Request for the Taking of Marine Mammals Incidental to the Operation of Northeast Gateway Deepwater Port and Algonquin Pipeline Lateral

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ACRONYMS AND ABBREVIATIONS

ABs	auto-detection buoys
Algonquin	Algonquin Gas Transmission, LLC
BRP	Cornell University's Bioacoustics Research Program
Certificate	Certificate of Public Convenience and Necessity
CFR	Code of Federal Regulations
dB	Decibel
dBL	decibel linear
DOT	U.S. Department of Transportation
DP	Dynamically Positioned
Excelerate	Excelerate Energy, LLC
FEIS/EIR	Final Environmental Impact Statement/Environmental Impact Report
FERC	Federal Energy Regulatory Commission
Gulf	Gulf of Mexico
GPS	global positioning system
Hz	Hertz
IHA	Incidental Harassment Authorization
ITS	Incidental Take Statement
IWC	International Whaling Commission
LNG	liquefied natural gas
LNGRV	Liquefied Natural Gas Regasification Vessel
LOA	Letter of Authorization
MARAD	Maritime Administration
MARU	Marine Autonomous Recording Unit
mgd	million gallons per day
MMPA	Marine Mammal Protection Act
MMO	Marine Mammal Observer
MP	Milepost
NEPA	National Environmental Policy Act
NEG Port or Port	Northeast Gateway Deepwater Port
NMFS	National Marine Fisheries Service
Northeast Gateway	Northeast Gateway Energy Bridge, L.L.C.
NOAA	National Oceanic and Atmospheric Administration
O&M	Operations and Maintenance
Pipeline Lateral	Algonquin's 16.1 mile natural gas pipeline
ROV	remotely operated vehicle
Project	Northeast Gateway Deepwater Port and Algonquin Pipeline Lateral
SBNMS	Stellwagen Bank National Marine Sanctuary
SPUE	Species per Unit Effort
STL	Submerged Turret Loading
TSS	Traffic Separation Scheme
USCG	U.S. Coast Guard
WHOI	Woods Hole Oceanographic Institution
ZOI	Zone of Influence
μPA	micro-Pascal

1.0 DESCRIPTION OF THE ACTIVITY

1.1 Introduction

On October 30, 2006, Northeast Gateway Energy Bridge, L.L.C. (Northeast Gateway) and Algonquin Gas Transmission, LLC (Algonquin) petitioned the National Marine Fisheries Service (NMFS) to issue an Incidental Harassment Authorization (IHA) pursuant to Section 101(a)(5) of the Marine Mammal Protection Act (MMPA) and 50 Code of Federal Regulations (CFR) § 216 Subpart I to allow for the incidental harassment of small numbers of marine mammals resulting from the construction and operation of the Northeast Gateway Deepwater Port (NEG Port or Port), an offshore liquefied natural gas (LNG) facility to be located in Massachusetts Bay, and the Algonquin Pipeline Lateral (Pipeline Lateral), a 16.1-mile (25.8-kilometer) long, 24-inch (61-centimeter) outside diameter natural gas pipeline which interconnects the Port to an offshore natural gas pipeline known as the HubLine[1]. The regulations set forth in Section 101(a)(5) of the MMPA and 50 CFR § 216 Subpart I allows for the incidental taking of marine mammals by a specific activity if the activity is found to have a negligible impact on the species or stock(s) of marine mammals and will not result in unmitigable adverse impact on the availability of the marine mammal species or stock(s) for certain subsistence uses. The IHA was approved by the NMFS on May 7, 2007 and subsequently amended on November 30, 2007. Level B take for incidental harassment was granted for the North Atlantic right whale (*Eubalaena glacialis*), humpback whale (*Megaptera novaeangliae*), fin whale (*Balaenoptera physalus*), minke whale (*Balaenoptera acutorostrata*), pilot whale (*Globicephala* spp.), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), common dolphin (*Delphinus delphis*), harbor porpoise (*Phocoena phocoena*), harbor seal (*Phocac vitulina*), and gray seal (*Halichoerus grypus*).

In support of continued Port operations, Northeast Gateway petitioned the NMFS to renew the IHA for a period of one year (May 15, 2008 through May 14, 2009). The IHA was renewed on May 15, 2008 with a recommendation that in the future Northeast Gateway and Algonquin seek a Letter of Authorization (LOA) to govern takes incidental to Port and Pipeline Lateral operations for a period of up to five years.

Per the recommendation of the NMFS, Northeast Gateway and Algonquin have prepared this request for the taking by harassment, of small numbers of marine mammals in Massachusetts Bay that is based on a five-year period of Project operation and maintenance pursuant to Section 101 (a) (5) of the MMPA and in accordance with 50 CFR § 216 Subpart I.

This section further describes the NEG Port and Algonquin Pipeline Lateral and the operational activities that could result in the potential take, by Level B harassment, of marine mammals under the MMPA.

1.2 Northeast Gateway Deepwater Port and Algonquin Pipeline Lateral

The NEG Port is located in Massachusetts Bay and consists of a submerged buoy system to dock specially designed LNG carriers approximately 13 miles (21 kilometers) offshore of Massachusetts in federal waters approximately 270 to 290 feet (82 to 88 meters) in depth. This facility delivers regasified LNG to onshore markets via the Algonquin Pipeline Lateral.

[1] HubLine is an existing 30-inch-diameter interstate natural gas pipeline that was constructed by Algonquin in 2002/2003. HubLine starts at its connection with the Maritimes & Northeast Pipeline, LLC Phase III Pipeline in Salem Harbor, Massachusetts and runs offshore to the south to the Algonquin "I" System Pipeline in Weymouth, Massachusetts.

The NEG Port consists of two subsea Submerged Turret Loading™ (STL[2]) buoys, each with a flexible riser assembly and a manifold connecting the riser assembly, via an 18-inch diameter subsea Flowline, to the Algonquin Pipeline Lateral. Northeast Gateway utilizes vessels from its current fleet of specially designed Liquefied Natural Gas Regasification Vessels (LNGRVs), each capable of transporting approximately 2.9 billion cubic feet (82 million cubic meters) of natural gas condensed to 4.9 million cubic feet (138,000 cubic meters) of LNG. Northeast Gateway will also be adding vessels to its fleet that will have a cargo capacity of approximately 151,000 cubic meters of LNG. The mooring system installed at the NEG Port is designed to handle both the existing vessels and any of the larger capacity vessels that may come into service in the future. The LNGRVs will dock to the STL buoys, which will serve as both the single-point mooring system for the vessels and the delivery conduit for natural gas. Each of the STL buoys is secured to the seafloor using a series of suction anchors and a combination of chain/cable anchor lines.

On June 13, 2005, Northeast Gateway submitted an application to the U.S. Coast Guard (USCG) and the Maritime Administration (MARAD) seeking a federal license under the Deepwater Port Act to own, construct, and operate a deepwater port for the import and regasification of LNG in Massachusetts Bay, off the coast of Massachusetts. The Northeast Gateway application was assigned Docket Number USCG-2005-22219. Simultaneous with this filing, Algonquin, now a subsidiary of Spectra Energy Corp, filed a Natural Gas Act Section 7(c) application with the Federal Energy Regulatory Commission (FERC) for a Certificate of Public Convenience and Necessity (Certificate) for the Algonquin Pipeline Lateral that would connect the NEG Port with the existing HubLine natural gas pipeline for transmission throughout New England (FERC Docket Number CP05-383-000).

The USCG, in coordination with the FERC, published a Final Environmental Impact Statement/Environmental Impact Report (FEIS/EIR) for the proposed NEG Port and Algonquin Pipeline Lateral on October 27, 2006. This document provides detailed information on the proposed NEG Port and Algonquin Pipeline Lateral, construction methods, and analysis of potential impacts on marine mammals as well as other environmental resources.

On May 14, 2007, MARAD issued a license to Northeast Gateway to own, construct, and operate a deepwater port. The FERC issued its Certificate to Algonquin on March 16, 2007. Construction of the NEG Port and Algonquin Pipeline Lateral was completed in December 2007, and the Port was commissioned for operation by the USCG in February 2008.

1.3 NEG Port and Algonquin Pipeline Lateral Operation and Maintenance Activities

This section describes the operation and maintenance (O&M) activities that are required for the NEG Port and Algonquin Pipeline Lateral. NEG Port O&M activities will be completed in accordance with the Classification Society Rules (American Bureau of Shipping). The Algonquin Pipeline Lateral and NEG Port Flowlines' O&M activities will be performed in accordance with U.S. Department of Transportation (DOT) regulations (49 CFR Part 192).

1.3.1 NEG Port Operations

During NEG Port operations, LNGRVs servicing the NEG Port shall utilize the newly configured and International Maritime Organization-approved Boston Traffic Separation Scheme (TSS) on their approach to and departure from the NEG Port at the earliest practicable point of transit. LNGRVs shall maintain

[2] STL is a trademark of Advanced Production & Loading AS.

speeds of 12 knots or less while in the TSS unless transiting the Off Race Point Seasonal Management Area between the dates of March 1 and April 30, the Great South Channel Seasonal Management Area between the dates of April 1 and July 31, or when there have been active right whale sightings[3], active acoustic[4] detections, or both, in the vicinity of the transiting LNGRV in the TSS or at the NEG Port whereby the vessels must slow their speeds to 10 knots or less. Appendix A contains the National Oceanic and Atmospheric Administration (NOAA)-approved Marine Mammal Detection, Monitoring, and Response Plan for Operation of the Northeast Gateway Energy Bridge Deepwater Port and Algonquin Pipeline Lateral, which describes in detail the measures required for LNGRVs transiting in the TSS or within the NEG Port area.

As an LNGRV makes its final approach to the NEG Port, vessel speed will gradually be reduced to 3 knots at 1.86 miles out to less than 1 knot at a distance of 1,640 feet from the NEG Port. When an LNGRV arrives at the NEG Port, it will retrieve one of the two permanently anchored submerged STL buoys. It will make final connection to the buoy through a series of engine and bow thruster actions. The LNGRV will require the use of thrusters for dynamic positioning during docking procedure. Typically, the docking procedure is completed over a 10- to 30-minute period, with the thrusters activated as necessary for short periods of time in second bursts, not a continuous sound source. Once connected to the buoy, the LNGRV will make ready to begin vaporizing the LNG into its natural gas state using the onboard regasification system. As the LNG is regasified, natural gas will be transferred at pipeline pressures off the LNGRV through the STL buoy and flexible riser via a steel flowline leading to the connecting Algonquin Pipeline Lateral. When the LNG vessel is on the buoy, wind and current effects on the vessel will be allowed to “weathervane” on the single-point mooring system; therefore, thrusters will not be used to maintain a stationary position.

It is estimated that the NEG Port could receive approximately 65 cargo deliveries a year. During this time period thrusters will be engaged in use for docking at the NEG Port approximately 10 to 30 minutes for each vessel arrival and departure.

1.3.2 NEG Port Maintenance

The specified design life of the NEG Port is about 40 years, with the exception of the anchors, mooring chain/rope, and riser/umbilical assemblies, which are based on a maintenance-free design life of 20 years. The buoy pick-up system components are considered consumable and will be inspected following each buoy connection, and replaced (from inside the STL compartment during the normal cargo discharge period) as deemed necessary. The underwater components of the NEG Port will be inspected once yearly in accordance with Classification Society Rules (American Bureau of Shipping) using either divers or remotely operated vehicles (ROV) to inspect and record the condition of the various STL system components. These activities will be conducted using the NEG Port’s normal support vessel (125-foot, 99 gross ton, 2,700 horsepower, aluminum mono-hull vessel), and to the extent possible will coincide with planned weekly visits to the NEG Port. Helicopters will not be used for marker line maintenance inspections.

[3] Active right whale sightings are all right whale sightings broadcast by the Mandatory Ship Reporting or Sighting Advisory System.

[4] Active acoustic detections are confirmed right whale vocalizations detected by a TSS auto-detection buoy (AB) within 24 hours of each scheduled data review period (e.g., every 30 minutes or every 12 hours, as detailed in subsequent text). Multiple confirmed acoustic detections at a single AB will extend the duration of minimum mandated LNGRV response to 24 hours from the last confirmed detection (within the reception area of the detecting AB). Confirmed acoustic detections at multiple ABs within the same 24-hour period will extend the area of minimum mandated LNGRV response to encompass the reception areas of all detecting ABs.

1.3.3 Algonquin Pipeline Lateral O&M Activities

The O&M activities associated with the Algonquin Pipeline Lateral can be subdivided into two categories, Routine O&M Activities and Unplanned Repair Work. While the 0.7 and 0.51-mile (1.13 and 0.82- kilometer) Flowlines are part of the NEG Port, because of their similar functions and requirements they will be discussed in this application as part of the Algonquin Pipeline Lateral activities.

1.3.3.1 Routine O&M Activities

The planned activities required for the O&M of the Algonquin Pipeline Lateral and Flowlines over a five-year period are limited. Similar to the inspection of the NEG Port underwater components, the only planned O&M activity is the annual inspection of the cathodic protection monitors by a ROV. The monitors are located at the ends of the Algonquin Pipeline Lateral and the adjacent Flowlines. Each inspection activity will take approximately three days and will utilize a ROV launched from a vessel of opportunity. The most likely vessel will be similar to the NEG Port's normal support vessel referenced in Section 1.3.2. This vessel is self-positioning and requires no anchors or use of thrusters. It will mobilize from Salem, Massachusetts and will inspect the monitors in the vicinity of the NEG Port and at the point where the Algonquin Pipeline Lateral interconnects with Algonquin's HubLine. These activities will be performed during daylight hours and during periods of good weather.

1.3.3.2 Unplanned Pipeline Repair Activities

Unplanned O&M activities may be required from time to time at a location along the Algonquin Pipeline Lateral or along one of the Flowlines should the line become damaged or malfunction. The application submitted by Algonquin to FERC on June 13, 2005, for authorization to construct and operate the Algonquin Pipeline Lateral, noted at various points that "[o]perational activities that may occur infrequently would include limited excavation to access the pipeline for repairs or cathodic protection maintenance" and that "[i]n this rare instance, Algonquin will coordinate with the applicable federal and state resource agencies to ensure that the work is performed in accordance with appropriate requirements and restrictions" (Appendix F-1 to FERC Application at 4-17, 4-102, 4-143). The FERC certificate of public convenience and necessity authorizing construction and operation of the Algonquin Pipeline Lateral authorizes Algonquin to construct and operate the pipeline lateral as "described in the application and in [the FERC] order" (FERC Order at 20). The USCG FEIS/EIR also noted that "[o]perational activities that may occur infrequently would include limited excavation to access the pipeline for repairs or cathodic protection maintenance" and that "[i]n this rare instance, Algonquin would coordinate with the applicable Federal, state and local resource agencies to ensure that the work was performed in accordance with appropriate requirements and restrictions." FEIS/EIR at 4-102. The FEIS also served as the biological assessment for purposes of consultation under section 7 of the Endangered Species Act (ESA) (FEIS/EIR at 1-17). The February 5 and November 30, 2007, biological opinions note on their cover pages that they considered the effects of the FERC certificate for the Algonquin Pipeline Lateral, and are based on information provided in the draft and final Coast Guard EISs and other sources of information.

Should repair work be required, it is likely a dive vessel would be the main vessel used to support the repair work. The type of diving spread and the corresponding vessel needed to support the spread would be dictated by the type of repair work required and the water depth at the work location. In addition, the type of vessel used may vary depending upon availability. The duration of an unplanned activity would also vary depending upon the repair work involved (e.g., repairing or replacing a section of the pipeline, connection, or valve) but can generally be assumed to take less than 40 work days to complete based on industry experience with underwater pipeline repairs.

A diving spread required to execute an unplanned activity might necessitate several vessels. Most likely the dive vessel would support a saturation diving spread and be moored at the work location using four anchors. This vessel would transit to and from the location in accordance with the conditions stated in the Marine Mammal Detection, Monitoring, and Response Plan for Operation of the Northeast Gateway Energy Bridge Deepwater Port and Algonquin Pipeline Lateral (see Appendix A) and would likely be accompanied by an attendant tug to assist with anchor placement. Once secured at the work location, the dive vessel would remain on site through the completion of the work, weather permitting. A crew/supply boat would be utilized to intermittently provide labor and supply transfers. Once or twice during the work, a tug may be required to bring a material barge to and from the location. While unlikely, there is a small possibility that a second dive vessel would be required to support the main dive vessel, depending upon the work activity. The second dive vessel would be on-site for a shorter work duration. As discussed in more detail in Section 13 and in Appendix A, the crews would be provided with project-specific training on the requirements for monitoring and reacting to the sighting of marine mammals. These vessels would be supported from an onshore base located between Quincy, Massachusetts and Gloucester, Massachusetts.

The selection of a dive vessel will be driven by the technical requirements of the work. In addition, the degree of urgency required to address the work and the availability of vessels will also enter into the decision process for securing a dive vessel. It may be that a four point moored dive vessel is either not available or doesn't meet the technical capabilities required by the work. It then becomes possible that a dynamically positioned (DP) dive vessel may have to be utilized. The use of a DP dive vessel removes the need for an attendant tug to support the vessel since no anchors will be deployed. However, potential impacts related to noise are increased when a DP dive vessel is used. The noise generated by a DP dive vessel varies, and results from the use of the thrusters which run at various levels to maintain the vessel's position during the work depending upon currents, winds, waves and other forces acting on the vessel at the time of the work. No vessels are operated or controlled by Algonquin in connection with its ownership or operation of the Algonquin Pipeline Lateral other than during inspection and potential repair activities described above.

1.4 NEG Port and Algonquin Pipeline Lateral Activities Resulting in the Potential Incidental Taking of Marine Mammals

Activities that could result in the incidental take of marine mammals are limited to the generation by vessels of underwater noise that has the potential to cause Level B harassment as defined by the MMPA. No other operation and maintenance activities as described in Sections 1.3.1, 1.3.2 and 1.3.3.1 are likely to result in the take of marine mammals.

1.4.1 NEG Port Activities

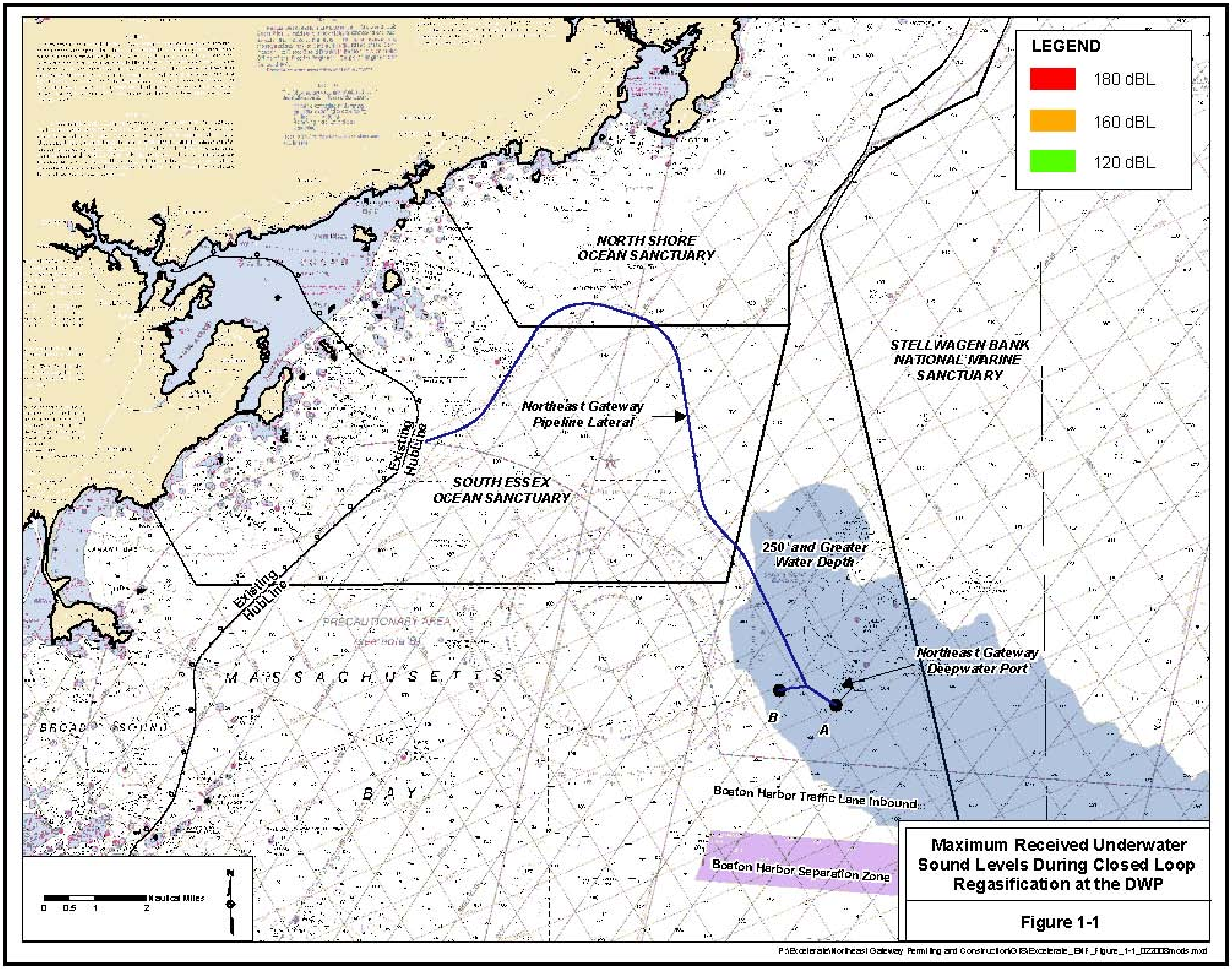
Underwater noise generated at the NEG Port has the potential to result from two distinct actions, including closed-loop regasification of LNG and/or LNGRV maneuvering during coupling and decoupling with STL buoys. To evaluate the potential for these activities to result in underwater noise that could harass marine mammals, Excelerate Energy, L.L.C. (Excelerate) conducted field sound survey studies during periods of March 21 to 25, 2005 and August 6 to 9, 2006 while the LNGRV *Excelsior* was both maneuvering and moored at the operational Gulf Gateway Port located 116 miles offshore in the Gulf of Mexico (the Gulf) (Appendices B and C). LNGRV maneuvering conditions included the use of both stern and bow thrusters required for dynamic positioning during coupling. These data were used to model underwater sound propagation at the NEG Port. A copy of the field survey report has been included as Appendix C. The pertinent results of the field survey are provided as underwater sound source pressure levels (decibel [dB] re: 1 micro-Pascal [μPA] at 1 meter) as follows:

- Sound levels during closed-loop regasification ranged from 104 to 110 decibel linear (dBL). Maximum levels during steady state operations were 108 dBL.
- Sound levels during coupling operations were dominated by the periodic use of the bow and stern thrusters and ranged from 160 to 170 dBL.

Figures 1-1 and 1-2 present the net acoustic impact of one LNGRV operating at the NEG Port. Figure 1-1 presents the impact of the maximum received underwater sound levels during closed-loop LNGRV regasification with a steady-state source level of 108 dBL re 1 μPa at 1 meter. As shown in this plot, there is no area of ensonification above the 120 dBL criteria. Figure 1-2 presents maximum underwater sound levels during LNGRV maneuvering and coupling using a source level of 170 dBL re: 1 μPa at 1 meter (thrusters used for dynamic positioning). Thrusters are operated intermittently and only for relatively short durations of time. The resulting area within the critical 120 dB isopleth is less than 1 square kilometer with the linear distance to the critical isopleths extending 430 meters. The area within the 160 dB isopleth is very localized and will not extend beyond the immediate area where LNGRV coupling operations are occurring.

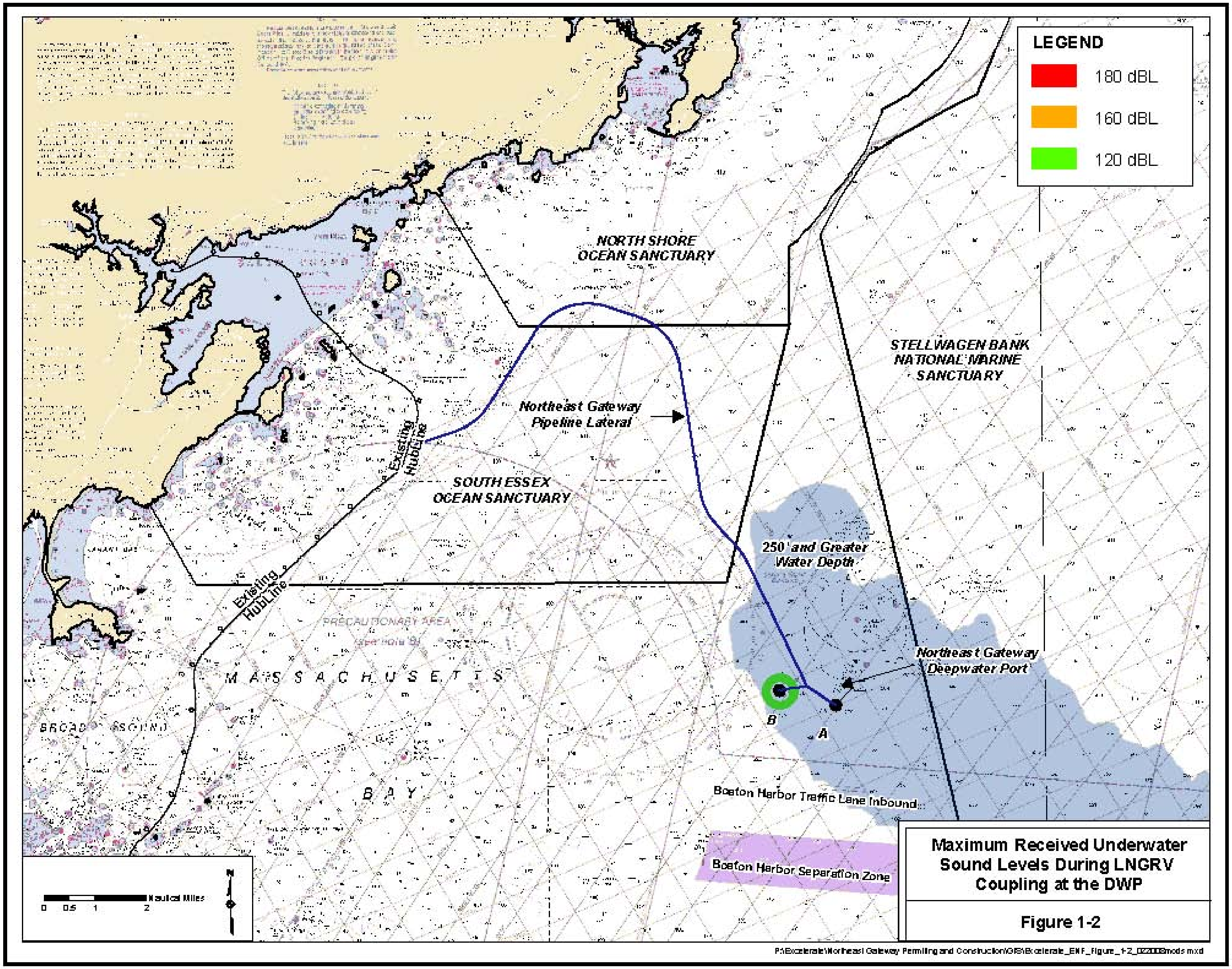
1.4.2 Unplanned Pipeline Lateral Repair Activities

As discussed in Section 1.3.3.2, pipeline repairs may be required from time to time should the pipeline become damaged or malfunction. While the need for repairs to underwater pipelines is typically infrequent, in the event that a pipeline repair is required, it is most likely that anchor-moored vessels will be used. If so, underwater noise will not be generated at the level of concern for marine mammals. However, there is the potential that underwater noise will be generated within the 120dB threshold for level B Harassment of concern for marine mammals if DP vessels are used to perform the work. Given the limited availability of DP dive support vessels, it is most likely that an anchor-moored dive vessel will be used, though the possibility that a DP vessel would be used cannot be ruled out. Depending on the nature of the repair, the work could last for up to 40 work days. The possibility that a DP vessel would be used to perform a pipeline repair is the only instance in which underwater noise will be generated within the 120dB threshold for level B Harassment in connection with Algonquin's ownership or operation of the Algonquin Pipeline Lateral**.**



Maximum Received Underwater Sound Levels During Closed Loop Regasification at the DWP

Figure 1-1

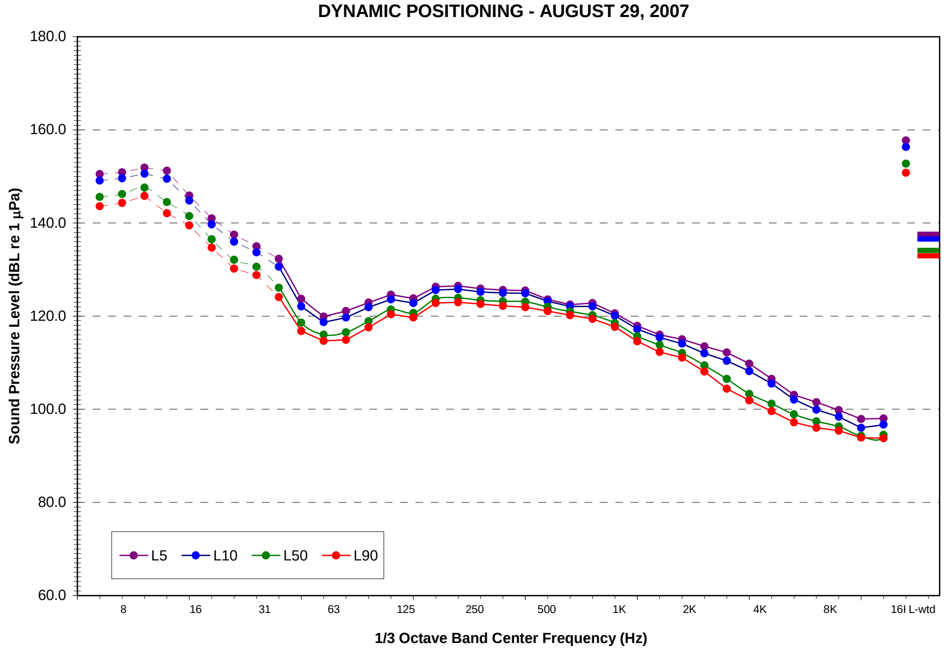

LEGEND
180 dBL
160 dBL
120 dBL
NORTH SHORE OCEAN SANCTUARY
STELLWAGEN BANK NATIONAL MARINE SANCTUARY
Northeast Gateway Pipeline Lateral
Existing HubLine
SOUTH ESSEX OCEAN SANCTUARY
250' and Greater Water Depth
Existing HubLine
PRECAUTIONARY AREA
Northeast Gateway Deepwater Port
MASSACHUSETTS
B
A
BAY
Boston Harbor Traffic Lane Inbound
Boston Harbor Separation Zone
Nautical Miles
0 0.5 1 2
N
Maximum Received Underwater Sound Levels During LNGRV Coupling at the DWP
Figure 1-2

In general, DP vessels are fitted with six thrusters of three main types: main propellers, tunnel thrusters and azimuth thrusters. Two or three tunnel thrusters are usually fitted in the bow. Stern tunnel thrusters are also common, operating together but controlled individually, as are azimuth or compass thrusters placed in the rear. Azimuth thrusters are located beneath the bottom of the vessel and can be rotated to provide thrust in any direction. During vessel operation, the thrusters engage in varying numbers and at varying intensity levels, as needed to control and maintain vessel location based on sea and weather conditions. While at least one thruster is always engaged in at least partial capacity, higher noise levels are generated periodically when greater numbers of thrusters need to engage, and when thrusters are at closer to their full capacity. Thruster underwater noise levels are principally caused by cavitation, which is a combination of broadband noise and tonal sounds at discrete frequencies.

In August 2007, during construction of the NEG Port and Algonquin Pipeline Lateral, Northeast Gateway collected sound measurements of vessels used to support construction including crew boats, support tugs, and diver support vessels which required the steady use of thrusters as well as unassociated boat movements routinely occurring outside the immediate construction zone. These vessels are similar to those which may be employed during pipeline repair.

As presented in Figure 1-3, the far right portion of the plots present overall linear broadband levels inclusive of background interferences (sound energy <31 Hz) as dots. The dashed marks represent the broadband data with low frequency energy interference removed from the broadband calculation (<31 Hz sound energy contribution due to measurement uncertainty) and is thus representative of actual construction sounds during this monitoring period. Based upon the measurement data collected, results showed no exceedances of the critical MMPA 180 dBL level for Level A Harassment during any of the monitoring periods in the acoustic far field ranging from 605 to 1050 meters (see Figure 1-3). However, construction activities involving the use of DP vessels did exceed the 120 dBL Level B Harassment criteria principally at low and mid-range frequencies. These results effectively confirm the results of the underwater noise screening level analysis which was completed for the LNGRVs and are further described in Section 1.4.1 and Appendix C.

Figure 1-3 **COMPARISON OF PERCENTILE FREQUENCY SPECTRUM OF RECEIVED UNDERWATER SOUND PRESSURE LEVELS AT A DISTANCE RANGE OF 605 to 1050 METERS DURING: DYNAMIC POSITIONING - AUGUST 29, 2007**



It is important to note, however, that even though measurements showed construction activities periodically resulted in the exceedances of the Level B harassment threshold, such received sound pressure levels may not in every instance be perceptible to marine life, as hearing thresholds are largely frequency-dependent and vary considerably from species to species. In addition, though ambient noise in shallow waters such as the Gulf of Maine tends to be highly variable in both time and location, existing elevated ambient conditions inherent within the Massachusetts Bay environment may effectively mask noise generated by future offshore repair work at short to moderate distances from where the work is occurring. This is particularly true during elevated wind and seastate conditions when the use of thrusters is more predominant. At the same time, the ambient underwater noise intensity levels will be higher during these periods as well.

