Transmission Developers Inc.

Champlain Hudson Power Express Project

Exhibit 4

Environmental Impacts

EXHIBIT 4
ENVIRONMENTAL IMPACTS

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EXHIBIT 4: ENVIRONMENTAL IMPACTS

4.1 CONSTRUCTION AND OPERATIONAL PROCEDURES

4.1.1 Construction Methods

The location and facility component descriptions are described in Exhibit 2, and cross-sections of the proposed Champlain Hudson Power Express Project (the Project) facilities are provided in Exhibit 5. The following paragraphs describe the proposed construction methods, procedures and equipment for the Project.

Given the length of the Project from the Canadian border to the New York/Connecticut State border (approximately 355.6 miles) and the diversity of landforms and water areas that are crossed by the Project route, a variety of construction methods and equipment will be employed. The goal of the cable installation will be to construct a high-voltage direct current (HVDC) cable system (and a small section of high-voltage alternating current [HVAC] cable system from the converter station to the substation) that, once properly installed and commissioned, will minimize the need for extensive maintenance and repair work during the operational life of the Project. Analysis of existing buried electric cable projects indicates that the vast majority of failures occur from external causes, not from manufacturing defects within the cable itself. Avoidance of damage from external causes will be accomplished primarily by burying the cable to suitable depths within each Project segment. External damage on land is usually caused by third parties who excavate near or over the buried cables without verifying the location of buried cables. For submarine cables, external damage is primarily caused by fishing trawls or ship anchors. Besides burial to an appropriate depth, other means of protection that are likely to be employed along the cable route are rip-rap, articulated concrete mats, or armored conduit sections. Cable protection measures will vary along the cable route and will be designed on a site specific basis as part of the Environmental Management & Construction Plan (EM&CP).

4.1.1.1 Underground Installation Methodology

For the underground portions of the Project route, the cables will be buried via excavated trenches or Horizontal Directional Drilling (HDD) methods. For underwater cable installation, the primary methods utilized for installation will be water jetting, plowing and dredging, with shoreline crossings completed by HDD. Further details of the cable installation methods and equipment are described below.

The underground portion of the Project route is located within or immediately adjacent to the existing Canadian Pacific Railroad (CP) and the CSX Railroad (CSX) rights-of-way. A minimum separation distance is required from the rails to the cables by each railroad; CP requires a minimum separation of 10 feet from the centerline of the outermost track to the cable trench and CSX requires a minimum separation of 25 feet from the centerline of the outermost track. The typical and preferred layout is to have one bipole (2 cables) installed on either side of the railroad tracks. With this layout, the limits of construction activity extend 15 feet beyond the required minimum setback of the railroads. This 15 foot area will include the area needed for excavation of the trench, installation of erosion and sediment control measures, installation of the two cables and stockpiling of excavated material. In total, the CP construction corridor will amount to approximately 50 feet (25 feet on either side of the track) and the CSX construction corridor will amount to approximately 80 feet (40 feet on either side of the track). There are areas that will require different configuration and pose additional engineering challenges, such as steep slopes, environmentally sensitive areas and existing structures. These areas will be identified and site specific engineering solutions will be developed as part of the EM&CP.

Each of the four underground cables will require a number of joints and a flat pad will be installed underneath each joint for splicing activities. The number of joints will be kept to a minimum and will be determined either by the maximum length of cable that can be transported in a single piece or by the maximum length of cable that can be pulled, whichever is the least. The jointing is performed in a jointing pit, with typical general dimensions for four cables being 30 feet long, 40 feet wide, and 7 feet deep. For land installation, typical segment lengths range from 0.5 to 0.1 miles. The following sections identify the general construction sequence for routine cable installation along the underground portion of the Project:

- Initial clearing operations and storm water and erosion control installation;
- Trench excavation;
- Cable installation;
- Backfilling; and
- Restoration and revegetation.

4.1.1.1.1 Initial Clearing Operations and Storm Water and Erosion Control Installation

Initial clearing operations will include the removal of vegetation within the cable trench area and within any temporary additional construction workspace (e.g., HDD workspace) either by mechanical or hand cutting. Vegetation will be cut at ground level, leaving existing root systems intact except for the immediate ditch area, and the aboveground vegetation removed for chipping or disposal. Tree stumps and rootstock will be left in the temporary workspace wherever possible to encourage natural revegetation. Brush and tree limbs will be chipped and spread in approved locations or hauled off-site for disposal. Timber will be removed from the right-of-way to approved locations.

The cleared width within the right-of-way and temporary construction workspace will be kept to the minimum that will allow for spoil storage, staging, assembly of materials, and all other activities required to safely install the cable.

Closely following initial disturbance of the soil, erosion controls will be properly installed as required. Design of the stormwater and erosion controls will be completed as part of the EM&CP and will include measures such as silt fences, haybales, temporary mulching, etc.

4.1.1.1.2 Trench Excavation

The typical trench will be up to 9 feet wide at the top and approximately 3 feet deep to allow for the proper depth and separation required for the burial of the cables. In general, the trench will be deep enough to provide for 3 feet of cover over the cable. The excavated material will be placed next to the trench.

Should it become necessary to remove water from the trench, it will be pumped to a stable, vegetated upland area (where practical) and/or filtered through a filter bag or siltation barrier.

In normal terrain, where soil conditions range from organic, loam, sand, gravel or other unconsolidated material, the trench will be excavated using rail mounted equipment. When this is not possible, traditional excavation equipment will be used. The mixing of topsoil with subsoil will be minimized by using topsoil segregation construction methods in wetlands (except when standing water or saturated soils are present). Topsoil will be stripped from the trench and subsoil stockpile area (trench plus spoil side method) and placed on one side of the ditch. Subsoil will be placed on the other side of the ditch.

Based on review of soils and geologic maps of the Project area, shallow bedrock has the potential to be encountered along some portions of the land segment of the Project alignment. Rock encountered during trenching will be removed using one of the following techniques. The technique selected is dependent on relative hardness, fracture susceptibility, and expected volume of the material. Techniques include:

- Conventional excavation with a backhoe;
- Hammering with a pointed backhoe attachment followed by backhoe excavation; or
- Blasting followed by backhoe excavation.

All blasting activity will be performed by licensed professionals according to strict guidelines designed to control energy release. Proper safeguards will be taken to protect personnel and property in the area. Charges will be kept to the minimum required to break up the rock. Where appropriate, mats made of heavy steel mesh or other comparable material or trench spoil will be utilized to prevent the scattering of rock and debris. These activities will strictly adhere to all industry standards applying to controlled blasting and blast vibration limits with regard to structures and underground utilities. Blasting in the vicinity of nearby utilities will be coordinated with the owner, as necessary. Blasted rock will be hauled off-site and disposed of in an appropriate manner.

