APPENDIX K
MARINE MAMMAL PROTECTION ACT ASSESSMENT

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LIST OF ACRONYMS

µPa	micro Pascals
BMP	best management practices
BOEM	Bureau of Ocean Energy Management
BWTT	Bluewater Texas Terminal, LLC
CFR	Code of Federal Regulations
dB	decibels
dBA	decibels on the A-weighted scale
DWH	Deepwater Horizon
DWP	Deepwater Port
ESA	Endangered Species Act of 1973
FPSO	floating production storage and offloading facility
ft	feet
GARFO	Greater Atlantic Region Field Office
GIWW	Gulf Intracoastal Waterway
GOM	Gulf of Mexico
HDD	horizontal directional drill
Hz	hertz
IMO	International Maritime Organization
km	kilometer
m	meter
m/s	meters per second
MARPOL	International Convention for the Prevention of Pollution from Ships
mi	mile
MMPA	Marine Mammal Protection Act of 1972
NMFS	National Marine Fisheries Service
NOAA	National Oceanic and Atmospheric Administration
NRDA	Natural Resource Damage Assessment
NTL	Notices to Lessees
oC	degrees Celsius
OCS	Outer Continental Shelf
oF	degrees Fahrenheit
P.L.	Public Law
PINS	Padre Island National Seashore
PK	peak sound pressure
PLEM	pipeline end manifold
POCC	Port of Corpus Christi
Project	Bluewater Single Point Mooring Project
PTS	permanent threshold shift
RMS	root mean square
SAV	submerged aquatic vegetation
SEL	sound exposure level
SELcum	cumulative sound exposure level
SERO	Southeast Regional Office
SPL	sound pressure level
SPM	single point mooring
TPWD	Texas Parks and Wildlife Department
TTS	temporary threshold shift

U.S.C.	United States Code
USCG	U.S. Coast Guard
USFWS	U.S. Fish and Wildlife Service
VLCC	very large crude carriers
ZOI	zone of influence

1 Proposed Project

1.1 Onshore

The Bluewater Single Point Mooring (SPM) Project (Project) area considered for marine mammal species encompass all estuarine and marine habitats within the immediate vicinity of the Inshore Pipelines, Offshore Pipelines, and both SPM buoys (which make up the SPM buoy systems). As no marine mammals will occur in onshore environments, Onshore Project Components are not discussed further.

1.2 Inshore

The inshore areas of the Proposed Project include those areas that are landward of San Jose Island and Mustang Island, including Redfish, Corpus Christ, and South Bay. All inshore waters will be crossed using horizontal directional drill (HDD) construction methods, which will avoid or minimize impacts on these habitats.

1.3 Offshore

The continental shelf portion of the Gulf of Mexico (GOM) extends over a gradual slope from the coastline to the shelf/slope transition, which is generally considered to be in water depths of about 660 feet (ft) (200 meters [m], Byrnes et al. 2017). The SPM buoy systems will be located on the continental shelf, at a water depth of 88.5 to 89.5 ft (27.0 to 27.3 m); the Offshore Pipelines will transit from the SPM buoy systems, moving through progressively shallower waters until reaching the shore of San Jose Island.

2 Applicable Laws and Regulations

2.1 Marine Mammal Protection Act

Under the Marine Mammal Protection Act (MMPA) of 1972 (16 United States Code [U.S.C.] 1361 et seq.), the Secretary of Commerce is responsible for the protection of all cetaceans (whales, porpoises, and dolphins) and pinnipeds (seals and sea lions), except walruses, and has delegated authority for implementing the MMPA to National Oceanic and Atmospheric Administration (NOAA) National Marine Fisheries Service (NMFS). Under Section 3 of the MMPA, all marine mammals are protected from "take" which is defined as "harass, hunt, capture, or kill or attempt to harass, hunt, capture, or kill any marine mammal," and "harassment" is defined as "any act of pursuit, torment, or annoyance that has the potential to injure marine mammal stock in the wild; or has the potential to disturb a marine mammal or marine mammal stock in the wild by disrupting behavioral patterns, including migration, breathing, nursing, breeding, feeding, or sheltering."

Substantial amendments were made to the MMPA in 1994 that allow for the incidental take of small numbers of marine mammals. NOAA identifies incidental take as activities other than commercial fishing that effect a small number, have no more than a negligible impact, and not have an unmitigated adverse impact on the stock for subsistence uses. Activities that are frequently identified as incidental take and therefore authorized include oil and gas development, geophysical surveys, and military training exercises.

2.2 Endangered Species Act

The Endangered Species Act (ESA) provides for the conservation of species that are endangered or threatened throughout all or a significant portion of their range, and the conservation of the ecosystems on which they depend. A species is considered endangered if it is in danger of extinction throughout all or a significant portion of its range. The ESA is administered by the U.S. Fish and Wildlife Service (USFWS) and the Commerce Department's NMFS. The USFWS has authority over terrestrial and freshwater organisms, while species under the purview of NMFS are primarily marine. The USFWS is a bureau with the Department of the Interior responsible for enforcement of the ESA. Other functions include, but are not limited to enforcing federal wildlife laws, protecting endangered species, and conserving and restoring wildlife habitat.

Critical habitat is also designated under the ESA and includes geographic areas that contain the physical or biological features that are essential to the conservation of the species and that may need special management or protection. Critical habitat may include areas that are not occupied by the species at the time of listing but are essential to its conservation.

The species evaluated in this report were based on a list of federally threatened and endangered species for San Patricio and Aransas Counties, Texas, available at the USFWS Information for Planning and Conservation website (USFWS 2019a) in order to facilitate compliance with the ESA, as amended. The potential for occurrence within the Project area for the species addressed in this report was based on: 1) documented occurrences; 2) existing information on distribution; and 3) qualitative comparisons of the habitat requirements of each species with vegetation communities or landscape features observed within the Project area. Possible impacts to these species resulting from construction of the Proposed Project were evaluated based on reasonably foreseeable Project-related activities.

3 Marine Mammals in the Project Area

Twenty-eight species of marine mammals (Table 1) are known to occur, at least occasionally, in waters of the GOM (Bureau of Ocean Energy Management [BOEM] 2017). With one species exception, all of these mammals belong to the order Cetacea. Of the 28 species of cetaceans occurring in the GOM, 7 belong to the suborder Mysticeti (baleen whales), and 21 belong to the suborder Odontoceti (toothed whales). The exception, the West Indian manatee (*Trichecus manatus*) and its sub-species, the Florida manatee (*Trichehus manatus latirostris*), belong to the order Sirenia. All of these species are protected by the MMPA, and seven are further protected by the ESA of 1973; species protected under the ESA are specifically discussed in Section 5.

Only two of the non-endangered mammal species are known to regularly inhabit the shallow shelf waters of the Project area: the Atlantic spotted dolphin (*Stenella frontalis*) and the bottlenose dolphin (*Tursiops truncatus*). A third species, the rough-toothed dolphin (*Steno bredanensis*), is also likely to be found in deeper waters, but has been identified in shelf waters near the Project. These three species are discussed further below. The remaining non-endangered marine mammal species that occur in the GOM are found in depths deeper than that of the Project and are considered unlikely to occur in the Projectarea.

Table 1:	**Marine Mammals Occurring in the Northern Gulf of Mexico**			
Common Name	**Scientific Name**	**Protection**	**Occurrence**	**Abundance and Occurrence in the GOM**
ORDER CETACEA				
Suborder Mysticeti (baleen whales)				
Blue Whale	*Balaenoptera musculus*	ESA (E), MMPA	Distributed in sub-polar to sub-tropical latitudes worldwide. Migrates toward polar waters in spring. While found in coastal waters, they are thought to occur generally more offshore than other whales.	An occasional visitor in U.S. waters in the Western North Atlantic, which could occur as far south as Florida and the GOM; however, the southern limit of the species' range is unknown and the population of this stock is small (perhaps between 400 and 600 individuals). Given the potential to occur in coastal waters, the species could occur in the Proposed Project area.
Bryde's whale	*Balaenoptera edeni*	MMPA (strategic stock), proposed endangered under the ESA	Occurs in tropical, sub-tropical and warm temperate waters worldwide.	No confirmed sightings of Bryde's whales have been documented in the north central or western GOM since NMFS began surveys in the early 1990s such that NMFS indicates that the species almost exclusively occurs in the northeastern GOM. Therefore, the species is not expected to occur in the Project area. The abundance of the northern GOM stock is 33.
Fin whale	*Balaenoptera physalus*	ESA (E), MMPA	Distributed in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes; less common in the tropics. Most migrate from the Arctic and Antarctic feeding areas in the summer to tropical breeding and calving areas in the winter.	An estimated 1,618 fin whales occur in the North Atlantic and GOM; individuals occur in deep, offshore waters but have also been observed in continental shelf waters. Given the potential to occur in continental shelf waters, the species could occur in the Proposed Project area.
Humpback whale	*Megaptera novaeanglia*	ESA (E), MMPA	Distributed throughout all major oceans from the equator to sub-polar latitudes. Not expected to occur often in the northern and western GOM.	The Gulf of Maine stock of humpback whales, which winters in the West Indies where the majority of whales are found in the waters of the Dominican Republic, is the nearest population to the Proposed Project; however, individuals occasionally occur in nearshore waters of the GOM during the winter and could occur in the Proposed Project area. The population size is unknown.
Minke whale	*Balaenoptera acutorostrata*	MMPA	Distributed in temperate, tropical, and high latitude waters. Common and widely distributed throughout the Atlantic Exclusive Economic Zone. Prefer the continental shelf from spring to fall; prefer oceanic waters from fall to spring.	Most abundant in New England during the spring to fall period of occurrence on the continental shelf, and occur in lower latitudes (which may include the GOM) in winter. The abundance of the Canadian East Coast stock, which extends to the GOM, is estimated at 2,591 individuals. Given the species is most abundant in New England waters when occurring on the continental shelf, the species is not expected to occur in the Project area.

Table 1:	**Marine Mammals Occurring in the Northern Gulf of Mexico**			
Common Name	**Scientific Name**	**Protection**	**Occurrence**	**Abundance and Occurrence in the GOM**
Sei whale	*Balaenoptera borealis*	ESA (E), MMPA	Distributed in sub-tropical, temperate, and sub-polar waters. May unpredictably and randomly occur in a specific area, sometimes in large numbers. These events may occur suddenly and then not occur again for long periods of time. May migrate toward lower latitudes during winter and higher latitudes during summer.	The movements of sei whales are not well known; however, individuals prefer temperate waters in the mid-latitudes and are typically observed in deeper waters far from the coastline. However, they occasionally enter shallower, more inshore waters. The Nova Scotia stock of sei whales is estimated at 357 individuals; NMFS does not track a GOM stock of this species. Therefore, the species may occur in the Project area.
Suborder Odontoceti (toothed whales and dolphins)				
Atlantic spotted dolphin	*Stenella frontalis*	MMPA	In the GOM, occur primarily along the continental shelf at 33 to 656 ft (10 to 200 m) deep, to the continental slope at 1,641 ft (500 m).	Likely to occur in the Project area. The current population size is unknown, but abundance estimates from data through 2004 included 37,611 individuals in the northern GOM.
Blainville's beaked whale	*Mesoplodon densirostris*	MMPA	Oceanic species; prefers temperate and tropical waters > 1,641, ft (500 m) deep.	Known to occur in the oceanic GOM; there have been 4 documented standings and 2 sightings in the northern GOM and observations occur at depths greater than 1,649 ft (500 m). Given the depth range of the species, it is not expected to occur in the Project area. The abundance in the GOM most recently estimated for Blainville's and Gervais' beaked whales is 149.
Bottlenose dolphin	*Tursiops truncatus*	MMPA	Western coastal stock occurs outside of bays and estuaries, and in GOM waters less than 20 m deep, from the Laguna Madre to the Florida Keys.	Likely to occur in the Project area. The abundance for stocks that may occur in the Project area are estimated at 20,161 animals (Western Coastal Stock), 51,192 animals (Continental Shelf Stock), 80 animals (Laguna Madre), and 58 animals (Nueces Bay/Corpus Christi Bay).
Clymene dolphin	*Stenella clymene*	MMPA	Endemic to tropical and sub-tropical waters of the Atlantic. Prefers deep, oceanic waters off the continental shelf in the GOM, west of the Mississippi River.	Not expected to occur in the Project area, since sightings in the GOM occur primarily in the deeper waters off the continental shelf (i.e., beyond the 200-m isobath), west of the Mississippi River. The abundance in the GOM is estimated to be 129 individuals.
Cuvier's beaked whale	*Ziphius cavirostris*	MMPA	Oceanic species; prefers waters > 1,641 ft (500 m) deep.	Known to occur in the oceanic GOM; observations of beaked whales in the northern GOM occur at depths greater than 1,649 ft (500 m). Given the depth range of the species, it is not expected to occur in the Project area. The abundance in the northern GOM is estimated to be 74 individuals

Table 1:	**Marine Mammals Occurring in the Northern Gulf of Mexico**			
Common Name	**Scientific Name**	**Protection**	**Occurrence**	**Abundance and Occurrence in the GOM**
Dwarf sperm whale	*Kogia simus*	MMPA	Distributed worldwide in temperate to tropical waters. Prefer oceanic waters in northern GOM.	Known to occur in the oceanic GOM; given the occurrence within oceanic (not continental shelf) waters, this species is not expected to occur in the Project area. The abundance in the GOM of dwarf and pygmy sperm whales, which are difficult to distinguish, is estimated to be 186 individuals.
False killer whale	*Pseudorca crassidens*	MMPA	Distributed worldwide in warm temperate and tropical oceans. In the northern GOM, this species prefers deep, oceanic waters.	Known to occur in the oceanic waters of the GOM; most sightings are documented in the eastern GOM. Given the occurrence within oceanic (not continental shelf) waters, this species is not expected to occur in the Project area. Data for abundance of this species is greater than 8 years old and therefore, unknown.
Fraser's dolphin	*Lagenodelphis hosei*	MMPA	Distributed worldwide in tropical waters. In the northern GOM, this species prefers oceanic waters > 656 ft (200 m) deep.	Sightings in the GOM have occurred in oceanic waters greater than 656 ft (200 m). The abundance in the GOM is unknown and this species was not identified within the GOM during surveys conducted in 2009. Given the depth range of the species and limited sightings, it is not expected to occur in the Project area.
Gervais' beaked whale	*Mesoplodon europaeus*	MMPA	Distributed worldwide in temperate and tropical waters of the world oceans. Prefers oceanic waters in the GOM > 1,641 ft (500 m) deep.	Known to occur in the oceanic GOM; there have been 16 documented strandings in the GOM and observations occur at depths greater than 1,649 ft (500 m). Given the depth range of the species, it is not expected to occur in the Project area. The abundance in the GOM most recently estimated for Blainville's and Gervais' beaked whales is 149.
Killer whale	*Orcinus orca*	MMPA	Distributed worldwide from tropical to polar regions. In the northern GOM, the killer whale prefers oceanic waters ranging from 840 to 8,701 ft (256 to 2,652 m).	Sightings in the GOM have been documented in waters with a depth range from 840 to 8,701 ft (256 to 2,652 m). The northern GOM stock is estimated to be 28 individuals. Given the lack of occurrence data in continental shelf waters (with only 3 occurrences documented, the most recent in 1987), the species is not expected to occur in the Project area.
Melon-headed whale	*Peponocephala electra*	MMPA	Distributed worldwide in tropical to sub-tropical waters. In the northern GOM, this species prefers oceanic waters west of Mobile Bay, Alabama that are > 2,625 ft (800 m) deep.	Sightings in the GOM have been documented in waters with a depth greater than 2,626 ft (800 m). Therefore, the species is not expected to occur in the Project area. The abundance in the GOM is estimated to be 2,235 individuals.