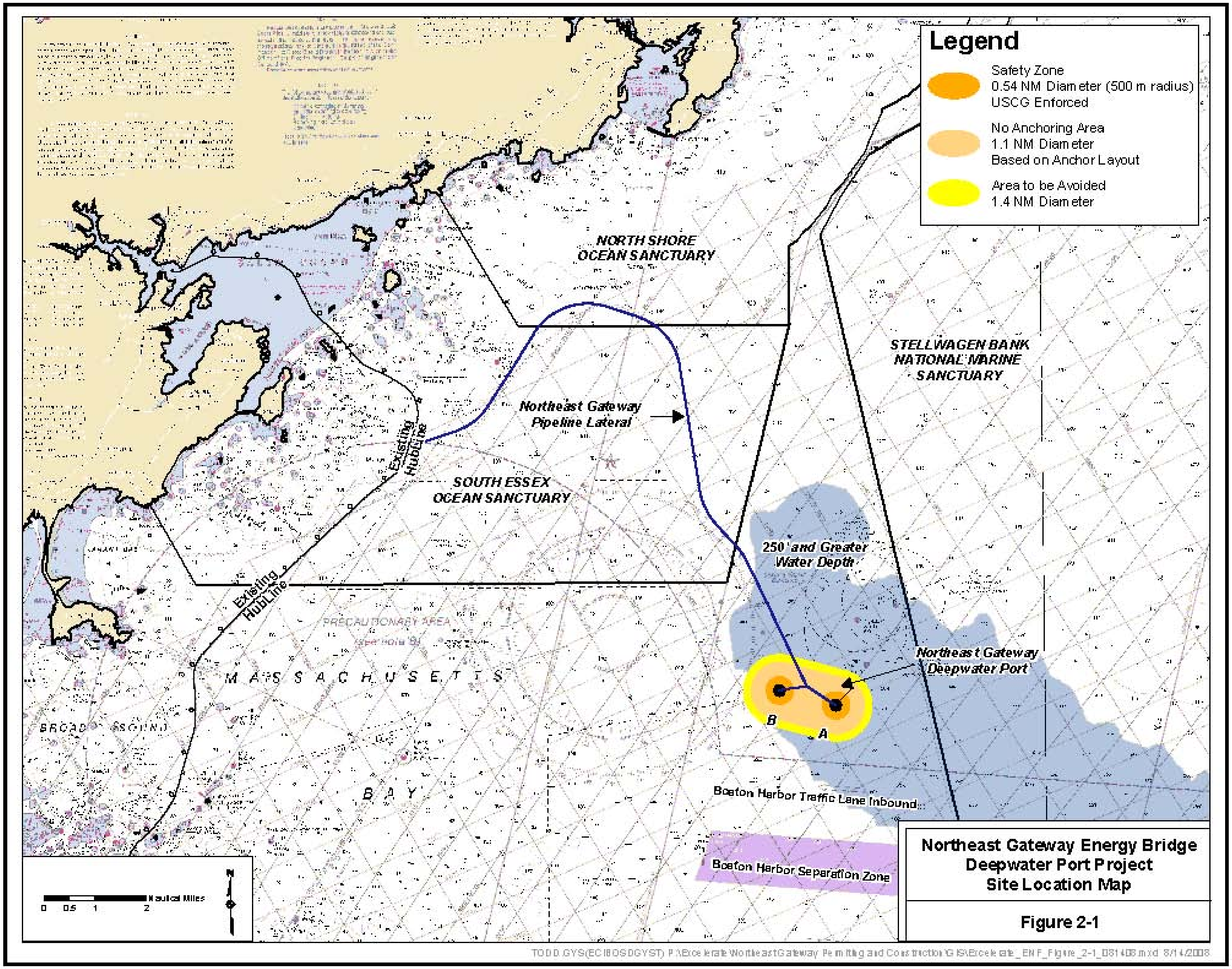
2.0 DATES, DURATION AND LOCATION OF NEG PORT AND ALGONQUIN PIPELINE LATERAL OPERATIONS

2.1 Operation Dates and Duration

The Algonquin Pipeline Lateral received final authorization from the FERC to commence in-service activities on December 5, 2007. The NEG Port completed commissioning activities on February 27, 2008, enabling the facility to receive natural gas and to begin its operations. The NEG Port is expected to receive LNG cargo deliveries for the design life of the facility of about 40 years.

2.2 Specific Geographic Region

The NEG Port is located at 42º 23’ 38.46” N/70º 35’ 31.02” W for Buoy A and 42º 23’ 56.40 N/70º 37’ 0.36” W for Buoy B in Massachusetts Bay. The Algonquin Pipeline Lateral begins near milepost (MP) 8 on the existing HubLine pipeline in waters approximately 3 miles (4.8 kilometers) to the east of Marblehead Neck in Marblehead, Massachusetts. From the HubLine connection (MP 0.0), the Algonquin Pipeline Lateral route extends northeast, crossing the outer reaches of the territorial waters of the Town of Marblehead, the City of Salem, the City of Beverly, and the Town of Manchester-by-the-Sea for approximately 6.3 miles (10.1 kilometers). At MP 6.3, the Algonquin Pipeline Lateral route curves to the east and southeast, exiting Manchester-by-the-Sea territorial waters and entering waters regulated by the Commonwealth of Massachusetts. The Algonquin Pipeline Lateral route continues to the south/southeast for approximately 6.2 miles (10 kilometers) to MP 12.5, where it exits state waters and enters federal waters. The Algonquin Pipeline Lateral route then extends to the south for another approximately 3.5 miles (5.7 kilometers), terminating at the NEG Port. The NEG Port and Algonquin Pipeline Lateral are depicted in Figure 2-1.


Legend
Safety Zone
0.54 NM Diameter (500 m radius)
USCG Enforced
No Anchoring Area
1.1 NM Diameter
Based on Anchor Layout
Area to be Avoided
1.4 NM Diameter
NORTH SHORE
OCEAN SANCTUARY
STELLWAGEN BANK
NATIONAL MARINE
SANCTUARY
Northeast Gateway
Pipeline Lateral
Existing
HubLine
SOUTH ESSEX
OCEAN SANCTUARY
250' and Greater
Water Depth
Existing
HubLine
Northeast Gateway
Deepwater Port
M A S S A C H U S E T T S
B A Y
B
A
Boston Harbor Traffic Lane Inbound
Boston Harbor Separation Zone
Nautical Miles
0 0.5 1 2
Northeast Gateway Energy Bridge
Deepwater Port Project
Site Location Map
Figure 2-1

3.0 MARINE MAMMAL SPECIES AND NUMBERS

Marine mammals known to traverse or occasionally visit the waters within the area of the NEG Port and Algonquin Pipeline Lateral include both threatened or endangered species, as well as those species that are not threatened or endangered. Marine mammals both protected under the MMPA as amended in 1994 and those that are listed as threatened or endangered under the Endangered Species Act are discussed in detail in Sections 3.2.4 and 3.3 of the USCG FEIS/EIR issued for this project. As shown in Table 3-1, 20 marine mammal species have the possible or confirmed occurrences within the marine waters of Massachusetts Bay.

Table 3-1 Marine Mammals Known to Occur in the Marine Waters of Massachusetts Bay

Common Name	Scientific Name	NMFS Status	Time of Year in Massachusetts Bay
Toothed Whales (Odontoceti)			
Atlantic white-sided dolphin	*Lagenorhynchus acutus*	Non-strategic	Year round
Bottlenose dolphin	*Tursiops truncates*	Non-strategic	Late summer, early fall
Short-beaked common dolphin	*Delphinus delphis*	Non-strategic	Fall and winter
Harbor porpoise	*Phocoena phocoena*	Non-strategic	Year round (Sept-April peak)
Killer whale	*Orcinus orca*	Non-strategic	July-Sept
Long-finned pilot whale	*Globicephala malaena*	Strategic	Year round (Sept-April peak)
Risso's dolphin	*Grampus griseus*	Non-strategic	Spring, summer, autumn
Striped dolphin	*Stenella coeruleoalba*	Non-strategic	Year round
White-beaked dolphin	*Lagenorhynchus albirostris*	Non-strategic	April-Nov
Sperm whale	*Physeter macrocephalus*	Endangered	Pelagic
Baleen Whales (Mysticeti)			
Minke whale	*Balaenoptera acutorostrata*	Non-strategic	April-Oct
Blue whale	*Balaenoptera musculus*	Endangered	Aug-Oct
Fin whale	*Balaenoptera physalus*	Endangered	April-Oct
Humpback whale	*Megaptera novaeangliae*	Endangered	April-Oct
North Atlantic right whale	*Eubalaena glacialis*	Endangered	Jan-Jul (year round)
Sei whale	*Balaenoptera borealis*	Endangered	May-Jun
Earless Seals (Phocidae)			
Gray seals	*Halichoerus grypus*	Non-strategic	Year round
Harbor seals	*Phoca vitulina*	Non-strategic	Late Sept-early May
Hooded seals	*Cystophora cristata*	Non-strategic	Jan-May
Harp seal	*Phoca groenlandica*	Non-strategic	Jan-May

4.0 AFFECTED SPECIES STATUS AND DISTRIBUTION

The status, distribution, and seasonal distribution of affected species or stocks that may be affected by the operation of the NEG Port and Algonquin Pipeline Lateral are discussed in detail in Sections 3.2.4 and 3.3 of the USCG FEIS/EIR issued for this NEG Port and Algonquin Pipeline Lateral, and in Table 3-1.

In general, Risso's dolphins, striped dolphins, sperm whales, hooded seals, and harp seals range outside the NEG Port area, usually in more pelagic waters. Additionally, the sei whale, also a more pelagic and northern species, generally ranges outside the NEG Port area. On March 27, 2008, NMFS issued an IHA to Northeast Gateway which authorizes the incidental harassment of species more commonly found in the shelf waters of Massachusetts Bay and that could potentially be encountered in the NEG Port area. These species include the gray seal, harbor seal, harbor porpoise, Atlantic white-sided dolphin, short-beaked common dolphin, bottlenose dolphin, long-finned pilot whale, killer whale, minke whale, North Atlantic right whale, humpback whale, and fin whale. These species, with the exception of the short-beaked common dolphin, bottlenose dolphin and killer whale, are the only ones observed during intensive right whale surveys (2001 to 2005) in nearby Cape Cod by the Provincetown Center for Coastal Studies. These species were also not observed during NEG Port construction activities during the months of May through November 2007 (see Appendix D), or during 2008 operational activities to date. However, given their potential for occurrence in the vicinity of the NEG Port and Algonquin Pipeline Lateral area, Northeast Gateway and Algonquin request harassment authorization for all 12 of these species under this application. A general summary of each of these species is provided in the following sections.

4.1 Toothed Whales (Odontonciti)

Long-finned pilot whale (*Globicephala melas*) – Strategic

The long-finned pilot whale is more generally found along the edge of the continental shelf (a depth of 330 to 3,300 feet [100 to 1,000 meters]), choosing areas of high relief or submerged banks in cold or temperate shoreline waters. This species is split between two subspecies: the Northern and Southern subspecies. The Southern subspecies is circumpolar with northern limits of Brazil and South Africa. The Northern subspecies, which could be encountered during operation of the NEG Port, ranges from North Carolina to Greenland (Reeves et al. 2002; Wilson and Ruff 1999). In the western North Atlantic, long-finned pilot whales are pelagic, occurring in especially high densities in winter and spring over the continental slope, then moving inshore and onto the shelf in summer and autumn following squid and mackerel populations (Reeves et al. 2002). They frequently travel into the central and northern Georges Bank, Great South Channel, and Gulf of Maine areas during the summer and early fall (May and October) (NOAA 1993). According to the species stock report, the population estimate for the Gulf of Maine/Bay of Fundy long-finned pilot whale is 14,524 individuals (Waring et al. 2004).

They feed preferentially on squid but will eat fish (e.g., herring) and invertebrates (e.g., octopus, cuttlefish) if squid are not available. They also ingest shrimp (particularly younger whales) and various other fish species occasionally. These whales probably take most of their prey at depths of 600 to 1,650 feet (200 to 500 meters), although they can forage deeper if necessary (Reeves et al. 2002). As a very social species, long-finned pilot whales travel in pods of roughly 20 individuals while following prey. These small pods are thought to be formed around adult females and their offspring. Behaviors of long-finned pilot whales range from quiet rafting or milling on the surface, to purposeful diving, to bouts of playfulness.

The long-finned pilot whales are subject to bycatch during gillnet fishing, pelagic trawling, longline fishing, and purse seine fishing. Approximately 215 pilot whales were killed or seriously injured each year by human activities during 1997 to 2001. Strandings involving hundreds of individuals are not unusual and demonstrate that these large schools have a high degree of social cohesion (Reeves et al. 2002). The species is rated as “strategic” by NMFS because the 1997 to 2001 estimated average annual fishery-related mortality exceeds the potential biological removal (Waring et al. 2004).

Harbor porpoise (*Phocoena phocoena*) – Non-Strategic

The harbor porpoise inhabits shallow, coastal waters, often found in bays, estuaries, and harbors. In the western Atlantic, they are found from Cape Hatteras north to Greenland. They are common visitors to Massachusetts Bay during September through April. During the spring, they are found from the Bay of

Fundy to south of Cape Cod. They concentrate in southwestern Gulf of Maine, Great South Channel, Jeffreys Ledge, and coastal Maine during the mid-spring months. After April, they migrate north towards the Gulf of Maine and Bay of Fundy. They generally eat small schooling fish such as mackerel, herring, and cod, as well as worms, squid, and sand eel (ACSonline 2004; NOAA 1993). According to the species stock report, the population estimate for the Gulf of Maine/Bay of Fundy harbor porpoise is 89,700 individuals (Waring et al. 2004).

The most common threat to the harbor porpoise is from incidental mortality from fishing activities, especially from bottom-set gillnets. It has been demonstrated that the porpoise echolocation system is capable of detecting net fibers, but they must not have the "system activated" or else they fail to recognize the nets (Reeves et al. 2002). Roughly 365 harbor porpoises are killed by human-related activities each year. In 1999, a Take Reduction Plan to reduce harbor porpoise bycatch in U.S. Atlantic gillnets was implemented. The plan that pertains to the Gulf of Maine focuses on sink gillnets and other gillnets that can catch groundfish in New England waters. The ruling implements time and area closures, some of which are complete closures, as well as requiring pingers on multispecies gillnets. In 2001, the harbor porpoise was removed from the candidate species list for the Endangered Species Act of 1973; a review of the biological status of the stock indicated that a classification of "Threatened" was not warranted (Waring et al. 2004). The species was recently downgraded in 2002 from a NMFS rating of "strategic" to "non-strategic" because its current average annual fishery-related mortality and serious injury does not exceed its potential biological removal (Waring et al. 2004).

Atlantic white-sided dolphin (*Lagenorhynchus acutus*) – Non-Strategic

The Atlantic white-sided dolphin is typically found at a depth of 330 feet (100 meters) in the cool temperate and subpolar waters of the North Atlantic, generally along the continental shelf between the Gulf Stream and the Labrador current to as far south as North Carolina (Bulloch 1993; Reeves et al. 2002).

NMFS recognizes three stocks of the Atlantic white-sided dolphin in the western North Atlantic: a Gulf of Maine stock, a Gulf of St. Lawrence stock, and a Labrador Sea stock (Waring et al. 2004). The Gulf of Maine stock occupies regions of both the Gulf of Maine (usually in the southwestern portion) and Georges Bank throughout the entire year. High-use areas for this species are widely located either side of the 328-foot (100 meters) isobath along the northern edge of Georges Bank, and north from the Great South Channel to Stellwagen Bank, Jeffreys Ledge, Platts Bank, and Cashes Ledge. In spring, high-use areas existed in the Great South Channel, northern Georges Bank, the steeply sloping edge of Davis Bank and Cape Cod, southern Stellwagen Bank, and the waters between Jeffreys Ledge and Platts Bank. In summer, high-use areas tend to shift and expand toward the east and northeast along most of the northern edge of Georges Bank between the 164- and 656-foot (50- and 200-meter) isobaths and northward from the Great South Channel along the slopes of Davis Bank and Cape Cod. In winter, high sightings occur at the northern tip of Stellwagen Bank and Tillies Basin (NOAA 2008).

This species is highly social and is commonly seen feeding with fin whales. They feed on a variety of fish such as herring, hake, smelt, capelin, and cod, as well as squid (NOAA 1993). Estimates of population size, which was arrived from summing the results of two separate aerial surveys, indicate that the population of the Gulf of Maine stock is approximately 51,640 individuals (Waring et al. 2004). Population estimates in U.S. shelf waters suggest around 30,000 individuals. An additional 12,000 animals have been estimated to summer in the Gulf of St. Lawrence (Reeves et al. 2002).

The biggest human-induced threat to the Atlantic white-sided dolphin is bycatch, because they are occasionally caught in fishing gillnets and trawling equipment. Approximately 100 dolphins each year were killed by human activities during 1997 to 2001 (Waring et al. 2004). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as “non-strategic” (Waring et al. 2004).

Killer whale (*Orcinus orca*) – Non-Strategic

The black-and-white killer whale is the largest member of the dolphin family, roughly 22 to 30 feet (6.7 to 9.1 meters) long and nearly 9,000 pounds (4,080 kilograms). This species is found in all of the world’s oceans with highest densities in the high latitudes (Wilson and Ruff 1999). Killer whales do not maintain a regular migration route because they generally migrate towards viable food sources, which are likely to be schools of bluefin tuna. Killer whale presence in the waters off the east coast of the United States is considered uncommon (Katona et al. 1988; Waring et al. 2004). When encountered, they are seen in the southwestern Gulf of Maine from mid-July to September. Killer whales have been found to overwinter in the Gulf of Maine and were seen on Jeffreys Ledge between the Isles of Shoals and Stellwagen Bank (NOAA 1993). They feed on a variety of fish, including tuna, herring, and mackerel, and have also been known to attack seals, seabirds, and other cetaceans such as large baleen and sperm whales (NOAA 1993; Blaylock et al. 1995). According to the species stock report, the population estimate for the western North Atlantic stock of killer whales is unknown (Baylock et al. 1995).

The killer whale is not endangered, although whaling or live-capture operations have depleted some regional populations. They are threatened by pollution, heavy ship traffic, and possibly reduced prey abundance. There have been no observed mortalities or serious injuries by NMFS Sea Samplers in the pelagic drift gillnet, pelagic longline, pelagic pair trawl, New England multispecies sink gillnet, mid-Atlantic coastal sink gillnet, or the North Atlantic bottom trawl fisheries (Blaylock et al. 1995). Recent evidence has also indicated that they are subject to biomagnification of toxic substances (ACSonline 2004). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as “non-strategic” (Blaylock et al. 1995).

Although this species is one of the most widely distributed small cetacean species in the world, they are not commonly seen in the vicinity of the NEG Port and the Algonquin Pipeline Lateral in Massachusetts Bay (NOAA 2008). No confirmed sightings of this species have occurred during construction and/or operation of the NEG Port and the Algonquin Pipeline Lateral (Northeast Gateway 2007; Northeast Gateway 2008).

Short-beaked common dolphin (*Delphinus delphis*) – Non-Strategic

Short-beaked common dolphins can be found either along the 200- to 2,000-meter (650- to 6,500-foot) isobaths over the continental shelf and in pelagic waters of the Atlantic and Pacific Oceans. They are present in the western Atlantic from Newfoundland to Florida. The short-beaked common dolphin is especially common along shelf edges and in areas with sharp bottom relief such as seamounts and escarpments (Reeves et al. 2002). They show a strong affinity for areas with warm, saline surface waters. Off the coast of the eastern United States, they are particularly abundant in continental slope waters from Georges Bank southward to about 35 degrees north (Reeves et al. 2002) and usually inhabit tropical and warm-temperate waters (Waring et al. 2004).

The long-beaked dolphin is more common in coastal waters, where the short-beaked dolphin inhabits offshore waters. If they do come to the Massachusetts Bay area to feed, it is usually during the fall and winter (NOAA 1993). According to the species stock report, the population estimate for the western North Atlantic common dolphin is 30,768 individuals (Waring et al. 2004).

These dolphins typically gather in schools of hundreds of thousands, although the schools generally consist of smaller groups of 30 or fewer. They are eager bow riders and are active at the surface (Reeves et al. 2002). The short-beaked common dolphin feeds on small schooling fish and squid. They have been known to feed on fish escaping from fishermen's nets or fish that are discarded from boats (NOAA 1993).

The short-beaked common dolphin is also subject to bycatch. It has been caught in gillnets, pelagic trawls, and during longline fishery activities. During 1997 to 2000, 190 dolphins were killed each year by human activities. Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2004).

Although this species is one of the most widely distributed small cetacean species in the world, they are not commonly seen in the vicinity of the NEG Port and the Algonquin Pipeline Lateral in Massachusetts Bay (NOAA 2008). No confirmed sightings of this species have occurred during construction and/or operation of the NEG Port and Algonquin Pipeline Lateral (Northeast Gateway 2007; Northeast Gateway 2008).

Bottlenose dolphin (*Tursiops truncatus*) – Non-Strategic

The bottlenose dolphin is a light- to slate-gray dolphin, roughly 8 to 12 feet (2.4 to 3.7 meters) long with a short, stubby beak. Because this species occupies a wide variety of habitats, it is regarded as possibly the most adaptable cetacean (Reeves et al. 2002). It occurs in oceans and peripheral seas at both tropical and temperate latitudes. In North America, bottlenose dolphins are found in surface waters with temperatures ranging from 50 to 90 °F (10 to 32 °C).

There are two distinct bottlenose dolphin populations: shallow water and deepwater population. The shallow water, coastal population resides along the inner continental shelf and around islands. These animals often move into or reside in bays, estuaries, and the lower reaches of rivers (Reeves et al. 2002). The deepwater population is the only one found in the northern latitudes of the North Atlantic, typically in Gulf Stream waters. This deepwater population extends along the entire continental shelf-break from Georges Bank to Cape Hatteras during the spring and summer months, and has been observed in the Gulf of Maine during the late summer and fall. The NMFS species stock assessment report estimates the population of western North Atlantic offshore bottlenose dolphin stock at 29,774 individuals (Waring et al. 2004).

Bottlenose dolphins feed on a large variety of organisms, depending on their habitat. The coastal, shallow population tends to feed on benthic fish and invertebrates, while deepwater populations consume pelagic or mesopelagic fish such as croakers, sea trout, mackerel, mullet, and squid (Reeves et al. 2002). Bottlenose dolphins appear to be active both during the day and night. Their activities are influenced by the seasons, time of day, tidal state, and physiological factors such as reproductive seasonality (Wells and Scott 2002).

The biggest threat to the population is bycatch because they are frequently caught in fishing gear, gillnets, purse seines, and shrimp trawls (Waring et al. 2004). They have also been adversely impacted by pollution, habitat alteration, boat collisions, human disturbance, and are subject to bioaccumulation of toxins. Scientists have found a strong correlation between dolphins with elevated levels of PCBs and illness, indicating certain pollutants may weaken their immune system (ACSonline 2004). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2004).

Although this species is one of the most widely distributed small cetacean species in the world, they are not commonly seen in the vicinity of the NEG Port and the Algonquin Pipeline Lateral in Massachusetts Bay (NOAA 2008). No confirmed sightings of this species have occurred during construction and/or operation of the NEG Port and Algonquin Pipeline Lateral (Northeast Gateway 2007; Northeast Gateway 2008).

4.2 Baleen Whales (Mysticeti)

North Atlantic right whale (*Eubalaena glacialis*) – Endangered
The North Atlantic right whale is a baleen whale and one of the most endangered large whale species in the world. The North Atlantic right whale has seen little to no recovery since it was listed as a protected species. This is a drastic difference from the stock found in the Southern Hemisphere, which has increased at a rate of 7 to 8 percent (Knowlton and Kraus 2001).

From the 2003 United States Atlantic and Gulf of Mexico Marine Mammal Stock Assessments, there were only 291 North Atlantic right whales in existence, which is less than what was reported in the Northern Right Whale Recovery Plan written in 1991 (NMFS 1991a; Waring et al. 2004). This is a tremendous difference from pre-exploitation numbers, which are thought to be around 1,000 individuals. When the right whale was finally protected in the 1930s, it is believed that the North Atlantic right whale population was roughly 100 individuals (Waring et al. 2004).

There are six major habitats or congregation areas for western North Atlantic right whales: coastal waters of the southeastern United States, Great South Channel, Georges Bank/Gulf of Maine, Cape Cod and Massachusetts Bays, Bay of Fundy, and the Scotian Shelf (Waring et al. 2004). New England waters are a primary feeding habitat for the North Atlantic right whale. North Atlantic right whales inhabit the waters off New England throughout the year, but their presence is highest in the Massachusetts Bay area during the winter/spring months. In the spring, the highest abundance of right whales is located over the deeper waters (328- to 525-foot [100- to 160-meter] isobaths) on the northern edge of the Great South Channel and deep waters (328 to 984 feet, 100 to 300 meters) parallel to the 328-foot (100-meter) isobath of northern Georges Bank and Georges Basin. High abundance was also found in the shallowest waters (<98 feet [< 30 meters]) of Cape Cod Bay, over Platts Bank and around Cashes Ledge. In the summer months, right whales move almost entirely away from the coast to deep waters over basins in the central Gulf of Maine (Wilkinson Basin, Cashes Basin between the 525- and 656-foot [160- and 200-meter] isobaths) and north of Georges Bank (Rogers, Crowell, and Georges Basins). Highest abundance was found north of the 328-foot (100-meter) isobath at the Great South Channel and over the deep slope waters and basins along the northern edge of Georges Bank. The waters between Fippennies Ledge and Cashes Ledge are also estimated as high-use areas. In the fall months, right whales have been sighted infrequently in the Gulf of Maine, with highest densities over Jeffreys Ledge and over deeper waters near Cashes Ledge and Wilkinson Basin. In winter, Cape Cod Bay, Scantum Basin, Jeffreys Ledge, and Cashes Ledge are the main high-use areas (NOAA 2008).

The primary prey for North Atlantic right whales off the coast of Massachusetts are zooplankton (i.e., copepods) (Kelly 1995). Right whales are considered grazers as they swim slowly with their mouths open. They are the slowest swimming whales and can only reach speeds up to 10 miles (16 kilometers) per hour. They can dive at least 1,000 feet (300 meters) and stay submerged for typically 10 to 15 minutes, feeding on their prey below the surface (ACSonline 2004).

Most ship strikes are fatal to the North Atlantic right whales (Jensen and Silber 2004). Right whales have difficulty maneuvering around boats. North Atlantic right whales spend most of their time at the surface, feeding, resting, mating, and nursing, increasing their vulnerability to collisions. Mariners should assume that North Atlantic right whales will not move out of their way nor will they be easy to detect from the bow of a ship for they are dark in color and maintain a low profile while swimming (WWF 2005).

Humpback whale (*Megaptera novaeangliae*) – Endangered

Humpback whales were commercially exploited by whalers throughout their whole range until they were protected in the North Atlantic in 1955 by the International Whaling Commission (IWC) ban. Before whaling activities, it was thought that the abundance of whales in the North Atlantic stock was in excess of 15,000 (Nowak 2002). Today, less than 10 percent of the initial population exists (NMFS 1991b). According to the species stock assessment report, the population estimate for the Gulf of Maine stock of humpback whales is 902 individuals (Waring et al. 2004).

The humpback whale is found in all of the world's oceans and it follows a normal migration route of feeding in the temperate and polar waters in the summer and mating and calving in tropical waters during the winter. Humpback whales inhabit waters mainly over the continental shelves; they stay along the edges and around some of the oceanic islands (NMFS 1991b; NOAA 1993). There are 13 separate stocks of humpback whales worldwide (NMFS 1991b). Through genetic analysis of the whales inhabiting the Gulf of Maine, it was determined that the Gulf has its own feeding stock. Most individuals arrive in early March to Massachusetts Bay from wintering grounds in eastern central Caribbean. The highest abundance for humpback whales is distributed primarily along a relatively narrow corridor following the 328-foot (100-meter) isobath across the southern Gulf of Maine from the northwestern slope of Georges Bank, south to the Great South Channel, and northward alongside Cape Cod to Stellwagen Bank and Jeffreys Ledge. The relative abundance of whales increases in the spring with the highest occurrence along the slope waters (between the 131- and 459-foot [40- and 140-meter] isobaths) off Cape Cod and Davis Bank, Stellwagen Basin, and Tillies Basin and between the 164- and 656-foot (50- and 200-meter) isobaths along the inner slope of Georges Bank. High abundance is also estimated for the waters around Platts Bank. In the summer months, abundance increases over the shallow waters (<164 feet, or <50 meter) of Stellwagen Bank, the waters (328 to 656 feet [100 to 200 meters]) between Platts Bank and Jeffreys Ledge, the steep slopes (between the 98- and 525-foot [30- and 160-meter] isobaths) of Phelps and Davis Bank north of the Great South Channel towards Cape Cod, and between the 164- and 328-foot (50- and 100-meter) isobath for almost the entire length of the steeply sloping northern edge of Georges Bank. This general distribution pattern has persisted in all seasons except winter, when humpbacks remained at high abundance in only a few locations, including Porpoise and Neddick Basins adjacent to Jeffreys Ledge, northern Stellwagen Bank and Tillies Basin, and the Great South Channel (NOAA 2008).

Humpback whales are thought to feed mainly while migrating and in summer feeding areas; little feeding is known to occur in their wintering grounds. Humpbacks feed over the continental shelf in the North Atlantic between New Jersey and Greenland, consuming roughly 95 percent small schooling fish and 5 percent zooplankton (i.e., krill), and they will migrate throughout their summer habitat to locate prey (Kenney and Winn 1986). They swim below the thermocline to pursue their prey, so even though the surface temperatures might be warm, they are frequently swimming in cold water (NMFS 1991b).

Stellwagen Bank has been identified as an important nursery for humpback mothers with calves. Herring, sand lance, and capelin are the primary prey species for the Gulf of Maine stock but they also eat haddock, mackerel, small pollock, cod, and hake (NMFS 1991b). Data found in the Northeast Gateway Environmental Impact Statement Baseline Evaluation show an increase in humpback whale sightings near the project area in 2002, with declining numbers seen since. There is no significant change in sightings between the periods 1995 to 1999 and 2000 to 2004 (Weinrich and Sardi 2005).

The biggest threats to humpback whales are gear entanglements and ship strikes. Approximately three humpback whales were killed each year by anthropogenic factors such as ship strikes and fishery-related incidents during 1997 to 2001. During one study of humpback whale carcasses, anthropogenic factors either contributed to or caused the death of 60 percent of the stranded whales (Wiley et al. 1995 as reported in Waring et al. 2004). Another study found that humpbacks are also subject to bioaccumulation of toxins (Taruski et al. 1975 as reported in NMFS 1991b). Increase in ambient noise levels has also had an impact on their utilization of habitats; humpback whales have demonstrated a short-term avoidance of areas with increased whale-watching activity (Corkeron 1995).

The species is listed as Endangered due to the depletion of its population from whaling (NMFS 1991b). A recovery plan has been written and is currently in effect (NMFS 1991b).

Fin whale (*Balaenoptera physalus*) – Endangered

The fin whale is found in all oceans of the world. Fin whales spend the winter in subtropical or offshore waters mating and calving and migrate into cooler temperate to polar waters for feeding during the spring, summer, and fall (Reeves et al. 1998). There has been some controversy regarding the number of fin whale stocks along the eastern coast of the United States. The IWC recognizes one western North Atlantic stock, consisting of whales, which inhabit the waters off New England, north to Nova Scotia, and the southeastern coast of Newfoundland (Donovan 1991 as reported in Waring et al. 2004); however, Breiwick (1993 as reported in Reeves et al. 1998) identified two stocks, one that remains off of Nova Scotia and New England and another that remains in Newfoundland waters. Fin whales are the most common large baleen whale species in the Gulf of Maine/Massachusetts Bay area. They have the largest standing stock and largest food requirements, thus having the largest impact on the ecosystem of any cetacean species (Hain et al. 1992 as reported in Waring et al. 2004). Fin whales are also the most observed cetacean species during whale-watching activities in the northeastern United States.

The waters off New England are an important feeding ground for the fin whale. They generally stay in deeper waters near the edge of the continental shelf (300 to 600 feet; 90 to 180 meters), but will migrate towards coastal areas if prey is available (NOAA 1993). They are known to herd prey such as sea lance, capelin, krill, herring, copepods, and squid for easier consumption (NOAA 1993; EPA 1993). Apparently, the favorite food of fin whales on Stellwagen Bank and in Massachusetts Bay has been sand lance (EPA 1993). According to the species stock assessment report, the population estimate for the western North Atlantic stock of fin whales is 2,814 (Waring et al. 2004). Even though some whales overwinter near Cape Cod, their abundance near Stellwagen Bank peaks between April and October. Off the eastern United States, they are generally found along the 100-meter (330-foot) isobaths, but will follow prey abundance and inhabit shallower water (Reeves et al. 1998).

Spatial patterns of habitat utilization by fin whales are very similar to those of humpback whales. NOAA indicates that spring and summer high-use areas follow the 328-foot (100-meter) isobath along the northern edge of Georges Bank (between the 164- and 656-foot, or 50- and 200-meter, isobaths), and northward from the Great South Channel (between the 164- and 525-foot [50- and 160-meter] isobaths). Waters around Cashes Ledge, Platts Bank, and Jeffreys Ledge are all high-use areas in the summer months. Stellwagen Bank is a high-use area for fin whales in all seasons, with highest abundance occurring over the southern Stellwagen Bank in the summer months. In addition to Stellwagen Bank, high abundance in winter was estimated for Jeffreys Ledge and the adjacent Porpoise Basin 328- to 656-foot (100- to 160-meter) isobaths, as well as Georges Basin and northern Georges Bank (NOAA 2008).

The biggest threats to fin whales are entanglements in gillnets and ship strikes. During 1997 to 2001, a total of seven fin whales of the western North Atlantic stock were killed by ship strikes and three whales were injured/killed from entanglement in fishing gear (Waring et al. 2004). Increase in ambient noise has also impacted fin whales, for whales in the Mediterranean have demonstrated at least two different avoidance strategies after being disturbed by tracking vessels (Jahoda et al. 2003). Fin whales are the most observed cetacean species during whale-watching activities in the northeastern United States. The species is listed as Endangered due to the depletion of its population from whaling (Reeves et al. 1998). A recovery plan has been written and is awaiting legal clearance (Waring et al. 2004).

Minke whale (*Balaenoptera acutorostrata*) – Non-Strategic

Minke whales are the smallest and are among the most widely distributed of all the baleen whales. They occur in the North Atlantic and North Pacific, from tropical to polar waters. Currently, scientists recognize two subspecies of the so-called "common" minke whale: the North Atlantic minke and the North Pacific minke. Generally, they inhabit warmer waters during winter and travel north to colder regions in summer, with some animals migrating as far as the ice edge. They are frequently observed in coastal or shelf waters and in the Massachusetts area, have been recorded in the shallow waters of Stellwagen Bank and southern Jeffreys Ledge from April until October. NOAA indicates that the highest abundance for minke whale is strongly associated with regions between the 164- and 328-foot (50- and 100-meter) isobaths, but with a slightly stronger preference for the shallower waters along the slopes of Davis Bank, Phelps Bank, Great South Channel and Georges Shoals on Georges Bank. Minke whales can be sighted in the Stellwagen Bank National Marine Sanctuary (SBNMS) in all seasons, with highest abundance estimated for the shallow waters (approximately 131 feet [40 meters]) over southern Stellwagen Bank in the summer and fall months. Platts Bank, Cashes Ledge, Jeffreys Ledge, and the adjacent basins (Neddick, Porpoise and Scantium) also supported high relative abundance. Very low densities of minke whales remain throughout most of the southern Gulf of Maine in winter. According to the species stock report, the population estimate for the Canadian east coast stock of minke whales is 4,018 individuals (NOAA 1993; Waring et al. 2004; Weinrich and Sardi 2005; Wilson and Ruff 1999).

As is typical of the baleen whales, minke whales are usually seen either alone or in small groups, although large aggregations sometimes occur in feeding areas (Reeves et al. 2002). Minke populations are often segregated by sex, age, or reproductive condition. Known for the curiosity, minkes often approach boats. They feed on schooling fish (i.e., herring, sand eel, capelin, cod, pollock, and mackerel), invertebrates (squid and copepods), and euphausiids. Minke whales basically feed below the surface of the water, and calves are usually not seen in adult feeding areas.

