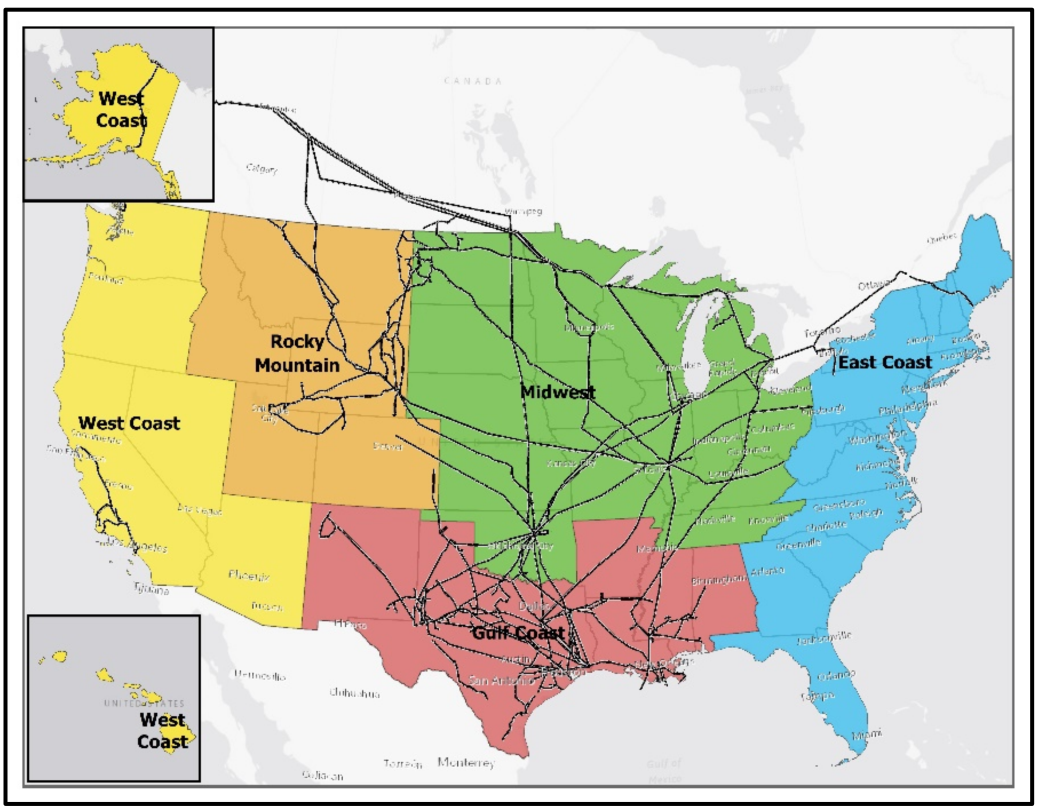
Areas of high crude oil production commonly have a number of major crude oil transport pipelines. As shown in Table 2-4 and Figure 2-4, the Gulf Coast region (PADD 3) and the Midwest region (PADD 2) have multiple existing major crude oil pipelines.

The export of domestic crude oil relies on the ability to transport crude oil from the production location to the export location. As such, the establishment of a crude oil export solution within an area containing existing crude oil pipelines allows for the necessary connectivity to areas of high crude oil production through the utilization of existing infrastructure, thereby promoting operational efficiencies. Furthermore, the positioning of a crude oil export solution within an area of numerous existing crude oil pipelines minimizes the need for the installation of additional transport infrastructure potentially resulting in additional environmental impacts.

Table 2-4: Number of Existing Major Crude Oil Pipelines in the U.S. by PADD

PADD Area	Number of Major Crude Oil Pipelines
East Coast (PADD 1)	7
Midwest (PADD 2)	62
Gulf Coast (PADD 3)	102
Rocky Mountain (PADD 4)	32
West Coast (PADD 5)	19
Source: EIA 2019e	

Figure 2-4: Existing Major Crude Oil Pipeline Infrastructure in the U.S. by PADD



Source: EIA 2019e

Regional Coastal Boundary

The most efficient and widely used form of crude oil export is via waterborne commerce. As such, access to offshore coastal waters is required for the navigation of incoming and outgoing vessels. The East Coast region (PADD 1) has the highest mileage of regional coastal boundary followed by the Gulf Coast region (Table 2-5).

Table 2-5: U.S. Regional Coastal Boundary Mileage

PADD Area	Mileage of Regional Coastal Boundary
East Coast (PADD 1)	27,370
Midwest (PADD 2)	0
Gulf Coast (PADD 3)	12,046
Rocky Mountain (PADD 4)	0
West Coast (PADD 5) *	7,863
**not including Alaska* *Source:* NOAA 2019	

An analysis of the five regional locations (PADD 1-PADD 5) was conducted based on the screening criteria listed above. The results of the U.S. region location screening are presented in Table 2-6.

Table 2-6: U.S. Regional Location Alternatives Decision Matrix

U.S Region Alternatives	East Coast (PADD 1)	Midwest (PADD 2)	Gulf Coast (PADD 3)	Rocky Mountain (PADD 4)	West Coast (PADD 5)
High Crude Oil Production	x 18,146 thousand bpd	x 634,514 thousand bpd	✓ 2,138,715 thousand bpd	x 261,404 thousand bpd	x 360,587 thousand bpd
Existing Crude Oil Transport Infrastructure: Number of Existing Major Crude Oil Pipelines	x 7	✓ 62	✓ 102	x 32	x 19
Regional Coastal Boundary: Mileage Coastal Boundary	✓ 27,370	x 0	✓ 12,046	x 0	✓ 7,863
Evaluation Score	1	1	3	0	1
Retained for Further Consideration	No	No	**Yes**	No	No

Tier II – U.S. Regional Alternatives Analysis Conclusion

Based on the results of the Tier I – U.S. Regional Location alternative analysis, as presented in Table 2-6, the Gulf Coast region (PADD 3) is the most practicable U.S. regional alternative to be carried forward.

2.4.2 State Alternatives

Based on the results of the U.S. regional screening (Section 2.4.1), the Gulf Coast region (PADD 3) was determined to be the best suited for the establishment of a crude oil export solution. To further refine the most optimal location for a crude oil export solution, a state alternatives screening was conducted for the six states located within PADD 3. The states analyzed include:

- Alabama
- Arkansas
- Louisiana
- Mississippi
- New Mexico
- Texas

The analysis of state alternatives was based on three screening criteria consisting of:

1. High Crude Oil Production: Establishment of a crude oil export solution within a state of the highest crude oil production.
2. Amount of Existing Crude Oil Transport Infrastructure: Establishment of a crude oil export solution within a state with existing crude oil transport infrastructure (i.e. pipelines) allows for connectivity thought the utilization of existing infrastructure; thereby, is cost-effective, promotes of operational efficiencies, and minimizes the need for additional infrastructure.
3. State Coastal Boundary: Access to coastal waters is required for the loading of vessels.

The following sections detail the analysis conducted for the state alternatives.

<u>High Crude Oil Production</u>

Texas is the leader of crude oil production within the Gulf Coast region. As of January 2019, Texas produced more than seven times the amount of crude oil than any other Gulf Coast state. New Mexico was the second most productive Gulf Coast state, followed by Louisiana in third (Table 2-7).

Table 2-7: Crude Oil Production by State in 2018

Crude Oil Production by State in 2018	
State	**Thousand barrels Annually**
Alabama	6,827
Arkansas	5,288
Louisiana	52,024
Mississippi	17,781
New Mexico	171,440
Texas	1,272,575
Source: EIA 2019	

Amount of Existing Crude Oil Transport Infrastructure

As a reflection of its annual crude oil production, Texas houses more than two times the number of major crude oil pipelines than any other state in the Gulf Coast (Table 2-8). Establishment of a crude oil export solution within a state having adequate existing crude oil transport infrastructure (i.e. pipelines) allows for optimal connectivity through the utilization of existing infrastructure and would thereby be cost-effective, promote use of existing operational efficiencies, and minimize the need for additional infrastructure.

Table 2-8: Number of Existing Major Crude Oil Pipeline Infrastructure by State

Number of Existing Major Crude Oil Pipelines by State	
State	**No.**
Alabama	5
Arkansas	2
Louisiana	24
Mississippi	18
New Mexico	8
Texas	63
Source: EIA 2019d	

State Coastal Boundary

As previously stated, access to offshore coastal waters is required for the navigation of incoming and outgoing vessels. As shown in Table 2-9, Louisiana and Texas have the highest mileage of regional coastal boundary.

Table 2-9: State Coastal Boundary Mileage

State	Miles of Coastal Boundary
Alabama	53
Arkansas	0
Louisiana	397
Mississippi	44
New Mexico	0
Texas	367
Source: Department of Commerce, National Oceanic and Atmospheric Administration, National Ocean Service.	

State Alternatives Analysis Summary

An analysis of the six states within the Gulf Coast was conducted based on the screening criteria listed above. The results of the state alternatives screening are presented in Table 2-10.

Table 2-10: State Alternatives Decision Matrix

U.S Region Alternatives	Alabama	Arkansas	Louisiana	Mississippi	New Mexico	Texas
High Crude Oil Production	X 6,827	X 5,288	X 52,024	X 17,781	X 171,440	✓ 1,272,575
Existing Crude Oil Transport Infrastructure: Number of Existing Major Crude Oil Pipelines	X 5	X 2	✓ 24	X 18	X 8	✓ 63
State Coastal Boundary: Mileage Coastal Boundary	X 53	X 0	✓ 397	X 44	X 0	✓ 367
Evaluation Score	0	0	2	0	0	3
Retained for Further Consideration	No	No	No	No	No	**Yes**

Tier II – State Alternatives Analysis Conclusion

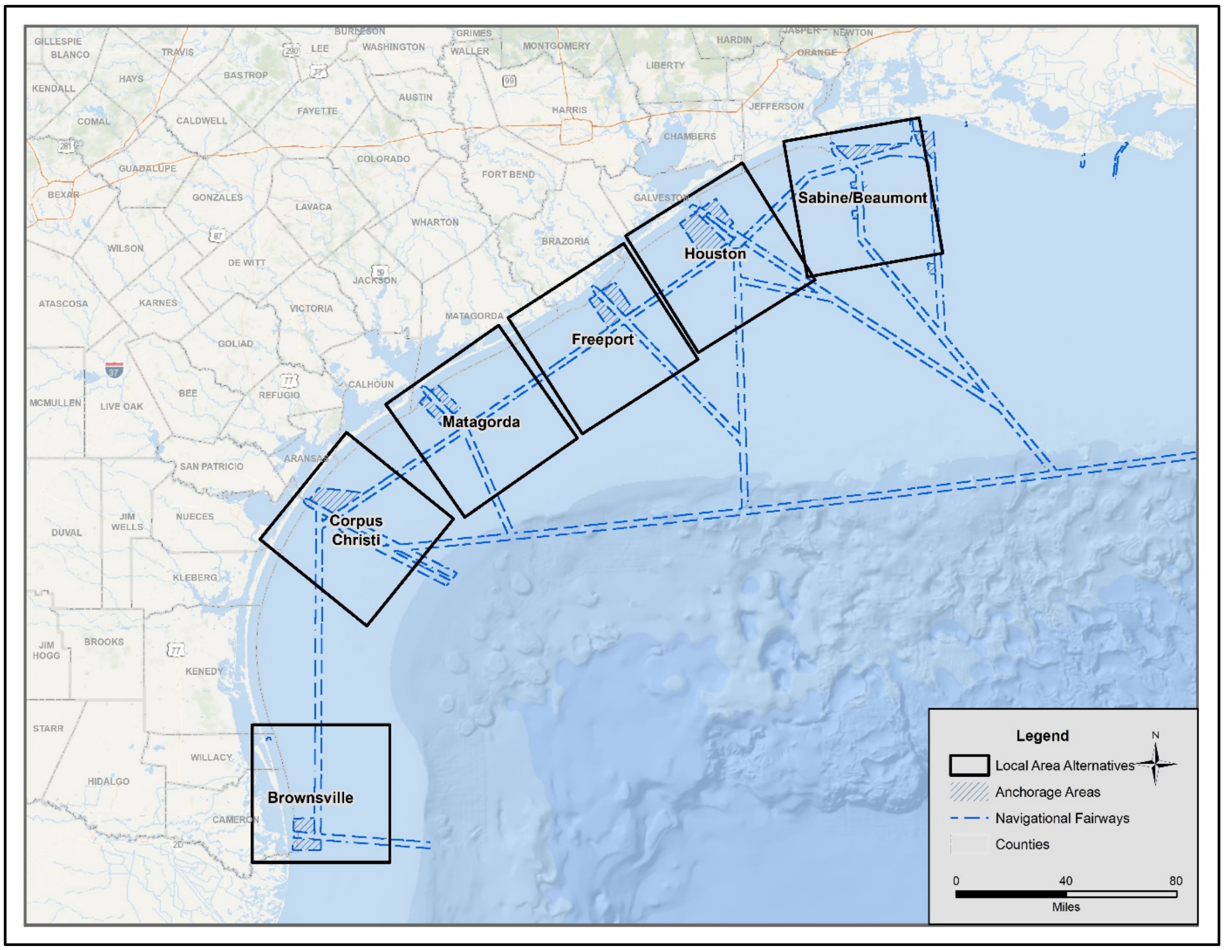
Based on the results of the Tier II – State alternative analysis, as presented in Table 2-10, Texas is the most practicable state alternative to be carried forward.

2.4.3 Local Area Alternatives

Based on the results of the state alternative screening, Texas was determined to be the most practicable state alternative for the establishment of a crude oil export solution. To further refine the most optimal location for a crude oil export solution, a local area screening was conducted to identify the most suitable area along the Texas coast. The Texas coast was categorized for analysis based on existing major ports and oil and gas related infrastructure. Refer to Figure 2-5 for a depiction of the local area alternatives analyzed. The local area alternatives consist of:

- Sabine/Beaumont
- Houston
- Freeport
- Matagorda
- Corpus Christi
- Brownsville

Figure 2-5: Local Area Alternatives



Sources: BOEM 2019; TNRIS 2019

An analysis of existing vessel navigation channels was conducted to determine if any exhibited the necessary depths to allow for the safe navigation and full and direct loading of a VLCC at an inland port facility. Based on the review conducted (Table 2-11), no existing inland ports exhibit the necessary depths to allow for the full and direct loading of VLCCs. As such, the use of an inland port under existing conditions does not fulfill the Project purpose and need, and therefore was not considered a viable alternative for further consideration.

Table 2-11: Existing Gulf Coast Inland Port Draft Restrictions

GULF COAST PORT DRAFT RESTRICTIONS	
Port Name	**Max Draft (feet)**
Brownsville Area	35.8
Corpus Christi Area	45.0
Matagorda Area	35.1
Freeport Area	42.0
Houston Area	44.9
Sabine/Beaumont Area	40.0

Source: USACE 2019a

To identify the most suitable Texas coast location for the development of a crude export solution, the incorporation of additional screening criteria was determined necessary to identify the most optimal location. The primary criteria used for determining the most optimal Texas coast location can be categorized as navigation and navigational safety, sensitive environmental resources, and existing and future crude oil infrastructure. The following sections describe specifics used during the analysis of Texas coast location alternatives.

Navigation and Navigation Safety Screening Criteria

The purpose of the proposed Project is to provide a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins. VLCCs are the preferred mode of international maritime transport of crude oil because they are the most efficient and economical way to transport very large volumes of crude oil for long distances. However, due to this significant size and transport capacity, offshore navigation and navigation safety must be taken into consideration. A VLCC when fully loaded requires a minimum draft depth of approximately 85 ft. in an offshore environment to allow for the required under keel clearance to ensure safe navigation. The optimal location for loading VLCCs would be one that minimizes impacts to existing navigation and navigational safety. Therefore, considerations with regards to navigation and navigation safety criteria were used during the analysis of the Texas coast location alternatives. The following navigation criteria were used for analysis:

- Navigation Criteria 1: Minimizes potential for interference with existing offshore structures and activities: The preferred Texas coast location would be one that has minimal existing offshore structures (i.e. platforms) thereby minimizing potential interference with existing offshore operations.
- Navigation Criteria 2: Minimizes necessary infrastructure to load a VLCC in an offshore environment: VLCCs require draft depths of approximately 85 ft. for offshore loading operations. As such, the preferred Texas coast location would be one that limits the distance to areas of sufficient water depths for offshore loading operations (approximately 85 ft.).
- Navigation Criteria 3: Minimizes impacts to areas of existing congested vessel traffic: The preferred Texas coast location would be one that minimizes interference with existing incoming and outgoing vessel traffic and navigation fairways.

Sensitive Environmental Resources Screening Criteria

Potential for impacts to sensitive ecological resources was used for the analysis of Texas coast location alternatives to identify the most preferred location. The following criteria were used for analysis of the Texas coast location alternatives with regards to potential impacts to sensitive ecological resources.

- Sensitive Environmental Resources Criteria 1: Minimize impacts to T&E species and their associated habitats: The preferred Texas coast location would be one that has limited T&E species critical habitat within the area.
- Sensitive Environmental Resources Criteria 2: Minimizes impacts to areas of lesser air quality: The preferred Texas coast location would be one that is located within an area, and consists of surrounding areas, that meet the National Ambient Air Quality Standards (NAAQS), and thereby are classified as attainment areas.

Crude Oil Infrastructure Screening Criteria

The export of domestic crude oil relies on the ability to transport crude oil from the production location to the export location. As such, the establishment of a crude oil export solution within an area containing existing crude oil pipelines allows for the necessary connectivity to areas of high crude oil production through the utilization of existing infrastructure, thereby promoting operational efficiencies for transporting the crude oil to export facilities. However, consideration should also be given to the destinations of planned crude oil pipeline infrastructure in response to the projected increases of domestic crude oil production as well as the Applicant's existing and/or planned infrastructure. The following criteria were used for analysis of the Texas coast location alternatives with regards to existing and future crude oil infrastructure.

- Crude Oil Infrastructure Criteria 1: Texas coast location with regards to existing crude oil pipeline infrastructure. The preferred Texas coast location would be one that has existing crude oil pipeline infrastructure.
- Crude Oil Infrastructure Criteria 2: Texas coast location with regards to planned crude oil pipeline infrastructure. The preferred Texas coast location is one that has planned future crude oil pipeline infrastructure within the area.
- Crude Oil Infrastructure Criteria 3: Texas coast location with regards to Applicant existing and/or planned infrastructure. The preferred Texas coast location is one that has Applicant existing and/or planned infrastructure.

Navigation and Navigation Safety Analysis

The following sections detail the analysis conducted for the previously described navigation and navigation safety screening criteria.