Table 1:	**Marine Mammals Occurring in the Northern Gulf of Mexico**			
Common Name	**Scientific Name**	**Protection**	**Occurrence**	**Abundance and Occurrence in the GOM**
Pantropical spotted dolphin	*Stenella attenuata*	MMPA	Distributed worldwide in tropical and certain sub-tropical oceans. In the northern GOM, this species prefers oceanic waters.	Occurrence is documented throughout oceanic waters greater than 656 ft (200 m) deep in the GOM. Given the depth range of the species, it is not expected to occur in the Project area. The abundance in the GOM is estimated to be 50,880 individuals.
Pygmy killer whale	*Feresa attenuata*	MMPA	Distributed worldwide in tropical and sub-tropical waters. In the northern GOM, pygmy killer whales prefer oceanic waters.	Sightings in the GOM have been documented primarily in oceanic waters. Given the lack of occurrence data in continental shelf waters, the species is not expected to occur in the Project area. The abundance in the GOM is estimated to be 152 individuals.
Pygmy sperm whale	*Kogia breviceps*	MMPA	Distributed worldwide in temperate to tropical waters. In northern GOM, the pygmy sperm whale prefers oceanic waters during all seasons.	Known to occur in the oceanic GOM; given the occurrence within oceanic (not continental shelf) waters, this species is not expected to occur in the Project area. The abundance in the GOM of dwarf and pygmy sperm whales, which are difficult to distinguish, is estimated to be 186 individuals.
Risso's dolphin	*Grampus griseus*	MMPA	Distributed worldwide in tropical to warm temperate waters. In the northern GOM, Risso's dolphin prefers oceanic waters but is concentrated in waters along the continental slope during all seasons.	Occurrence is documented throughout oceanic waters greater than 656 ft (200 m) deep in the GOM. Given the depth range of the species, it is not expected to occur in the Project area. The abundance in the GOM is estimated to be 2,442 individuals.
Rough-toothed dolphin	*Steno bredanensis*	MMPA	Distributed worldwide in tropical to warm temperate waters. In the northern GOM, this species occurs in oceanic waters averaging 640 ft (195 m) deep and sometimes along the continental shelf.	Occur in oceanic, and, to a lesser extent, continental shelf waters in the northern GOM. Most observations have occurred in oceanic waters greater than 656 ft (200 m). The species could occur in the Project area given observations along the continental shelf. The abundance of the GOM is estimated to be 624; however, this is believed to be an underestimated approximation.
Short-finned pilot whale	*Globicephala macrorhynchus*	MMPA	Distributed worldwide in tropical to temperate waters. In the northern GOM, the short-finned pilot whale occurs primarily on the continental slope during all seasons.	Occur throughout the oceanic GOM, individuals are typically observed along the continental slope and therefore not expected to occur in the Project area. The best abundance estimate for the northern GOM is estimated at 2,415 individuals.
Sperm whale	*Physeter macrocephalus*	ESA (E), MMPA	Distributed worldwide, but generally prefer waters deeper than 1,641 ft (500 m).	Occurs in deep waters throughout the oceanic GOM; therefore, the species is not expected to occur in the Project area. The population of the GOM stock is estimated to be 763 individuals.

Table 1:	**Marine Mammals Occurring in the Northern Gulf of Mexico**			
Common Name	**Scientific Name**	**Protection**	**Occurrence**	**Abundance and Occurrence in the GOM**
Spinner dolphin	*Stenella longirostris*	MMPA	Distributed worldwide in tropical to temperate oceanic waters. In the northern GOM, the spinner dolphin is located generally east of the Mississippi River.	Occur throughout the oceanic GOM; documented sightings are in the eastern GOM and at depths greater than 328 ft (100 m). The best abundance estimate for the northern GOM is estimated at 11,441 individuals. The species is not expected to occur in the Project area, given that documented occurrences are in the eastern GOM.
Striped dolphin	*Stenella coeruleoalba*	MMPA	Distributed worldwide in tropical to temperate oceanic waters. In the northern GOM the striped dolphin prefers oceanic waters.	Occur throughout the oceanic GOM; given the occurrence within oceanic (not continental shelf) waters, this species is not expected to occur in the Project area. The best abundance estimate (from 2009) for the GOM is estimated at 1,849.
Sowerby's beaked whale	*Mesoplodon bidens*	MMPA	Prefers northern temperate waters of the northern Atlantic. In the GOM considered extralimital due to only 1 reported stranding throughout its history.	The Western North Atlantic stock ranges from New England waters up to the ice pack but is considered rare in Canada. Sightings have occurred south to the central-eastern coast of Florida, along the shelf edge and deeper waters. One stranding record for the west coast of Florida in 1989. As the species is considered extralimital to the GOM and does not occur over shelf waters where known, it is not anticipated in the Project area.
ORDER SIRENIA (SEA COWS)				
Florida manatee	*Trichechus manatus latirostris*	ESA (E), MMPA	Distributed throughout the northeastern GOM. Prefers riverine and shallow nearshore waters where temperatures are above 63 degrees Fahrenheit (°F) with abundant seagrasses, water hyacinth, and aquatic weeds.	May occur in nearshore waters in the Project area. The range-wide population of this species is estimated at 1,300 individuals.
Sources: Fulling et al. 2003, Byrnes et al. 2017, Hayes et al. 2017a,b, NMFS 2012, 2018a, USFWS 2019a, Waring et al. 2011, 2013, 2015, 2016				

3.1 Atlantic Spotted Dolphin

The Atlantic spotted dolphin (*Stenella frontalis*) is common in the northern GOM, where it is found in shallow continental shelf waters (32 ft [10 m] deep) down to slope waters less than 1,640 ft (500 m) deep. The species occurs in two forms that may be distinct sub-species; however, only the larger, heavily spotted form is known to occur in the GOM. Evidence has further supported predominantly independent populations within the GOM, one of which primarily occupies the shelf waters from the Texas/Mexico border to the Florida panhandle, and the other of which is concentrated over the western shelf of Florida (see Figure 1). The current population size is unknown, but abundance estimates from data through 2004 included 37,611 individuals in the northern GOM (Waring et al. 2016).

3.2 Bottlenose Dolphin

The bottlenose dolphin (*Tursiops truncatus*) is commonly found in most tropical, temperate, and sometimes cooler waters across the world. Within the GOM, bottlenose dolphins are classified as one of 36 different stocks according to their habitat and general location. The various stocks occur in bays/estuaries, coastal areas, on the continental shelf, and in oceanic waters. The two stocks most likely to occur in the nearshore and Offshore Project waters include the Western Coastal Stock and the Continental Shelf Stock. The two stocks most likely to occur in the inshore waters of the Project area include the Copano/Aransas/San Antonio/Redfish/Espiritu Santo Bay and the Nueces Bay/Corpus Christi Bay Estuary Stock.

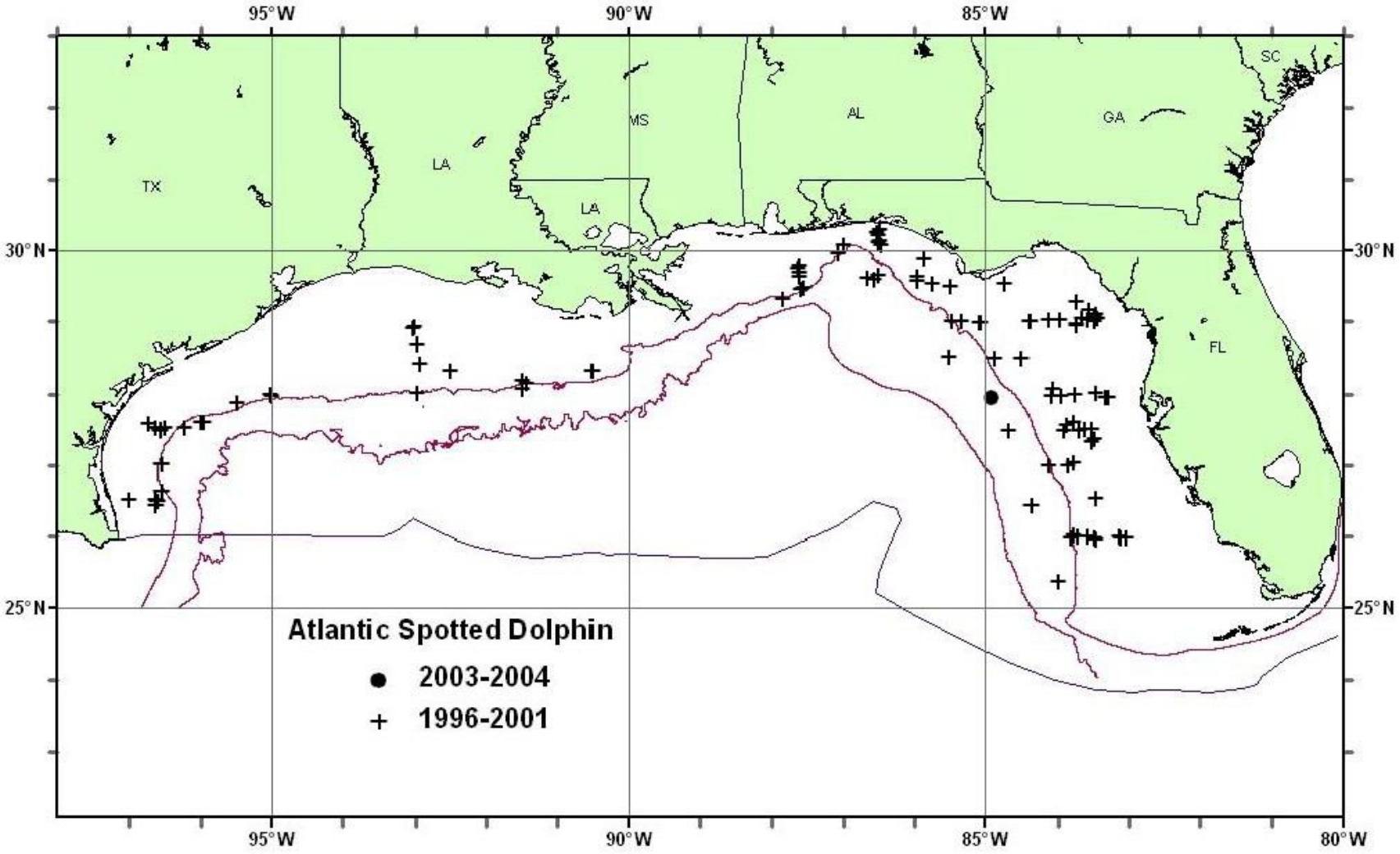
The Western Coastal Stock is defined as those dolphins that occur between the shore, barrier islands (in this case Mustang and San Jose Islands), or outer bay boundaries, out to the 66-ft (20-m) isobath from the Texas/Mexico border to the Mississippi River delta (see Figure 2). The Continental Shelf Stock includes those dolphins occurring between the 66-ft (20-m) and 656-ft (200-m) isobaths across the entire northern GOM (see Figure 3). The degree of overlap between the two stocks is unknown, but genetic studies have shown significant differences between them. The best population estimates for these two stocks are 20,161 animals (Western Coastal Stock) and 51,192 animals (Continental Shelf Stock). Neither stock is considered "strategic" under the MMPA, which indicates that human-caused mortality does not exceed the potential biological removal level (i.e., human-caused mortalities do not preclude a stock's ability to reach or maintain its optimum sustainable population (Waring et al. 2016).

In addition to nearshore and offshore stocks, bottlenose dolphins distributed throughout the bays, sounds, and estuaries of the GOM have been identified as 31 individual stocks. These inshore stocks are generally believed to have year-round residencies in their respective estuarine waters with limited or no interbreeding and intermixing between stocks; recent analysis indicates that there may also be multiple, demographically-independent populations within a given estuarine stock, particularly those in larger bays and estuaries. Resident animals are also believed to have limited movements through passes to the GOM. The best population estimates for these two stocks are 55 animals (Copano/Aransas/San Antonio/Redfish/Espiritu Santo Bay) and 58 animals (Nueces Bay/Corpus Christi Bay). NMFS considers 30 of the 31 inshore stocks (all but the Sarasota Bay/Little Sarasota Bay stock) to be strategic stocks based on their small/unknown populations, which indicates that a relatively few mortalities and serious injuries could exceed the potential biological removal level (NMFS 2018a).

3.3 Rough-toothed Dolphin

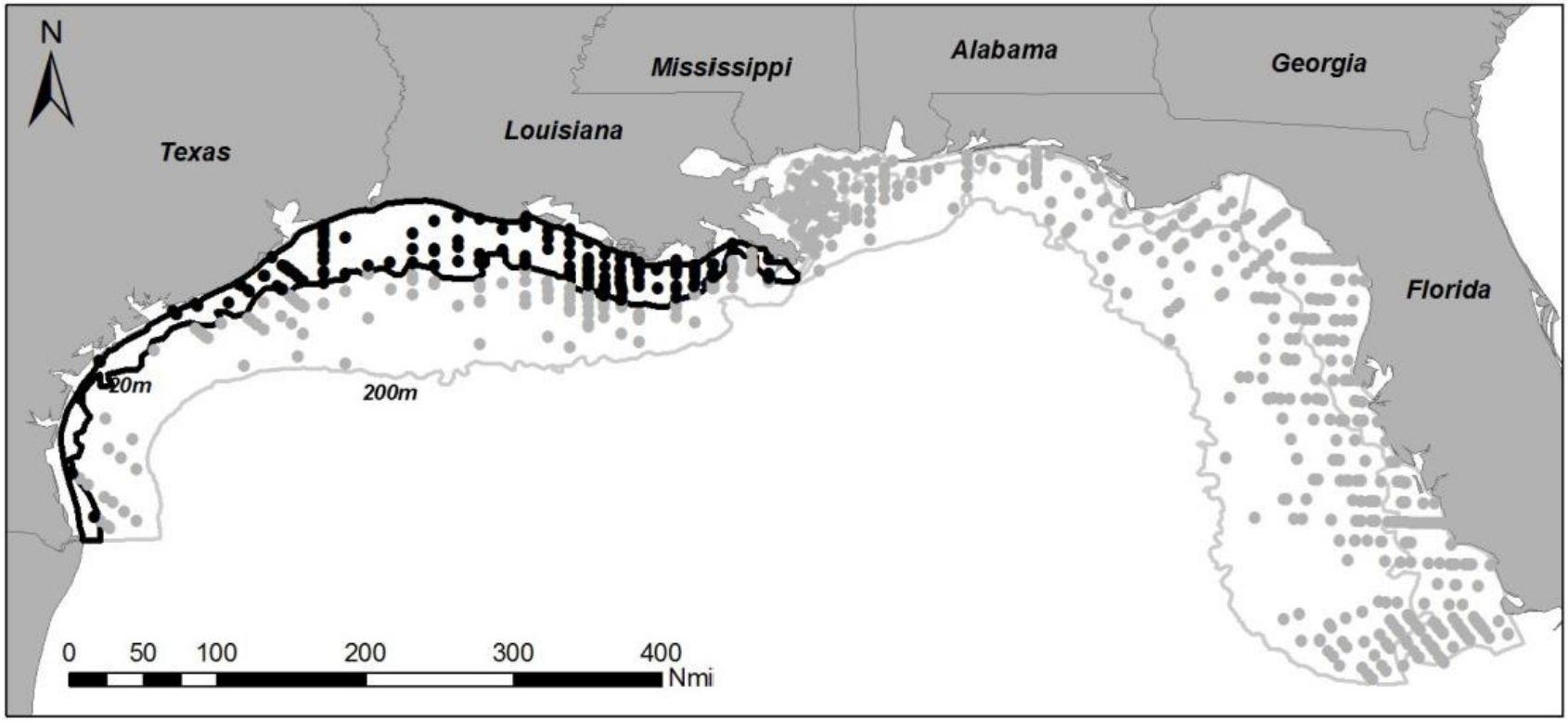
The rough-toothed dolphin (*Steno bredanensis*) is distributed throughout the world in tropical to warm temperate oceanic waters, and to a lesser extent within continental shelf waters (see Figure 4; Hayes et al. 2017a). The GOM population is considered its own management stock, although there is currently no information to identify differentiation from the Atlantic stock, nor to determine if there is more than one GOM stock. The current northern GOM stock is estimated at 624 individuals. Generally, the rough-toothed dolphin prefers northern GOM waters, with depths averaging 640 ft (195 m) (Hayes et al. 2017a). Although this species may occur in shelf waters, its preferred depths make it unlikely to occur with any regularity in the immediate Project area.