Minke whales are impacted by ship strikes and bycatch from gillnet and purse seine fisheries. Approximately four minke whales were killed or seriously injured per year by human means during 1997 to 2001, with an average annual mortality from ship strikes of 0.2 (Waring et al. 2004). In addition, hunting for Minke whales continues today, by Norway in the northeastern North Atlantic and by Japan in the North Pacific and Antarctic (Reeves et al. 2002). International trade in the species is currently banned. Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2004).

4.3 Earless Seals (Phocidae)

Harbor seal (*Phocac vitulina*) – Non-Strategic
Harbor seals are the most abundant seals in eastern United States waters and are commonly found in all nearshore waters of the Atlantic Ocean and adjoining seas above northern Florida; however, their "normal" range is probably only south to New Jersey. In the western North Atlantic, they inhabit the waters from the eastern Canadian Arctic and Greenland, south to southern New England and New York, and occasionally as far south as South Carolina. Some seals spend all year in eastern Canada and Maine, while others migrate to southern New England in late September and stay until late May. According to the species stock report, the population estimate for the western North Atlantic stock of harbor seals is 99,340 (Marine Mammal Center 2002; NOAA 1993; Waring et al. 2004).

Harbor seals forage in a variety of marine habitats, including deep fjords, coastal lagoons and estuaries, and high-energy, rocky coastal areas. They may also forage at the mouths of freshwater rivers and streams, occasionally traveling several hundred miles upstream (Reeves et al. 2002). They haul out on sandy and pebble beaches, intertidal rocks and ledges, and sandbars, and occasionally on ice floes in bays near calving glaciers.

Except for the strong bond between mothers and pups, harbor seals are generally intolerant of close contact with other seals. Nonetheless, they are gregarious, especially during the molting season, which occurs between spring and autumn, depending on geographic location. They may haul out to molt at a tide bar, sandy or cobble beach, or exposed intertidal reef. During this haulout period, they spend most of their time sleeping, scratching, yawning, and scanning for potential predators such as humans, foxes, coyotes, bears, and raptors (Reeves et al. 2002). In late autumn and winter, harbor seals may be at sea continuously for several weeks or more, presumably feeding to recover body mass lost during the reproductive and molting seasons and to fatten up for the next breeding season (Reeves et al. 2002).

Harbor seals are opportunistic feeders feeding on squid and small schooling fish (i.e., herring, alewife, flounder, redfish, cod, yellowtail flounder, sand eel, and hake). They spend about 85 percent of the day diving, and much of the diving is presumed to be active foraging in the water column or on the seabed. They dive to depths of about 30 to 500 feet (10 to 150 meters), depending on location.

Historically, these seals have been hunted for several hundred to several thousand years. Harbor seals are still killed legally in Canada, Norway, and the United Kingdom to protect fish farms or local fisheries (Reeves et al. 2002). According to the stock assessment reports, 955 seals are taken in gillnets each year. The other human-caused mortalities, in order of frequency, were "other" (6.1), non-observed fishery-related (4.8), power plant entrainment (4.4), and boat strikes (1.6).

Approximately 1,000 harbor seals were killed each year by these during 1997 to 2001 (Waring et al. 2004). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as "non-strategic" (Waring et al. 2004).

Gray seal (*Halichoerus grypus*) – Non-Strategic
Gray seals inhabit both sides of the North Atlantic in both the temperate and subarctic waters (Morris 2004). Scientists recognize three primary populations of this species, all in the northern Atlantic Ocean. The gray seals that reside in Nantucket Sound are part of the eastern Canada stock, which can be found from northernmost Cape Chidley in Labrador to most recently Long Island Sound (Katona et al. 1993). Gray seals form colonies on rocky island or mainland beaches, though some seals give birth in sea caves

or on sea ice, especially in the Baltic Sea. Gray seals prefer haulout and breeding sites that are surrounded by rough seas and riptides where boating is hazardous. Pupping colonies have been identified at Muskegat Island (Nantucket Sound), Monomoy National Wildlife Refuge, and in eastern Maine (Rough 1995). According to the species stock report, the population estimate for the western North Atlantic stock of gray seals is 143,000, but the Massachusetts population was reported as greater than 5,600 in 1999 (NOAA 1993; Waring et al. 2004).

Gray seals are gregarious, gathering to breed, molt, and rest in groups of several hundred or more at island coasts and beaches or on land-fast ice and pack-ice floes. They are thought to be solitary when feeding and telemetry data indicates that some seals may forage seasonally in waters close to colonies, while others may migrate long distances from their breeding areas to feed in pelagic waters between the breeding and molting seasons (Reeves et al. 2002). Gray seals molt in late spring or early summer and may spend several weeks ashore during this time. When feeding, most seals remain within 45 miles (72 kilometers) of their haulout sites. They generally feed on fish (i.e., skates, alewife, sand eel, and herring) and invertebrates.

The biggest threats to gray seals are entanglements in gillnets or plastic debris (Waring et al. 2004). Approximately 300 gray seals were killed each year by human activities during 1997 to 2001 (Waring et al. 2004). Average annual fishery-related mortality and serious injury does not exceed the potential biological removal for this species; therefore, NMFS considers this species as “non-strategic” (Waring et al. 2004).

5.0 TYPE OF INCIDENTAL TAKE REQUESTED

Northeast Gateway and Algonquin request the taking of small numbers of marine mammals pursuant to Section 101(a)(5) of the MMPA to authorize the potential non-lethal incidental takes by Level B harassment as defined in the MMPA of small numbers of marine mammals during the O&M of the NEG Port and Algonquin Pipeline Lateral. The request is based upon projected O&M activities for a period of 5 years commencing in May of 2009.

As detailed in Section 1.0, the only activities that would generate underwater noise with sounds exceeding the 120 dB threshold for Level B harassment are those stemming from the maneuvering of LNGRVs during final docking and/or decoupling maneuvers and during the potential use of DP vessels to support a pipeline repair. In each case, the loudest noise sources will emanate from thrusters used intermittently from the dynamic positioning of LNGRVs or dive vessels (see Section 1.4). No other forms of take are likely or anticipated. The requested take authorization would apply to the NEG Port and Algonquin Pipeline Lateral activities described regardless of the individual actor (e.g., vessel owner, operator, contractor, etc.) provided that the conditions of the take authorization are met.

Northeast Gateway and Algonquin, in cooperation with the NOAA, the NMFS, and SBNMS, have developed a comprehensive acoustic and visual monitoring and mitigation measure to minimize potential takes of marine mammals (see Sections 11.0 and 13.0 and Appendix A). Given these measures, no take by serious injury or death is likely as a result of NEG Port and Algonquin Pipeline Lateral O&M activities.

6.0 NUMBERS OF MARINE MAMMAL THAT MIGHT BE TAKEN

Northeast Gateway and Algonquin seek authorization for potential “taking” of small numbers of marine mammals under the jurisdiction of the NMFS in the proposed region of activity. Species for which authorization is sought include the gray seal, harbor seal, harbor porpoise, Atlantic white-sided dolphin, short-beaked common dolphin, bottlenose dolphin, long-finned pilot whale, killer whale, minke whale, North Atlantic right whale, humpback whale, and fin whale. These 12 species, described in detail in Section 4.0, have the highest likelihood of occurring, at least occasionally, in the NEG Port and Algonquin Pipeline Lateral area.

The only anticipated impacts to marine mammals are associated with noise propagation from the use of DP thrusters resulting in short-term displacement of marine mammals from within ensonified zones produced by such noise sources. The O&M activities proposed by Northeast Gateway and Algonquin are not expected to take more than small numbers of marine mammals, or have more than a negligible effect on their populations based on the seasonal density and distribution of marine mammals, and the vulnerability of these animals to harassment from the frequency of noises.

6.1 Basis for Estimating Numbers of Marine Mammals that Might be "Taken by Harassment"

There are three kinds of noises recognized by NMFS: continuous, intermittent, and pulse. No pulse noise activities, such as seismic, blasting, loud sonar, or pile driving, are associated with the operation and maintenance of the NEG Port and Algonquin Pipeline Lateral; thus, the 160/170 dB threshold value does not apply. The noise sources of potential concern are regasification/offloading (continuous) and dynamic positioning of vessels using thrusters (intermittent). Both continuous and intermittent noise sources carry the 120 dB isopleth threshold.

None of the continuous sound sources associated with the O&M of the NEG Port or Algonquin Pipeline Lateral is expected to exceed the 120 dB threshold for Level B harassment. However, the intermittent noise from thruster use associated with dynamic positioning of vessels during the docking with and/or decoupling of the LNGRVs from NEG Port facilities or in a potential repair of the Algonquin Pipeline Lateral, may result in the occasional exceedance of the 120 dB threshold for intermittent noise sources. Consequently, LNGRV bow thruster and DP dive support vessel thruster use has the potential for take by harassment for any marine mammal occurring with a zone of ensonification (>120 dB) emanating from the sound source. This area, known as the Zone of Influence (ZOI), has a variable maximum radius dependent on water depth and associated differences in transmission loss. Specifically:

- For shallow water depths (40 meters) representative of the northern segment of the Algonquin Pipeline Lateral, the radius is 3.31 kilometers and associated ZOI is 34 square kilometers.
- For moderate depths (80 meters) representative of the NEG Port location and Algonquin Pipeline Lateral segment nearest SBNMS, the radius is 2.56 kilometers and associated ZOI is 21 square kilometers.
- For deeper depths (120 m) representative of the deepest waters of the project analysis area, the radius is 2.18 kilometers and associated ZOI is 15 square kilometers.

The basis for the take estimate is the number of marine mammals that would be exposed to sound levels in excess of 120 dB. Typically this is determined by multiplying the ZOI by local marine mammal density estimates, and then correcting for seasonal use by marine mammals, seasonal duration of noise-generating activities, and estimated duration of individual activities when the maximum noise-generating activities are intermittent or occasional. In the absence of any part of this information, it becomes prudent to take a conservative approach to ensure the potential number of takes is not greatly underestimated.

6.2 Estimate of Numbers of Marine Mammals that Might be "Taken by Harassment"

On May 15, 2008, the NMFS reauthorized the Northeast Gateway Incidental Take Statement (ITS) for the operational period of May 2008 through May 2009. This reauthorization of take was based upon the most recent site-specific marine mammal data collected in the immediate vicinity of the NEG Port and Algonquin Pipeline Lateral. Under the IHA, dated May 15, 2008, the maximum number of estimated exposures to sound levels above 120 dB during NEG Port operations has been set at 21 right, 90 fin, 165 humpback, 15 minke, 104 pilot whales and 336 Atlantic white-sided dolphins, for the period of May 2008 through May 2009.

In recognition of the efforts already made by the NMFS to evaluate the potential take of marine mammal as a result of NEG Port and Algonquin Pipeline Lateral activities, and given that Port and Pipeline Lateral O&M activities are not likely to change over the next five years, Northeast Gateway and Algonquin, under the recommendation by the NMFS, evaluated the maximum number of estimated exposures that could potentially occur during NEG Port and Algonquin Pipeline Lateral O&M activities per year, over a 5-year period from May 2009 to May 2014 as described in the following sections.

6.2.1 Estimate of Potential NEG Port Takes by Harassment

For O&M activities conducted at the NEG Port, Northeast Gateway requests that the maximum number of estimated annual exposures remain set at 21 right, 90 fin, and 165 humpback whales, 15 minke, 104 pilot whales and 336 Atlantic white-sided dolphins. Operational activities will only result in intermittent noise from bow thruster use when LNGRVs are in the process of docking with and/or disengaging from the NEG Port facilities. Over a 5-year operating period of May 2009 through May 2014, Northeast Gateway anticipates a maximum of 65 Port calls per year for a total of 325 Port calls from LNGRVs over a 5-year period. During this 5-year period, during NEG Port operations, marine mammals could therefore be exposed to sound levels above 120 dB re: 1 µPa while thrusters are in use (approximately 10 to 30 minutes for each vessel arrival and departure). This equates to a maximum period of potential harassment of 65 hours over the course of one operating year, and 325 hours during the 5-year period.

6.2.2 Estimate of Potential Pipeline Lateral Takes by Harassment

For Algonquin Pipeline Lateral O&M activities, Algonquin expects that no more than one repair will be required in any given year, and no more than two repairs will be required over the 5-year period. If a DP rather than an anchored vessel is used to complete the repair, thruster use will occur at varying sound levels as necessary for the vessel to hold its position for up to 40 work days, with operations expected to be occurring up to 24 hours per day 7 days per week. Accordingly, during a repair of the Algonquin Pipeline Lateral, marine mammals could be exposed to sound levels above 120dB for a maximum period of potential harassment of up to 40 days (up to 960 hours) over the course of one operating year.

Algonquin estimates that the maximum number of potential exposures to sound levels above 120 dB over a given 40 day repair event where DP vessels are employed would consist of 21 right, 28 fin, 127 humpback, 16 minke, and 104 pilot whales and 335 Atlantic white-sided dolphins. With the exception of right whales, pilot whales and Atlantic white-sided dolphins, the take estimates were calculated based on marine mammal sighting data collected during the May to December 2007, NEG Port and Algonquin Pipeline Lateral construction period. For each month, a daily sighting frequency was calculated for all species of marine mammals observed within the 2-mile (3.31-kilometer) radius ZOI. Based on the data collected during Port and Algonquin Pipeline Lateral construction, which included the use of similar construction vessels equipped with thrusters, it is not expected that received underwater sound levels would exceed the levels presented for the larger sized thrusters as used by the LNGRVs during docking and/or decoupling from the NEG Port (for which the 2-mile radius ZOI was established). Therefore, both the 2-mile ZOI and the provided take estimates are conservative.

Take estimates for fin, humpback, and minke whales were determined by multiplying peak daily frequency sightings (from the NEG Port and Algonquin Pipeline Lateral sighting data collected during construction in 2007) by the 40 day repair window. More specifically, the highest average daily frequency for each species was multiplied by 30 days to estimate take for the month in which that frequency was associated. Then the highest average daily frequency of the two months adjacent to the first month was multiplied by 10 to account for potential take in the remaining 10 days of the potential 40 day repair window. For example, based upon the 2007 construction sightings data the highest average daily frequency for humpback whales was 3.53 for the month of September, and the second highest, was 2.10 for the month of October. Take was then estimated using the following equation:

$$(3.53 \times 30) + (2.10 \times 10) = 127$$

Highest Average Daily Frequency x 30 Days + Second Highest Average Daily Frequency x 10 Days = Estimated Take

The sighting frequency data used in the take calculations is provided in Table 6-1.

Table 6-1 Daily Sighting Frequency, Compiled per Month, for Whales Observed Within 2 Miles (3.31 km) of Algonquin Pipeline Construction Activities Conducted May to December, 2007.

	Humpback	Fin	Minke
May	0.25	0.00	0.00
June	0.17	0.10	0.07
July	0.61	0.29	0.42
Aug	0.90	0.71	0.35
Sept	3.53	0.70	0.07
Oct	2.10	0.19	0.00
Nov	0.96	0.00	0.29
Dec	0.35	0.29	0.12

Data actually used in take estimation are highlighted.

The take estimates for the North Atlantic right whale, pilot whale, and Atlantic white-sided dolphin were determined using the same methodology as described in the NMFS 2008 Northeast Gateway IHA notice in the Federal Register (Vol. 72 No. 99) on May 21, 2008 The Federal Register notice states that take estimates were determined by multiplying the ZOI by local marine mammal density estimates, corrected to account for 50 percent marine mammals that may be underwater, and then by the estimated number of potential events that could result in take over a period of one year. NMFS noted in the Federal Register notice that the marine mammal density is the Species per Unit Effort (SPUE) divided by twice the transect width, which was identified as 0.4 kilometers. The identified SPUE for the North Atlantic Right Whale, pilot whale, and Atlantic white-sided dolphin was stated to be 0.0082, 0.0407, and 0.1314 animals per square kilometer, respectively. For example, based upon the methodology defined by NOAA in the NMFS 2008 IHA, for the North Atlantic right whale with a SPUE of 0.0082, a conservatively estimated

ZOI of 34 square kilometers (representative of the shallowest portion of the project area), a correction factor of 1.5, and one pipeline repair event (estimated at 40 days per year), density would be determined as follows:

0.0082 / 2(0.4) = 0.01025

SPUE / 2 (Transect Width) = Density

Take estimates would then be calculated using the following equation:

0.01025 x 34 x 1.5 x 40 = 21

Density x ZOI x Correction Factor x Event Days per Year = Estimated Take

It should be noted that Northeast Gateway and Algonquin believe the aforementioned estimates of take during a pipeline repair event are conservative in nature in light of the following:

- the estimated 40-day duration for a pipeline repair represents the maximum number of days likely required to complete a given repair activity;
- DP vessels may not be deployed to support a given repair activity;
- calculations are based upon times of highest densities and sightings;
- pipeline repair activities are conservatively assumed to occur within the shallowest portions of the project area (i.e., the northern segment of the Algonquin pipeline lateral), which has a larger (34 square kilometer) associated ZOI (compared to the 21 square kilometer ZOI associated with the deeper location of the NEG Port and the 15 square kilometer ZOI associated with the deepest portions of the project area); and
- existing elevated ambient conditions inherent within the Massachusetts Bay environment may effectively mask noise generated by offshore repair work.

7.0 EFFECTS TO MARINE MAMMAL SPECIES OR STOCKS

Consideration of negligible impact is required for the NMFS to authorize the incidental take of marine mammals. In 50 CFR § 216.103, the NMFS defines negligible impact to be “an impact resulting from a specified activity that cannot be reasonably expected to, and is not reasonably likely to, adversely affect the species or stocks [of marine mammals] through effects on annual rates of recruitment or survival.” Based upon best available data regarding the marine mammal species (including density, status, and distribution) that are likely to occur in the NEG Port and Algonquin Pipeline Lateral area as well as in-field acoustic assessment surveys of NEG Port activities, Northeast Gateway and Algonquin conclude that exposure to marine mammal species and stocks due to NEG Port and Algonquin Pipeline Lateral operations would result in short-term minimal effects and would not likely affect the overall annual recruitment or survival for the following reasons:

- As evidenced in Section 1.4 and Appendices B and C, potential acoustic exposures from NEG Port and Algonquin Pipeline Lateral activities are within the non-injurious behavioral effects zone (Level B harassment);

- The potential for take as estimated in Section 6.2 represent conservative estimates of harassment based upon worst-case operating scenarios without taking into consideration the effects of standard mitigation and monitoring measures; and
- The protective measures as described in Sections 11.0 and 13.0 and Appendix A are designed to minimize the potential for interactions with and exposure to marine mammals.

8.0 MINIMIZATION OF ADVERSE EFFECTS TO SUBSISTENCE USES

There are no traditional subsistence hunting areas in the NEG Port or Algonquin Pipeline Lateral area.

9.0 EFFECTS TO MARINE MAMMALS FROM LOSS OR MODIFICATION OF HABITAT AND THE LIKELIHOOD OF RESTORATION

Operation of the NEG Port and Algonquin Pipeline Lateral will not result in short-term effects; however, long-term effects on the marine environment, including alteration of the seafloor conditions, continued disturbance of the seafloor, regular withdrawal of sea water, and regular generation of underwater noise, will result from NEG Port and Algonquin Pipeline Lateral O&M activities. Specifically, a small area (0.14 acre) along the Algonquin Pipeline Lateral has been permanently altered (armored) at two cable crossings. In addition, the structures associated with the NEG Port (Flowlines, mooring wire rope and chain, suction anchors, and pipeline end manifolds) occupy 4.8 acres of seafloor. An additional area of the seafloor of up to 43 acres (worst case scenario based on severe 100-year storm with LNGRVs occupying both STL buoys) will be subject to disturbance due to chain sweep while the buoys are occupied.

Each LNGRV will require the withdrawal of an average of 4.97 million gallons per day (mgd) of sea water for general ship operations during its 8-day stay at the NEG Port. Plankton associated with the sea water will not likely survive. Based on densities of plankton in Massachusetts Bay, it is estimated that sea water use during operation will consume, on a daily basis, about 3-200 x 10^{10} phytoplankton cells (about several hundred grams of biomass), 6.5 x 10^{8} zooplankters (equivalent to about 1.2 kilograms of copepods), and on the order of 30,000 fish eggs and 5,000 fish larvae.

Approximately 4.8 acres of seafloor will be converted from soft substrate to the artificial hard substrate of the structures associated with the NEG Port and Algonquin Pipeline Lateral. An additional area of up to 38 acres is subject to disturbance due to chain sweep while the buoys are occupied by the LNGRVs. Given the relatively small size of the NEG Port area that will be directly affected by NEG Port operations (see Section 1.2), Northeast Gateway and Algonquin do not anticipate that habitat loss will be significant. In addition, the possible removal benthic or planktonic species, resulting from the relatively minor LNGRV water use requirements while at Port, is unlikely to affect in a measurable way the food sources available to marine mammals. At the end of their useful life (approximately 40 years), the NEG Port and Algonquin Pipeline Lateral will be removed and or abandoned in place, in compliance with all applicable and appropriate regulations, guidelines, and technologies in place at that time to ensure habitat integrity.

10.0 THE EFFECTS OF HABITAT LOSS OR MODIFICATION ON MARINE MAMMALS

As stated above, approximately 4.8 acres of seafloor will be converted from soft substrate to artificial hard substrate. The soft-bottom benthic community may be replaced with organisms associated with naturally occurring hard substrate, such as sponges, hydroids, bryozoans, and associated species. The benthic community in the up to 43 acres (worst case scenario based on severe 100-year storm with LNGRVs occupying both STL buoys) of soft bottom that may be swept by the anchor chains while

LNGRVs are docked will have limited opportunity to recover, so this area will experience a long-term reduction in benthic productivity. In addition, disturbance from anchor chain movement would result in increased turbidity levels in the vicinity of the buoys that could affect prey species for marine mammals; however, as indicated in the FEIS/FEIR, these impacts are expected to be short-term, indirect, and minor.

Daily removal of sea water from LNGRV intakes will reduce the food resources available for planktivorous organisms. Massachusetts Bay circulation will not be altered, however, so plankton will be continuously transported into the NEG Port area. The removal of these species is minor and unlikely to affect in a measurable way the food sources available to marine mammals.

11.0 MEANS OF AFFECTING THE LEAST PRACTICABLE IMPACT UPON EFFECTED SPECIES OR STOCKS

Northeast Gateway and Algonquin have committed to a comprehensive set of mitigation measures during operation as well as on-going consultations with NMFS. These measures include:

- Passive acoustics program
- Visual monitoring program
- Safety zones
- Reporting
- Vessel speed restrictions
- Ramp-up procedures

Details of the proposed mitigations are discussed in the Marine Mammal Detection, Monitoring, and Response Plan included as Appendix A to this application. The following procedures will be used in addition to those outlined in Appendix A for any repair work that occurs on the Algonquin Pipeline Lateral using a DP vessel. These procedures outlined in the following section have been previously approved by the NMFS and effectively employed during NEG Port and Algonquin Pipeline Lateral construction.

Marine Mammal Observers

Two qualified Maine Mammal Observers (MMOs) will be assigned to each DP vessel (each operating individually in designated shifts to accommodate adequate rest schedules). Their exclusive responsibility is to watch for marine mammals and to alert the construction crew supervisor if marine mammals are visually detected within the most conservatively estimated ZOI, within 2 miles (3.31 kilometers) of the DP vessel, to allow for mitigating responses (see Section 6.1 for calculated ZOIs along the NEG Port and Algonquin Pipeline Lateral operational areas). MMOs will maintain logs at all times while on watch. All personnel will have experience in marine mammal detection and observation during marine construction. MMOs will maintain in situ records while on watch and therefore visual observation will not be affected. Additional MMOs may be assigned to additional vessels if auto-detection buoy (AB) data shows sound levels from additional vessels in excess of 120 dB re: 1 μPa, further than 100 meters from the vessel.

Each MMO will scan the area surrounding the construction vessels for visual signs of non-vocalizing whales that may enter the construction area. Observations will take place from the highest available vantage point on the vessels. General 360° scanning will occur during the monitoring periods, and target scanning by the observer will occur when alerted of a whale presence.

Searching will take place at all hours of the day. Night-time observations will be conducted with the aid of a night-vision scope where practical. Observers, using binoculars, will estimate distances to marine mammals either visually or by using reticled binoculars. If higher vantage points (>25 feet) are available, distances can be measured using inclinometers. Position data will be recorded using hand-held or vessel global positioning system (GPS) units for each sighting, vessel position change, and any environmental change.

Environmental data to be collected will include Beaufort sea state, wind speed, wind direction, ambient temperature, precipitation, glare, and percent cloud cover. Wind and temperature data will be extracted from onboard meteorological stations (when available). Animal data to be collected includes number, species, position, distance, behavior, direction of movement, and apparent reaction to construction activity. All data will be entered at the time of observation. Notes of activities will be kept and a daily report will be prepared and attached to the daily field form.

Response Plan for Whale Detection

The response plan focuses on the DP vessels, since they are the source of the loudest and potentially damaging noises, and also focuses on the North Atlantic right whale, since it is the most critically endangered marine mammal species in the area. However, MMOs will look for and report all marine mammals sighted within the construction zone.

For all whales near DP vessels, the MMO observation will be the principal detection tool available. If a North Atlantic right whale, other marine mammals or sea turtles are seen within the 2 mile ZOI of a DP vessel or other construction vessel that has been shown to emits noises in excess of 120 dB re 1 μPa, then the MMO will alert the construction crew to minimize the use of thrusters until the animal has moved away unless there are divers in the water or an ROV is deployed.

The DP vessel must maintain position at all times during the repair activity, and therefore must maintain use of thrusters, particularly if divers are in the water or a ROV is deployed. If they did not do so, the health and safety of the vessel and divers would be at severe risk, and loss of the ROV is possible. If there are no divers in the water, and the ROVs can be secured, then the thruster use can be minimized until the marine mammal leaves the area.

12.0 THE EFFECTS OF NEG PORT AND ALGONQUIN PIPELINE LATERAL ACTIVITIES ON SPECIES OR STOCK OF MARINE MAMMALS AVAILABLE FOR ARCTIC SUBSISTENCE USES

Potential impacts to species or stocks of marine mammals will be limited to individuals of marine mammal species located of the Northeast Region of the United States, and will not affect Arctic marine mammals. Given that the NEG Port and Algonquin Pipeline Lateral are not located in Arctic waters, the activities associated with the NEG Port and Algonquin Pipeline Lateral will not have an adverse affect on the availability of marine mammals for subsistence uses allowable under the MMPA.

13.0 MONITORING AND REPORTING

Northeast Gateway shall monitor the noise environment in Massachusetts Bay in the vicinity of the NEG Port and Algonquin Pipeline Lateral using an array of 19 Marine Autonomous Recording Units (MARUs) that were deployed initially in April 2007 to collect data during the preconstruction and active construction phases of the NEG Port and Algonquin Pipeline Lateral. A description of the MARUs can be found in Appendix A of this application. These 19 MARUs shall remain in the same configuration for a period of five years during full operation of the NEG Port and Algonquin Pipeline Lateral. The MARUs collect archival noise data and are not designed to provide real-time or near-real-time information about vocalizing whales. Rather, the acoustic data collected by the MARUs shall be analyzed to document the seasonal occurrences and overall distributions of whales (primarily fin, humpback, and right whales) within approximately 10 nautical miles of the NEG Port, and shall measure and document the noise "budget" of Massachusetts Bay so as to eventually assist in determining whether an overall increase in noise in the Bay associated with the NEG Port and Algonquin Pipeline Lateral might be having a potentially negative impact on marine mammals. The overall intent of this system is to provide better information for both regulators and the general public regarding the acoustic footprint associated with long-term operation of the NEG Port and Algonquin Pipeline Lateral in Massachusetts Bay, and the distribution of vocalizing marine mammals during NEG Port and Algonquin Pipeline Lateral O&M activities (analyzed to assess impacts of former on latter). In addition to the 19 MARUs, Northeast Gateway shall deploy 10 ABs within the TSS for the operational life of the NEG Port and Algonquin Pipeline Lateral. A description of the ABs can be found in Appendix A of this application. The purpose of the ABs shall be to detect a calling North Atlantic right whale an average of 5 nautical miles from each AB (detection ranges will vary based on ambient underwater conditions). The AB system shall be the primary detection mechanism that alerts the LNGRV Master and/or Algonquin Pipeline support vessel captains to the occurrence of right whales, heightens LNGRV or pipeline support vessel awareness, and triggers necessary mitigation actions as described in the Marine Mammal Detection, Monitoring, and Response Plan included as Appendix A of this application.

Northeast Gateway has engaged representatives from Cornell University's Bioacoustics Research Program (BRP) and the Woods Hole Oceanographic Institution (WHOI) as the consultants for developing, implementing, collecting, and analyzing the acoustic data; reporting; and maintaining the acoustic monitoring system.

Further information detailing the deployment and operation of arrays of 19 passive seafloor acoustic recording units (MARUs) centered on the terminal site and the 10 ABs that are to be placed at approximately 5-mile intervals within the recently modified TSS can be found in the Marine Mammal Detection, Monitoring, and Response Plan included as Appendix A of this application.

14.0 RESEARCH

Northeast Gateway is actively monitoring the noise environment in Massachusetts Bay in the vicinity of the NEG Port and Algonquin Pipeline Lateral using an array of 19 MARUs that were deployed initially in April 2007 to collect data during the preconstruction and active construction phases of the NEG Port and Algonquin Pipeline Lateral. These 19 MARUs shall remain in the same configuration for a period of five years during full operation of the NEG Port and Algonquin Pipeline Lateral. The MARUs collect archival noise data and are not designed to provide real-time or near-real-time information about vocalizing whales. Rather, the acoustic data collected by the MARUs shall be analyzed to document the seasonal occurrences and overall distributions of whales (primarily fin, humpback, and right whales) within approximately 10 nautical miles of the NEG Port and Algonquin Pipeline Lateral, and shall measure and document the noise "budget" of Massachusetts Bay so as to eventually assist in determining whether an overall increase in noise in the Bay associated with the NEG Port and Algonquin Pipeline Lateral might be having a potentially negative impact on marine mammals. The overall intent of the MARU system is to provide better information for both regulators and the general public regarding the acoustic footprint associated with long-term operation of the NEG Port and Algonquin Pipeline Lateral in Massachusetts Bay, and the distribution of vocalizing marine mammals during NEG Port and Algonquin Pipeline Lateral O&M activities (analyzed to assess impacts of former on latter).

In addition to the 19 MARUs, Northeast Gateway is monitoring 10 ABs within the TSS for the operational life of the NEG Port and Algonquin Pipeline Lateral. The purpose of the ABs is to detect a calling North Atlantic right whale an average of 5 nautical miles from each AB (detection ranges will vary based on ambient underwater conditions). The AB system is the primary detection mechanism that alerts the LNGRV Master and/or pipeline support vessel captains to the occurrence of right whales, heightens LNGRV and pipeline support vessel awareness, and triggers necessary mitigation actions as described in the Marine Mammal Detection, Monitoring, and Response Plan included as Appendix A of this application.

Cornell University's BRP and the WHOI worked closely with Northeast Gateway to develop and implement the acoustic monitoring program. BRP and WHOI are also responsible for collecting and analyzing the acoustic data, reporting, and maintaining the acoustic monitoring system.

Further information regarding the deployment and operation of the MARU array and the 10 ABs is detailed in the Marine Mammal Detection, Monitoring, and Response Plan included as Appendix A of this application.

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Appendix A

Marine Mammal Detection, Monitoring, and Response Plan
for Operation of the
Northeast Gateway Energy Bridge Deepwater Port and Algonquin Pipeline Lateral

Marine Mammal Detection, Monitoring, and Response Plan for Operation of the Northeast Gateway Energy Bridge Deepwater Port and Pipeline Lateral

Submitted by

Northeast Gateway Energy Bridge, LLC

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And

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Acronyms and Abbreviations

AB	Auto-detection Buoy
AIS	Automatic Identification System
Algonquin	Algonquin Gas Transmission, LLC
ATBA	Area To Be Avoided
BO	Biological Opinion
CCB-SMA	Cape Cod Bay Seasonal Management Area
Cornell	Cornell University's Bioacoustics Research Program
DEIS	Draft Environmental Impact Statement
EBRV	Energy Bridge Regasification Vessel
ESA	Endangered Species Act
FEIS	Final Environmental Impact Statement
GPS	Global Positioning System
GSC-SMA	Great South Channel Seasonal Management Area
GT	Gross Tons
HubLine	Algonquin's existing offshore natural gas pipeline system in Massachusetts Bay
IHA	Incidental Harassment Authorization
IMO	International Maritime Organization
ITS	Incidental Take Statement
LNG	Liquefied Natural Gas
MARAD	Department of Transportation - Maritime Administration
MARSEC	Maritime Security
MARU	Marine Autonomous Recording Units
MMDMRP	Marine Mammal Detection, Monitoring, and Response Plan
MMPA	Marine Mammal Protection Act
MSR	Mandatory Ship Reporting
MSRA	Mandatory Ship Reporting Area
NBDP	Narrow Band Direct Printing
NEG Port or Port	Northeast Gateway Deepwater Port
NEG	Northeast Gateway Energy Bridge, L.L.C.
NER	Northeast Region
NMFS	National Marine Fisheries Services
NMSA	National Marine Sanctuary Act
NMSP	National Marine Sanctuary Program
NOAA	National Oceanographic Atmospheric Administration
ORP-SMA	Off Race Point Seasonal Management Area
Pipeline Lateral	Algonquin's new 16.06–mile long, 24–inches diameter natural gas pipeline connecting the NEG Port to the existing Hubline
PMMP	Prevention, Monitoring, and Mitigation Plan
PSV	Port Service Vessel
SAS	Sighting Advisory System
SBNMS	Stellwagen Bank National Marine Sanctuary
STL	Submerged Turret Loading
TSS	Traffic Separation Scheme
USCG	United States Coast Guard
VTS	Vessel Traffic Services
WHOI	Woods Hole Oceanographic Institution
ZOI	Zone of Influence

1 Deepwater Port Project Description

Northeast Gateway Energy Bridge, L.L.C. (NEG) filed an application with the U.S. Department of Transportation, Maritimes Administration (MARAD) on June 13, 2005, for a license to construct, own, and operate the Northeast Gateway Deepwater Port (NEG Port or Port), located approximately 13 miles southeast of Gloucester, MA. The Maritime Administrator issued a License to own, construct, and operate a Deepwater Port to NEG on May 14, 2007.

The Port, which will be located in Massachusetts Bay, will consist of a submerged buoy system to moor specially designed Liquefied Natural Gas (LNG) carriers approximately 13 miles (21 kilometer) offshore of Massachusetts in Federal waters approximately 270 to 290 feet (82 to 88 meters) in depth. The facility will deliver regasified LNG to onshore markets via new and existing pipeline facilities owned and operated by Algonquin Gas Transmission, LLC (Algonquin). Algonquin built and will operate a new 16.06–mile (25.8 kilometer) long, 24–inches (61–centimeters) diameter natural gas pipeline (called the Northeast Gateway Pipeline Lateral or Pipeline Lateral) to connect the Port to Algonquin's existing offshore natural gas pipeline system in Massachusetts Bay called the HubLine. NEG's fleet of purpose-built Energy Bridge Regasification Vessels (EBRVs) is based on the design of conventional LNG transport vessels fitted with patented on-board regasification equipment and will transport LNG to the Port. Once at the Port, the EBRVs will begin regasification of the LNG back into its gaseous state and then deliver the natural gas into the submerged Pipeline Lateral connected to the existing HubLine for delivery into the New England energy market.

