DRAFT

AUTHORIZATION TO DISCHARGE UNDER THE NATIONAL POLLUTION DISCHARGE ELIMINATION SYSTEM

In compliance with the provisions of the Federal Clean Water Act as amended, (33U.S.C.§§1251 et seq.; the "CWA", and the Massachusetts Clean Waters Act, as amended, (M.G.L. Chap. 21, §§26-53),

Northeast Gateway Energy Bridge, LLC
1330 Lake Robbins Drive, Suite 270
The Woodlands, TX 77380

are authorized to discharge from a facility located at

Northeast Gateway Energy Bridge
Massachusetts Bay

to receiving waters named

Massachusetts Bay

In accordance with effluent limitations, monitoring requirements and other conditions set forth herein.

This permit shall become effective (see***below)

This permit and the authorization to discharge shall expire at midnight five (5) years from the last day of the month preceding the effective date.

This permit shall be effective only during time periods when a National Oceanic and Atmospheric Administration Incidental Take Statement, that exempts the U.S. Environmental Protection Agency from the take prohibitions of the Endangered Species Act, is in effect for the Northeast Gateway Energy Bridge Project.

This permit consists of 7 pages in Part I including effluent limitations, monitoring requirements, etc., 25 pages in Part II including General Conditions and Definitions, and 9 pages (plus introductory pages) in Attachment A, *Operational Monitoring Program for the Northeast Gateway Port Massachusetts Bay Offshore Gloucester, MA, August 2007.*

Signed this   day of

____
Stephen S. Perkins, Director
Office of Ecosystem Protection
Environmental Protection Agency
Boston, MA

***This permit will become effective on the date of signature if no comments are received during public notice. If comments are received during public notice, this permit will become 40 days after signature.

A. EFFLUENT LIMITATIONS AND MONITORING REQUIREMENTS

1. Any Energy Bridge™ Regasification Vessel (EBRV) while moored at the deepwater port must comply with this permit, and this permit applies only when the EBRV is moored at the deepwater port.

2. During the period beginning on the effective date of the permit and lasting through expiration, the permittee is authorized to discharge through **outfall serial numbers 01A and 01B: Main Condenser Cooling Water.** Discharge shall be limited and monitored by the permittee as specified below:

OUTFALL 01A- **Buoy A**
Latitude 42º 23’ 38.46” Longitude 70º 35’ 31.02”

OUTFALL 01B- **Buoy B**
Latitude 42º 23’ 56.40” Longitude 70º 37’ 0.36”

Effluent Characteristic (units)	**Discharge Limitations**			**Monitoring Requirements**	
	Annual Total	**Monthly Average**	**Maximum Daily**	**Measurement Frequency**	**Sample Type**
Total Discharge Time (hours)[1]	520	----	----	Continuous	Meter
Flow rate (MGD)[2]	----	----	7.82	Continuous	Estimate[3]
Temperature Rise, ΔT (°C)[4]	----	Report	2.6	Hourly	Calculation

[1] Total Discharge Time equals the sum of the discharge time from outfalls 01A and 01B. Annual total will be based on the calendar year. Report year-to-date totals for each outfall on monthly discharge monitoring reports. Total discharge time limit is based on a maximum flow rate of 32,700 gallons per minute.

[2] Flow rate is the flow from each outfall (01A and 01B).

[3] The daily flow rate shall be calculated based upon the pump curve values and the hours of operation for the pump(s) during the reporting period and shall be reported in the units of millions of gallons per day (MGD).The permittee shall also report the total number of days during the reporting period in which there was a discharge from the outfall(s) (to be noted on Discharge Monitoring Report under the “event total” parameter).

[4]Temperature Rise (ΔT) is the difference between the discharge temperature and the intake temperature. The intake and discharge temperatures shall be continuously measured and recorded by instruments or computers (thermistors) which record a minimum of 12 times per hour. The intake temperature shall be monitored at the intake structure of each unit that is operating. The temperature rise shall be calculated as an hourly average, based on the hourly average intake temperature and the hourly average discharge temperature measured during the same hour.