Navigation Criteria 1

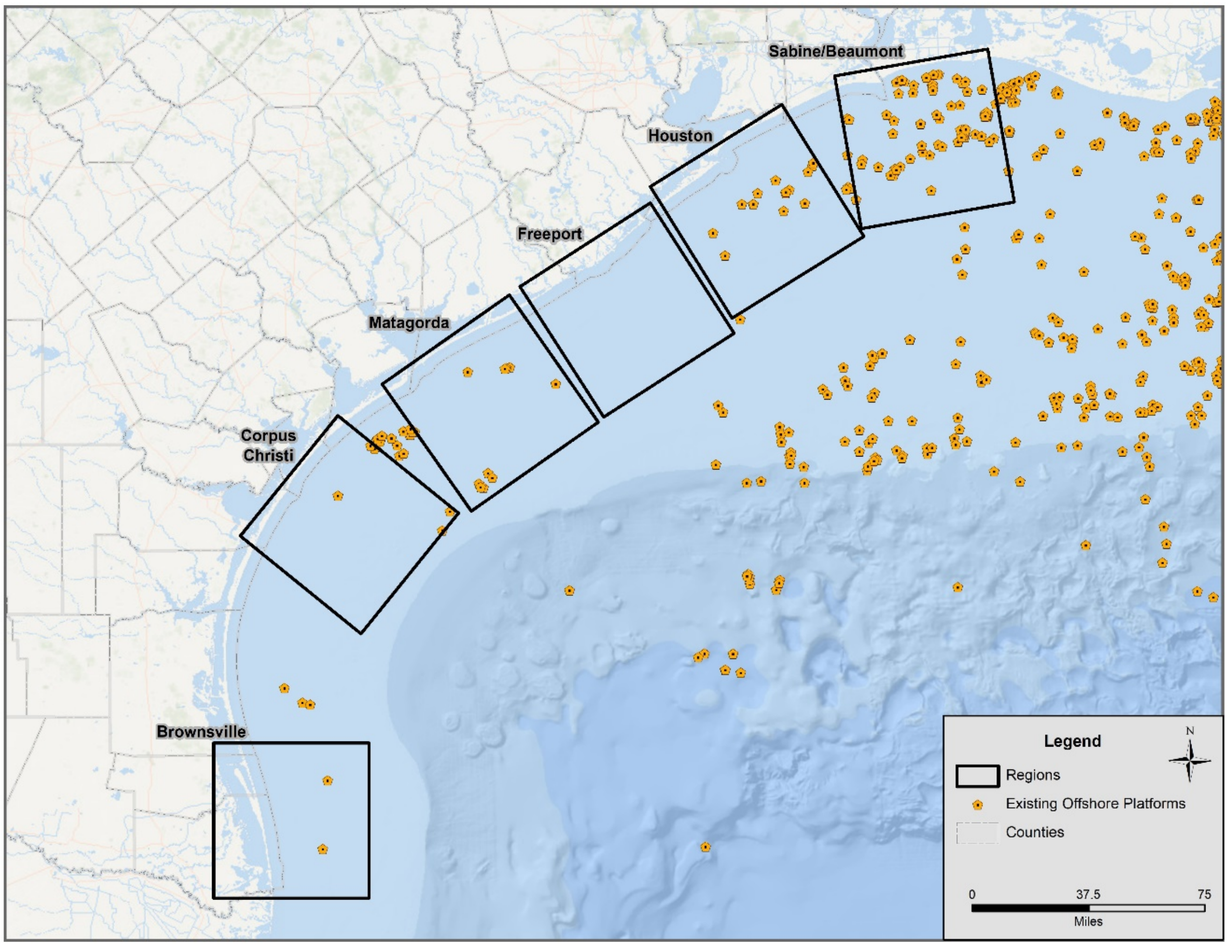
As a significant source of oil and natural gas, the Gulf of Mexico has significant numbers of existing offshore infrastructure including pipelines and platforms. To prevent potential interference with existing offshore oil and gas operations, as well as potential vessel navigations concerns, consideration was given to the number and density of existing offshore platforms. Table 2-12 provides a breakdown of the number of existing offshore platforms located within each Texas coast location (Figure 2-6).

Table 2-12: Number of Existing Offshore Platforms

Texas Coast Location	Number of Existing Offshore Platforms
Sabine/Beaumont Area	96
Houston Area	22
Freeport Area	0
Matagorda Area	10
Corpus Christi Area	7
Brownsville Area	2

Source: BOEM 2019

Figure 2-6: Existing Offshore Platforms



Source: BOEM 2019

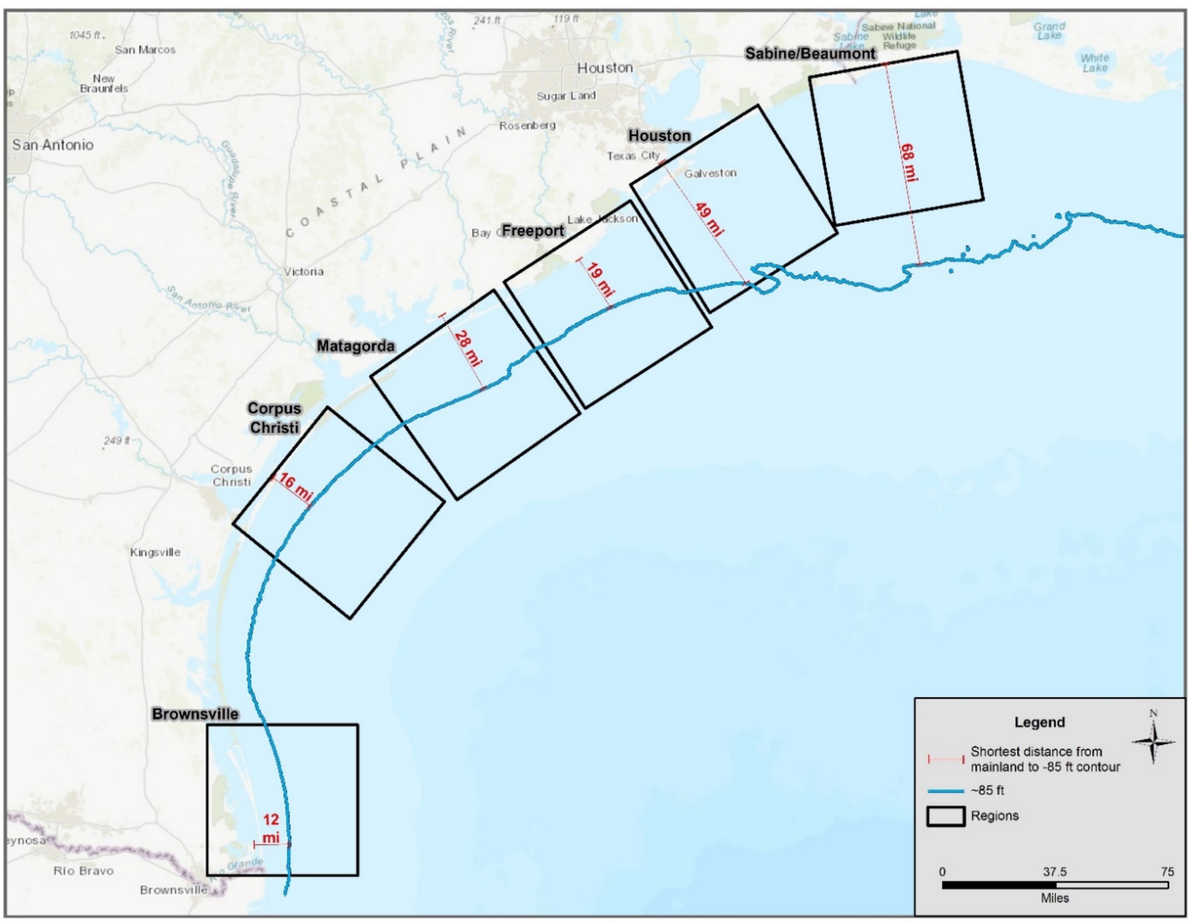
Navigation Criteria 2

Based on the determination that existing navigation channels do not exhibit the required depths to allow for the direct and full loading of VLCCs, the use of an inland port under existing conditions was not determined feasible alternative for the proposed Project. As such, consideration was given to limit the distance from the shoreline to areas of sufficient water depths (approximately 85 ft.) to be able to load a VLCC in an offshore environment. Table 2-13 and Figure 2-7 provide the distances from the shoreline to the 85-foot water depth contour. Based on this measurement, the Brownsville area offers the shortest distance from the shoreline to 85 ft. water depths, followed by the Corpus Christi area.

Table 2-13: Distance from Shoreline to 85-foot Water Depth

Texas Coast Location	Approximate Distance to 85 ft. Water Depth
Sabine/Beaumont Area	68 miles
Houston Area	49 miles
Freeport Area	19 miles
Matagorda Area	28 miles
Corpus Christi Area	16 miles
Brownsville Area	12 miles

Figure 2-7: Texas Coast Location Distances to 85-foot Water Depths

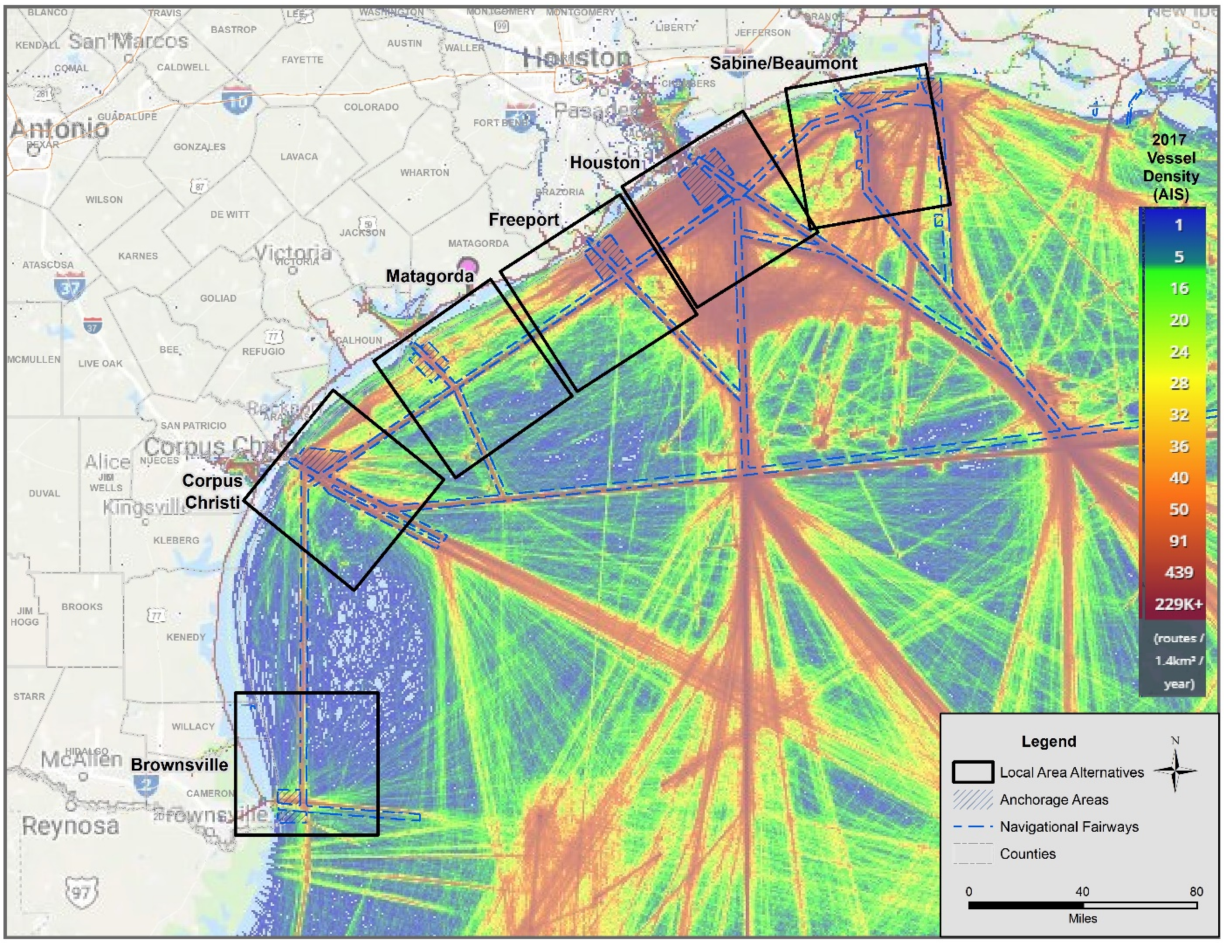


Sources: BOEM 2019; TNRIS 2019

Navigation Criteria 3

The Texas coast has multiple major ports used for waterborne commerce. It is anticipated that the incremental increases in crude oil production will result in greater exports, and therefore greater vessel traffic and congestion within existing navigation fairways. As such, consideration was given to the potential for incoming and outgoing VLCCs to not impact already congested areas and to promote navigational safety. Figure 2-8 provides an overview of vessel densities within existing navigational fairways along the Texas coast. Based on a review of this information, the Houston and Sabine/Beaumont areas currently have the highest vessel traffic densities and congestion within safety fairways.

Figure 2-8: Existing Navigation Fairways and Vessel Densities



Sources: BOEM 2019; Marine Cadastre 2019

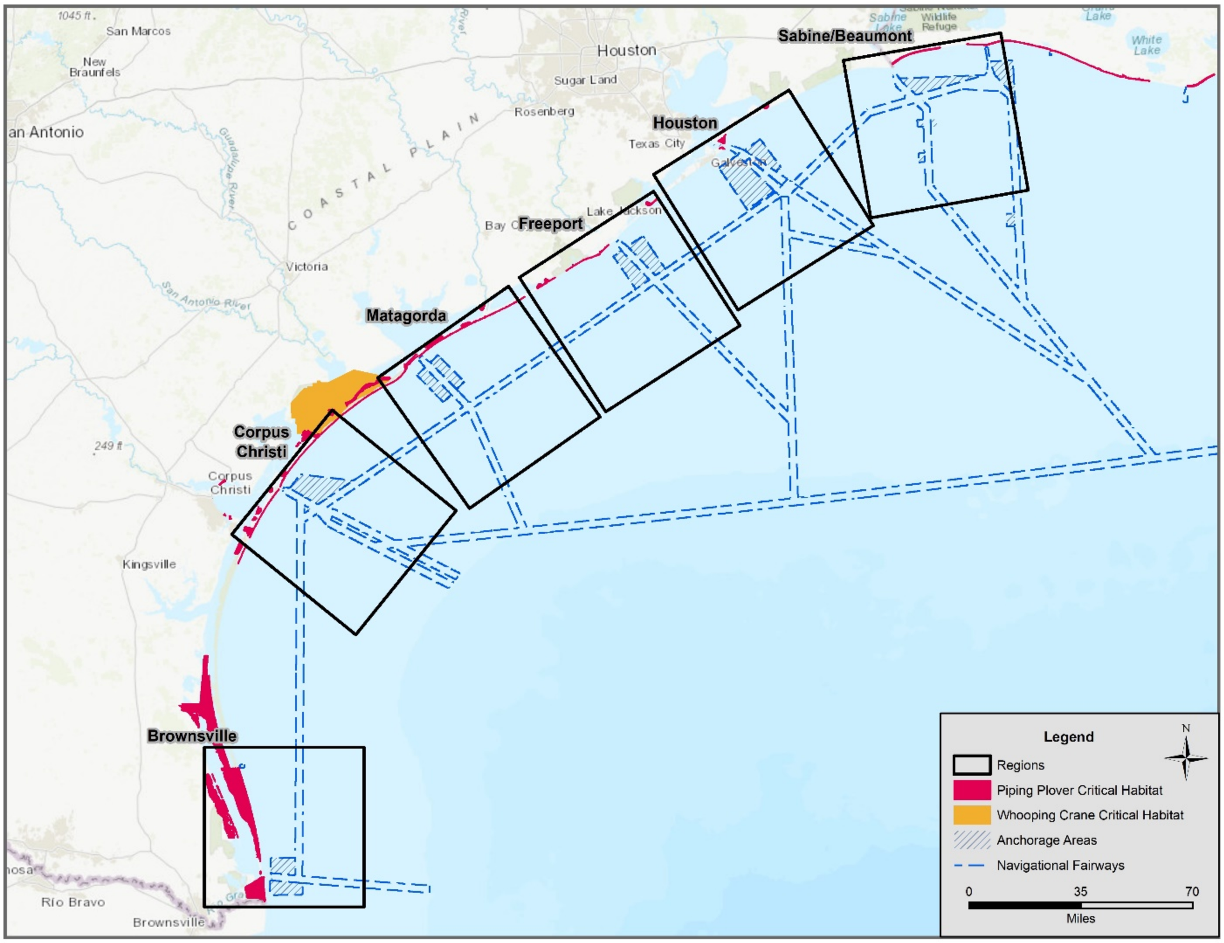
<u>Sensitive Environmental Resources Analysis</u>

The following sections detail the analysis conducted for the previously described sensitive environmental resources screening criteria.

Sensitive Environmental Resources Criteria 1

Potential for impacts to sensitive ecological resources was used for the analysis of Texas Gulf Coast location alternatives to identify the most suitable location. A review of T&E species critical habitats was conducted to determine which of the Texas Gulf Coast location alternative would result in the minimal amount of impacts to T&E species critical habitats (Figure 2-9 and Table 2-14).

Figure 2-9: Threatened and Endangered Species Critical Habitat



Source: USFWS 2019

Table 2-14: Texas Coast Location Alternatives T&E Species Critical Habitats

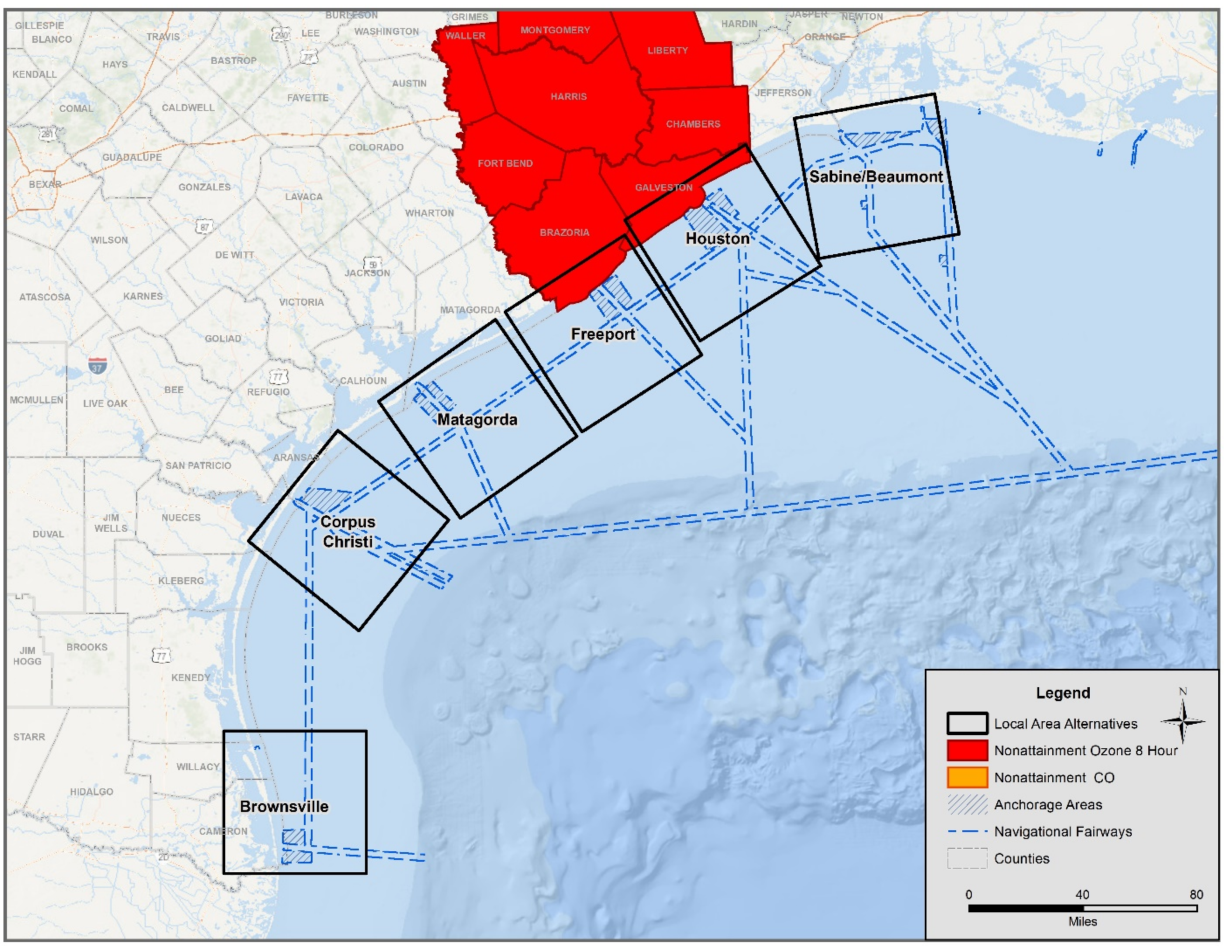
Texas Coast Location	Acreage of T&E Critical Habitat	T&E Critical Habitat Species
Sabine/Beaumont Area	3,950 acres	Piping Plover
Houston Area	2,580 acres	Piping Plover
Freeport Area	4,100 acres	Piping Plover
Matagorda Area	15,340 acres	Piping Plover and Whooping Crane
Corpus Christi Area	19,750 acres	Piping Plover
Brownsville Area	90,970 acres	Piping Plover

Source: USFWS 2019

Sensitive Environmental Resources Criteria 2

Additionally, a review was also conducted to determine the classification status of Texas Gulf Coast location alternatives with regards to NAAQS (Table 2-15). Houston and Freeport are both within nonattainment counties whereas Sabine/Beaumont, Matagorda, Corpus Christi, and Brownsville areas are all in attainment (Figure 2-10).