4.1.1.1.3 Cable Installation

For the underground sections of the Project's route, two cables within each bipole system will typically be laid side-by-side (approximately 3 feet apart) in a trench approximately 3 feet deep. Once a pre-selected length of trench is excavated to the necessary depth and the base prepared, rollers will be placed in the bottom of the trench to facilitate pulling the cable into the trench. A cable attached to a winch at the opposite end of the trench from the cable spool will be attached to the cable and reeled in, pulling the cable down the length of the trench on the rollers. Depending upon the soil conditions on the bottom of the trench, the bottom of the trench may have some padding fill placed before pulling the cable into the trench. Once the cable segment is pulled down the length of the trench, it is moved off the rollers.

Given the need to schedule work with the railroad and the overall Project schedule, it is anticipated that cable installation activities will occur twenty fours hour per day/seven days per week in most areas, with nighttime shutdowns occurring in select sensitive receptor areas. This will require that nighttime lighting be used. To the extent possible, directed lighting will be employed when in residential areas to minimize lighting of areas outside of the workspace. In addition, the continual construction schedule will result in the operation of heavy machinery and equipment (e.g., generators, excavators, and vehicle engines) during all hours of the day and night. Certain activities may be limited to daytime periods, depending upon noise sensitivity of nearby areas (e.g., blasting, if required).

During cable installation, it is anticipated that the majority of supplies and equipment will be transported along the cable route via the railroad. However, it will also be necessary in certain instances or for certain components of the work, for vehicles to arrive and depart from work areas via local roadways. Workers may arrive at contractor yards or the right-of-way in pickup trucks, supplies may be delivered directly to the site, and equipment such as dewatering pumps, generators or excavators may also need to access the site via local roads. Procedures for traffic management will be developed as part of the EM&CP and may include items such as detours, police details, or signage.

4.1.1.1.4 Backfilling

Subsequent to laying the cables, the trenches will be backfilled with low thermal resistivity material. Because the operation of the cables results in the generation of heat, and heat reduces the electrical conductivity of the cables, it is important to backfill with this material to prevent heat from one cable affecting a nearby cable. There will be a protective concrete cover or a layer of weak concrete directly above the low thermal resistive backfill material. The whole assembly will have a marker tape placed 1 to 2 feet above the cables. Where two bipole transmission systems are present, two trenches will be required, and the bipoles will have a minimum separation of approximately 12 feet. A typical installation for an underground cable is shown in Exhibit 5 Typical RR009. The top of the trench may be slightly crowned to compensate for settling.

In areas of wetlands or perched water tables, trench plugs or other methods to prevent draining of wetlands or surface waters down the trench will be used. In areas of wetland soils, the organic surface layer will be backfilled over the subsoil backfill to reestablish an adequate soil profile for wetland restoration objectives. Another component of the backfilling process that will be assessed and addressed is soil compaction. Soil compaction is a small concern if the trenching, stockpiling, cable installation and backfilling is conducted from the railroad, as heavy equipment operation on the ground surface along the cable trenches will be minimal. In addition, location of the construction corridor within the railroad right-of-way (and not on adjacent fields or agricultural lands) further reduces the likelihood of soil compaction concerns.

4.1.1.1.5 Restoration and Revegetation

A cleanup crew will complete the restoration and revegetation of the rights-of-way and temporary construction workspace. In conjunction with backfilling operations, any remnant woody material and construction debris will be removed from the rights-of-way. The temporary construction area will be seeded with an approved seed mix for the area and allowed to revegetate naturally.

4.1.1.1.6 Environmental Training

Environmental training will be given to construction contractor personnel whose activities may impact the environment during cable installation. The level of training will be commensurate with the type of duties of the personnel. The training will be given prior to the start of construction and throughout the construction process, as needed for new workers arriving on-site. The training program will cover the job-specific permit conditions, company policies, cultural resource procedures, threatened and endangered species restrictions, Spill Prevention Control and Countermeasures Plan (SPCCP), State Pollutant Discharge Elimination System (SPDES) Storm Water Plan, and any other pertinent information related to the Project. In addition to those with environmental monitoring and compliance responsibilities, all other construction personnel are expected to play an important role in maintaining strict compliance with all permit conditions to protect the environment during construction.

4.1.1.2 Underwater Cable Installation Methodology

The two underwater cables associated with each transmission system bipole will be laid approximately 6 feet apart, and the two bipoles will be separated by approximately 30 feet. The separation distance between bipoles may vary with depth of water, with greater separation for deep water and reduced separation in shallow water and underwater to underground transition areas. The minimum separation will never be less than 12 feet between bipoles. Generally, the underwater power cables will be manufactured with armoring and buried primarily at a 3-foot depth. Cable burial may be performed at the same time the cable is laid or at a later date, as deemed appropriate or necessary due to subsurface conditions. The cables will be laid by specialized cable-laying vessels or a specially outfitted laybarge, depending on navigation constraints along the route.

The cable will be transported from the manufacturer by a special cable transport vessel and transferred onto the cable installation vessel. The linear cable machines onboard the installation vessel will pull the cables from coils on the transport vessel onto the installation vessel and into prefabricated tubs. After the cable has been transferred, the installation vessel will travel to the construction commencement location. This process will be repeated as required to deliver and install all the required cable along the length of the various waterways.

Given the need for certain installation activities to occur uninterrupted (e.g., HDDs and jetting), it is anticipated that cable installation activities will occur twenty four hours per day/seven days per week in most areas, with nighttime shutdowns occurring only in select sensitive receptor areas. This will require that nighttime lighting be used. To the extent possible, directed lighting will be employed to minimize lighting of areas outside of the workspace. In addition, the continual construction schedule will result in the operation of heavy machinery and equipment (e.g., generators, water pumps, and vessel engines) during all hours of the day and night. Certain activities may be limited to daytime periods depending upon noise sensitivity of nearby areas.