3. During the period beginning on the effective date of the permit and lasting through expiration, the permittee is authorized to discharge through **outfall serial numbers 02A and 02B: Auxiliary Seawater Service Cooling.** Discharge shall be limited and monitored by the permittee as specified below:

OUTFALL 02A- Buoy A
Latitude 42º 23' 38.46" Longitude 70º 35' 31.02"

OUTFALL 02B- Buoy B
Latitude 42º 23' 56.40" Longitude 70º 37' 0.36"

Effluent Characteristic (units)	**Discharge Limitations**			**Monitoring Requirements**	
	Annual Total	**Monthly Average**	**Maximum Daily**	**Measurement Frequency**	**Sample Type**
Discharge Time (hours)[1]	520	----	----	Continuous	Meter
Flow rate (MGD)[2]	----	----	0.99	Continuous	Estimate[3]
Temperature Rise, ΔT, (°C)[4]	----	Report	5.5	Hourly	Calculation

[1] Total Discharge Time equals the sum of the discharge time from outfalls 02A and 02B. Annual total will be based on the calendar year. Report year-to-date totals for each outfall on monthly discharge monitoring reports. Total discharge time limit is based on a maximum flow rate of 4,200 gallons per minute.

[2] Flow rate is the flow from each outfall (02A and 02B).

[3] The daily flow rate shall be calculated based upon the pump curve values and the hours of operation for the pump(s) during the reporting period and shall be reported in the units of millions of gallons per day (MGD).The permittee shall also report the total number of days during the reporting period in which there was a discharge from the outfall(s) (to be noted on Discharge Monitoring Report under the "event total" parameter).

[4]Temperature Rise (ΔT),is the difference between the discharge temperature and the intake temperature. The intake and discharge temperatures shall be continuously measured and recorded by instruments or computers (thermistors) which record a minimum of 12 times per hour. The intake temperature shall be monitored at the intake structure of each unit that is operating. The temperature rise shall be calculated as an hourly average, based on the hourly average intake temperature and the hourly average discharge temperature measured during the same hour.

4. During the period beginning on the effective date of the permit and lasting through expiration, the permittee is authorized to discharge through **outfall serial numbers 03A and 03B: Water Curtain.** Discharge shall be limited and monitored by the permittee as specified below:

OUTFALL 03A- Buoy A
Latitude 42º 23' 38.46" Longitude 70º 35' 31.02"

OUTFALL 03B- Buoy B
Latitude 42º 23' 56.40" Longitude 70º 37' 0.36"

	Discharge Limitations		**Monitoring Requirements**	
Effluent Characteristic (units)	**Annual Total**	**Maximum Daily**	**Measurement Frequency**	**Sample Type**
Total Discharge Time (hours)[1]	9,640	----	Continuous	Meter
Flow rate (MGD)[2]	----	0.6	Continuous	Estimate[3]

[1] Total Discharge Time equals the sum of the discharge time from outfalls 03A and 03B. Annual total will be based on the calendar year. Report year-to-date totals for each outfall on monthly discharge monitoring reports. Total discharge time limit is based on a maximum flow rate of 400 gallons per minute.

[2] The daily flow rate shall be calculated based upon the pump curve values and the hours of operation for the pump(s) during the reporting period and shall be reported in the units of millions of gallons per day (MGD).The permittee shall also report the total number of days during the reporting period in which there was a discharge from the outfall(s) (to be noted on Discharge Monitoring Report under the "event total" parameter).

[3] The daily flow rate shall be calculated based upon the pump curve values and the hours of operation for the pump(s) during the reporting period and shall be reported in the units of millions of gallons per day (MGD).The permittee shall also report the total number of days during the reporting period in which there was a discharge from the outfall(s) (to be noted on Discharge Monitoring Report under the "event total" parameter.

Part I.A (continued)

