October 30, 2006

Ken Hollingshead
Office of Protected Species
National Marine Fisheries Service
1315 East West Highway, Silver Spring, MD 20910

RE: Northeast Gateway Deepwater Port Project –Docket Number USCG-2005-22219
Incidental Harassment Authorization Request

Dear Mr. Hollingshead:

Northeast Gateway Energy Bridge™ L.L.C. (Northeast Gateway) and Algonquin Gas Transmission, LLC (Algonquin) submit this request in accordance with 50 CFR 216.104 for Incidental Harassment Authorizations (IHAs) for the taking of small numbers of marine mammals incidental to the proposed action described herein or to make a finding that incidental take is unlikely to occur.

On June 13, 2005, Northeast Gateway submitted an application to the U.S. Coast Guard (USCG) and Maritime Administration (MARAD) seeking a federal license under the DWPA to construct, own, and operate a deepwater Port for the import and regasification of LNG located approximately 13 miles (21 kilometers) offshore of Gloucester, Massachusetts in federal waters approximately 270 to 290 feet (82 to 88 meters) in depth. This facility will deliver regasified LNG to onshore markets via new and existing pipeline facilities owned and operated by Algonquin Gas Transmission Company (Algonquin). Simultaneous with this filing, Algonquin, a subsidiary of Duke Energy Gas Transmission, filed a Natural Gas Act Section 7(c) application with the Federal Energy Regulatory Commission (FERC) for a Certificate of Public Convenience and Necessity to build and operate a new, 16.06-mile (25.8 kilometers) long, 24-inch (61-centimeter) outside diameter natural gas pipeline lateral (Pipeline Lateral) to interconnect the Port to Algonquin's existing offshore natural gas pipeline system in Massachusetts Bay (HubLine)[1] (FERC Docket Number CP05-383-000).

The USCG published a final Environmental Impact Statement/Environmental Impact Report (FEIS/EIR) for the proposed Northeast Gateway Port and Pipeline Lateral on October 26, 2006. This document provides detailed information on the proposed project facilities, construction methods and analysis of potential impacts on marine mammal. The FEIS/EIR is incorporated herein by reference (USCG, 2006).

[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, L.L.C. Phase III Pipeline in Salem Harbor and runs offshore to the south to the Algonquin "I" System Pipeline in Weymouth.

Please feel free to call me at (832) 813-7629 or Greg Green with Tetra Tech ECI at (425) 482-7795 if you have any questions.

Mike Trammel

Mike Trammel
Director – Environmental
Northeast Gateway, L.L.C.

Cc: Mark Prescott, USCG
Keith Lesnick, MARAD
Patience Whitten, USCG
Project File - NEG

Northeast Gateway Energy Bridge, L.L.C. 1330 Lake Robbins Drive Suite 270 The Woodlands, Texas 77380 TEL 832.813.7100 FAX 832.813.7100

Application for Incidental Harassment Authorization for the Non-Lethal Taking of Marine Mammals in Conjunction with

Northeast Gateway Energy Bridge™ Deepwater Port
and
Northeast Gateway Pipeline Lateral

Prepared by:

Northeast Gateway Energy Bridge, L.L.C.
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Waltham, MA 02451

October, 2006

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Northeast Gateway Energy Bridge™ L.L.C. (Northeast Gateway) and Algonquin Gas Transmission, LLC (Algonquin) submit this request for Incidental Harassment Authorizations (IHAs) under 50 CFR 216.104.

50 CFR 216.104 "Submission of Requests"
(a) In order for the National Marine Fisheries Service (NMFS) to consider authorizing the taking by U.S. citizens of small numbers of marine mammals incidental to a specified activity (other than commercial fishing), or to make a finding that incidental take is unlikely to occur, a written request must be submitted to the Assistant Administrator. All requests must include the following information for their activity:

1.0 A Detailed Description of the Specific Activity or Class of Activities That Can Be Expected to Result in Incidental Taking of Marine Mammals

Northeast Gateway is proposing to construct, own and operate the Northeast Gateway Deepwater Port (Port or Northeast Port) to import liquefied natural gas (LNG) into the New England region. The Port, which will be located in Massachusetts Bay, will consist of a submerged buoy system to dock specifically 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 will deliver regasified LNG to onshore markets via new and existing pipeline facilities owned and operated by Algonquin. Algonquin will build and operate a new, 16.06-mile (25.8 kilometers) long, 24-inch (61-centimeter) outside diameter natural gas pipeline lateral (Pipeline Lateral) to interconnect the Port to Algonquin's existing offshore natural gas pipeline system in Massachusetts Bay (HubLine)[1].

The Port will consist of two subsea Submerged Turret Loading™ (STL™) buoys, each with a flexible riser assembly and a manifold connecting the riser assembly, via a steel flowline, to the subsea Pipeline Lateral. Northeast Gateway will utilize vessels from its current fleet of specially designed Energy Bridge™ Regasification Vessels (EBRVs), each capable of transporting approximately 2.9 billion cubic feet (Bcf; 82 million cubic meters) of natural gas condensed to 4.9 million cubic feet (138,000 cubic meters) of LNG. Northeast Gateway will add vessels to its fleet that will have a cargo capacity of approximately 151,000 cubic meters. The proposed mooring system to be installed at the 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 EBRVs 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 will be 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 Maritime Administration (MARAD) seeking a federal license under the DWPA to own, construct, and operate a deepwater Port for the import and regasification of LNG in Massachusetts Bay, off of the coast of Massachusetts. The project was assigned Docket Number USCG-2005-22219. Simultaneous with this filing, Algonquin), a subsidiary of Duke Energy Gas Transmission, filed a Natural Gas Act Section 7(c) application with the Federal Energy Regulatory Commission (FERC) for a Certificate of Public Convenience and Necessity for the 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 published a final Environmental Impact Statement/Environmental Impact Report (FEIS/EIR) for the proposed Northeast Gateway Port and Pipeline Lateral on October 27, 2006. This document provides detailed information on the proposed project facilities, construction methods and analysis of potential impacts on marine mammal. The FEIS/EIR is incorporated herein by reference (USCG, 2006).

[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, L.L.C. Phase III Pipeline in Salem Harbor and runs offshore to the south to the Algonquin "I" System Pipeline in Weymouth.

1.1 Construction Activities

Construction of the Pipeline Lateral and Northeast Gateway Port includes the installation of the "hot tap" on the existing HubLine pipeline; the lay, burial, and commissioning of the Pipeline Lateral commencing at the hot tap and extending to a location near the Northeast Port; and the installation of the Northeast Port buoys, risers, pipeline end manifolds (PLEMs), and flowlines. The Port and Pipeline Lateral will be constructed during the May to November timeframe.

1.1.1 Pipeline Construction

In general, traditional marine pipeline construction vessels and equipment will be utilized to construct the Pipeline Lateral. The pipeline will be buried such that the top of the pipeline is a minimum of 1.5 feet (0.46 meter) below the seabed with a target burial depth of 3 feet (.92 meter). In limited areas, primarily at the crossing of the Hibernia Atlantic communications cable and at any sites not feasible to plow due to unforeseen subsurface conditions, the pipeline will be laid on the surface and armored with rock or concrete mats.

Pipeline trenching operations in the marine environment will cause a temporary re-suspension of some bottom sediments off the seafloor and into the water column. Plowing produces a very minor plume because it involves a mechanical process of cutting a trench under the pipeline and displacing the sediment spoil off to the side. The short sections where jetting may occur will create a minor localized plume because the jetting process involves injecting high-pressure sea water into the sediments to fluidize them, and compressed air to lift sediments out of the trench and discharge the spoil to either side. The resulting sediment plumes are exposed to currents that have the potential to carry the plume short distances into the surrounding environment. Impacts to the water column, resulting from the presence of the sediment plume, are temporary and localized due to the nature of the plowing and backfill plowing activities, which are the least sediment-disturbing means of creating a trench for the pipeline and returning cover over the pipe in the trench. The spatial extent is also limited due to the short time period that material stays in the water column and rapid dilution in an open ocean setting. Jetting will only occur in short, discrete sections and will therefore only create localized and temporary plumes; albeit, at the jetting devices these plumes would be more concentrated and larger than for plowing and backfill plowing.