4.1.1.2.1 Water Jetting

The proposed method for laying and burial of the majority of the underwater cable is by the water jetting embedment process. This method involves the use of a positioned cable vessel and a hydraulically-powered water jetting device that simultaneously lays and embeds the underwater cable in one continuous trench. At this time, the primary proposed installation vessel will be dynamically positioned, using thrusters and the vessel propulsion system. In relatively shallow water depths (typically less than 15 feet), shallow draft vessels/barges, which typically use anchors for positioning, may be used for installation. Deeper draft vessels equipped with dynamic positioning thrusters are proposed for deeper water locations. Dynamically positioned cable installation vessels do not contact or directly disturb the bottom; however, depending on navigation limitations along the route, it is possible that a tugboat positioned vessel or an anchor-positioned vessel may be used for some or all of the cable installation. An anchor-positioned vessel will propel itself along the route with forward winches while letting out on aft winches with other lateral anchors holding the side-to-side alignment during the installation. The 4-to-8 point anchor mooring system will require an anchor handling tug to move anchors while the installation and burial proceeds uninterrupted on a 24-hour basis.

Water jetting embedment methods for underwater cable installations are considered to be the most effective and least environmentally damaging when compared to traditional mechanical dredging and trenching operations. This method of laying and burying the cables simultaneously ensures the placement of the underwater cable system at the target burial depth with minimum bottom disturbance, with much of the fluidized sediment settling back into the trench. For these reasons, it is the installation methodology that appears to be preferred by state and federal regulatory agencies based on review of past underwater cable projects.

Water jetting equipment uses pressurized water (taken from existing waterbodies) from water pump systems onboard the cable vessel to fluidize sediment. The water jetting device is typically fitted with hydraulic pressure nozzles located down the length of “swords” that are inserted into the sediment on either side of the cable and which create a direct downward and backward “swept flow” force inside the trench. This provides a down and back flow of re-suspended sediments within the trench, thereby “fluidizing” the *in situ* sediment column as it progresses along the predetermined underwater cable route such that the underwater cable settles into the trench under its own weight to the planned depth of burial. The water jetting device’s hydrodynamic forces do not work to produce an upward movement of sediment into the water column, since the objective of this method is to maximize settling of re-suspended sediments within the trench to bury or “embed” the cable system as it progresses along its route. The pre-determined deployment depth of the jetting swords controls the cable burial depth using adjustable hydraulics on the water jetting device.

The cable system location and burial depth will be recorded during installation for use in the preparation of as-built location plans. The water jetting device is equipped with horizontal and vertical positioning equipment that records the laying and burial conditions, position, and burial depth. This information is monitored continually on the installation vessel. This information will be forwarded to appropriate agencies and organizations as required for inclusion on future navigation charts.

Burial can be performed by either a towed or self-propelled burial machine. In this instance the self-propelled water jetting device moves forward by the reaction of the backward thrust of the hydraulic jetting power that is fluidizing the soil and keeping the created trench open for the cable to sink into. The forward rate of progress is regulated by the varying types of soil and the water pressure applied through the jets.

A skid/pontoon-mounted water jetting device or wheeled, frame-mounted water jetting device, deployed and operated in conjunction with the cable-laying vessel, is proposed for the Project's underwater installation. For burial, the cable vessel is used as the platform to operate the water jetting device at a safe distance as the laying/burial operation progresses. The cable system is deployed from the vessel to the funnel of the water jetting device. The water jetting swords are lowered onto the seabed, pump systems are initiated, and the jet trencher progresses along the pre-selected underwater cable route with the simultaneous lay and burial operation. It is anticipated that, to install each of the four cables to the required depth – providing a minimum of 3 feet of cover in the sediments that are generally found along the proposed underwater cable route – the water jetting device will fluidize a pathway approximately 2 feet wide and 4 feet deep into which the cable settles through its own weight. The pontoons can be made buoyant to serve different installation needs.

Temporarily re-suspended *in situ* sediments are largely contained within the limits of the trench wall, with only a minor percentage of the re-suspended sediment traveling outside of the trench (more so for fine sediments than coarse). Any re-suspended sediments that leave the trench tend to settle out quickly in areas immediately flanking the trench, depending upon the sediment grain-size, composition, water currents and the hydraulic jetting forces imposed on the sediment column necessary to achieve desired burial depths.

As the water jetting device progresses along the route, the water pressure at the device nozzles will be adjusted as sediment types and/or densities change to achieve the required minimum burial depth. A test trench may be preformed to ensure proper depth of burial. In the unlikely event that the minimum burial depth is not met during water jetting embedment, additional passes with the water jetting device or the use of diver-assisted water jet probes will be utilized to achieve the required depth.

Jet water pressure varies with different bottom sediment materials, with typical pressures including:

Material	**Estimated Jet Water Pressure**
Sand and Silt	400-600 psi
Soft Clay	600-800 psi
Hard Clay	800-1,000 psi

Some types of water jetting devices also employ an ejector system to assist in the trenching operation in certain sediment types that do not fluidize well. The ejector system employs an air lift system to create a suction force within the ejector pipes that entrains sediment and releases it at the end of the ejector pipes to either side of the water jetting device. This addition to the water jetting methodology will only be employed to assist in burial if monitoring of the installation reveals difficulty in obtaining the required burial depth due to lack of adequate fluidization of sediments.

In addition to continuous closed circuit video monitoring, divers will make regularly scheduled dives in order to monitor the cable installation operation and inspect the condition of the cable trench and jet sled. Occasionally, the jet sled may require maintenance during cable burial operations due to nozzle wear or loss. During these maintenance periods, the jet leg roller load cells, suction piping and hose connections are checked, and hydraulic fluid is replenished as required. An SPCCP will be developed for the Project and will be followed during construction equipment maintenance and repair activities.

In certain small areas – typically transition areas between HDDs and cable trenches – a diver-operated hand jet may be used to bury the cable. In this process, a support vessel provides pressurized water through a hose with a nozzle that is maneuvered by a diver. The diver works the sediment under the cable to create a trench into which the cable settles. This method will be employed for short distances only, typically less than 100 feet.

4.1.1.2.2 Mechanical Plowing

For sections where water jetting is not possible, "plowing" may be necessary. For the plowing technique, a trench is made for the cable by towing a plow, and the cable settles into the trench, either at the same time or in a subsequent pass of the cable-laying vessel. There are pre-lay and post-lay plows, depending on the needs of the Project. For a pre-lay plow, the cable is simultaneously fed into the trench as it is created by the plow. For a post-lay plow, the cable has already been laid, the plow is lowered on the bottom and the cable placed inside the plow device, which then embeds it into the bottom as the plow is pulled forward. In either situation, the plow is not self-propelled, but is instead tethered to a surface support vessel which supplies the pulling power. Usually, the bottom sediment is allowed to naturally backfill the trench over the cable by slumping of the trench walls, wave action, or bed load transport of sediments. If the sediments are not likely to result in adequate backfill over the cable, a backfill plow can be used which employs horizontal blades that capture some of the sediment pushed off to the sides during plowing and pulls it back into the trench over the cable.