5. In addition to any other grounds specified herein, this permit shall be modified or revoked at any time if, on the basis of any new data, the director determines that continued discharges may cause unreasonable degradation of the marine environment.
6. The discharge shall not cause objectionable discoloration of the receiving waters.
7. The effluent shall not contain visible oil sheen, foam, or floating solids at any time.
8. The discharge shall not contain materials in concentrations or combinations which are hazardous or toxic to human health, aquatic life of the receiving waters.
9. Pollutants which are not limited by this permit, but which have been specifically disclosed in the permit application, may be discharged up to the frequency and level disclosed in the application, provided that such discharge does not violate Section 307 or 311 of the Clean Water Act (CWA).
10. The permittee shall identify potential sources of pollution that may reasonably be expected to affect the quality of the curtain water discharges, and ensure implementation of best management practices (BMPs) which will be used to eliminate or minimize any exposure of the curtain water to pollutants. BMPs must include good housekeeping measures, preventative maintenance programs, spill prevention and response procedures, and runoff management practices. All BMPs shall be properly maintained and be in effective operating condition.
11. All existing manufacturing, commercial, mining, and silvicultural dischargers must notify the Director as soon as they know or have reason to believe:
    a. That any activity has occurred or will occur which would result in the discharge, on a routine basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"
        i One hundred micrograms per liter (100 µg/l);
        ii Two hundred micrograms per liter (200 µg/l)for acrolein and acrylonitrite; five hundred micrograms per liter (500 µg/l) for 2,4-dinitrophenol; and one milligram per liter (1 mg/L) for antimony;
        iii Five (5) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 C.F.R.§122.21(g)(7); or
        iv Any other notification level established by the Director in accordance with 40C.F.R.§122.44(f)
    b. That any activity has occurred or will occur which would result in the discharge, on a non-routine or infrequent basis, of any toxic pollutant which is not limited in the permit, if that discharge will exceed the highest of the following "notification levels:"
        i Five hundred micrograms per liter (500 µg/L);
        ii One milligram per liter (1 mg/L) for antimony;
        iii Ten (10) times the maximum concentration value reported for that pollutant in the permit application in accordance with 40 C.F.R.§122.21(g)(7).

iv Any other notification level established by the Director in accordance with 40C.F.R.§122.44(f).

c. That they have begun or expect to begin to use or manufacture as an intermediate or final product or byproduct any toxic pollutant which was not reported in the permit application.

B. COOLING WATER INTAKE AND THERMAL DISCHARGE MONITORING REQUIREMENTS

1. Energy Bridge Regasification Vessels (EBRVs) shall be constructed, maintained and operated to ensure the following cooling water intake structure (CWIS) location, design, construction and capacity criteria:

   a. CWISs are located at least 23 feet below the water surface,

   b. cooling water intake systems (including the structure and associated intake pumps) maintain a controlled intake velocity no greater than 0.5 feet per second, except during the 4-hour start-up and shut-down periods when intake velocity may not exceed 0.82 feet per second,

   c. CWISs maintain screen openings no greater than 0.83 inches, and

   d. the EBRVs only use closed loop shell-and-tube vaporization technology to regasify LNG.

2. Written notification and approval by EPA shall be required, should the permittee propose changes to existing or new EBRVs which would result in a violation of the criteria specified in paragraph I.B.1 above.

3. The permitee is required to monitor the potential impact of the thermal discharge and ongoing water withdrawal. This monitoring should be done in accordance with requirements in the monitoring program in Attachment A to this permit. The permitee shall submit an annual report detailing the results of this monitoring effort no later than March 1 of the following year. Copies of this report shall be submitted to:

   Phil Colarusso
   Ocean & Coastal Unit
   U.S. Environmental Protection Agency
   One Congress Street (COP)
   Boston, MA 02114-2023

   Chris Boelke
   National Marine Fisheries Service
   1 Blackburn Drive
   Gloucester, MA 01930

   Leila Hatch
   Stellwagen Bank National Marine Sanctuary Office
   175 Edward Foster Road
   Scituate, MA 02066

C. MONITORING AND REPORTING

1. The permittee shall notify the EPA, 48 hours prior to Energy Bridge Regasification Vessel (EBRV) arrival at the port by calling George Harding, EPA (617-918-1870). The permittee shall provide transportation for inspectors by appointment, as requested by EPA, from a coastal port location to, and from, the EBRV.
2. Monitoring results obtained during the previous month shall be summarized for each month and reported on separate discharge monitoring report (DMR) forms postmarked no later than the 15th day of the month following the effective date of the permit.
3. Signed and dated originals of these, and all other reports required herein, shall be submitted to the Director and the State at the following address:

U.S. Environmental Protection Agency
Water Technical Unit (SEW)
P.O. Box 8127
Boston, MA 02114

ATTACHMENT A

Operational Monitoring Program for the Northeast Gateway Port Massachusetts Bay Offshore Gloucester, MA

OPERATIONAL MONITORING PROGRAM
FOR THE
NORTHEAST GATEWAY PORT
MASSACHUSETTS BAY
OFFSHORE GLOUCESTER, MA

AUGUST 2007

OPERATIONAL MONITORING PROGRAM
FOR THE
NORTHEAST GATEWAY PORT
MASSACHUSETTS BAY
OFFSHORE GLOUCESTER, MA

Prepared for
TETRA TECH EC, INC.
133 Federal Street, 6th Floor
Boston, MA 02110

and

EXCELERATE ENERGY, LLC
1330 Lake Robbins Dr., Suite 270
The Woodlands, TX 77380

Prepared by
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25 Nashua Road
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R-20152.008