Figure 2-10: NAAQS Nonattainment Counties



Source: EPA 2019

Table 2-15: Texas Coast Location Alternatives National Ambient Air Quality Standards Status

Texas Coast Location	Counties	2019 NAQQS Status
Sabine/Beaumont Area	Jefferson County	Attainment
	Orange County	Attainment
Houston Area	Chambers County	Nonattainment
	Galveston County	Nonattainment
Freeport Area	Brazoria County	Nonattainment
Matagorda Area	Matagorda County	Attainment
	Calhoun County	Attainment
Corpus Christi Area	San Patricio County	Attainment
	Nueces County	Attainment
	Kleberg County	Attainment
Brownsville Area	Cameron County	Attainment

Source: EPA 2019

<u>Crude Oil Infrastructure Analysis</u>

The following sections detail the analysis conducted for the previously described existing and planned crude oil infrastructure screening criteria.

Crude Oil Infrastructure Criteria 1

Understanding that the efficient export of U.S. crude oil requires connectivity to transport facilities (i.e. pipelines), consideration was given to the presence of existing crude oil pipeline infrastructure. Existing crude oil transport infrastructure allows for greater efficiencies for transporting the crude oil to export facilities. However, consideration should also be given to the destinations of future crude oil pipeline infrastructure being constructed in response to the forecasted increases of U.S. crude oil production. Based on a review of existing crude oil pipeline infrastructure (Table 2-16), the Sabine/Beaumont and Houston areas will have the greatest connectivity to crude oil pipeline infrastructure.

Table 2-16: Number of Existing Major Crude Oil Pipelines by Texas Coast Location

Texas Coast Location	Number of Existing Major Crude Oil Pipelines
Sabine/Beaumont Area	8
Houston Area	7
Freeport Area	1
Matagorda Area	0
Corpus Christi Area	4
Brownsville Area	0

Source: EIA 2019

Crude Oil Infrastructure Criteria 2

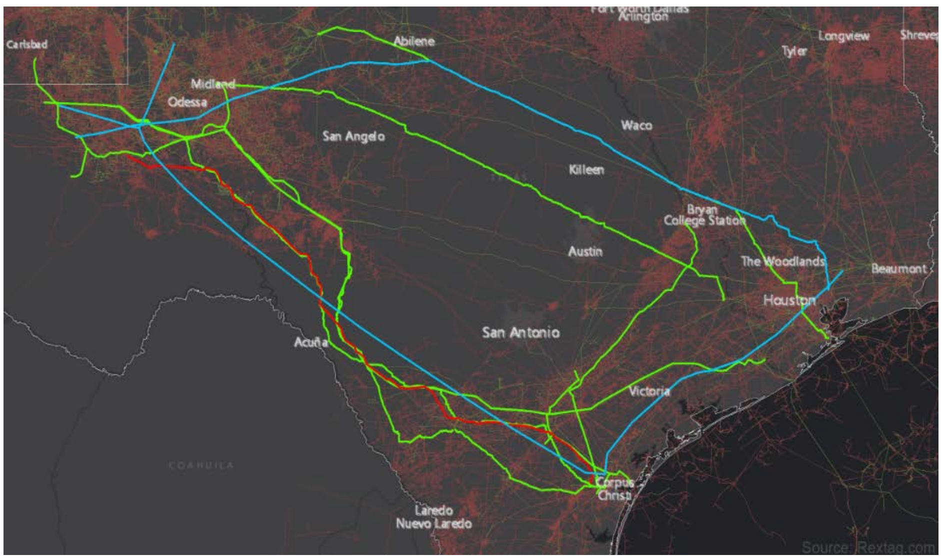
However, consideration should also be given to the destinations of planned crude oil pipeline infrastructure being constructed in response to the forecasted increases of U.S. crude oil production. Based on a review of future crude oil pipeline infrastructure (Table 2-17 and Figure 2-11), the Corpus Christi area will have the greatest future connectivity to crude oil pipeline infrastructure.

Table 2-17: Number of Planned Major Crude Oil Pipelines by Texas Coast Location

Texas Coast Location	Number of Future Major Crude Oil Pipelines
Sabine/Beaumont Area	2
Houston Area	5
Freeport Area	1
Matagorda Area	0
Corpus Christi Area	7
Brownsville Area	0

Source: EIA 2019

Figure 2-11: Planned Major Crude Oil Pipelines



Source: Rextag 2019

Crude Oil Infrastructure Criteria 3

The Applicant, Bluewater Texas Terminal LLC, is an affiliate of Phillips 66 Company. As such, consideration was given to the location with regards to existing and planned Phillips 66 infrastructure. The ability to site a crude oil export facility near existing and planned multi-use infrastructure owned and operated by Phillips 66 allows for greater connectivity and operational efficiencies to establish stability within a growing market. The infrastructure analyzed during this screening is either existing or strategically planned multi-use infrastructure intended to serve multiple crude oil outlets within the region. As shown in Table 2-18 and Figure 2-12, Phillips 66 has most of their existing/planned infrastructure within the Corpus Christi Area.

Table 2-18: Number of Phillips 66 Existing/Planned Crude Oil Infrastructure by Texas Coast Location

Texas Coast Location	Number of Phillips 66 Existing/Planned Infrastructure
Sabine/Beaumont Area	2
Houston Area	1
Freeport Area	1
Matagorda Area	0
Corpus Christi Area	6
Brownsville Area	0

Texas Coast Location Alternatives Summary

An analysis of the six Texas Gulf Coast location alternatives was conducted based on the navigation and navigational safety, sensitive environmental resources, and crude oil infrastructure screening criteria previously listed. The results of the state alternatives screening are presented in Table 2-19.

Table 2-19: Local Area Location Alternatives Decision Matrix

Local Area Location Alternatives	Sabine/ Beaumont Area	Houston Area	Freeport Area	Matagorda Area	Corpus Christi Area	Brownsville Area
Navigation Criteria 1: Limited Existing Offshore Platforms	X 92 platforms	X 22 platforms	✓ 0 platforms	✓ 12 platforms	✓ 8 platforms	✓ 2 platforms
Navigation Criteria 3: Distance to 85 ft. Water Depth (<20 miles)	X ~ 68 miles	X ~ 49 miles	✓ ~ 19 miles	X ~ 28 miles	✓ ~ 16 miles	✓ ~ 12 miles
Navigation Criteria 4: Existing Vessel Traffic and Congestion	X High	X High	✓ Low	✓ Low	✓ Low	✓ Low
Environmental Resources Criteria 1: Acreage of Critical Habitat (<5,000 acres)	✓ 3,950 acres	✓ 2,580 acres	✓ 4,100 acres	X 15,340 acres	X 19,750 acres	X 90,970 acres
Environmental Resources Criteria 2: NAAQS Classification	✓ Attainment	X Nonattainment	X Nonattainment	✓ Attainment	✓ Attainment	✓ Attainment
Crude Oil Infrastructure Criteria 1: Existing Major Crude Oil Pipelines (>3 pipelines)	✓ 8	✓ 7	X 1	X 0	✓ 4	X 3
Crude Oil Infrastructure Criteria 2: Future Major Crude Oil Pipelines (>3 pipelines)	X 0	✓ 3	X 1	X 0	✓ 6	X 0
Crude Oil Infrastructure Criteria 3: Phillips 66 Existing/Planned Crude Oil Infrastructure	X 2	X 1	X 1	X 0	✓ 6	X 0
Evaluation Score	3	3	4	3	7	4
Retained for Further Consideration	No	No	No	No	**Yes**	No

Tier II – Local Area Alternatives Analysis Conclusion

Based on the results of the Tier II – Local Area alternative analysis, as presented in Table 2-19, the Corpus Christi area is the most practicable local area alternative to be carried forward. Additionally, as a result of this analysis, it was determined that existing inland port conditions do not consist of the necessary draft depths to allow for the safe, full loading of VLCC vessels. As such, the use of an inland port was not considered a feasible alternative for further evaluation.

2.5 Tier III – Existing Infrastructure vs. New Infrastructure

As determined during the Tier II screening analysis, the Corpus Christi area was determined to be the best suited location for the establishment of a safe and environmentally sustainable crude export solution. Additionally, the results of the Tier II alternatives analysis concluded that the loading of vessels in an inshore port facility was not considered a feasible alternative due to insufficient depths within existing navigation channels. As such, the establishment of a crude oil export solution within an offshore environment was determined the most practicable alternative to fulfill the purpose and need of the Project. Therefore, Tier III of the alternatives analysis investigates the feasibility for utilizing existing offshore infrastructure to minimize impacts to the maximum extent practicable while fulfilling Project objectives and the purpose and need.

Of the existing offshore infrastructure located within the Corpus Christi area, the use of existing underutilized pipelines and or platform structures was analyzed to determine the technical feasibility for the use for the proposed Project. The following criteria were used for analysis of existing offshore pipelines and or platform infrastructure.

Existing Offshore Platform Infrastructure Criteria

- Existing Platform Criteria 1: Existing platform is located within water depths of approximately 85 ft. to allow for the direct and full loading of VLCCs.
- Existing Platform Criteria 2: Existing platform should be sited to not interfere with other existing offshore operations. As such, the existing platform structure should be a minimum of 1 statue mile from any other active or abandoned platforms.
- Existing Platform Criteria 3: Existing platform location should be sited such that the required connecting pipeline infrastructure should not be routed across existing anchorage areas or safety fairways.

Existing Offshore Pipeline Infrastructure Criteria

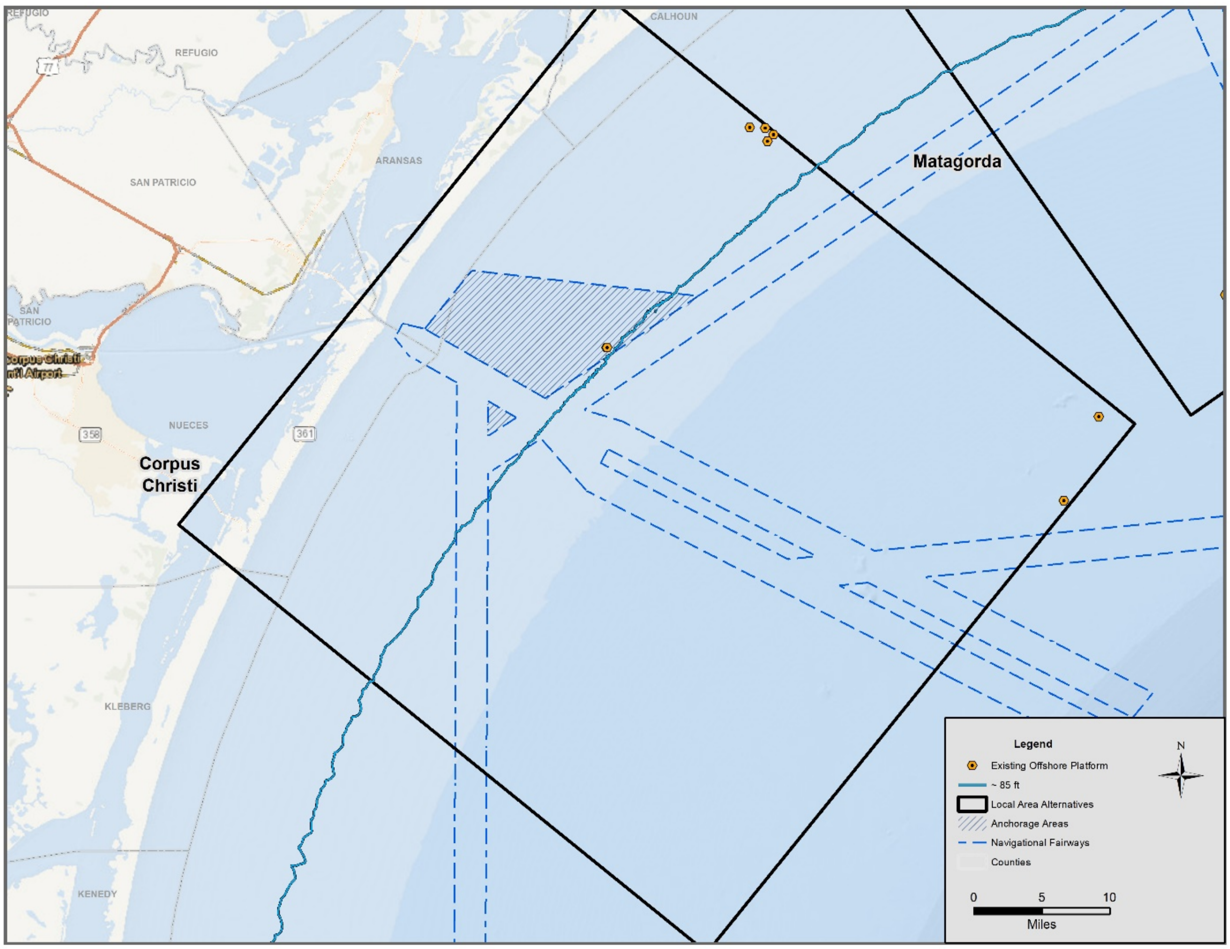
- Existing Pipeline Criteria 1: Existing pipeline infrastructure extends from the shoreline to water depths of approximately 85 ft. to allow for the direct and full loading of VLCCs.
- Existing Pipeline Criteria 2: Existing pipeline infrastructure is capable of supporting loading rates of approximately 80,000 barrels per hour bph for the loading of approximately 16 VLCCs per month.

Failure to identify either existing offshore platform or pipeline infrastructure with the ability to fulfill the above described criteria indicates the need for the installation of new infrastructure. The following sections discuss the analysis of existing offshore platform and pipeline infrastructure and their ability to fulfill the siting criteria listed above.

Utilization of Existing Offshore Platforms

An analysis of existing offshore platform infrastructure was conducted within the Corpus Christi area. This analysis included a review of abandoned platform infrastructure. A total of 7 existing offshore platforms were identified within the 50-mile radius area previously described as the Corpus Christi area (Figure 2-12). Of the platforms identified, 2 are located within water depths greater than 85 ft. and are greater than 1 mile away from other offshore platforms. However, the platforms identified would require the installation of pipeline infrastructure across existing safety fairways. Additionally, the distance of the identified platforms to the shoreline is in excess of 50 miles, thereby requiring the installation of long distances of offshore pipeline infrastructure. For the described reasons, the use of existing offshore platform infrastructure was not considered technically feasible for the proposed Project.

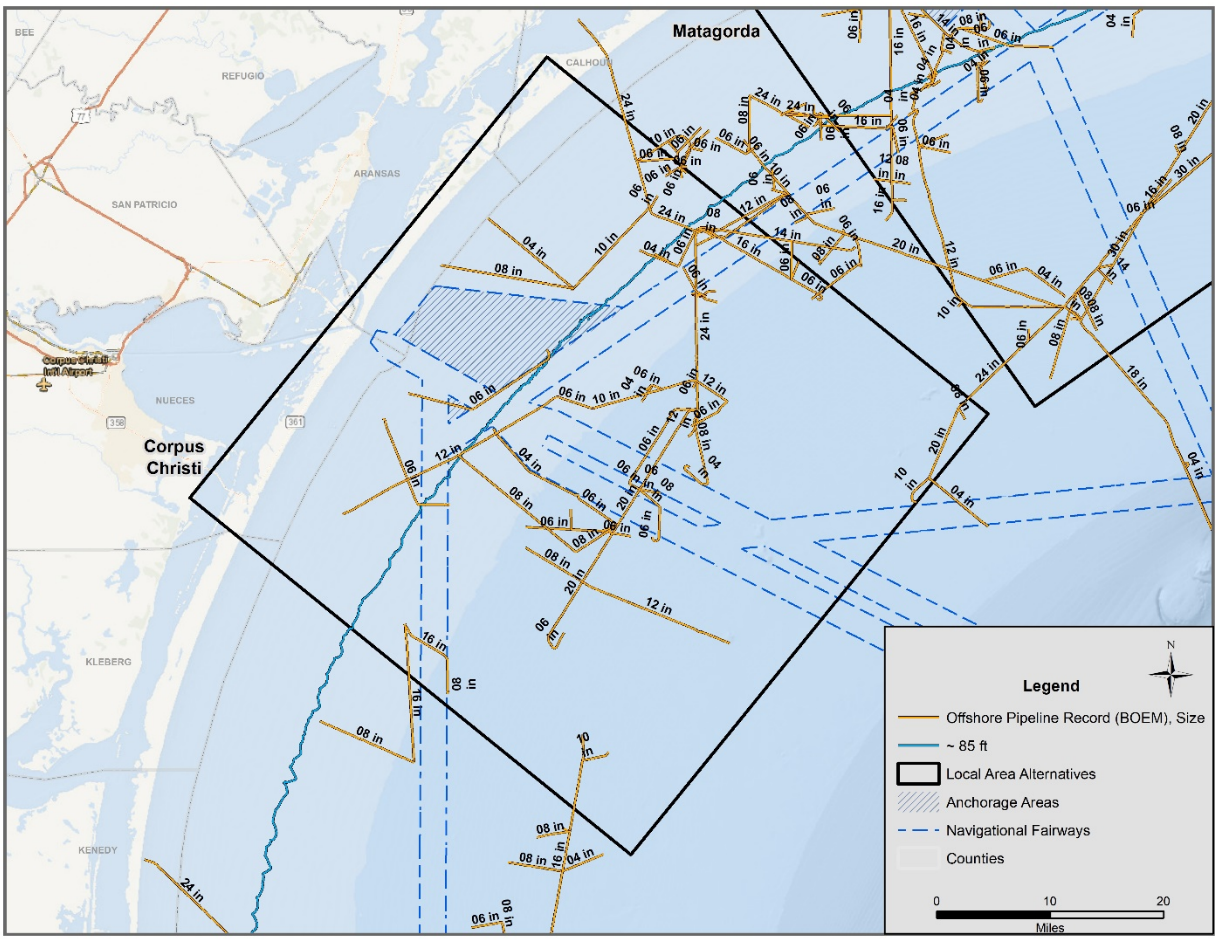
Figure 2-12: Existing Offshore Platform Infrastructure



Utilization of Existing Offshore Pipelines

An analysis of existing offshore pipeline infrastructure was conducted within the Corpus Christi area. This analysis included a review of both abandoned and underutilized offshore pipeline infrastructure. For existing offshore pipelines to be technically feasible for use, the existing pipeline infrastructure would need to extend from a point onshore to offshore depths of a minimum of 85 ft. Additionally, to support the Project objective of the loading rates of 80,000 bph, the existing offshore pipeline infrastructure would need to be that of either one (1) 42-inch-diameter pipeline, or two (2) 30-inch-diameter pipelines. The analysis of offshore pipelines was conducted within the 50-mile radius area previously described as the Corpus Christi Area selected based on the results of the Tier II analysis (Table 2-19). The identified offshore pipelines within the Corpus Christi Area are presented in Figure 2-13. Based on this analysis, the Corpus Christi area contains existing offshore pipelines ranging in size from 6 to 24-inch-diameter. Based on this analysis, there is no existing offshore pipeline infrastructure of sufficient size to support the required loading rate of 80,000 bph. As such, the use of existing offshore pipeline infrastructure was not determined technically feasible for the fulfillment of Project objectives, and therefore, the purpose and need of the Project.