Construction of the Northeast Gateway Project will require offshore construction techniques that are briefly described herein and in further detail in the FEIS/EIR. The activities will be performed in the general sequence as follows:

Construction Activity	Vessel Type
Hot tapping of the HubLine pipeline	Dive Support Vessel (DSV)
Preparation of the Hibernia cable crossing and removal of any obstructions along the pipeline route.	DSV
Fabrication and laying of the Pipeline Lateral on the seafloor.	Derrick Lay Barge
Trenching in or lowering of the Pipeline Lateral by plowing will be done following pipe lay. Some short sections will require use of a jetting tool to lower the pipeline.	Derrick Barge
No blasting will be required for Port or Pipeline Lateral construction.	N/A
Filling pipe with sea water prior to backfilling.	DSV
Covering the pipe in the trench with sediment using a backfill plow.	Derrick Barge
Hydrostatic testing, tying-in and drying the pipeline following burial of the pipeline and its components.	DSV

Hydrostatic testing will incorporate a mesh screen sized to prohibit entrainment of sea turtles.	DSV
Placement of sand and/or rock at discrete tie-ins, side taps, and other remedial locations and performing final surveying activities.	Derrick Barge

Delivery of pipe may require transiting through the Cape Cod Canal (Canal). If required, vessels will follow the westernmost route through Cape Cod Bay proposed in the Port Access Route Study (PARS) and avoid whale identified aggregations in the eastern portion of Cape Cod Bay. To the extent practicable, pipe deliveries will be avoided during the January to May timeframe. In the unlikely event the Canal is closed during construction, the pipe haul barges would come around the Cape following the traffic separation scheme (TSS) and appropriate measures agreed to for the EBRVs when transiting to the Port.

The construction barges used to fabricate and lay the pipeline on the seafloor, pull the pipeline plow along the laid pipeline, and pull the backfill plow along the trenched pipeline will be positioned and advanced along the route using a series of anchors. Approximately 2- to 3-inch diameter steel cable is let out or hauled in to move the barge. The anchors are positioned using anchor handling tugs, and mid-line buoys are used to help hold much of the cable off the seafloor. In addition to the barges and tugs, pipeline construction will require the use of pipe-haul barges pulled by tugs, crew and supply vessels, survey vessels, and dive support vessels (DSVs). The types of vessels that could be used in construction of the Pipeline Lateral are described in Table 1-1.

Table 1-1. Characteristics of Vessels Involved in Pipeline Lateral Construction

Vessel	Horsepower	Estimated Time on Station	Thruster Equipped
DSV 1	8,900	24hrs/day for 180 days	Yes
DSV 2	8,900	24hrs/day for 180 days	Yes
Crew/Supply Barge	2,500	12 hrs/day for 105 days	No
Derrick Lay Barge	6,685	24hrs/day for 45 days	No
Anchor Tug 1	4,200	24 hrs/day for 45 days	No
Anchor Tug 2	4,200	24 hrs/day for 45 days	No
Derrick Barge (Plow/Backfill Plow)	6,685	24rs/day for 60 days	No
Anchor Tug 1	4,200	24 hrs/day for 60 days	No
Anchor Tug 2	4,200	24 hrs/day for 60 days	No
Pipe Haul Barge Tug 1	4,200	8 hrs/day for 40 days	No
Pipe Haul Barge Tug 2	4,200	8 hrs/day for 40 days	No
Pipe Haul Barge Tug 3	4,200	8 hrs/day for 40 days	No
110-foot Survey Vessel	2,500	24 hrs/day for 90 days	No
Tremie Barge	5,685	6 hrs/day for 11 days	No

During the pipe laying, plowing and backfill plowing activities, the vessel position and movement is controlled by anchors.

The operation of the Dynamically Positioned (DP) DSVs differs from the operation of the pipe lay/plow construction vessels in that this vessel will primarily hold its position at a single location. The vessel will periodically relocate from one position to another, but during the process of performing diving activities; the vessel is required to maintain its position at a single location. The DSV maintains its position or stationing with the use of thrusters. The importance of maintaining the position of the vessel is a demand that cannot be compromised. As a DSV, most of its time will be spent providing the surface support for a diver or divers operating on the seabed. The safety of the diver is paramount to the operation of the vessel and its station-keeping capabilities.

In general, the DP vessels are fitted with three main types of thrusters: main propellers, tunnel thrusters, and azimuth thrusters. Main propellers, either single or twin screw, are provided in a similar fashion to conventional vessels. In addition to main propellers, a DP must have well-positioned thrusters to control position. Typically, a conventional monohull-type DP vessel will have six thrusters, three at the bow and three aft. Forward thrusters tend to be tunnel thrusters, operating athwart ships. Two or three tunnel thrusters are usually fitted in the bow. Stern tunnel thrusters are common, operating together but controlled individually, as are azimuth or compass thrusters aft. Azimuth thrusters project beneath the bottom of the vessel and can be rotated to provide thrust in any direction

Sound generated by vessel and barge movements and the thrusters of DP vessels will be the dominant source of underwater sound during pipeline construction activities. Auxiliary equipment including onboard generators and compressors, winches, tensioners, cranes, pumps, and sonar and survey equipment are considered secondary in comparison, by at least one order of magnitude. The sound energy generated by onboard mechanical equipment is effectively dampened by the hull of the vessel, in comparison to thruster and propeller sounds, which is driven by cavitations that are occurring directly in the water. Sounds generated by construction activity occurring above water, including impact noise, are subject to a large transmission loss when moving across the water-air interface from the in-air source to the underwater receiver due to the impedance mismatch between these two fluids.

1.1.2 Port Construction

For each buoy, construction of the Northeast Port will involve the installation of the steel flowline section and eight mooring anchors, followed by installation of the PLEM, spoolpieces, riser, control umbilical, and STL™ buoy. Conventional marine pipeline construction and installation techniques will be employed with consideration of site-specific conditions and requirements at the mooring locations. Development of the Gulf Gateway Deepwater Port and several projects in the North Sea, have provided extensive experience with these construction techniques.

The proposed design for the STL™ buoy incorporates eight mooring anchors in a spoked wheel-shaped array to hold the buoy in place. Based on preliminary soil data, a system of suction anchors is planned. A mooring ground chain is attached to the side of the suction anchor cylinder, and embeds along with the cylinder. Final anchor placement will be accomplished using a DP anchor handling vessel (AHV).

The preferred installation method for each of the STL™ buoys involves transporting the buoy from an onshore mobilization site and pre-connecting all eight wire rope segments to the buoy while it is onboard the DSV. The buoy is placed in the water and temporarily secured with synthetic lines to two of the mooring chains already deployed on the seafloor during the suction anchor installation. A diver-operated connection frame, utilizing hydraulic cylinders to facilitate positioning, will be used to connect each wire rope to its respective anchor chain on the seafloor. When all eight mooring lines are connected, the clump weight is retrieved and the buoy is released from the clump weight to float at its submerged draft.

The PLEM will either be lowered and embedded (suction-pile foundation) similar to that used to install the mooring anchors or lowered and placed on the seabed with penetration accomplished by the dead weight of the PLEM. The PLEM will be set in place by an anchor-moored derrick barge.

Due to the equipment fitted to the PLEM requiring a vertical and heading-controlled orientation, it will be lifted by crane or by use of an A-frame and set into the water, rather than lowered over the stern of the vessel. The flexible riser will be transported on a reel on the dynamically positioned installation vessel and will be unreeled over a lay arch (an installation aid that controls the curvature of the flexible riser) into position in the water. A temporary pull line running through the center of the STL™ buoy will be connected to the end of the flexible riser, and will be used to thread the riser through the center of the buoy, where it will be secured. As the remainder of the riser is deployed into the water, buoyancy will be achieved at pre-determined locations to form the "S" shape. The PLEM end of the riser will be lowered to the seafloor, where divers will attach it to the PLEM. A hydraulic torque tool will secure the bolts to the specification of the flange manufacturer. The flowline between the Pipeline Lateral and each PLEM will likely be installed by the moored construction vessel that lays the Pipeline Lateral.

Steel spoolpieces will be fabricated and installed as part of the buoy system installation. Saturation divers will make the spoolpiece connections supported by a DP vessel.

The types of vessels used in construction of the Port are described in Table 1-2.

Table 1-2. Characteristics of Vessels Involved in Port Construction

Vessel	Horsepower	Estimated Time on Station	Thruster Equipped
AHV	12,000	24hrs/day for 34 days	No
DSV	10,000	24hrs/day for 88 days	Yes
Restoration Vessel	4,800	24hrs/day for 14 days	Yes
Crew Boat	1,200	24rs/day for 28 days	No