Figure 1: Distribution of Atlantic Spotted Dolphins Sighted During 1996-2004



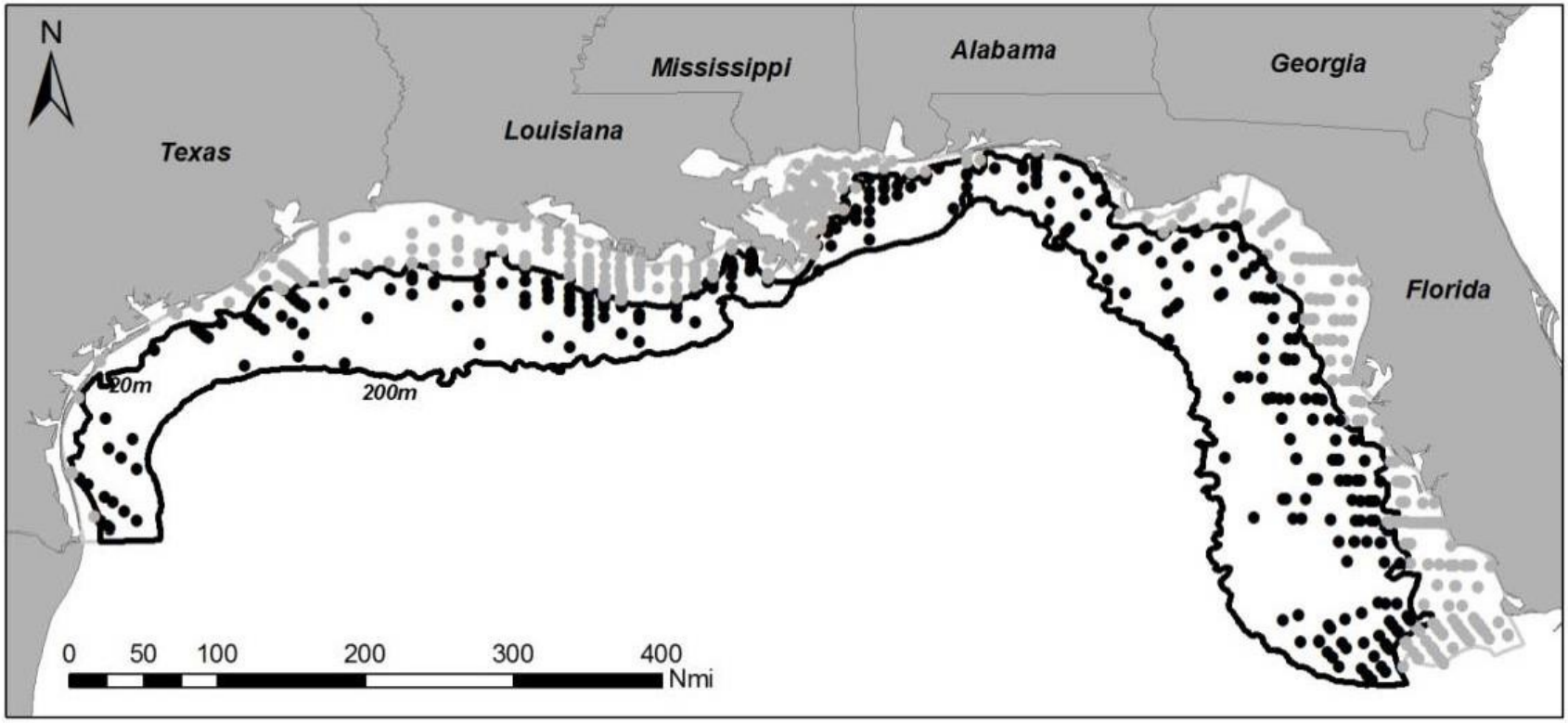
Source: Waring et al. 2016

Figure 2: Distribution of the Western Coastal Stock of Bottlenose Dolphins 2011-2012



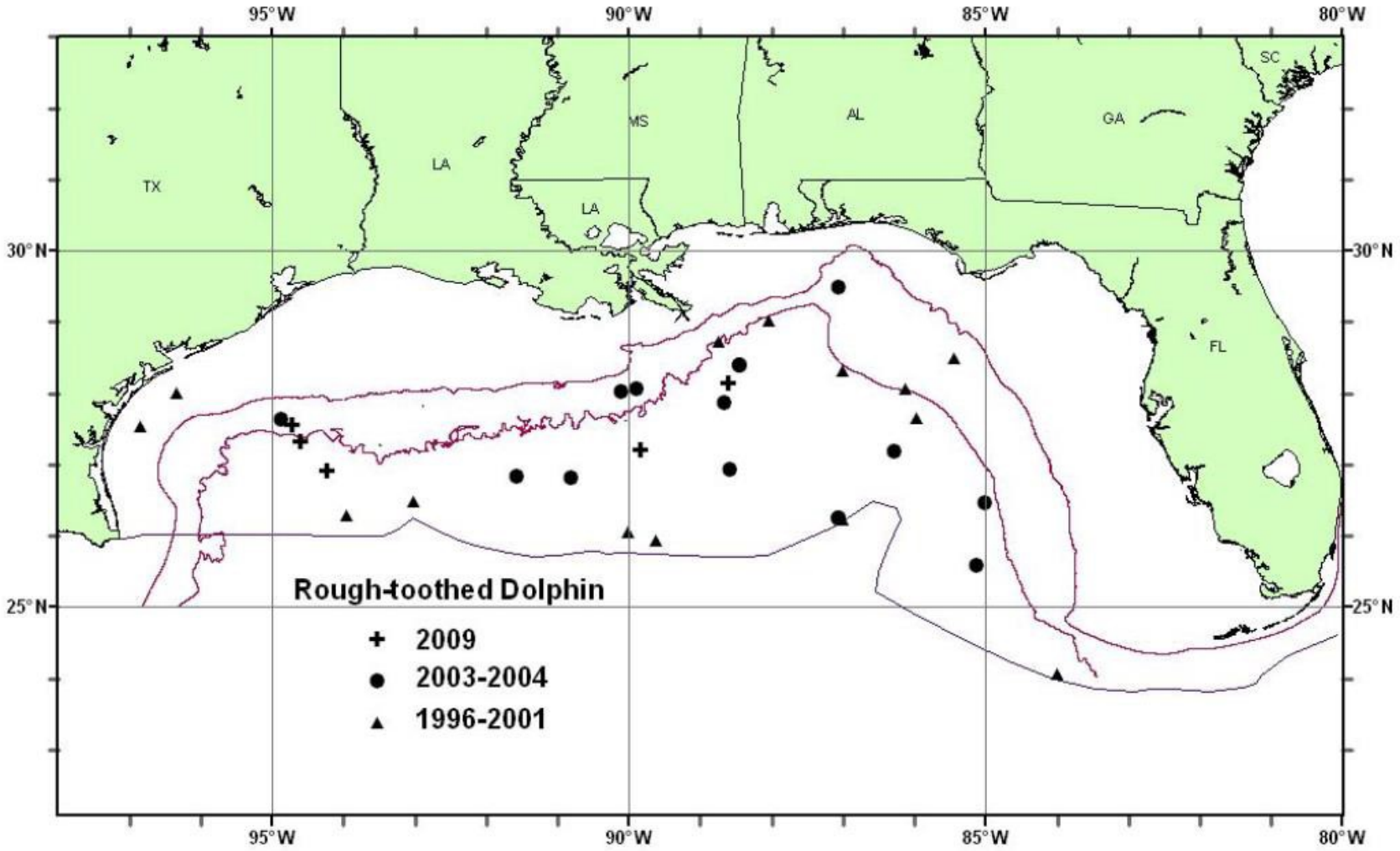
Source: Waring et al. 2016

Figure 3: Distribution of the Continental Shelf Stock of Bottlenose Dolphins 2011-2012



Source: Waring et al. 2016

Figure 4: Distribution of the Rough-toothed Dolphins Between 1996 and 2009



Source: Hayes et al. 2017a

3.4 Marine Mammal Species Not Anticipated to Occur in the Project Area

Of the remaining species listed in Table 1, none are expected to occur in the vicinity of the Project due to depth preference and/or known range, as identified in Table 1. These species include:

- Blainville's beaked whale
- Clymene dolphin
- Cuvier's beaked whale
- Dwarf sperm whale
- Gervais' beaked whale
- Killer whale
- Fraser's dolphin
- Melon-headed whale
- Pantropical spotted dolphin
- Pygmy killer whale
- Pygmy sperm whale
- Risso's dolphin
- Short-finned pilot whale
- Sowerby's beaked whale
- Spinner dolphin
- Striped dolphin
- False killer whale
- Minke whale

4 Impacts on Marine Mammals from the Proposed Project

4.1 Construction

As discussed in Section 3: Project Description and Framework for Environmental Evaluation, the environmental consequences of the Proposed Project will vary in duration and significance. Four levels of impact duration were considered: temporary, short-term, long-term, and permanent. Temporary impacts generally occur during construction, with the resource returning to pre-construction conditions almost immediately afterward. Short-term impacts are considered to be those that may continue for up to 3 years following construction. Impacts are considered long-term if the resource will require more than 3 years to recover. A permanent impact could occur as a result of any activity that modified a resource to the extent that it will not return to pre-construction conditions during the life of the Proposed Project, such as within the footprint of Project. When determining the significance of an impact, we consider the duration of the impact, the geographic and biological context in which the impact will occur, and the magnitude and intensity of the impact. The duration, context, and magnitude of impacts vary by resource and therefore significance varies accordingly. Refer to Appendix A: Construction, Operation and Decommissioning Procedures, for a detailed description of techniques, procedures, and phases of the Proposed Project that were used to evaluated environmental consequences in the following sections.

4.1.1 Inshore

Marine mammals with the potential to occur in inshore waters are limited to the common bottlenose dolphins and the Florida manatee. As a species listed under the ESA, the Florida manatee is discussed in Section 5.

The Inshore Pipelines will be constructed using a combination of HDD and open-cut methods. All open water areas within inshore habitat will be crossed using HDD construction methods; this method will result in impacts at the

entry and exit points of the drill, which are located at upland locations, but will generally avoid impacts between the two points. As direct impacts on open water areas and shorelines will be avoided by HDD construction methods, impacts on seagrasses, oyster beds, and aquatic wildlife and protected species will also be avoided.

Although HDD construction generally minimizes impacts on sensitive resources, there is the potential for an inadvertent return of drilling fluids, during which HDD drilling mud forces through fractures in the overlying material and discharges to the surface. As the drilling fluid will follow the path of least resistance, fluids may come to the surface over the Inshore Pipelines, or in a nearby area. Although an inadvertent return is possible, HDD drilling mud is a benign, non-toxic substance composed primarily of bentonite clay and would result in temporary and negligible impacts on any marine mammals present. The substance is denser than seawater and will settle on the seafloor after discharge, resulting in an increase in localized turbidity. In the case of any inadvertent return, Bluewater Texas Terminal, LLC (BWTT) will implement its Project-specific HDD Inadvertent Returns Contingency Plan, which includes measures to prevent, detect, and mitigate for inadvertent releases of drilling fluid. Although small vessels may be used within inshore waters to monitor for potential inadvertent returns, BWTT will restrict vessels in shallow waters to airboats, johnboats, shallow water boats, or trolling motors to avoid impacts on seagrasses from propeller scars, as recommended by Texas Parks and Wildlife Department (TPWD).

4.1.2 Offshore

4.1.2.1 Offshore Pipeline Installation

The most sensitive portion of the Offshore Pipelines route is near shore, where it passes through shallow water and makes landfall on San Jose Island. To avoid impacts on the coast of the barrier island, the Offshore Pipelines will be installed by HDD, avoiding the shoreline of San Jose Island, and the adjacent shallow waters to a point about 3,900 ft (1,189 m) offshore of the shoreline. From this point, the Offshore Pipelines will cross soft-bottom habitats to the terminus at pipeline end manifold (PLEM) 2, about 17.0 miles (mi) (27.4 kilometers [km]) offshore. Offshore Pipeline installation will be completed using a submersible pipeline jetting sled operated from an anchored pipe laying barge, and will occur over an estimated 5-month period for both pipelines, including pipelaying, jetting, and tie-ins. The pipelines will be buried a minimum of 3 ft (0.9 m) below the sediment surface. Operation of the sled will redeposit some material over the pipeline, but full backfilling will occur naturally.

Installation of the proposed Offshore Pipelines in soft-bottom habitat will produce a turbidity plume within the immediate vicinity of construction. Turbidity refers to the insoluble, suspended particulates that impede the passage of light through water by scattering and absorbing light energy. Suspended sediments resettle following disturbance; coarser sediments generally fall out and resettle quickly, while finer sediments generally remain suspended for longer periods of time, and thus may travel farther from the Project workspaces. As previously discussed, the only marine mammals expected to occur in the vicinity of the Offshore Pipelines are dolphins. Dolphins are highly mobile and are unlikely to be adversely affected by localized increases in turbidity and sedimentation. As such, these impacts are anticipated to be temporary and negligible.

4.1.2.2 Deepwater Port Pile-Driving and Installation

The seafloor in the Offshore Project area is a soft-bottom environment; no hard bottom habitat is present within the Project area. To minimize impacts associated with offshore construction, the SPM buoy systems and associated components will be fabricated onshore and delivered to the site by barge; fabrication will occur at controlled facilities in various countries depending on the vendor selected during final design. Similarly, 24 anchor piles will be prefabricated on land prior to installation by industry acceptable practices at the offshore location. Once installed, the anchor chains will be attached to the piles, and subsequently to the applicable SPM buoy. In addition, 10 PLEM foundation piles will be prefabricated on land and installed offshore to anchor the applicable PLEM to the seafloor. These construction activities will be of limited duration and are not anticipated to cause long-term adverse effects to the biological community.

Construction and installation of the SPM buoy systems components will result in an increase in turbidity in the water column within and adjacent to the Project footprint; however, this effect is expected to be localized and limited to the time of facility placement. Deposition of suspended sediments in soft-bottom habitats is expected to occur over a short distance from active construction and cover a small area relative to the total habitat available. Overall, the increased turbidity and sedimentation is considered a temporary and negligible impact given the extent of locally available soft-bottom and water column habitat.

Some installation activities will continue 24 hours a day and require continuous lighting. Lights in the form of navigational beacons will also be required. Although lighting may attract fishes, and their predators, to the construction area, resulting impacts are expected to be temporary and negligible.

4.1.2.3 Noise Effects

Temporary underwater noise during construction will result from installation of the pipelines (including vessel activity and jetting to bury the Offshore Pipelines after they are laid on the seafloor) and construction of the SPM buoy systems (including vessel activity and pile-driving). Underwater noise may be generated by continuous sources, such as vessels in transit, and short, intense (impulse) sources, such as pile-driving.

4.1.2.3.1 FUNDAMENTALS OF UNDERWATER SOUND

Sound is a physical disturbance in a medium, such as air or water, which can be detected by a human or animal ear. Sound pressure levels (intensity) are measured in units of decibels (dB) with respect to a reference pressure value on a logarithmic scale; the reference pressure in water is 1 micro Pascal (µPa) at 1 m.

Sound travels much faster through water than through air (about 1,500 meters per second [m/s] in water and about 330 m/s in air) (OSPAR Commission 2009). As sound spreads away from the source, the acoustic intensity is reduced. The difference between the measured sound pressure level at the source and at a receiver some distance away is known as transmission loss (OSPAR Commission 2009). The way that sound travels away from a source may be affected by water depth, bathymetry, salinity, and temperature (OSPAR Commission 2009).

The root mean squared (RMS) sound pressure is the standard measurement used for continuous underwater sound (Hildebrand 2009). The RMS exposure level represents the effective pressure and intensity produced by a sound source; it is the square root of the average squared pressures over the duration of a pulse. Impulsive sounds, such as pile-driving, may be presented as the peak sound pressure level (the largest absolute value of instantaneous sound pressure). To measure exposure to a sound over time, sound exposure level (SEL) incorporates both the sound level and duration. The cumulative SEL (SEL_{cum}) measures the sound energy accumulated over a period of time.

4.1.2.3.2 AMBIENT UNDERWATER SOUND

Ambient underwater sound sources in the GOM and inshore waters include natural sources (such as wind-driven waves, , tidal currents, and marine mammals) and anthropogenic (manmade) sources. Anthropogenic underwater noise in the GOM originates from a variety of activities including shipping traffic, seismic surveys, explosions (such as from platform removal), and oil and gas production and development (BOEM 2012). Similarly, anthropogenic noise is inshore waters is likely to be generated by vessel traffic in the Gulf Intracoastal Waterway (GIWW) and the smaller local channels. As with airborne noise, ambient underwater noise varies over time due to changes in the intensity and abundance of noise sources. In addition, noise generated from each of these sources may be transient, or may occur over an extended time.

Vessel traffic generates low-frequency sounds that can travel considerable distances; ambient underwater sound in the 10 to 500 hertz (Hz) range is mostly due to vessel traffic (Tyack 2008, Hildebrand 2009). Ambient sound in the mid-frequency range of 500 to 25,000 Hz is primarily due to sound from breaking waves, bubble formation and collapse, and spray; the intensity of sound in this frequency range increases with wind speed (Tyack 2008, Hildebrand 2009). Higher frequency sounds attenuate quickly and are primarily generated by thermal sound,

which is the sound of the random movement of water molecules (Hildebrand 2009). Biological sounds associated with a host of mammals, fishes, and invertebrates can generate noise in a broad frequency range, from 1 to > 100,000 Hz (Simmonds et al. 2004). For example, echolocation clicks of the bottlenose dolphin are in the high-frequency range (110,000 to 130,000 Hz), while blue whales emit low-frequency calls (10 to 15 Hz; Simmonds et al. 2004).