2 Introduction

In accordance with Condition 12 of Annex A to the MARAD License, NEG in cooperation with MARAD, the United States Coast Guard (USCG), the National Oceanographic and Atmospheric Administration (NOAA), the Commonwealth of Massachusetts and other Federal and State agencies has established a program for preventing, monitoring, and mitigating environmental impacts (Prevention, Monitoring, and Mitigation Plan [PMMP]). As required, the PMMP is comprised of all Federal, State, and Local environmental permits, certificates, licenses, and approved monitoring and mitigation plans obtained by NEG and Algonquin to support the collective pre-construction, construction, post-construction, and operation of the NEG Port and Pipeline Lateral. Integral to the PMMP, this Marine Mammal Detection, Monitoring, and Response Plan (MMDMRP) has been developed to support the requirements identified in the PMMP to minimize adverse impacts to marine mammals. The information presented in this MMDMRP shall serve as a guide to help NEG and EBRV personnel better understand the procedural requirements for marine mammal protection as identified in the MARAD License, the Endangered Species Act (ESA) Biological Opinion (BO), the Marine Mammal Protection Act (MMPA), Incidental Harassment Authorization (IHA), and Incidental Take Statement (ITS) as amended, and the National Marine Sanctuary Act (NMSA) Section 304 (d) Recommendations. This MMDMRP has been specifically developed for the NEG Port and vessels calling at the Port.

This MMDMRP is organized under four major headings, beginning with a brief description of the project (Section 1.0); this introduction (Section 2.0), which describes the purpose of this MMDMRP and the NOAA/National Marine Fisheries Service (NMFS) regulatory oversight for the project relative to marine mammals; Section 3.0 which summarizes the requirements for marine mammal detection, monitoring, and response requirements of MARAD and USCG License, the terms and conditions of the BO, IHA, and ITS as well as the NMSA Section 304 (d) Recommendations and describes the actions to be taken by NEG to meet the identified requirements; and Section 4.0 details the acoustic monitoring strategy. A detailed Heightened Awareness Protocol has also been included as Appendix A to the MMDMRP. In addition, all crew members with navigation responsibilities on the EBRVs (including look-outs) will receive training on marine mammal sighting/reporting and vessel strike avoidance measures. This training module has been included as Appendix B.

This MMDMRP does not supersede any of the conditions of the Deepwater Port License or the NOAA authorizations listed above; rather, this MMDMRP is intended to provide further detail as to how these conditions are to be implemented during day-to-day operations of the NEG Port. It is important to recognize that the safety of a vessel, its crew, and cargo must be maintained at all times; as such the procedures outlined within the context of this MMDMRP shall be adhered to at all times except under extraordinary circumstances when the safety of the vessel, crew and cargo are in doubt. As defined in the MARAD License issued on May 14, 2007, the amended BO, IHA, ITS all issued on November 30, 2007, extraordinary circumstances are defined as instances:

(1) where the vessel's Master determines that compliance is not possible "taking into account safety and weather conditions" (BO, Section 2.4, Operational Mitigation Measures; IHA, Section 5.2(b)(ii));

(2) where the vessel's Master determines that "hydrographic, meteorological or traffic conditions dictate prudent deviation from these procedures to maintain the safety or maneuverability of the vessel" (BO, Section 2.4, Operational Mitigation Measures; IHA, Section 5.2 (b) (v));

(3) where the vessel's Master must "respond to safety concerns or for safety reasons, or for exigent circumstances at the time of approach to or departure from the NEG Port (MARAD License, Section 12 (b)(ii)(1)(c)(1)); and

In all cases where the vessel Master cannot execute the mitigation and monitoring requirements in this MMDMRP due to the above mentioned extraordinary conditions, each such deviation shall be documented in the logbook of the vessel and reported at the conclusion of the regasification activities of the EBRV to the NMFS Northeast Region (NER) Ship Strike Coordinator and the NOAA National Marine Sanctuary Program (NMSP)/ Stellwagen Bank National Marine Sanctuary (SBNMS).

2.1 NOAA Regulatory Oversight: Marine Mammals

NOAA/NMFS, has determined that serious injury or mortality of even a single individual of the critically endangered North Atlantic right whale could jeopardize this species' continued existence. In addition, serious injury or mortality to other large whale species that frequent greater Massachusetts Bay waters, including North Atlantic fin, humpback, sei and blue whales, is also prohibited due to their endangered status. Therefore, Federal actions that could lead to even a very small increased risk of serious injury or mortality must contain plans to mitigate the potential impact of those actions to these species. Specifically, Federal agencies whose actions may affect endangered and/or threatened species must consult with NMFS as specified under the implementing regulations for Section 7 of the ESA. Any harassment to any marine mammal species due to the licensed activity must also be permitted by NMFS as specified under the MMPA. Under Section 304 (d) of the NMSA, Federally licensed activities likely to adversely affect species within a National Marine Sanctuary are subject to consultation with NOAA's NMSP. Finally, NMSP regulations at 15 CFR Part 922 require a permit to be obtained for any activity conducted in a sanctuary that is otherwise prohibited (such as disturbing the seabed with anchors or moorings). As a result of consultation under NMSA, 13 specific recommendations were developed by NMSP for the NEG Project and submitted to the MARAD/USCG. As required by NMSA, the MARAD/USCG indicated their response to each of the NMSP recommendations, and those accepted were included in the project description as evaluated under ESA as well as in NEG's applications for IHA under the MMPA and the permit for deployments of passive acoustic array elements within the SBNMS. Mitigation/monitoring activities mandated as part of NEG's construction and operation activities resulting from consultations were also included in the Final Environmental Impact Statement (FEIS) issued for this project by the MARAD/USCG on October 27, 2006, the Record of Decision, issued by MARAD on February 7, 2007, and the Project's License, issued by the MARAD/USCG on May 14, 2007.

3 Marine Mammal Detection, Monitoring, and Response Recommendations and Requirements

3.1 NEG Port and EBRV Operational Requirements to Reduce Vessel-Whale Strikes

All NOAA consultations relevant to marine mammal species cited the importance of reducing the potential for vessel-whale strikes by EBRVs during the operational phase of the Project. As such, the MARAD License, the BO, ITS and IHA as amended, and NMSA Section 304 (d) Recommendations have established procedural requirements to ensure that operation of the NEG Port will not adversely affect marine mammals. The specific procedural requirements during the operation of the NEG Port consist of the following:

A. EBRV's shall utilize the newly-configured and International Maritime Organization (IMO)-approved Boston Traffic Separation Scheme (TSS) on their approach to and departure from the NEG Port at the earliest practicable point of transit[1] (subject to exceptional circumstances as defined in Section 1.0) in order to lower the risk of whale strikes. Upon entering the TSS the EBRV shall go into a "heighten awareness" mode of operation. The Heightened Awareness Protocol is included as Appendix A.

B. Prior to entering areas where North Atlantic right whales are known to occur, including the Great South Channel Seasonal Management Area (GSC-SMA) and the SBNMS, the EBRV Master and navigation watch shall:

    (1) consult recent right whale sighting information through NAVTEX, NOAA Weather Radio, the NOAA Right Whale Sighting Advisory System (SAS) or other means to obtain current right whale sighting information; and

    (2) receive up-to-date information on acoustic detections of right whales from the passive network of near-real-time auto-detection buoys (ABs) prior to and during transit through the northern leg of the TSS where such buoys are installed.

C. In accordance with NOAA Regulation 50 CFR 224.103 (c)[2], all vessels associated with Port activities shall not approach closer than 500 yards (460 meters) to a North Atlantic right whale.

D. In response to active right whale sightings[3] and active acoustic detections[4], and taking into account exceptional circumstances as defined in Section 1.0, EBRVs shall take appropriate actions to minimize the risk of striking whales. Specifically EBRVs shall:

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1 The most practical point at which EBRVs might enter the TSS will be in the Off Race Point area, but generally north of the point after the TSS angles to the west, northwest.

2 NMFS has implemented specific regulations for some ESA-listed marine mammals which address interactions with humans in the wild. These regulations prohibit approaches closer than 500 yards (460 meters) to right whales in the North Atlantic (50 CFR 224.103].

3 Active right whale sightings are all right whale sightings broadcast by the MSR or SAS.

4 Active acoustic detections are confirmed right whale vocalizations detected by a TSS AB within 24 hours of each scheduled data-review period (e.g., every 30 minutes or every 12 hours, as detailed in subsequent text). Multiple confirmed acoustic detections at a single AB will extend the duration of minimum mandated EBRV response to 24 hours from the last confirmed detection (within in the reception area of the detecting AB). Confirmed acoustic detections at multiple ABs within the same 24 hour time period will extend the area of minimum mandated EBRV response to encompass the reception areas of all detecting ABs.

(1) respond to active right whale sightings reported on the Mandatory Ship Reporting (MSR) or SAS by concentrating monitoring efforts towards the area of most recent detection (see Heightened Awareness Protocol included as Appendix A) and reducing speed to 10 knots or less if the vessel is within the circular area centered on an area 8 nautical miles in radius from the sighting location.

(2) respond to active acoustic detections by concentrating monitoring efforts towards the area of most recent detection (see Heightened Awareness Protocol included as Appendix A) and reducing speed to 10 knots or less within an area 5 nautical miles in radius centered on the detecting auto AB.

(3) respond to additional sightings made by the designated look-outs on the EBRV within a 2-mile radius of the vessel by slowing the EBRV to 10 knots or less and concentrating monitoring efforts towards the area of most recent sighting (see Heightened Awareness Protocol included as Appendix A) .

E. In the event that a whale is visually observed within 1 kilometer of the NEG Port or a confirmed acoustic detection is reported on either of the two ABs closest to the Port (western-most in the TSS array), departing EBRVs shall delay their departure from the Deepwater Port, unless exceptional circumstances, as defined in Section 1.0, require that departure is not delayed. This departure delay shall continue until either the observed whale has been visually (during daylight hours) confirmed as more than 1 kilometer from the NEG Port or 30 minutes have passed without another confirmed detection either acoustically within the acoustic detection range of the two ABs closest to the Port, or visually within 1 kilometer from the NEG Port.

F. EBRVs that are approaching or departing from the Port and are within the Area To Be Avoided (ATBA)[5] surrounding the Port, shall remain at least 1 kilometer away from any visually detected North Atlantic right whale and at least 100 yards (91.4 meters) away from all other visually detected whales unless exceptional circumstances, as defined in Section 1.0, require that the vessel stay its course. The Vessel Master shall designate at least one look-out to be exclusively and continuously monitoring for the presence of marine mammals at all times while the EBRV is approaching or departing from the Port as outlined in the Heightened Awareness Protocol included as Appendix A.

G. NEG shall ensure that other vessels providing support to the NEG Port operations during regasification activities that are approaching or departing from the Port and are within the ATBA, shall be operated so as to remain at least 1 kilometer away from any visually detected North Atlantic right whale, and at least 100 yards (91.4 meters) from all other visually detected whales.

To further ensure that marine mammals will not be adversely affected by the operation of the NEG Port, the MARAD License, the BO, ITS and IHA as amended, and NMSA Section 304 (d) Recommendations have also established specific speed restrictions that EBRVs must comply with when calling at the Port. The specific speed restrictions required for all EBRVs consist of the following:

[5] The ATBA is a 1.4-nautical mile diameter area around the NEG Port facility. This is the largest area of the port that will be marked on nautical charts that is enforceable by the USCG.

A. EBRVs and support vessels[6] shall travel at 10 knots maximum speed when transiting to/from the TSS or to/from the Port. At 1.86 miles (3 kilometers) from the Port, speed will be reduced to 3 knots and to less than 1 knot at 1,640 feet (500 meters) from the NEG buoys.

B. EBRVs shall maintain speeds of 12 knots or less while in the TSS until reaching the vicinity of the ABs (except during the seasons and areas defined under conditions “C”, “D”, and “E” below, when speed shall be limited to 10 knots or less) unless exceptional circumstances, as defined in Section 1.0, dictate the need for an alternate speed.

C. EBRVs shall reduce their maximum authorized transit speed while in the TSS from 12 knots or less to 10 knots or less from March 1 to April 30 in all waters bounded by straight lines connecting the following points in the order stated below unless exceptional circumstances, as defined in Section 1.0, dictate the need for an alternate speed. This area shall hereafter be referred to as the Off Race Point Seasonal Management Area (ORP-SMA).

42°30' N 70°30' W	41°40' N 69°57' W
42°30' N 69°45' W	42°12' N 70°15' W
41°40' N 69°45' W	42°12' N 70°30' W
42°04.8' N 70°10' W	42°30' N 70°30' W

D. EBRVs shall reduce their maximum authorized transit speed while in the TSS from 12 knots or less to 10 knots or less unless exceptional circumstances, as defined in Section 1.0, dictate the need for an alternate speed from April 1 to July 31 in all waters bounded by straight lines connecting the following points in the order stated below. This area shall hereafter be referred to as the GSC-SMA.

42°30' N 69° 45' W	41°40' N 69°45' W
42°30' N 67°27' W	42°30' N 69°45' W
42°09' N 67°08.4' W	41°00' N 69°05' W

E. EBRVs are not expected to transit Cape Cod Bay; however, in the event that transit through Cape Cod Bay is required, EBRVs shall reduce transit speed from 12 knots or less to 10 knots or less (unless exceptional conditions as defined in Section 1.0 dictate the need for an alternate speed) from January 1 to May 15 in all waters in Cape Cod Bay, extending to all shorelines of Cape Cod Bay, with a northern boundary of 42°12’ N latitude. This area shall hereafter be referred to as the Cape Cod Bay Seasonal Management Area (CCB-SMA).

F. The NEG Port area is within the Mandatory Ship Reporting Area (MSRA), as such all EBRVs transiting to and from the NEG Port shall report their activities to the mandatory reporting Section of the USCG to remain apprised of North Atlantic right whale movements within the area. All vessels entering and exiting the MSRA shall report their activities to WHALESNORTH. Vessel operators shall contact the USCG by standard procedures promulgated through the Notice to Mariner system.

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[6] The NEG utilizes a Port Service Vessel (PSV) that operates within the vicinity of the NEG deepwater port for enhanced maritime domain security awareness, crewing, maintenance, transportation of port personnel, performance of surveys, and environmental studies. PSV activities are carefully coordinated and dedicated to those necessary while an EBRV is moored to the subsea buoy and cargo transfer operations are being performed.

The importance of maritime domain security awareness is recognized. The PSV will normally be present at least 70 percent of the time while an EBRV is moored at the NEG during Maritime Security (MARSEC) 1. If the PSV is performing others duties outside of domain awareness it can return to station at the NEG Port within one hour, which will require the vessel to travel at speeds greater than 10 knots in response to a heightened security situation.

G. The EBRV Master shall receive reports as often as every 30 minutes regarding right whale call detections made by the ABs prior to and during transit through the portion of the TSS where the buoys are installed (see Section 3.1.1). Should a detection occur the following procedures shall be followed:

   (1) In response to active right whale sightings or acoustic detections (as defined in footnotes 3 and 4) and taking into account exceptional circumstances that may exist as defined in Section 1.0, EBRVs shall take appropriate actions to minimize the risk of striking whales, including reducing speed to 10 knots or less and alerting the posted look-out to concentrate monitoring efforts towards the area of most recent detection (see Heightened Awareness Protocol included as Appendix A).

   (2) EBRVs shall respond to active right whale sightings reported on the MSR or SAS by alerting the look-out posted for marine mammal monitoring duties to concentrate monitoring efforts towards the area of most recent detection (see Heightened Awareness Protocol included as Appendix A) and by reducing speed to 10 knots or less if the vessel is within an 8 nautical mile radius centered on the location of the sighting.

   (3) EBRVs shall respond to active acoustic detections by concentrating monitoring efforts towards the area of most recent detection (see Heightened Awareness Protocol included as Appendix A) and reducing speed to 10 knots or less within a 5 nautical mile radius centered on the detecting AB.

   (4) EBRVs shall respond to visual observations made by the look-out within the 2-mile Zone of Influence (ZOI) around the ship by concentrating monitoring efforts towards the area of observation (see Heightened Awareness Protocol is included as Appendix A) and by reducing speed to 10 knots or less.

H. All individuals onboard the EBRVs responsible for the navigation duties and any other personnel that could be assigned to monitor for marine mammals shall receive training on marine mammal sighting/reporting and vessel strike avoidance measures. See Appendix B for a copy of the marine mammal and sea turtle training materials.

   While an EBRV is navigating within the designated TSS there are three people with lookout duties on or near the bridge of the ship including the Master, the Officer-of-the-Watch and the Helmsman on watch. In addition to the standard watch procedures, while the EBRV is transiting within the designated TSS, maneuvering within the ATBA, and/or while actively engaging in the use of thrusters, an additional look-out shall be designated to exclusively and continuously monitor for marine mammals (see Heightened Awareness Protocol included as Appendix A).

   All sightings of marine mammals by the designated look-out, individuals posted to navigational lookout duties and/or any other crew member while the EBRV is transiting within the TSS, maneuvering within the ATBA, and/or when actively engaging in the use of thrusters, shall be immediately reported to the Officer-of-the-Watch who shall then alert the Master. The Master or Officer-of-the-Watch shall ensure the required reporting procedures as defined in Appendix A are followed and the designated marine mammal look-out records all pertinent information relevant to the sighting. The Master shall then be responsible for implementing the measures as described in this MMDMRP to ensure impacts to marine mammals are minimized.

   Once the Submerged Turret Loading™ (STL) buoy is locked into place within the EBRV and regasification activities have begun, the vessel is no longer considered in Heightened Awareness status. However, when regasification activities conclude and the EBRV prepares to depart from the

NEG Port, the Master shall once again ensure the responsibilities as defined in this MMDMRP are carried out.

I. Visual sightings made by look-outs from the EBRVs will be recorded using a standard sighting log form (see Attachment 1 to the Heightened Awareness Protocol). Estimated locations will be reported for each individual and/or group of individuals categorized by species, when known, or by general classes (i.e. one large whale, multiple large whales, 100+ dolphins etc.) when species or number is unknown. This data will be entered into a database and a summary of monthly sighting activity will be provided in the Cornell reports and ITS/IHA reports to NOAA (see Section 4.2). Estimates of take and copies of these log sheets will also be included in ITS/IHA reports.

3.2 Acoustic Detection Operational and Maintenance Requirements to Reduce Vessel-Whale Strikes

Vessels associated with maintaining the acoustic seafloor array of Marine Autonomous Recording Units (MARUs) and the AB network operating as part of the mitigation/monitoring protocols under this MMDMRP shall adhere to the following speed restrictions and marine mammal monitoring requirements. These restrictions and requirements are also referred to in the SBNMS permit for this activity (permit number SBNMS-2007-002):

A. Vessels greater than 300 gross tons (GT) shall not exceed 10 knots.

B. Vessels less than 300 GT shall not exceed 15 knots at any time, but shall adhere to speeds of 10 knots or less in the following areas and seasons:

   (1) In the ORP-SMA between March 1 and April 30 as described in the Draft Environmental Impact Statement (DEIS) for the North Atlantic Right Whale Ship Strike Reduction Strategy and implemented in the BO for this project.

   (2) In the CCB-SMA between January 1 and May 15 as described in the DEIS for the North Atlantic Right Whale Ship Strike Reduction Strategy and implemented in the BO for this project.

C. In accordance with NOAA Regulation 50 CFR 224.103 (c), all vessels associated with NEG Port activities shall not approach closer than 500 yards (460 meters) to a North Atlantic right whale (see footnote 2).

D. All vessels shall post look-outs during operations to help avoid collisions with marine mammals. Individuals posted as look-outs shall receive training in marine mammal observation.

E. All vessels shall obtain the latest right whale sighting information via the NAVTEX, MSR, SAS, NOAA Weather Radio, or other available means prior to operations to determine if there are right whales present in the operational area.

3.3 Injured/Dead Protected Species Reporting

During all phases of the NEG Project's operation, sightings of any injured or dead protected species (sea turtles and marine mammals) shall be reported immediately, regardless of whether the injury or death was caused by Port activities. Sightings of injured or dead whales and sea turtles not associated with NEG Project activities can be reported to the USCG on VHF Channel 16, or to NMFS Stranding and Entanglement Hotline: (978) 281-9351.

In addition, if the injury or death was caused by a NEG Port vessel or NEG Port-related equipment or material/activity (e.g., EBRV, support vessel, or construction vessel, entanglement, buoy, etc.), NEG shall notify

MARAD and the USCG immediately, and shall provide a full report to NOAA/NMFS NER and NOAA/NMSP/SBNMS. The reports to NOAA shall include the following information:

(1) the time, date and location (latitude/longitude) of the incident;
(2) the name and type of the vessel involved or other equipment/material that caused the injury or death;
(3) the vessel's speed during the incident, if applicable;
(4) a description of the incident;
(5) water depth;
(6) environmental conditions (e.g., wind speed and direction, sea state, cloud cover and visibility);
(7) the species identification or description of the animal, if possible; and
(8) the fate of the animal.

4 Acoustic Monitoring Strategy

As reflected in MARAD/USCG License, the BO, ITS and IHA as amended, and the NMSA Section 304 (d) Recommendations, the impacts from operation can be effectively monitored and mitigated utilizing passive acoustic detection technology. As such, NEG shall monitor the noise environment in Massachusetts Bay in the vicinity of the NEG Port and Pipeline Lateral using an array of 19 MARUs that were deployed initially in April 2007 to collect data during the preconstruction and active construction phases of the Project. MARUs are depicted in Figure 1. These 19 MARUs shall remain in the same configuration for a period of 5 years during full operation of the NEG Port. The MARUs collect archival noise data and are not designed to provide real-time or near-real-time information about vocalizing whales. Rather, the acoustic data collected by the MARUs shall be analyzed to document the seasonal occurrences and overall distributions of whales (primarily fin, humpback and right whales) within approximately 10 nautical miles of the NEG Port and shall measure and document the noise "budget" of Massachusetts Bay so as to eventually assist in determining whether or not an overall increase in noise in the Bay associated with the NEG Project might be having a potentially negative impact on marine mammals. The overall intent of this system is to provide better information for both regulators and the general public regarding the acoustic footprint associated with long-term operation of the NEG Port in Massachusetts Bay, and the distribution of vocalizing marine mammals during NEG Port operation (analyzed to assess impacts of former on latter). In addition to the 19 MARUs, NEG shall deploy 10 ABs (Figure 2) within the Separation Zone of the TSS for the operational life of the NEG Project. The purpose of the ABs shall be to detect a calling North Atlantic right whale an average of 5 nautical miles from each AB (detection ranges will vary based on ambient underwater conditions). The AB system shall be the primary detection mechanism that alerts the EBRV Master to the occurrence of right whales, heightens EBRV awareness, and triggers necessary mitigation actions as described in this MMDMRP.

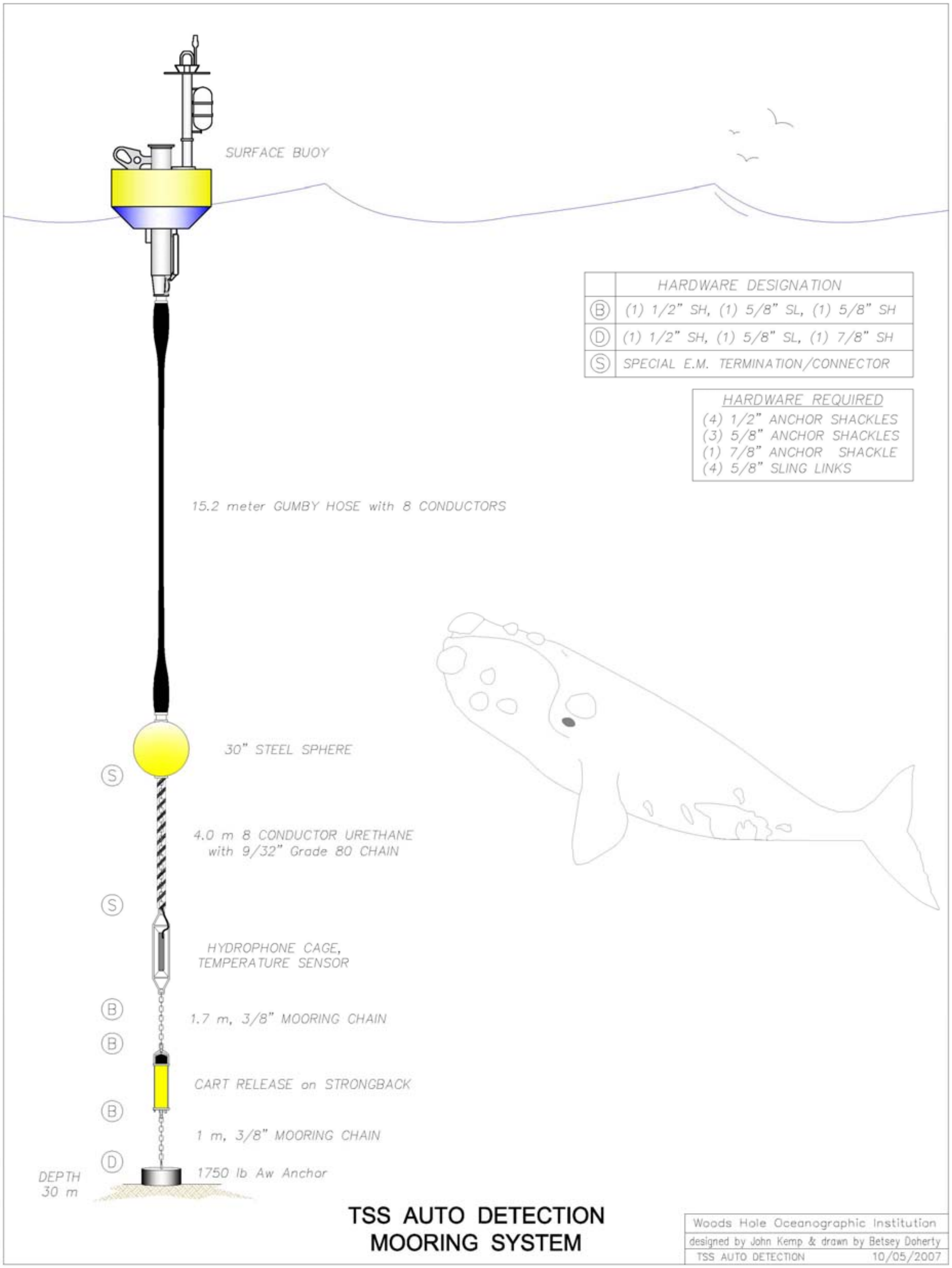
NEG has engaged representatives from Cornell University's Bioacoustics Research Program (Cornell) and the Woods Hole Oceanographic Institution (WHOI) as the consultants for developing, implementing, collecting and analyzing the acoustic data, reporting, and maintaining the acoustic monitoring system.

The following sections detail the deployment and operation of arrays of 19 passive seafloor acoustic recording units MARUs centered on the terminal site and the 10 ABs (Figure 3)[7] that are to be placed at approximately 5-mile intervals within the recently modified TSS.

[7] The configurations of the MARU array and AB network presented in this plan were based upon the configurations developed and recommended by NOAA personnel. This plan represents a technological design based on scientific research. Impacts to MARUs and ABs from vessels transiting the TSS are not known. Modifications to the deployment schedules and configurations of the MARU array and AB network may be required to respond to any adverse impacts from these two activities.

Figure 1. Marine Autonomous Recording Units (MARUs)

Figure 2. Auto-detection buoy (AB) schematic and picture of AB operating off the coast of New England



4.1 Acoustic Whale Detection and Response Plan

During NEG Port operations, the NEG Port Manager shall notify Cornell when he receives the USCG required 96-hour notification of arriving vessel from the Master of the EBRV. By this notification Cornell shall be able to determine and the NEG Port Manager will confirm when an EBRV is within 24 hours of entering the TSS.

4.1.1 Right Whale Detection and Notifications

At the completion of the construction phase, the six ABs utilized in this phase shall be removed from the construction corridor. Ten (10) newly constructed ABs shall be manufactured by the WHOI and Cornell, and shall be deployed within the TSS. The ABs shall be placed approximately 5 nautical miles from each other within the TSS northward as it approaches and then transits the SBNMS (Figure 3).

Each AB shall continuously screen the low-frequency acoustic environment (less than 1,000 Hertz) for right whale contact calls occurring within an approximately 5 nautical mile radius from each buoy (the AB's detection range) and rank detections on a scale from 1 to 10. Each AB shall transmit all detection data for detections of rank greater than or equal to 6 via Iridium satellite link to the Cornell server website every 20 minutes[8].

There are two procedures for evaluating the AB data and posting the evaluation results, where posting refers to the protocol by which confirmed detections are communicated to an EBRV:

(1) Under a normal monitoring condition (no EBRV at the Port, no EBRV in the TSS, no EBRV expected to enter TSS within 24 hours), Cornell staff with expertise in right whale call identification shall evaluate all available AB data and post detection results every 12 hours.

(2) Under a monitoring-alert condition (when the EBRV is within 24 hours of entering the TSS, is in the TSS or is in the NEG Port area) Cornell staff with expertise in right whale calls shall evaluate all available AB data and post detection results every 30 minutes[9]. During this monitoring-alert condition Cornell personnel with expertise in right whale calls shall be available full-time to confirm all detections.

Once a confirmed detection is made, Cornell shall immediately initiate a process to alert the Master of any EBRVs operating in the area. Until the Automatic Identification System (AIS) transmission is available for communicating confirmed whale detections, the time that Cornell establishes contact with the EBRV Master regarding the presence of a confirmed detection starts the 24 hour period in which that acoustic detection remains "active." Additional communications between Cornell and the EBRV Master regarding new confirmed detections (as often as every 30 minutes or every 12 hours under different monitoring conditions) shall either restart the 24 hour clock at an AB that has received multiple confirmed calls, or start additional 'clocks' associated with coincident detections at additional buoys.

[8] This 20-minute transmission schedule was determined by consideration of a combination of factors including the tendency of right whale calls to occur in clusters [leading to a sampling logic of listening for other calls rather than transmitting immediately upon detection of a possible call] and the amount of battery power required to complete a satellite transmission.

[9] The time required to complete the transmission of AB data is directly related to the size of the data package (i.e., large packages require more time than small ones.) Therefore, the exact length of time between the start of data transmission from an AB and evaluation of those AB data cannot be precisely specified. In order for Cornell staff to keep up with data evaluation from the same AB, the sum of transmission and evaluation times must be less than 20 minutes. Given the best available information at this time, we anticipate that data evaluation for a single AB data package transmitted every 20 minutes, could be completed within 10 minutes after the start of data transmission. By this schedule, the longest delay time between the actual occurrence of a right whale call detected at an AB and the posting of a message that a calling right whale had been detected would be 30 minutes.

Currently, only the EBRV Excellence and the EBRV Excelerate are authorized to call upon the NEG Port. The contact info and notification content are:

Energy Bridge Regasification Vessels:

EBRV Excellence:
Phone: 764 337 789 (Bridge - CCR)
Phone: 764 337 790 (Capt. Cabin)
Fax: 764 337 791
Satcom C Telex: 420 543 411
Ocean region to be monitored: AORW (874 for Voice and 574 for Telex)
Call sign: ONBG
E-mail: master.excelerate@rmx2.rydex.co.uk - or - excellence@shipmanagement.exmar.be

EBRV Excelerate:
Phone: 764 642 316 (Bridge - CCR)
Phone: 764 642 317 (Capt. Cabin)
Fax: 764 642 318
Satcom C Telex: 420 544 410
Ocean region to be monitored: AORW (874 for Voice and 574 for Telex)
Call sign: ONDY
E-mail: master.excelerate@rmx2.rydex.co.uk - or - excelerate@shipmanagement.exmar.be

The Notification Content shall include:

- Time of detection – Designated in Local Time (LT)
- Detection AB – Designated by AB-ID# and LAT/LON Coordinates
- Active detection time period – Indicate start (as defined for pre-AIS communication methodology, above, and post-AIS communication methodology, below) and end times for 24 hour mandated response
- Special instructions – Any pertinent information

In order to ensure the efficiency with which whale detection information is transmitted to EBRV Masters, additional notification methods may be developed in cooperation between NOAA, USCG, Cornell, and NEG.

Presently, the default notification mechanism is that Cornell shall make telephone calls to the Master of any EBRV operating in the area. Information detailing the detection shall also be faxed to the NEG Port Manager (Fax #: +1 978 744 5973). Two alternative notification mechanisms, NAVTEX Reporting and AIS Reporting, are being developed in cooperation with NOAA, USCG, Cornell, and NEG to provide content information to the EBRVs.

The objective of these alternative notification methods is to ensure that whale detection information is transmitted in a manner that (1) allows it to be most efficiently integrated with additional information utilized by EBRV Masters and crew members, and (2) will facilitate broadening of the audience for detection notices to non-EBRV vessels in the area, following either voluntary reception and use of these messages by such additional vessels or determination by NOAA to propose the use of these messages in the agency's ship strike mitigation strategy (including associated evaluation of the impacts of such action, and additional governmental and public review and comment).

Since implementation of these two methods have not been fully developed by NOAA, USCG, Cornell, and NEG at this time, they are not included as part of this MMDMRP for Operation. NEG shall continue to cooperate in the development activities for these two alternative notifications methods and when either method is tested and confirmed that the EBRVs can integrate the methods into their operating protocols, this MMDMRP shall be amended to describe how the alternative reporting systems shall be implemented and the EBRV crews shall be trained on their implementation. A brief general description of each of the proposed alternative reporting methodologies is provided below.

4.1.2 NAVTEX Reporting

NAVTEX is a standard Narrow Band Direct Printing (NBDP) system that assures a nearly 100 percent delivery of messages in all weather conditions. The NBDP system can be configured such that all detection messages can be prioritized. Therefore this notification procedure shall require receiver (vessel operator) acknowledgement or an audible alarm keeps repeating. Most vessels over 300 tons have NAVTEX. The IMO has designated NAVTEX as the primary means for transmitting coastal urgent marine safety information to ships worldwide. In the United States, NAVTEX is broadcast from USCG facilities in Cape Cod MA, Chesapeake VA, Savannah GA, Miami FL, New Orleans LA, San Juan PR, Cambria CA, Pt. Reyes CA, Astoria OR, Kodiak AK, Honolulu HI, and Guam. The USCG has been operating NAVTEX from Boston in 1983.

4.1.3 AIS Reporting of North Atlantic Right Whale Detections

The AIS is currently being used by ship-to-ship, line-of-site communication and principally for identification and locating vessels for navigation safety and collision avoidance. AIS helps to resolve the difficulty of identifying ships when many ships are in one area or when ships are not in sight (e.g., in fog, at far distance) by providing a means for ships to exchange identification, position, course, speed, and other ship data with all other nearby ships and Vessel Traffic Services (VTS) stations. It works by integrating a standardized VHF transceiver system with an electronic navigation system, such as a LORAN-C or Global Positioning System (GPS) receiver, and other navigational sensors aboard a ship (e.g., gyrocompass, rate of turn indicator, speed log, etc.).