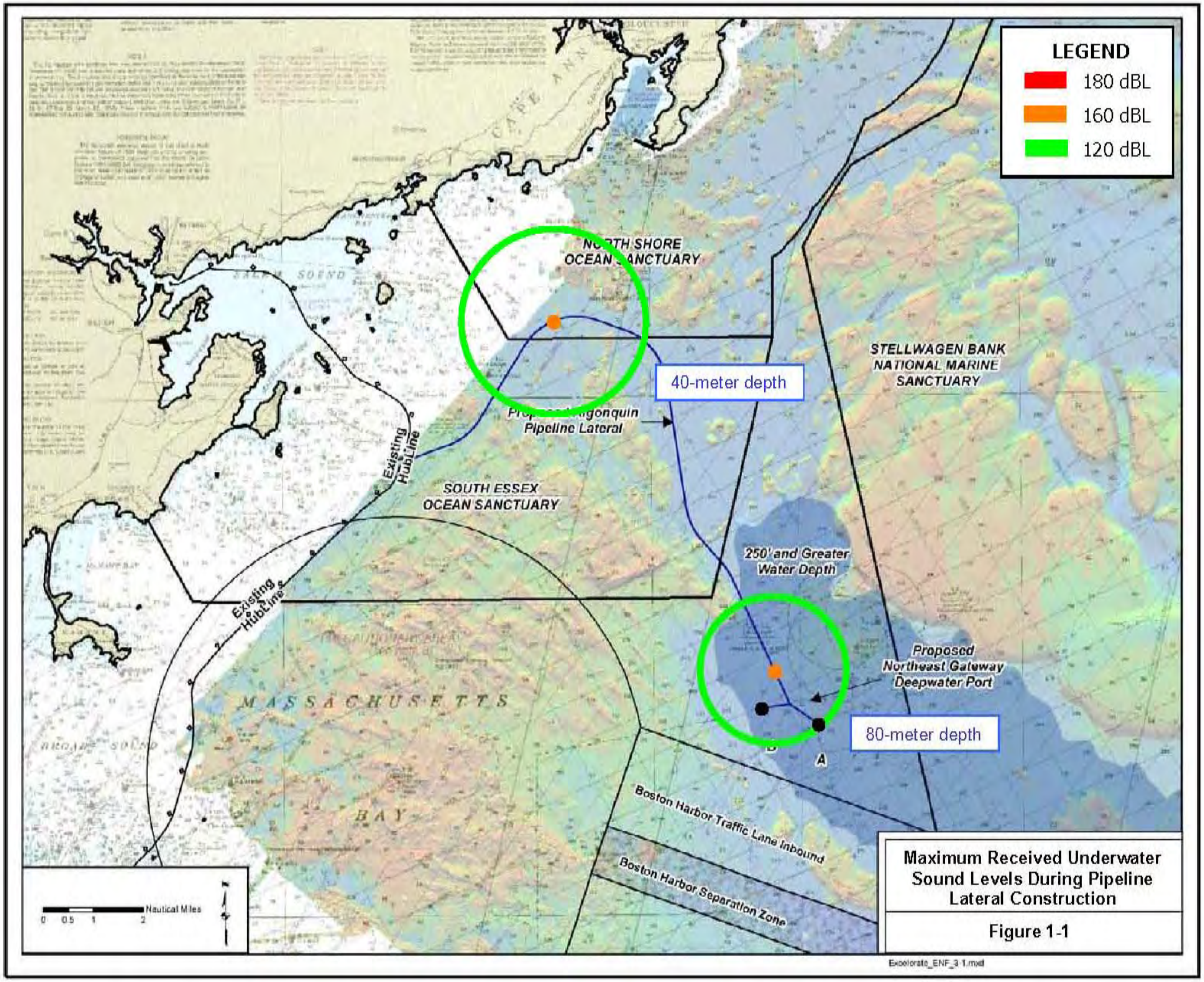
As described in Section 1.1.1 for the pipeline construction scenario, sound generated by vessel and barge movements and the thrusters of DP vessels will be the dominant source of underwater sound during Port construction activities.

1.1.3 Construction Noise

Acoustic analyses were completed for activities related to construction of the Port and Pipeline Lateral. Activities considered potential noise sources include trenching (plowing and jetting at isolated locations), lowering of materials (pipe, anchors, chains, PLEM, and spool pieces), and vessel operations (engine-driven vessel movements or maintaining station by use of thrusters). Of these potential noise sources, vessel movements and thruster use for dynamic positioning are the dominant sources by at least one order of magnitude. Simulated vessels were positioned at two discrete locations along the proposed pipeline alignment closest to the Stellwagen Basin National Marine Sanctuary (SBNMS), as well as centered on the easterly Port buoy location. (See Appendix A for a discussion of the acoustic modeling methodology used for this analysis.) Figure 1-1 presents the results of the acoustic modeling for construction vessels operating at two depth locations along the Pipeline Lateral (40 meters and 80 meters) with source levels ranging from 140 to 160 dBL re 1 μPa at 1 meter for construction vessel movements to 180 dBL re 1 μPa at 1 meter for vessel thrusters used for dynamic positioning. Due to water column depth dependencies, the isopleths distance from source vary with construction activities occurring in shallower depths resulting in increased impact distances. Figure 1-2 shows a similar acoustic impact analysis of construction vessels operating simultaneously at the Port with the same estimated construction source levels. The resultant contour plots present the worst-case instantaneous received sound level, the dominant source being the use of vessel thrusters.

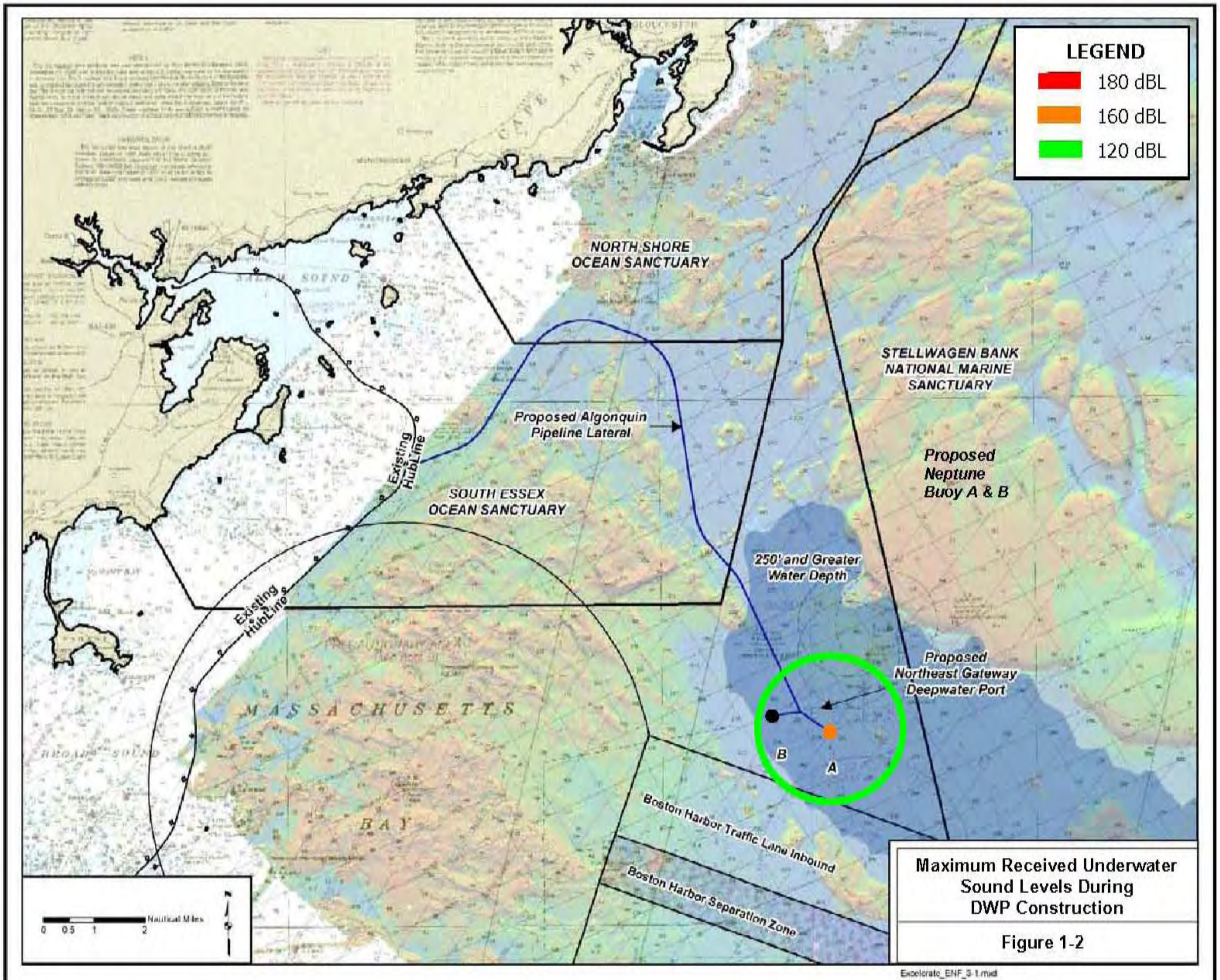
Thrusters used during construction activities are operated intermittently and only for short durations of time. For a water column depth of 80 meters, representative of the immediate area near the Deepwater

Port, the linear distance to the 120 dBL isopleths would extend 2,560 meters, resulting in an area of 120 dBL esonification of 20.6 square kilometers. For a water column depth of 40 meters, representative of northern sections of the Pipeline Lateral, the linear distance to the 120 dBL isopleths is 3,310 meters resulting in an area of esonification of 34.4 square kilometers. The non-continuous short-term sounds generated by construction of the Pipeline Lateral will be above the 120 dB criteria. Exceedances of the 160 dB impulse criteria (defined as a brief sound with a fast rise time) will be very localized and will not extend beyond the immediate area where construction activities are occurring for both the Pipeline Lateral and Deepwater Port construction scenarios.