Noise produced by ships is the dominant source of anthropogenic sound in the sea (Tyack 2008). Vessel sound is primarily generated by propeller cavitation (the formation of air bubbles, followed by their collapse), propulsion machinery (engine noise), the flow of water over the hull, and flexing of the hull (Marine Mammal Commission 2007). Vessel traffic is concentrated along major commercial shipping lanes and near major ports, and sound generated by vessel traffic is transient at any given location. However, low-frequency sounds, such as those generated by large ships, can propagate great distances with little attenuation (Marine Mammal Commission 2007, Hildebrand 2009). Therefore, shipping sound contributes to ambient noise across ocean basins (Hildebrand 2009). Vessels in the Project area may include commercial vessels in the GOM traveling along shipping fairways or calling at the nearby Port of Corpus Christi (POCC), commercial vessels traveling in the GIWW across inshore waters, and smaller, recreational boats in both the inshore bays and the GOM.

The intensity of sound produced by vessels is generally greater for larger ships, and as vessel speed and load size increases. In addition, larger vessels produce sound in a lower frequency range than small boats. Typical sound levels range from 150 dB re: 1 µPa for tugboats to between 185 and 190 dB re: 1 µPa for a supertanker (Jasny 2005). The contribution of shipping to ambient noise in the ocean has increased by between 10 and 12 dB over the past few decades (McDonald et al. 2006, Andrew et al. 2002). While these data were not collected in the GOM, similar ambient noise increases have likely occurred due to global increases in commercial shipping (BOEM 2012).

While shipping is the predominant source of anthropogenic underwater sound, other sources may include marine seismic surveys, explosions, and oil and gas development (such as the operation of platforms). Marine seismic surveys use an air-gun or air-gun array to generate an energy wave that, when directed at the ocean floor, creates a pattern of reflected waves that map layers below the ocean surface. Sound generated by seismic surveys are in a range of 215 to 255 dB re: 1 µPa, with the majority of sound generated in the low-frequency range, as summarized by Simmonds et al. (2004). The removal of offshore structures using explosions generates sudden, impulsive sound; peak broadband sound levels measured for underwater explosions are near 280 dB re: 1 µPa (Simmonds et al. 2004). While blasting is not planned for the Proposed Project, the practice is used for other ongoing projects in the GOM.

Underwater sounds generated from the operation of fixed structures, such as oil and gas platforms common in the GOM, are estimated to range between about 20 and 40 dB above background levels within the low (30-300 Hz) frequency range at a distance of about 100 ft (31 m) from the structure (Gales 1982). Since equipment is placed on above-water decks and the surface area of the platform in contact with the water is limited, underwater sound from platforms on metal legs is expected to be relatively low (BOEM 2012). Helicopters used to transport supplies and workers to offshore oil and gas facilities also generate underwater sound; however, most sound is reflected by the surface of the ocean and noise from helicopters is transient (Richardson et al. 1995). Underwater sound levels range from 101 to 109 dB re: 1 µPa, and helicopter sound has been documented to be detectible for less than 1 minute under water (Richardson et al. 1995).

NMFS recognizes the sound level for “effective quiet” or the safe exposure level at which risks for impacts on marine organisms are low (NMFS 2018b). While defining the sound level of effective quiet for all species groups is not possible due to a lack of available data, we have assumed a conservative level of 150 dB re 1µPa SEL (NMFS 2018b). While measurements of background sound levels are not available in the Project area, we assume that sound from construction of the Project below the 150 dB level of effective quiet will not harass marine organisms.

4.1.2.3.3 CONTINUOUS NOISE

Installation of the Offshore Pipelines in the GOM will be conducted by jetting, using a pipe laying barge and support vessels. Underwater pipeline installation will progress along the route such that construction at any one location is of short duration, and pipe laying may occur up to 24 hours per day. Underwater sound levels from pipe laying have been measured to be a mean of 130.5 dB re: 1 µPa at a distance of 0.9 mi (1.5 km); that measurement includes a pipe laying fleet of nine vessels and is similar to the sound levels generated by other commercial vessels (Johansson and Andersson 2012). Installation of the Offshore Pipelines will require a pipe laying barge and 2 to 3 support vessels and is therefore expected to produce a lower sound level. Sound levels associated with vessels used for underwater trenching have been shown to be similar to sound generated by other commercial vessels (Johansson and Andersson 2012). The Project is in an area subject to noise impacts by commercial vessels operating in the shipping fairways in the GOM. Underwater HDD activity offshore of San Jose Island may cause transient underwater noise in the immediate vicinity of the pipelines; however, underwater noise will be limited to the 8-week HDD construction period. Because the underwater sound levels associated with installation of the pipelines will be temporary, limited to the period of active construction, and consistent with similar activity in the Project vicinity, underwater noise impacts will be minor.

The most prevalent sources of continuous underwater sound associated with installation of the SPM buoy systems will be the vessels used for construction, during construction activity and transit. Construction vessels will be in the 164 - 328 (50 – 100 m) size class, and sound levels for each vessel will likely range between 160 and 180 dB re: 1 µPa (Richardson et al. 1995, OSPAR Commission 2009).

Vessel traffic will temporarily increase during construction of the SPM buoy systems for the transportation of supplies and construction crews over the 16-week-long construction period for the SPM buoy systems and components. Given the amount of vessel traffic in the GOM, the noise associated with construction and supply vessels transiting to the offshore facilities will have a negligible contribution to total ambient underwater sound levels. Similarly, nearshore vessel activity will be generally concentrated in established shipping channels and near industrial port areas and will be consistent with the existing noise environment in those areas. Therefore, impacts from underwater sound due to Project construction, including vessel activity, will be negligible and are unlikely to affect biological resources in the Project area.

4.1.2.3.4 IMPULSIVE SOUNDS

Pile-driving will be used for installation of 24 anchor piles for the SPM buoy systems and 10 PLEM foundation piles, and will occur in depths of approximately 88.5 to 89.5 ft (27.0 to 27.3 m). The intensity of sound produced during pile-driving is dependent on the material and size of the pile, depth of water, and method of pile- driving. The 10, 18-inch (0.5-m)-diameter piles and 24 72-inch (1.8-m)-diameter piles are anticipated to be required for the Project and all be installed using an impact hydraulic hammer for the anchor piles of the SPM buoys. Pile-driving will occur over the 16-week installation timeframe for the SPM buoy systems, and only one pile will be driven at a time.

NMFS has established thresholds for physical and behavioral effects of underwater noise due to sound generated from pile-driving activity on marine mammals (NMFS 2018b, c, d). Effect levels for marine mammals are based on hearing groups, which have different generalized hearing frequency ranges; low-frequency (baleen whales) and mid-frequency (dolphins, toothed whales, beaked whales, bottlenose whales) cetaceans could occur in the vicinity of pile-driving (NMFS 2018b). Table 2 summarizes the Project-related pile-driving sound level impacts and these behavioral effects levels.

Table 2: Estimated Sound Levels from Underwater Pile-Driving and Effects Levels for Marine Mammals			
Pile-driving Activity or Effect Level	**Cumulative Sound Exposure Level (SEL) (dB re 1 µPa²s)**	**Root Mean Square Sound Level (dB RMS) (dB re 1 µPA)**	**Peak Sound Level (dB re 1 µPA)**
18-inch-diameter concrete piles at 33 ft (10 m) away	155[a]	166	185
72-inch-diameter CISS piles at 33 ft (10 m) away	182[a]	189	214
Marine Mammals			
Low-frequency cetaceans (baleen whales)			
Injury (Temporary Threshold Shift for impulsive/non-impulsive noise)[b,c]	168/179	--	213/ --
Injury (Permanent Threshold Shift for impulsive/non-impulsive noise)[b,c]	183/199	--	219/ --
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)			
Injury (Temporary Threshold Shift for impulsive/non-impulsive noise) [b,c]	170/178	--	224/ --
Injury (Permanent Threshold Shift for impulsive/non-impulsive noise)[b,c]	185/198	--	230/ --
All species			
Marine Mammal Behavioral Effects (impulsive/non-impulsive noise)[a]	--	160/120	--

[a] These measurements are single strike SELs, rather than cumulative levels.

[b] Use of impact hammers is considered impulsive noise; other continuous sound is considered non-impulsive noise.

[c] The injury threshold is the general level for temporary threshold shift (TTS) or PTS onset for cetaceans by hearing frequency group as identified by NMFS (2018b); however, threshold shifts are influenced by the frequency of noise received and a cumulative sound exposure exceeding this level may not cause a threshold shift if outside the range of hearing.

Source: NMFS 2018, b, c, d

By using a standard transmission loss constant (15 dB) to account for attenuation over distance, as defined by NMFS, a zone of influence (ZOI), the area in which pile-driving sound exceeds the thresholds, was identified for pile-driving related impacts on each species group. The ZOIs were calculated using the estimated sound levels for the 72-inch (1.8 m)-diameter proxy piles, which will have a greater sound level impact than the smaller 18-inch (0.5-m)-diameter piles and are therefore a conservative estimate of Project impacts. Table 3 identifies the distance at which sound levels from pile-driving will attenuate to the effects levels described in Table 2. Impacts by species are included below. Figure 5 depicts the estimated ZOIs for injury and behavioral effects on marine mammals. Additional discussion on the method of calculating the ZOIs is provided in Attachment A: Marine Mammal Noise Calculations, which further discusses NMFS-developed methodologies for calculating impacts.

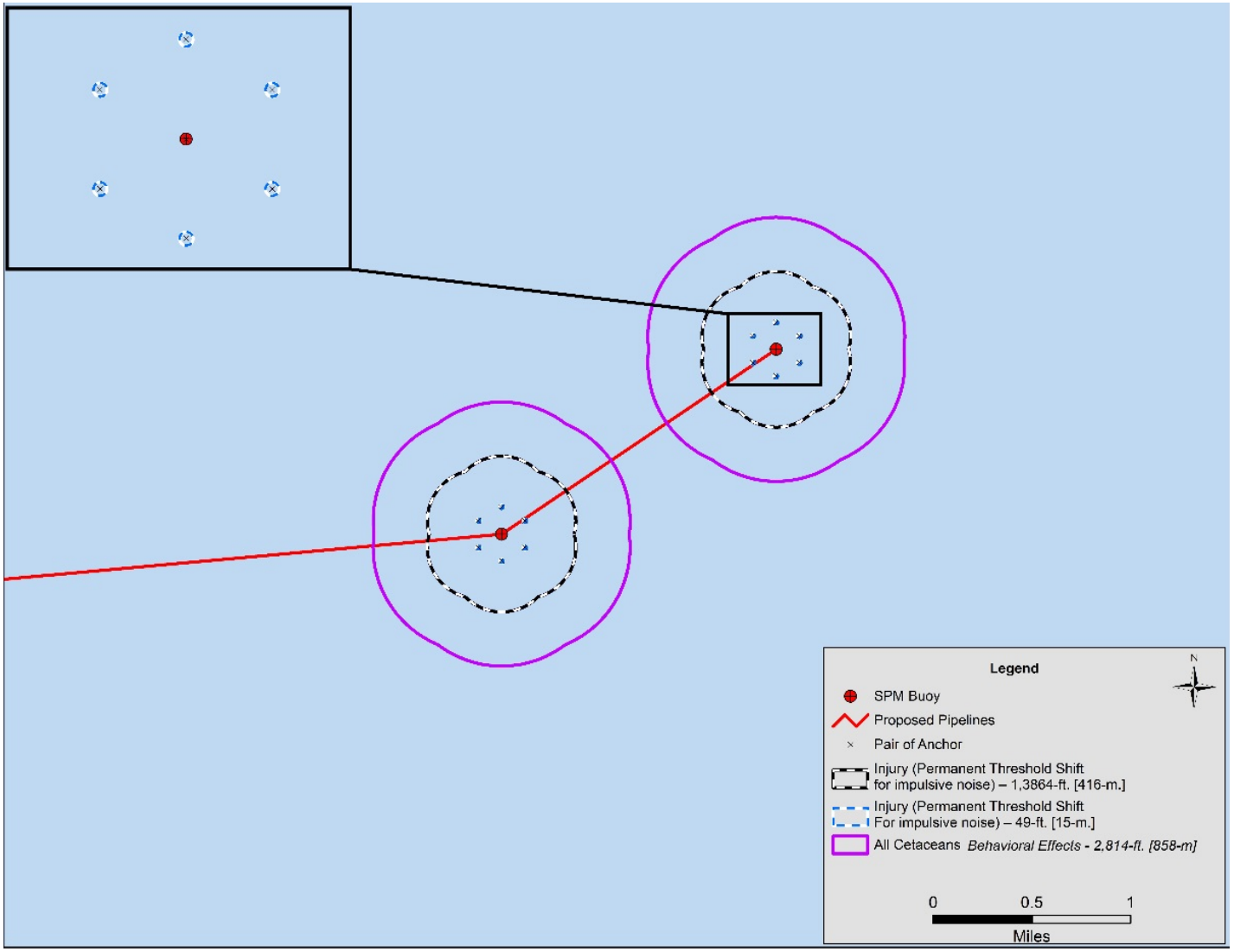
Table 3: Estimated Zone of Influence for Sound Levels from Underwater Pile-Driving for Marine Species without Noise Abatement

Pile-driving Activity or Effect Level	Zone of Influence for Impulsive Sounds (ft [m])[a]		
	Cumulative Sound Exposure Level (SEL) (dB re 1 µPa²s)	Root Mean Square Sound Level (dB RMS) (dB re 1 µPA)	Peak Sound Level (dB re 1 µPA)
Sea Turtles			
Sea Turtle Injury	1,172 (357)		112 (34)
Sea Turtle Behavioral Effects	--	2,814 (858)	--
Marine Mammals			
Low-frequency cetaceans (baleen whales)			
Injury (Temporary Threshold Shift for impulsive noise)[a]	NA	--	NA
Injury (Permanent Threshold Shift for impulsive noise)[a]	1,364 (416)	--	16 (5)
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)			
Injury (Temporary Threshold Shift for impulsive noise)[a]	NA	--	NA
Injury (Permanent Threshold Shift for impulsive noise)[a]	49 (15)	--	NA
All species			
Marine Mammal Behavioral Effects (impulsive noise)	--	2,814 (858)	--
Fish			
Injury Onset (all sizes)	--	--	112 (34)
Injury Onset (>2 grams)	1,172 (357)	--	--
Injury Onset (<2 grams)	2,165 (660)	--	--
Behavioral Effects		13,061 (3,981)	

[a] The injury threshold is the general level for temporary or PTS onset for cetaceans by hearing frequency group as identified by NMFS (2018a); however, threshold shifts are influenced by the frequency of noise received and a cumulative sound exposure exceeding this level may not cause a threshold shift if outside the range of hearing.

Source: NMFS 2018a,b,c; NMFS 2019

Figure 5: Zones of Influence for Effects on Marine Mammals due to Pile- Driving



Source: NMFS 2018, b, c, d

In addition to pile-driving, the SPM buoy is required to be equipped with a nautical hazard prevention device, or a foghorn; requirements for foghorns are detailed in 33 Code of Federal Regulations (CFR) 67. The foghorn will be mounted to the top of the SPM buoy approximately 16.5 ft above the surface of the water. It will produce intermittent sound (likely a two-minute blast followed by 18 seconds of silence) and may produce source levels of 134 decibels on the A-weighted scale (dBA) at 1 m. Using standard sound attenuation over distance, and assuming no attenuation due to damping, we estimate that in-air sound could be perceived as moderate to loud up to 0.5-mi from the SPM buoy but will attenuate over distance (see Table 4).

Table 4: Estimated Fog Horn Sound Levels at Select Distances

Equipment	Sound Pressure Level (SPL) (dBA) at 1 m (3.3 ft)	SPL (dBA) at 500 ft	SPL (dBA) at 1,000 ft	SPL (dBA) at 0.5 mi	SPL (dBA) at 17.0 mi (27.4 km)
Foghorn	134	90	84	76	45

4.1.2.3.5 NOISE IMPACTS

Installation of the proposed pipelines and SPM buoy systems will result in an increase in airborne and underwater noise, which will be most pronounced at the sites of the HDDs on San Jose Island, and at the SPM buoy systems, about 17.0 mi (27.4 km) offshore. Sources of continuous noise, such as underwater pipeline installation and vessel activity, will have a negligible contribution to total ambient underwater sound levels, as described above. Noise from support vessels (and vessels in general) are dependent on the size and speed, with larger, faster vessels creating more noise (BOEM 2017). Although increases in underwater noise from transiting vessels could mask important biological sounds, they will be temporary in nature. Therefore, impacts from and underwater sound due to these continuous sources will be negligible and are unlikely to result in temporary noise levels that are injurious to marine species. However, impulsive sound from pile-driving will exceed thresholds established by NOAA for the protection of marine mammals.