NOAA has suggested that the active whale detections be transmitted over the AIS to facilitate the efficiency with which these data are integrated with additional navigational information utilized by vessels fitted with AIS equipment. NEG shall work with representatives from Cornell and the University of New Hampshire to further investigate this new application for the AIS. Transmission of whale detection notifications over the AIS shall require authorization from the USCG and IMO.[10]

4.1.4 Maintenance of the Auto-detect Buoy Systems

AB units shall be refurbished and repaired every three to six months as necessary, and the schedule for such repairs shall be carefully orchestrated so as not to impact auto-detection coverage in the TSS. For example, units would be swapped out during periods when no NEG Project vessels are in the area or expected to enter the area. NEG shall be required to maintain this system for the life of the project. Cornell shall provide regularly reports to MARAD, USCG, and NOAA (both NMFS and NMSP) that includes information on the functioning and performance of this system (see Section 4.2).

4.2 Long-term MARU Noise Monitoring and Reporting

Throughout the construction phase, 19 MARUs have been deployed to record the acoustic environment in the area surrounding the NEG Port. This long-term monitoring effort shall continue seamlessly during the

[10] NOAA is facilitating the acquisition of this authorization. The USCG has reviewed the binary code proposed for transmission of whale detection notices to NEG's EBRVs and has conditionally approved the use of AIS for this purpose. Additional development and testing are scheduled to take place between December 2007 and March-April 2008, with transmissions scheduled to be available for EBRV reception no later than May 2008. Until this development and testing phase are completed, received information on right whale detections will be reported to the transiting Excelerate Energy EBRVs using the default reporting procedures outlined in Section 3.1.1.

construction to operational transition period, and throughout the first five years of NEG Port operations. Given the present MARU deployment-redeployment schedule, the 19 MARUs deployed in mid-October 2007 near the end of construction shall be recovered and replaced in mid-January 2008 after the start of the operational phase. During the operational phase these MARUs shall continue to be redeployed in the same locations as they were during the construction period. However, based on the best available evidence from activities to date, and in consultation with all necessary parties and taking into consideration the need for permitting of any new locations for deployments within the SBNMS, Cornell shall evaluate the MARU deployment geometry plan and possibly make slight adjustments to the deployment geometry. This might happen, for example, based on changes in the fishing season, new information on bottom topography that indicates a better place to locate a unit where it is less likely to get trawled, or because it can be located in a place that provides better acoustic coverage now that construction is over. MARUs shall be recovered and redeployed on a three-month schedule to provide continuous, year-around passive acoustic monitoring coverage for five years after construction is complete.

Throughout operations, NEG will provide regular reports to MARAD, USCG and NOAA (both NMFS and NMSP) regarding the progress and status of the Project's operational marine mammal detection and monitoring requirements. These reports are summarized in Table 4.2-1.

For the first six months of NEG Port operation, Cornell shall provide a monthly Auto Detection Buoy Report that includes detailed information on the functioning and performance of the AB system as well as reports of whale detections, presence of EBRVs, and EBRV responses to notification. After this initial six-month period, Auto Detection Buoy Report shall be submitted quarterly (every three months) beginning after the ninth month of operation.

On a quarterly basis (approximately every three months) from the start of operations, Cornell will also provide a Passive Acoustic Monitoring Report to MARAD, USCG, and NOAA (both NMFS and NMSP). This report will include information regarding the noise environment of the adjacent area of Massachusetts Bay, the noises attributable to the operation of the Port, and, as feasible, the movement of vocalizing whales in the detection area based on empirical data collected by the MARUs. Included with this report will be a summary of the sighting information collected by the EBRV look-outs. Cornell also has access to both the SAS and MSR data for any given reporting period and will use this data in combination with the visual sighting information collected by the EBRV look-outs (see Section 3.1 and below) to assist in their estimation of the presence of whales during the operation of the Port.

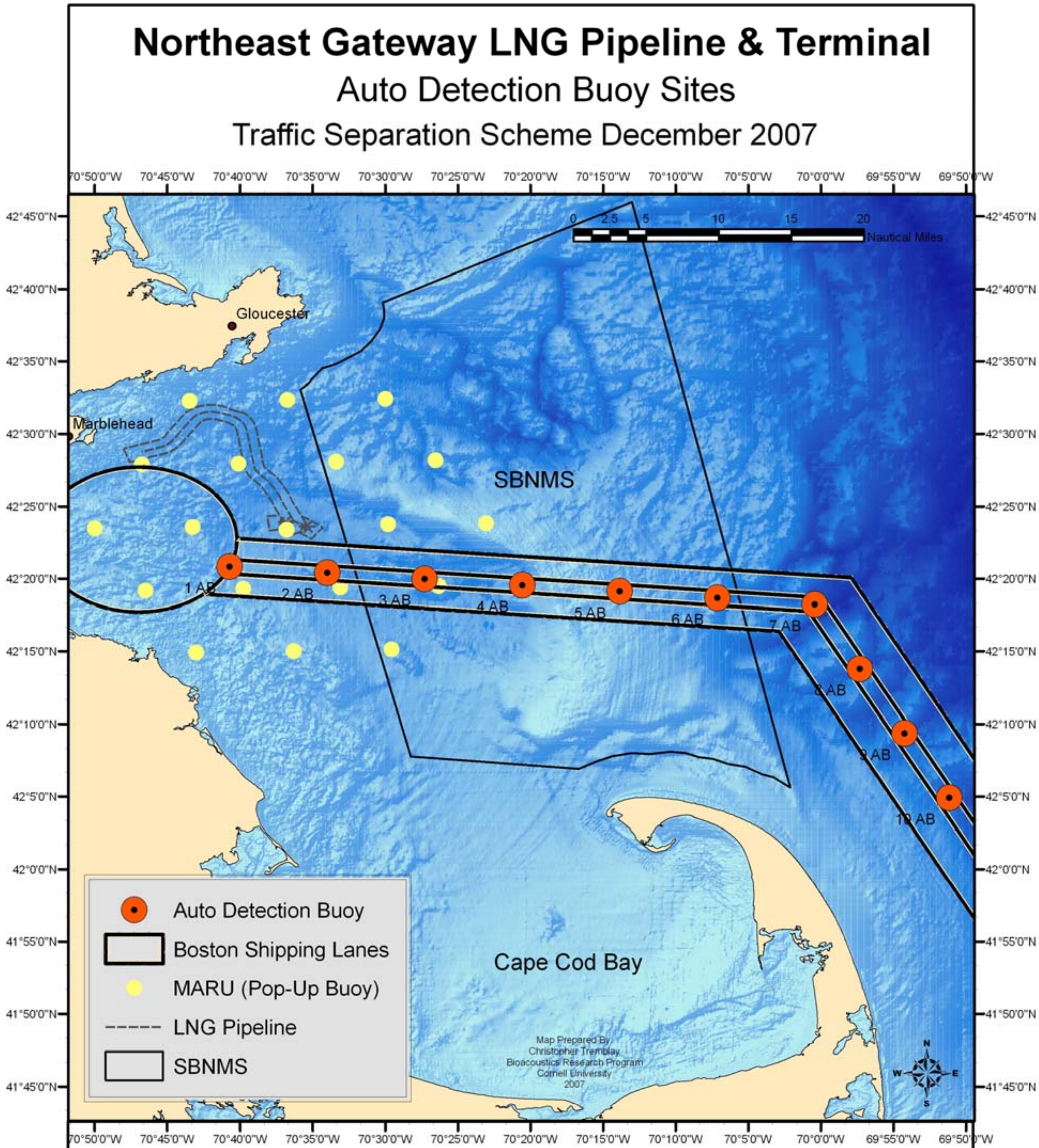
Throughout NEG Port Operations, NEG will provide a monthly IHA/ITS Report. The IHA/ITS Report will include both copies of the raw visual EBRV lookout sighting information of marine mammals and/or sea turtles that occurred within 2 miles of the EBRV while the vessel EBRV is transiting within the TSS, maneuvering within the ATBA, and/or when actively engaging in the use of thrusters, and a summary of the data collected by the look-outs over each reporting period (see Attachment 1 to Appendix A for a copy of the look-out sighting log). This visual sighting data will then be correlated to periods of thruster activity to provide estimates of marine mammal takes (per species/species class) that took place during each reporting period.

At the end of each five-year monitoring period, Cornell shall prepare a MMDMRP Summarization Report and provide it to NEG and to designated representatives of the MARAD, USCG, and NOAA (both NMFS and NMSP).

Table 4.2-1 Marine Mammal Detection and Monitoring Reporting Requirements

Report Title	Scheduled delivery to NOAA	Summary of Contents
ITS/IHA Report	Monthly throughout operations	Tabulation of number of marine mammals visually detected within 2 miles of the EBRV; estimation of take per species/species class; raw sighting logs for month
Auto Detection Buoy Report	Monthly for first 6 months, then every three months (beginning 9 months into operations)	Whale detections by TSS ABs, presence of EBRVs, and EBRV responses to notification
Passive Acoustic Monitoring Report	Approximately every three months during operations, in coordination with the recovery schedule of the MARUs.	Functioning and performance of the MARU network, including information on the noise environment in the MARU monitoring area, the presence of vocalizing whales in the MARU monitoring area, numbers of whales occurring in the MARU monitoring area and in the vicinity of Port Operations (based on the visually and acoustically located animals), and the movements of vocalizing whales based on empirical data collected by the MARUs. This would also include, as feasible, the attribution of specific operational events (as noted in Operations logs), with specific sound events (as recorded on the MARUs).
MMDMRP Summarization Report	Every five years	Overall review of the performance and effectiveness of the passive acoustic monitoring and mitigation systems within the areas of the MARU and AB networks; including documentation, quantification and measurements of the contributors to ocean ambient noise.

Figure 3. Geometry of 19 MARUs (yellow) surrounding the operating terminal site and 10 ABs (red) in the newly designated TSS during Operations.



TSS AB LOCATIONS:

AB 1:	42 20.835 N	070 40.669 W	AB 6:	42 18.682 N	070 07.111 W
AB 2:	42 20.419 N	070 33.978 W	AB 7:	42 18.231 N	070 00.398 W
AB 3:	42 19.994 N	070 27.260 W	AB 8:	42 13.786 N	069 57.306 W
AB 4:	42 19.563 N	070 20.542 W	AB 9:	42 09.339 N	069 54.221 W
AB 5:	42 19.126 N	070 13.826 W	AB 10:	42 04.891 N	069 51.143 W

Appendix A: Heightened Awareness Protocol

In accordance with Annex A of the Northeast Gateway, L.L.C. (Northeast Gateway) Maritime Administration (MARAD) License, the Revised NOAA Biological Opinion (issued November 30, 2007), Incidental Take Statement (issued November 30, 2007), the Revised Incidental Harassment Authorization (issued November 30, 2007), and the National Marine Sanctuary Program (NMSP) recommendations, Northeast Gateway must both acoustically and visually monitor for whale presence while transiting within the designate Boston Traffic Separation Scheme (TSS), while maneuvering within the confines of the Northeast Gateway Deepwater Port (NEG Port or Port)[11], and while EBRV vessels are actively engaging in the use of thrusters. While engaging in any of these activities, the EBRV crew will be placed on heightened awareness. The following document identifies the specific actions and reporting protocols for the EBRV crew to follow during heightened awareness events.

Heightened Awareness Protocols for Operating EBRVs

- Prior to entering and navigating the modified TSS the Master of the vessel will :
  - Consult NAVTEX, NOAA Weather Radio, the NOAA Right Whale Sighting Advisory System (SAS) or other means to obtain current right whale sighting information as well as the most recent Cornell acoustic monitoring buoy data for the potential presence of marine mammals;
  - Post a look-out who has successfully completed the required Marine Mammal and Sea Turtle Training Program, to visually monitor for the presence of marine mammals and/or sea turtles;
  - Place the vessel in the Heightened Awareness mode and ensure the Protocols stated in this in appendix are initiated and implemented as presented.
- While transiting the TSS, maneuvering within the ATBA, and/or while engaging in the use of thrusters, the vessel is considered operating under the requirement of this Heightened Awareness Protocol
- The vessel look-out assigned to visually monitor for the presence of marine mammals and/or sea turtles will be equipped with the following:
  - Recent NAVTEX, NOAA Weather Radio, SAS and/or acoustic monitoring buoy detection data;
  - Binoculars to support observations;
  - Marine mammal detection guide sheets (see attachment 1); and
  - Sighting log (see attachment 2 and reporting requirements below).
- The look-out will concentrate his/her observation efforts within the 2-mile radius zone of influence (ZOI) from the maneuvering EBRV.
- If a marine mammal detection was reported by either NAVTEX, NOAA Weather Radio, SAS, and/or an acoustic monitoring buoy, the look-out will concentrate visual monitoring efforts towards the areas of the most recent detection.

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[11] The ATBA is a 1.4-nautical mile diameter area around the NEG Port facility. This is the largest area of the port that will be marked on nautical charts that is enforceable by the USCG.

- If the look-out (or any other member of the crew) visually detects a marine mammal within the 2-mile radius ZOI of a maneuvering EBRV, he/she will take the following actions:
  - The Officer-of-the-Watch will be notified immediately;
  - The sighting will be recorded in the sighting log by the designated marine mammal look-out (see attachment 2 and the reporting requirements below).
- If the Officer-of-the-Watch is notified by any crewmember of a marine mammal sighting, he/she will relay the sighting information to the Master immediately so that the appropriate action(s) can be taken to ensure impacts to the marine mammal(s) are successfully avoided and/or minimized.
- Once the STL buoy is locked into place within the EBRV and regasification activities have begun, the vessel is no longer considered in Heightened Awareness status. However, when regasification activities conclude and the EBRV prepares to depart from the NEG Port, the crew the crew will once again assume the responsibilities as defined in this Plan.

Heightened Awareness Reporting Protocols

- The look-out responsible for visual monitoring during any given watch period must keep a log of all marine mammal sightings. A sample sighting log sheet has been included as attachment 2. The basic reporting requirements include the following:
  - Date;
  - Time monitoring watch commenced / Time monitoring watch was suspended;
  - Name of look-out;
  - Vessel Name;
  - Lookout Position;
  - Weather and sea-state conditions;
  - Time of sighting;
  - Type of species sighted (categories will include: species [if known], unknown large whale, unknown small whale, unknown dolphin/porpoise, unknown seal, unknown sea turtle), as well as comment area for unusual or obvious behaviors;
  - Number of individuals sighted (record will include: exact number [if known], 5+, 10+, 50+, 100+);
  - Approximate location (latitude and longitude) at the time of the sighting;
  - General direction and distance of sighting from the vessel (distance should be recorded as within 50 yards, within 100 yards, within 500 yards, within 0.5 mile; within 1 mile, within 2 miles, greater than 2 miles);
  - Activity of the vessels at the time of sighting; and
  - Action taken by the observer.
- At the end of each monitoring watch the look-out will provide the log entries to the Officer of the Watch.
- The Officer of the Watch will be responsible for providing the sighting log entries to the Port Manager.
- The NEG will provide a monthly IHA/ITS Report that includes copies of the sighting logs, a summary for the species sited for the month, and an estimate of Take on a monthly basis to the following:

- Kristen Koyama
  NOAA NMFS Northeast Regional Office (NERO)
  Ship Strike Coordinator
  One Blackburn Drive
  Gloucester, MA 01930
  Kristen.Koyama@noaa.gov
  978-281-9300 x 6531
- Leila Hatch
  Regional Marine Bioacoustic Coordinator
  NOS/NOAA
  Stellwagen Bank National Marine Sanctuary
  175 Edward Foster Road
  Scituate, MA 02066
  Leila.Hatch@noaa.gov
  (781) 545-8026 x203
- Shane Guan
  NOAA NMFS Office of Protected Resources
  1315 East-West Highway
  SSMC-3 Suite 13756
  Silver Spring, MD 20910
  Shane.Guan@noaa.gov
  301-713-2289 x 137
- Sean T. Connaughton
  Maritime Administrator
  U.S. Department of Transportation
  Maritimes Administration
  Office of Deepwater Ports and Offshore Activities
  1200 New Jersey Avenue SE, #W21-201
  Washington, D.C. 20590-0001
- Admiral Thad W. Allen
  U.S. Coast Guard Commandant
  USCG Headquarters
  2100 Second Street, S.W., Room 2212
  Washington, D.C. 20593-0001

Attachment 1 – Marine Mammal Sighting Guide

Contact Numbers:

Whale Watching Information

For more information on the whale watching guidelines or laws pertaining to marine mammals, call: NMFS, Protected Resources Division: **978-281-9300, X-6505**

Right Whale Sighting

All sightings of a right whale should be called in to the NMFS Sightings Advisory System: **978-585-8473 (pager)**

Entangled Whale

Any sighting of an entangled whale should be reported. Vessels should stand-by and keep the whale in sight until help arrives (an estimated 45 min. or more) or arrange for another vessel to maintain contact with the whale. Call the Disentanglement HOTLINE (weekdays): **800-900-3622**, the Disentanglement Pager: **508-307-5300**, the NMFS Hotline: **978-281-9351**, or the USCG on **CH-16**

Entangled Right Whale

Maintain 500 yards. To report or get authorization to approach call the Disentanglement HOTLINE (weekdays): **800-900-3622**, the Disentanglement Pager: **508-307-5300**, or the NMFS Hotline: **978-281-9351**

Dead Whale

Any sighting of a dead whale should be reported to the NMFS Hotline: **978-281-9351**

Potential Violations

Any activity that appears to be an intentional or negligent action leading to a collision or harassment incident should be reported to NOAA Enforcement HOTLINE: **800-853-1964**

National Marine Fisheries Service
Northeast Region
One Blackburn Drive
Gloucester, MA 01930-2298
http://www.nero.noaa.gov

Gerry E. Studds/Stellwagen Bank
National Marine Sanctuary
175 Edward Foster Road
Scituate, MA 02066
http://www.stellwagen.noaa.gov

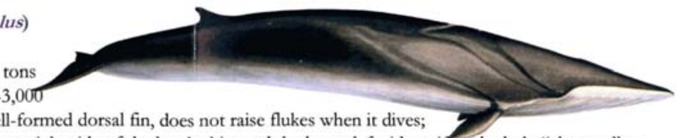
NATIONAL MARINE SANCTUARIES

7/26/06

GREAT WHALES OF THE NORTHEAST REGION

Including Stellwagen Bank National Marine Sanctuary

Fin Whale (*Balaenoptera physalus*)



Status: Endangered
Size: up to 80 feet in length, 70-80 tons
Gulf of Maine Population: 2,000-3,000
Features: fast swimming; large, well-formed dorsal fin, does not raise flukes when it dives; asymmetrical coloration with the lower right side of the head white and the lower left side uniformly dark; "chevron" or white streak that starts behind blow hole and continues along each side used for identifying individuals.
Prey: sand lance, herring, mackerel, other small schooling fish, and krill.
Range: abundant on Stellwagen Bank, Jeffreys Ledge, off the coasts of Maine, New Hampshire, Cape Ann, Cape Cod, and Long Island from spring-fall; moves south and/or offshore into deep water in the winter; breeding/calving areas unknown.

Humpback Whale (*Megaptera novaeangliae*)

Status: Endangered
Size: up to 55 feet in length, 40 tons
Gulf of Maine Population: 800-900
Features: stocky baleen whale; long, white pectoral flippers; lifts flukes, which have saw-toothed trailing edges, when it dives; variable black and white coloration on underside of each fluke used for identifying individuals; small dorsal fin; acrobatic behaviors including breaches, flipper and tail slaps.
Prey: sand lance, herring, mackerel, other small schooling fish, and krill. Uses bubble clouds or nets to corral or concentrate fish.
Range: abundant on Stellwagen Bank, Jeffreys Ledge, off the coasts of Maine, New Hampshire, Cape Ann, and Cape Cod from spring-fall; juveniles seen off Virginia in winter; migrate to Caribbean Sea to breed and calve in winter.

North Atlantic Right Whale (*Eubalaena glacialis*)

Status: Endangered
Size: up to 60 feet in length, 80 tons
Gulf of Maine Population: Approx. 300
Features: slow-moving; generally stays close to shore; robust body; long baleen; "callosities" on head and jaw used to identify individuals; usually lifts smooth- edged, triangular flukes when diving; lacks dorsal fin.
Prey: skim feeds (surface and subsurface) on dense concentrations of zooplankton, particularly copepods.
Range: Cape Cod Bay and occasionally Stellwagen Bank during late winter and early spring; Great South Channel in late spring.

Minke Whale (*Balaenoptera acutorostrata*)

Status: Common
Size: up to 30 feet, 10 tons
Gulf of Maine Population: Approx. 3000-4000
Features: Second smallest of the baleen whales, distinctive sickle-shaped dorsal fin; white bands on pectoral flippers; rarely lifts its flukes to dive; displays little or no visible breath or spout.
Prey: similar to fin and humpback whales
Range: similar to fin whales

Whale Illustrations by Garth Mix

Attachment 2 – Marine Mammal Sighting Log

Northeast Gateway Deepwater Port Sighting Log
Boston, Massachusetts

LOOK OUT:	**DATE:**
LOOK OUT POSITION:	**OBSERVATION SHIFT (START/END):** /
VESSEL:	**TOTAL OBSERVATION HOURS:**

WEATHER AND WATER CONDITIONS:	**% Cloud Cover:**	**Sea State:**
	Clarity:	**Visibility:**

Sightings Logs

Time	Species	# Sighted	Approximate Location	General Direction / Closest Distance to Vessel	Vessel Activity	Action Taken by Observer
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: : Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: : Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: : Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: : Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: : Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		
	Known: ____ ☐ Large whale ☐ Small whale ☐ Dolphin/Porpoise ☐ Sea turtle ☐ Seal ☐ Other: : Behavior: ____	Known: ____ ☐ 5+ ☐ 10+ ☐ 50+ ☐ 100+	Lat: ____ Long: ____	Direction: ____ ☐ ≤50 yd ☐ ≤100 yd ☐ ≤500 yd ☐ ≤0.5 mi ☐ ≤1 mi ☐ ≤2 mi ☐ >2 mi		

SIGNATURE OF LOOK OUT:	**SIGNATURE OF OFFICER OF THE WATCH:**

Appendix B

Northeast Gateway Acoustic Modeling Methodology

Prepared for

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B1. Underwater Acoustic Concepts

The loudness of sound is dependent on the radiated sound power of the source and the propagation and attenuation characteristics of the medium through which the sound passes (sea water). The standard unit of sound is the decibel (dB), a logarithmic scale formed by taking 20 times the logarithm (base 10) of the ratio of two pressures: the measured sound pressure divided by a reference sound pressure. For underwater sound, this reference sound pressure is 1 micro-Pascal (μPa). The hearing capabilities and frequency (Hz) responses of marine mammals vary significantly. Therefore, underwater sound levels are typically expressed using unweighted or linear broadband levels (dBL) spanning the entire frequency spectrum under consideration. (For this study, the frequencies analyzed span 10 Hz to 20k Hz). The National Marine Fisheries Service (NMFS) criteria used to assess impact and determine the potential of acoustic take or harassment are also presented in dBL sound levels.

Sound sources are typically presented as sound pressure levels at a distance of 1 meter from an idealized point source, i.e. dB re 1 μPa at 1 meter. This standardized reference distance was developed to allow for direct comparison of different sound source levels. Received sound levels include the effects of propagation and attenuation that occurred between the source and receptor. Under standard propagation conditions and in non-shallow water environments, received underwater sound levels lower at a horizontal distance 100 meters away from a source will be approximately 40 dBL lower than the source level at a reference of 1 meter. However, because many man-made underwater sound sources have dimensions that are much larger than an idealized point source, the relationship between near-field and far-field sound levels is more complicated than this simple rule and must therefore be determined through field measurements. In the acoustic near field, propagation losses will be generally lower than expected. Conversely, received source levels extrapolated from far-field measurements will be higher when the acoustic energy from a large area source is back-calculated to characterize an idealized point source. To account for sound propagation resulting from a large area source such as the Energy Bridge Regasification Vessel (EBRV), the transition from the acoustic near to far field, as well as the site-specific characteristics, must be well understood.

The propagation and attenuation of sound waves under water is a complex phenomena influenced by gradients of temperature, water column depth, salinity, currents, sea surface turbulence and wake bubbles, scattering by seafloor and surface, etc. Within close range of the sound source, attenuation and propagation losses are primarily driven by geometric spreading, i.e. sound levels decreasing with increased distance from the sound source as the sound energy is gradually spread across increasingly larger and larger surfaces. In unbounded sea water, free field spherical wave spreading will occur at a decay rate of $TL = 20 \log R$, where R is the horizontal propagation path between the source and receptor in meters and TL symbolizes sound energy transmission loss. Extensive research has demonstrated that spherical wave spreading, together with seawater absorption rates, provides a reasonable fit to measured underwater sound levels under a wide variety of conditions. Because the ocean is bounded by the surface above and the seafloor below, additional adjustments must be made. When the propagation path becomes greater than the water depth, free field spherical spreading can no longer continue. If perfectly reflective boundaries were assumed, the spherical wave spreading would transition to cylindrical spreading, represented by the decay rate of $TL = 10 \log R$. However, to account for the fact that neither the surface or seabed floor are perfectly reflective, modified or transitional cylindrical spreading represented by decay rate of $TL = 15 \log R$ has been shown to have the best fit when compared to actual TL measurements made at sea. At horizontal propagation distances much greater than the depth, standard cylindrical spreading combined with a linear (dB per km) absorption and scattering rate provides conservative modeling results.

B2. Methodology

A multitude of underwater acoustic modeling programs have been developed, both proprietary and publicly available. These computer models employ different calculation approaches including the parabolic equation (PE), wave number integration, wave tracing, and normal mode theory, and the models and can be either range-dependent or independent. These models were initially designed to calculate sound propagation for narrow frequency bands at a set of standard range of water depths, with some models being more appropriate than others for certain applications. The majority of the programs have been developed or supported by Navy sponsors for use in the prediction of sonar propagation and sonar performance prediction. The accuracy of these models is largely dependant on the accuracy of the intrinsically dynamic data inputs used to describe the medium between the path and receiver. The exacting information required can never be achieved for all possible modeling situations, particularly for long-range acoustic modeling where uncertainties in model inputs vary increasingly over large propagation distances. Prediction of received sound levels to the nearest tenth of a decibel at distances beyond 100 meters, regardless of the detail of input parameters, should be viewed with skepticism.

The modeling approach that was developed specifically for the analyses of underwater sound resulting from the construction and operation of the Port attempts to simplify the calculation procedure by employing standardized acoustic modeling algorithms with conservative assumptions to provide a transparent calculation methodology that can be easily reviewed by regulators. The resulting decibel levels are not expected to be exceeded under the vast majority of real world Gulf of Maine conditions. Source terms were taken directly from a comprehensive sound survey completed at an existing deepwater port located in the Gulf of Mexico (see Appendix C). For other sources, namely the construction vessels used in the Pipeline Lateral and Port construction, source terms were developed for both the acoustic power emitted and frequency spectrums using frequency shapes from similar vessels reported in the literature. The results do not include existing acoustic ambient conditions (levels estimated at 100 to 120 dBL), which are expected to effectively mask Port sounds.

Assumptions employed in the propagation calculations are as follows:

- Spherical spreading losses (20 log R) for horizontal propagation ranges up to 1.5 times the water depth (D) at the source;
- Modified cylindrical spreading (15 Log R) for horizontal propagation ranges greater than 1.5D; and
- Cylindrical spreading (10 Log R) combined with a 0.5 dB/km linear absorption and scattering rate for propagation distances greater than 1 kilometer.

In addition to geometric spreading losses, frequency dependant seawater absorption rates were incorporated into the attenuation calculation. Corrections for near-field to far-field transition for the EBRV vessel during closed-loop regasification were determined first by calculations, and later verified during the second Gulf Gateway field survey.

B3. Acoustic Output Files

The resulting sound level isopleths presented in Figures 1-1 and 1-2 of the Incidental Harassment Authorization (IHA) application show the contour plots for the received sound isopleths of concern (120, 160, and 180 dB). These plots are representative of the maximum received sound levels expected for each of the sound sources and activities. Output files of frequency and broadband results or received sound levels have also been provided in the attached Tables B-1 through B-6, with red text identifying distance and frequency levels at the critical 120 dBL isopleths. The calculated received underwater sound levels during construction of the Pipeline Lateral at a location with a water column depth of 80 meters are shown in Table B-1 for a construction vessel transiting the Project area and in Table B-2 for a construction vessel using thrusters. Tables B-3 and B-4 are for the same two sources simulated in a water column with a depth of 40 meters. The 40-meter water column depth is representative of northern areas that the Pipeline Lateral traverses and the 80-meter water column depth for areas near the Port. Table B-5 presents worst case received sound levels during EBRV closed loop regasification and offloading during steady state conditions. As shown in the corresponding Figure 1-2, received sound levels will not exceed the 120-dBL isopleths at any appreciable distance from the EBRV. Finally, Table B-6 presents data and propagation calculations for an EBRV coupling at the Port with sound level contours displayed in Figure 1-2.

TABLE B-1: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING CONSTRUCTION ACTIVITIES AT A LOCATION ALONG THE PIPELINE LATERAL (dBL)

1/3 Octave Band Center Frequencies (Hertz)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad Band
Input Data for Propagation Calculations																																		
Dominant sound source	Construction vessel transiting																																	
Average depth (D) at source	80.0	meters																																
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.8	-1.2	-1.6	-2.7	-4.0	
Source spectral density (dB re 1 uPa at 1 m)	160.0	161.0	162.0	164.0	162.0	161.0	161.0	157.7	151.0	151.0	147.6	144.2	140.8	137.4	134.0	132.0	130.0	128.0	126.0	124.0	122.0	120.0	118.0	116.0	114.0	112.0	110.0	108.0	106.0	104.0	102.0	100.0	98.0	170.1
Distance and near field / far field adjustments (dB)	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.1	-40.1	-40.1	-40.2	-40.3	-40.4	---
Adjusted source spectrum at 100 m (dB re 1 uPa)	120.0	121.0	122.0	124.0	122.0	121.0	121.0	117.7	111.0	111.0	107.6	104.2	100.8	97.4	94.0	92.0	90.0	88.0	86.0	84.0	82.0	80.0	78.0	76.0	74.0	72.0	70.0	67.9	65.9	63.9	61.8	59.7	57.6	130.1

General Notes on Calculation Method:

- Source level and frequency spectrum estimated at a maximum 160 dBL with energy peaking at 25 Hz to coincide with propeller cavitations
- The conservative acoustic modeling approach applied spherical spreading losses (20logR) at ranges 1.5 times the water depth (D), modified cylindrical spreading (15LogR) for distances greater than 1.5D, and cylindrical spreading (10LogR) with 0.5 dB/km linear absorption and scattering at distances greater than 1 km
- The tabulated results are independent of existing area ambient levels in the Gulf of Maine
- Red text shows the worst case distance to the critical 120 dBL isopleth