Maximum Received Underwater Sound Levels During Pipeline Lateral Construction

Figure 1-1



Maximum Received Underwater Sound Levels During DWP Construction

Figure 1-2

1.2 Operations

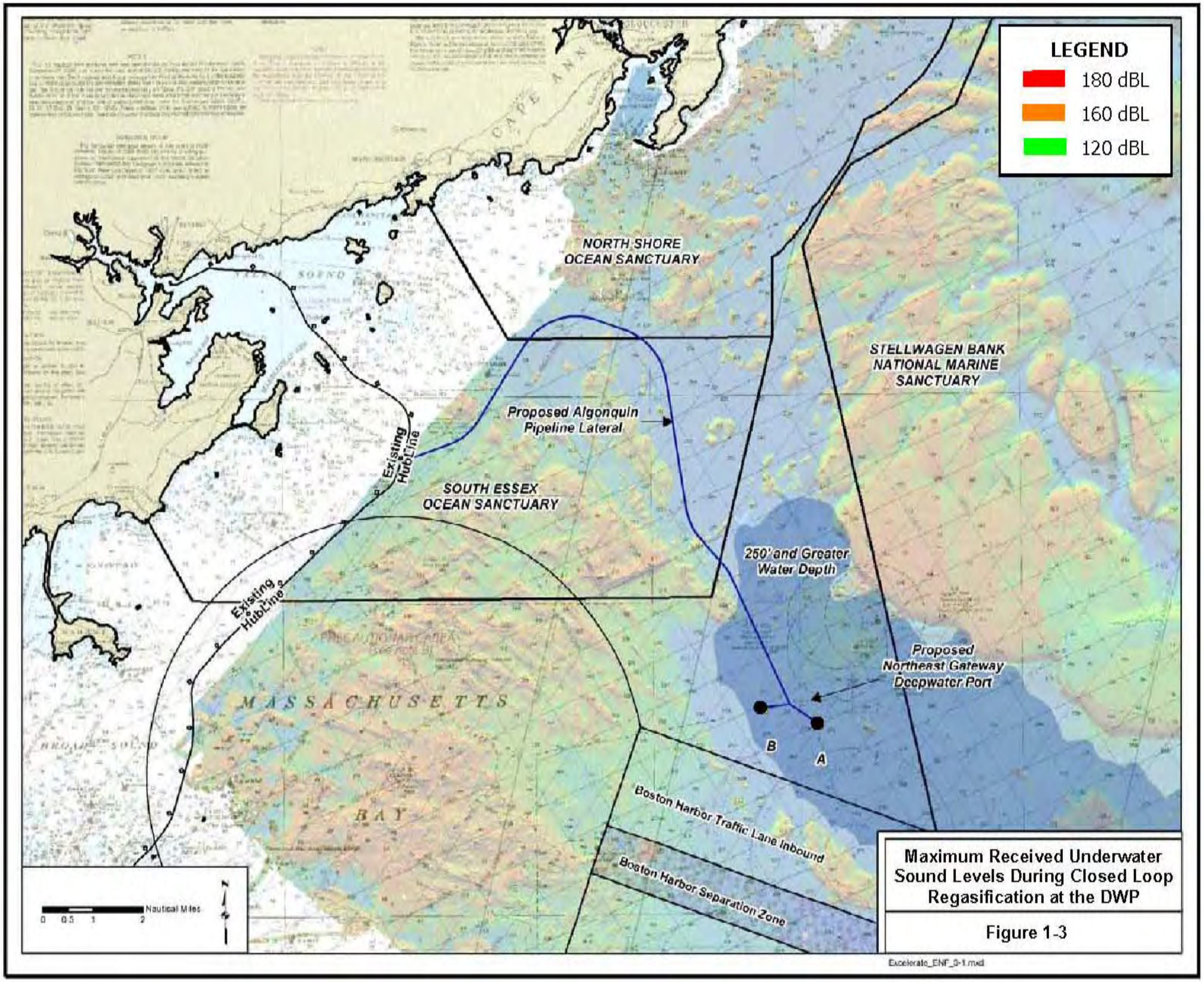
As an EBRV makes its final approach to the Port, vessel speed will gradually be reduced to 3 knots at 1.86 miles out to less than 1 knot at a distance of 1,640 feet from the Port. When an EBRV arrives at the Port, it will retrieve one of the two permanently anchored submerged STL™ buoys. It will make final connection to the buoy through a series of engine and bow thruster actions. The EBRV 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 EBRV will 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 EBRV through the STL™ buoy and flexible riser via a steel flowline leading to the connecting Pipeline Lateral. When the LNG vessel is on the buoy, wind and current affects 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.

1.2.1 Port Operations Noise

Underwater sound generated during Port operation is limited to regasification and EBRV maneuvering during coupling and decoupling with STL™ buoys. Sound propagation calculations (see Section 1.1.3 for methodology and acoustic concepts) used source data included measurements collected on August 6 to 9, 2006 from the *Excelsior* EBRV while it was moored at the operational Gulf Gateway Deepwater Port located 116 miles offshore in the Gulf of Mexico (the Gulf). The overall purpose of this survey was to verify measurements completed during the first sound survey completed March 21 to 25, 2005 when the *Excelsior* first visited the Port and to further document sound levels during additional operational and EBRV maneuvering conditions, including the use of stern and bow thrusters required for dynamic positioning during coupling. The recently collected data were used to confirm theoretical calculations 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 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 data were used to model underwater sound propagation at the Northeast Gateway site. The pertinent results of the field survey are provided as underwater sound source pressure levels (dB re 1 μPA at 1m) as follows:

- Sound levels during closed-loop regasification ranged from 104 to 110 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 1-3 and 1-4 present the net acoustic impact of one EBRV operating at the Deepwater Port. Figure 1-3 presents the maximum received underwater sound levels impact during closed-loop EBRV 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 esonification above the 120 dBL criteria. Figure 1-4 presents maximum underwater sound levels during EBRV 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 resultant 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 EBRV coupling operations are occurring.


LEGEND
180 dBL
160 dBL
120 dBL
NORTH SHORE
OCEAN SANCTUARY
STELLWAGEN BANK
NATIONAL MARINE
SANCTUARY
Proposed Algonquin
Pipeline Lateral
Existing
HubLine
SOUTH ESSEX
OCEAN SANCTUARY
250' and Greater
Water Depth
Existing
HubLine
Proposed
Northeast Gateway
Deepwater Port
MASSACHUSETTS
BAY
B
A
Boston Harbor Traffic Lane Inbound
Boston Harbor Separation Zone
Nautical Miles
0 0.5 1 2
CAPE ANN
Maximum Received Underwater
Sound Levels During Closed Loop
Regasification at the DWP
Figure 1-3
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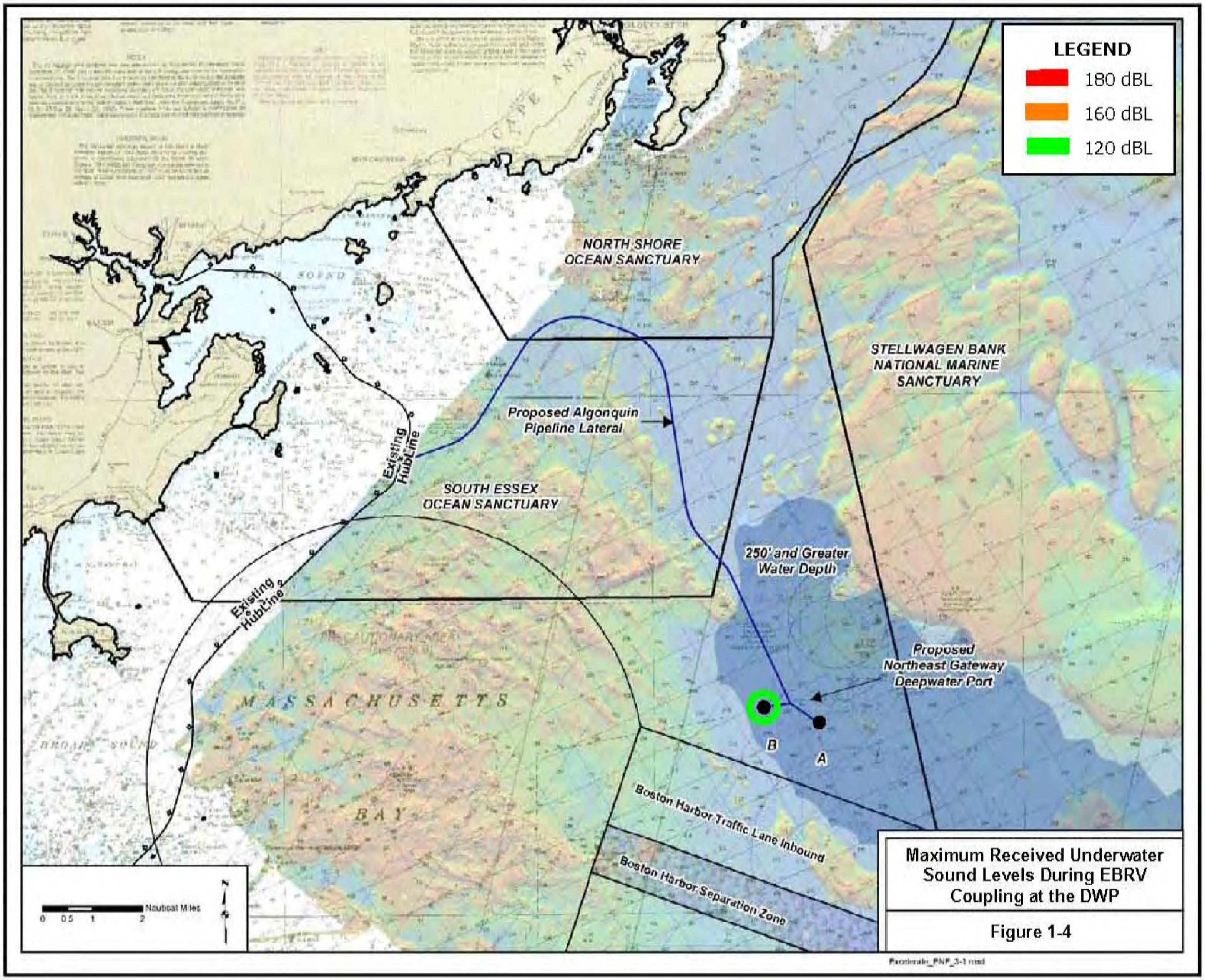
LEGEND
180 dBL
160 dBL
120 dBL
NORTH SHORE
OCEAN SANCTUARY
STELLWAGEN BANK
NATIONAL MARINE
SANCTUARY
Proposed Algonquin
Pipeline Lateral
Existing
HubLine
SOUTH ESSEX
OCEAN SANCTUARY
250' and Greater
Water Depth
Proposed
Northeast Gateway
Deepwater Port
B
A
MASSACHUSETTS
BAY
Boston Harbor Traffic Lane Inbound
Boston Harbor Separation Zone
Nautical Miles
0 0.5 1 2
Maximum Received Underwater
Sound Levels During EBRV
Coupling at the DWP
Figure 1-4