Figure 2-13: Existing Offshore Pipeline Infrastructure



Existing Infrastructure vs. New Infrastructure Alternatives Summary

An analysis to determine the technical feasibility of the utilization of existing offshore infrastructure was conducted based on the screening criteria previously listed. The results of the existing infrastructure vs. new infrastructure alternatives summary is presented in Table 2-20.

Table 2-20: Existing Infrastructure vs. New Infrastructure Alternatives Decision Matrix

Existing Platform Siting Criteria	Utilization of Existing Offshore Platform
Existing Platform Criteria 1: Existing platform is located within water depths of approximately 85 ft. or greater	✓ Yes
Existing Platform Criteria 2: Minimum of 1 mile from other offshore platforms	✓ Yes
Existing Platform Criteria 3: Connecting pipeline infrastructure avoids crossing of anchorage areas or fairways	X No
Utilization of Existing Offshore Platform Considered Technically Feasible?	**No**
Existing Pipeline Siting Criteria	**Utilization of Existing Offshore Platform**
Existing Pipeline Criteria 1: Existing pipeline infrastructure extends to water depths of approximately 85 ft.	✓ Yes
Existing Pipeline Criteria 2: Existing pipeline infrastructure is capable of supporting loading rates of approximately 80,000 bph	X No
Utilization of Existing Offshore Pipelines Considered Technically Feasible?	**No**

Tier III – Existing Infrastructure vs. New Infrastructure Alternatives Analysis Conclusion

Based on the results of the Tier III – Existing Infrastructure vs. New Infrastructure analysis, as presented in Table 2-20, neither the utilization of existing offshore platform nor existing pipeline infrastructure was determined technically feasible to fulfill the required Project objectives or purpose and need of the Project. As such, the installation of new infrastructure was considered the most practicable alternative for further evaluation.

2.6 Tier IV – Siting Analysis of Required Project Components

Based on the results of the Tier II and Tier III screening analysis, BWTT determined that the construction and installation of a DWP via new infrastructure was the most practicable alternative to fulfill the required Project objectives and the overall purpose and need. Additionally, during the Tier II screening analysis, it was determined that Phillips 66 has an existing planned multi-use terminal infrastructure located south of Taft, Texas. The planned multi-use terminal will consist of multiple incoming and outgoing crude oil pipelines to service multiple outlets within the Corpus Christi area. As such, BWTT proposes to connect the proposed Project infrastructure to the planned multi-use terminal to minimize the need for the construction of additional facilities and maximize operational efficiencies.

Tier IV of the alternative analysis consist of a siting analysis for the location of the necessary components associated with a new offshore DWP. The necessary components include a DWP, pipeline infrastructure connecting the planned multi-use terminal to the DWP, and a booster station. As such, Tier IV consists of the screening of location alternatives for required components. Tier IV is organized in the following section:

- Deepwater Port Site Alternatives
- Pipeline Routing Alternatives
- Booster Station Location Alternatives

The location alternatives for the siting of the DWP were analyzed first followed by the associated pipeline infrastructure and booster station. The objective is to determine a combination which best fulfills the Project objectives and the Project purpose and need. As a result of the DWP siting analysis, two potential DWP sites were selected to be carried forward for further analysis.

Following the DWP siting analysis, multiple pipeline routes were analyzed for each of the two DWP sites carried forward for further evaluation. Multiple potential pipeline routes for each DWP site alternative were evaluated based on their ability to fulfill the prescribed siting criteria.

Once a single pipeline route was selected for each DWP site alternative, alternative booster station locations were evaluated along the selected pipeline routes. Multiple booster station locations were evaluated along the selected pipeline routes based on technical feasibility, and their ability to fulfill the prescribed siting criteria.

The screening of potential DWP sites, pipeline routes, and booster station locations make up the Tier IV Siting Analysis. The Tier IV screening analysis is configured to determine the best combination of the component alternatives. As a result of the Tier IV screening analysis, two potential alternatives capable of fulfilling the Project purpose and need will be carried forward for further evaluation to demonstrate compliance with NEPA and determine the least environmentally damaging practicable alternative. The two alternatives retained for further evaluation will be designated as either the proposed action, or a reasonable alternative to the proposed action.

2.6.1 Deepwater Port Site Alternatives

The Applicant evaluated three DWP region alternatives to determine a location that best fulfills the purpose and need of the Project and the Project objectives. Four DWP regions were considered during analysis including:

- DWP Site Alternative 1: A 10 mile long area centered at Latitude 27.915122, Longitude -96.638613
- DWP Site Alternative 2: A 10 mile long area centered at Latitude 27.810388, Longitude -96.760992
- DWP Site Alternative 3: A 10 mile long area centered at Latitude 27.699993, Longitude -96.883888
- DWP Site Alternative 4: A 10 mile long area centered at Latitude 27.565124, Longitude -96.992913

The analysis of potential DWP sites was based upon the necessary siting criteria for the DWP to be capable of directly and fully loading a VLCC including:

- DWP Site Criteria 1: Suitable Water Depth for the DWP. In order to fulfill the purpose and need of the Project, it is required that the DWP site be situated within suitable water depths that allows for the direct and full loading of VLCCs within an offshore environment. As such the DWP site must consist of a minimum of 85 ft. of water to safely navigate incoming and outgoing vessels.
- DWP Site Criteria 2: Proximity to Existing Safety Fairways. The preferred DWP site would be located near an existing fairway thereby allowing VLCCs to utilize them to the maximum extent practicable.
- DWP Site Criteria 3: Proximity to Existing Anchorage Areas. The preferred DWP site would be located near a dedicated anchorage area.
- DWP Site Criteria 4: Required Pipeline Infrastructure Impacts to Safety Fairways: The preferred DWP site would be located such that the required pipeline infrastructure extending to the shore would not require any crossings of existing safety fairways.
- DWP Site Criteria 5: Required Pipeline Infrastructure Impacts to Anchorage Areas: The preferred DWP site would be located such that the required pipeline infrastructure extending to the shore would not require any crossings of existing anchorage areas.
- DWP Site Criteria 6: Minimizes impacts to Existing Artificial Reefs. The preferred DWP site would be one located a minimum of 5 miles from existing artificial reefs.
- DWP Site Criteria 7: Minimizes interference existing or proposed DWP projects. The preferred DWP site would be located outside of any existing DWP application areas or a minimum of 10 miles away from an existing or proposed DWP.
- DWP Site Criteria 8: Proximity to Existing Offshore Marine Infrastructure. The preferred DWP site would be located a minimum of 5 miles away from existing offshore marine infrastructure such as platforms.

Figure 2-14 depicts the four DWP site alternatives evaluated. The following sections discuss each of the four regions and their ability to fulfill the siting criteria listed above.

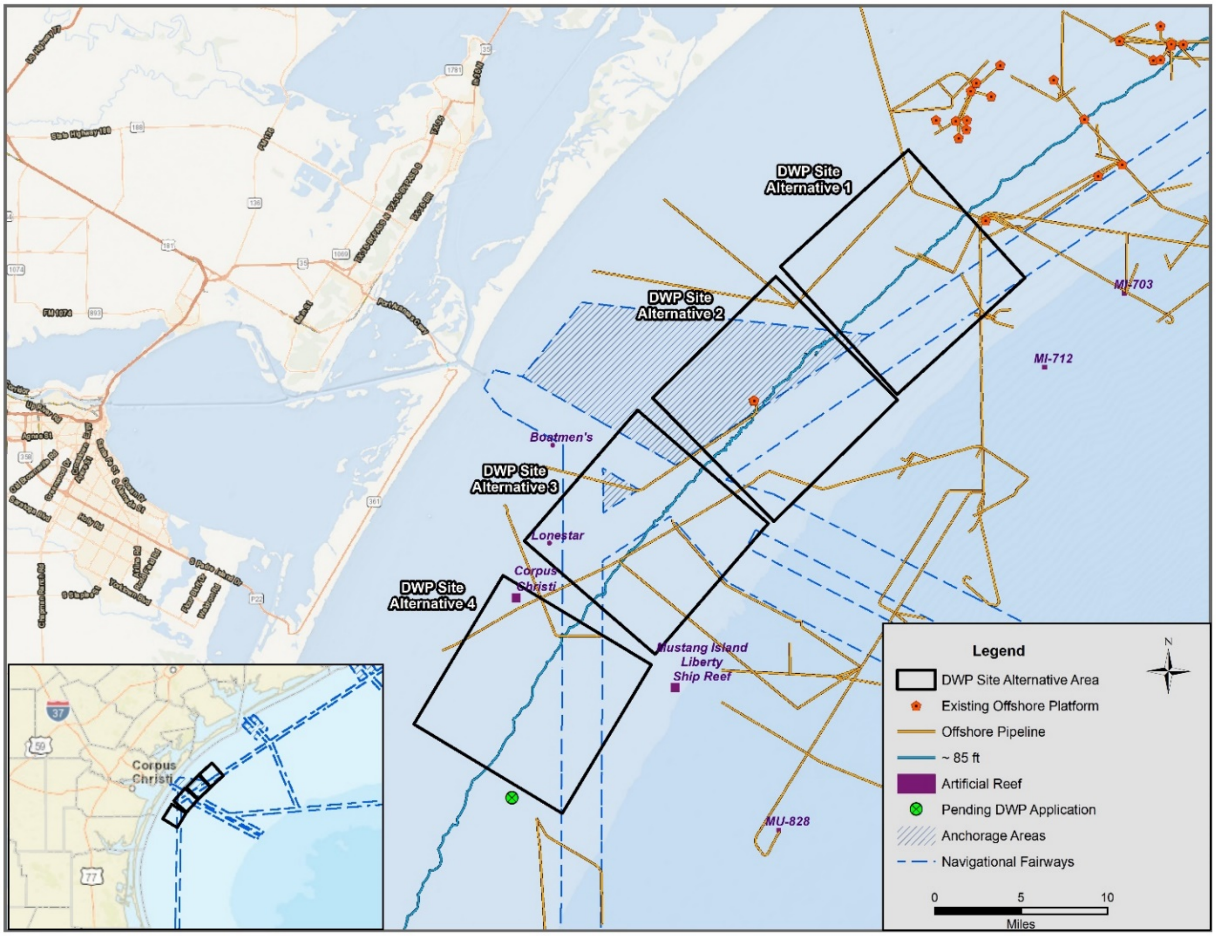
<u>DWP Site Alternative 1 Analysis</u>

DWP Site Alternative 1 is situated within at least 85 ft of water and contains a potential DWP location that is directly northwest of the navigation fairway. This alternative DWP site is also adjacent to a federal anchorage area. A DWP located within the Site Alternative 1 area could be located in minimum 85 ft water depth without the need to cross the fairway or anchorage area. This alternative is located 9.5 miles from the nearest artificial reef and approximately 35 miles from the closest proposed DWP. The nearest existing offshore platform is located over 11.5 miles to the southwest. Overall DWP Site Alternative 1 meets all eight of the analysis criteria.

<u>DWP Site Alternative 2 Analysis</u>

DWP Site Alternative 2 is situated within at least 85 ft of water and contains a potential DWP location that is directly east/southeast of the navigation fairway. This alternative DWP site is approximately 3.6 miles from the nearest federal anchorage area, which is located on the other side of the fairway from the potential DWP location. A DWP located within the Site Alternative 2 area would require pipeline infrastructure to cross two fairways and the federal anchorage area in order to be located in minimum 85 ft water depth. This alternative is located 14.2 miles from the nearest artificial reef and approximately 24 miles from the closest proposed DWP. The nearest existing offshore platform is located 3.6 miles to the northwest. Overall DWP Site Alternative 2 meets five of the eight analysis criteria.

Figure 2-14: Evaluated Deepwater Port Locations



Sources: BOEM 2019; RRC 2019; TPWD 2019

<u>DWP Site Alternative 3 Analysis</u>

DWP Site Alternative 3 is situated within at least 85 ft of water and contains a potential DWP location that is directly east/southeast of the navigation fairway. This alternative DWP site is approximately 3.4 miles from the nearest federal anchorage area, which is located on the other side of the fairway from the potential DWP location. A DWP located within the Site Alternative 3 area would require pipeline infrastructure to cross a fairway in order to be located in minimum 85 ft water depth. This alternative is located 5.5 miles from the nearest artificial reef and approximately 15.8 miles from the closest proposed DWP. The nearest existing offshore platform is located 11.25 miles to the northeast. Overall DWP Site Alternative 3 meets six of the eight analysis criteria.

<u>DWP Site Alternative 4 Analysis</u>

DWP Site Alternative 4 is situated within at least 85 ft of water and contains a potential DWP location that is directly west of the navigation fairway. This alternative DWP site is approximately 3.4 miles from the nearest federal anchorage area, which is located 18.2 miles north of the potential DWP location. A DWP located within the Site Alternative 3 area would not require pipeline infrastructure to cross a fairway or anchorage area in order to be located in minimum 85 ft water depth. This alternative is located 6.3 miles from the nearest artificial reef and approximately 5 miles from the closest proposed DWP. The nearest existing offshore platform is located 27 miles to the northeast. Overall DWP Site Alternative 3 meets five of the eight analysis criteria.

Deepwater Ports Site Alternatives Summary

The analysis of the DWP site alternatives was conducted based on their ability to fulfill the Project purpose and need, the necessary siting criteria for the direct and full loading of a VLCC, and minimize environmental impacts to the maximum extent practicable. The results of the analysis conducted for the DWP site alternatives are presented in Table 2-21.

Table 2-21 Deepwater Port Site Alternatives Decision Matrix

Deepwater Port Siting Criteria	DWP Site Alternative 1	DWP Site Alternative 2	DWP Site Alternative 3	DWP Site Alternative 4
DWP Site Criteria 1: Suitable Water Depth for the DWP (85 ft.).	✓ Yes	✓ Yes	✓ Yes	✓ Yes
DWP Site Criteria 2: Proximity to Existing Safety Fairways.	✓ Yes	✓ Yes	✓ Yes	✓ Yes
DWP Site Criteria 3: Proximity to Existing Anchorage Areas.	✓ Yes	✓ Yes	✓ Yes	X No
DWP Site Criteria 4: Required Pipeline Infrastructure Impacts to Safety Fairways	✓ No	X Yes	X Yes	✓ No
DWP Site Criteria 5: Required Pipeline Infrastructure Impacts to Anchorage Areas	✓ No	X Yes	✓ No	✓ No
DWP Site Criteria 6: Minimizes impacts to Existing Artificial Reefs.	✓ Yes	✓ Yes	X No	X No
DWP Site Criteria 7: Minimizes interference existing or proposed DWP projects.	✓ Yes	✓ Yes	✓ Yes	X No
DWP Site Criteria 8: Proximity to Existing Offshore Marine Infrastructure.	✓ No	X Yes	✓ No	✓ No
Evaluation Score	**8**	5	**6**	5
Selected as Preferred Area for DWP	**Yes**	No	**Yes**	No

Based on the DWP Siting analysis above, the two alternative sites that had the highest analysis score were DWP Site Alternative 1 and DWP Site Alternative 3. Both DWP Site Alternatives 1 and 3 are carried forward to the next tier of analysis in order to provide a more comprehensive scope of multiple alternative DWP locations and thorough screening process for the selection of a pipeline route.

Tier IV – Deepwater Port Siting Analysis Conclusion

Based on the results of the Tier IV – Deepwater Port Siting Analysis, as presented in Table 2-21, DWP Site Alternative 1 and 3 were determined the most practicable alternatives to be carried forward.