Distance (m)	Distance (ft)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Band
Data for contour plot																																			
60.0	196.8	124.4	125.4	126.4	128.4	126.4	125.4	125.4	122.1	115.4	115.4	112.0	108.6	105.2	101.8	98.4	96.4	94.4	92.4	90.4	88.4	86.4	84.4	82.4	80.4	78.4	76.4	74.4	72.4	70.4	68.4	66.3	64.3	62.2	134.5
70.0	229.7	123.1	124.1	125.1	127.1	125.1	124.1	124.1	120.8	114.1	114.1	110.7	107.3	103.9	100.5	97.1	95.1	93.1	91.1	89.1	87.1	85.1	83.1	81.1	79.1	77.1	75.1	73.1	71.1	69.0	67.0	65.0	62.9	60.8	133.2
80.0	262.5	121.9	122.9	123.9	125.9	123.9	122.9	122.9	119.6	112.9	112.9	109.5	106.1	102.7	99.3	95.9	93.9	91.9	89.9	87.9	85.9	83.9	81.9	79.9	77.9	75.9	73.9	71.9	69.9	67.9	65.8	63.8	61.7	59.6	132.0
90.0	295.3	120.9	121.9	122.9	124.9	122.9	121.9	121.9	118.6	111.9	111.9	108.5	105.1	101.7	98.3	94.9	92.9	90.9	88.9	86.9	84.9	82.9	80.9	78.9	76.9	74.9	72.9	70.9	68.9	66.8	64.8	62.8	60.7	58.6	131.0
100.0	328.1	120.0	121.0	122.0	124.0	122.0	121.0	121.0	117.7	111.0	111.0	107.6	104.2	100.8	97.4	94.0	92.0	90.0	88.0	86.0	84.0	82.0	80.0	78.0	76.0	74.0	72.0	70.0	67.9	65.9	63.9	61.8	59.7	57.6	130.1
110.0	360.9	119.2	120.2	121.2	123.2	121.2	120.2	120.2	116.8	110.2	110.2	106.8	103.4	100.0	96.6	93.2	91.2	89.2	87.2	85.2	83.2	81.2	79.2	77.2	75.2	73.1	71.1	69.1	67.1	65.1	63.0	61.0	58.9	56.7	129.2
120.0	393.7	118.4	119.4	120.4	122.4	120.4	119.4	119.4	116.1	109.4	109.4	106.0	102.6	99.2	95.8	92.4	90.4	88.4	86.4	84.4	82.4	80.4	78.4	76.4	74.4	72.4	70.4	68.4	66.4	64.3	62.3	60.2	58.1	55.9	128.5
130.0	426.5	117.9	118.9	119.9	121.9	119.9	118.9	118.9	115.6	108.9	108.9	105.5	102.1	98.7	95.3	91.9	89.9	87.9	85.9	83.9	81.9	79.9	77.9	75.9	73.9	71.9	69.9	67.8	65.8	63.8	61.7	59.7	57.5	55.3	128.0
140.0	459.3	117.4	118.4	119.4	121.4	119.4	118.4	118.4	115.1	108.4	108.4	105.0	101.6	98.2	94.8	91.4	89.4	87.4	85.4	83.4	81.4	79.4	77.4	75.4	73.4	71.4	69.4	67.4	65.3	63.3	61.2	59.2	57.0	54.8	127.5
150.0	492.1	117.0	118.0	119.0	121.0	119.0	118.0	118.0	114.6	108.0	108.0	104.6	101.2	97.8	94.4	91.0	89.0	87.0	85.0	83.0	81.0	78.9	76.9	74.9	72.9	70.9	68.9	66.9	64.9	62.8	60.8	58.7	56.5	54.3	127.0
175.0	574.1	116.0	117.0	118.0	120.0	118.0	117.0	117.0	113.6	107.0	107.0	103.6	100.2	96.8	93.4	90.0	88.0	86.0	84.0	81.9	79.9	77.9	75.9	73.9	71.9	69.9	67.9	65.9	63.9	61.8	59.7	57.6	55.4	53.2	126.0
200.0	656.2	115.1	116.1	117.1	119.1	117.1	116.1	116.1	112.8	106.1	106.1	102.7	99.3	95.9	92.5	89.1	87.1	85.1	83.1	81.1	79.1	77.1	75.1	73.1	71.1	69.0	67.0	65.0	63.0	60.9	58.8	56.7	54.5	52.2	125.2
250.0	820.2	113.6	114.6	115.6	117.6	115.6	114.6	114.6	111.3	104.6	104.6	101.2	97.8	94.4	91.0	87.6	85.6	83.6	81.6	79.6	77.6	75.6	73.6	71.6	69.6	67.6	65.6	63.5	61.5	59.4	57.3	55.2	52.9	50.6	123.7
300.0	984.2	112.4	113.4	114.4	116.4	114.4	113.4	113.4	110.1	103.4	103.4	100.0	96.6	93.2	89.8	86.4	84.4	82.4	80.4	78.4	76.4	74.4	72.4	70.4	68.4	66.4	64.4	62.3	60.3	58.2	56.1	53.9	51.6	49.2	122.5
350.0	1148.3	111.4	112.4	113.4	115.4	113.4	112.4	112.4	109.1	102.4	102.4	99.0	95.6	92.2	88.8	85.4	83.4	81.4	79.4	77.4	75.4	73.4	71.4	69.4	67.4	65.4	63.3	61.3	59.2	57.2	55.0	52.9	50.5	48.0	121.5
400.0	1312.3	110.6	111.6	112.6	114.6	112.6	111.6	111.6	108.2	101.6	101.6	98.2	94.8	91.4	88.0	84.6	82.6	80.6	78.6	76.6	74.5	72.5	70.5	68.5	66.5	64.5	62.5	60.4	58.4	56.2	54.1	51.9	49.4	46.9	120.6
440.0	1443.6	110.0	111.0	112.0	114.0	112.0	111.0	111.0	107.6	101.0	101.0	97.6	94.2	90.8	87.3	83.9	81.9	79.9	77.9	75.9	73.9	71.9	69.9	67.9	65.9	63.9	61.8	59.8	57.7	55.6	53.4	51.2	48.7	46.1	120.0
450.0	1476.4	109.8	110.8	111.8	113.8	111.8	110.8	110.8	107.5	100.8	100.8	97.4	94.0	90.6	87.2	83.8	81.8	79.8	77.8	75.8	73.8	71.8	69.8	67.7	65.7	63.7	61.7	59.6	57.6	55.4	53.3	51.1	48.5	45.9	119.9
500.0	1640.4	109.1	110.1	111.1	113.1	111.1	110.1	110.1	106.8	100.1	100.1	96.7	93.3	89.9	86.5	83.1	81.1	79.1	77.1	75.1	73.1	71.1	69.1	67.1	65.0	63.0	61.0	58.9	56.8	54.7	52.5	50.3	47.7	45.0	119.2
550.0	1804.4	108.5	109.5	110.5	112.5	110.5	109.5	109.5	106.2	99.5	99.5	96.1	92.7	89.3	85.9	82.5	80.5	78.5	76.5	74.5	72.5	70.5	68.4	66.4	64.4	62.4	60.3	58.3	56.2	54.1	51.8	49.6	47.0	44.2	118.6
600.0	1968.5	107.9	108.9	109.9	111.9	109.9	108.9	108.9	105.6	98.9	98.9	95.5	92.1	88.7	85.3	81.9	79.9	77.9	75.9	73.9	71.9	69.9	67.9	65.9	63.8	61.8	59.8	57.7	55.6	53.4	51.2	48.9	46.3	43.5	118.0
650.0	2132.5	107.4	108.4	109.4	111.4	109.4	108.4	108.4	105.1	98.4	98.4	95.0	91.6	88.2	84.8	81.4	79.4	77.4	75.4	73.4	71.4	69.4	67.3	65.3	63.3	61.3	59.2	57.2	55.1	52.9	50.6	48.3	45.6	42.7	117.5
700.0	2296.6	106.9	107.9	108.9	110.9	108.9	107.9	107.9	104.6	97.9	97.9	94.5	91.1	87.7	84.3	80.9	78.9	76.9	74.9	72.9	70.9	68.9	66.9	64.8	62.8	60.8	58.7	56.7	54.5	52.4	50.1	47.8	45.0	42.0	117.0
750.0	2460.6	106.5	107.5	108.5	110.5	108.5	107.5	107.5	104.1	97.5	97.5	94.1	90.7	87.3	83.9	80.5	78.5	76.5	74.5	72.4	70.4	68.4	66.4	64.4	62.4	60.3	58.3	56.2	54.1	51.9	49.6	47.3	44.4	41.4	116.5
800.0	2624.6	106.1	107.1	108.1	110.1	108.1	107.1	107.1	103.7	97.1	97.1	93.7	90.3	86.9	83.5	80.0	78.0	76.0	74.0	72.0	70.0	68.0	66.0	64.0	61.9	59.9	57.8	55.8	53.6	51.4	49.1	46.8	43.9	40.8	116.1
850.0	2788.7	105.7	106.7	107.7	109.7	107.7	106.7	106.7	103.3	96.7	96.7	93.3	89.9	86.5	83.1	79.7	77.6	75.6	73.6	71.6	69.6	67.6	65.6	63.5	61.5	59.5	57.4	55.3	53.2	51.0	48.7	46.3	43.3	40.2	115.7
900.0	2952.7	105.3	106.3	107.3	109.3	107.3	106.3	106.3	103.0	96.3	96.3	92.9	89.5	86.1	82.7	79.3	77.3	75.3	73.3	71.2	69.2	67.2	65.2	63.2	61.1	59.1	57.0	54.9	52.8	50.6	48.2	45.8	42.8	39.6	115.4
950.0	3116.8	104.9	105.9	106.9	108.9	106.9	105.9	105.9	102.6	95.9	95.9	92.5	89.1	85.7	82.3	78.9	76.9	74.9	72.9	70.9	68.9	66.9	64.8	62.8	60.8	58.7	56.7	54.6	52.4	50.2	47.8	45.4	42.3	39.1	115.0
1000.0	3280.8	104.6	105.6	106.6	108.6	106.6	105.6	105.6	102.3	95.6	95.6	92.2	88.8	85.4	82.0	78.6	76.6	74.6	72.6	70.6	68.5	66.5	64.5	62.5	60.4	58.4	56.3	54.2	52.1	49.8	47.4	45.0	41.9	38.5	114.7
2000.0	6561.6	101.1	102.1	103.1	105.1	103.1	102.1	102.1	98.8	92.1	92.1	88.7	85.3	81.9	78.5	75.1	73.0	71.0	69.0	66.9	64.9	62.9	60.8	58.7	56.6	54.5	52.3	50.0	47.6	44.8	41.7	38.4	33.3	27.4	111.2
2450.0	8038.0	100.0	101.0	102.0	104.0	102.0	101.0	101.0	97.7	91.0	91.0	87.6	84.2	80.8	77.4	74.0	71.9	69.9	67.9	65.8	63.8	61.7	59.6	57.5	55.4	53.3	51.1	48.7	46.2	43.4	40.1	36.6	31.0	24.5	110.0
3000.0	9842.4	98.8	99.8	100.8	102.8	100.8	99.8	99.8	96.5	89.8	89.8	86.4	83.0	79.6	76.2	72.8	70.8	68.7	66.7	64.6	62.6	60.5	58.4	56.3	54.2	52.0	49.8	47.4	44.8	41.8	38.3	34.6	28.3	21.2	108.9
4000.0	13123.2	97.1	98.1	99.1	101.1	99.1	98.1	98.1	94.7	88.1	88.1	84.7	81.3	77.9	74.4	71.0	69.0	67.0	64.9	62.8	60.8	58.7	56.6	54.4	52.3	50.1	47.7	45.3	42.5	39.2	35.4	31.2	23.9	15.4	107.1
5000.0	16404.0	95.6	96.6	97.6	99.6	97.6	96.6	96.6	93.3	86.6	86.6	83.2	79.8	76.4	73.0	69.5	67.5	65.5	63.4	61.3	59.2	57.1	55.0	52.8	50.7	48.4	46.0	43.4	40.5	37.0	32.8	28.2	19.7	9.9	105.7
6000.0	19684.8	94.3	95.3	96.3	98.3	96.3	95.3	95.3	92.0	85.3	85.3	81.9	78.5	75.1	71.7	68.2	66.2	64.2	62.1	60.0	57.9	55.7	53.6	51.4	49.2	46.9	44.4	41.8	38.7	34.9	30.4	25.3	15.8	4.7	104.4
7000.0	22965.6	93.2	94.2	95.2	97.2	95.2	94.2	94.2	90.8	84.1	84.1	80.7	77.3	73.9	70.5	67.1	65.0	63.0	60.9	58.8	56.6	54.5	52.3	50.1	47.9	45.5	43.0	40.2	37.0	33.0	28.0	22.5	11.9	-0.5	103.2
8000.0	26246.4	92.1	93.1	94.1	96.1	94.1	93.1	93.1	89.7	83.1	83.1	79.7	76.2	72.8	69.4	66.0	63.9	61.9	59.8	57.6	55.5	53.3	51.1	48.9	46.6	44.2	41.6	38.8	35.4	31.1	25.8	19.9	8.2	-5.6	102.1
9000.0	29527.2	91.1	92.1	93.1	95.1	93.1	92.1	92.1	88.7	82.1	82.0	78.6	75.2	71.8	68.4	64.9	62.9	60.8	58.6	56.5	54.3	52.1	49.8	47.5	46.2	42.6	39.8	36.7	32.8	27.8	21.5	14.2	-0.6	-18.2	101.1
10000.0	32808.0	90.1	91.1	92.1	94.1	92.1	91.1	91.1	87.8	81.1	81.1	77.7	74.3	70.8	67.4	64.0	61.9	59.8	57.7	55.5	53.3	51.0	48.7	46.4	44.0	41.5	38.6	35.4	31.4	26.1	19.4	11.7	-4.3	-23.2	100.2

TABLE B-2: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING CONSTRUCTION ACTIVITIES AT A LOCATION ALONG THE PIPELINE LATERAL (dBL)

																					Hertz													Broad
1/3 Octave Band Center Frequencies	**12.5**	**16**	**20**	**25**	**31**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12000**	**16000**	**20000**	**Band**
Input Data for Propagation Calculations																																		
Dominant sound source	Construction vessel thrusters																																	
Average depth (D) at source	80.0 meters																																	
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.8	-1.2	-1.6	-2.7	-4.0	
Source spectral density (dB re 1 uPa at 1 m)	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	168.0	166.0	164.0	162.0	160.0	158.0	156.0	154.0	152.0	150.0	148.0	146.0	144.0	142.0	140.0	138.0	136.0	134.0	132.0	130.0	128.0	126.0	124.0	180.3
Distance and near field / far field adjustments (dB)	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.1	-40.1	-40.1	-40.2	-40.3	-40.4	----
Adjusted source spectrum at 100 m (dB re 1 uPa)	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	128.0	126.0	124.0	122.0	120.0	118.0	116.0	114.0	112.0	110.0	108.0	106.0	104.0	102.0	100.0	98.0	96.0	93.9	91.9	89.9	87.8	85.7	83.6	140.3

General Notes on Calculation Method:

- Source level and frequency spectra estimated at a maximum 180 dBL with dominant energy in the low frequencies caused by turbulent flow conditions
- The conservative acoustic modeling approach applied spherical spreading losses (20logR) at ranges 1.5 times the water depth (D), modified cylindrical spreading (15LogR) for distances greater than 1.5D, and cylindrical spreading (10LogR) with 0.5 dB/km linear absorption and scattering at distances greater than 1 km
- The tabulated results are independent of existing area ambient levels in the Gulf of Maine
- Red text shows the worst case distance to the critical 120 dBL isopleth

Data for contour plot

Distance (m)	Distance (ft)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Band
60.0	196.8	134.4	134.4	134.4	134.4	134.4	134.4	134.4	134.4	134.4	134.4	132.4	130.4	128.4	126.4	124.4	122.4	120.4	118.4	116.4	114.4	112.4	110.4	108.4	106.4	104.4	102.4	100.4	98.4	96.4	94.4	92.3	90.3	88.2	144.7
70.0	229.7	133.1	133.1	133.1	133.1	133.1	133.1	133.1	133.1	133.1	133.1	131.1	129.1	127.1	125.1	123.1	121.1	119.1	117.1	115.1	113.1	111.1	109.1	107.1	105.1	103.1	101.1	99.1	97.1	95.0	93.0	91.0	88.9	86.8	143.4
80.0	262.5	131.9	131.9	131.9	131.9	131.9	131.9	131.9	131.9	131.9	131.9	129.9	127.9	125.9	123.9	121.9	119.9	117.9	115.9	113.9	111.9	109.9	107.9	105.9	103.9	101.9	99.9	97.9	95.9	93.9	91.8	89.8	87.7	85.6	142.2
90.0	295.3	130.9	130.9	130.9	130.9	130.9	130.9	130.9	130.9	130.9	130.9	128.9	126.9	124.9	122.9	120.9	118.9	116.9	114.9	112.9	110.9	108.9	106.9	104.9	102.9	100.9	98.9	96.9	94.9	92.8	90.8	88.8	86.7	84.6	141.2
100.0	328.1	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	130.0	128.0	126.0	124.0	122.0	120.0	118.0	116.0	114.0	112.0	110.0	108.0	106.0	104.0	102.0	100.0	98.0	96.0	93.9	91.9	89.9	87.8	85.7	83.6	140.3
110.0	360.9	129.2	129.2	129.2	129.2	129.2	129.2	129.2	129.2	129.2	129.2	127.2	125.2	123.2	121.2	119.2	117.2	115.2	113.2	111.2	109.2	107.2	105.2	103.2	101.2	99.1	97.1	95.1	93.1	91.1	89.0	87.0	84.9	82.7	139.5
120.0	393.7	128.4	128.4	128.4	128.4	128.4	128.4	128.4	128.4	128.4	128.4	126.4	124.4	122.4	120.4	118.4	116.4	114.4	112.4	110.4	108.4	106.4	104.4	102.4	100.4	98.4	96.4	94.4	92.4	90.3	88.3	86.2	84.1	81.9	138.7
130.0	426.5	127.9	127.9	127.9	127.9	127.9	127.9	127.9	127.9	127.9	127.9	125.9	123.9	121.9	119.9	117.9	115.9	113.9	111.9	109.9	107.9	105.9	103.9	101.9	99.9	97.9	95.9	93.8	91.8	89.8	87.7	85.7	83.5	81.3	138.2
140.0	459.3	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	127.4	125.4	123.4	121.4	119.4	117.4	115.4	113.4	111.4	109.4	107.4	105.4	103.4	101.4	99.4	97.4	95.4	93.4	91.3	89.3	87.2	85.2	83.0	80.8	137.7
150.0	492.1	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	127.0	125.0	123.0	121.0	119.0	117.0	115.0	113.0	111.0	109.0	107.0	104.9	102.9	100.9	98.9	96.9	94.9	92.9	90.9	88.8	86.8	84.7	82.5	80.3	137.3
175.0	574.1	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	126.0	124.0	122.0	120.0	118.0	116.0	114.0	112.0	110.0	107.9	105.9	103.9	101.9	99.9	97.9	95.9	93.9	91.9	89.9	87.8	85.7	83.6	81.4	79.2	136.3
200.0	656.2	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	123.1	121.1	119.1	117.1	115.1	113.1	111.1	109.1	107.1	105.1	103.1	101.1	99.1	97.1	95.0	93.0	91.0	89.0	86.9	84.8	82.7	80.5	78.2	135.4
250.0	820.2	123.6	123.6	123.6	123.6	123.6	123.6	123.6	123.6	123.6	123.6	121.6	119.6	117.6	115.6	113.6	111.6	109.6	107.6	105.6	103.6	101.6	99.6	97.6	95.6	93.6	91.6	89.5	87.5	85.4	83.3	81.2	78.9	76.6	133.9
300.0	984.2	122.4	122.4	122.4	122.4	122.4	122.4	122.4	122.4	122.4	122.4	120.4	118.4	116.4	114.4	112.4	110.4	108.4	106.4	104.4	102.4	100.4	98.4	96.4	94.4	92.4	90.4	88.3	86.3	84.2	82.1	79.9	77.6	75.2	132.7
350.0	1148.3	121.4	121.4	121.4	121.4	121.4	121.4	121.4	121.4	121.4	121.4	119.4	117.4	115.4	113.4	111.4	109.4	107.4	105.4	103.4	101.4	99.4	97.4	95.4	93.4	91.4	89.3	87.3	85.2	83.2	81.0	78.9	76.5	74.0	131.7
400.0	1312.3	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6	118.6	116.6	114.6	112.6	110.6	108.6	106.6	104.6	102.6	100.5	98.5	96.5	94.5	92.5	90.5	88.5	86.4	84.4	82.2	80.1	77.9	75.4	72.9	130.9
450.0	1476.4	119.8	119.8	119.8	119.8	119.8	119.8	119.8	119.8	119.8	119.8	117.8	115.8	113.8	111.8	109.8	107.8	105.8	103.8	101.8	99.8	97.8	95.8	93.7	91.7	89.7	87.7	85.6	83.6	81.4	79.3	77.1	74.5	71.9	130.1
500.0	1640.4	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	119.1	117.1	115.1	113.1	111.1	109.1	107.1	105.1	103.1	101.1	99.1	97.1	95.1	93.1	91.0	89.0	87.0	84.9	82.8	80.7	78.5	76.3	73.7	71.0	129.4
550.0	1804.4	118.5	118.5	118.5	118.5	118.5	118.5	118.5	118.5	118.5	118.5	116.5	114.5	112.5	110.5	108.5	106.5	104.5	102.5	100.5	98.5	96.5	94.4	92.4	90.4	88.4	86.3	84.3	82.2	80.1	77.8	75.6	73.0	70.2	128.8
600.0	1968.5	117.9	117.9	117.9	117.9	117.9	117.9	117.9	117.9	117.9	117.9	115.9	113.9	111.9	109.9	107.9	105.9	103.9	101.9	99.9	97.9	95.9	93.9	91.9	89.8	87.8	85.8	83.7	81.6	79.4	77.2	74.9	72.3	69.5	128.2
650.0	2132.5	117.4	117.4	117.4	117.4	117.4	117.4	117.4	117.4	117.4	117.4	115.4	113.4	111.4	109.4	107.4	105.4	103.4	101.4	99.4	97.4	95.4	93.3	91.3	89.3	87.3	85.2	83.2	81.1	78.9	76.6	74.3	71.6	68.7	127.7
700.0	2296.6	116.9	116.9	116.9	116.9	116.9	116.9	116.9	116.9	116.9	116.9	114.9	112.9	110.9	108.9	106.9	104.9	102.9	100.9	98.9	96.9	94.9	92.9	90.8	88.8	86.8	84.7	82.7	80.5	78.4	76.1	73.8	71.0	68.0	127.2
750.0	2460.6	116.5	116.5	116.5	116.5	116.5	116.5	116.5	116.5	116.5	116.5	114.5	112.5	110.5	108.5	106.5	104.5	102.5	100.5	98.4	96.4	94.4	92.4	90.4	88.4	86.3	84.3	82.2	80.1	77.9	75.6	73.3	70.4	67.4	126.8
800.0	2624.6	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	114.1	112.1	110.1	108.1	106.0	104.0	102.0	100.0	98.0	96.0	94.0	92.0	90.0	87.9	85.9	83.8	81.8	79.6	77.4	75.1	72.8	69.9	66.8	126.4
850.0	2788.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	115.7	113.7	111.7	109.7	107.7	105.7	103.6	101.6	99.6	97.6	95.6	93.6	91.6	89.5	87.5	85.5	83.4	81.3	79.2	77.0	74.7	72.3	69.3	66.2	126.0
900.0	2952.7	115.3	115.3	115.3	115.3	115.3	115.3	115.3	115.3	115.3	115.3	113.3	111.3	109.3	107.3	105.3	103.3	101.3	99.3	97.2	95.2	93.2	91.2	89.2	87.1	85.1	83.0	80.9	78.8	76.6	74.2	71.8	68.8	65.6	125.6
950.0	3116.8	114.9	114.9	114.9	114.9	114.9	114.9	114.9	114.9	114.9	114.9	112.9	110.9	108.9	106.9	104.9	102.9	100.9	98.9	96.9	94.9	92.9	90.8	88.8	86.8	84.7	82.7	80.6	78.4	76.2	73.8	71.4	68.3	65.1	125.2
1000.0	3280.8	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	114.6	112.6	110.6	108.6	106.6	104.6	102.6	100.6	98.6	96.6	94.5	92.5	90.5	88.5	86.4	84.4	82.3	80.2	78.1	75.8	73.4	71.0	67.9	64.5	124.9
2000.0	6561.6	111.1	111.1	111.1	111.1	111.1	111.1	111.1	111.1	111.1	111.1	109.1	107.1	105.1	103.1	101.1	99.0	97.0	95.0	92.9	90.9	88.9	86.8	84.7	82.6	80.5	78.3	76.0	73.6	70.8	67.7	64.4	59.3	53.4	121.4
2560.0	8398.8	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	107.7	105.7	103.7	101.7	99.7	97.7	95.7	93.6	91.6	89.5	87.5	85.4	83.3	81.2	79.0	76.8	74.5	71.9	69.0	65.7	62.2	56.4	49.8	120.0
3000.0	9842.4	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	108.8	106.8	104.8	102.8	100.8	98.8	96.8	94.7	92.7	90.6	88.6	86.5	84.4	82.3	80.2	78.0	75.8	73.4	70.8	67.8	64.3	60.6	54.3	47.2	119.1
4000.0	13123.2	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	105.1	103.1	101.1	99.0	97.0	95.0	93.0	90.9	88.8	86.8	84.7	82.6	80.4	78.3	76.1	73.7	71.3	68.5	65.2	61.4	57.2	49.9	41.4	117.4
5000.0	16404.0	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	105.6	103.6	101.6	99.6	97.6	95.5	93.5	91.5	89.4	87.3	85.2	83.1	81.0	78.8	76.7	74.4	72.0	69.4	66.5	63.0	58.8	54.2	45.7	35.9	115.9
6000.0	19684.8	104.3	104.3	104.3	104.3	104.3	104.3	104.3	104.3	104.3	104.3	102.3	100.3	98.3	96.3	94.2	92.2	90.2	88.1	86.0	83.9	81.7	79.6	77.4	75.2	72.9	70.4	67.8	64.7	60.9	56.4	51.3	41.8	30.7	114.6
7000.0	22965.6	103.2	103.2	103.2	103.2	103.2	103.2	103.2	103.1	103.1	103.1	101.1	99.1	97.1	95.1	93.1	91.0	89.0	86.9	84.8	82.6	80.5	78.3	76.1	73.9	71.5	69.0	66.2	63.0	59.0	54.0	48.5	37.9	25.5	113.4
8000.0	26246.4	102.1	102.1	102.1	102.1	102.1	102.1	102.1	102.1	102.1	102.1	100.1	98.0	96.0	94.0	92.0	89.9	87.9	85.8	83.6	81.5	79.3	77.1	74.9	72.6	70.2	67.6	64.8	61.4	57.1	51.8	45.9	34.2	20.4	112.4
9000.0	29527.2	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.1	101.0	99.0	97.0	95.0	93.0	90.9	88.9	86.8	84.6	82.5	80.3	78.1	75.8	73.5	71.2	68.6	65.8	62.7	58.8	53.8	47.5	40.2	25.4	7.8	111.3
10000.0	32808.0	100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1	100.1	98.1	96.1	94.0	92.0	90.0	87.9	85.8	83.7	81.5	79.3	77.0	74.7	72.4	70.0	67.5	64.6	61.4	57.4	52.1	45.4	37.7	21.7	2.8	110.4

TABLE B-3: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING CONSTRUCTION ACTIVITIES AT A LOCATION ALONG THE PIPELINE LATERAL (dBL)

Input Data for Propagation Calculations

Dominant sound source: Construction vessel transiting

Average depth (D) at source: 40.0 meters

1/3 Octave Band Center Frequencies (Hertz)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Source spectral density (dB re 1 uPa at 1m)	160.0	161.0	162.0	164.0	162.0	161.0	161.0	157.7	151.0	151.0	147.6	144.2	140.8	137.4	134.0	132.0
Distance and near field / far field adjustments (dB)	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0
Adjusted source spectrum at 100 m (dB re 1 uPa)	120.0	121.0	122.0	124.0	122.0	121.0	121.0	117.7	111.0	111.0	107.6	104.2	100.8	97.4	94.0	92.0

1/3 Octave Band Center Frequencies (Hertz)	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad Band
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.8	-1.2	-1.6	-2.7	-4.0	
Source spectral density (dB re 1 uPa at 1m)	130.0	128.0	126.0	124.0	122.0	120.0	118.0	116.0	114.0	112.0	110.0	108.0	106.0	104.0	102.0	100.0	98.0	170.1
Distance and near field / far field adjustments (dB)	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.1	-40.1	-40.1	-40.2	-40.3	-40.4	----
Adjusted source spectrum at 100 m (dB re 1 uPa)	90.0	88.0	86.0	84.0	82.0	80.0	78.0	76.0	74.0	72.0	70.0	67.9	65.9	63.9	61.8	59.7	57.6	130.1

General Notes on Calculation Method:

- Source level and frequency spectrrum estimated at a maximum 160 dBL with energy peaking at 25 Hz to coincide with propeller cavitations
- The conservative acoustic modeling approach applied spherical spreading losses (20logR) at ranges 1.5 times the water depth (D), modified cylindrical spreading (15LogR) for distances greater than 1.5D, and cylindrical spreading (10LogR) with 0.5 dB/km linear absorption and scattering at distances greater than 1 km
- The tabulated results are independent of existing area ambient levels in the Gulf of Maine
- Red text shows the worst case distance to the critical 120 dBL isopleth

Data for contour plot

Distance (m)	Distance (ft)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400
60.0	196.8	123.3	124.3	125.3	127.3	125.3	124.3	124.3	121.0	114.3	114.3	110.9	107.5	104.1	100.7	97.3	95.3
70.0	229.7	122.3	123.3	124.3	126.3	124.3	123.3	123.3	120.0	113.3	113.3	109.9	106.5	103.1	99.7	96.3	94.3
80.0	262.5	121.5	122.5	123.5	125.5	123.5	122.5	122.5	119.1	112.5	112.5	109.1	105.7	102.3	98.9	95.5	93.5
90.0	295.3	120.7	121.7	122.7	124.7	122.7	121.7	121.7	118.4	111.7	111.7	108.3	104.9	101.5	98.1	94.7	92.7
100.0	328.1	120.0	121.0	122.0	124.0	122.0	121.0	121.0	117.7	111.0	111.0	107.6	104.2	100.8	97.4	94.0	92.0
110.0	360.9	119.4	120.4	121.4	123.4	121.4	120.4	120.4	117.0	110.4	110.4	107.0	103.6	100.2	96.8	93.4	91.4
120.0	393.7	118.8	119.8	120.8	122.8	120.8	119.8	119.8	116.5	109.8	109.8	106.4	103.0	99.6	96.2	92.8	90.8
130.0	426.5	118.3	119.3	120.3	122.3	120.3	119.3	119.3	116.0	109.3	109.3	105.9	102.5	99.1	95.7	92.3	90.3
140.0	459.3	117.8	118.8	119.8	121.8	119.8	118.8	118.8	115.5	108.8	108.8	105.4	102.0	98.6	95.2	91.8	89.8
150.0	492.1	117.4	118.4	119.4	121.4	119.4	118.4	118.4	115.0	108.4	108.4	105.0	101.6	98.2	94.8	91.4	89.4
200.0	656.2	115.5	116.5	117.5	119.5	117.5	116.5	116.5	113.2	106.5	106.5	103.1	99.7	96.3	92.9	89.5	87.5
250.0	820.2	114.0	115.0	116.0	118.0	116.0	115.0	115.0	111.7	105.0	105.0	101.6	98.2	94.8	91.4	88.0	86.0
300.0	984.2	112.8	113.8	114.8	116.8	114.8	113.8	113.8	110.5	103.8	103.8	100.4	97.0	93.6	90.2	86.8	84.8
350.0	1148.3	111.8	112.8	113.8	115.8	113.8	112.8	112.8	109.5	102.8	102.8	99.4	96.0	92.6	89.2	85.8	83.8
400.0	1312.3	111.0	112.0	113.0	115.0	113.0	112.0	112.0	108.6	102.0	102.0	98.6	95.2	91.8	88.4	85.0	83.0
460.0	1476.4	110.2	111.2	112.2	114.2	112.2	111.2	111.2	107.9	101.2	101.2	97.8	94.4	91.0	87.6	84.2	82.2
470.0	1542.0	109.9	110.9	111.9	113.9	111.9	110.9	110.9	107.6	100.9	100.9	97.5	94.1	90.7	87.3	83.9	81.9
500.0	1640.4	109.5	110.5	111.5	113.5	111.5	110.5	110.5	107.2	100.5	100.5	97.1	93.7	90.3	86.9	83.5	81.5
550.0	1804.4	108.9	109.9	110.9	112.9	110.9	109.9	109.9	106.6	99.9	99.9	96.5	93.1	89.7	86.3	82.9	80.9
600.0	1968.5	108.3	109.3	110.3	112.3	110.3	109.3	109.3	106.0	99.3	99.3	95.9	92.5	89.1	85.7	82.3	80.3
650.0	2132.5	107.8	108.8	109.8	111.8	109.8	108.8	108.8	105.5	98.8	98.8	95.4	92.0	88.6	85.2	81.8	79.8
700.0	2296.6	107.3	108.3	109.3	111.3	109.3	108.3	108.3	105.0	98.3	98.3	94.9	91.5	88.1	84.7	81.3	79.3
750.0	2460.6	106.9	107.9	108.9	110.9	108.9	107.9	107.9	104.5	97.9	97.9	94.5	91.1	87.7	84.3	80.9	78.9
800.0	2624.6	106.5	107.5	108.5	110.5	108.5	107.5	107.5	104.1	97.5	97.5	94.1	90.7	87.2	83.8	80.4	78.4
850.0	2788.7	106.1	107.1	108.1	110.1	108.1	107.1	107.1	103.7	97.1	97.1	93.7	90.3	86.9	83.5	80.0	78.0
900.0	2952.7	105.7	106.7	107.7	109.7	107.7	106.7	106.7	103.4	96.7	96.7	93.3	89.9	86.5	83.1	79.7	77.7
950.0	3116.8	105.3	106.3	107.3	109.3	107.3	106.3	106.3	103.0	96.3	96.3	92.9	89.5	86.1	82.7	79.3	77.3
1000.0	3280.8	105.0	106.0	107.0	109.0	107.0	106.0	106.0	102.7	96.0	96.0	92.6	89.2	85.8	82.4	79.0	77.0
2000.0	6561.6	101.5	102.5	103.5	105.5	103.5	102.5	102.5	99.2	92.5	92.5	89.1	85.7	82.3	78.9	75.5	73.4
2450.0	8038.0	100.4	101.4	102.4	104.4	102.4	101.4	101.4	98.0	91.4	91.4	88.0	84.6	81.2	77.8	74.3	72.3
3000.0	9842.4	99.2	100.2	101.2	103.2	101.2	100.2	100.2	96.9	90.2	90.2	86.8	83.4	80.0	76.6	73.2	71.2
4000.0	13123.2	97.5	98.5	99.5	101.5	99.5	98.5	98.5	95.1	88.5	88.5	85.1	81.7	78.3	74.8	71.4	69.4
5000.0	16404.0	96.0	97.0	98.0	100.0	98.0	97.0	97.0	93.7	87.0	87.0	83.6	80.2	76.8	73.4	69.9	67.9
6000.0	19684.8	94.7	95.7	96.7	98.7	96.7	95.7	95.7	92.4	85.7	85.7	82.3	78.9	75.5	72.1	68.6	66.6
7000.0	22965.6	93.5	94.5	95.5	97.5	95.5	94.5	94.5	91.2	84.5	84.5	81.1	77.7	74.3	70.9	67.5	65.4
8000.0	26246.4	92.5	93.5	94.5	96.5	94.5	93.5	93.5	90.1	83.5	83.5	80.1	76.6	73.2	69.8	66.4	64.3
9000.0	29527.2	91.5	92.5	93.5	95.5	93.5	92.5	92.5	89.1	82.4	82.4	79.0	75.6	72.2	68.8	65.3	63.3
10000.0	32808.0	90.5	91.5	92.5	94.5	92.5	91.5	91.5	88.2	81.5	81.5	78.1	74.7	71.2	67.8	64.4	62.3