1.3 Maintenance

The specified design life of the Northeast Gateway Deepwater 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 Deepwater Port will be inspected once yearly in accordance with Classification Society Rules (ABS) using either divers or remotely operated vehicles (ROVs) to inspect and record the condition of the various STL™ system components. These activities will be conducted using the Port's normal support vessel, and to the extent possible will coincide with planned weekly visits to the Port. Helicopters will not be used for marker line maintenance inspections. No noise sources related to the Project are likely to exceed ambient conditions during routine maintenance activities.

2.0 The Dates and Duration of Such Activity and the Specific Geographic Region Where It Will Occur

2.1 Construction Dates and Duration

Construction of the Northeast Gateway Deepwater Port Project, including the Pipeline Lateral, is scheduled to begin in May with completion in November. Figure 2-1 shows the sequence of activities during the 7-month construction phase.

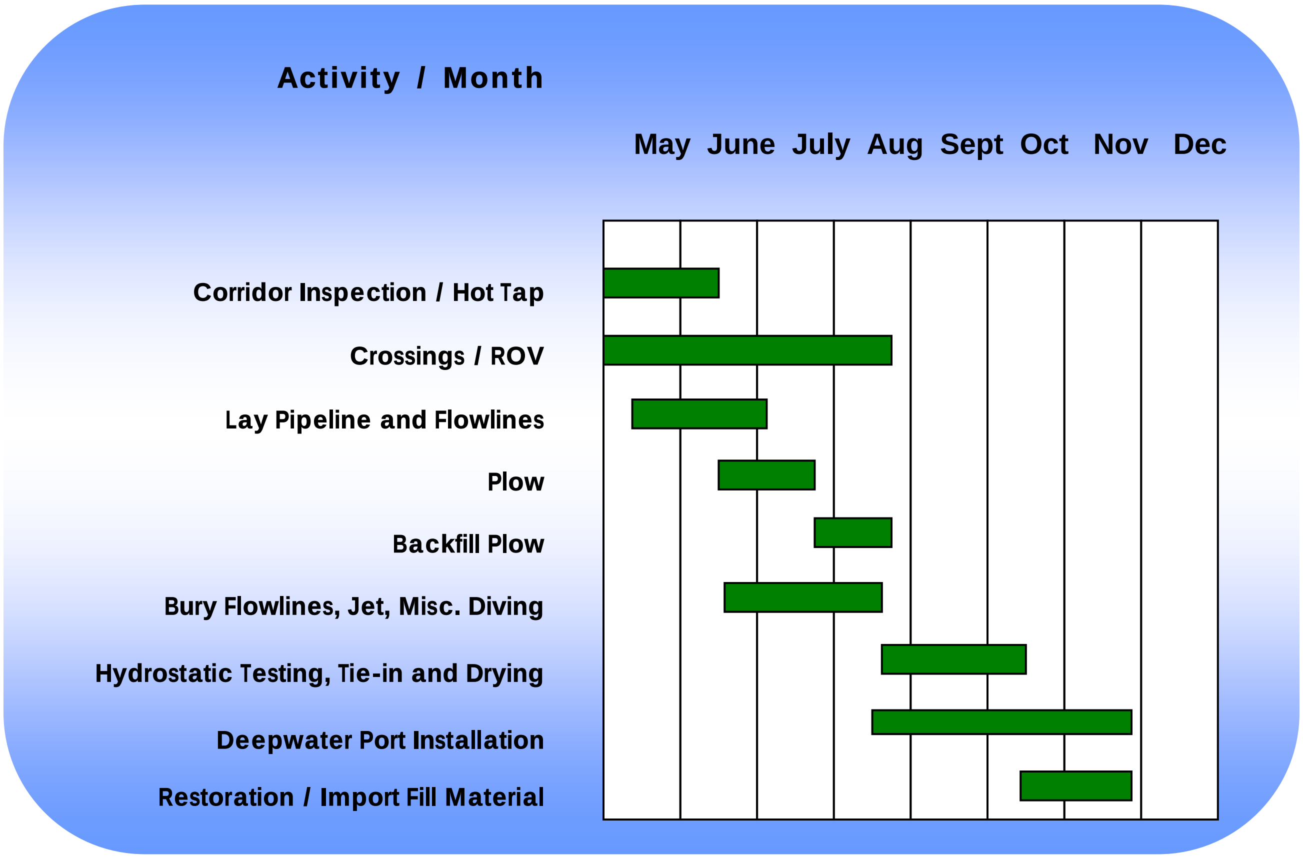

Figure 2-1 Construction Activity Sequence

Selection of the Port and Pipeline Lateral contractors along with development of the final implementation plan for construction activity duration and sequencing is currently ongoing and may result in changes that may revise the above sequence and/or durations. Also, the availability of the appropriate construction equipment may impact the start dates and the sequence of work. The durations, the estimated weather downtime, time vessels will be on station, and the sequence of activities have been developed with due consideration for construction limitations posed by working in and around Massachusetts Bay. The planned durations and work methods reflect Algonquin's experiences on the HubLine Project as well as the optimized construction methods, in particular the burial methods, planned for the Pipeline Lateral and Port flowlines.

2.2 Specific Geographic Region

The Northeast Gateway Port is located at 42º 23' 38.46"N/70º 35' 31.02" W for Buoy A and 42º 23' 56.40N/70º 37 0.36" W for Buoy B in Massachusetts Bay. The 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 Pipeline Lateral route extends towards the 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 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 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 Pipeline Lateral route then extends to the south for another approximately 3.5 miles (5.7 kilometers), terminating at the Northeast Gateway Port.