4.1.1.2.3 Dredged Trench Excavation (Conventional Dredging)

While it is intended that the use of conventional underwater trench excavation methods will be minimized, there will be some locations where conventional dredging will be required. These circumstances may include instances where the cable route is located within an existing navigation channel. In these locations, either a clam-shell dredge or a barge-mounted excavator will be used to pre-dredge a trench into which the cable will be laid. The trench will typically be over-excavated by approximately 20 percent to allow for slumping of trench sidewalls prior to cable installation. Trench spoil will be brought to the surface and placed on barges, either for re-use as backfill or for approved disposal. This work will most likely occur from spud barges, although anchor-moored or jack-up barges may also be employed, depending upon equipment availability and site conditions. A typical spud dredge barge will be equipped with three spuds, with one spud being a walk-away spud. The barge will have a crane, typically outfitted with a 6 to 9 cubic yard clamshell bucket. Alternatively, the barge may have a track hoe excavator working off the deck of the barge, possibly with an extended boom for areas of deeper water. Once a segment of trench is excavated, cable will be laid, and the clam-shell dredge or excavator will place sediment back into the trench.

4.1.1.2.4 Non-Burial Installation

In limited areas along the Project route, surficial geology may not permit adequate cable burial depths within the lake/canal/river/seabed to ensure adequate cable protection. In these areas, the HVDC cables will be laid on the lake/canal/river/seabed with protective coverings, such as rip-rap or articulated concrete mats. Areas where this method may occur are at foreign pipeline or cable crossings, small unavoidable bedrock areas, and potentially in areas of contaminated sediments. In these locations, the plow or water jetting device will be lifted off the bottom moved forward past the obstacle and then re-deployed to the bottom once safely across. In a separate activity, the cable laying on the sediment surface will be covered with sloping stone rip-rap or articulated concrete mats. Typically this method will be used only for short distances.

Articulated concrete mats are made of small pre-formed blocks of concrete that are interconnected by cables or synthetic ropes in a two dimensional grid, typically creating shapes ranging from 6 feet by 6 feet to 8 feet by 25 feet. The concrete mats are lifted off barges and lowered into the water over the cable using a crane. Positioning is monitored by divers. Rip-rap will be sized to remain in place under current and wave conditions expected at the site. Rip-rap will be lowered from a supply barge using either a clamshell dredge or an excavator. Rip-rap thickness will be monitored by divers to prevent over- or under-placement of material. This type of cable installation and protection is similar to methods potentially used for certain infrastructure crossings, as further described below. The location of these areas will be identified for appropriate engineering as part of the EM&CP.

4.1.1.2.5 Infrastructure Crossing Installation Methodology

Preliminary review of the underwater cable route identified numerous areas where the Project will encounter existing submarine infrastructure (e.g., electric cables, gas pipelines, ferry cables, etc.) that must be crossed. Champlain Hudson Power Express, Inc. (CHPEI) is working with New York State Office of General Services (NYOGS) to complete the list and collect additional details regarding each crossing that will be required. The complete list of submarine infrastructure crossings will be provided as part of the supplemental information to be submitted in July 2010.

There are several different installation techniques that can be utilized when crossing existing infrastructure based on the type, burial depth, and existing protective coverings of the infrastructure. In many cases, it is anticipated that the underwater cables will be laid over the existing infrastructure with protective coverings (e.g., rip-rap or articulated concrete mats). The design of utility crossings will follow industry standards. An overview of typical methods for crossing of utilities is shown in Exhibit E-3, Figure E-3-8.

Crossing of utilities owned by a third party, such as existing cables and pipelines, will require formal crossing agreements to be made. The design of the protection at these crossings will be subject to such agreements. Detailed discussions on methodologies and safety issues will be conducted with the owners of these infrastructures. The detailed designs for each crossing will be provided as part of the EM&CP.

Crossing of Fiber Optic, Telecommunication Cables, and Power Cables

Wherever possible, the HVDC cables will cross existing fiber optic and telecommunication cables at right angles, extending approximately 150 to 300 feet in length. The method of embedding and protection will be determined by the burial depth of the existing cables.

A minimum separation between the Project's transmission cable and the existing telecommunication cables will be provided by installing a protective sleeve on the cable at each crossing. The protective sleeve will extend for approximately 50 and 80 feet on each side of the crossing point. The HVDC cables, including the section with sleeve protection, will be buried by water jetting or plowing to the specified depth, or as limited by the actual burial depths of the existing cables (Exhibit E-3, Figure E-3-9).

In some cases, existing telecommunication cables are buried less than 3 feet; therefore, special measures may be utilized at the crossing site. Potential measures used for crossing shallow buried existing utilities may include the following: the use of protective sleeves on the HVDC cables along with burial until touching the existing cables, increasing the burial depth of the existing cables by water jetting at the crossing point prior to installing the HVDC cables, or cutting and re-splicing the telecommunication cables after installing the HVDC cables. The details of these crossings will be coordinated with the owners of the existing facilities.

Crossing of Gas or Oil Pipelines

Where the HVDC cables cross existing pipelines or power cables, the HVDC cables will cross the existing infrastructure as close as possible to right-angles, extending for approximately 300 feet on each side of the crossing point. The method of cable embedding and protection will be determined by the burial depth of the existing infrastructure.

For deep-buried pipelines or cables, a protective sleeve will be applied to the HVDC cables at each crossing to provide a minimum separation between the HVDC cables and the existing infrastructure. The sleeve will be installed for up to 80 feet to either side of the crossing location to ensure that it will cover the crossing point. The HVDC cables, including the portion with sleeve protection, will be buried by water jetting or plowing to the target depth or as limited by the actual burial depths of the existing pipeline or cable.

For shallow buried pipelines, a minimum separation between the HVDC cable and the pipeline will be provided by pre-installing a 150 millimeters (mm)-thick grout-filled mattress on top of the infrastructure at each crossing. The HVDC cable and pipeline will be post-lay protected by further placement of grout-filled mats or articulated concrete mats (Exhibit E-3, Figure E-3-10). The HVDC cables will be buried using the water jetting device to the target depth, as close as possible to the grout-filled mats.