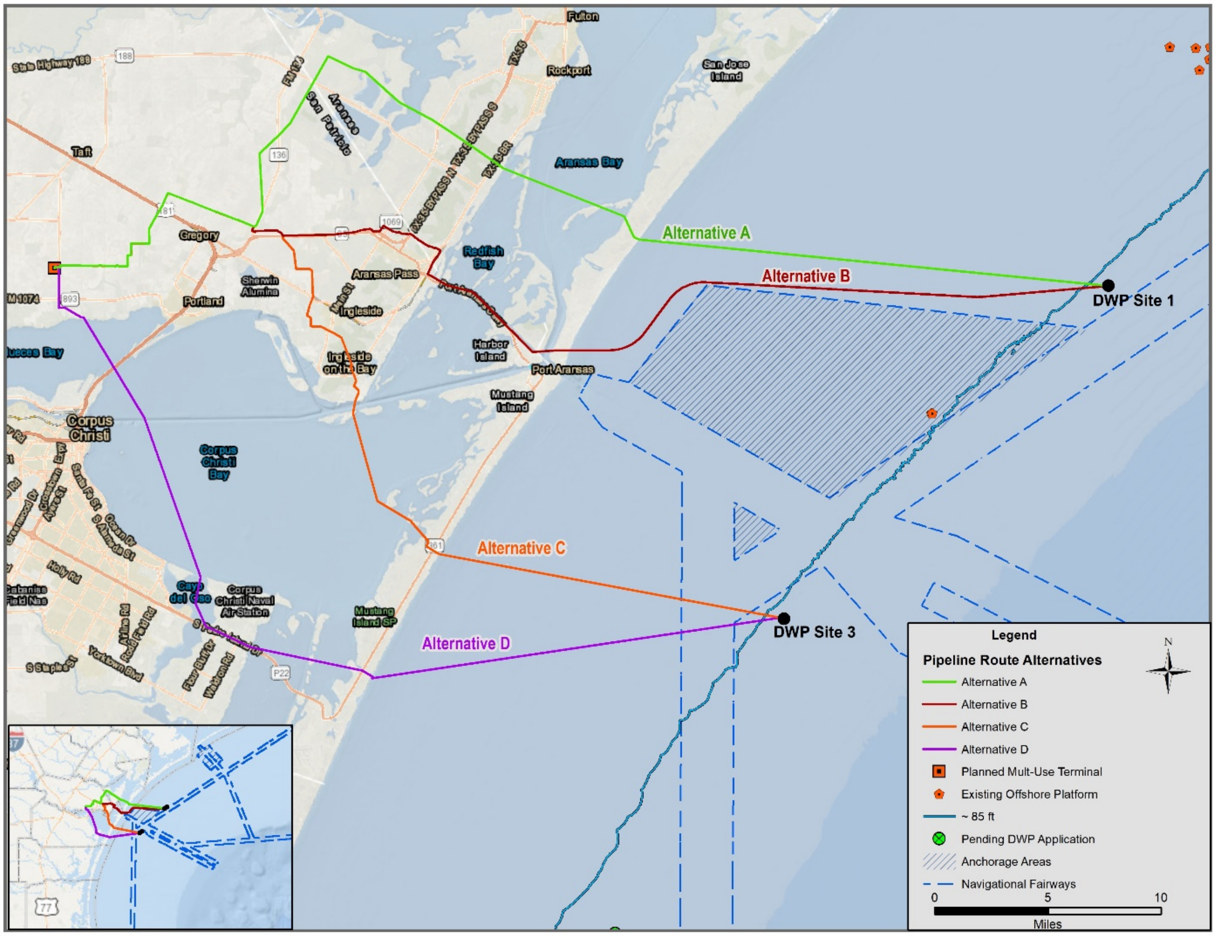
2.6.2 Pipeline Routing Alternatives

Based on the results of the DWP siting analysis, DWP Site Alternatives 1 and 3 were determined the most practicable alternatives. The DWP not only includes the location of the port infrastructure but also the associated product transfer infrastructure, or pipeline. The pipeline route for the DWP is weighted equally in the screening of alternatives as the terminus DWP location. As such, the Applicant evaluated multiple potential pipeline routes to each of the selected DWP site alternatives. As discussed during the Tier II screening analysis, Phillips 66 has a planned multi-use terminal infrastructure positioned south of the City of Taft, Texas. The planned multi-use terminal will consist of multiple incoming and outgoing crude oil pipelines that will service multiple outlets within the Corpus Christi area. To minimize the need for the construction of additional facilities, the pipeline routes analyzed as part of this screening analysis originate at the fence line of the planned multi-use terminal. The pipeline routes terminate at either DWP Site Alternative 1 or Alternative 3.

The pipeline routes analyzed generally consisted of three sections including onshore, inshore, and offshore. The onshore segment of the pipelines is described as that extending from the planned multi-use terminal to the mean high tide (MHT) line of an inshore waterbody (i.e. estuarine bay complex). The inshore pipeline segment is described as that extending from the inshore waterbody MHT line to the MHT line located at the Gulf of Mexico. The offshore pipeline segment is described as that extending from the Gulf of Mexico MHT line to the location of the associated DWP site alternative. Pipeline routes were considered as a continuous line between the planned multi-use terminal and the selected DWP Site. The DWP terminus point for each DWP Site Alternative was located at the optimal position within each of the previously identified DWP Site Alternative areas (1 and 3). The optimal location for the DWP was selected based on the criteria listed in Section 2.6.1: to avoid interference with navigational fairways and anchorages, and to achieve a minimum water depth of 85 ft., while minimizing overall distance from the planned multi-use terminal location. A total of four pipeline route alternatives (two routes per DWP site alternative) were considered during the analysis including (Figure 2-15):

- Alternative A (DWP Site 1 with Pipeline Route A): Approximate 57.7 miles of pipeline extending to DWP Site 1. The pipeline consists of approximately 30.5 miles of onshore, 6.8 miles of inshore, and 20.4 miles of offshore pipeline.
- Alternative B (DWP Site 1 with Pipeline Route B): Approximate 56.48 miles of pipeline extending to DWP Site 1. The pipeline consists of approximately 22.2 miles of onshore, 7.2 miles of inshore, and 27.1 miles of offshore pipeline.
- Alternative C (DWP Site 3 with Pipeline Route C): Approximate 48.58 miles of pipeline extending to DWP Site 3. The pipeline consists of approximately 23.1 miles of onshore, 8.4 miles of inshore, and 17.07 miles of offshore pipeline.
- Alternative D (DWP Site 3 with Pipeline Route D): Approximate 44.2 miles of pipeline extending to DWP Site 3. The pipeline consists of approximately 3.4 miles of onshore, 22.6 miles of inshore, and 18.2 miles of offshore pipeline.

Figure 2-15: Pipeline Route Alternatives



<u>Development of Alternative Pipeline Routes and Deepwater Port Location Alternatives</u>

Alternatives A, B, C, and D consist of different combinations of DWP locations and their associated pipeline routes. Alternatives A, B, C, and D were developed to maximize the utilization of existing pipeline corridors and disturbed areas to the maximum extent practicable. The analysis of pipeline routes was based upon the below necessary siting criteria including:

- Pipeline Route Criteria 1: Minimizes overall pipeline length. A preferred pipeline route would be one that minimizes the required overall distance of pipeline to be installed.
- Pipeline Route Criteria 2: Minimizes inshore waterbody crossings via trench and bury techniques. A preferred pipeline route would be one that minimizes the required crossings of inshore waterbodies via trench and bury techniques due to technical constructability limitations.
- Pipeline Route Criteria 3: Maximizes the ability to use horizontal directional drilling (HDD) techniques to minimize environmental impacts. A preferred pipeline route would be one that maximizes the use of HDD pipeline installation methods, thereby minimizing environmental impacts and soil disturbances where practicable.
- Pipeline Route Criteria 4: Minimizes crossing distances of existing offshore safety fairways. A preferred pipeline route would be one that minimizes the crossing distances of existing offshore safety fairways to

minimize interference with existing vessel traffic and additional environmental impacts to the seabed for the compliance with regulations for installing a pipeline across a safety fairway.

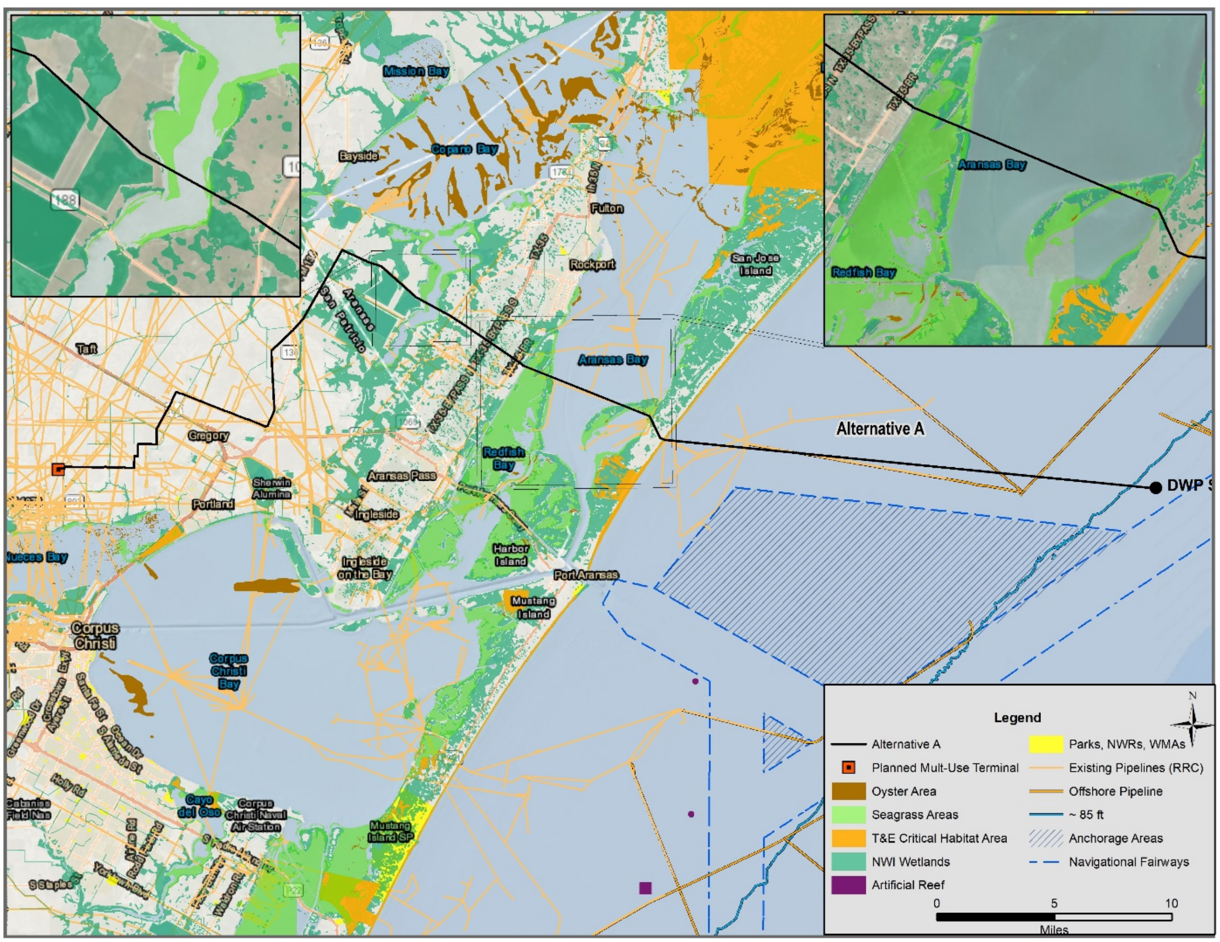
- Pipeline Route Criteria 5: Avoids crossings of existing anchorage areas. A preferred pipeline route would be one that minimizes the crossings of existing anchorage areas to minimize interference with existing vessel traffic and additional environmental impacts to the seabed for the compliance with regulations for installing a pipeline across an anchorage area.
- Pipeline Route Criteria 6: Location has similar land use types. A preferred pipeline route would be one that utilizes existing pipeline corridors to the maximum extent practicable.
- Pipeline Route Criteria 7: Minimizes impacts to T&E species critical habitat. A preferred pipeline route would be one that minimizes impacts to T&E species critical habitat.
- Pipeline Route Criteria 8: Minimizes impacts to artificial reefs and sand sources. A preferred pipeline route would be one that is located away from artificial reefs and sand sources used for beach nourishment.
- Pipeline Route Criteria 9: Minimizes potential impacts to WOUS including aquatic resources (i.e. seagrass and oysters).
- Pipeline Route Criteria 10: Minimizes required number of crossings of existing offshore pipelines.
- Pipeline Route Criteria 11: Minimizes impacts to properties of known federal interest. A preferred pipeline route would be one that minimizes impacts to properties of known federal interest (i.e. existing dredged material disposal areas)

The following section discuss each of the three alternatives and their ability to fulfill the siting criteria listed above.

<u>Alternative A (DWP Site 1 with Pipeline Route A)</u>

Alternative A consists of approximately 57.7 miles of pipeline length that terminates at DWP Site 1. Onshore pipelines begin at the planned multi-use terminal facility and head in a generally northeast direction before turning east/south east towards Aransas Bay. The onshore pipeline sections traverse through portions of land used for agriculture, residential or ranch land, wetland areas, Copano Bay, and residential areas of City By The Sea and Estes TX. Inshore portions of Alternative A pipeline cross through Redfish Bay, which is a federally protected research area, Aransas Bay and San Jose Island. Although some of aquatic inshore areas can be constructed using horizontal drilling to avoid some sensitive area, large sections of the inshore pipeline will have to be installed using trench and bury methods due to distance limitation of horizontal drilling. This pipeline route does not cross any fairways or anchorage areas. Alternative A pipeline route was designed utilizing existing pipeline corridors where practicable however does contain large sections that traverse natural and forested areas rather than mostly agriculture and industrial areas which would be ideal to maintain land use. Alternative A does cross through Piping Plover critical habitat area on the shore of San Jose Island. Alternative A is not located near any artificial reefs. Alternative A pipeline crosses 9 existing offshore pipelines. A map depicting the criteria that were evaluated for Alternative A is shown in Figure 2-16.

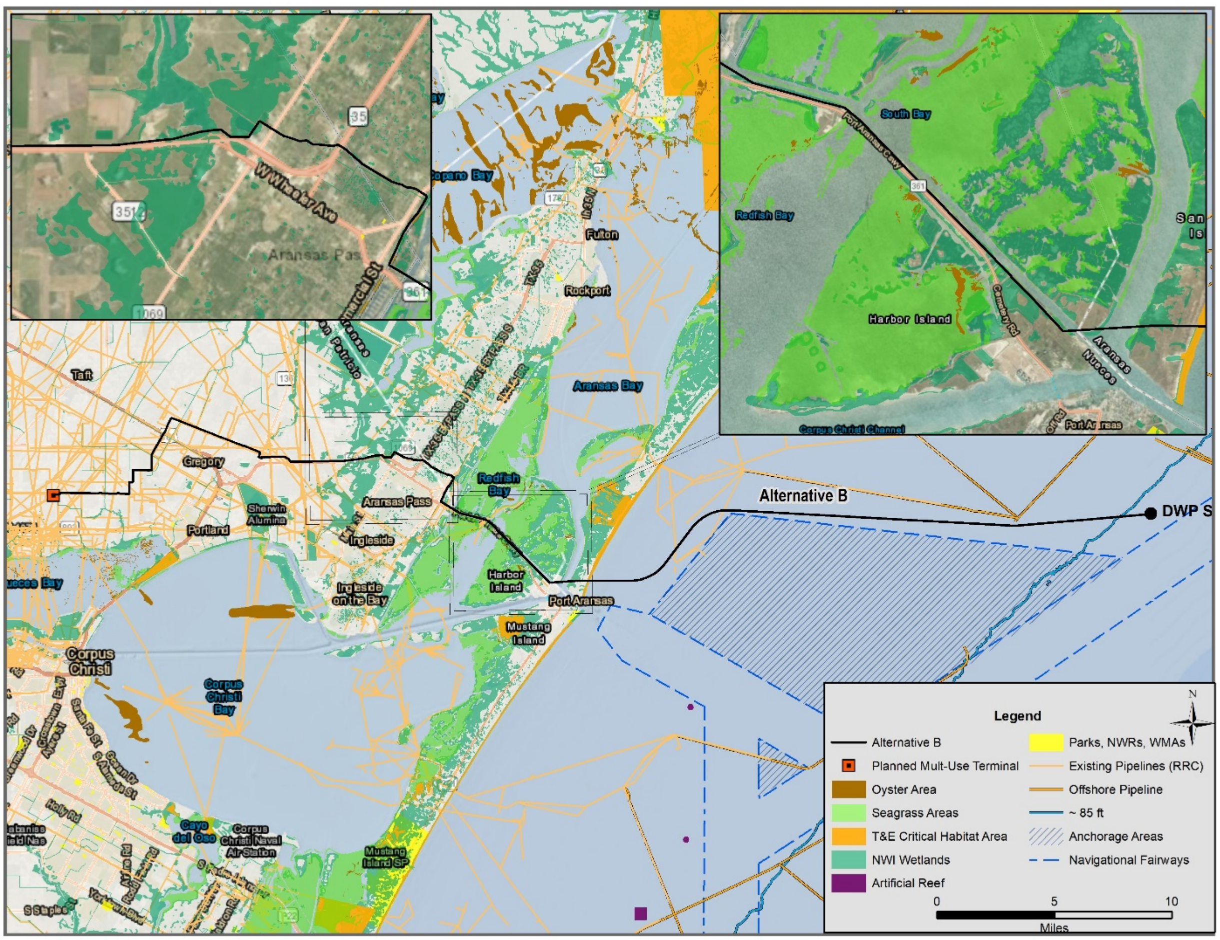
Figure 2-16: Alternative A (DWP Site 1 with Pipeline Route A)



Alternative B (DWP Site 1 with Pipeline Route B)

Alternative B consists of approximately 56.5 miles of pipeline length that terminates at DWP Site 1. Onshore pipelines begin at the planned multi-use terminal facility and head in a generally east direction before turning south east towards Port Aransas. The onshore pipeline sections traverse through portions of land used primarily for agriculture or large ranch land and some commercial areas of Aransas Pass, TX. Inshore portions of Alternative B pipeline cross channels as it runs parallel with State Highway 361. All of the channel crossing and aquatic inshore areas can be constructed using horizontal drilling to avoid interference with channels and any sensitive estuarine areas. This pipeline route does not cross any fairways or anchorage areas. Alternative B pipeline route was designed utilizing existing pipeline corridors where practicable and traverses mostly agriculture, commercial and industrial areas which is ideal to maintain land use. Alternative B does cross through Piping Plover critical habitat area on the shore of San Jose Island. Alternative B is not located near any artificial reefs. Alternative B pipeline crosses 2 existing offshore pipelines. A map depicting the criteria that were evaluated for Alternative B is shown in Figure 2-17.