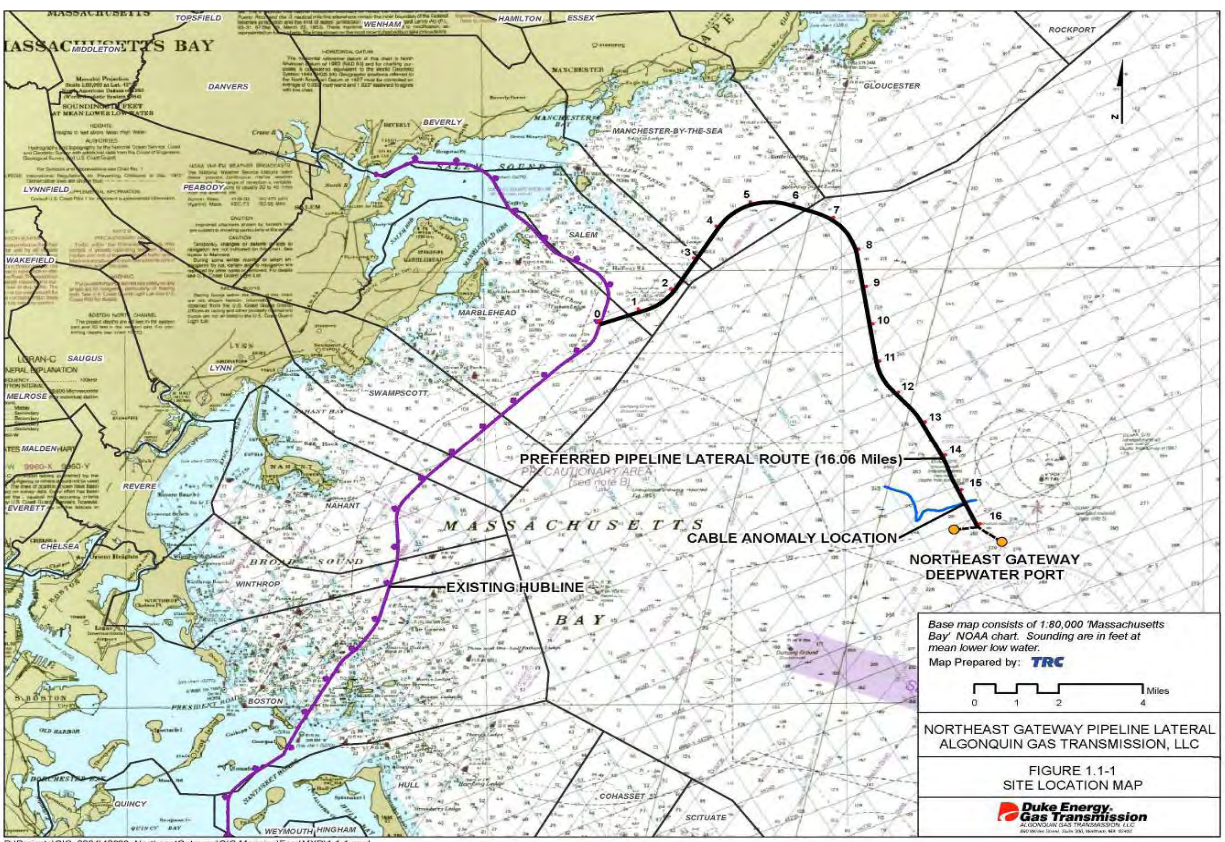

Figure 2-2. Location of the Pipeline Lateral and Northeast Gateway Deepwater Port

3.0 Species and Numbers of Marine Mammals in Area

Marine mammals known to traverse or occasionally visit the waters within the Project area include both threatened or endangered species, as well as those species that are not. Sections 3.2.3 and 3.3 of the FEIS/EIR discuss marine mammals both protected under the Marine Mammal Protection Act of 1972 as amended in 1994 (MMPA) and those that are listed as threatened or endangered under the Endangered Species Act (ESA). These species are listed in Table 3-1.

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 seals	*Phoca groenlandica*	Non-strategic	Jan-May

Source: NMFS 1993, 2003, 2005a, 2005b, 2005c, 2005d, 2005e; NOAA 1993a; Waring et al. 2004; Wilson et al. 1999

4.0 Status, Distribution, and Seasonal Distribution of Affected Species or Stocks of Marine Mammals

The status, distribution, and seasonal distribution of affected species or stocks are discussed in Sections 3.2.3 and 3.3 of the FEIS/EIR, and in Table 3-1 above. In general, Risso's dolphins, striped dolphins, sperm whales, hooded seals, and harp seals range outside the Project area, usually in more pelagic waters, while white-beaked dolphins, bottlenose dolphins, killer whales, long-finned pilot whales, blue whales, and sei whales occasionally occur in the shelf waters of the Project area. Given their behavior and distribution, none of the above species is expected to be encountered during the construction or operation phases of the Project, although sightings are possible. Species more commonly found in the shelf waters of Massachusetts Bay and potentially encountered in the Project area include the gray seal, harbor seal, harbor porpoise, Atlantic white-sided dolphin, short-beaked common dolphin, long-finned pilot whale, minke whale, North Atlantic right whale, humpback whale, and fin whale. These latter 10 species are the only ones observed during intensive right whale surveys (2001 to 2005) in nearby Cape Cod by the Province Center for Coastal Studies. These are also the species for which Northeast Gateway is seeking harassment authorization under this application.

5.0 The Type of Incidental Taking Authorization that is Being Requested (i.e., Takes by Harassment only; Takes by Harassment, Injury, and /or Death) and the Method Of Take

The only type of incidental taking sought in this application is takes by Level B noise harassment. The only Project-created noise with sounds exceeding 120 dB (threshold for continuous and intermittent noise) at the source are those stemming from the vessels associated with Pipeline Lateral construction, Port construction, and maneuvering of EBRVs during final docking. In all three cases the loudest noise sources emanate from thrusters used for dynamic positioning (see Sections 1.1.3 and 1.2.1).

6.0 Numbers of Marine Mammals that May Potentially be Taken

Northeast Gateway seeks 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 includes the 10 species mentioned in Section 4 that have the highest likelihood of occurring, at least occasionally, in the Project area.

The only anticipated impacts to marine mammals are associated with noise propagation from vessel movement resulting in short-term displacement of marine mammals from within ensonified zones produced by such noise sources. The construction and operations activities posed 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 project, 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 construction or operation of the Northeast Gateway Project is expected to exceed the 120 dB threshold for Level B harassment. However, the intermittent noise from bow thruster use associated with dynamic positioning of vessels during either construction or operation (docking) may result in the occasional exceedance of the 120 dB threshold for intermittent noise sources. Consequently, bow thruster use has the potential for "take" by harassment for any marine mammal occurring with a zone of esonification (>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 (see Sections 1.1.3 and 1.2.1):

- For shallow water depths (40 m) representative of the northern segment of the Pipeline Lateral construction, the radius is 3.31 km and associated ZOI is 34 km^2.
- For moderate depths (80 m) representative of the Deepwater Port location and Pipeline Lateral segment nearest SBNMS, the radius is 2.56 km and associated ZOI is 21 km^2.
- For deeper depths (120 m) representative of the deepest waters of the Project analysis area, the radius is 2.18 km and associated ZOI is 15 km^2

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.

There are no good marine mammal density estimates for the Project area. Studies in the nearest area (approximately 20 to 30 km south) where intensive marine mammal surveys have occurred (Cape Cod Bay) focused on individual right whales; no density estimates were calculated for other marine mammals. Fortunately, these Cape Cod Bay surveys, conducted by the Provincetown Center for Coastal Studies, involved a 100 percent survey coverage of the 1,500 km^2 bay (flying 1.5 km-wide strip transects) every 2 weeks from January to May for the years 2002 to 2005 (Brown et al. 2002, 2003; Mayo et al. 2004, Jaquet et al. 2005). Consequently, density estimates can be calculated by dividing the number of animals of each species recorded by the total trackline surveyed 2002 to 2005 (57,500 km), then correcting for animals not at the surface (30 percent).

Table 6-1 provides the corrected density estimates from the Cape Cod Bay studies. Because of the intensity of these studies, the near location of these studies to the Deepwater Port Project, and bathymetric similarity of the Project area and Cape Cod Bay, animal density data from Cape Cod Bay provide an adequate and conservative surrogate for marine mammals expected to inhabit the Project area. The Cape Cod Bay studies did not record gray seals during their aerial surveys, but they did record 352 unidentified seals, some of which may be gray seals. Also, many of the 969 harbor seals recorded during the surveys were presumably hauled out in large groups. Similarly, while 343 Atlantic white-sided dolphins and 83 common dolphins were recorded, 2,875 unidentified dolphins were also recorded; these were presumably either white-sided or common dolphins, but the exact identity was not determined. Thus, in a conservative attempt to ensure any given species is not underestimated, the unidentified seal numbers were added to both the harbor seal and gray seal numbers, and the unidentified dolphin numbers to both white-sided dolphins and common dolphin numbers in the density calculations.

Table 6-1. Estimates of Marine Mammal Densities in the Northeast Gateway Deepwater Port Project, Based on Aerial Survey Data Collected by the Provincetown Center For Coastal Studies in Cape Cod Bay (2002-2005), and the Numbers of Marine Mammals of Potential Risk of Harassment "Take" by this Project

Species	*n*	*n*/km	*n*/km^2	*n*/km^2 Corrected*	Estimated Take	Requested Authorization**
North Atlantic right whale	573	0.0100	0.0278	0.0361	1.23	2
Minke whale	46	0.0008	0.0022	0.0029	0.10	1
Fin whale	228	0.0040	0.0111	0.0144	0.49	2
Humpback whale	153	0.0030	0.0083	0.0108	0.37	2
Atlantic white-sided dolphin	346	0.0060	0.0167	0.0217	0.74	50
Common dolphin	83	0.0010	0.0028	0.0036	0.12	55
Harbor porpoise	22	0.0004	0.0011	0.0014	0.05	3
Long-finned pilot whale	115	0.0020	0.0056	0.0073	0.25	20
Unidentified dolphin	2875	0.0500	0.1389	0.1806	6.14	NA
Harbor seal	969	0.0170	0.0472	0.0614	2.09	3
Gray seal	0	0.0000	0.0000	0.0000	0.00	3
Unidentified seal	352	0.0060	0.0167	0.0217	0.74	NA

*30 percent correction value used.