Crossings of Other Infrastructure Types

A "chain-ferry" operates across the proposed underwater cable route within Lake Champlain. The chain ferry utilizes ferry cables laid on the bottom of Lake Champlain. The normal penetration of the ferry cables into the seabed will be assessed, and if deemed necessary, additional protection in the form of deeper burial at the crossing point or the use of an outer protection sleeve against abrasion will be considered. The ferry cables will be temporarily removed to facilitate the installation of the underwater cables. The ferry cables will then be replaced over the top of the transmission cables. The ferry cables are replaced every four years; therefore, there may be an opportunity to coordinate the cable installation schedule with the ferry cable replacement schedule. Detailed coordination and discussions will be required with the ferry operator on methodologies and scheduling.

The underwater cable will be routed beneath overhead infrastructures, including road bridges and electrical transmission lines. These will not be of concern for the cable systems once in operation, but the superstructure on the cable-laying vessels will be designed to take account of any height restrictions.

4.1.1.2.6 In-water Support Vessels

Because of the size and need to stay on-station for long periods of time, the major cable-laying and/or cable burial vessels will not make daily or frequent movements to ports. Instead, these vessels will be supported by a variety of smaller vessels that will support crew shift changes, bring supplies, re-fuel, and monitor the work. Geophysical survey vessels may be used to assess cable installation adequacy of burial depth and, when necessary, backfilled conditions of the lake/canal/river/seabed.

On-water refueling may be necessary not only for vessel engines but also for cranes, excavators, diesel generators, diesel water pumps, etc. Refueling will be performed with care to minimize the potential for spills. Spill control and clean up materials will be onboard refueling vessels to handle small spills, but for larger spills, a specialty marine spill contractor will be on-call for immediate response. Proper reporting protocols will be followed in the event of reportable quantities of fuel or other pollutants being discharged to the water. These protocols will be outlined in the EM&CP.

Good housekeeping practices will be enforced on all vessels to prevent the unintentional discharge of trash and debris overboard. Routine inspections of working deck surfaces will be performed and debris and trash will be removed expediently into trash receptacles.

4.1.1.3 Horizontal Directional Drilling

HDD is a common technique used for transmission cable installation projects to minimize environmental impacts for sensitive resource areas as well as when necessary because of route constraints on traditional trench installation (e.g., major highway crossings). HDD is a trenchless method for installing pipelines that transport liquids and gasses, or for installing conduit ducts for cable or wire line products. The technology is used in many situations, including the following: lake crossings, wetland crossings, canal and watercourse crossings, valley crossings, sensitive wildlife habitat, existing underground infrastructure crossings and road and railway crossings. HDD is a multi-stage process composed of the four steps listed below and further depicted in Exhibit E-3, Figures E-3-1, E-3-2 and E-3-1:

- Pre-site planning;
- Drilling a pilot hole;
- Expanding the pilot hole by reaming if necessary;
- Pull back of drill string with simultaneous installation of conduit; and
- Cable pull through the conduit.

The HVDC cables cannot be installed via shallow burial when in close proximity to railroad trestles for river or road overpasses; therefore, the HVDC cables will be installed within conduits that are installed under those roads or watercourses utilizing HDD techniques. Cable installation will be site-specific at each crossing point, but typical examples of HDD cable installation techniques along railroad and roadway crossings are shown in Exhibit 5, Figures RR 001, RR 002, RR 003, RR 004 and RR 005.

For each proposed HDD location, four separate drills will be required, one for each cable. Each cable will be installed within an 8 to 10 inch-diameter high density polyethylene (HDPE) casing. To maintain minimum separation between cables, a minimum of 6 feet will be required between each drill path. HDD will be employed in a number of situations during Project construction, including both underground sections of the Project's route and at shoreline crossing locations. Underground HDD will have both the entry and exit holes staged on land. For the shoreline crossing HDDs, the entry hole is typically staged on land and the exit hole is staged from the water. Locations of all proposed crossings will be identified and all HDDs will be engineered on a site-specific basis during development of the EM&CP.

At the transition of the HVDC underwater cables from water to land, installation will be accomplished through the use of HDD methodology in order to minimize disturbance to the bank and near shore area. The HDD will be staged at the onshore landfall area and involve the drilling of the boreholes from land toward the offshore exit point. Conduits will then be installed the length of the boreholes and the transmission cable will be pulled through the conduits from the submarine end toward the land. A transition manhole/transmission cable splicing vault will be installed using conventional excavation equipment (backhoe) at the onshore transition point where the underwater and underground transmission cables will be connected.

A drill rig will be setup onshore behind a bentonite pit, where a drill pipe with a pilot-hole drill bit will be set in place to begin the horizontal drilling. Drilling fluid will then be pumped into the hole as the cutting head is advanced into the soil. The HDD construction process will involve the use of drilling fluid in order to transport drill cuttings to the surface for recycling, aid in stabilization of the *in situ* soil/sediment to keep the hole open, and to provide lubrication for the HDD drill string and down-hole assemblies. This drilling fluid is composed of a carrier fluid and solids. The selected carrier fluid for this drilled crossing will consist of water (approximately 95 percent) and inorganic bentonite clay (approximately 5 percent). The bentonite clay is a naturally occurring hydrated aluminosilicate composed of sodium, calcium, magnesium and iron that is environmentally benign.

After each section of drilling, an additional length of drill pipe is added until the final drill length is achieved. To minimize the release of the bentonite drilling fluid into the water, freshwater may be used as a drilling fluid to the extent practicable for the final section of drilling, just prior to the drill bit emerging in the pre-excavated pit. This will be accomplished by pumping the drilling fluid out of the drill stem and replacing it with freshwater as the drill bit nears the pre-excavated pit. When the drill bit emerges in the pre-excavated pit, the bit is replaced with a hole opening tool called a reamer to widen the borehole. For this Project, it is anticipated that a single reaming pass will be necessary to allow installation of the conduit. Once the desired hole diameter is achieved, a pulling head is attached to the end of the drill pipe and the drill pipe is used to pull back the HDPE conduit pipe into the bored hole. As with the pilot hole drilling process, freshwater will be utilized, if practicable, as the reaming tool nears the pre-excavated pit. Once the HDPE conduits are in place, the underwater cables will be pulled through the conduit which will be permanently sealed at each end to complete the installation process.

To further facilitate the HDD operation, a temporary cofferdam may be constructed at the exit hole location. The cofferdam will be rectangular in shape and will be open at the end facing away from shore to allow for manipulation and pull back of the conduits and the cables. The area enclosed by the cofferdam will be approximately 16 feet wide by 30 feet long with a depth of approximately 8 feet. The cofferdam will be constructed using steel sheet piles driven from a barge-mounted crane. The cofferdam is intended to help reduce turbidity associated with the dredging and HDD operations as well as to help maintain the exit pit.