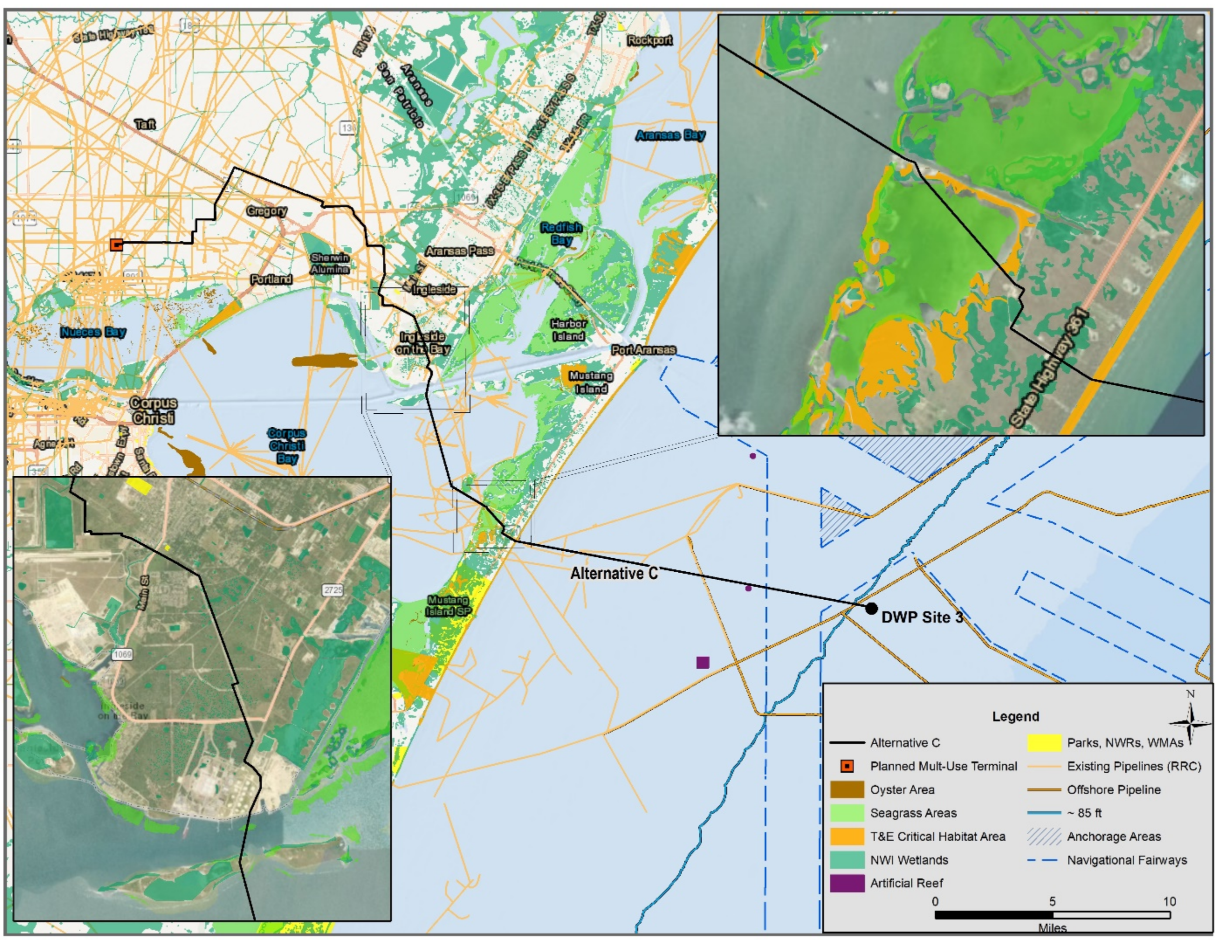
Figure 2-17: Alternative B (DWP Site 1 with Pipeline Route B)



Alternative C (DWP Site 3 with Pipeline Route C)

Alternative C consists of approximately 48.6 miles of pipeline length that terminates at DWP Site 3. Onshore pipelines begin at the planned multi-use terminal facility and head in a easterly direction before turning southeast across Corpus Christi Bay towards Mustang Island. The onshore pipeline sections traverse through portions of land used primarily for agriculture or industrial area. Inshore portions of Alternative C pipeline cross ship channels and a narrow portion of Corpus Christi Bay, following multiple other pipeline routes. All of the channel crossings can be constructed using horizontal drilling to avoid interference with channels, however the majority of the inshore pipeline length would be installed with trenching. HDD could also be used to avoid significant areas of seagrass and wetlands. This pipeline route crosses a main navigational fairway before reaching DWP Site 3. Alternative C pipeline route was designed utilizing existing pipeline corridors where practicable and crosses agriculture, estuarine bay, and natural land adjacent to Corpus Christi Bay. Alternative C does cross through significant areas of Piping Plover critical habitat area on the bay side and Gulf of Mexico shore of Mustang Island. Alternative C is located near Lonestar Artificial Reef. Alternative C pipeline crosses 6 existing offshore pipelines. A map depicting the criteria that were evaluated for Alternative C is shown in Figure 2-18.

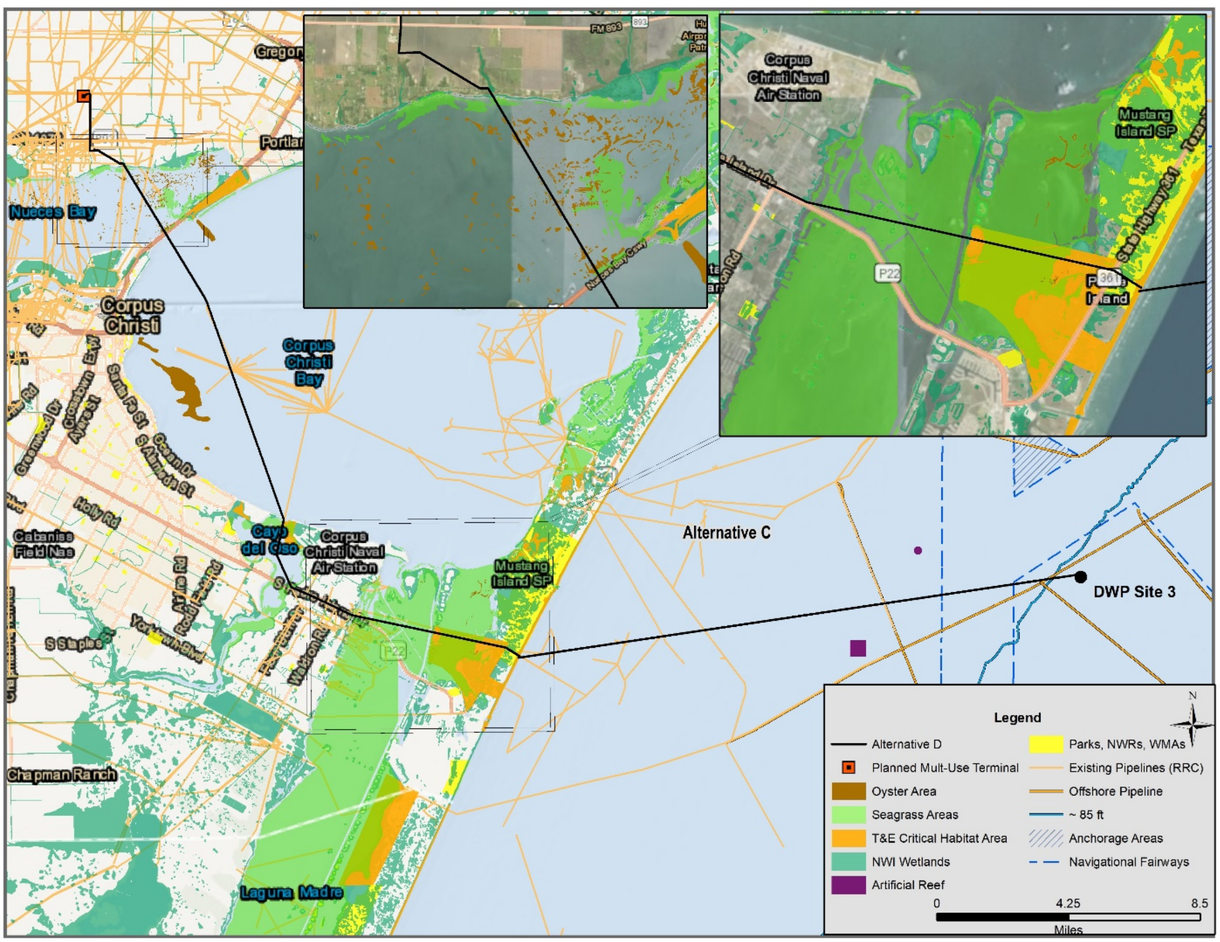
Figure 2-18: Alternative C (DWP Site 2 with Pipeline Route C)



Alternative D (DWP Site 3 with Pipeline Route D)

Alternative D consists of approximately 44.2 miles of pipeline length that terminates at DWP Site 3. Onshore pipelines begin at the planned multi-use terminal facility and head south before turning southeast across Corpus Christi Bay towards Mustang Island. The onshore pipeline sections traverse through portions of land used primarily for agriculture or industrial area. Inshore portions of Alternative D pipeline cross ship channels and the entire length of Corpus Christi Bay, following a previously existing pipeline path. All of the channel crossings can be constructed using horizontal drilling to avoid interference with channels, however the majority of the inshore pipeline length would be installed with trenching near oyster or seagrass areas. HDD could also be used to avoid significant areas of seagrass and wetlands near the bays edge, however drilling would have to occur in bay waters. This pipeline route crosses a main navigational fairway before reaching DWP Site 3. Alternative D pipeline route was designed utilizing existing pipeline corridors where practicable and crosses agriculture, estuarine bay, and natural land adjacent to Corpus Christi Bay and portions of undeveloped land adjacent to Mustang Island State Park. Alternative D does cross through significant areas of Piping Plover critical habitat area on the bay side and Gulf of Mexico shore of Mustang Island. Alternative D is located near Corpus Christi Artificial Reef. Alternative D pipeline crosses 7 existing offshore pipelines. A map depicting the criteria that were evaluated for Alternative D is shown in Figure 2-19.

Figure 2-19: Alternative D (DWP Site 2 with Pipeline Route D)



Pipeline Routing Alternatives Analysis Summary

An analysis of the pipeline route and DWP location alternatives was conducted based on their ability to fulfill the above described criteria. The above sections provide an overview of the pipeline route and DWP location alternative considered as part of this analysis. The results of the analysis conducted for pipeline routing and DWP location alternatives are presented in Table 2-22.

Table 2-22: Alternative Pipeline Routes and Deepwater Port Location Alternatives Decision Matrix

Siting Criteria	Alternative A	Alternative B	Alternative C	Alternative D
	DWP Location Alternative 1		DWP Location Alternative 3	
	Pipeline Route Alternative A	Pipeline Route Alternative B	Pipeline Route Alternative C	Pipeline Route Alternative D
Pipeline Route Criteria 1: Minimize overall pipeline length.	X 57.7 miles	✓ 56.5 miles	✓ 48.6 miles	X 44.2 miles
Pipeline Route Criteria 2: Minimize inshore waterbody crossing via trench and bury techniques.	X No	✓ Yes	X No	X No
Pipeline Route Criteria 3: Maximize use of HDD techniques to avoid environmental impacts.	X No	✓ Yes	X No	X No
Pipeline Route Criteria 4: Minimize crossing of existing safety fairways.	✓ Yes	✓ Yes	X No	X No
Pipeline Route Criteria 5: Minimize crossings of existing anchorage areas.	✓ Yes	✓ Yes	✓ Yes	✓ Yes
Pipeline Route Criteria 6: Location has similar land use types.	X No	✓ Yes	X No	X No
Pipeline Route Criteria 7: Minimizes impacts to T&E species critical habitat.	X No	✓ Yes	✓ Yes	X No
Pipeline Route Criteria 8: Minimizes impacts to artificial reefs and sand sources.	✓ Yes	✓ Yes	X No	X No
Pipeline Route Criteria 9: Minimizes potential impacts to WOUS including aquatic resources	X No	✓ Yes	✓ Yes	X No
Pipeline Route Criteria 10: Minimizes required number of crossings of existing offshore pipelines	X No	✓ Yes	X No	X No
Pipeline Routing Criteria 11: Minimizes impacts to areas and/or properties of Federal interest	X No	✓ Yes	✓ Yes	X No
Evaluation Score	3	**11**	**5**	1
Selected as Preferred Alternative	No	**Yes**	**Yes**	No

Tier IV – Pipeline Routing Alternatives Analysis Conclusion

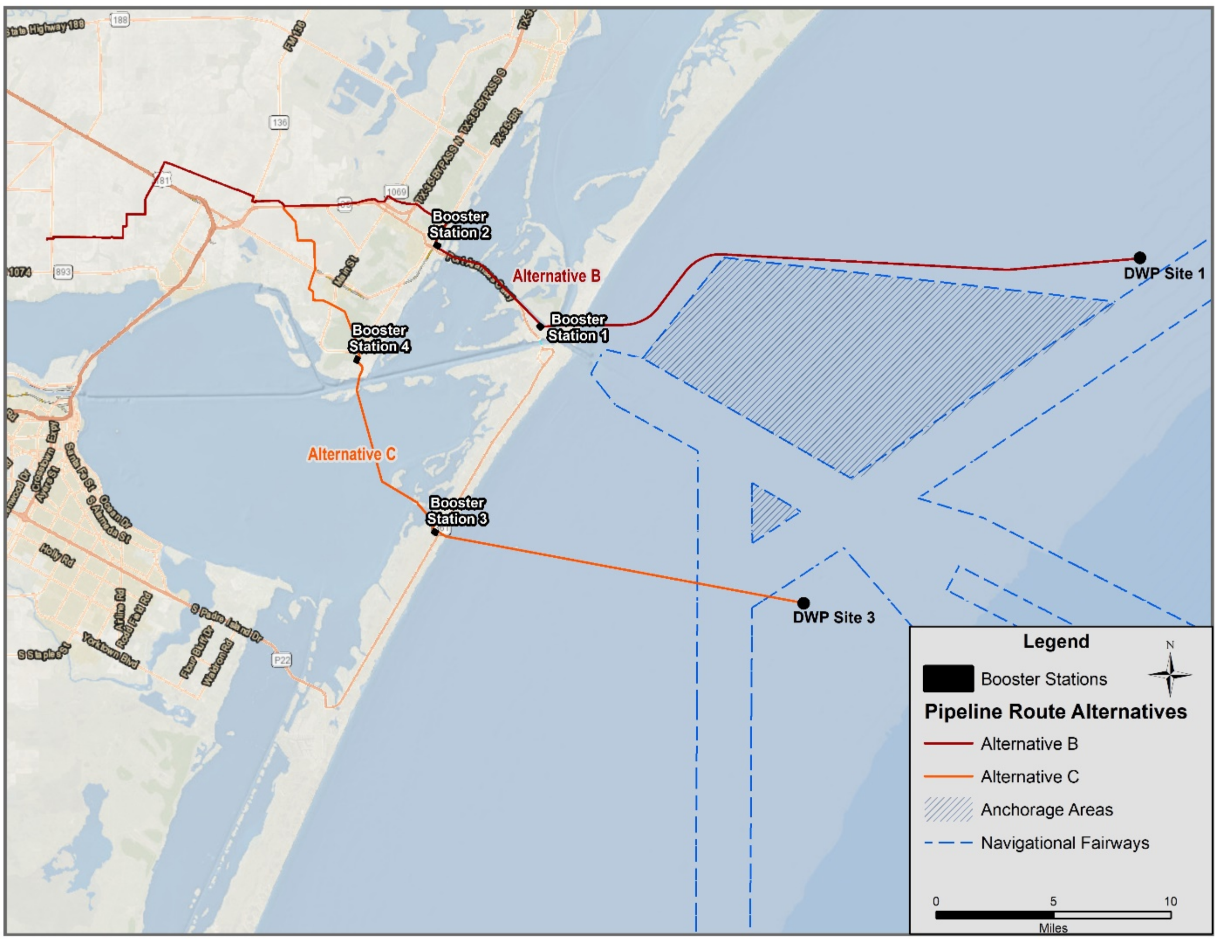
Based on the results of the Tier IV – Pipeline Routing Alternatives Analysis, as presented in Table 2-22, Alternative B (DWP Site 1 and Pipeline Route Alternative B) and Alternative C (DWP Site 3 and Pipeline Route Alternative C) were determined the most practicable alternatives to be carried forward.

2.6.3 Booster Station Location Alternatives

Based on the results of the pipeline routing alternatives analysis, two alternatives including Alternative B (DWP Site 1 and Pipeline Route Alternative B) and Alternative C (DWP Site 3 and Pipeline Route Alternative C) were determined the most practicable alternatives. As such, multiple booster station locations were evaluated along the selected pipeline routes. The booster station would house the necessary pumping infrastructure to support the transport of crude oil to the DWP site. A total of four booster station location alternatives (two routes per DWP site and pipeline route alternatives) were considered during the analysis including (Figure 2-20):

- Booster Station Alternative 1: DWP Site 1/Pipeline Route A with Booster Station Location Alternative 1
- Booster Station Alternative 2: DWP Site 1/Pipeline Route A with Booster Station Location Alternative 2
- Booster Station Alternative 3: DWP Site 3/Pipeline Route C with Booster Station Location Alternative 3
- Booster Station Alternative 4: DWP Site 3/Pipeline Route C with Booster Station Location Alternative 4

Figure 2-20: Booster Station Alternatives



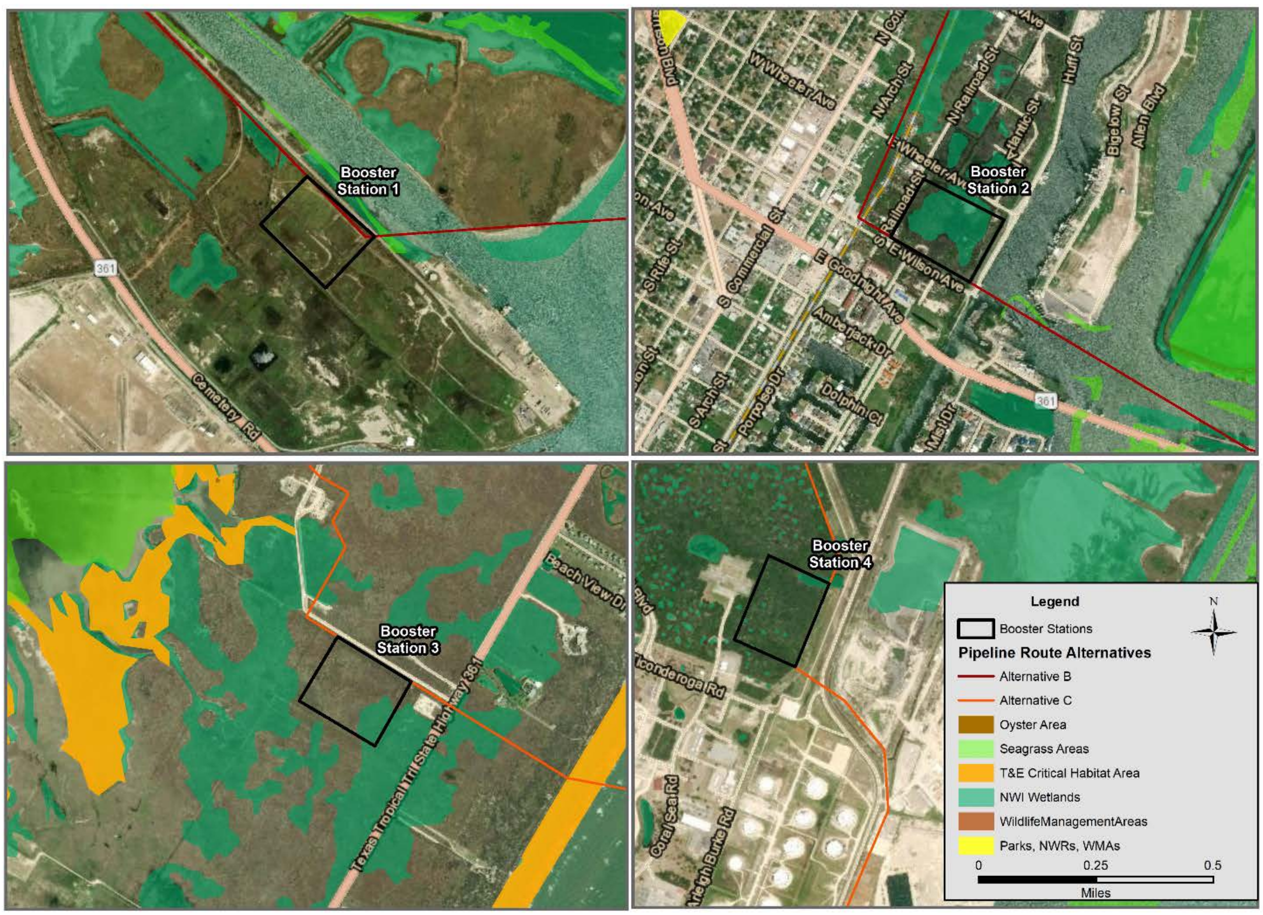
Development of Booster Station Alternatives

Based on a review of the infrastructure necessary to support the transport of crude oil to the DWP, an approximate 19-acre area is required to house the necessary components. Booster Station Alternatives 1, 2, 3, and 4 were evaluated based on their ability to fulfill the below necessary siting criteria including (Figure 2-21):

- Booster Station Criteria 1: Situated within an area of similar or historically similar land use
- Booster Station Criteria 2: Minimizes impacts to WOUS, including wetlands
- Booster Station Criteria 3: Minimizes required road infrastructure improvements
- Booster Station Criteria 4: Minimizes the pipeline distance to the DWP Site Alternative
- Booster Station Criteria 5: Minimizes required site build-up to withstand potential storm surge

An evaluation of the booster station locations was conducted to determine which site along the pipeline route best fulfilled the screening criteria listed above. The following sections discuss each of the alternative booster station locations analyzed and their ability to fulfill the required siting criteria.