** Average group size based on data from CeTAP 1982, Hamilton and May 1990, and Clapham 1993.

Although the sound transmission loss, and therefore the ZOI, varies with water depth, we are providing the most conservative estimate of “take” by using the largest ZOI (34 km^2) in our calculations. Table 6-1 provides our conservative estimate of the number of marine mammals that could be harassed by this Project, based on the calculations. However, because for all these estimates except for harbor seal the number of animals of potential “take” is less than the average group size, we are requesting for each species the authorization to “take” one group. The exceptions are for the seals where the calculated take is slightly higher than published in-water group size estimates.

7.0 The Anticipated Impact of the Activity on the Species or Stock

The only anticipated impacts to marine mammals associated with noise propagation from vessel movement, pipe laying and installation of the Port, anchors, chains and PLEMs would be the temporary and short-term displacement of seals and whales from within ensonified zones produced by such noise sources. However, from the most conservative estimates of both marine mammal densities in the Project area and the size of the 120-dBZOI, the calculated number of individual marine mammals for each species that could potentially be harassed is: one right whale (1.23), seven dolphins, and three seals. Consequently, construction and operation of the Northeast Gateway Deepwater Port Project does not constitute a population-level harassment threat to local marine mammal stocks.

8.0 The Anticipated Impact of the Activity on the Availability of the Species or Stocks of Marine Mammals for Subsistence Uses

There are no traditional subsistence hunting areas in the Project area.

9.0 Anticipated Impact on Habitat

Short-term Impacts – Construction of the Port and Pipeline Lateral will alter marine mammal habitat in several ways: disturbance of the seafloor, removal of sea water for hydrostatic testing, and generation of additional underwater noise. Although approximately 1,042 acres of seafloor (43 acres for the Port; 999 acres for the Pipeline Lateral) will be disturbed during construction, the majority of this impact will be temporary. Seafloor disturbance will include plowing to construct a trench for the pipeline. The pipelay and plow vessels will be maneuvered using a multi-point anchor system. Although the anchor system will include mid-line buoys to minimize cable sweep of the seafloor, approximately 814 acres may be affected this way. Crossing of two existing cables will require armoring, a change in substrate conditions in an area about 0.14 acres in size. Once the lateral and flowlines are installed, about 3,100,000 gallons of sea water, including planktonic organisms, will be withdrawn to be used for hydrostatic testing. Although the sea water will be returned to the environment, the associated plankton will be unlikely to survive.

Long-term Impacts – Operation of the Port and Pipeline Lateral will result in 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. As indicated under the short-term impacts discussion, a small area (0.14 acre) along the Pipeline Lateral will be permanently altered (armored) at two cable crossings. In addition, the structures associated with the Port (flowlines, mooring wire rope and chain, suction anchors, and PLEMs) will occupy 4.8 acres of seafloor. An additional area of the seafloor of up to 38 acres will be subject to disturbance due to chain sweep while the buoys are occupied.

Each EBRV 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 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 kg of copepods), and on the order of 30,000 fish eggs and 5,000 fish larvae.

10.0 Anticipated Impact of Habitat Loss or Modification

Short-term Impacts – Construction of the Port and Pipeline Lateral will result in a reduction of benthic productivity in the Project footprint. Once the disturbance ceases, the substrate will be available for recruitment of benthic organisms. Re-establishment of a benthic community similar to that in adjacent areas is expected to take a period of weeks to several years.

The volume of water required for hydrostatic testing is small compared to the volume of Massachusetts Bay. Although planktonic organisms will not likely survive the hydrostatic test activities, this will not affect the sustainability of the plankton communities in the Bay. Circulation patterns in the Bay ensure that plankton will be transported into the Project area continuously. In addition, temporary water quality impacts associated with increased TSS levels could also affect, in a very local area, the survival of certain planktonic species and lifestages, or could cause mobile species to temporarily move out of the area.

Long-term Impacts – Approximately 4.8 acre 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 38 acres of soft bottom that may be swept by the anchor chains while EBRVs are docked will have limited opportunity to recover, so this area will experience a long-term reduction in benthic productivity.

Daily removal of sea water 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 Project 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 The Availability and Feasibility (Economic and Technological), Methods, and Manner of Conducting Such Activity or Means of Effecting the Least Practicable Impact Upon Affected Species or Stock, Their Habitat, and of Their Availability for Subsistence Uses, Paying Particular Attention to Rookeries, Mating Grounds, and Areas of Similar Significance

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

- Passive acoustics program;
- Visual monitoring program;
- Safety zones;
- Reporting;
- Vessel speed;
- Ramp-up procedures;
- Construction debris.

Details of the proposed mitigations are discussed in the Marine Mammal and Turtle Monitoring and Mitigation Plan that is included as Appendix C to this application.

There are no traditional subsistence hunting areas in the Project area.

12.0 Where the Proposed Activity Would Take Place in or Near a Traditional Arctic Subsistence Hunting Area and/or May Affect the Availability of a Species or Stock of Marine Mammal for Arctic Subsistence Uses, the Applicant Must Submit a Plan of Cooperation or Information that Identifies What Measures Have Been Taken and/or Will be Taken to Minimize Any Adverse Effects on the Availability of Marine Mammals for Subsistence Uses. A Plan Must Include the Following:

There are no traditional Arctic subsistence hunting areas in the Project area and there are no Project activities that may affect the availability of a species or stock of marine mammal for Arctic subsistence uses.

13.0 The Suggested Means of Accomplishing the Necessary Monitoring and Reporting that Will Result in Increased Knowledge of the Species, the Level of Taking or Impacts on the Population of Marine Mammals that Are Expected to Be Present while Conducting Activities and Suggested Means of Minimizing Burdens by Coordinating Such Reporting Requirements with Other Schemes Already Applicable to Persons Conducting Such Activity. Monitoring Plans Should Include a Description of the Survey Techniques that Would Be Used to Determine the Movement and Activity of Marine Mammals Near the Activity Site(s), Including Migration and Other Habitat Uses, Such as Feeding:

See the proposed Marine Mammal Monitoring and Mitigation Measures Plan for the construction and operation of the Project, which is included as Appendix C of this application.

14.0 Suggested Means of Learning of, Encouraging, and Coordinating Research Opportunities, Plans, and Activities Relating to Reducing Such Incidental Taking and Evaluating its Effects:

Northeast Gateway and Algonquin have engaged personnel from NMFS regarding available passive acoustic technology that could be utilized to enhance the Plan. Northeast Gateway will continue its discussions and consultations with NMFS personnel to develop the appropriate level of inclusion of this technology. At the suggestion of NMFS, Northeast Gateway has engaged personnel from the Cornell University Bioacoustics Laboratory as consulting partners to assist with the development of a passive acoustic system.

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Appendix A

Northeast Gateway Acoustic Modeling Methodology

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October 2006

A1. 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.

A2. 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 Northeast Gateway Deepwater Port Project 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 B). For other sources, namely the construction vessels used in the Pipeline Lateral and Deepwater 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 Project 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.

A3. Acoustic Output Files

The resulting sound level isopleths presented in Figures 1-1 to 1-4 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 A-1 through A-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 A-1 for a construction vessel transiting the Project area and in Table A-2 for a construction vessel using thrusters. Tables A-3 and A-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 Deepwater Port. The plots of the worst-case construction vessel thruster sound levels are presented in Figures 1-1 and 1-2. Table A-5 presents worst case received sound levels during EBRV closed loop regasification and offloading during steady state conditions. As shown in the corresponding Figure 1-3, received sound levels will not exceed the 120-dBL isopleths at any appreciable distance from the EBRV. Finally, Table A-6 presents data and propagation calculations for an EBRV coupling at the Deepwater Port with sound level contours displayed in Figure 1-4.