Sound is important to marine mammals, and noise can result in a variety of behavioral and physical effects. Noise associated with pile-driving can adversely affect marine mammals if the sound is very loud or occurs close to them. Noise from pile-driving will be audible to marine mammals in the Project vicinity. Noise created by pile-driving at the SPM buoy systems is expected to be approximately 182 dB re 1 µPa SEL with a peak sound level of 214 214 dB re 1 µPa without mitigation, which is above the levels of harassment and injury designated by NMFS for the protection of marine mammals.

Underwater pile-driving will exceed the thresholds for injury (permanent threshold shift [PTS]) on mid-frequency cetaceans (including dolphins, as well as toothed, beaked, and bottlenose whales) within a ZOI estimated to extend about 49 ft (15 m) from pile-driving activities. BWTT will use biological monitors during pile-driving activities and will cease pile-driving if a marine mammal is identified within the injury zone; pile-driving will not restart until the mammal had left the area of its own accord, thereby avoiding injury. In addition, underwater pile-driving will exceed the thresholds for PTS on low-frequency cetaceans (baleen whales) within a ZOI estimated to extend about 1,364 ft (416 m) from pile-driving activities. However, as it is highly unlikely that these baleen whales will be present on the continental shelf in the vicinity of the Project during the short period of pile-driving (a period of 16 weeks), BWTT believes that the potential for impact on baleen whales through pile-driving noise is so small as to be discountable (negligible).

The threshold for marine mammal behavioral effects will be exceeded in a ZOI extending about 2,814 ft (858 m) from pile-driving activities. As the ZOIs for marine mammal behavioral effects and low-frequency cetacean injury are too large to be effectively monitored, BWTT will ensure proper coordination with NMFS to identify what

additional measures, if any, will need to be implemented during pile-driving to minimize impacts on marine mammals.

In addition to pile-driving, helicopter overflights in close proximity to local marine mammals may elicit a startle response, abrupt dives or turns, or other changes in behavior as the aircraft approaches (BOEM 2017); however, these impacts are anticipated to be temporary and minor. The effects of airborne noise on marine mammals are not widely studied and no thresholds for behavioral effects or injury have been established; therefore, individual responses to intermittent fog horn use is anticipated to be similar to that described for helicopter noise.

4.1.2.4 Construction Vessel Operations

The presence of construction vessels traveling to and from the Deepwater Port (DWP) components could affect the marine mammals through vessel strikes, inadvertent spills of contaminants, and an increase in lost marine debris. Increased vessel traffic increases the likelihood of collision between ships and marine mammals, resulting in possible injury or death to some animals. Most species of non-threatened and non-endangered marine mammals in the GOM are the smaller delphinids that often choose to ride the bow waves of nearby vessels and seem adept at avoiding injury. However, a study by Nowacek et al. (2001) identified changes in the behavior of bottlenose dolphins in the presence of vessels. These behavioral changes included longer interbreath intervals, decreased interanimal distance, changes in heading, and increased swimming speeds.

To minimize the potential for impacts on marine mammals*, Bureau of Ocean Energy Management (BOEM) NTL No. 2016-G01, Vessel Strike Avoidance and Injured/Dead Protected Species Reporting*, will be followed by all Project construction and support vessels. The NTL states that a distance of 148 ft (45 m) or greater should be maintained between vessels and the smaller cetaceans. The NTL also specifies reduced speeds of 10 knots when traveling near groups of cetaceans and a travel path parallel to that of the animals. In compliance with the NTL, vessel personnel will report any sightings of injured or dead marine mammals to the appropriate authorities. Given the high mobility of the dolphin species potentially occurring in the Project area, and with adherence to NTL No. 2016-G01, the increase in vessel traffic associated with port construction is not expected to directly impact non-threatened and non-endangered marine mammals.

Potential spills of construction-related fuels and chemicals can result in adverse impacts to local water quality, which may affect fauna in the immediate vicinity of a spill. Each of the vessels involved in Project construction will operate in accordance with U.S. Coast Guard (USCG) and International Maritime Organization (IMO) International Convention for the Prevention of Pollution from Ships (MARPOL) requirements to minimize the potential for a release of oils and/or chemicals to the GOM. A Project-specific spill response plan will be developed prior to construction, which will identify measures to prevent, contain, and clean up any inadvertent spills. Each vessel operator will monitor its own operations and will have sorbent materials available to contain and clean up a release, should one occur. Therefore, significant impacts related to spills and releases are not anticipated. In the highly unlikely event of a diesel spill, the diesel fuel will immediately begin dissipating. Because diesel fuel is a mixture of relatively light hydrocarbons, spreading, evaporation, dispersion, and dissolution will occur rapidly, and virtually the entire volume of fuel will have dissipated within 12 to 24 hours (ITOPF 2002). Furthermore, no oil or mixtures containing more than 15 parts of oil per million may be discharged within 50 mi (80 km) offshore (MARPOL 73/78).

Marine mammals can ingest or become entangled in marine debris that is lost from fishing vessels and offshore activities associated with oil and gas development. Although up to 49 percent of marine debris is considered to be from land-based sources, incidental debris loss from service vessels and Outer Continental Shelf (OCS) structures also contributes to the debris in the GOM (BOEM 2017). About 13 percent of debris found at Padre Island National Seashore (PINS), south of the Project area, has been attributed to offshore oil and gas activity (Miller et al. 1995). Plastic bags and plastic fragments are the most commonly reported debris items in the digestive tracts of cetaceans. Per U.S. and MARPOL regulations, no solid debris may be discharged from OCS structures and vessels

(30 CFR 250.40 and MARPOL, Annex V, Public Law [P.L.] 100-220 [101 Statute 1458]). To further minimize the potential for lost debris during offshore construction activities, BWTT will adhere to NTL No. 2015-BSEE-G03, Marine Trash and Debris Awareness and Elimination. This NTL states, among other things, that marine discharge of trash and debris is prohibited under 30 CFR 250.300, that prominent placards regarding marine debris and trash disposal be placed in relevant areas, and that offshore employees and contractors must complete marine trash and debris awareness training at the start of employment and annually thereafter. With adherence to the NTL and applicable federal regulations, impacts on protected species from debris lost as a result of Project construction is anticipated to be negligible.

4.2 Operation

Impacts on marine mammals during operation of the Project will generally be limited to the presence of the SPM buoy systems, port calls by the very large crude carriers (VLCCs; 16 per month), the sporadic transit of support vessels and helicopters to and from the offshore port, and the presence of the restricted zones. Once installed, the pipelines will be buried a minimum of 3 ft (0.9 m) below the seafloor; no additional impacts will be incurred during operations. Although not anticipated to occur, a release of petroleum products from the SPM buoy systems or pipelines will also impact the aquatic environment.

4.2.1 Inshore

No impacts on inshore waters, and therefore marine mammals, will occur through operation of the Inshore Project Components as the Inshore Pipelines will be buried under the bed of the bays and channels.

4.2.2 Offshore

4.2.2.1 Deepwater Port Presence

The SPM buoy systems will require operational lighting for 24-hour operations, as well as navigational beacons. Project lighting may cause behavioral changes in nearby marine mammals by attracting them to areas of congregating prey species. This impact is anticipated to be negligible.

4.2.2.2 Noise Effects

Fluids, such as oil and gas, flowing through pipelines generate sound levels that are related to flow velocity. Measurements of a 10-inch-diameter natural gas pipeline conducted by Glaholt et al. indicated gas pipeline noise is of low intensity (2004). While similar data are not available for oil pipelines, sound levels from operation of the pipeline are not anticipated to exceed ambient levels. The pipelines will be buried approximately 3 ft (0.9 m) below the seafloor; burial will have a damping effect on any flow-related sound. Operation of the buried pipelines is not expected to impact ambient underwater sound levels.

While measurements of underwater sound levels from SPM buoys similar to the Proposed Project are not available, underwater sound levels generated by floating production storage and offloading facilities (FPSO), which gather oil and gas from multiple sub-sea wells, store, and offload the product to shuttle tankers, have been quantified. Erbe et al. (2013) estimate the mean underwater sound level associated with FPSOs to be 181 dB re: 1 µPa, which is similar to the sound levels associated with large commercial vessels that operate in the GOM (Richardson et al. 1995). Given the greater scope of activity on an operating FPSO, underwater sound levels generated during Project operations are expected to be almost negligible in comparison. Underwater sounds generated from the operation of fixed structures are estimated to range between about 20 and 40 dB above background levels. The sound levels associated with operation of the Proposed Project are expected to be similar. The underwater noise associated with the Project will result in a permanent, localized increase in noise levels.

Cumulatively, the operational noise will result in a permanent increase in ambient noise levels in the immediate vicinity of the SPM buoy systems, which could result in masking of biologically important sounds and behavioral

modifications to individuals or groups within range, likely in the form of area avoidance. However, impacts are unlikely to result in noise levels that are injurious to marine species.

In addition to continuous operation of equipment at the facilities, intermittent service vessel activity for supply and VLCCs calling at the SPM buoy systems (about 192 times per year) are expected. Noise from vessels will be transient in the immediate Project vicinity, limited to the time when they are approaching, loading, and leaving the SPM buoy systems. A minimum of two support tugs and one hose-handling boat will be present during loading operations at each SPM buoy. Support vessels are expected to be between 279 and 180 ft (55 and 85 m) long. Underwater sound levels of these small ships range from 170 to 180 dB re: 1 µPa at a distance of 1 m (3 ft) (Richardson et al. 1995). VLCCs are expected to be the size of large commercial vessels and supertankers, ranging from about 443 to 1,116 ft (135 to 340 m) long; similarly, sized vessels produce underwater sound levels at low frequencies ranging between 169 and 198 dB: 1 µPa, and can exceed 205 dB re: 1 µPa for broadband sound levels (Richardson et al. 1995). VLCCs that will call at the SPM buoy systems are similar to other vessels operating in the GOM. Further, vessels transiting to the SPM buoy systems will generally use established shipping lanes. No significant increase in vessel traffic is anticipated in the Project area, and therefore underwater noise impacts from vessel traffic during operations will be negligible.

4.2.2.3 Inadvertent Product Releases

The probability of a major crude oil spill is extremely low. The major elements of the Project that could leak crude oil include: the SPM buoy systems, the Offshore Pipelines from shore to the SPM buoy systems, and the flexible hoses connecting the pipelines to the SPM buoy systems and the SPM buoy systems to the loading tankers. At the SPM connection point during connecting/disconnecting operations, the SPM hoses will connect directly to the manifold on the VLCC, thereby minimizing the potential for crude oil residue releases.

In the event of an oil spill, some individual marine mammals would likely be exposed to the resulting oil on the surface, in the water column, and where volatile organic compounds and oil droplets enter the air over unweathered oil. Dolphins and whales have been observed swimming in oil-contaminated waters, and would not necessarily avoid a large spill if it were to occur (Dias et al. 2017). In addition to impacts on marine mammals, a spill could degrade their habitats including the shelf and marine waters of the GOM.

Exposure pathways for marine mammals include inhalation, ingestion, and dermal contact (DWH NRDA Trustees 2016). Marine mammals breathe, rest, and swim at the surface, where the greatest amount of oil would likely occur (DWH NRDA Trustees 2016). Marine mammals near the surface of large oil spills may inhale volatile petroleum compounds, where they are the most highly concentrated (Geraci 1990 in NRC 2003, Takeshita et al. 2017). While foraging in the water column, droplets of oil may be ingested along with contaminated prey; some marine mammals (such as bottlenose dolphins) also forage in sediments, which could become contaminated. When marine mammals pass through floating oil, their skin can become fouled (NRC 2003).

Inhalation of volatile petroleum compounds may result in inflammation and lung congestion (Geraci & St. Aubin 1990 as cited by Dias et al. 2017). Oil that comes into contact with the skin of marine mammals may result in skin and eye irritation, and can foul the baleen of large whales. Ingestion can lead to gastrointestinal injury, vomiting, and absorption of oil into the body tissues (Takeshita et al. 2017). As summarized by Schwacke et al., studies of bottlenose dolphins following the Deepwater Horizon (DWH) oil spill found evidence of poor health, reproductive failure, and increased mortality; health effects included lung disease and an impaired stress response (2017).

Recent research following the DWH oil spill has found that long-term, chronic effects of oil exposure can result in decreased survival and lowered reproductive success (Takeshita et al. 2017). The level, timeframe, and large geographic scale of oil exposure that affected marine mammals during the DWH oil spill would not occur for the worst-case scenario spill for the Project. Further, airborne volatile petroleum compounds, such as benzene, would be dispersed and diluted to low concentrations within a short distance of the oil. If a marine mammal were present during an oil spill, it would be impacted and could sustain impacts as described above; however, the population-

level injury estimated by the DWH Natural Resource Damage Assessment (NRDA) Trustees following that incident would not occur.

4.2.2.4 Support Vessel Mooring and Ancillary Operations

Support vessels will regularly transit from shore to the SPM buoy systems and between the SPM buoy systems and incoming VLCCs. In addition, a minimum of two supply tugs and a hose-handling boat will be on-site at each operating SPM buoy. The presence of additional vessels traveling to and from the DWP components could affect the faunal community through vessel strikes, inadvertent spills of contaminants, and an increase in lost marine debris; however, the potential for these impacts will be mitigated as discussed above and are not anticipated to significantly affect faunal communities.

4.2.2.5 VLCC Transit

The primary threat to marine mammals resulting from vessel transits in shipping lanes in the GOM will be an increased risk of vessel strikes while VLCCs and support vessels are underway. In areas of intense ship traffic, marine mammals can experience propeller or collision injuries. Vulnerability to collision with VLCCs will be greatest while whales and other marine mammals feed, swim, and rest near the surface of the water. VLCCs push a considerable bow wave when underway on the open ocean because of their design and large displacement tonnage. This wave pushes water, flotsam, and other small objects away from the vessel. Dolphins are known to ride the bows of traveling vessels, positioning themselves in such a manner so that they are lifted up and pushed forward by the circulating water generated by a vessel's bow pressure (Wursig 2009); however, dolphins are also at risk of vessel strikes in the presence of large and small vessels.

The VLCCs and support vessels traveling to the SPM buoy systems will use established and well-traveled shipping lanes. In addition, BWTT will provide the operators of VLCCs with NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners (NMFS 2008) and request that these measures be used when transiting to and from the SPM buoy systems. Based on the whales' characteristics and habitat requirements, and because BWTT will provide vessel operators with NMFS' recommended strike avoidance measures, ship strikes are not anticipated.

4.3 Decommissioning

4.3.1 Inshore

At the end of its useful life (50 years), the Project will be decommissioned. Decommissioning of the proposed Onshore and Inshore Pipelines will consist of purging the pipe of crude oil liquids and filling them with water. No decommissioning activities are anticipated to occur in inshore waterbodies.

4.3.2 Offshore

The Project Components associated with the offshore SPM buoy systems and pipelines will be disassembled and brought to shore. The removal of SPM buoy systems structures and Offshore Pipelines will cause a temporary increase in turbidity to both the lower water column and the seafloor, but will have negligible impacts on fauna and their habitat. The planned decommissioning sequence is provided in Volume II, however, a more comprehensive decommissioning plan will be prepared prior to any decommissioning activities taking place. It is estimated that decommissioning will take approximately 5 months to complete.

5 Federally Listed and Candidate Marine Mammal Species

There are six threatened and endangered marine mammal species, as well as one species that is proposed for listing, which could occur within the Proposed Project area. These include the Bryde's whale, blue whale, humpback whale, fin whale, sei whale, sperm whale, and Florida manatee. Although these species are not likely to occur in the Project area, potential impacts on each species is discussed below. In addition, if present, each

could experience impacts associated with vessel strikes, noise impacts, and impacts in the event of an inadvertent product release.