The area inside the cofferdam will be excavated to create an exit pit, to expose the seaward end of the borehole. Approximately 140 cubic yards of sediment will be excavated from within the cofferdam. The dredged material will be temporarily placed on a barge for storage. At the end of cable installation, the exit pit will be backfilled rather than allowed to in-fill over time. If necessary for the required volume of backfill, the dredged material backfill will be supplemented with imported clean sandy backfill to restore the bottom to preconstruction grade.

The drilling fluid system will recycle drilling fluids (made up of a combination of water, bentonite, and the material being excavated) and contain and process drilling returns for offsite disposal. Although considered environmentally benign, the discharge or release of drilling fluids to the water will be minimized by including a drilling fluid overburden breakout (frac-out) monitoring plan. It is likely that some residual volume of drilling fluid will be released into the pre-excavated exit pit when the pilot hole and reaming cutting heads come to the surface. The depth of the pit and the temporary cofferdam are expected to contain much of the drilling fluid that may be released into the exit pit.

It is expected that the HDD conduit systems will be drilled through sediment overburden at the landfall location. However, it is anticipated that drilling depths in the overburden will be sufficiently deep to avoid pressure-induced breakout of drilling fluid through the sediments along most of the length of the drill path. Nevertheless, a visual and operational monitoring program will be implemented during the HDD operation to detect a fluid loss. This monitoring includes:

- Visual monitoring of surface waters along the drill path and in the vicinity of the exit hole on a daily basis to observe potential drilling fluid breakout points;
- Drilling fluid volume monitoring by technicians throughout the drilling and reaming operations for each HDD conduit system; and
- Implementation of a fluid loss response plan and protocol by the drill operator in the event that a fluid loss occurs. The response plan could include injection of loss circulation additives such as Benseal that can be mixed in with drilling fluids at the mud tanks, and other mitigation measures as appropriate.

4.1.1.4 Cable Installation Methodologies Utilized Along the Project Route

Cable installation methodologies utilized along the Project's HVDC transmission cable route vary based on a number of factors, including but not limited to: sediment type and hardness, bathymetry, infrastructure crossings, and marine traffic.

Sediment types along river, canal, and marine portions of the route influence submarine cable design and protection requirements. The substrate composition and its associated cable installation methods will vary along the underwater cable route. For example, stiff clay sediments can hinder submarine cable burial and can affect heat dissipation and cable performance. Rock outcroppings and areas of bedrock can prevent cable burial and often require additional cable protection measures to prevent excess wear and cable fatigue. Silt, sand and gravelly sands are the preferred sediment types along the underwater portions of the cable route; therefore, the cable route has been sited within the preferred sediment types wherever possible.

Bathymetry is also an important factor to consider during submarine cable burial, protection, and installation. Steep or abrupt submarine bathymetry makes cable installation more difficult and can affect submarine cable design and life-span performance.

Crossing submerged infrastructure, such as submarine cables and pipelines require special HVDC installation techniques based on the type, size and burial depth of the existing submerged infrastructure, as described above. The HVDC underwater cables will encounter submerged infrastructure in several locations along the proposed route. The current owners/operators of such structures will be contacted to coordinate appropriate crossing design for the HVDC cables, and to determine the level of coordination necessary to deploy and operate the cables in proximity of the structures. Each of these situations will be identified and site-specific engineering will be used to design the appropriate method to address each situation. Site-specific engineering will be provided in the EM&CP.

General installation methodologies and descriptions of specific sections of the cable route are described in the following sections. Figures depicting the Project route are provided in Exhibit 2.

4.1.1.4.1 Canada/United States Border to the Champlain Canal

The transmission route within the United States begins at the international border within Lake Champlain and continues south for approximately 110 miles towards the beginning of the Champlain Canal at Lock C12. Four HVDC underwater cables will be installed within the New York jurisdictional waters of Lake Champlain along a relatively direct (straight north to south) route that facilitates the depths required for the cable-laying vessels while also avoiding the deepest portions of the lake (to avoid the need for double-armored cables). The underwater cables may be transported from New York on cable transporting vessels through the Champlain Canal, or by train from Montreal followed by transfer to a vessel for transport down the Richelieu River.

As the transmission cable route enters Lake Champlain from the Richelieu River, water depths range from approximately 6 to 50 feet. The HVDC underwater cables follow a 55-mile route crossing Lake Champlain towards Fields Bay, with water depths varying from very shallow to more than 400 feet; the cable route will avoid areas that are too shallow for the cable-laying vessel to navigate or areas that are too deep for the single-armored cables.

The 15 mile section from the Fields Bay area to the Lake Champlain Toll Bridge and onwards to Champlain Canal Lock C12 is a continuation of Lake Champlain. However, much of the lake's length south of the Lake Champlain Toll Bridge is more similar to that of a river, with water depths in the central portion ranging between 20 and 30 feet.

Within Lake Champlain, the HVDC underwater cables will be buried by water jetting, plowing, or excavation, depending on the lakebed conditions. Based on an analysis of the Lake Champlain bottom sediments, it is anticipated that cable installation will utilize water jetting technology for the majority of the underwater cable route within Lake Champlain.

Numerous submarine cables (some of which are decommissioned) have been identified within Lake Champlain and will require special techniques for cable crossings. In areas where the HVDC underwater cables cross existing submerged infrastructure, the cables will utilize the aforementioned methodologies for infrastructure crossings, as appropriate.

In addition to numerous submarine cables, a ferry cable system is located at the bottom of Lake Champlain. As discussed above, it is anticipated that coordination with the cable ferry service will be required in order to temporarily remove the ferry cables to facilitate burial of the Project's underwater transmission cables underneath the ferry cables.

4.1.1.4.2 Champlain Canal Lock C12 to Lock C8

South of Lake Champlain, the HVDC transmission cables approach the beginning of the Champlain Canal at Lock C12 in Whitehall, New York. The HVDC transmission cables have been primarily sited within the Champlain Canal between Locks C12 and C8, with the exception of short underground bypass routes utilized to circumvent the lock and dam infrastructure. Where the HVDC cables approach Locks C12, C11, and C9 (there is no Lock C10), four HVDC cables will exit the canal north of each lock and dam system and follow an underground bypass route before re-entering the canal south of each lock and dam system. Both underground and underwater cable installation methodologies will be utilized along this portion of the Project route, as further detailed below.