Figure 2-21: Booster Station Alternative 1, 2, 3, and 4



Booster Station Alternative 1 (DWP Site 1/Pipeline Route B with Booster Station Location 1)

Booster Station Alternative 1 is located on Harbor Island, approximately 27 pipeline miles away from the DWP location (Site 1). Booster Station 1 is not located in an area previously used for industrial purposes and does not contain areas of wetlands. There is preexisting road infrastructure adjacent to the site, therefore, improvements are not required. The site would have to be raised to withstand potential storm surge.

Booster Station Alternative 2: DWP Site 1/Pipeline Route B with Booster Station Location 2

Booster Station Alternative 2 is located near Aransas Pass, approximately 32 pipeline miles away from the DWP location (Site 1). Booster Station 2 is located near residential areas and does contain areas of wetlands. There is preexisting road infrastructure adjacent to the site, therefore, improvements are not required. The site would have to be raised to withstand potential storm surge.

Booster Station Alternative 3: DWP Site 3/Pipeline Route C with Booster Station Location 3

Booster Station Alternative 3 is located on Mustang Island, approximately 16 pipeline miles away from the DWP location (Site 3). Booster Station 3 is located in undeveloped land near industry and commercial property and does contain areas of wetlands. There is preexisting road infrastructure adjacent to the site, therefore, improvements are not required. The site would have to be raised to withstand potential storm surge.

Booster Station Alternative 4: DWP Site 3/Pipeline Route C with Booster Station Location 4

Booster Station Alternative 4 is located on near Ingleside, approximately 25 pipeline miles away from the DWP location (Site 3). Booster Station 4 is located near industrial properties and does contain very minor areas of wetlands. There is preexisting road infrastructure adjacent to the site, however there are no roads within the property therefore infrastructure improvements would be necessary. The site would not have to be raised to withstand potential storm surge.

Booster Station Location Alternatives Analysis Summary

An analysis of the booster station location alternatives was conducted based on their ability to fulfill the above described criteria. The above sections describe and depict each of the booster stations analyzed and their ability to fulfill the previously prescribed siting criteria. The results of the analysis conducted for the booster station alternative locations are presented in Table 2-23.

Table 2-23 Alternative Booster Station Location Alternatives Decision Matrix

Siting Criteria	DWP Location Alternative 1		DWP Location Alternative 3	
	Pipeline Route Alternative B		Pipeline Route Alternative C	
	Booster Station Location 1	Booster Station Location 2	Booster Station Location 3	Booster Station Location 4
Booster Station Criteria 1: Situated within an area of similar or historically similar land use	✓ Yes	X No	✓ Yes	✓ Yes
Booster Station Criteria 2: Minimizes impacts to WOUS, including wetlands	✓ Yes	X No	X No	X No
Booster Station Criteria 3: Minimizes required road infrastructure improvements	✓ Yes	✓ Yes	✓ Yes	X No
Booster Station Criteria 4: Minimizes distance to DWP Site Alternative	X No	X No	✓ Yes	X No
Booster Station Criteria 5: Minimizes required site build-up to withstand potential storm surge	X No	X No	X No	✓ Yes
Evaluation Score	**3**	1	**3**	2
Selected as Preferred Alternative	**Yes**	No	**Yes**	No

Tier IV – Booster Station Location Alternatives Analysis Conclusion

Based on the results of the Tier IV – Booster Station Location Alternatives Analysis, as presented in Table 2-23, Alternative 1 (DWP Site 1, Pipeline Route Alternative B, and Booster Station Location 1) and Alternative 3 (DWP Site 3, Pipeline Route Alternative C, and Booster Station Location 3) were determined the most practicable alternatives to be carried forward.

2.7 Tier V – Evaluation of Design Alternatives

During the Tier IV screening analysis, the Applicant identified two alternatives which fulfilled the purpose and need of the proposed Project to be carried forward for analysis. As such, Tier V of the alternatives analysis was conducted to evaluate design alternatives to determine the most practicable design of the necessary components to allow for the for the safe export of crude oil while minimizing environmental impacts to the maximum extent practicable. The Tier V analysis consists of the screening of alternative designs including:

- Deepwater Port Design Alternatives
- SPM Buoy Anchoring Alternatives

The following sections detail the design alternatives analysis conducted for the above described components. The results of the Tier V analysis will be the proposed design to be carried forward for both alternatives described as a result of the Tier IV analysis.

2.7.1 Deepwater Port Design Alternatives

The Applicant evaluated potential DWP design alternatives to determine the DWP design that best fulfills the purpose and need of the Project while minimizing environmental impacts to the maximum extent practicable. As defined by the DWPA, the term "deepwater port" is 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. To meet the previously described Project objectives, the DWP design must allow for the simultaneous loading of VLCCs. As such, the DWP design configurations analyzed were those capable of allowing for the simultaneous loading of VLCCs. For this analysis, the following DWP design alternatives were considered:

- DWP Design Alternative 1: Two SPM Buoy System Design
- DWP Design Alternative 2: Dual Berth Fixed Platform Design

The analysis of potential DWP design alternatives was based upon seven screening criteria including:

- DWP Design Criteria 1: Minimizes the potential for interference with natural processes
- DWP Design Criteria 2: Maximizes berth availability
- DWP Design Criteria 3: Minimizes personnel required for operation
- DWP Design Criteria 4: Minimizes length of construction schedule
- DWP Design Criteria 5: Minimizes maintenance requirements
- DWP Design Criteria 6: Minimizes seabed and above water footprint
- DWP Design Criteria 7: Minimizes chances of accidental collision damage

The following section discusses each of the DWP design alternatives ability to fulfill the criteria listed above.

<u>DWP Design Alternative 1: Two SPM Buoy System Design</u>

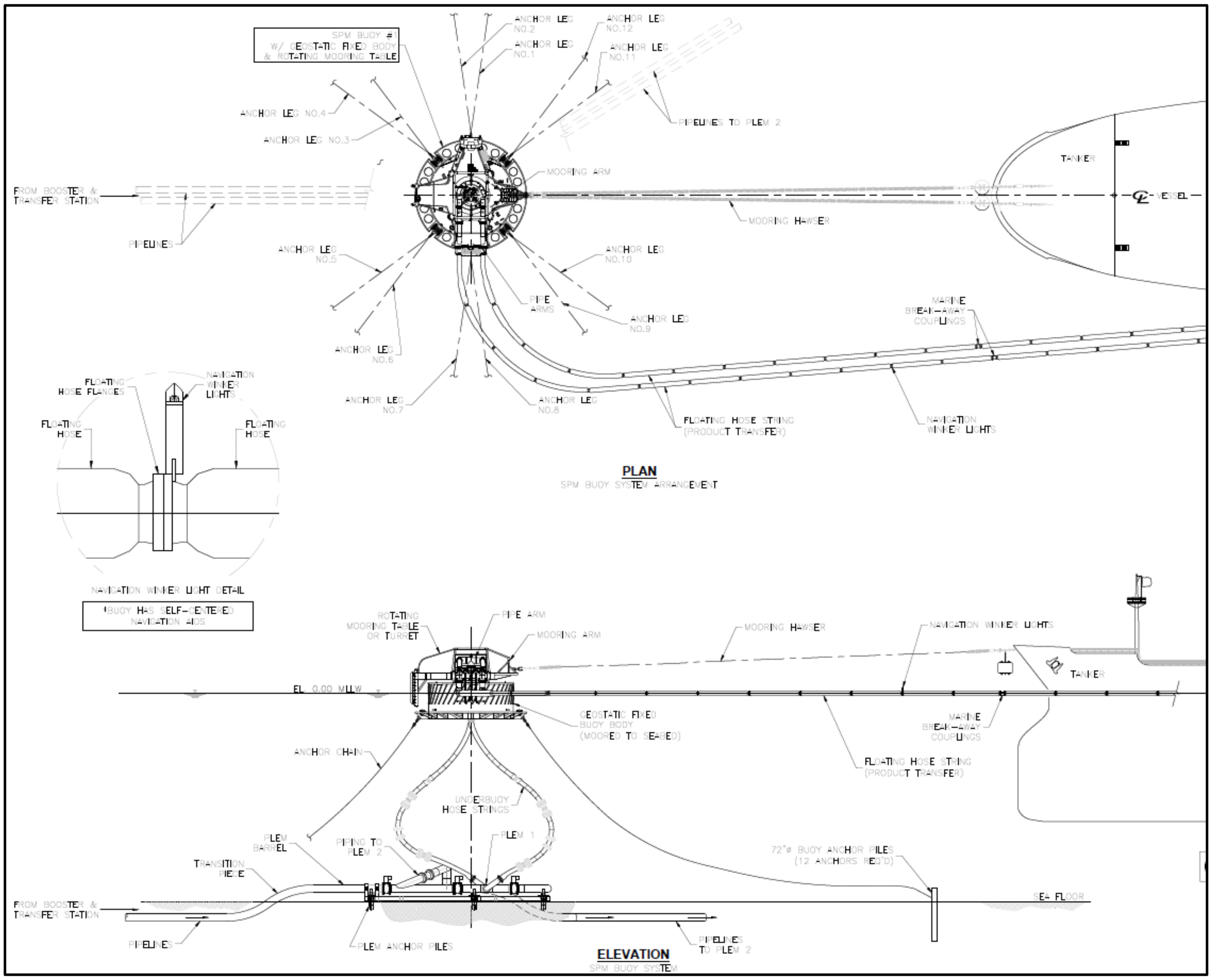
A SPM buoy is a floating buoy anchored offshore to allow for the handling of liquid cargo, such as crude oil, for the loading and/or unloading of vessels. SPM buoys are connected to shore-based facilities using offshore pipeline infrastructure for the loading and/or unloading of liquid cargo from vessels of large capacity, such as a VLCC.

SPM buoys are moored to the seabed using a mooring arrangement which includes anchors and anchor chains. Mooring arrangements are such that it allows the buoy to move freely within defined limits based on vessel conditions, wind, waves, and currents. The body of the SPM buoy system floats above the water surface and consists of a rotating table which connects to the vessels through a hawser arrangement. The cargo transfer from the SPM buoy system and the vessel begins with a pipeline end manifold (PLEM) located on the seabed directly under the

SPM buoy. The PLEM serves as the connection point between offshore pipelines and the SPM buoy. A series of floating hose strings connect the SPM buoy to the vessel allowing for the transfer of liquid cargo.

Refer to Figure 2-22 for a depiction of the general arrangement of an SPM buoy system. Refer to Figure 2-23 for a depiction of a vessel moored at an SPM buoy system.

Figure 2-22: Single Point Mooring Buoy System General Arrangement



Source: LEI Engineering Drawings

SPM buoy systems are capable of operating efficiently in rough seas and are not sensitive to directional changes of wind, waves, and currents. Due to vessels being moored to the SPM buoy via bow lines, vessels "weather-vane" around the buoy to stay head-on during various weather, wind, wave, and current forces. The ability to load vessels during various offshore conditions allows for greater terminal utilization and operational efficiencies.

Below is a general overview of how a SPM buoy system works.

- Vessels would approach the SPM buoy
- Support vessels are used to safely navigate vessels into position for mooring to the SPM buoy,
- Vessels are moored to the SPM buoy for the loading of cargo,

- Cranes located on the vessel are used to lift floating product transfer hoses for connection to the vessel manifold,
- Once connections are made, valves are operated from shore-based facilities to initiate the transfer of cargo to the vessel,
- Once vessel loading is complete, floating product transfer lines are disconnected from the vessel manifold and lowered using cranes fixed on the vessel.

An SPM buoy system is an unmanned system remotely operated from a land-based facility. The use of support vessels for the SPM buoy operations is limited to the mooring/unmooring and product hose connection and disconnection. As such, the use of an SPM buoy system for the loading of vessels reduces operational dependency of onsite personnel and support vessels.

The onsite construction and installation of the two SPM buoy systems is estimated to require 2 months. This includes the transport of the prefabricated SPM to the designated location, installation of anchoring systems, installation of the PLEM, and connection to sub-sea pipeline infrastructure.

Figure 2-23: Single Point Mooring Buoy System in Operation

Source: Phillips 66 Tetney Buoy

DWP Alternative 2: Fixed Platform Design

The design and functionality of a fixed platform for the offshore loading of vessels is similar to that of a fixed dock or terminal used at inland port facilities. The use of an offshore fixed platform for the loading of VLCCs would require an approximate 25,000 square ft. platform equipped with marine loading arms and dock supporting infrastructure, mooring dolphins, and catwalks. The offshore fixed platform would be connected to shore-based facilities using sub-sea/offshore pipeline infrastructure for the loading of vessels.

The fixed offshore platform would be supported by multiple large-diameter pile arrangements installed on the seafloor and installed to sufficient depths to ensure structural integrity. Additionally, the mooring of vessels at a fixed platform requires the installation of mooring dolphins and catwalks to safely secure vessels during loading operations. Below is a general overview of the processes required for the loading of vessels at an offshore fixed platform.

- Vessels would approach the offshore fixed platform.
- Support vessels are used to safely navigate vessels for mooring at the fixed platform.
- A combination of platform personnel and support vessels aid in the mooring of the vessel.
- Marine loading arms are connected to the vessel manifold.
- Fixed platform personnel operate valves for the transfer of crude oil to the vessel.
- Once the vessel is fully loaded, marine loading is disconnected from the vessel.
- A combination of platform personnel and support vessels aid in the unmooring of the vessel.
- Support vessels are used to safely navigate vessels away from the fixed platform.

The fixed offshore platform is a manned system requiring the use of onsite personnel for operations. Additionally, a fixed platform requires the use of support vessels which are required for vessel approach, mooring/unmooring, and departure product hose connection and disconnection. As such, the use of a fixed platform requires the transport of onsite personnel to and from the location of the offshore fixed platform and the necessary facilities to support the health and safety of onsite personnel.

The onsite construction of a fixed platform is estimated to require 4 months. This includes the transport of the prefabricated materials to the designated location, installation of platform supporting piles, mooring dolphins, installation marine loading arms, and connection to sub-sea pipeline infrastructure.

DWP Design Criteria 1 - Minimizes the Potential for Interference with Natural Processes

Natural processes such as wind, waves, and currents exert forces on and below the water surface. The minimization of the overall structures above and below the water surface results in minimal interference with forces exerted by natural processes. The Two Buoy System Design is smaller than that of the Dual Berth Fixed Platform Design. Additionally, the Two Buoy System Design would be supported in location by tension chains designed to allow for movement with natural forces. A rigid fixed dock platform requires the installation of multiple rigid pile structures both above and below the water surface. Additionally, vessels moored to a SPM buoy system are not sensitive to directional changes of wind, waves, and currents as the vessel is free to “weather-vane” around the SPM buoy to stay head-on during various weather, wind, wave, and current forces.

DWP Design Criteria 2 – Berth Availability

Berth availability and ability to safely moor a vessel at an offshore DWP is dependent on the environmental conditions such as weather, winds, and waves as well as the DWP’s design capabilities for accommodating the safe mooring of vessels in such conditions. Variations of wind and currents occur seasonally within the Gulf of Mexico. As such a DWP system that allows for the accommodation for various conditions allows for the safe mooring of vessels, and thereby greater efficiency and utilization of the DWP. The use of SPM buoy systems allows for vessels to “weather-vane” around the buoy to stay head-on during various weather, wind, wave, and current forces, whereas a fixed dock structure requires the vessels be positioned in a designated manner to allow for loading operations. The ability of the SPM buoy systems to accommodate for the various offshore conditions allows for greater berth availability.

DWP Design Criteria 3 – Personnel Required for Operation

An SPM buoy system is an unmanned system remotely operated from a land-based facility. The use of support vessels for the SPM buoy operations is limited to the mooring/unmooring and product hose connection and disconnection. The fixed offshore platform is a manned system requiring the use of onsite personnel for operations. Additionally, a fixed platform requires the use of support vessels for the vessel approach, mooring/unmooring, and departure product hose connection and disconnection. As such, the use of a fixed platform requires the transport of onsite personnel to and from the location of the offshore fixed platform and the necessary facilities to support the health and safety of onsite personnel. The optimal DWP design would be one that minimizes potential safety hazards through the minimization of the number of onsite personnel required at the DWP during operations. As such, the use of an SPM buoy system for the loading of vessels reduces operational dependency of onsite personnel and support vessels, thereby minimizes potential health and safety exposures.

DWP Design Criteria 4 – Length of Construction Schedule

A longer onsite construction timeframe results in greater disturbance of the marine environment and impacts to benthic habitats, underwater noise disturbance, suspension of sediments, and prolonged impacts to water quality. The onsite construction of a fixed platform is estimated to require 4 months whereas the onsite construction of two SPM buoy systems is estimated to require 2 months. As such, the construction of the SPM buoy systems minimizes the length of onsite construction required for the installation of a DWP.

DWP Design Criteria 5 – Maintenance Requirements

The maintenance of a fixed berth will be greater than an SPM buoy due to its multiple fixed components such as loading arms, valves, and controls equipped on the deck of the platform. The greater amounts of maintenance associated with an offshore platform require prolonged hazard exposure to personnel in an offshore environment, thereby presenting significant safety concerns.

DWP Design Criteria 6 – Seabed and Above Water Footprint

The SPM buoy system would provide a smaller footprint on the seabed and above water than a fixed platform which in turn would result in less environmental impacts. Each SPM buoy system would consist of multiple components including a PLEM, a floating buoy, mooring hawsers, floating hoses, and sub-marine hoses. The PLEM system would be an approximate 65 ft. by 34 ft. steel frame structure positioned directly beneath the proposed SPM buoy system and would be anchored directly to the seafloor with anchor piles. Above the water, each SPM will be approximately 1,000 square ft. and approximately 25 ft. in height. A fixed platform with the ability to load VLCCs would require an approximate 25,000 square ft. platform with mooring dolphins with catwalks connecting each structure. Additionally, a fixed platform would likely require a helipad to transport personnel to and from the structure for maintenance and operations. As such, for the purposes of simultaneously loading VLCCs in an offshore environment, the use of SPM buoy systems requires less surface area, subsurface area, and impacts to the seafloor.