5.1 Bryde's Whale (*Balaenoptera brydei*)

5.1.1 Habitat Range and Requirements

Bryde's whales have a wide distribution and occur in tropical, sub-tropical, and warm temperate waters (61° to 72°F) around the world. They live in all oceans from 40° south to 40° north. Some populations of Bryde's whales migrate with the seasons, moving away from the equator during the summer and toward the equator during the winter. Other populations of Bryde's whales are residents, meaning that they do not migrate. They are usually seen singly or in groups of 2–3 in the North Pacific, with a maximum group size of 12 (Kato and Perrin 2009). Stranding records from the Southeast U.S. stranding network, the Smithsonian Institution, and the literature (Waring et al 2016) include 22 Bryde's whale strandings in the GOM from 1954 to 2012, although three have uncertain species identification. Most strandings were recorded east of the Mississippi River through west central Florida, but two were recorded west of Louisiana. There are no documented Bryde's whale strandings in Texas, although strandings of fin (*B. physalus*), sei (*B. borealis*), and minke (*B. acutorostrata*) whales have been documented (Mullin et al. 2003; Waring et al. 2016). Occurrence records of Bryde's whales in the northern GOM occur almost entirely in the De Soto Canyon area of northeastern GOM at depths greater than 328 ft (100 m; Hayes 2017b). No confirmed sightings of Bryde's whales have been documented in the north central or western GOM since NMFS began surveys in the early 1990s.

Bryde's whales are vulnerable to many stressors and threats, including vessel strikes, ocean noise, and whaling outside the United States. The GOM sub-species is also threatened by oil and gas activities, as well as oil spills and cleanup. Scientists believe that there are fewer than 100 GOM Bryde's whales.

5.1.2 Determination of Impact

Individual Bryde's whales in the Project vicinity could be subject to mortality or injury due to vessel strikes during construction or operation of the Project. To minimize the potential for impacts on marine mammals, *BOEM Notice to Lessees (NTL) No. 2016-G01, Vessel Strike Avoidance and Injured/Dead Protected Species Reporting*, will be followed by all Project construction and support vessels. The NTL states that a distance of 300 ft (91 m) or greater should be maintained between vessels and whales. The NTL also specifies reduced speeds of 10 knots when traveling near mother/calf pairs or groups of cetaceans and a travel path parallel to that of the animals. In addition, when whales are sited in close proximity to a moving vessel, the NTL specifies that the vessel reduce speed and shift the engine to neutral until the animal(s) are clear of the area. In compliance with the NTL, vessel personnel will report any sightings of injured or dead marine mammals to the appropriate authorities. Although BWTT will not control movements of the VLCCs, these vessels will use established and well-traveled shipping lanes.

In addition, Bryde's whales could be exposed to noise from pile-driving during Project construction. As discussed above, underwater pile-driving will exceed the thresholds for injury (PTS) on low-frequency cetaceans (baleen whales) within a ZOI estimated to extend about 1,364 (416 m) ft from pile-driving activities for PTS and about 13,061 ft (3,981 m) for behavioral effects. As these ZOIs are too large to be effectively monitored, BWTT will ensure proper coordination with NMFS to identify what additional measures, if any, will need to be implemented during pile-driving to minimize impacts on marine mammals. However, as it is highly unlikely that Bryde's whales will be present on the continental shelf in the vicinity of the Project during the short period of pile-driving (a period of 16 weeks), BWTT believes that the potential for impact on Bryde's whales through pile-driving noise is so small as to be discountable.

If any marine mammal, including Bryde's whale, are present in the vicinity of an oil spill they could be exposed to oil via inhalation, ingestion, and dermal contact. Recent research following the DWH oil spill has found that long-term, chronic effects of oil exposure can result in decreased survival and lowered reproductive success (Takeshita

et al. 2017). The level, timeframe, and large geographic scale of oil exposure that affected marine mammals during the DWH oil spill will not occur for the worst-case scenario spill for the Project. Airborne volatile petroleum compounds, such as benzene, will be dispersed and diluted to low concentrations within a short distance of the oil. In the unlikely event that a Bryde's whale were present during an oil spill, it could experience health and reproductive effects; however, the population-level injury estimated by the DWH NRDA Trustees following that incident will not occur.

Potential spills of construction-related fuels and chemicals can result in adverse impacts to local water quality, which may affect fauna in the immediate vicinity of a spill. Each of the vessels involved in Project construction will operate in accordance with USCG and IMO MARPOL requirements to minimize the potential for a release of oils and/or chemicals to the GOM. A Project-specific spill response plan will be developed prior to construction, which will identify measures to prevent, contain, and clean up any inadvertent spills. Each vessel operator will monitor its own operations and will have sorbent materials available to contain and clean up a release, should one occur. Therefore, significant impacts related to spills and releases are not anticipated. In the highly unlikely event of a diesel spill, the diesel fuel will immediately begin dissipating. Because diesel fuel is a mixture of relatively light hydrocarbons, spreading, evaporation, dispersion, and dissolution will occur rapidly, and virtually the entire volume of fuel will have dissipated within 12 to 24 hours (ITOPF 2002). Furthermore, no oil or mixtures containing more than 15 parts of oil per million may be discharged within 50 mi (80 km) offshore (MARPOL 73/78).

Whales can ingest or become entangled in marine debris that is lost from fishing vessels and offshore activities associated with oil and gas development. Although up to 49 percent of marine debris is considered to be from land-based sources, incidental debris loss from service vessels and OCS structures also contributes to the debris in the GOM (BOEM 2017). About 13 percent of debris found at PINS, south of the Project area, has been attributed to offshore oil and gas activity (Miller et al. 1995). Plastic bags and plastic fragments are the most commonly reported debris items in the digestive tracts of cetaceans. Per U.S. and MARPOL regulations, no solid debris may be discharged from OCS structures and vessels (30 CFR 250.40 and MARPOL, Annex V, P.L 100-220 [101 Statute 1458]). Therefore, although additional debris may enter the water column incidentally, the anticipated amount is expected to be extremely small. To further minimize the potential for lost debris during offshore construction activities, BWTT will adhere to *NTL No. 2015-BSEE-G03, Marine Trash and Debris Awareness and Elimination*. This NTL states, among other things, that marine discharge of trash and debris is prohibited under 30 CFR 250.300, that prominent placards regarding marine debris and trash disposal be placed in relevant areas, and that offshore employees and contractors must complete marine trash and debris awareness training at the start of employment and annually thereafter. With adherence to the NTL and applicable federal regulations, impacts on the Bryde's whale from debris lost as a result of Project construction is anticipated to be negligible.

Although entanglement of large whales in anchor lines has been known to occur (Seattle Times 2017, NMFS 2018a), entanglement in anchor lines is not known to be a prevalent impact on large whales and BWTT believes that the potential for such an impact is so low as to be discountable at the Project site. Further, anchor lines will be separated from each other as they radiate from vessels or the SPM buoy systems and will not create a "web effect".

Because Bryde's whales have not been documented to occur in the north central or western GOM, this species is not expected to occur in the Project vicinity. Therefore, the *Project will have no effect* on Bryde's whales.

5.2 Blue Whale (*Balaenoptera musculus*)

5.2.1 Habitat Range and Requirements

Blue whales are distributed in sub-polar to sub-tropical latitudes worldwide, and migrate toward polar waters in the spring. Although found in coastal waters, they generally occur farther offshore. The blue whale is an occasional visitor in U.S. waters in the Western North Atlantic, which could occur as far south as Florida and the GOM;

however, the southern limit of the species' range is unknown and the population of this stock is small (perhaps between 400 and 600 individuals; Waring 2011). Given the potential to occur in coastal waters, the species could occur in the Proposed Project area.

5.2.2 Determination of Impact

Underwater noise threatens whale populations, interrupting their normal behavior and driving them away from areas important to their survival. Increasing evidence suggests that exposure to intense underwater sound in some settings may cause some whales to strand and ultimately die (NMSF 2015). Drilling for oil and gas generally produces low-frequency sounds with strong tonal components in frequency ranges in which large baleen whales communicate. There are few data on the noise from conventional drilling platforms, but recorded noise from an early study of one drilling platform and three combined drilling production platforms found that noise was so weak it was almost undetectable alongside the platform at Beaufort scale sea states of three or above. The strongest tones were at low frequencies, near 5 Hz (Richardson et al. 1995). The ZOI associated with underwater noise from pile-driving for the Proposed Project is described in Section 5.1.2, above.

Given that blue whales are typically observed in deeper waters, it is unlikely that this species will occur in the Proposed Project area; however, blue whales occasionally enter shallower waters and could enter the waters near the SPM buoy systems. If a blue whale were to occur in the Proposed Project vicinity, the greatest potential for impacts will be due to vessel strikes and noise associated with pile-driving during construction. In addition, marine mammals in the vicinity could be exposed to oil in the event of an oil spill during operation of the SPM buoy systems. The potential impacts and mitigation for these activities are further discussed in Section 8: Wildlife and Protected Resources.

Given the low likelihood of occurrence in the Proposed Project area and BWTT's proposed mitigation (including use of applicable Notices to Lessees (NTLs) and pending consultation with NMFS regarding pile-driving noise), we conclude that the Proposed Project *may affect but is not likely to adversely affect* the blue whale.

5.3 Humpback Whale (*Megaptera novaeanglia*)

5.3.1 Habitat Range and Requirements

Humpback whales are distributed throughout all major oceans from the equator to sub-polar latitudes; however, the Gulf of Maine stock of humpback whales, which winters in the West Indies where the majority of whales are found in the waters of the Dominican Republic, is the nearest population to the Project. Therefore, the species is not likely to occur in the Project area; however, individuals could be present in the vicinity of the Proposed Project during winter (Waring 2015, NMFS 2012). The population size is unknown (Waring 2015).

5.3.2 Determination of Impact

Given that wintering humpback whales are most commonly found in the waters of the Dominican Republic, it is unlikely that this species will occur in the Proposed Project area; however, humpback whales occasionally enter the Gulf of Mexico and could enter the waters near the SPM buoy systems during winter. If a humpback whale were to occur in the Proposed Project vicinity, the greatest potential for impacts will be due to vessel strikes and noise associated with pile-driving during construction. In addition, marine mammals in the vicinity of the Proposed Project could be exposed to oil in the event of an oil spill during operation of the SPM buoy systems. The potential impacts and mitigation for these activities are further discussed in Section 8: Wildlife and Protected Resources.

Given the low likelihood of occurrence in the Proposed Project area and BWTT's Proposed mitigation (including use of applicable Notices to Lessees (NTLs) and pending consultation with NMFS regarding pile-driving noise), we conclude that the Proposed Project *may affect but is not likely to adversely affect* the humpback whale.

5.4 Sei Whale (*Balaenoptera borealis*)

5.4.1 Habitat Range and Requirements

Sei whales are usually observed alone or in small groups of two to five animals. Today, there are around 8,600 sei whales in the North Pacific. This is only little more than 20 percent of the original population estimate of 42,000 for this area. The total population of sei whales in all U.S. waters is unknown (NMFS 2015). Sei whales have a cosmopolitan distribution and occur in sub-tropical, temperate, and sub-polar waters around the world. This species may unpredictably and randomly occur in a specific area, sometimes in large numbers. These events may occur suddenly and then not occur again for long periods of time. Populations of sei whales, like other rorquals, may seasonally migrate toward the lower latitudes during the winter and higher latitudes during the summer (NMFS 2015).

The movements of sei whales are not well known; however, individuals prefer temperate waters in the mid-latitudes and are typically observed in deeper waters far from the coastline (NMFS 2018a). However, they occasionally enter shallower, more inshore waters (Hayes 2017a). The Nova Scotia stock of sei whales is estimated at 357 individuals; NMFS does not track a GOM stock of this species (Hayes 2017a).

5.4.2 Determination of Impact

Given that sei whales are typically observed in deeper waters, it is unlikely that this species will occur in the Project area; however, sei whales occasionally enter shallower waters and could enter the waters near the SPM buoy systems. If a sei whale were to occur in the Project vicinity, the greatest potential for impacts will be due to vessel strikes and noise associated with pile-driving during construction. In addition, marine mammals in the vicinity could be exposed to oil in the event of an oil spill during operation of the SPM System. Impacts from these activities will be identical to those identified above for the Bryde's whale.

Given the low likelihood of occurrence in the Project area and BWTT's proposed mitigation (including use of applicable NTLs and pending consultation with NMFS regarding pile-driving noise), we conclude that the Project *may affect but is not likely to adversely affect* the Bryde's whale.

5.5 Fin Whale (*Baelanoptera physalus*)

5.5.1.1 Habitat and Range Requirements

Fin whales are the second-largest species of whale, with a maximum length of about 75 ft (22 m) in the Northern Hemisphere, and 85 ft (26 m) in the Southern Hemisphere. A fin whale has a sleek, streamlined body with a V-shaped head. It has a tall, hooked dorsal fin, about two-thirds of the way back on the body, which rises at a shallow angle from the back. Fin whales have distinctive coloration: black or dark brownish-gray on the back and sides, white on the underside. Head coloring is asymmetrical—dark on the left side of the lower jaw, white on the right-side lower jaw, and the other way around on the tongue. Many fin whales have several light-gray, V-shaped "chevrons" behind their heads; on many of them, the underside of the tail flukes is white with a gray border. These markings are unique and can be used to identify individual fin whales (NMFS 2015).

Fin whales are found in deep, offshore waters of all major oceans, primarily in temperate to polar latitudes (Davis et al. 2002). They are less common in the tropics. They occur year-round in a wide range of locations, but the density of individuals in any one area changes seasonally. Most migrate from the Arctic and Antarctic feeding areas in the summer to tropical breeding and calving areas in the winter. The location of winter breeding grounds is not known. Fin whales travel in the open seas, away from the coast, so they are difficult to track (NMFS 2015). There are an estimated 1,618 fin whales in the North Atlantic and GOM (NMFS 2018a). NMFS manages the Western North Atlantic stock of fin whales, and individuals have been documented in continental shelf waters during aerial surveys (Hayes 2017b).

5.5.2 Determination of Impact

While typically found in deep, offshore waters, and occurrence in the Project area is unlikely, fin whales have been observed in continental shelf waters and it is possible that a fin whale could transit the Project area. If a fin whale were to occur in the Project vicinity, the greatest potential for impacts will be due to vessel strikes and noise associated with pile-driving during construction, as discussed above. In addition, marine mammals in the vicinity could be exposed to oil in the event of an oil spill during operation of the SPM System. Impacts from these activities will be identical to those identified above for the Bryde's whale.

Given the low likelihood of occurrence in the Project area and BWTT's proposed mitigation (including use of applicable NTLs and pending consultation with NMFS regarding pile-driving noise), we conclude that the Project *may affect but is not likely to adversely affect* the fin whale.

5.6 Sperm Whale (*Physeter macrocephalus*)

5.6.1 Habitat and Range Requirements

Sperm whales are the largest of the toothed whales and have one of the widest global distributions of any marine mammal species. They are found in all deep oceans, from the equator to the edge of the pack ice in the Arctic and Antarctic (Jaquet and Gendron 2002; Mullin 2003; NMFS 2019). Their distribution is dependent on their food source and suitable conditions for breeding and varies with the sex and age composition of the group. In some mid-latitudes, sperm whales seem to generally migrate north and south depending on the seasons, moving toward the poles in the summer. However, in tropical and temperate areas, there appears to be no obvious seasonal migration (Davis et al., 2002; Jaquet and Gendron 2002). Sperm whales tend to inhabit areas with a water depth of 1,968 ft (600 m) or more and are uncommon in waters less than 984 ft (300 m) deep. Female sperm whales are generally found in deep waters (at least 3,280 ft, or 1,000 m) of low latitudes (less than 40°, except in the North Pacific where they are found as high as 50°). These conditions generally correspond to sea surface temperatures > 15 degrees Celsius (°C), and while female sperm whales are sometimes seen near oceanic islands, they are typically far from land (Davis et al., 2002; Jaquet and Gendron 2002). Sperm whales occur in deep waters throughout the oceanic GOM, and the GOM stock of the sperm whale is estimated to be about 763 individuals (Waring et al. 2015).

5.6.2 Determination of Impact

The endangered sperm whale is the only ESA-listed whale that is known to commonly occur in the GOM and may be considered a resident species. However, the habitat and range requirements for the sperm whale tend to be areas with a water depth of 1,968 ft (600 m) or more and sperm whales are uncommon in waters less than 984 ft (300 m) deep. The Proposed Project area only reaches depths to 89.5 ft or 27.3 m within the continental shelf. It is highly unlikely that these large species that require more depth for food and overall room will be found within the Project area vicinity. Because sperm whales occur at depths greater than the Project area and occur in oceanic (not continental shelf) waters of the GOM, they are not expected to occur in the Project area and the Project will have *no effect* on the sperm whale.