The underwater cables will be transported from on cable transporting vessels through the Champlain Canal. Water depths within the Champlain Canal have minimum depths of approximately 12 feet. The lock width (45 feet) and length (328 feet) will determine the size of the cable-laying vessels that can be used and the length of cable that can be carried. In general, sediment types within the Champlain Canal vary between silts, sand, and gravel. Within the Champlain Canal, it is anticipated that the four HVDC underwater cables will primarily be installed using water jetting technology.

It is anticipated that HDD techniques will be utilized for each landfall junction. Additionally, where the HVDC underground cables cross existing infrastructure (e.g., paved roads, bridges, utilities, etc.), it is anticipated that HDD will be utilized to install the HVDC cables.

As the Project route approaches the Champlain Canal, four HVDC cables will exit the waterway using HDD on the western shoreline of Lake Champlain, just north of Lock C12. Subsequently, four HVDC cables will be buried within excavated trenches along a 1.7 mile railroad right-of-way before entering the Champlain Canal (using HDD methods) south of Lock C12 near the Poultney Street Bridge.

South of Lock C12, four HVDC underwater cables are sited for 5.7 miles through the Champlain Canal and will be installed via a cable-laying barge primarily using water jetting. Approximately 1,000 feet north of Lock C11, the four HVDC cables exit the canal on the western shoreline using HDD methods. Subsequently, four HVDC land cables will be buried in excavated trenches along a 0.4 mile railroad right-of-way before re-entering the Champlain Canal (using HDD methods) approximately 1,000 feet south of Lock C11.

South of Lock C11, four HVDC underwater cables are sited within the Champlain Canal for 8.8 miles and will be installed via a cable-laying barge primarily utilizing water jetting. Approximately 1,000 feet north of Lock C9 (there is no Lock C10), the HVDC cables exit the Champlain Canal on the eastern shoreline using HDD methods. Four HVDC land cables will be buried within excavated trenches along a 0.5 mile underground route on Canal Corp-owned land before re-entering the Champlain Canal (using HDD methods) approximately 1,000 feet south of Lock C9. South of Lock C9, four HVDC underwater cables are sited within the Champlain Canal for 2.8 miles and will be installed via a cable-laying barge primarily using water jetting.

4.1.1.4.3 Champlain Canal Lock C8 to Albany

In order to avoid activities associated with the Upper Hudson River Polychlorinated Biphenyls (PCB) Dredging Project, a bypass route was evaluated. Based on these evaluations, an approximate 69.9-mile underground railroad right-of-way bypass route was identified as the most feasible route, as further detailed in Exhibit 3 and as shown in Exhibit 2 (Figures 2.1-1 through 2.1-3).

North of Lock C8, near Durham Basin, the HVDC cables exit the Champlain Canal on the western shoreline (using HDD methods) and follow a railroad right-of-way bypass route for approximately 69.9 miles before entering the Hudson River south of Albany, in the town of Coeymans. The 69.9-mile railroad right-of-way bypass section extends southwest from the Champlain Canal through Schenectady towards the Rotterdam junction. At Rotterdam junction, the bypass route continues south-southeast through the Selkirk rail yard towards the Hudson River south of Albany. Along this portion of the route, four HVDC land cables will be buried in excavated trenches within the railroad right-of-way. HDD methods will be used where existing infrastructure crossings and other obstacles are encountered, as well as at the shoreline crossings.

4.1.1.4.4 Coeymans, New York to Yonkers, New York

Four HVDC land cables will leave the 69.9-mile on-land railroad right-of-way bypass route and enter the Hudson River south of Albany, in the Town of Coeymans using HDD methods. Upon entering the Hudson River, four HVDC underwater cables will extend along the Hudson River for approximately 118 miles to Yonkers, New York, using water jetting as the primary burial method.

In general, the Hudson River is composed of five major surficial sediment types:

- Mud (clay, silt, fine sands);
- Sands with a smooth to mottled bottom;
- Coarse gravel and sand mixtures with irregular bottom composed of compact gravel and cobble deposits intermixed with sand;
- Mix of mud, sand, and gravel; and
- Bedrock, cobbles, and boulders that are often overlain by a variable thickness of unconsolidated sediments.

From Coeymans, the cable route is sited within the Hudson River to the Binnen Kill confluence just south of Castleton-on-Hudson, with water depths ranging from 8 feet near shore to 32 feet in the channel. Continuing south of Castleton-on-Hudson, water depths within the Hudson River range from approximately 7 feet near shore to 116 feet, with a median depth of approximately 50 feet.

On the Hudson River, a 32-foot deep navigation channel is maintained from Albany to New York City. The channel is 600 feet wide from New York City to Kingston and 400 feet wide from Kingston upstream to Albany. For the majority of the route within the Hudson River, the HVDC underwater cables have been sited outside of the navigation channel. However, there are limited areas where siting constraints will require the cables to be sited within or cross the navigation channel in order to avoid sensitive resources.

Significant river traffic is anticipated, especially in proximity to New York City, resulting in a greater possibility of ships' anchors damaging the cable; therefore, cable burial and protection methodologies will be carefully evaluated within this portion of the HVDC route.

There are also a number of locations within the Hudson River where the underwater cable will cross existing submerged infrastructure, such as submarine cables and pipelines. Existing infrastructure has been identified within the Hudson River near the municipalities of Castleton-on-Hudson, Kingston, Marlboro, Clinton Point, Poughkeepsie, Athens, Palisades, Roseton, Highland Falls, Buchanan, Stony Point and Guttenberg. CHPEI is working with the NYOGS to identify all such possible crossings. Additionally, pipelines cross the river near Glenmont and Hannacroix. Where the HVDC underwater cables cross existing infrastructure, the cables will be installed according to the aforementioned methodology for infrastructure crossings, as appropriate.

4.1.1.4.5 Yonkers HVDC Converter Station Connection

At Yonkers, New York two of the four HVDC cables (one bipole transmission system) will make landfall and terminate at the Yonkers HVDC converter station. The two remaining HVDC cables continue for another 66 miles through the Hudson River, Harlem River, East River, and Long Island Sound to the New York State border before eventually terminating in Bridgeport, Connecticut.

The two HVDC cables, which will connect to and terminate at the Yonkers HVDC converter station, will be installed using HDD methods to transition from the Hudson River to the termination points located inside the HVDC converter station site. Additional information on the converter station is included in Exhibit E-2 with more details to be provided with the supplemental information in July 2010. Construction drawings of the proposed converter station will be submitted as part of the EM&CP.