DWP Design Criteria 7 – Accidental Collision Damage

Based on conversations with major SPM buoy venders, SPM buoys under service contracts experience minor, if any, damage as a result of operations. An SPM buoy system is anchored to the seafloor by chains which are set at appropriate tensions to allow for the flexibility and movement of the SPM buoy system in response to various offshore conditions. A fixed platform is supported by pile structures which are rigid structures. In the situation of an accidental collision, the SPM buoy design allows for the dissipation of forces exerted by the vessel whereas rigid structures associated with a fixed platform absorb forces. As such, damages as a result of an accidental collision would be less for an SPM buoy than that of a fixed platform.

Deepwater Port Design Alternatives Analysis Summary

The analysis of the DWP design alternatives was conducted based on their ability to fulfill the necessary design criteria and minimize environmental impacts to the maximum extent practicable. The results of the analysis conducted for the DWP design alternatives are presented in Table 2-24.

Table 2-24 Deepwater Port Design Alternatives Decision Matrix

Screening Criteria	**DWP Design Alternative 1: Two SPM Buoy System**	**DWP Design Alternative 2: Dual Berth Fixed Platform Design**
DWP Design Criteria 1: Minimizes the potential for interference with natural processes	✓ SPM buoy design allows for moored vessels to accommodate for existing natural processes	X Fixed platform design consists of rigid fixed structures incapable of accommodating for various offshore processes once installed
DWP Design Criteria 2: Maximizes berth availability	✓ Vessel is allowed to freely weathervane around the SPM buoy	X Vessel remains fixed to platform and mooring structures
DWP Design Criteria 3: Minimizes personnel occupancy required	✓ Un-manned system (excluding the assist tugs during berthing and de-berthing)	X Requires personnel to be onsite the fixed platform during operations
DWP Design Criteria 4: Minimizes length of construction schedule	✓ 2-month timeframe of disturbance of the marine environment	X 4-month timeframe and disturbance of the marine environment
DWP Design Criteria 5: Minimizes maintenance requirements	✓ Shorter timeframe of required maintenance	X Longer timeframe of required maintenance
DWP Design Criteria 6: Minimizes seabed and above water footprint	✓ Smaller footprint on the seabed and above water	X Larger footprint on the seabed and above water
DWP Design Criteria 7: Minimizes chance of accidental collision damage	✓ Chains to the seabed will cause less damage	X Rigid dolphins and platform of a fixed dock structure will cause more damage
Evaluation Score	**7**	0
Selected as Preferred Alternative	**Yes**	No

Tier V – Deepwater Port Design Alternatives

Based on the results of the Tier V – Deepwater Port Design Alternatives analysis, as presented in Table 2-24, the use of the SPM buoy systems alternative was determined to be the most practicable DWP design alternative to be carried forward.

2.7.2 SPM Buoy Anchoring Alternatives

Based on the results of the DWP design alternatives screening, the use of an SPM buoy system was determined to be the best suited DWP design which fulfilled the Project purpose and need while minimizing environmental impacts.

Three SPM buoy anchoring alternatives were considered during analysis including:

- Drag Anchors
- Gravity Anchors
- Anchor Piles

The analysis of SPM buoy anchoring alternatives was based upon two screening criteria including:

- Anchoring Alternative Criteria 1: Suitable design to ensure structural integrity and support the load requirements of the SPM buoy given the offshore sediment composition
- Anchoring Alternative Criteria 2: Minimize footprint on the seabed

The following describes each of the SPM anchoring alternatives. An evaluation of the three anchor designs was conducted to determine which design best fulfilled the screening criteria listed above.

<u>Drag Anchors</u>

Drag anchors generate their holding power by embedding in the seafloor when pulled horizontally, mobilizing the sheer strength of the soil to resist the pulling force. The use of drag anchors is mainly for situations where the mooring line arrives on the seabed horizontally. Drag anchors do not perform well under vertical forces.

<u>Gravity Anchors</u>

Gravity anchors depend primarily on their own mass, geometry, and soil characteristics for holding power. The holding power is proportional to its weight. Due to the size of vessels mooring to the SPM buoy systems (i.e. VLCC), gravity anchors can easily weigh several tons in order to provide the necessary holding power. Commonly used materials are concrete and steel.

<u>Anchor Piles</u>

Anchor piles generate their holding power by mobilizing lateral earth pressure and skin friction in the surrounding soil. Anchor piles are a commonly used practice within the Gulf of Mexico due to sediment composition. Anchor piles are steel cylindrical piles driven into the seabed to depths sufficient to withstand the load requirements. Since their holding power is reliant on lateral earth pressure, anchor piles require a minimal footprint on the seafloor.

Anchoring Alternative Criteria 1 – Maximizes practicality and safety

Within the Gulf of Mexico, the composition of sediments at these water depths primarily consists of loose recent soils. Based on initial geotechnical analysis of offshore sediments at the proposed location of the SPM buoys, the use of drag anchors or gravity anchors for the anchoring of the SPM buoy systems is not practicable. As such, the practical and safe solution for the anchoring of the SPM buoy system is the use of anchor piles. Discussions of the soils is presented in Volume II, Section 11 - Geological Resources.

Anchoring Alternative Criteria 2 – Minimize seabed footprint

Drag anchors generate their holding power by embedding in the seafloor when pulled horizontally, mobilizing the sheer strength of the soil to resist the pulling force. Gravity anchors depend primarily on their own mass to provide holding capacity. Anchor piles generate their holding power by mobilizing lateral earth pressure and skin friction in the surrounding soil.

The use of anchor piles for the anchoring of the SPM buoy system minimizes environmental impacts as they require a larger footprint on the seabed than drag anchors.

SPM Buoy Anchoring Alternatives Analysis Summary

The analysis of the SPM buoy anchoring alternatives was conducted based on their ability to fulfill the necessary criteria and minimize environmental impacts to the maximum extent practicable. The results of the analysis conducted is presented in Table 2-25.

Table 2-25 SPM Buoy Anchoring Alternatives Decision Matrix

Siting Criteria	Drag Anchors	Gravity Anchors	Anchor Piles
Anchoring Alternative Criteria 1: Suitable design to ensure structural integrity	X Larger seabed footprint	X Larger seabed footprint	✓ Smaller seabed footprint
Anchoring Alternative Criteria 2: Minimize footprint on the seabed	X Initial geotechnical analysis shows that piles would be required to safely hold the SPM buoy system in place	X Initial geotechnical analysis shows that piles would be required to safely hold the SPM buoy system in place	✓ Initial geotechnical analysis shows that piles would be required to safely hold the SPM buoy system in place
Evaluation Score	0	0	2
Selected as Preferred Alternative	No	No	**Yes**

Tier V – SPM Buoy Anchoring Alternatives

Based on the results of the Tier V – SPM Buoy Anchoring Alternatives analysis, as presented in Table 2-25, the use of the anchor piles alternative was determined to be the most practicable SPM buoy anchoring alternative to be carried forward.

2.8 Alternatives Analysis Summary

Table 2-26 presents summary of the tiered screening analysis, the alternatives evaluated, and the chosen alternative(s) as a result of the analysis conducted.

Table 2-26 Alternatives Analysis Summary Table

	Alternatives Analysis	Selection
Tier I Screening: No-Action Alternative		
No-Action Alternative	No-Action Alternative	Not considered for further review.
Tier II Screening: Location Alternatives		
U.S. Region Alternatives	East Coast (PADD 1)	Gulf Coast (PADD 3)
	Midwest (PADD 2)	
	Gulf Coast (PADD 3)	
	Rocky Mountain (PADD 4)	
	West Coast (PADD 5)	
Gulf Coast (PADD 3) State Alternatives	Alabama	Texas
	Arkansas	
	Louisiana	
	Mississippi	
	New Mexico	
	Texas	
Texas Coast Location Alternatives	Sabine/Beaumont Area	Corpus Christi Area
	Houston Area	
	Freeport Area	
	Matagorda Area	
	Corpus Christi Area	
	Brownsville Area	
Tier III Screening: Existing Infrastructure vs. New Infrastructure		
Infrastructure Alternatives	Existing Pipeline and/or Platform Infrastructure	Installation of New Offshore Pipeline Infrastructure
	Installation of New Offshore Pipeline Infrastructure	
Tier IV Screening: Siting Analysis of Required Project Components		
Deepwater Port Location Alternatives	DWP Site Alternative 1	DWP Site Alternative 1
	DWP Site Alternative 2	
	DWP Site Alternative 3	DWP Site Alternative 3
	DWP Site Alternative 4	
Pipeline Routing Alternatives	Alternative A (DWP Site 1 with Pipeline Route A)	Alternative B (DWP Site 1 with Pipeline Route B)
	Alternative B (DWP Site 1 with Pipeline Route B)	
	Alternative C (DWP Site 3 with Pipeline Route C)	Alternative C (DWP Site 3 with Pipeline Route C)
	Alternative D (DWP Site 3 with Pipeline Route D)	

<table>
<tr><th></th><th colspan="2">Alternatives Analysis</th><th>Selection</th></tr>
<tr><td rowspan="4">Booster Station Location Alternatives</td><td colspan="2">Booster Station Alternative 1
DWP Site 1/Pipeline Route A with Booster Station Location Alternative 1</td><td rowspan="2">Booster Station Alternative 1
DWP Site 1/Pipeline Route A with Booster Station Location Alternative 1</td></tr>
<tr><td colspan="2">Booster Station Alternative 2
DWP Site 1/Pipeline Route A with Booster Station Location Alternative 2</td></tr>
<tr><td colspan="2">Booster Station Alternative 3
DWP Site 3/Pipeline Route C with Booster Station Location Alternative 3</td><td rowspan="2">Booster Station Alternative 3
DWP Site 3/Pipeline Route C with Booster Station Location Alternative 3</td></tr>
<tr><td colspan="2">Booster Station Alternative 4
DWP Site 3/Pipeline Route C with Booster Station Location Alternative 4</td></tr>
<tr><th colspan="4">Tier V Screening: Evaluation of Design Alternatives</th></tr>
<tr><td rowspan="2">Deepwater Port Design Alternatives</td><td colspan="2">Fixed Platform</td><td rowspan="2">Single-Point Mooring Buoy System</td></tr>
<tr><td colspan="2">Single-Point Mooring Buoy System</td></tr>
<tr><td rowspan="3">SPM Buoy Anchoring Alternatives</td><td colspan="2">Drag Anchors</td><td rowspan="3">Anchor Piles</td></tr>
<tr><td colspan="2">Gravity Anchors</td></tr>
<tr><td colspan="2">Anchor Piles</td></tr>
<tr><th colspan="4">Alternatives Carried Forward for Further Consideration</th></tr>
<tr><th colspan="2">Alternative Project A</th><th colspan="2">Alternative Project B</th></tr>
<tr><td>Deepwater Port Location Alternatives</td><td>DWP Site Alternative 1</td><td>Deepwater Port Location Alternatives</td><td>DWP Site Alternative 3</td></tr>
<tr><td>Pipeline Routing Alternatives</td><td>Alternative B (DWP Site 1 with Pipeline Route B)</td><td>Pipeline Routing Alternatives</td><td>Alternative C (DWP Site 3 with Pipeline Route C)</td></tr>
<tr><td>Booster Station Location Alternatives</td><td>Booster Station Alternative 1
DWP Site 1/Pipeline Route A with Booster Station Location Alternative 1</td><td>Booster Station Location Alternatives</td><td>Booster Station Alternative 3
DWP Site 3/Pipeline Route C with Booster Station Location Alternative 3</td></tr>
<tr><td>Deepwater Port Design Alternatives</td><td>Single-Point Mooring Buoy System</td><td>Deepwater Port Design Alternatives</td><td>Single-Point Mooring Buoy System</td></tr>
<tr><td>SPM Buoy Anchoring Alternatives</td><td>Anchor Piles</td><td>SPM Buoy Anchoring Alternatives</td><td>Anchor Piles</td></tr>
</table>

Based on the results of the alternatives analysis conducted, two alternatives (Alternative Project A and Alternative Project B) were identified as practicable alternatives to provide a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins. Both Alternative Project A and B would allow for the direct, full, and simultaneous loading of VLCCs at a proposed DWP, via two SPM buoy systems. Section 2.9 analyzes both Alternative Project A and Alternative Project B to define a “Proposed Project” and a “Alternative Project” based on the ability to fulfill Project goals and objectives while minimizing environmental impacts to the maximum extent practicable.

2.9 Defining the Proposed Project and Alternative Project

Based on the results of the alternatives analysis conducted, two alternatives (Alternative Project A and Alternative Project B) were identified as practicable alternatives to provide a safe and environmentally sustainable solution for the export of abundant domestic crude oil supply from major shale basins. This section of the alternatives analysis provides a comparative analysis of Alternative Project A and Alternative Project B to define a "Proposed Project" and a "Alternative Project" based on the ability to fulfill Project goals and objectives while minimizing environmental impacts to the maximum extent practicable.

The determination of the Proposed Project and the Alternative Project is based on previous screening analysis utilized in the following analysis:

- Tier IV – Deepwater Port Siting Analysis
  - DWP Site Criteria 1: Suitable Water Depth for the DWP
  - DWP Site Criteria 2: Proximity to Existing Safety Fairways
  - DWP Site Criteria 3: Proximity to Existing Anchorage Areas
  - DWP Site Criteria 4: Required Pipeline Infrastructure Impacts to Safety Fairways
  - DWP Site Criteria 5: Required Pipeline Infrastructure Impacts to Anchorage Areas
  - DWP Site Criteria 6: Minimizes impacts to Existing Artificial Reefs
  - DWP Site Criteria 7: Minimizes interference existing or proposed DWP projects.
  - DWP Site Criteria 8: Proximity to Existing Offshore Marine Infrastructure
- Tier IV – Pipeline Routing Alternatives
  - Pipeline Route Criteria 1: Minimizes overall pipeline length
  - Pipeline Route Criteria 2: Minimizes inshore waterbody crossings via trench and bury techniques
  - Pipeline Route Criteria 3: Maximizes the ability to use horizontal directional drilling (HDD) techniques to minimize environmental impacts
  - Pipeline Route Criteria 4: Minimizes crossing distances of existing offshore safety fairways
  - Pipeline Route Criteria 5: Avoids crossings of existing anchorage areas
  - Pipeline Route Criteria 6: Location has similar land use types
  - Pipeline Route Criteria 7: Minimizes impacts to T&E species critical habitat
  - Pipeline Route Criteria 8: Minimizes impacts to artificial reefs and sand sources
  - Pipeline Route Criteria 9: Minimizes potential impacts to WOUS including aquatic resources
  - Pipeline Route Criteria 10: Minimizes required number of crossings of existing offshore pipelines
  - Pipeline Route Criteria 11: Minimizes impacts to properties of known federal interest
- Tier IV – Booster Station Location Alternatives
  - Booster Station Criteria 1: Situated within an area of similar or historically similar land use
  - Booster Station Criteria 2: Minimizes impacts to WOUS, including wetlands
  - Booster Station Criteria 3: Minimizes required road infrastructure improvements
  - Booster Station Criteria 4: Minimizes distance to DWP Site Alternative
  - Booster Station Criteria 5: Minimizes required site build-up to withstand potential storm surge

Table 2-27 presents the results of the alternatives analysis conducted for the proposed Alternative Project A and Alternative Project B.

Table 2-27 Proposed Project and Alternative Project Decision Matrix

Siting Criteria	Alternative Project A	Alternative Project B
DWP Site Criteria 1: Suitable Water Depth for the DWP (85 ft.)	✓ Yes	✓ Yes
DWP Site Criteria 2: Proximity to Existing Safety Fairways	✓ Yes	✓ Yes
DWP Site Criteria 3: Proximity to Existing Anchorage Areas	✓ Yes	✓ Yes
DWP Site Criteria 4: Required Pipeline Infrastructure Impacts to Safety Fairways	✓ No	X Yes
DWP Site Criteria 5: Required Pipeline Infrastructure Impacts to Anchorage Areas	✓ No	✓ No
DWP Site Criteria 6: Minimizes impacts to Existing Artificial Reefs	✓ Yes	X No
DWP Site Criteria 7: Minimizes interference existing or proposed DWP projects	✓ Yes	✓ Yes
DWP Site Criteria 8: Proximity to Existing Offshore Marine Infrastructure	✓ No	✓ No
Pipeline Route Criteria 1: Minimize overall pipeline length	✓ Yes	✓ Yes
Pipeline Route Criteria 2: Minimize inshore waterbody crossing via trench and bury techniques	✓ Yes	X No
Pipeline Route Criteria 3: Maximize use of HDD techniques to avoid environmental impacts	✓ Yes	X No
Pipeline Route Criteria 4: Minimize crossing of existing safety fairways	✓ Yes	X No
Pipeline Route Criteria 5: Minimize crossings of existing anchorage areas	✓ Yes	✓ Yes
Pipeline Route Criteria 6: Location has similar land use types	✓ Yes	X No
Pipeline Route Criteria 7: Minimizes impacts to T&E species critical habitat	✓ Yes	✓ Yes
Pipeline Route Criteria 8: Minimizes impacts to artificial reefs and sand sources	✓ Yes	X No
Pipeline Route Criteria 9: Minimizes potential impacts to WOUS including aquatic resources	✓ Yes	✓ Yes
Pipeline Route Criteria 10: Minimizes required number of crossings of existing offshore pipelines	✓ Yes	X No
Pipeline Routing Criteria 11: Minimizes impacts to areas and/or properties of Federal interest	✓ Yes	✓ Yes
Booster Station Criteria 1: Situated within an area of similar or historically similar land use	✓ Yes	✓ Yes

Siting Criteria	Alternative Project A	Alternative Project B
Booster Station Criteria 2: Minimizes impacts to WOUS, including wetlands	✓ Yes	X No
Booster Station Criteria 3: Minimizes required road infrastructure improvements	✓ Yes	✓ Yes
Booster Station Criteria 4: Minimizes distance to DWP Site Alternative	X No	✓ Yes
Booster Station Criteria 5: Minimizes required site build-up to withstand potential storm surge	X No	X No
Evaluation Score	22	14
Proposed vs. Alternative Project Selection	**Proposed Project**	**Alternative Project**

Proposed Project and Alternative Project Conclusion

Based on the results of the alternatives analysis conducted, the Applicant has identified Alternative Project A as the Proposed Project and Alternative Project B as the Alternative Project. Pursuant to NEPA, governmental decision-makers must consider reasonable alternatives to a proposed action that would result in a significant environmental effect. As such, both the Proposed Project and the Alternative Project are carried forward for further evaluation as part of the Environmental Evaluation conducted for the proposed Bluewater SPM Project to identify related environmental consequences and their level of impact to environmental resources.

Within Volume II, Section 3 – Project Description and Framework for Environmental Evaluation are descriptions of the Proposed Project and the Alternative Project and their associated components. Additionally, Section 3 presents the framework and methodology used to identify related environmental consequences and their level of impact to environmental resources as described in the technical sections (Section 4 through 16) of Volume II.

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