5.7 West Indian Manatee (*Trichechus manatus*)

5.7.1 Habitat and Range Requirements

The West Indian manatee is a migratory marine mammal of Florida, the Greater Antilles, Central America, and South America (USFWS 2001, USFWS 2019b). Texas is the extreme western edge of this species' distribution and thus this species is unlikely to occur in the Project area (USFWS 2019b). However, a recent sighting of this species occurred in 2014 within South Padre Island Harbor (Garza 2014). Although the manatee is unlikely to occur in the vicinity of the Project area, the Project will still implement best management practices (BMPs) to ensure its activities adhere to federal laws.

The Proposed Project area is unlikely to be used by manatees. While areas of seagrasses in the inshore Project area provide suitable feeding habitat, only one manatee observation has been made within 10 mi of the Proposed Project area. Due to the transient nature of this species and the fact that it is rarely observed within this region, we have determined that the species is highly unlikely to occur in the Project area.

5.7.2 Determination of Impact

Texas is the extreme western edge of this species' distribution, and thus it is unlikely that this species will occur in the Project area and be exposed to the Project's activities. Although areas of seagrass are within the inshore waters of the Project and provide suitable feeding habitat for the species, all inshore waters will be crossed using HDD methods, thereby avoiding impacts on the seagrasses. Based on the previous analysis, the Project *may affect, but is not likely to adversely affect* the manatee in the estuarine inshore and marine offshore environments.

6 Summary of Impacts

Two of the non-endangered mammal species are known to regularly inhabit the shallow shelf waters of the Project area: the Atlantic spotted dolphin and the bottlenose dolphin. A third species, the rough-toothed dolphin, is also likely to be found in deeper waters, but has been identified in shelf waters near the Project area. In addition, there are four threatened and endangered marine mammal species, as well as one species that is proposed for listing, which could occur within the Proposed Project area. During construction, operation, and decommissioning of the Proposed Project, the greatest potential for impacts on marine mammals are associated with vessel strikes, noise impacts (including from pile-driving), and impacts in the event of an inadvertent product release. A summary of impacts s for the both the Proposed Project is presented in Table 5 below.

Table 5: Summary of Impacts				
		Construction	**Operation**	**Decommissioning**
Proposed Project	**Onshore**	None	None	None
	Inshore	Impacts anticipated to be avoided by HDD. Temporary and negligible potential impacts from inadvertent releases of hazardous materials and drilling fluids.	None	None
	Offshore	Temporary and negligible impacts from turbidity during component placement, and construction lighting. Injury from noise is considered discountable or mitigated and behavioral impacts will be mitigated through coordination with NMFS. Vessel strikes not anticipated.	Unlikely, but possible, impacts from inadvertent releases that would not reach population-level effects. No anticipated ship strikes with proposed mitigation. Permanent but localized impacts from operational noise.	Temporary and negligible impacts from removal of Offshore Components.

7 Mitigation of Proposed Project Impacts

The Proposed Project has been developed in a manner that minimizes impacts on marine mammals and their habitats to the extent possible. In addition to siting the SPM buoy systems and Offshore Pipelines in soft-bottom habitats, which are the most prevalent and least sensitive habitat in the GOM, the following BMPs have also been incorporated into the Project:

- Using HDD construction methods for the coastal landfall approach of the Offshore Pipelines to San Jose Island and across all inshore waters between San Jose Island and the mainland, which will avoid impacts on estuarine resources, including submerged aquatic vegetation (SAV), oyster beds, and the species that use them.
- Designing the Project to have the smallest footprint practicable to minimize impacts on marine resources.
- Construction and support vessels under the purview of BWTT will be required to implement *NTL No. 2015-BSEE-G03, Marine Trash and Debris Awareness and Elimination*, which will minimize the potential for marine species to ingest, or become entangled in, lost debris.
- Land-based fabrication of the offshore SPM buoy systems, to minimize the timing and disturbance associated with offshore installation.
- To minimize the potential for vessel strikes of marine mammals, *BOEM NTL No. 2016-G01, Vessel Strike Avoidance and Injured/Dead Protected Species Reporting*, will be followed by all Project construction and support vessels.
- A Project-specific spill response plan will be developed prior to construction, which will identify measures to prevent, contain, and clean up any inadvertent spills from construction and support vessels.
- The Project will meet all lighting stipulations as noted in 33 CFR, Part 149, which requires limiting Terminal lighting to that required for safety and navigational concerns, in order to reduce the disruptive effects of lighting, and will down-shield lighting, to the greatest extent possible, to reduce light dispersion.
- BWTT will provide the operators of VLCCs with NMFS' Vessel Strike Avoidance Measures and Reporting for Mariners and request that these measures be used when transiting to and from the SPM buoy systems to minimize the potential for impacts from vessel strikes.
- Pile-driving associated with installation of the SPM buoy systems could result in injury or harassment of marine mammals. BWTT will use biological monitors during pile-driving activities and will cease pile-driving if a marine mammal is identified within the injury zone for mid-frequency cetaceans; pile-driving will not restart until the mammal had left the area of its own accord, thereby avoiding injury. As the PTS ZOI for low-frequency cetaceans is too large to be effectively monitored, BWTT will ensure proper coordination with NMFS to identify what additional measures will need to be implemented during pile-driving to minimize impacts on marine mammals. To further minimize the sound level impacts associated with pile-driving, BWTT will consult with NMFS to determine any additional mitigation necessary for species protection. While identification of mitigation is not final, measures may include:
    - Use of the lowest energy hammer feasible for installation of the piles;
    - The use of "soft starts," using a lower hammer energy level to begin pile-driving, which allows sensitive species to avoid the vicinity prior to peak pile-driving noise; and
    - The use of a bubble curtain or other sound damping system to minimize propagation of pile-driving noise.

8 References

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Attachment A Marine Species Underwater Noise Calculations

A.1 Noise Assessment and Calculations

A.1.1 Marine Mammals

NMFS has established thresholds for physical and behavioral effects of underwater noise due to sound generated from pile-driving activity on marine mammals (NMFS 2018a, b, c). Effects levels for marine mammals are based on hearing groups, which have different generalized hearing frequency ranges; low-frequency (baleen whales) and mid-frequency (dolphins, toothed whales, beaked whales, bottlenose whales) cetaceans could occur in the vicinity of pile-driving (NMFS 2018a).

In April 2018, NMFS released an update to its Technical Guidance for Assessing the Impact of Anthropogenic Sound on Marine Mammals (NMFS 2018a). The Technical Guidance provides underwater acoustic thresholds for the onset of PTS and TTS, respectively, or changes in the threshold of audibility. PTS and TTS thresholds are dependent upon noise type (impulsive or continuous) and marine mammal hearing group. For impulsive sounds, the dual metric acoustic thresholds are presented as a flat or unweighted peak sound pressure (PK [flat]) and hearing group frequency weighted SEL_{cum} for impulsive sounds. NMFS considers onset of PTS (or TTS) to have occurred when either one of the two metrics is exceeded (whichever comes first). For non-impulsive (continuous) sounds, there is a single SEL_{cum} threshold; however, if a non-impulsive sound has the potential of exceeding the PK sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered. The guidance was specifically updated to revise the optional User Spreadsheet tool (NMFS 2018b) to facilitate its use by applicants. NMFS' interim guidance on thresholds for behavioral effects on marine mammals is also consistent with that represented in Table A-1.

The Greater Atlantic Region Field Office (GARFO) acoustics spreadsheet[1] (NMFS 2018c) compiles applicable noise references to identify source levels and is continually updated; the most recent revision was in July 2018 to reflect updates in the NMFS 2018 guidance for marine mammal harassment other than behavioral effects. The GARFO spreadsheet is applicable to behavioral effects in marine mammals, but directs the user to use the User Spreadsheet from the NMFS 2018 guidance for PTS/TTS onsets for marine mammals (NMFS 2018a,b). PTS equates to Level A harassment, whereas TTS and behavioral effects equate to Level B harassment (83 FR 48799). More recently, NMFS' Southeast Regional Office (SERO) created a separate spreadsheet to assess underwater noise impacts on sea turtles and fish (NMFS 2019). The SERO spreadsheet includes a 72-inch diameter pile with a peak sound level of 214 dB (at 10 m), a RMS value of 189 dB, and a SEL of 182 dB re 1 µPA; as these sound levels were more conservative than the sound levels for an equivalent-sized pile in the GARFO spreadsheet, and these values were used as a proxy for the larger piles associated with the Proposed Project. An 18-inch diameter concrete pile in a water depth of 10 ft (3 m) was chosen as a proxy for the proposed offshore 18-inch-diameter piles. Table A-1 summarizes the Project-related pile-driving sound level impacts and these behavioral effects levels for marine species.

[1] Available at: https://www.greateratlantic.fisheries.noaa.gov/protected/section7/guidance/consultation/index.html

Table A-1: Estimated Sound Levels from Underwater Pile-Driving and Effects Levels for Marine Species			
Pile-driving Activity or Effect Level	**Cumulative Sound Exposure Level (dB SEL) (dB re 1 µPa²s)**	**Root Mean Square Sound Level (dB RMS) (dB re 1 µPA)**	**Peak Sound Level (dB re 1 µPA)**
18-inch-diameter concrete piles at 33 ft (10 m) away	155[a]	166	185
72-inch-diameter CISS piles at 33 ft (10 m) away	182[a]	189	214
Sea Turtles			
Sea Turtle Injury (impulsive/non-impulsive noise)	187/234	--	206
Sea Turtle Behavioral Effects	--	160	--
Marine Mammals			
Low-frequency cetaceans (baleen whales)			
Injury (Temporary Threshold Shift for impulsive/non-impulsive noise)[b,c]	168/179	--	213/ --
Injury (Permanent Threshold Shift for impulsive/non-impulsive noise)[b,c]	183/199	--	219/ --
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)			
Injury (Temporary Threshold Shift for impulsive/non-impulsive noise) [b,c]	170/178	--	224/ --
Injury (Permanent Threshold Shift for impulsive/non-impulsive noise)[b,c]	185/198	--	230/ --
All species			
Marine Mammal Behavioral Effects (impulsive/non-impulsive noise)[a]	--	160/120	--
Fish			
Injury Onset, all sizes	--	--	206
Injury Onset, >2 grams (impulsive/non-impulsive noise)	187/234	--	--
Injury Onset, <2 grams (impulsive, non-impulsive noise)	183/191	--	--

[a] These measurements are single strike SELs, rather than cumulative levels.

[b] Use of impact hammers is considered impulsive noise; other continuous sound is considered non-impulsive noise.

[c] The injury threshold is the general level for TTS or PTS onset for cetaceans by hearing frequency group as identified by NMFS (2018a); however, threshold shifts are influenced by the frequency of noise received and a cumulative sound exposure exceeding this level may not cause a threshold shift if outside the range of hearing.

Source: NMFS 2018a, b, c; NMFS 2019

A.1.1.1 Level B Harassment Assessment

By using a standard transmission loss constant (15 dB) to account for attenuation over distance, as defined by NMFS, a ZOI, the area in which pile-driving sound exceeds the thresholds, was identified for pile-driving related behavioral impacts for marine mammals. As previously noted, the GARFO spreadsheet was used for these calculations. The ZOIs were calculated using the estimated sound levels for the 72-inch (1.8 m)-diameter proxy piles, which will have a greater sound level impact than the smaller 18-inch (0.5-m)-diameter piles, and are therefore a conservative estimate of Project impacts. Table A-4, below, identifies the distance at which sound levels from pile-driving will attenuate to the effects levels described in Table A-1.

Tables A-2 and A-3, from the GARFO spreadsheet, further indicate the source data for these two pile scenarios. No attenuation methods (i.e. wooden/nylon cushion blocks in-between the hammer and the pile) were noted in the proxy data for either pile scenario. The tables below represent the Practical Spreading Loss Model for sound attenuation with an attenuation loss constant of 15 dB.

Table A-2: Proxy Projects for Estimating Underwater Noise

Project Location	Water Depth (m)	Pile Size (inches)	Pile Type	Hammer Type	Transmission Loss Constant (dB)
Not Available	3	18	Concrete	Impact	15
Not Available	5	72	Steel	Impact	15

Table A-3: Proxy-Based Estimates for Underwater Noise

Type of Pile	Hammer Type	Estimated Peak Noise Level (dB Peak)	Estimated Cumulative Sound Exposure Level (dB cSEL)	Estimated Pressure Level (dB RMS)	Estimated Cumulative Sound Exposure Level (dB sSEL)
18" Concrete	Impact	185	NA	166	155
72" Steel	Impact	214	NA	189	182

sSEL single strike SEL.

The ZOI were obtained through the extrapolation of the source levels listed in Table A-3. Table A-4 includes extrapolated ZOIs for marine mammals (behavioral effects); these tables were extracted from the GARFO spreadsheet and are automatically populated once the proxy data is chosen. As the ZOI data were output directly from the GARFO spreadsheet, no further calculations were applied by BWTT.

Table A-4: Estimated Distances to Cetacean Behavioral Thresholds

Type of Pile	Hammer Type	Distance (ft [m]) to 160 dB RMS (behavior for impulsive noise)	Distance (m) to 120 dB RMS (behavior for non-pulse noise)
18" Concrete	Impact	82 (25)	11,659.1
72" Steel Pipe	Impact	2,814 (858)	NA

A summary of the resultant ZOIs for each species group is provided in Table A-5. ZOIs for sea turtles and fish were determined using the SERO spreadsheet, as described further below.

Table A-5: Estimated Zone of Influence for Sound Levels from Underwater Pile-Driving for Marine Species without Noise Abatement

Pile-driving Activity or Effect Level	Zone of Influence for Impulsive Sounds (ft [m])[a]		
	Sound Exposure Level (SEL) (dB re 1 µPa²s)	Root Mean Square Sound Level (dB RMS) (dB re 1 µPA)	Peak Sound Level (dB re 1 µPA)
Sea Turtles			
Sea Turtle Injury	1,172 (357)	--	112 (34)
Sea Turtle Behavioral Effects	--	2,814 (858)	--
Marine Mammals			
Low-frequency cetaceans (baleen whales)			
Injury (Temporary Threshold Shift for impulsive noise)[a]	NA	--	NA
Injury (Permanent Threshold Shift for impulsive noise)[a]	1,364 (416)	--	16 (5)
Mid-frequency cetaceans (dolphins, toothed whales, beaked whales, bottlenose whales)			
Injury (Temporary Threshold Shift for impulsive noise)[a]	NA	--	NA
Injury (Permanent Threshold Shift for impulsive noise)[a]	49 (15)	--	NA
All species			
Marine Mammal Behavioral Effects (impulsive noise)	--	2,814 (858)	--
Fish			
Injury Onset (all sizes)	--	--	112 (34)
Injury Onset (>2 grams)	1,172 (357)	--	--
Injury Onset (<2 grams)	2,165 (660)	--	--
Behavioral Effects		13,061 (3,981)	

[a] The injury threshold is the general level for TTS or PTS onset for cetaceans by hearing frequency group as identified by NMFS (2018a); however, threshold shifts are influenced by the frequency of noise received and a cumulative sound exposure exceeding this level may not cause a threshold shift if outside the range of hearing.

Source: NMFS 2018a,b,c,d; NMFS 2019

The threshold for marine mammal behavioral effects (Level B harassment) will be exceeded in a ZOI extending about 2,814 ft (858 m) from pile-driving activities. As the ZOIs for marine mammal behavioral effects and low-frequency cetacean injury are too large to be effectively monitored, BWTT will ensure proper coordination with NMFS to identify what additional measures, if any, will need to be implemented during pile-driving to minimize impacts on marine mammals.

A.1.1.2 Level A Harassment Assessment

To assess the potential for Level A harassment on marine mammals, the NMFS Technical Guide User Spreadsheet was assessed. When further specification on pile-driving activities is available during final design and engineering, this conservative assessment may be and possibly result in lower ZOI for marine mammals. Available data that could assist in the calculations include the number of strikes anticipated per pile and further specification of the duration of pile-driving activities (currently estimated to take up to 16 weeks for 34 piles). With the information known at this point in Project design, the following assumptions were used in the NMFS User Spreadsheet (see Figure A-1):

- Only one pile is driven, using an impact hammer, per day.
- Strike duration is 0.1 second (default per the NMFS 2018 User Manual [NMFS 2018a]).
- Number of strikes per pile will be 675, which is the most conservative estimate in the "No. Strikes per Pile Data" tab of the SERO spreadsheet.

The NMFS 2018(b) user tool does not provide impact levels for TTS thresholds at this time; however, given the behavioral ZOIs presented in Table A-5 (about 0.5 mi [0.8 km]) and the PTS ZOIs estimated in Figure A-1 (above), it can be assumed that the threshold for TTS will be exceeded at some distance between 0.25 and 0.5 mi (0.4 and 0.8 km) from pile-driving activities (for low-frequency cetaceans).