August 2007

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1.0 INTRODUCTION

Excelerate Energy LLC ("Excelerate") has been licensed by the Department of Transportation Maritime Administration ("MARAD") and the U.S. Coast Guard ("USCG") under the Deepwater Port Act of 1973 ("DWP") as amended in 2002 to construct and operate an offshore deepwater port in Massachusetts Bay for the delivery through regasification and offloading via pipeline of liquefied natural gas ("LNG") from specially equipped vessels (Energy Bridge Regasification Vessels or EBRVs). Resource agencies have identified water use (uptake and discharge) during operation as the primary concern related to the port. Withdrawal of seawater for daily operations and ballast will result in the entrainment of ichthyoplankton. Discharge has the potential to affect the quality of the receiving water (Massachusetts Bay). Both of these potential impacts were thoroughly addressed in the Deep Water Port application and the EIS using available data and modeling. This document describes a five-year operational monitoring program designed to confirm the results of the previous impact assessment.

1.1 PROJECT DESCRIPTION

Northeast Gateway Energy Bridge, L.L.C. (Northeast Gateway) has received a license to construct, own, and operate the Northeast Gateway Deepwater Port (Northeast Port or Port), located approximately 13 miles southeast of Gloucester, MA (Figure 1). The Port, which will be located in Massachusetts Bay, will consist of a submerged buoy system to dock specifically designed Liquified Natural Gas (LNG) carriers approximately 13 mi (21 km) offshore of Massachusetts in federal waters approximately 270 to 290 ft (82 to 88 m) in depth. This facility will deliver regasified LNG to onshore markets via new and existing pipeline facilities owned and operated by Algonquin Gas Transmission, LLC (Algonquin). Algonquin will build and operate a new, 16.06-mile (25,8 km) long, 24-in (61-cm) diameter natural gas pipeline (called the Norheast Gateway Pipeline Lateral or Pipeline Lateral) to connect the Port to Algonquin's existing offshore natural gas pipeline system in Massachusetts Bay, called the HubLine.

Northeast Gateway's fleet of purpose built Energy Bridge Regasification Vessels (EBRVs) are conventional LNG transport vessels fitted with patented regasification equipment on board, and will transport LNG to the Port. Once at the Port, the EBRVs will begin regasification of the LNG back into gaseous natural gas and deliver the natural gas into a submerged pipeline system connected to existing pipeline infrastructure delivering in to the New England energy market. Excelerate has committed to using a closed loop system for regasification, thereby limiting the amount of sea water required for this process.

Water requirements will vary over the time that the ship is at port. During start-up and shut-down, each taking approximately four hours, the ship will withdraw 8.82 million gallons for engine condenser cooling and main seawater cooling. During routine operations (including the start-up and shut-down periods), the ship will withdraw 2.77 MGD for ballast, water curtain and freshwater generation. Water will be brought into the ship via both the upper and lower sea chests. The depth of the intakes on the ship ranges from 23-38 feet.

Water from several sources will be discharged from a depth of 17-28 feet (5-8 meters) below the surface into Massachusetts Bay while the EBRVs are moored. The discharge volume will vary according to the types of operations, similar to the seawater intake. On the first and last days that an