Distance (m)	Distance (ft)	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Band
60.0	196.8	93.3	91.3	89.3	87.3	85.3	83.3	81.3	79.3	77.3	75.3	73.3	71.3	69.3	67.3	65.2	63.2	61.1	133.4
70.0	229.7	92.3	90.3	88.3	86.3	84.3	82.3	80.3	78.3	76.3	74.3	72.3	70.3	68.3	66.2	64.2	62.1	60.0	132.4
80.0	262.5	91.5	89.5	87.4	85.4	83.4	81.4	79.4	77.4	75.4	73.4	71.4	69.4	67.4	65.4	63.3	61.2	59.1	131.5
90.0	295.3	90.7	88.7	86.7	84.7	82.7	80.7	78.7	76.7	74.7	72.7	70.7	68.6	66.6	64.6	62.5	60.4	58.3	130.7
100.0	328.1	90.0	88.0	86.0	84.0	82.0	80.0	78.0	76.0	74.0	72.0	70.0	67.9	65.9	63.9	61.8	59.7	57.6	130.1
110.0	360.9	89.4	87.4	85.4	83.4	81.4	79.4	77.4	75.4	73.4	71.3	69.3	67.3	65.3	63.3	61.2	59.1	56.9	129.4
120.0	393.7	88.8	86.8	84.8	82.8	80.8	78.8	76.8	74.8	72.8	70.8	68.8	66.7	64.7	62.7	60.6	58.5	56.3	128.9
130.0	426.5	88.3	86.3	84.3	82.3	80.3	78.3	76.3	74.3	72.3	70.3	68.2	66.2	64.2	62.1	60.1	57.9	55.8	128.4
140.0	459.3	87.8	85.8	83.8	81.8	79.8	77.8	75.8	73.8	71.8	69.8	67.8	65.7	63.7	61.6	59.6	57.4	55.2	127.9
150.0	492.1	87.4	85.4	83.4	81.3	79.3	77.3	75.3	73.3	71.3	69.3	67.3	65.3	63.2	61.2	59.1	57.0	54.8	127.4
200.0	656.2	85.5	83.5	81.5	79.5	77.5	75.5	73.5	71.5	69.4	67.4	65.4	63.4	61.3	59.3	57.2	54.9	52.7	125.5
250.0	820.2	84.0	82.0	80.0	78.0	76.0	74.0	72.0	70.0	68.0	66.0	63.9	61.9	59.8	57.7	55.6	53.4	51.0	124.1
300.0	984.2	82.8	80.8	78.8	76.8	74.8	72.8	70.8	68.8	66.8	64.8	62.7	60.7	58.6	56.5	54.4	52.0	49.6	122.9
350.0	1148.3	81.8	79.8	77.8	75.8	73.8	71.8	69.8	67.8	65.8	63.7	61.7	59.7	57.6	55.4	53.3	50.9	48.4	121.9
400.0	1312.3	81.0	79.0	76.9	74.9	72.9	70.9	68.9	66.9	64.9	62.9	60.8	58.8	56.7	54.5	52.3	49.9	47.4	121.0
460.0	1476.4	80.2	78.2	76.2	74.2	72.2	70.2	68.1	66.1	64.1	62.1	60.0	58.0	55.9	53.7	51.5	49.0	46.4	120.3
470.0	1542.0	79.9	77.9	75.9	73.9	71.9	69.9	67.9	65.8	63.8	61.8	59.7	57.7	55.6	53.4	51.2	48.7	46.0	120.0
500.0	1640.4	79.5	77.5	75.5	73.5	71.5	69.5	67.5	65.4	63.4	61.4	59.3	57.3	55.1	52.9	50.7	48.2	46.5	119.6
550.0	1804.4	78.9	76.9	74.9	72.9	70.8	68.8	66.8	64.8	62.8	60.7	58.7	56.6	54.5	52.3	50.0	47.4	44.7	119.0
600.0	1968.5	78.3	76.3	74.3	72.3	70.3	68.3	66.2	64.2	62.2	60.2	58.1	56.0	53.9	51.6	49.4	46.7	43.9	118.4
650.0	2132.5	77.8	75.8	73.8	71.8	69.8	67.7	65.7	63.7	61.7	59.6	57.6	55.5	53.3	51.1	48.8	46.1	43.2	117.9
700.0	2296.6	77.3	75.3	73.3	71.3	69.3	67.2	65.2	63.2	61.2	59.1	57.1	55.0	52.8	50.5	48.2	45.4	42.5	117.4
750.0	2460.6	76.9	74.8	72.8	70.8	68.8	66.8	64.8	62.8	60.7	58.7	56.6	54.5	52.3	50.0	47.7	44.9	41.9	116.9
800.0	2624.6	76.4	74.4	72.4	70.4	68.4	66.4	64.3	62.3	60.3	58.2	56.2	54.0	51.8	49.5	47.2	44.3	41.3	116.5
850.0	2788.7	76.0	74.0	72.0	70.0	68.0	66.0	63.9	61.9	59.9	57.8	55.7	53.6	51.4	49.1	46.7	43.8	40.7	116.1
900.0	2952.7	75.7	73.7	71.6	69.6	67.6	65.6	63.6	61.5	59.5	57.4	55.4	53.2	51.0	48.7	46.3	43.3	40.1	115.7
950.0	3116.8	75.3	73.3	71.3	69.3	67.3	65.2	63.2	61.2	59.1	57.1	55.0	52.8	50.6	48.2	45.8	42.8	39.5	115.4
1000.0	3280.8	75.0	73.0	71.0	68.9	66.9	64.9	62.9	60.8	58.8	56.7	54.6	52.5	50.2	47.8	45.4	42.3	39.0	115.1
2000.0	6561.6	71.4	69.4	67.3	65.3	63.2	61.2	59.1	57.0	54.9	52.7	50.4	48.0	46.2	42.2	38.9	33.7	27.9	111.6
2450.0	8038.0	70.3	68.3	66.2	64.2	62.1	60.0	57.9	55.8	53.7	51.5	49.1	46.6	43.8	40.5	37.0	31.4	25.0	110.4
3000.0	9842.4	69.1	67.1	65.0	63.0	60.9	58.8	56.7	54.6	52.4	50.2	47.8	45.2	42.2	38.7	35.0	28.8	21.6	109.3
4000.0	13123.2	67.4	65.3	63.2	61.2	59.1	57.0	54.8	52.7	50.5	48.1	46.7	42.9	39.7	35.8	31.7	24.3	15.9	107.5
5000.0	16404.0	65.9	63.8	61.7	59.6	57.5	55.4	53.2	51.1	48.8	46.4	43.8	40.9	37.4	33.2	28.6	20.2	10.4	106.1
6000.0	19684.8	64.5	62.5	60.4	58.3	56.1	54.0	51.8	49.6	47.3	44.8	42.2	39.1	35.3	30.8	25.7	16.2	5.1	104.8
7000.0	22965.6	63.4	61.3	59.2	57.0	54.9	52.7	50.5	48.3	45.9	43.4	40.6	37.4	33.4	28.5	23.0	12.4	0.0	103.6
8000.0	26246.4	62.3	60.2	58.0	55.9	53.7	51.5	49.3	47.0	44.6	42.0	39.2	35.8	31.5	26.2	20.3	8.6	-5.1	102.5
9000.0	29527.2	61.2	59.0	56.9	54.7	52.5	50.2	47.9	45.6	43.0	40.2	37.1	33.2	28.3	21.9	14.7	-0.2	-17.7	101.5
10000.0	32808.0	60.2	58.0	55.9	53.7	51.4	49.1	46.8	44.4	41.9	39.0	35.8	31.8	26.5	19.8	12.1	-3.8	-22.7	100.6

TABLE B-4: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING CONSTRUCTION ACTIVITIES AT A LOCATION ALONG THE PIPELINE LATERAL (dBL)

	Hertz																																	Broad
1/3 Octave Band Center Frequencies	**12.5**	**16**	**20**	**25**	**31**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12000**	**16000**	**20000**	**Band**
Input Data for Propagation Calculations																																		
Dominant sound source	Construction vessel thrusters																																	
Average depth (D) at source	40.0	meters																																
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.8	-1.2	-1.6	-2.7	-4.0	
Source spectral density (dB re 1 uPa at 1m)	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	170.0	168.0	166.0	164.0	162.0	160.0	158.0	156.0	154.0	152.0	150.0	148.0	146.0	144.0	142.0	140.0	138.0	136.0	134.0	132.0	130.0	128.0	126.0	124.0	180.3
Distance and near field / far field adjustments (dB)	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-38.9	-39.0	-39.0	-39.1	-39.2	-39.3	----
Adjusted source spectrum at 100 m (dB re 1 uPa)	131.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	129.1	127.1	125.1	123.1	121.1	119.1	117.1	115.1	113.1	111.1	109.1	107.1	105.1	103.1	101.1	99.1	97.1	95.1	93.0	91.0	88.9	86.8	84.7	141.4

General Notes on Calculation Method:

- Source level and frequency spectra estimated at a maximum 180 dBL with dominant energy in the low frequencies caused by turbulent flow conditions
- The conservative acoustic modeling approach applied spherical spreading losses (20logR) at ranges 1.5 times the water depth (D), modified cylindrical spreading (15LogR) for distances greater than 1.5D, and cylindrical spreading (10LogR) with 0.5 dB/km linear absorption and scattering at distances greater than 1 km
- The tabulated results are independent of existing area ambient levels in the Gulf of Maine
- Red text shows the worst case distance to the critical 120 dBL isopleth

1/3 Octave Band Center Frequencies		**12.5**	**16**	**20**	**25**	**31**	**40**	**50**	**63**	**80**	**100**	**125**	**160**	**200**	**250**	**315**	**400**	**500**	**630**	**800**	**1000**	**1250**	**1600**	**2000**	**2500**	**3150**	**4000**	**5000**	**6300**	**8000**	**10000**	**12000**	**16000**	**20000**	**Band**
Data for contour plot																																			
Distance (m)	Distance (ft)																																		
60.0	196.8	134.4	134.4	134.4	134.4	134.4	134.4	134.4	134.4	134.4	134.4	132.4	130.4	128.4	126.4	124.4	122.4	120.4	118.4	116.4	114.4	112.4	110.4	108.4	106.4	104.4	102.4	100.4	98.4	96.4	94.4	92.3	90.3	88.2	144.7
70.0	229.7	133.4	133.4	133.4	133.4	133.4	133.4	133.4	133.4	133.4	133.4	131.4	129.4	127.4	125.4	123.4	121.4	119.4	117.4	115.4	113.4	111.4	109.4	107.4	105.4	103.4	101.4	99.4	97.4	95.4	93.4	91.4	89.4	87.3	143.7
80.0	262.5	132.6	132.6	132.6	132.6	132.6	132.6	132.6	132.6	132.6	132.6	130.6	128.6	126.6	124.6	122.6	120.6	118.6	116.6	114.6	112.6	110.6	108.6	106.6	104.6	102.6	100.6	98.5	96.5	94.5	92.5	90.5	88.5	86.4	142.9
90.0	295.3	131.8	131.8	131.8	131.8	131.8	131.8	131.8	131.8	131.8	131.8	129.8	127.8	125.8	123.8	121.8	119.8	117.8	115.8	113.8	111.8	109.8	107.8	105.8	103.8	101.8	99.8	97.8	95.8	93.8	91.7	89.7	87.7	85.6	142.1
100.0	328.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	131.1	129.1	127.1	125.1	123.1	121.1	119.1	117.1	115.1	113.1	111.1	109.1	107.1	105.1	103.1	101.1	99.1	97.1	95.1	93.1	91.0	89.0	86.9	84.9	141.4
110.0	360.9	130.5	130.5	130.5	130.5	130.5	130.5	130.5	130.5	130.5	130.5	128.5	126.5	124.5	122.5	120.5	118.5	116.5	114.5	112.5	110.5	108.5	106.5	104.5	102.5	100.5	98.5	96.5	94.5	92.4	90.4	88.4	86.3	84.2	140.8
120.0	393.7	129.9	129.9	129.9	129.9	129.9	129.9	129.9	129.9	129.9	129.9	127.9	125.9	123.9	121.9	119.9	117.9	115.9	113.9	111.9	109.9	107.9	105.9	103.9	101.9	99.9	97.9	95.9	93.9	91.9	89.8	87.8	85.7	83.6	140.2
130.0	426.5	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4	129.4	127.4	125.4	123.4	121.4	119.4	117.4	115.4	113.4	111.4	109.4	107.4	105.4	103.4	101.4	99.4	97.4	95.4	93.4	91.3	89.3	87.3	85.2	83.0	139.7
140.0	459.3	128.9	128.9	128.9	128.9	128.9	128.9	128.9	128.9	128.9	128.9	126.9	124.9	122.9	120.9	118.9	116.9	114.9	112.9	110.9	108.9	106.9	104.9	102.9	100.9	98.9	96.9	94.9	92.9	90.8	88.8	86.8	84.6	82.5	139.2
150.0	492.1	128.5	128.5	128.5	128.5	128.5	128.5	128.5	128.5	128.5	128.5	126.5	124.5	122.5	120.5	118.5	116.5	114.5	112.5	110.5	108.5	106.5	104.5	102.5	100.5	98.4	96.4	94.4	92.4	90.4	88.3	86.3	84.2	82.0	138.8
200.0	656.2	126.6	126.6	126.6	126.6	126.6	126.6	126.6	126.6	126.6	126.6	124.6	122.6	120.6	118.6	116.6	114.6	112.6	110.6	108.6	106.6	104.6	102.6	100.6	98.6	96.6	94.6	92.5	90.5	88.5	86.4	84.3	82.2	80.0	136.9
250.0	820.2	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	125.1	123.1	121.1	119.1	117.1	115.1	113.1	111.1	109.1	107.1	105.1	103.1	101.1	99.1	97.1	95.1	93.1	91.1	89.0	87.0	84.9	82.8	80.6	78.3	135.4
300.0	984.2	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	124.0	122.0	120.0	118.0	116.0	113.9	111.9	109.9	107.9	105.9	103.9	101.9	99.9	97.9	95.9	93.9	91.9	89.9	87.8	85.7	83.7	81.5	79.3	76.9	134.2
350.0	1148.3	122.9	122.9	122.9	122.9	122.9	122.9	122.9	122.9	122.9	122.9	120.9	118.9	116.9	114.9	112.9	110.9	108.9	106.9	104.9	102.9	100.9	98.9	96.9	94.9	92.9	90.9	88.8	86.8	84.7	82.6	80.5	78.1	75.7	133.2
400.0	1312.3	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	122.1	120.1	118.1	116.1	114.1	112.1	110.1	108.1	106.1	104.1	102.1	100.0	98.0	96.0	94.0	92.0	90.0	87.9	85.9	83.8	81.7	79.5	77.1	74.6	132.4
450.0	1476.4	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	121.3	119.3	117.3	115.3	113.3	111.3	109.3	107.3	105.3	103.3	101.3	99.3	97.3	95.3	93.2	91.2	89.2	87.2	85.1	83.0	80.8	78.7	76.2	73.7	131.6
500.0	1640.4	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6	120.6	118.6	116.6	114.6	112.6	110.6	108.6	106.6	104.6	102.6	100.6	98.6	96.6	94.6	92.6	90.5	88.5	86.5	84.4	82.3	80.1	77.9	75.4	72.8	130.9
550.0	1804.4	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	120.0	118.0	116.0	114.0	112.0	110.0	108.0	106.0	104.0	102.0	100.0	98.0	95.9	93.9	91.9	89.9	87.9	85.8	83.7	81.6	79.4	77.2	74.6	72.0	130.3
600.0	1968.5	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	119.4	117.4	115.4	113.4	111.4	109.4	107.4	105.4	103.4	101.4	99.4	97.4	95.4	93.4	91.3	89.3	87.3	85.2	83.1	81.0	78.8	76.5	73.9	71.2	129.7
650.0	2132.5	118.9	118.9	118.9	118.9	118.9	118.9	118.9	118.9	118.9	118.9	116.9	114.9	112.9	110.9	108.9	106.9	104.9	102.9	100.9	98.9	96.9	94.9	92.8	90.8	88.8	86.7	84.7	82.6	80.4	78.2	75.9	73.3	70.5	129.2
700.0	2296.6	118.4	118.4	118.4	118.4	118.4	118.4	118.4	118.4	118.4	118.4	116.4	114.4	112.4	110.4	108.4	106.4	104.4	102.4	100.4	98.4	96.4	94.4	92.3	90.3	88.3	86.3	84.2	82.1	79.9	77.7	75.4	72.7	69.8	128.7
750.0	2460.6	118.0	118.0	118.0	118.0	118.0	118.0	118.0	118.0	118.0	118.0	116.0	114.0	112.0	110.0	108.0	106.0	104.0	102.0	99.9	97.9	95.9	93.9	91.9	89.9	87.8	85.8	83.7	81.6	79.4	77.2	74.9	72.1	69.1	128.3
800.0	2624.6	117.6	117.6	117.6	117.6	117.6	117.6	117.6	117.6	117.6	117.6	115.6	113.6	111.6	109.6	107.6	105.6	103.5	101.5	99.5	97.5	95.5	93.5	91.5	89.4	87.4	85.4	83.3	81.2	79.0	76.7	74.4	71.5	68.5	127.9
850.0	2788.7	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	117.2	115.2	113.2	111.2	109.2	107.2	105.2	103.1	101.1	99.1	97.1	95.1	93.1	91.1	89.0	87.0	84.9	82.9	80.7	78.5	76.2	73.9	71.0	67.9	127.5
900.0	2952.7	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	116.8	114.8	112.8	110.8	108.8	106.8	104.8	102.8	100.8	98.8	96.7	94.7	92.7	90.7	88.7	86.6	84.6	82.5	80.3	78.1	75.8	73.4	70.5	67.4	127.1
950.0	3116.8	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	116.4	114.4	112.4	110.4	108.4	106.4	104.4	102.4	100.4	98.4	96.4	94.4	92.3	90.3	88.3	86.3	84.2	82.1	80.0	77.7	75.4	73.0	70.0	66.8	126.7
1000.0	3280.8	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	116.1	114.1	112.1	110.1	108.1	106.1	104.1	102.1	100.1	98.1	96.0	94.0	92.0	90.0	88.0	85.9	83.8	81.7	79.6	77.3	75.0	72.5	69.5	66.2	126.4
2000.0	6561.6	112.6	112.6	112.6	112.6	112.6	112.6	112.6	112.6	112.6	112.6	110.6	108.6	106.6	104.6	102.6	100.6	98.5	96.5	94.5	92.4	90.4	88.3	86.2	84.1	82.0	79.8	77.5	75.1	72.4	69.3	66.0	60.9	55.1	122.9
3000.0	9842.4	110.3	110.3	110.3	110.3	110.3	110.3	110.3	110.3	110.3	110.3	108.3	106.3	104.3	102.3	100.3	98.3	96.2	94.2	92.1	90.1	88.0	85.9	83.8	81.7	79.5	77.3	74.9	72.3	69.3	65.9	62.2	55.9	48.8	120.6
3310.0	10859.4	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	109.8	107.7	105.7	103.7	101.7	99.7	97.7	95.7	93.6	91.5	89.5	87.4	85.3	83.2	81.1	78.9	76.6	74.2	71.6	68.5	64.9	61.1	54.5	47.0	120.0
3350.0	10990.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	109.7	107.7	105.7	103.7	101.7	99.6	97.6	95.6	93.5	91.5	89.4	87.3	85.2	83.1	81.0	78.8	76.5	74.1	71.5	68.4	64.8	60.9	54.3	46.8	120.0
4000.0	13123.2	108.6	108.6	108.6	108.6	108.6	108.6	108.6	108.6	108.6	108.6	106.6	104.6	102.6	100.6	98.5	96.5	94.5	92.4	90.3	88.3	86.2	84.1	82.0	79.8	77.6	75.3	72.8	70.0	66.8	63.0	58.8	51.5	43.1	118.9
5000.0	16404.0	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	107.1	105.1	103.1	101.1	99.1	97.1	95.0	93.0	90.9	88.8	86.7	84.6	82.5	80.4	78.2	75.9	73.5	70.9	68.0	64.5	60.4	55.8	47.4	37.6	117.4
6000.0	19684.8	105.8	105.8	105.8	105.8	105.8	105.8	105.8	105.8	105.8	105.8	103.8	101.8	99.8	97.8	95.8	93.7	91.7	89.6	87.5	85.4	83.3	81.1	78.9	76.7	74.4	71.9	69.3	66.2	62.5	57.9	52.9	43.4	32.3	116.1
7000.0	22965.6	104.7	104.7	104.7	104.7	104.7	104.7	104.7	104.7	104.7	104.6	102.6	100.6	98.6	96.6	94.6	92.5	90.5	88.4	86.3	84.1	82.0	79.8	77.6	75.4	73.0	70.5	67.7	64.5	60.5	55.6	50.1	39.5	27.1	114.9
8000.0	26246.4	103.6	103.6	103.6	103.6	103.6	103.6	103.6	103.6	103.6	103.6	101.6	99.6	97.5	95.5	93.5	91.4	89.4	87.3	85.1	83.0	80.8	78.6	76.4	74.1	71.8	69.2	66.3	62.9	58.6	53.4	47.4	35.8	22.1	113.9
9000.0	29527.2	102.6	102.6	102.6	102.6	102.6	102.6	102.6	102.6	102.6	102.6	100.5	98.5	96.5	94.5	92.4	90.4	88.3	86.1	83.9	81.7	79.5	77.2	74.9	72.5	69.9	67.1	63.8	59.8	54.6	47.9	40.2	24.3	5.5	112.8
10000.0	32808.0	101.6	101.6	101.6	101.6	101.6	101.6	101.6	101.6	101.6	101.6	99.6	97.6	95.5	93.5	91.5	89.4	87.3	85.1	82.9	80.7	78.5	76.1	73.8	71.4	68.8	65.8	62.5	58.4	52.9	45.8	37.7	20.7	0.5	111.9

TABLE B-5: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING EBRV CLOSED LOOP REGASIFICATION AND OFFLOADING AT THE NEG DWP (dBL)

1/3 Octave Band Center Frequencies	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	Hertz 1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad Band
Input Data for Propagation Calculations																																		
Dominant sound source	EBRV regasification																																	
Average depth (D) at source	80.0	meters																																
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.8	-1.2	-1.6	-2.7	-4.0	
Source spectral density (dB re 1 uPa at 1m)	93.5	96.4	98.6	95.7	100.2	96.7	93.6	96.1	88.3	88.5	92.7	86.7	87.9	85.2	83.9	93.4	98.2	82.5	80.0	101.1	84.8	92.6	88.9	83.8	78.0	77.6	77.7	77.8	77.8	79.4	81.4	82.9	82.9	108.2
Distance and near field / far field adjustments (dB)	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.3	-0.4	-0.4	-0.6	-0.7	---
Adjusted source spectrum at 100 m (dB re 1 uPa)	93.2	96.1	98.3	95.4	99.9	96.4	93.3	95.8	88.0	88.2	92.4	86.4	87.6	84.9	83.6	93.1	97.9	82.2	79.7	100.8	84.5	92.3	88.6	83.5	77.7	77.3	77.4	77.5	77.5	79.0	81.0	82.4	82.2	107.9

General Notes on Calculation Method:

- Source level and frequency spectra documented from measurements completed at the existing Gulf Gateway DWP
- The conservative acoustic modeling approach applied spherical spreading losses (20logR) at ranges 1.5 times the water depth (D), modified cylindrical spreading (15LogR) for distances greater than 1.5D, and cylindrical spreading (10LogR) with 0.5 dB/km linear absorption and scattering at distances greater than 1 km
- The tabulated results are independent of existing area ambient levels in the Gulf of Maine.
- Red text shows the worst case distance to the critical 120 dBL isopleth

Data for contour plot

Distance (m)	Distance (ft)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	Hertz 1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad Band
60.0	196.8	93.5	96.4	98.6	95.7	100.2	96.7	93.6	96.1	88.3	88.5	92.7	86.7	87.9	85.2	83.9	93.4	98.2	82.5	80.0	101.1	84.8	92.6	88.9	83.8	78.0	77.6	77.7	77.8	77.8	79.4	81.4	82.9	82.9	108.2
70.0	229.7	93.5	96.4	98.6	95.7	100.2	96.7	93.6	96.1	88.3	88.5	92.7	86.7	87.9	85.2	83.9	93.4	98.2	82.5	80.0	101.1	84.8	92.6	88.9	83.8	78.0	77.6	77.7	77.8	77.8	79.4	81.4	82.9	82.9	108.2
80.0	262.5	93.5	96.4	98.6	95.7	100.2	96.7	93.6	96.1	88.3	88.5	92.7	86.7	87.9	85.2	83.9	93.4	98.2	82.5	80.0	101.1	84.8	92.6	88.9	83.8	78.0	77.6	77.7	77.8	77.8	79.4	81.4	82.9	82.9	108.2
90.0	295.3	93.5	96.4	98.6	95.7	100.2	96.7	93.6	96.1	88.3	88.5	92.7	86.7	87.9	85.2	83.9	93.4	98.2	82.5	80.0	101.1	84.8	92.6	88.9	83.8	78.0	77.6	77.7	77.8	77.8	79.4	81.4	82.9	82.9	108.2
100.0	328.1	93.2	96.1	98.3	95.4	99.9	96.4	93.3	95.8	88.0	88.2	92.4	86.4	87.6	84.9	83.6	93.1	97.9	82.2	79.7	100.8	84.5	92.3	88.6	83.5	77.7	77.3	77.4	77.5	77.5	79.0	81.0	82.4	82.2	107.9
110.0	360.9	92.6	95.5	97.7	94.8	99.3	95.8	92.7	95.2	87.4	87.6	91.8	85.8	87.0	84.3	83.0	92.5	97.3	81.6	79.1	100.2	83.9	91.7	88.0	82.9	77.1	76.7	76.8	76.9	76.8	78.4	80.3	81.7	81.6	107.3
120.0	393.7	92.0	94.9	97.1	94.2	98.7	95.2	92.1	94.6	86.8	87.0	91.2	85.2	86.4	83.7	82.4	91.9	96.7	81.0	78.5	99.6	83.3	91.1	87.4	82.3	76.5	76.1	76.2	76.3	76.3	77.8	79.8	81.1	81.0	106.7
130.0	426.5	91.5	94.4	96.6	93.7	98.2	94.7	91.6	94.1	86.3	86.5	90.7	84.7	85.9	83.2	81.9	91.4	96.2	80.5	78.0	99.1	82.8	90.6	86.9	81.8	76.0	75.6	75.7	75.8	75.7	77.3	79.2	80.6	80.4	106.2
140.0	459.3	91.0	93.9	96.1	93.2	97.7	94.2	91.1	93.6	85.8	86.0	90.2	84.2	85.4	82.7	81.4	90.9	95.7	80.0	77.5	98.6	82.3	90.1	86.4	81.3	75.5	75.1	75.2	75.3	75.2	76.8	78.7	80.1	79.9	105.7
150.0	492.1	90.6	93.5	95.7	92.8	97.3	93.8	90.7	93.2	85.4	85.6	89.8	83.8	85.0	82.3	81.0	90.5	95.3	79.6	77.1	98.2	81.9	89.7	86.0	80.9	75.1	74.7	74.7	74.8	74.8	76.3	78.3	79.6	79.4	105.3
175.0	574.1	89.6	92.5	94.7	91.8	96.3	92.8	89.7	92.2	84.4	84.6	88.8	82.8	84.0	81.3	80.0	89.5	94.3	78.6	76.1	97.2	80.9	88.7	85.0	79.9	74.1	73.6	73.7	73.8	73.8	75.3	77.2	78.5	78.3	104.2
200.0	656.2	88.7	91.6	93.8	90.9	95.4	91.9	88.8	91.3	83.5	83.7	87.9	81.9	83.1	80.4	79.1	88.6	93.4	77.7	75.2	96.3	80.0	87.8	84.1	79.0	73.2	72.8	72.8	72.9	72.9	74.4	76.3	77.6	77.3	103.4
250.0	820.2	87.2	90.2	92.3	89.5	94.0	90.5	87.4	89.9	82.1	82.3	86.5	80.5	81.7	79.0	77.7	87.2	92.0	76.3	73.8	94.8	78.5	86.3	82.6	77.5	71.7	71.3	71.4	71.4	71.4	72.9	74.8	76.0	75.7	101.9
300.0	984.2	86.1	89.0	91.2	88.3	92.8	89.3	86.2	88.7	80.9	81.1	85.3	79.3	80.5	77.8	76.5	86.0	90.8	75.1	72.6	93.7	77.4	85.1	81.4	76.3	70.5	70.1	70.2	70.2	70.1	71.6	73.5	74.7	74.3	100.7
350.0	1148.3	85.1	88.0	90.2	87.3	91.8	88.3	85.2	87.7	79.9	80.1	84.3	78.3	79.5	76.8	75.5	85.0	89.8	74.1	71.6	92.7	76.3	84.1	80.4	75.3	69.5	69.1	69.1	69.2	69.1	70.6	72.4	73.5	73.1	99.7
400.0	1312.3	84.2	87.1	89.3	86.4	90.9	87.4	84.3	86.8	79.0	79.2	83.4	77.4	78.6	75.9	74.6	84.1	88.9	73.2	70.7	91.8	75.5	83.3	79.6	74.4	68.6	68.2	68.3	68.3	68.2	69.6	71.5	72.5	72.0	98.9
450.0	1476.4	83.4	86.3	88.5	85.6	90.1	86.6	83.5	86.0	78.2	78.4	82.6	76.6	77.8	75.1	73.8	83.3	88.1	72.4	69.9	91.0	74.7	82.5	78.8	73.7	67.8	67.4	67.5	67.5	67.4	68.8	70.6	71.6	71.0	98.1
500.0	1640.4	82.7	85.7	87.8	85.0	89.5	86.0	82.9	85.4	77.6	77.8	81.9	75.9	77.1	74.4	73.1	82.6	87.4	71.7	69.2	90.3	74.0	81.8	78.1	73.0	67.1	66.7	66.8	66.8	66.7	68.1	69.9	70.8	70.2	97.4
550.0	1804.4	82.1	85.0	87.2	84.3	88.8	85.3	82.2	84.7	76.9	77.1	81.3	75.3	76.5	73.8	72.5	82.0	86.8	71.1	68.6	89.7	73.4	81.2	77.5	72.3	66.5	66.1	66.1	66.1	66.0	67.4	69.2	70.1	69.3	96.8
600.0	1968.5	81.5	84.5	86.6	83.8	88.3	84.8	81.7	84.2	76.4	76.6	80.8	74.8	76.0	73.3	72.0	81.5	86.2	70.5	68.0	89.1	72.8	80.6	76.9	71.8	65.9	65.5	65.5	65.5	65.4	66.8	68.5	69.4	68.6	96.2
650.0	2132.5	81.0	83.9	86.1	83.2	87.7	84.2	81.1	83.6	75.8	76.0	80.2	74.2	75.4	72.7	71.4	80.9	85.7	70.0	67.5	88.6	72.3	80.1	76.4	71.2	65.4	65.0	65.0	65.0	64.8	66.2	67.9	68.7	67.8	95.7
700.0	2296.6	80.5	83.5	85.6	82.8	87.3	83.8	80.7	83.2	75.4	75.6	79.8	73.8	75.0	72.3	71.0	80.4	85.2	69.5	67.0	88.1	71.8	79.6	75.9	70.7	64.9	64.5	64.5	64.5	64.3	65.7	67.3	68.1	67.2	95.2
750.0	2460.6	80.1	83.0	85.2	82.3	86.8	83.3	80.2	82.7	74.9	75.1	79.3	73.3	74.5	71.8	70.5	80.0	84.8	69.1	66.6	87.7	71.3	79.1	75.4	70.3	64.5	64.0	64.0	64.0	63.8	65.1	66.8	67.5	66.5	94.7
800.0	2624.6	79.7	82.6	84.8	81.9	86.4	82.9	79.8	82.3	74.5	74.7	78.9	72.9	74.1	71.4	70.1	79.6	84.4	68.7	66.1	87.2	70.9	78.7	75.0	69.9	64.0	63.6	63.6	63.6	63.4	64.7	66.3	66.9	65.9	94.3
850.0	2788.7	79.3	82.2	84.4	81.5	86.0	82.5	79.4	81.9	74.1	74.3	78.5	72.5	73.7	71.0	69.7	79.2	84.0	68.3	65.8	86.8	70.5	78.3	74.6	69.5	63.6	63.2	63.2	63.1	62.9	64.2	65.8	66.4	65.3	93.9
900.0	2952.7	78.9	81.8	84.0	81.1	85.6	82.1	79.0	81.5	73.7	73.9	78.1	72.1	73.3	70.6	69.3	78.8	83.6	67.9	65.4	86.5	70.1	77.9	74.2	69.1	63.2	62.8	62.8	62.7	62.5	63.8	65.4	65.9	64.7	93.6
950.0	3116.8	78.5	81.5	83.6	80.8	85.3	81.8	78.7	81.2	73.4	73.6	77.8	71.8	73.0	70.3	69.0	78.5	83.2	67.5	65.0	86.1	69.8	77.6	73.8	68.7	62.9	62.4	62.4	62.4	62.1	63.4	65.0	65.4	64.2	93.2
1000.0	3280.8	78.2	81.1	83.3	80.4	84.9	81.4	78.3	80.8	73.0	73.2	77.4	71.4	72.6	69.9	68.6	78.1	82.9	67.2	64.7	85.8	69.5	77.2	73.5	68.4	62.5	62.1	62.1	62.0	61.7	63.0	64.5	64.9	63.6	92.9
2000.0	6561.6	74.7	77.6	79.8	76.9	81.4	77.9	74.8	77.3	69.5	69.7	73.9	67.9	69.1	66.4	65.1	74.6	79.4	63.6	61.1	82.1	65.8	73.5	69.7	64.6	58.6	58.0	57.8	57.5	56.7	57.3	58.0	56.3	52.4	89.3
2460.0	8038.0	73.6	76.5	78.7	75.8	80.3	76.8	73.7	76.2	68.4	68.6	72.8	66.8	68.0	65.3	64.0	73.5	78.2	62.5	60.0	81.0	64.6	72.4	68.6	63.4	57.4	56.8	56.6	56.1	55.3	55.6	56.1	54.0	49.5	88.2
3000.0	9842.4	72.4	75.4	77.5	74.7	79.2	75.7	72.6	75.1	67.3	67.5	71.7	65.7	66.8	64.1	62.8	72.3	77.1	61.3	58.8	79.8	63.4	71.1	67.4	62.1	56.2	55.5	55.2	54.7	53.7	53.9	54.1	51.4	46.2	87.0
4000.0	13123.2	70.7	73.6	75.8	72.9	77.4	73.9	70.8	73.3	65.5	65.7	69.9	63.9	65.1	62.4	61.1	70.5	75.3	59.5	57.0	78.0	61.6	69.3	65.5	60.2	54.2	53.5	53.1	52.4	51.2	51.0	50.8	46.9	40.4	85.2
5000.0	16404.0	69.2	72.1	74.3	71.4	75.9	72.4	69.3	71.8	64.0	64.2	68.4	62.4	63.6	60.9	59.6	69.0	73.8	58.0	55.5	76.5	60.1	67.7	63.9	58.6	52.5	51.7	51.3	50.4	48.9	48.3	47.7	42.8	35.0	83.7
6000.0	19684.8	67.9	70.9	73.0	70.2	74.7	71.2	68.1	70.6	62.7	62.9	67.1	61.1	62.3	59.6	58.3	67.7	72.5	56.7	54.1	75.1	58.7	66.3	62.5	57.1	51.0	50.2	49.6	48.6	46.9	45.9	44.8	38.8	29.7	82.4
7000.0	22965.6	66.8	69.7	71.9	69.0	73.5	70.0	66.9	69.4	61.6	61.8	66.0	60.0	61.1	58.4	57.1	66.6	71.3	55.5	52.9	73.9	57.4	65.0	61.2	55.8	49.7	48.7	48.1	46.9	44.9	43.6	42.1	35.0	24.5	81.2
8000.0	26246.4	65.7	68.6	70.8	67.9	72.4	68.9	65.8	68.3	60.5	60.7	64.9	58.9	60.1	57.3	56.0	65.5	70.2	54.4	51.8	72.7	56.3	63.9	59.9	54.6	48.4	47.4	46.6	45.3	43.0	41.3	39.4	31.2	19.4	80.1
9000.0	29527.2	64.7	67.6	69.8	66.9	71.4	67.9	64.8	67.3	59.5	59.7	63.9	57.9	59.0	56.3	55.0	64.4	69.1	53.3	50.6	71.5	55.0	62.5	58.6	53.1	46.8	45.6	44.5	42.8	39.8	37.0	33.8	22.4	6.8	79.1
10000.0	32808.0	63.7	66.6	68.8	65.9	70.4	66.9	63.8	66.3	58.5	58.7	62.9	56.9	58.1	55.3	54.0	63.4	68.1	52.3	49.6	70.5	54.0	61.5	57.5	52.0	45.6	44.3	43.2	41.3	38.0	34.9	31.2	18.8	1.9	78.1

TABLE B-6: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING EBRV COUPLING OPERATIONS AT THE NEG DWP (dBL)

1/3 Octave Band Center Frequencies (Hertz)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad Band
Input Data for Propagation Calculations																																		
Dominant sound source	BERG thrusters																																	
Average depth (D) at source	80.0	meters																																
Seawater absorption rates (dB per 1 km)	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1	-0.2	-0.2	-0.3	-0.4	-0.5	-0.8	-1.2	-1.6	-2.7	-4.0	
Source spectral density (dB re 1 uPa at 1 m)	145.9	143.2	168.7	144.1	139.5	148.8	139.3	149.4	152.3	146.6	146.2	147.9	150.6	149.6	149.4	149.5	147.6	146.3	145.5	149.4	148.2	146.0	147.1	148.9	150.4	151.1	151.2	151.0	150.9	151.4	151.5	151.4	150.6	170.0
Distance and near field / far field adjustments (dB)	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.0	-40.1	-40.1	-40.1	-40.2	-40.3	-40.4	----
Adjusted source spectrum at 100 m (dB re 1 uPa)	105.9	103.2	128.7	104.1	99.5	108.8	99.3	109.4	112.3	106.6	106.2	107.9	110.6	109.6	109.4	109.5	107.6	106.3	105.5	109.4	108.2	106.0	107.1	108.9	110.4	111.1	111.2	110.9	110.8	111.3	111.3	111.1	110.2	130.0