Using the NMFS 2018(b) user tool, the distance to the PTS injury threshold will be exceeded for both mid- and low-frequency cetaceans. While the occurrence of large marine mammals in the Project vicinity is considered unlikely (but possible), dolphin species could occur in the Project area and, if present, could be affected by pile-driving noise. BWTT will use biological monitors during pile-driving activities and will cease pile-driving if a marine mammal is identified within the injury zone for mid-frequency cetaceans; pile-driving will not restart until mammal had left the area of its own accord, thereby avoiding injury. As the PTS ZOI for low-frequency cetaceans is too large to be effectively monitored, BWTT will ensure proper coordination with NMFS to identify what additional measures will need to be implemented during pile-driving to minimize impacts on marine mammals. The NMFS guidance (2018a) also indicates that for stationary, impulsive sources with high source levels (e.g., impulsive pile-driving associated with large piles) accumulating over a 24-h period, the user tool could lead to unrealistically large isopleths associated with PTS onset and recommends that the action proponents consult with NMFS on possible alternative methods of assessment.

In the unlikely event that individuals of these species do occur in the Project area, impacts on those individuals could include each of the impacts discussed above for the dolphins. One slight difference exists for the *Kogia* spp., which are high-frequency cetaceans as opposed to mid-frequency cetaceans. For those two species, the ZOI for PTS will extent out to 1,624 ft (495 m); however, as previously discussed, consultation with NMFS will determine if additional noise mitigation is needed to minimize or avoid impacts on marine mammals, should they occur in the Project area. ZOIs for marine mammals are depicted in Figure A-2.

Figure A-1: Inputs/Outputs for a 72-inch-diameter Steel Pile

E.1-1: METHOD TO CALCULATE PK AND SEL_{cum} (USING RMS SPL SOURCE LEVEL)

SEL_{cum}	
Source Level (RMS SPL)	189
Number of piles per day	1
Strike Duration[Δ] (seconds)	0.1
Number of strikes per pile	675
Duration of Sound Production (seconds)	67.5
10 Log (duration of sound production)	18.29
Propagation (xLogR)	15
Distance of source level measurement (meters)	10

[Δ]Window that makes up 90% of total cumulative energy (5%-95%) based on Madsen 2005

Unless otherwise specified, source levels are referenced 1 m from the source.

PK	
Source Level (PK SPL)	214
Distance of source level measurement (meters)	10
Source level at 1 meter	229.0

Unless otherwise specified, source levels are referenced 1 m from the source.

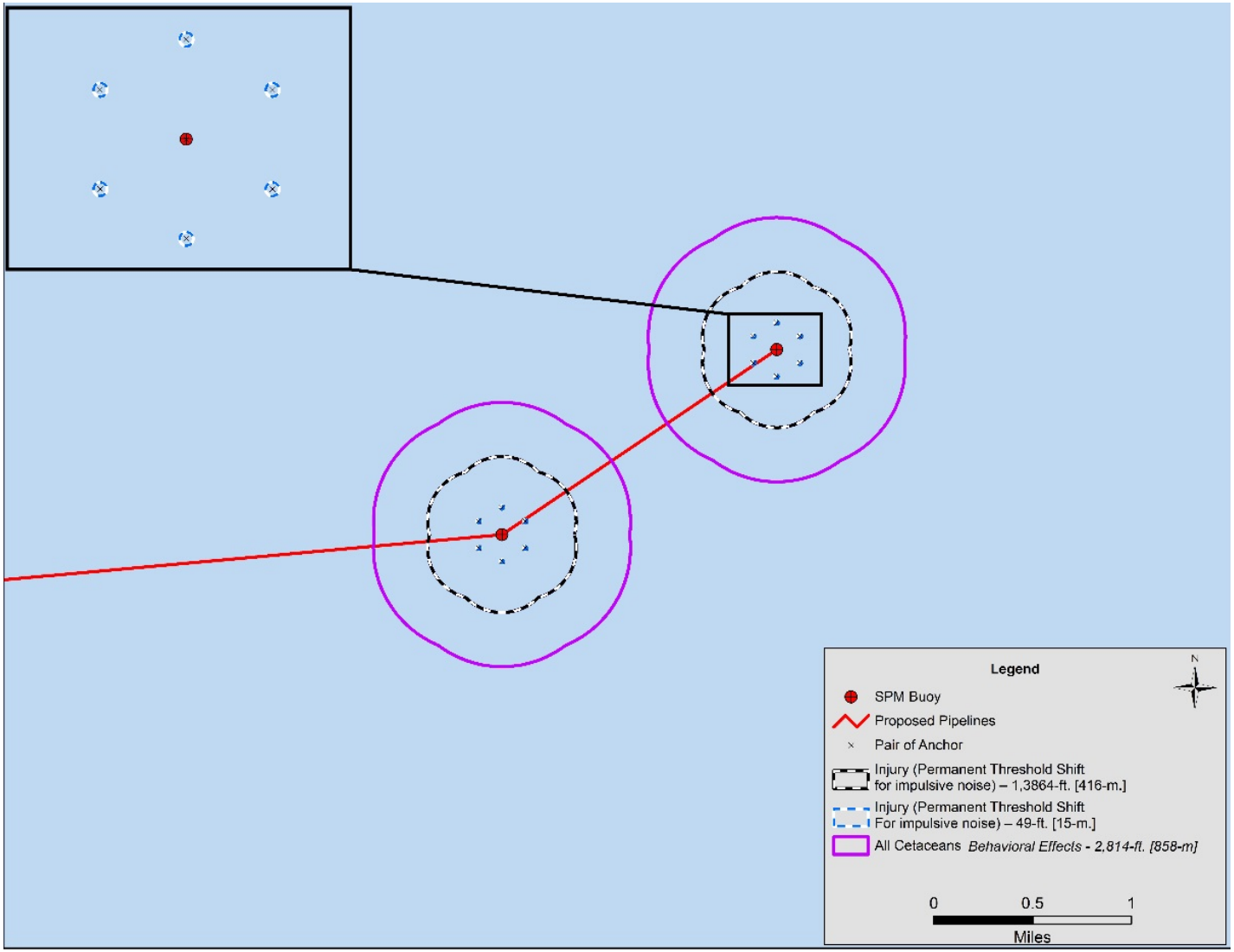
NOTE: The User Spreadsheet tool provides a means to estimates distances associated with the Technical Guidance's PTS onset thresholds. Mitigation and monitoring requirements associated with a Marine Mammal Protection Act (MMPA) authorization or an Endangered Species Act (ESA) consultation or permit are independent management decisions made in the context of the proposed activity and comprehensive effects analysis, and are beyond the scope of the Technical Guidance and the User Spreadsheet tool.

RESULTANT ISOPLETHS*

*Impulsive sounds have dual metric thresholds (SELcum & PK). Metric producing largest isopleth should be used.

Hearing Group	Low-Frequency Cetaceans	Mid-Frequency Cetaceans	High-Frequency Cetaceans	Phocid Pinnipeds	Otariid Pinnipeds
SEL_{cum} Threshold	183	185	155	185	203
PTS Isopleth to threshold (meters)	**415.9**	**14.8**	**495.3**	**222.5**	**16.2**
PK Threshold	219	230	202	218	232
PTS PK Isopleth to threshold (meters)	**4.6**	**NA**	**63.1**	**5.4**	**NA**

Figure A-2: Zones of Influence for Effects on Marine Mammals due to Pile-Driving



Source: NMFS 2018, b, c, d

A.1.2 Sea Turtles and Marine Fishes

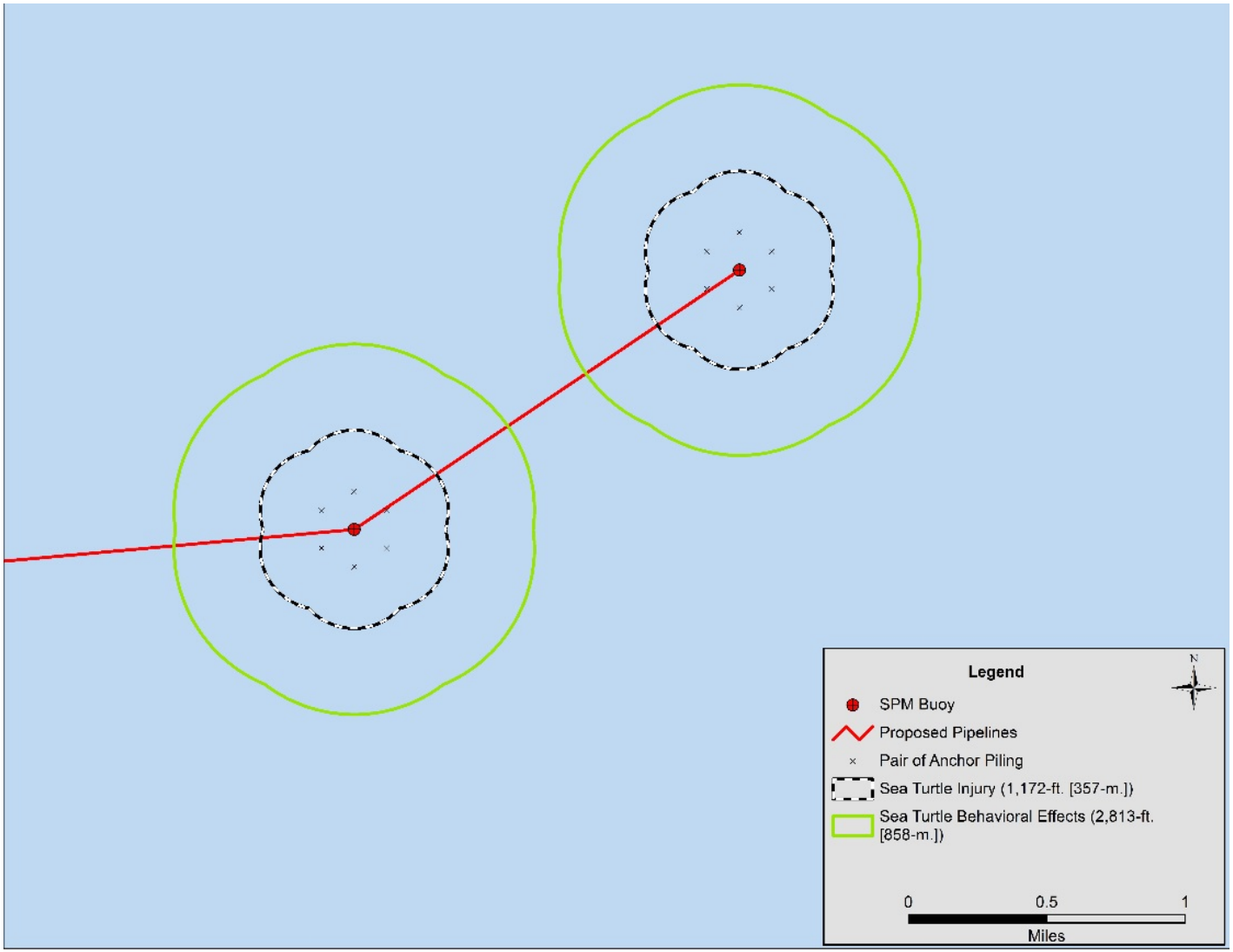
Similar to the GARFO spreadsheet, the NMFS SERO also developed a spreadsheet to determine impacts on ESA-listed species (sea turtles and fish) from underwater noise; NMFS provided this spreadsheet to BWTT during early Project consultation (NMFS 2019). Behavioral and physiological (injury) thresholds from the SERO spreadsheet are represented in Table A-1.

With the information known at this point in Project design, the following assumptions were used in the SERO spreadsheet:

- Only one pile is driven, using an impact hammer, per day.
- Noise estimates based on the 72-inch steel pipe with a source level of 214 dB at 10 m in the "Pile Driving Noise Data" tab of the SERO spreadsheet will be similar to that expected for the Proposed Project.
- Number of strikes per pile will be 675, which is the most conservative estimate in the "No. Strikes per Pile Data" tab of the SERO spreadsheet.
- Noise abatement will likely be used, but specific abatement will be determined in consultation with NMFS.

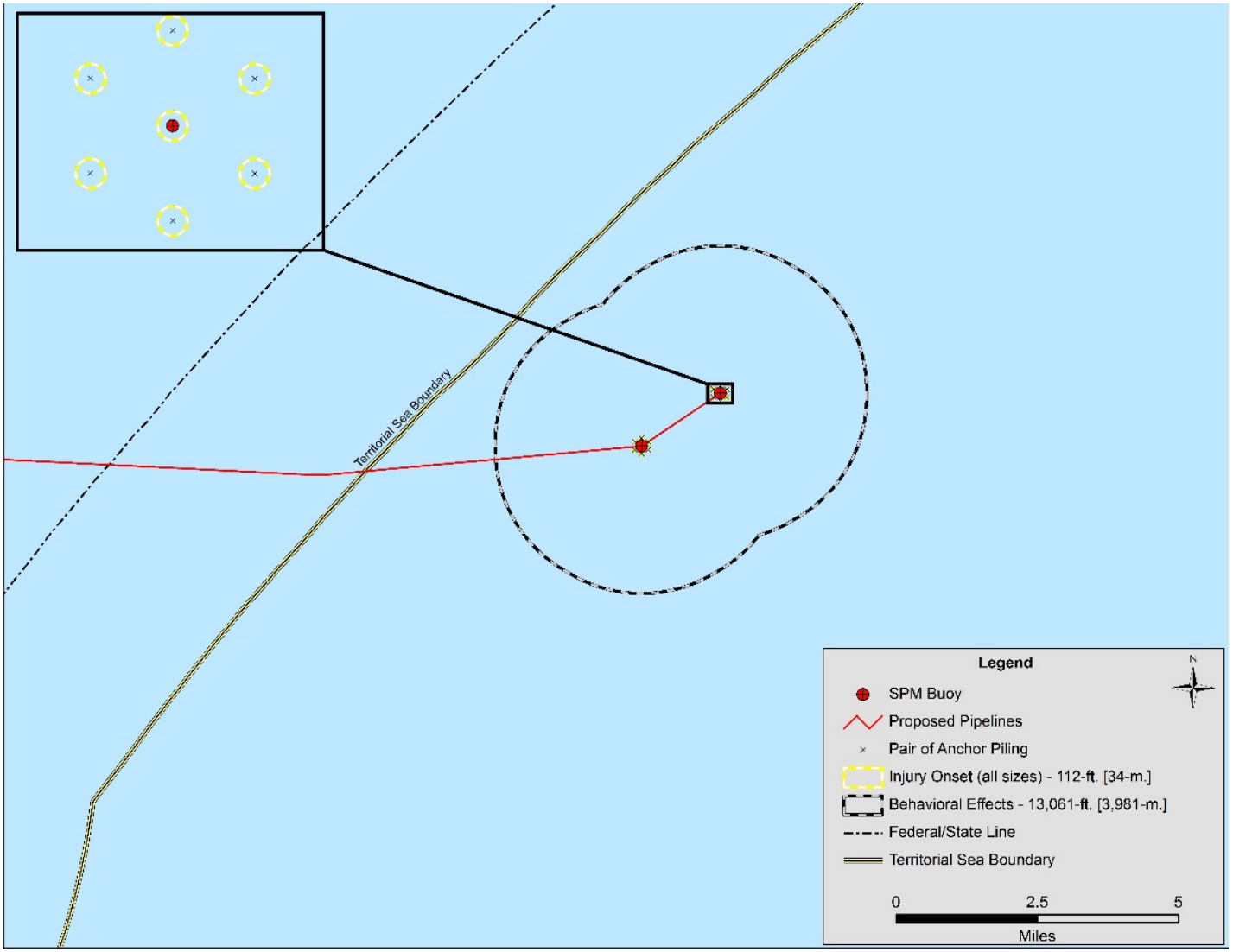
As the ZOI for sea turtles (depicted in Figure A-3) is too large to be effectively monitored, BWTT will ensure proper coordination with NMFS to identify what additional measures will need to be implemented during pile-driving to minimize impacts on sea turtles. Any such mitigation will also minimize the potential impacts of underwater noise on marine fishes (ZOIs for fish are depicted in Figure A-4).

Figure A-3: Zones of Influence for Effects on Sea Turtles due to Pile-Driving



Source: NMFS 2018, b, c, d

Figure A-4: Zones of Influence for Effects on Fish due to Pile-Driving



Source: NMFS 2018, b, c, d

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