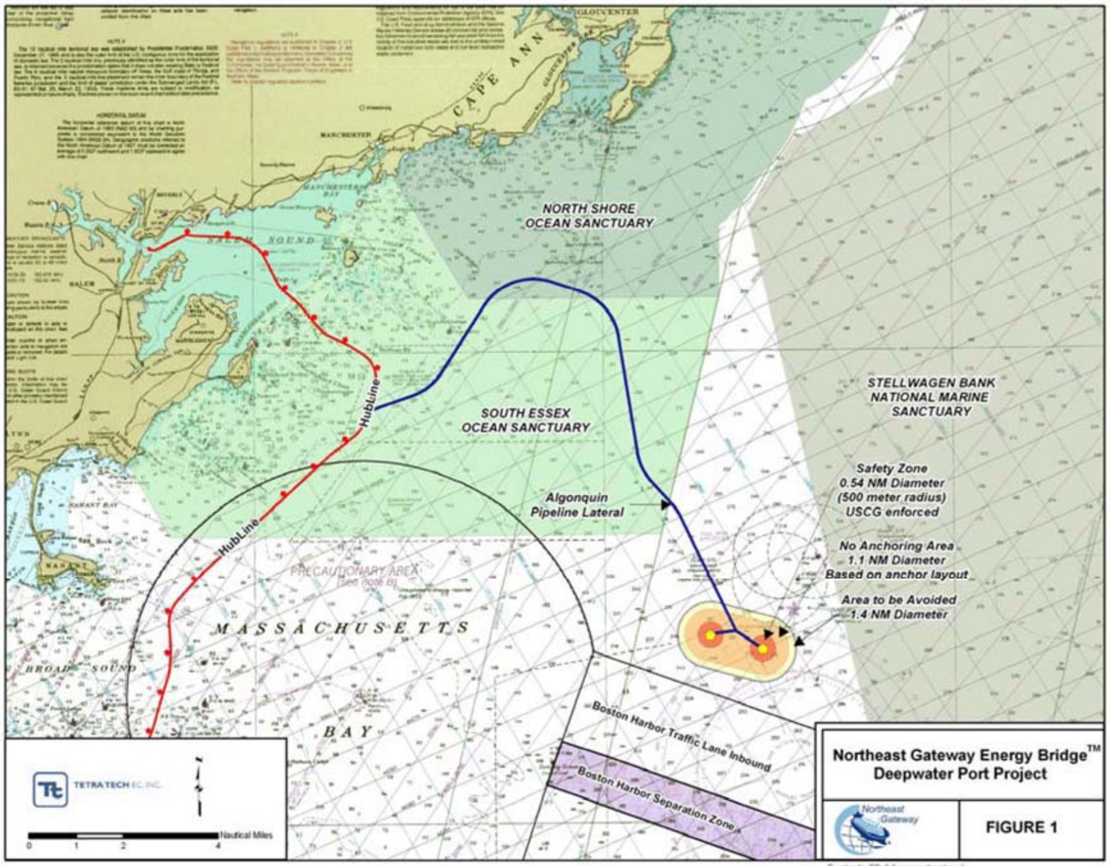

Figure 1. Northeast Gateway Deepwater Port and Pipeline Lateral Location.

EBRV is at port, the discharge volume will be approximately 9.69 MGD. During the remaining period, the discharge volume will be approximately 0.88 MGD. It is estimated that the discharge of treated wastewater will not exceed 0.005 MGD and will be compliant with MARPLO and EPA regulations. No bilge water will be discharged. The majority of the seawater withdrawn will be used for the main condenser cooling (7.82 MGD) and auxiliary seawater service cooling (0.99 MGD) during start-up and shut-down. No chemicals will be added to the water used for these purposes, but contact with the evaporation system will increase the water temperature. A small component of the discharge (0.27 MGD) will come from the freshwater generator and have slightly elevated salinity.

1.2 POTENTIAL FISHERIES IMPACTS

Entrainment of ichthyoplankton through water intake for various ship operations is a potential fisheries impact of concern to resource managers and regulators related to operation of Northeast Gateway. Comments related to fisheries issues from National Marine Fisheries Service on the DWP application centered on the suitability of available ichthyoplankton data for estimating impacts due to entrainment in the general shipboard water uptake system. Impact analysis during the licensing process used a variety of data sources, including general (non-quantitative) information for Massachusetts Bay, quantitative data from waters offshore of Hampton, NH (hydrologically linked, but somewhat distant from the project area), and quantitative data from NMFS's MARMAP and EcoMon programs.

MARMAP and EcoMon are broad scale programs that include stations in the vicinity of the proposed Northeast Gateway. MARMAP ended in the mid-1980s during a period when fisheries resources in New England waters were starting to undergo substantial declines. Ichthyoplankton data from the period prior to the decline, therefore, are unlikely to be representative of current conditions. The EcoMon program was initiated shortly after MARMAP ended, although ichthyoplankton data for the project area are available only for the period from 2000 through 2004. Data from these programs were used to quantify anticipated impacts to ichthyoplankton and adult populations caused by entrainment.

The purpose of the proposed sampling plan is to provide project-specific data to aid in quantifying the impacts related to entrainment of ichthyoplankton. Survey techniques are designed to sample the portion of the water column that will be affected by the EBRV intakes, a portion of that sampled during the MARMAP and EcoMon programs. Thus, sampling has been conducted prior construction to provide a recent baseline against which to compare operational data.