TABLE A-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 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	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Band
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	45.2	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 A-2: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING CONSTRUCTION ACTIVITIES AT A LOCATION ALONG THE PIPELINE LATERAL (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	1250 (Hertz)	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Broad 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 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)	-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	74.6	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	46.7	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 A-3: 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	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)	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

Data for contour plot

Distance (m)	Distance (ft)	12.5	16	20	25	31	40	50	63	80	100	125	160	200	250	315
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
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
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
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
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
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
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
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
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
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
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
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
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
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
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
450.0	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
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
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
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
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
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
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
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
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
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
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
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
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
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
2460.0	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
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
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
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
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
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
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
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
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

Distance (m)	Distance (ft)	400	500	630	800	1000	1250	1600	2000	2500	3150	4000	5000	6300	8000	10000	12000	16000	20000	Band
60.0	196.8	95.3	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	94.3	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	93.5	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	92.7	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	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	91.4	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	90.8	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	90.3	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	89.8	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	89.4	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	87.5	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	86.0	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	84.8	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	83.8	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	83.0	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
450.0	1476.4	82.2	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	81.9	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	81.5	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	45.5	119.6
550.0	1804.4	80.9	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	80.3	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	79.8	77.8	75.8	73.8	71.8	69.8	67.7	65.7	63.7	61.7	59.6	57.6	55.5	53.3	51.1	48.8	46.1	43.2	117.9
700.0	2296.6	79.3	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	46.4	42.5	117.4
750.0	2460.6	78.9	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	78.4	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	78.0	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	77.7	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	77.3	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	77.0	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	73.4	71.4	69.4	67.3	65.3	63.2	61.2	59.1	57.0	54.9	52.7	50.4	48.0	45.2	42.2	38.9	33.7	27.9	111.6
2460.0	8038.0	72.3	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	71.2	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	69.4	67.4	65.3	63.2	61.2	59.1	57.0	54.8	52.7	50.5	48.1	45.7	42.9	39.7	35.8	31.7	24.3	15.9	107.5
5000.0	16404.0	67.9	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	66.6	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	65.4	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	64.3	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	63.3	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	62.3	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 A-4: 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 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

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	133.4	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 A-5: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING EBRV CLOSED LOOP REGASIFICATION AND OFFLOADING 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	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 1 m)	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	-0.5	-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	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	64.6	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	46.8	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	46.6	44.5	42.8	39.8	37.0	33.8	22.4	8.8	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 A-6: CALCULATED RECEIVED UNDERWATER SOUND LEVELS DURING EBRV COUPLING OPERATIONS AT THE NEG DWP (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	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 1m)	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

																						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**
Data for contour plot																																			
Distance (m)	Distance (ft)																																		
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
450.0	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
2450.0	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 B

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

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October 2006

B1. 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 Northeast Gateway Deepwater Port and future prospective project areas.

B2. 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.

B3. 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 B-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.

B4. 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 B-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 C

Marine Mammal and Turtle Monitoring and Mitigation Plan

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October 2006

A Marine Mammal/Sea Turtle Monitoring Plan (Plan) has been developed to minimize the potential for impacts to marine mammals and sea turtles from construction and operation of the Northeast Gateway Deepwater Port and Pipeline Lateral.

C1.0 CONSTRUCTION MINIMIZATION MEASURES

This Plan utilizes passive acoustics detection system, human visual observers, and other measures to assist in the detection of marine mammals within the immediate construction area during the construction phase of the Project.

C1.1 Passive Acoustics Program

Northeast Gateway and Algonquin have engaged personnel from NMFS regarding available passive acoustic technology that could be utilized to enhance the Plan. Northeast Gateway will continue its discussions and consultations with NMFS personnel to develop the appropriate level of inclusion of this technology. At the suggestion of NMFS, Northeast Gateway has engaged personnel from the Cornell University Bioacoustics Laboratory as consulting partners to assist with the development of a passive acoustic system.

C1.2 Visual Monitoring Program

The Project will employ two qualified marine mammal/sea turtle observers on each lay barge, bury barge, and diving support vessel for visual shipboard surveys during construction activities. Qualifications for these individuals will include direct field experience on a marine mammal/sea turtle observation vessel and/or aerial surveys in the Atlantic Ocean/Gulf of Mexico. The observers (one primary and one secondary) are responsible for visually locating marine mammals and sea turtles at the ocean's surface and, to the extent possible, identifying the species. The primary observer will act as the identification specialist and the secondary observer will serve as data recorder and also assist with identification. Both observers will have responsibility for monitoring for the presence of marine mammals and sea turtles. All observers will meet the experience requirements established by the National Marine Fisheries Service (NMFS).

The shipboard observers will monitor the construction area beginning at daybreak using 25x power binoculars and/or hand-held binoculars resulting in a conservative effective search range of 0.5 mile during clear weather conditions for the shipboard observers. The observer will scan the ocean surface by eye for a minimum of 40 minutes every hour. All sightings will be recorded on marine mammal field sighting logs. Observations of marine mammals and sea turtles will be identified to species or the lowest taxonomic level and their relative position will be recorded. During construction, the following procedures will be followed upon detection of a marine mammal or sea turtle within 0.5 mile of the construction vessels:

If any marine mammals or sea turtles are visually detected within 0.5 mile of the construction vessel, the vessel superintendent or on-deck supervisor will be notified immediately. The vessel's crew will be put on a heightened state of alert. The marine mammal will be monitored constantly to determine if it is moving toward the construction area. The observer is required to report all Northern Atlantic right whale sightings to NMFS. This contact is to be made as soon as possible. The phone numbers for NMFS are 800-900-3622 (entangled whales), 978-585-7149 (dead, ship-struck, or injured whales), or 978-585-8473 (general sightings).

Construction vessel(s) in the vicinity of the sighting will be directed to cease any movement and/or stop noise emitting activities that exceed 120 decibels (dB) in the event that a right whale comes to within 500 yards of any operating construction vessel. For other whales and sea turtles this distance will be established at 100 yards. Vessels transiting the construction area such as pipe haul barge tugs will also be required to maintain these separation distances.

Construction will resume after the marine mammal/sea turtle is positively reconfirmed outside the established zones (either 500 yards or 100 yards, depending upon species).

C1.3 Other Measures

During construction, weekly status reports will be provided to NMFS utilizing standardized reporting forms.

The Northeast Port Project area is within the Mandatory Ship Reporting Area (MSRA), so all construction and support vessels will report their activities to the mandatory reporting section of the United States Coast Guard (USCG) to remain apprised of North Atlantic right whale movements within the area. All vessels entering and exiting the MSRA will report their activities to WHALESNORTH. Vessel operators will contact the USCG either by e-mail (RightWhale.MSR@noaa.gov) or Telex (236737831). If they are unable to use satellite communications equipment, they will contact the USCG Communication Area Master Station, Chesapeake, VA via SITOR/NBDP on 8426.3 kHz, 12590.8 kHz, or 16817.8 kHz 24 hours per day, or 6314.3 kHz from 2300 GMT until 1100 GMT and 22387.8 kHz from 1100 GMT until 2300 GMT.

While under way, all construction vessels will remain 500 yards away from right whales, and 100 yards away from all other whales to the extent physically feasible given navigational constraints as required by NMFS.

All construction vessels greater than 300 gross tons will maintain a speed of 10 knots or less when operating within the construction area and local ports. Crew and supply boats, which move at up to 15 knots, when smaller than 300 gross tons will not be restricted to 10 knots; however, the crew members will be required to monitor the area for marine mammals and report any sightings to the other construction vessels operating in the area.

Mesh grates will be used during flooding and hydrostatic testing of the pipeline and flowlines to minimize impingement and entrainment of marine mammals and sea turtles.

Operations involving excessively noisy equipment will “ramp-up” sound sources, as long as this does not jeopardize the safety of vessels or construction workers, allowing whales a chance to leave the area before sounds reach maximum levels. Contractors will be required to utilize vessel quieting technologies that minimize noise.

During construction, individual crew members will be responsible for ensuring that debris is not discharged into the marine environment. Additionally, training of construction crews will include a requirement explaining that the discharge of trash and debris overboard is harmful to the marine mammals, and the environment, and is illegal under the Act to Prevent Pollution from Ships and the Ocean Dumping Act, depending on the type of material. Discharge of debris will therefore be prohibited, and violations will be subject to enforcement actions.

Northeast Gateway and Algonquin will require their contractors to maintain individual Spill Prevention, Control, and Containment (SPCC) Plans in place for construction vessels during construction.

Although not anticipated, if blasting is determined to be required as a result of ongoing geophysical and geotechnical surveys, Algonquin will prepare a Blasting Mitigation Plan in consultation with NMFS.

C2.0 OPERATIONS MINIMIZATION MEASURES

All individuals onboard the EBRVs responsible for the navigation and lookout duties on the vessel will receive training, a component of which will be training on marine mammal sighting/reporting and vessel strike avoidance measures, as required by International Maritime Organization (IMO) standards. Crew training of EBRV personnel should stress individual responsibility for marine mammal awareness and reporting.

If a marine mammal or sea turtle is sighted by a crew member, an immediate notification will be made to the Person-in-Charge on board the vessel and the Northeast Port Manager, who will ensure that the required reporting procedures are followed.

The Northeast Gateway Port Project area is within the MSRA, so all EBRVs transiting to and from the MSRA will 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 will report their activities to WHALESNORTH. Vessel operators will contact the USCG either by e-mail (RightWhale.MSR@noaa.gov) or Telex (236737831). If they are unable to use satellite communications equipment, they will contact the USCG Communication Area Master Station, Chesapeake, VA via SITOR/NBDP on 8426.3 kHz, 12590.8 kHz, or 16817.8 kHz 24 hours per day, or 6314.3 kHz from 2300 GMT until 1100 GMT and 22387.8 kHz from 1100 GMT until 2300 GMT.

As part of the Deepwater Port docking process, EBRV speed will gradually be reduced to approximately 3 knots at 1.86 miles out from the Northeast Port and to less than 1 knot at a distance of 1,640 feet from the Northeast Port.