General Notes on Calculation Method:

- Source level and frequency spectra documented from measurements completed at the existing Gulf Gateway DIP
- The conservative acoustic modeling approach applied spherical spreading losses (20logR) at ranges 1.5 times the water depth (D), modified cylindrical spreading (15LogR) for distances greater than 1.5D, and cylindrical spreading (10LogR) with 0.5 dB/km linear absorption and scattering at distances greater than 1 km
- The tabulated results are independent of existing area ambient levels in the Gulf of Maine.
- Red text shows the worst case distance to the critical 120 dBA isopleths

Data for contour plot

Distance (m)	Distance (ft)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad Band
60.0	196.8	110.3	107.6	133.1	108.5	103.9	113.2	103.7	113.8	116.7	111.0	110.6	112.3	115.0	114.0	113.8	113.9	112.0	110.7	109.9	113.8	112.6	110.4	111.5	113.3	114.8	115.5	115.6	115.4	115.3	115.8	115.8	115.7	114.8	134.4
70.0	229.7	109.0	106.3	131.8	107.2	102.6	111.9	102.4	112.5	115.4	109.7	109.3	111.0	113.7	112.7	112.5	112.6	110.7	109.4	108.6	112.5	111.3	109.1	110.2	112.0	113.5	114.2	114.3	114.1	113.9	114.4	114.5	114.3	113.4	133.1
80.0	262.5	107.8	105.1	130.6	106.0	101.4	110.7	101.2	111.3	114.2	108.5	108.1	109.8	112.5	111.5	111.3	111.4	109.5	108.2	107.4	111.3	110.1	107.9	109.0	110.8	112.3	113.0	113.1	112.9	112.8	113.2	113.3	113.1	112.2	131.9
90.0	295.3	106.8	104.1	129.6	105.0	100.4	109.7	100.2	110.3	113.2	107.5	107.1	108.8	111.5	110.5	110.3	110.4	108.5	107.2	106.4	110.3	109.1	106.9	108.0	109.8	111.3	112.0	112.1	111.9	111.7	112.2	112.3	112.1	111.2	130.9
100.0	328.1	105.9	103.2	128.7	104.1	99.5	108.8	99.3	109.4	112.3	106.6	106.2	107.9	110.6	109.6	109.4	109.5	107.6	106.3	105.5	109.4	108.2	106.0	107.1	108.9	110.4	111.1	111.2	110.9	110.8	111.3	111.3	111.1	110.2	130.0
110.0	360.9	105.1	102.4	127.9	103.3	98.7	108.0	98.5	108.6	111.5	105.8	105.4	107.1	109.8	108.8	108.6	108.7	106.8	105.5	104.7	108.6	107.4	105.2	106.3	108.1	109.5	110.2	110.3	110.1	110.0	110.4	110.5	110.3	109.3	129.1
120.0	393.7	104.3	101.6	127.1	102.5	97.9	107.2	97.7	107.8	110.7	105.0	104.6	106.3	109.0	108.0	107.8	107.9	106.0	104.7	103.9	107.8	106.6	104.4	105.5	107.3	108.8	109.5	109.6	109.4	109.2	109.7	109.7	109.5	108.5	128.4
130.0	426.5	103.8	101.1	126.6	102.0	97.4	106.7	97.2	107.3	110.2	104.5	104.1	105.8	108.5	107.5	107.3	107.4	105.5	104.2	103.4	107.3	106.1	103.9	105.0	106.8	108.3	109.0	109.0	108.8	108.7	109.1	109.2	108.9	107.9	127.9
140.0	459.3	103.3	100.6	126.1	101.5	96.9	106.2	96.7	106.8	109.7	104.0	103.6	105.3	108.0	107.0	106.8	106.9	105.0	103.7	102.9	106.8	105.6	103.4	104.5	106.3	107.8	108.5	108.6	108.3	108.2	108.6	108.7	108.4	107.4	127.4
150.0	492.1	102.9	100.2	125.7	101.1	96.5	105.8	96.3	106.4	109.3	103.6	103.2	104.9	107.6	106.6	106.4	106.5	104.6	103.3	102.5	106.4	105.1	102.9	104.0	105.8	107.3	108.0	108.1	107.9	107.7	108.2	108.2	107.9	106.9	126.9
175.0	574.1	101.9	99.2	124.7	100.1	95.5	104.8	95.3	105.4	108.3	102.6	102.2	103.9	106.6	105.6	105.4	105.5	103.6	102.3	101.4	105.3	104.1	101.9	103.0	104.8	106.3	107.0	107.1	106.9	106.7	107.1	107.1	106.8	105.8	125.9
200.0	656.2	101.0	98.3	123.8	99.2	94.6	103.9	94.4	104.5	107.4	101.7	101.3	103.0	105.7	104.7	104.5	104.6	102.7	101.4	100.6	104.5	103.3	101.1	102.2	104.0	105.4	106.1	106.2	106.0	105.8	106.2	106.2	105.9	104.8	125.0
250.0	820.2	99.5	96.8	122.3	97.7	93.1	102.4	92.9	103.0	105.9	100.2	99.8	101.5	104.2	103.2	103.0	103.1	101.2	99.9	99.1	103.0	101.8	99.6	100.7	102.5	104.0	104.7	104.7	104.5	104.3	104.7	104.7	104.3	103.2	123.6
300.0	984.2	98.3	95.6	121.1	96.5	91.9	101.2	91.7	101.8	104.7	99.0	98.6	100.3	103.0	102.0	101.8	101.9	100.0	98.7	97.9	101.8	100.6	98.4	99.5	101.3	102.8	103.5	103.5	103.3	103.1	103.5	103.4	103.0	101.8	122.4
350.0	1148.3	97.3	94.6	120.1	95.5	90.9	100.2	90.7	100.8	103.7	98.0	97.6	99.3	102.0	101.0	100.8	100.9	99.0	97.7	96.9	100.8	99.6	97.4	98.5	100.3	101.8	102.4	102.5	102.2	102.1	102.4	102.4	101.9	100.6	121.4
400.0	1312.3	96.5	93.8	119.3	94.7	90.1	99.4	89.9	100.0	102.9	97.2	96.8	98.5	101.2	100.2	100.0	100.1	98.2	96.9	96.1	99.9	98.7	96.5	97.6	99.4	100.9	101.6	101.6	101.4	101.1	101.5	101.4	100.8	99.5	120.5
430.0	1410.7	96.0	93.3	118.8	94.2	89.6	98.9	89.4	99.5	102.4	96.7	96.3	98.0	100.7	99.7	99.5	99.6	97.7	96.4	95.6	99.5	98.3	96.1	97.1	98.9	100.4	101.1	101.1	100.9	100.7	101.0	100.9	100.3	98.9	120.0
460.0	1476.4	95.7	93.0	118.5	93.9	89.3	98.6	89.1	99.2	102.1	96.4	96.0	97.7	100.4	99.4	99.2	99.3	97.4	96.1	95.3	99.2	98.0	95.8	96.8	98.6	100.1	100.8	100.8	100.6	100.3	100.7	100.6	99.9	98.5	119.7
500.0	1640.4	95.0	92.3	117.8	93.2	88.6	97.9	88.4	98.5	101.4	95.7	95.3	97.0	99.7	98.7	98.5	98.6	96.7	95.4	94.6	98.5	97.3	95.1	96.2	97.9	99.4	100.1	100.1	99.8	99.6	99.9	99.8	99.1	97.6	119.0
550.0	1804.4	94.4	91.7	117.2	92.6	88.0	97.3	87.8	97.9	100.8	95.1	94.7	96.4	99.1	98.1	97.9	98.0	96.1	94.8	94.0	97.9	96.7	94.4	95.5	97.3	98.8	99.4	99.5	99.2	99.0	99.2	99.1	98.4	96.8	118.4
600.0	1968.5	93.8	91.1	116.6	92.0	87.4	96.7	87.2	97.3	100.2	94.5	94.1	95.8	98.5	97.5	97.3	97.4	95.5	94.2	93.4	97.3	96.1	93.9	95.0	96.7	98.2	98.9	98.9	98.6	98.3	98.6	98.4	97.7	96.1	117.8
650.0	2132.5	93.3	90.6	116.1	91.5	86.9	96.2	86.7	96.8	99.7	94.0	93.6	95.3	98.0	97.0	96.8	96.9	95.0	93.7	92.9	96.8	95.6	93.3	94.4	96.2	97.7	98.3	98.4	98.1	97.8	98.0	97.8	97.0	95.3	117.3
700.0	2296.6	92.8	90.1	115.6	91.0	86.4	95.7	86.2	96.3	99.2	93.5	93.1	94.8	97.5	96.5	96.3	96.4	94.5	93.2	92.4	96.3	95.1	92.9	93.9	95.7	97.2	97.8	97.9	97.5	97.3	97.5	97.3	96.4	94.6	116.8
750.0	2460.6	92.4	89.7	115.2	90.6	86.0	95.3	85.8	95.9	98.8	93.1	92.7	94.4	97.1	96.1	95.9	96.0	94.1	92.8	91.9	95.8	94.6	92.4	93.5	95.3	96.7	97.4	97.4	97.1	96.8	97.0	96.8	95.8	94.0	116.4
800.0	2624.6	92.0	89.3	114.8	90.2	85.6	94.9	85.4	95.5	98.4	92.7	92.3	94.0	96.7	95.7	95.4	95.5	93.6	92.3	91.5	95.4	94.2	92.0	93.1	94.8	96.3	96.9	97.0	96.6	96.3	96.5	96.3	95.3	93.4	115.9
850.0	2788.7	91.6	88.9	114.4	89.8	85.2	94.5	85.0	95.1	98.0	92.3	91.9	93.6	96.3	95.3	95.1	95.1	93.2	91.9	91.1	95.0	93.8	91.6	92.6	94.4	95.9	96.5	96.5	96.2	95.9	96.1	95.8	94.7	92.8	115.5
900.0	2952.7	91.2	88.5	114.0	89.4	84.8	94.1	84.6	94.7	97.6	91.9	91.5	93.2	95.9	94.9	94.7	94.8	92.9	91.6	90.7	94.6	93.4	91.2	92.3	94.0	95.5	96.1	96.1	95.8	95.5	95.6	95.3	94.2	92.2	115.2
950.0	3116.8	90.8	88.1	113.6	89.0	84.4	93.7	84.2	94.3	97.2	91.5	91.1	92.8	95.5	94.5	94.3	94.4	92.5	91.2	90.4	94.3	93.1	90.8	91.9	93.7	95.1	95.8	95.8	95.4	95.1	95.2	94.9	93.7	91.7	114.8
1000.0	3280.8	90.5	87.8	113.3	88.7	84.1	93.4	83.9	94.0	96.9	91.2	90.8	92.5	95.2	94.2	94.0	94.1	92.2	90.9	90.1	93.9	92.7	90.5	91.6	93.3	94.8	95.4	95.4	95.1	94.7	94.8	94.5	93.3	91.1	114.5
2000.0	6561.6	87.0	84.3	109.8	85.2	80.6	89.9	80.4	90.5	93.4	87.7	87.3	89.0	91.7	90.7	90.5	90.5	88.6	87.3	86.4	90.3	89.1	86.8	87.8	89.5	90.9	91.4	91.2	90.6	89.7	89.1	87.9	84.7	80.0	110.8
2460.0	8038.0	85.9	83.2	108.7	84.1	79.5	88.8	79.3	89.4	92.3	86.6	86.2	87.9	90.6	89.6	89.4	89.4	87.5	86.2	85.3	89.2	87.9	85.6	86.6	88.3	89.7	90.2	89.9	89.2	88.3	87.5	86.1	82.4	77.1	109.7
3000.0	9842.4	84.7	82.0	107.5	82.9	78.3	87.6	78.1	88.2	91.1	85.4	85.0	86.7	89.4	88.4	88.2	88.3	86.3	85.0	84.1	88.0	86.7	84.4	85.4	87.1	88.4	88.9	88.6	87.8	86.7	85.7	84.1	79.7	73.8	108.5
4000.0	13123.2	83.0	80.3	105.8	81.2	76.6	85.9	76.4	86.5	89.4	83.7	83.3	85.0	87.7	86.6	86.4	86.5	84.6	83.2	82.3	86.2	84.9	82.6	83.5	85.2	86.5	86.8	86.5	85.5	84.1	82.8	80.7	75.3	68.0	106.7
5000.0	16404.0	81.5	78.8	104.3	79.7	75.1	84.4	74.9	85.0	87.9	82.2	81.8	83.5	86.2	85.2	84.9	85.0	83.1	81.7	80.8	84.6	83.3	81.0	81.9	83.6	84.8	85.1	84.6	83.5	81.9	80.2	77.7	71.1	62.5	105.2
6000.0	19684.8	80.2	77.5	103.0	78.4	73.8	83.1	73.6	83.7	86.6	80.9	80.5	82.2	84.9	83.9	83.6	83.7	81.8	80.4	79.5	83.3	81.9	79.6	80.5	82.1	83.3	83.5	83.0	81.7	79.8	77.8	74.8	67.2	57.3	103.9
7000.0	22965.6	79.1	76.4	101.9	77.3	72.7	82.0	72.5	82.5	85.4	79.7	79.3	81.0	83.7	82.7	82.5	82.5	80.6	79.2	78.3	82.0	80.7	78.3	79.2	80.8	81.9	82.1	81.4	80.0	77.9	75.4	72.0	63.3	52.1	102.7
8000.0	26246.4	78.0	75.3	100.8	76.2	71.6	80.9	71.4	81.5	84.4	78.7	78.3	79.9	82.6	81.6	81.4	81.4	79.5	78.1	77.1	80.9	79.5	77.1	78.0	79.5	80.6	80.7	80.0	78.4	76.0	73.2	69.4	59.6	47.0	101.6
9000.0	29527.2	77.0	74.3	99.8	75.2	70.6	79.9	70.4	80.5	83.4	77.6	77.2	78.9	81.6	80.6	80.3	80.4	78.4	76.9	76.0	79.7	78.3	75.8	76.6	78.1	79.0	78.9	77.9	75.8	72.7	68.9	63.7	50.8	34.4	100.6
10000.0	32808.0	76.0	73.3	98.8	74.2	69.6	78.9	69.4	79.5	82.4	76.7	76.3	78.0	80.6	79.6	79.4	79.4	77.4	76.0	75.0	78.7	77.2	74.7	75.5	76.9	77.9	77.7	76.6	74.4	71.0	66.8	61.2	47.1	29.4	99.6

Appendix C

Gulf Gateway Deepwater Port: Summary of the Updated Underwater Sound Level Measurement Results

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C1. Introduction

Tech Environmental, Inc. (TE), in cooperation with Tetra Tech EC, Inc. (TtEC), has completed the second comprehensive sound survey of the Excelerate Energy Bridge™ Regasification Vessel (EBRV) the *Excelsio*r while moored at the Gulf Gateway Deepwater Port on August 6 to 9, 2006. The field survey included underwater sound measurements at a site located 116 miles offshore in the Gulf of Mexico (the Gulf). The overall purpose of this survey was to verify measurements completed during the initial sound survey completed March 21 to 25, 2005, and to further document sound levels during additional operational and EBRV maneuvering conditions such as EBRV coupling and decoupling from the buoy system, including the use of stern and bow thrusters required for dynamic positioning. The data collected were also used to confirm theoretical calculations that were employed in supplemental submittals for the Draft Environmental Impact Statement/Environmental Impact Report (Draft EIS/EIR) to assess sound energy generated during closed-loop versus open-loop regasification and offloading operations. In addition to normalizing complex sound components into source terms, data were used to confirm EBRV sound source energy generation and propagation characteristics, and the identification of near-field and far sound fields under different operating and EBRV maneuvering procedures.

These sound measurement data results will be used update the preliminary (and previously estimated) source data that were input into the acoustic model to determine sound effects of the proposed Northeast Gateway Deepwater Port Project (Northeast Port) off the coast of Cape Ann, Massachusetts. The results of this second sound survey will be of further use in the evaluation of the potential for underwater noise impacts on marine life at the Port and future prospective project areas.

C2. Methodology

Acoustic engineers from Tech Environmental, Inc. and Tetra Tech EC, Inc. completed underwater sound level monitoring of operational sounds from the *Excelsior* EBRV at a location about 116 miles offshore in the Gulf of Mexico. The overall purpose of this second sound survey was to document sound levels emitted by the EBRV under operational conditions and maneuvering exercises.

Measurements were made with hydrophones when measuring underwater sound. The survey included measurements to characterize tanker operational sound as a function of operating conditions during closed-loop regasification and offloading. The sound generated by the EBRV is transmitted into the air directly from mechanical equipment located on or near the deck, and into the water primarily through energy transmitted through the EBRV hull. During EBRV maneuvering, sound is generated by the bow and stern thrusters. The survey also included the measurement of baseline sound levels in the Gulf in the vicinity of the Gulf Gateway Deepwater Port. These data were used to subtract out extraneous sounds of wave action against the observation vessel, turbulence around the hydrophone (low frequency), and the general movement of the equipment on the boat by waves (affecting very low frequencies <12 Hz). All engines and mechanical equipment on the observation vessel were shut down and the EBRV was anchored and stationary during all measurements.

Measurement positions and distances from the EBRV relative to the observation vessel were determined using a laser range finder. Measurements were completed at multiple distances and reference hydrophone depths to ensure the most accurate measurement data possible. Measurements were also completed directly from the EBRV deck to determine near-field source levels immediately adjacent to the EBRV hull. All measurements were completed during weather and sea state conditions conducive to accurate acoustic measurement. Measurements included broadband and linear one-third-octave band rms (root mean square) sound pressure levels on a decibel (dB) scale. All measurement equipment used on this Project is laboratory tested regularly according to ANSI requirements to ensure a high degree of measurement accuracy. All equipment meets or exceeds ANSI Type 1 Standards for high precision measurement instrumentation.

Underwater sound measurements were completed with Bruel & Kjaer (B&K) model 8104 hydrophones directly connected to model 824 Larson Davis frequency analyzers. The first 8104 hydrophone was equipped with an integral 100-meter cable allowing for deepwater measurements and measurements made directly from the elevated deck of the EBRV. The second 8104 hydrophone was equipped with an integral 10-meter cable for collecting underwater measurements at depths closer to the surface. Simultaneous underwater measurements at two discrete depths were completed where possible to help isolate EBRV source levels from extraneous source contributions such as surface agitation and sound generated from wave action against the observation boat hull. The B&K hydrophones have a frequency response range of 0.1 Hz to 120 kHz. The frequency range used in the survey was selected to include the known frequencies that are audible for marine animals. On-board calibration of the hydrophone measurement chain was accomplished with a B&K model 4229 Hydrophone Calibrator.

The hydrophone was deployed from the EBRV or observation vessel using a system of flotation devices and weights specifically designed to decouple the hydrophone from the boat's movements. Measurements were logged in 1-second intervals using the "Fast" time constants in order to provide a detailed time history. The resultant sound levels were analyzed and compared to the detailed ship logs of operations. A maximum dBL and range of sound source levels for each operation was developed. For measurements completed from the observation vessel as it drifted alongside the EBRV, the data were corrected for divergence and Gulf seawater absorption rates to calculate source terms. Underwater sound levels are reported without weighting as linear values (dBL). The dB reference level for underwater sound measurements is re: 1 micro Pascal.

C3. Measurement Results

Sources associated with degasification and offloading from the EBRV have been identified in Section 4 of the Draft EIS/EIR. The sound generated by the EBRV is transmitted into the air directly from mechanical equipment located on or near the deck of the ship and into the water primarily by energy transmitted through the ship's hull including sound generated during regasification and offloading into the riser and pipeline. An initial sound survey of underwater and in-air sound generated by the EBRV was taken during LNG regasification and offloading operations in the Gulf (March 21 to 25, 2005). Measurements were conducted at the Gulf Gateway site when the vessel was moored and operating in the open-loop regasification mode. Northeast Gateway has committed to operate the EBRVs calling on the Northeast Port only in the quieter closed-loop regasification mode (and this will be a condition of its license). Operating in the closed-loop regasification mode will reduce underwater sound levels and thereby lower the potential for noise harassment of marine mammals to well below the 120 dB threshold limit for Level B harassment.

The reason for the difference in received sound levels between the modes of operation is that operating in the open-loop regasification mode, the vessel draws in sea water in a once-through use to warm and regasify the LNG. As the water passes through the regasification system operating in open loop, it is discharged below the bow of the vessel through either of two discharge pipes with reducer nozzles (depending upon which bank of vaporizers are being operated) located on the bottom of the hull of the EBRV. The turbulence and substantial amount of air bubbles created by this discharge is one of the principal sources of low-frequency underwater noise represented in the data tables of the Draft EIS/EIR. The difference between open- and closed-loop vaporization noise and the noise signature of an EBRV was conservatively estimated to reduce overall broadband levels by a minimum of 7 dB, given that the significant amount of water discharged in open-loop mode is no longer occurring. This reduction was modeled by using two 0.6-meter diameter pipes discharging vertically downward. The discharge rate is 1.74 cubic meters per second (m^3/s) (27,500 gallons per minute) per nozzle and is equivalent to the flow rates seen on the EBRV during the initial sound sampling at Gulf Gateway. The changes in fluid pressure result in pressure variation, turbulence, and flow noise. The flow noise frequency characteristics are partially dependant on depth. As the depth of the discharge increases (as product is being offloaded), the flow noise also increases and moves to the lower end of the frequency spectrum. This increase in noise is caused by the decrease of pressure with depth, which allows for an increase in the formation of turbulence bubbles. The results of the calculations were confirmed during the second Gulf Gateway survey (August 1 to 5, 2006) with maximum source levels during closed-loop regasification and offloading ranging from 105 dBL (approaching ambient levels immediately adjacent to the EBRV hull) to 111 dBL re 1 μPa at 1 meter, dependant on load and output. Each EBRV is expected to be moored during regasification and offloading for 4 days to 1 week per shipment (continuous sound source).

Once at the buoys, dynamic positioning during EBRV coupling requires the used of thrusters. Field measurements documented during the second Gulf field survey resulted in source levels of 160 to 170 dBL re 1 μPa at 1 meter from normal thruster operations during coupling/decoupling operations and EBRV maneuvering at the Deepwater Port, depending on percent load. Thrusters typically operate for relatively short periods of time and are necessary at EBRV arrival for docking. Thrusters are typically operated intermittently within a 10- to 30-minute total maneuvering period during normal docking procedures and are the dominant source of underwater sound during these activities.

The results of the second sound survey are presented in Table C-1 and can be readily employed to estimate sound levels from similar deepwater port projects. However, sound wave propagation and attenuation underwater is a very complex phenomenon influenced by gradients of temperature, salinity, currents, sea surface turbulence, and bathymetric data as well as existing ambient ocean sound levels. Research has shown spherical wave spreading, together with seawater absorption, provides a reasonable fit to measured underwater sound levels under a wide variety of conditions. For sound transmission loss in the open ocean, empirical data show spherical wave spreading explains measured sound levels near the source. Because the ocean is bounded at the surface and bottom, a transition from spherical wave spreading to cylindrical wave spreading occurs for distances that are very large compared to the depths of the water. Therefore, for higher energy sound source levels and long-distance propagation scenarios, divergence based on water column depth and source frequency components will need to be incorporated into the modeling analysis.

C4. Conclusions

Tech Environmental, Inc., in cooperation with Tetra Tech, EC, Inc., completed an investigation of the underwater sound radiated by Excelerate Energy's EBRV moored at the Gulf Gateway Deepwater Port. The results of these measurements can be used for subsequent siting studies and impact analyses. The following conclusions are drawn:

NMFS has established guidelines for what constitutes harassment and acoustic takes on marine mammals under the Marine Mammal Protection Act (MMPA) and the Endangered Species Act (ESA). Two levels of harassment have been defined in the MMPA: Level A harassment with the potential to injure a marine mammal in the wild, and Level B harassment with the potential to disturb a marine mammal in the wild by causing disruption to behavioral patterns such as migration, breeding, feeding, and sheltering. The current thresholds are 180 dBL for Level A harassment, and 160 dBL (impulse) and 120 dBL (continuous) for Level B harassment. The results of this second sound survey clearly demonstrate that during closed-loop regasification, maximum continuous underwater sound levels are well below the NMFS 120 dBL criteria level. Under no circumstances are exceedances of the 180 dBL Level A harassment criteria expected.

Underwater sound generated during EBRV maneuvering (use of bow and stern thrusters) at the Gulf Gateway Deepwater Port were documented at levels well below the conservative estimates used in the Draft EIS/EIR and supporting acoustic modeling calculations. Revisions to the acoustic modeling will be necessary to provide a more accurate characterization of resultant underwater sound levels during these conditions.

Table C-1: Summary of Maximum Underwater Sound Source Levels During Deepwater Port Operation and EBRV Maneuvering Exercises

Sound Source	Sound Source Level (dBL re 1 µPA at 1 meter)
Operation	
Closed-Loop Regasification and Offloading	<105 to 111
EBRV Maneuvering	
Coupling (Dynamic Positioning Using Thrusters)	160 to 170

Appendix D

Northeast Gateway Construction Marine Mammal Sightings and Take Summary Report

A summary of marine mammal sightings for the Northeast Gateway Construction Project have been compiled for data collected between 26 May 2007 and 31 October 2007. There have been six vessels working on the project between this time period with a maximum of three vessels working during any one time period. There were 4 MMOs assigned to each construction vessel and observation was conducted 24 hours per day. Table 1 shows the total number of work days for each vessel and the total number of sightings per month as well as the sightings per observer day per month. Results are shown graphically in figure 1.

Table 1. Monthly sighting summary

Number of Observation Days per vessel (approx.)	May	Jun	Jul	Aug	Sep	Oct
Lonestar (Anchored)	**4**	**29**	**0**	**0**	**0**	**0**
Atlantic (Anchored)	**0**	**24**	**31**	**31**	**30**	**31**
Jumbo Javelin (DP)	**0**	**0**	**9**	**27**	**0**	**0**
Agnes Candies (DP)	**0**	**0**	**0**	**19**	**11**	**6**
Island Vanguard (DP)	**0**	**0**	**0**	**13**		**0**
Texas (DP)	**0**	**0**	**0**	**6**	**30**	**30**
TOTAL OBSERVER DAYS	**4**	**53**	**40**	**96**	**74**	**67**
# (#) = Number of sighting per species (number of sightings per observer day)	**May**	**Jun**	**Jul**	**Aug**	**Sep**	**Oct**
Humpback	4 (1)	5 (0.09)	10 (0.25)	54 (0.56)	117 (1.58)	42 (0.63)
Fin	0 (0)	2 (0.04)	7 (0.18)	22 (0.23)	27 (0.36)	8 (0.12)
Minke	0 (0)	1 (0.02)	11 (0.27)	6 (0.06)	10 (0.13)	0 (0)
UID Whale	0 (0)	0 (0)	5 (0.13)	27 (0.28)	9 (0.12)	3 (0.04)
AWS Dolphin	0 (0)	0 (0)	0 (0)	1 (0.01)	3 (0.04)	6 (0.09)
Seal (Harbor & Gray)	0 (0)	0 (0)	10 (0.25)	5 (0.05)	1 (0.01)	1 (0.01)
Other Marine Mammal *	1 (0.25)	0 (0)	3 (0.08)	1 (0.01)	0 (0)	0 (0)
Marine Turtle	0	0	0	1	0	0

Number of Observation Days per vessel (approx.)	May	Jun	Jul	Aug	Sep	Oct
Lonestar (Anchored)	4	29	0	0	0	0
Atlantic (Anchored)	0	24	31	31	30	31
Jumbo Javelin (DP)	0	0	9	27	0	0
Agnes Candies (DP)	0	0	0	19	11	6
Island Vanguard (DP)	0	0	0	13		0
Texas (DP)	0	0	0	6	30	30
TOTAL OBSERVER DAYS	4	53	40	96	74	67
# (#) = Number of sighting per species (number of sightings per observer day)	May	Jun	Jul	Aug	Sep	Oct
	(0)	(0)	(0)	(0.01)	(0)	(0)

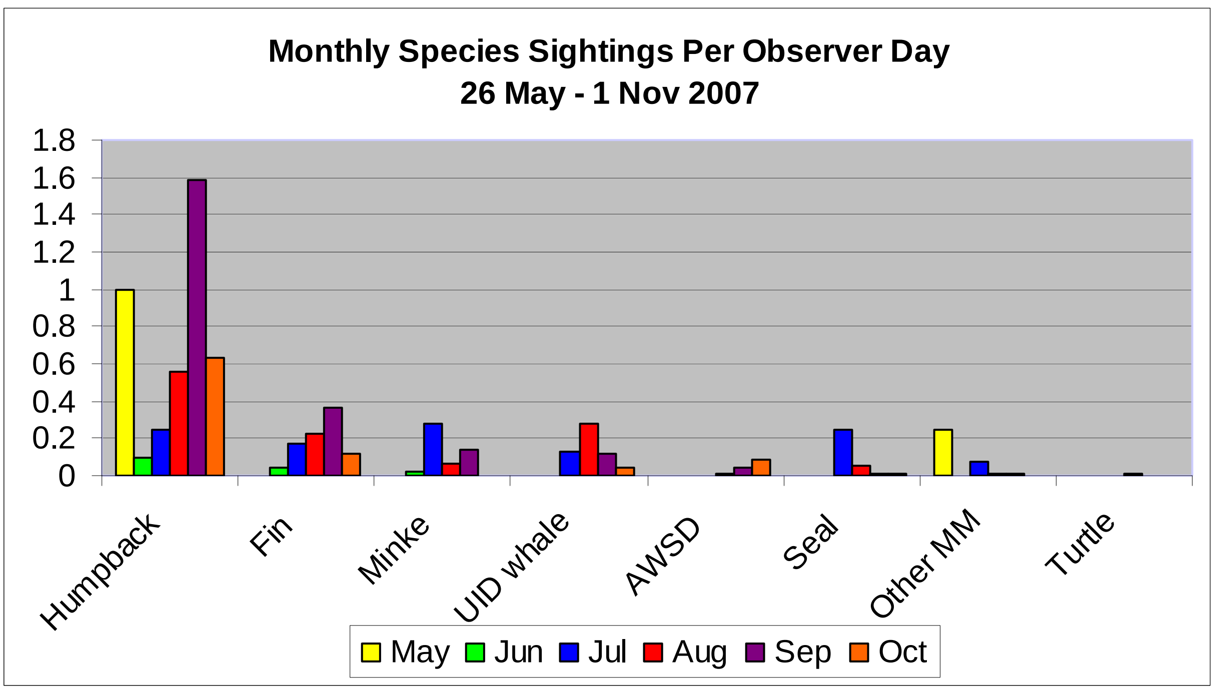

Figure 1. Monthly species sightings per observer day.

Distances were calculated for different categories defined by regulations and biological opinions. Only species defined in the IHA (Fin, Humpback, NARW) were used for these calculations and only those sighting records with a closest vessel distance of 2 miles (3500 yrds) or less. Sightings were summaries in 4 categories. The first category includes any sightings within the general marine mammal exclusion of 100yrds. The second category is any sightings recorded between the outer edge of the general marine mammal exclusion zone and the outer edge of the NARW exclusion zone (101 – 500yrds). The third category is defined as the outer edge of the NARW exclusion zone to 0.5 miles from the vessel. One-half mile was used as a defining distance because it is mentioned in all regulatory documents as the presumed distance of sufficient visibility for marine mammal observers to detect and identify marine mammals within the project area. Table 2 lists the number of sightings and individuals for each distance category.

During visual observation it is likely that an animal is recorded multiple times, particularly when viewed from different vessels or locations within the project site. Upon examination of the sighting data for animals recorded within 2 miles (3500 yards) of the observer, we determined that sighting records within 30 minutes of one another and within the same general bearing and distance were duplicate records. Records within 500yrds of the vessel had very low (~1.5%) duplication, this duplication came mainly in the number of individuals and not in the number of sighting records. Record duplication increased with distance. We calculated the duplication percentage for all sightings of Fin and Humpback whales recorded at distances of greater than 500yrds from the vessel. We calculated a conservative estimate of duplication for each of the two whale species in the analysis. We estimated that 25% of all fin whale sightings were duplications and 40% of all humpback sightings were likely duplications. The actual duplication number is probably higher. We then calculated the same records for only DP vessels. (Table 3)

Table 2. Summary of distance data for all vessels (Data compiled through 321 Oct 07)

		0-100 yrds	101-500 yrds	501-880 yrds		0.5 miles or less	880-3500 yrds	Total affected area
All Vessels	Description of location	General Exclusion Zone	Exclusion zone to NARW Exclusion zone	NARW exclusion zone to 0.5 mile (corrected with % duplication)	Total for 0.5 miles or less	25% duplication in Fin sightings 40% duplication in HB sightings beyond 500 yrds	0.5 mile to 2 mile (% duplication)	Corrected Numbers from 0 - 2 miles
Fin	*Individuals*	2	12	7 (6)	21	20	35 (26)	46
	Sightings	2	9	6 (5)	17	16	24 (18)	34
Humpback	*Individuals*	30	23	47 (28)	100	81	111 (67)	148
	Sightings	21	16	23 (14)	60	51	52 (31)	82

Table 3. Summary of distance data for DP vessels only (Data compiled through 321 Oct 07)

		0-100 yrds	101-500 yrds	501-880 yrds		0.5 miles or less	880-3500 yrds	Total affected area
DP Vessels Only	Description of location	General Exclusion Zone	Exclusion zone to NARW Exclusion zone	NARW exclusion zone to 0.5 mile (corrected with % duplication)	Total of 0.5 miles or less	25% duplication in Fin sightings 40% duplication in HB sightings beyond 500 yrds	0.5 mile to 2 mile	Corrected Numbers from 0 - 2 miles
Fin	*Individuals*	0	8	4 (3)	12	11	31 (23)	34
	Sightings	0	6	4 (3)	10	9	20 (15)	24
Humpback	*Individuals*	11	17	27 (16)	55	44	71 (43)	87
	Sightings	11	12	12 (7)	35	30	30 (18)	48

Take assessment can be approached in a number of ways, but should only include the DP vessels that utilize thrusters for positioning. Using the 100-yrd and 500-yrd exclusion zones as the location for takes under the IHA:

- We have not exceeded the allowance of right whales (0/3)
- We have not exceeded the allowance of Fins (0/13)
- We have not exceeded the allowance of Humpbacks (11/24)

If we use the assumption that 0.5 miles is the acceptable visual detection distance that can be applied for assessing takes and use only sighting records and not individuals due to probable high duplication in individual numbers

- We have not exceeded the allowance for Right Whales (0/3)
- We have not exceeded the allowance for Fins (11/13)
- We have exceeded the allowance for Humpbacks (30/24)

In the worst case situation where we use 2.0 miles of influence and use the individual animal numbers:

- We have not exceeded the allowance for Right Whales (0/3)
- We have exceeded the allowance for Fins (34/13)
- We have exceeded the allowance of Humpbacks (87/24)

Hopefully this helps out in sorting out the sighting records in relation to takes and other regulatory requirements. Please keep in mind that these numbers are rough and a number of assumptions have been made. There may be minor adjustments made in the final logs after careful review of individual sighting records and field notes. There is likely to be greater differences in the numbers of individuals than the number of sighting records due to duplication and this will increase with distance. Please let me know if you need further information.