Entrainment losses of ichthyoplankton can appear to be very high in terms of absolute numbers, but the extremely high natural mortality rate for ichthyoplankton means that very few of these organisms would survive to maturity. These losses can be put into perspective through Equivalent Adult (EA) calculations that use natural mortality rates of individual species during their developmental stages to estimate the number of equivalent adults that are represented by the losses of eggs and larvae. Preliminary calculations for EA for several species were included in the Northeast Gateway EIS based on MARMAP and EcoMon data. These predictions will be evaluated based on the results of the preconstruction sampling and annually based on the operational period data.

1.3 POTENTIAL WATER QUALITY IMPACTS

Discharge plume modeling has been performed on the Project to estimate the estent of the thermal discharge plume from the EBRVs into Massachusetts Bay. Modeling was conducted on the EBRV Main Condenser and Auxiliary Seawater Cooling System two 4-hour discharge event estimates of 8.81 million gallons using the CORMIX Model. CORMIX is an analytical tool recommended by the EPA in several key guidance documents on the permitting of industrial, municipal, thermal, and other point source discharges to receiving waters. CORMIX was used to develop predictions related to the thermal plume behavior of the EBRV discharge quantity including the initial mixing, transport, and dilution in the nearfield plus 1,640 feet (500 meters).

Under various scenarios, the modeled plumes showed rapid transport of 33 feet (10 meters) or less to the surface within 65 to 130 feet (20 to 40 meters) horizontally downdrift of the discharge points. During this time, the plumes remained as a more or less coherent jet of warm water. With some spreading and diluting occurring as ambient water is entrained into the jet. Once at the surface, the buoyant plumes spread out rapidly and further mixed with the ambient surface water. The resulting surface plume was also transported downdrift of the vessel with the ambient current. The maximum surface temperature elevation estimated by CORMIX was 0.61°C (1.1°F) during summer conditions. The estimated surface temperature elevation at a distance of 1,640 feet (500 meters) downdrift from the discharge point was 0.10°C (0.18°F).

About 90% of the water processed through the freshwater generator will be discharged with a salinity about 10% higher than ambient conditions. This brinewater (0.27 MGD) will be mixed with other sources prior to being discharged (0.88 to 9.69 MGD total) so that the salinity of the resulting discharge will be only negligibly higher than ambient.

2.0 ICHTHYOPLANKTON MONITORING STUDY DESIGN

2.1 STUDY PARAMETERS

The study is designed to collect site-specific data in the immediate port area over a pre-operational period of one year and an operational period of five years on ichthyoplankton diversity and abundance per volume of water at depths typically withdrawn by EBRVs. During operational period monitoring, additional collections will be made over the entire water column to ensure that impacts to species that exhibit diurnal vertical migrations are fully accounted for. These data will be analyzed in terms of likely impact to Massachusetts Bay fish populations in two ways—by comparing the population per volume withdrawn with the overall Massachusetts Bay volumes at equivalent depths, and by estimating the EA mortality implied by the entrainment.

Study parameters therefore include time of year and abundance by species of all identifiable finfish and lobster eggs and larvae. Densities of ichthyoplankton in the Port (no./1000 m^3) will be multiplied by estimated volume of water withdrawn (m^3) to estimate the number of ichthyoplankton entrained at the EBRVs.

Mortality rates for early life stages were generally available for the species of interest in the literature. Larval length data obtained during this monitoring program will be examined to evaluate whether they can be used to refine the mortality rates used in the Equivalent Adult modeling conducted for the Environmental Impact Statement for Northeast Gateway.

2.2 STUDY LOCATIONS

One general survey area was used to represent the two buoy sites during preconstruction sampling and the same area will be used during operational monitoring as well. The laboratory methods are designed to ensure that appropriate data are available to develop life stage-specific mortality rates for numerically or ecologically important species. Long-term monitoring of ichthyoplankton for power plants with open water intakes, such as Seabrook Nuclear Power Station located in coastal New Hampshire, has demonstrated that spatial differences in the ichthyoplankton populations in the source water body can not be readily detected even with a Before-After Control-Impact (BACI) sampling design because stations well outside the zone of influence of the intake are hydrologically linked to the intake area. Given the circulation patterns in outer Massachusetts Bay, therefore, additional survey areas would provide no greater resolution of the potential impacts of the Northeast Gateway system.

The sampling location was defined as a polygon encompassing the three alternative buoy locations analyzed during the licensing process. The polygon extends 0.5 nmi east and south of Buoy A and 0.5 nmi north and west of buoy C. The relationship of the sampling polygon to the buoys is depicted on Figure 2. Coordinates for the corners of the polygon are:

Corner	Longitude	Latitude
1 NW	70.6453°	42.4154°
2 SW	70.6457°	42.3872°
3 SE	70.5823°	42.3867°
4 NE	70.5819°	42.4149°

2.3 FIELD METHODS

Sampling will be conducted twice monthly and focus on two depth regimes: the depth zone (approximately 20-40 feet) where the intakes are located, and, hence, that is most vulnerable to withdrawal; and the full water column (within about 15 feet of the bottom, consistent with ECOMON protocols). The collection gear will be towed in an oblique manner through the depth zone. Three pseudo-replicate (sequential) samples will be taken in each depth zone (i.e., intake and full water column), each with a target volume of 300 m^3. Sampling will be conducted during daylight hours as well as at night. Night is defined as the period from 2+ hours after sunset to 2+ hours before sunrise. Daylight is defined as 2+ hours after sunrise to 2+ hours before sunset. Additional samples will be collected during the crepuscular period (i.e., the period from 1 hour before to 1 hour after sunrise and sunset), but will only be analyzed if results from the day and night collections are statistically different (e.g., through numerical classification), suggesting a period of significant vertical migration. The total number of samples collected annually is shown in Table 1.

Table 1. Planned Sampling Effort (number of samples) for Northeast Gateway Ichthyoplankton Monitoring Program

Diel Period	May 2006 – May 2007	Operational Period Years 1 - 5
Day	72	144
Night	72	144
Crepuscular	72**	144**
TOTAL	144**	288**

** totals exclude samples collected during crepuscular period that are to be archived and processed only if necessary.

Collection gear will be a 1.0 m^2 Tucker trawl, or a similar plankton net that can be opened or closed at depth, equipped with a 0.330 mm mesh net and a calibrated flowmeter. The net will be lowered to the target depth in a closed position and then opened with a messenger activating a double trip release mechanism (DTRM). At the end of the approximate 10- minute tow a second messenger will be sent down the wire to close the net. Pre- and post-deployment flowmeter readings will be recorded. The nets will be washed down using filtered seawater and the contents preserved in 5 to 10 percent buffered formalin. Preserved samples will be transported to the Biological Laboratory for analysis.

A detailed field log will be maintained by the Chief Scientist during each survey. All station

Point	ET_Lon	ET_Lat
B	-70¦ 37'0.36"	42¦ 23'56.38"
A	-70¦ 35'31.03"	42¦ 23'38.45"
C	-70¦ 38'8.26"	42¦ 24'29.09"
1	-70¦ 38'43.10"	42¦ 24'55.43"
2	-70¦ 38'44.47"	42¦ 23'13.85"
3	-70¦ 34'56.23"	42¦ 23'12.09"
4	-70¦ 34'54.75"	42¦ 24'53.67"

Figure 2. Ichthyoplankton Sampling Area (scale incorrect).

locations (starting point of tow) will be recorded using GPS. Water depth, bottom depth for full water column tows, and tidal stage will be recorded. Samples will be logged on Normandeau's standard chain-of-custody forms that will accompany the samples to the laboratory.

2.4 LABORATORY METHODS

All samples collected during daytime and nighttime periods will be processed in the laboratory. Samples collected during the crepuscular periods will be archived until the data analyst determines whether it would be necessary to analyze them. In the laboratory, all eggs and larvae will be identified to the lowest practical taxon. Subsampling will be allowed following Normandeau's standard laboratory procedures so that a minimum of 200 eggs and 100 larvae are identified. For eggs it may be necessary to group some taxa such as Labridae/yellowtail flounder, and hake/fourbeard rockling due to similarities in morphology and spawning season. Larvae are typically identified to the species level. For species that have clearly defined larval life stages (e.g., yolk sac, post-yolk sac, etc.), individuals will be assigned to the appropriate life stage. During the permitting process, 12 species of commercial or ecological importance (Table 2) were identified for impact assessment using Equivalent Adult Loss modeling techniques. Laboratory analysis will include length measurement to the nearest 0.5 mm will be made for these species, and any other abundant species, because length is a necessary parameter for estimating mortality rates for larvae. In addition, if lobster larvae are present in the samples, they will be enumerated by life stage.

Table 2. Fish species for which the Port area has been designated Essential Fish Habitat for larvae.

Common Name	Scientific Name
Atlantic cod	*Gadus morhua*
Atlantic herring	*Clupea harengus*
Atlantic mackerel	*Scomer scombrus*
Butterfish	*Peprilus triacanthus*
Cunner	*Tautogolabrus adspersus*
Haddock	*Melanogrammus aeglefinus*
Hake	*Urophycis* spp.
Pollock	*Pollachius virens*
Sand lance	*Ammodytes* spp.
Silver hake	*Merluccius bilinearis*
Winter flounder	*Pseudopleuronectes americanus*
Yellowtail flounder	*Limanda ferruginea*

Laboratory personnel will participate in Normandeau's standard Quality Control program in which 10% of each sorter's samples (randomly selected out of batches of 10 samples) are reexamined by a qualified supervisor to ensure a minimum of 95% of the ichthyoplankton individuals have been removed. Sorting efficiency (%) will be calculated as:

$$\frac{\text{QC count} - \text{original count}}{\text{QC count}} \times 100$$

Taxonomists also participate in the Quality Control program, with a randomly selected 10% of each taxonomist's samples being reanalyzed by a senior taxonomist to ensure a minimum taxonomic efficiency of 95%. Accuracy is calculated by species and lifestage as:

$$\frac{\text{QC count} - \text{original count}}{\text{QC count}} \times 100$$

Data will be recorded on laboratory data sheets and submitted to Normandeau's Data Processing Department. Normandeau typically includes several steps in the initial data processing to ensure quality of the data file. These steps include double keying of the original data, development of numerous range checks, and QC of the data entry by a taxonomist familiar with the data.

2.5 DATA ANALYSIS

2.5.1 Community Structure

Density of eggs and larvae will be presented as twice-monthly mean abundances (no./1000 m^3). Seasonal patterns will be described using numerical classification techniques. Life history of common species will be discussed in reference to Port construction and operation.

2.5.2 Entrainment Impacts

Twice-monthly mean abundances will be used to calculate the number of individuals (by species, life stage, and size class) that are vulnerable to entrainment by multiplying abundance by intake volume. To place these numbers in perspective, however, it is important to account for the naturally high mortality rates experienced by early life stages of marine organisms. With knowledge of life stage-specific mortality rates for individual species, entrainment losses can be converted to Equivalent Adult losses. The term Equivalent Adults reflects the number of fish that would survive to adulthood (at a defined age) assuming natural mortality rates.

Length measurements obtained during sample analysis will be used to develop regressions of density versus length with the slope of this line representing the mortality rate. If the site-specific samples do not provide sufficient data to estimate mortality rates for each species, values will be derived from the literature.

Ichthyoplankton abundance data will be used to estimate the reduction in reproductive age fish populations caused by entrainment of fish eggs and larvae by Northeast Gateway. It will be assumed that 100% of the organisms entrained in the vessel will be killed.

3.0 DISCHARGE WATER QUALITY MONITORING STUDY DESIGN

Discharge of heated water into Massachusetts Bay is the primary impact to water quality caused by operation of the Northeast Gateway Deepwater Port. Modeling of the discharge occurring on the first and last days at port has indicated that changes to water quality will be limited in space. Sampling will be conducted to confirm the model predictions, to demonstrate that a persistent discharge plume is not discernable at a great distance from the vessel, and to document plume characteristics during winter mixed water column conditions, spring and fall transitional conditions, and summer stratified conditions.

Modifications to this study design may be made as a result of requirements outlined in the NPDES permit.

3.1 STUDY PARAMETERS

Water quality monitoring will be conducted on a quarterly basis for a period of five years with the primary purpose of documenting the extent of the thermal plume. Additional parameters that will be measured are salinity, dissolved oxygen, and current direction.

3.2 FIELD METHODS

At a distance of up to 3000 feet (1000 meters) from an EBRV in the first or last day of operation (highest discharge volume), average current direction of the uppermost 30 feet (10 meters) of the water column will be measured using an Acoustic Doppler Current Profiler (ADCP). This information will be used to determine the orientation of the sampling transect. The sampling vessel will maneuver as close to the EBRV's discharge as possible. Operating along a downcurrent transect, the field crew will collect temperature, salinity, and dissolved oxygen profiles at 300 foot (100 meter) intervals. The length of the transect will be a minimum of 1,640 feet (500 meters) and extend until two adjacent sampling points have surface temperatures within 0.5°C of each other. At each sampling location, measurements will be made at 3-foot (1-meter) intervals using appropriate probes along a vertical profile through the uppermost 30 feet (10 meters) of the water column.

3.3 DATA ANALYSIS

Geo-referenced data from the quarterly water column sampling will be plotted to document the two-dimensional behavior of the discharge plume. Results will be compared to the predictions of the CORMIX model.