4.1.1.4.6 Yonkers HVDC Converter Station to the Sherman Creek Substation

The Yonkers HVDC converter station will be connected to approximately 6.6 miles of double-circuit 345 kilovolt (kV) alternating current (AC) cable, which will terminate at a new step-down 345/138 kV AC transformer substation adjacent to and tied into the existing Consolidated Edison Company of New York, Inc. (Con Edison) Sherman Creek substation, near the intersection of West 201st Street and 9th Avenue in the Borough of Manhattan. Additional information on the proposed Sherman Creek transformer substation is included in Exhibit E-2 with more details to be provided with the supplemental information in July 2010. Construction drawings of the proposed transformer substation will be submitted as part of the EM&CP.

The 345 kV AC cable will follow the same path through the Hudson and Harlem Rivers as the HVDC bipole system that continues into Connecticut. The Harlem River is scoured daily by tidal action, and sediments tend to be a mixture of sand, gravel, and cobble. Within the Harlem

River, water depths range from approximately 14 to 27 feet, extending from the Hudson River confluence to the East River confluence. Based on an evaluation of the environmental conditions within the Harlem River, it is anticipated that the HVDC underwater cables will be primarily installed and buried using water jetting.

4.1.1.4.7 Sherman Creek Substation to New York State Border

The East River has similar conditions to the Harlem River, with the lower East River substrate consisting of a shallow layer of sediment (2 to 12 inches) on top of gravel, cobble, rocks, and boulders. The East River main channel has a Project depth of 35 feet. The route continues northeast in the East River through the Hell Gate channel towards Long Island Sound, passing west of North Brother Island in water depths ranging from 20 to 80 feet. The cable route follows relatively uniform water depths and avoids deeper holes (i.e., greater than 100 feet) along this portion of the Project route.

According to information reviewed for the East River, it is anticipated that the surficial geology of portions of the East River will not facilitate burial depths for adequate cable protection. Therefore, it is anticipated that for those portions, the two HVDC cables (single bipole system) will be laid on the riverbed with protective coverings installed on top, such as rip-rap or articulated concrete mats. Wherever possible, the HVDC cables will be buried beneath the riverbed, using water jetting. When additional geophysical investigations are completed, the construction methodologies will be refined and presented in the EM&CP.

From the East River, the cables travel northeast into Long Island Sound. In general, sand occurs along most of the near-shore margins. Silty sand and sand-silt-clay mark transitions within Long Island Sound from higher to lower energy environments, such as on the flanks of bathymetric highs. Clayey silt and silty clay are predominant in low-energy environments, such as on the floors of the central and western basins. Water depths along the Project cable route within Long Island Sound generally range from approximately 20 to 100 feet.

Within Long Island Sound, significant marine traffic is expected, resulting in a greater possibility of ships' anchors damaging the cable; therefore, the cable burial and protection methodologies will be carefully evaluated within this area. Based on sediment types, bathymetry and marine traffic patterns, it is anticipated that the HVDC underwater cables will be primarily installed using water jetting within Long Island Sound. The cable route will leave New York State waters in Long Island Sound and enter the waters of Connecticut until its final destination in Bridgeport, Connecticut.

4.1.1.5 Construction Support Facilities

Additional construction support facilities such as lay down and storage areas, access roads and additional temporary workspace will likely be necessary to facilitate construction of the Project. Location and specific size of the support facilities will vary based on the final engineering and construction plan and will be provided as part of the EM&CP.

4.1.1.5.1 Underground Cable Installation Support Facilities

The underground portion of the route will likely require additional support facilities dispersed throughout the route. Examples of support facilities envisioned for this portion of the Project include: contractor yards, storage areas, access roads and additional work space. Areas where additional work space may be required are HDD locations, cable jointing locations and areas with steep slopes. To the extent possible, the installation of the underground portion of the Project along the railroads will be from rail-mounted equipment. In addition, transportation of the Project construction equipment and materials will be by rail to the extent possible. To the extent possible, these support facilities will be sited within the existing railroad rights-of-way and limited to the minimum space necessary to facilitate safe installation of the Project. Underground work at the canal bypasses will be staged at the immediate locations. Specific locations will be identified during site specific engineering and provided in the EM&CP.

4.1.1.5.2 Underwater Cable Installation Support Facilities

The underwater sections of the Project are expected to need very minimal land-based support. Transportation of the cables is expected to be via the cable-laying vessel, supported by re-supply barges operated from an intermittent storage area on land. This land-based support facility is envisioned to be no greater than 200 by 300 feet in size, and will be located at a port with heavy lift facilities. The detailed engineering and construction schedule will identify the need for and the location of these facilities, which will be incorporated into the EM&CP.

4.1.1.6 Project Schedule

The Overall Project Schedule (Figure 4.1-1) details the expected permitting, manufacturing, construction, and testing sequence for the Project. Complete construction of the Project will take multiple years and occur simultaneously in multiple sections of the Project. A detailed construction schedule will be developed as part of the EM&CP.

4.1.2 Project Operations

The Project's HVDC transmission cable system is designed to be relatively maintenance free and operate within the specified working conditions. However, selected portions or aspects of the transmission cable system will be inspected to ensure equipment integrity is maintained.

Subsequent to installation, regular inspections of visible parts of the HVDC cables, as well as landfall and near shore protection, will be carried out to ensure cable integrity is maintained. The entire underwater cable route is accessible by either divers or remote operating vehicles, and therefore, inspections will be performed in accordance with manufacturer's specifications in order to ensure equipment integrity and protection (e.g., appropriate burial depths, concrete mats, rip-rap, etc.) is maintained. Additionally, spot checks of the cable protection will be performed during or after the first season. These spot checks will occur more frequently at locations where strong currents are expected or in other areas where abnormalities have been identified (e.g., extreme storm conditions or ice crush outages).

Subsequent to the Project's commercial operation date, a scan of the installed cable will be conducted using a Time Domain Reflectometer (TDR) or pulse echo meter and/or an Optical Time Domain Reflectometer (OTDR). These scans provide an extremely accurate route location as required by agencies including but not limited to the Army Corp of Engineers, the New York State Public Service Commission (NYSPSC), New York State Office of General Services, and the United States Coast Guard (USCG).

Although there are no components of the HVDC transmission cable system that require regular replacement, regular inspections in accordance with the manufacturer's specification of terminations and surge arrestors will be performed during scheduled outages to ensure equipment integrity is maintained. For example, insulators will be inspected and cleaned if there are excess deposits of industrial contaminants and soot. Additionally, metal parts, such as nuts, bolts, cable cleats, and grounding scraps will be inspected for corrosion and tightness.

As part of the operations of the Project, an Emergency Repair and Response Plan (ERRP) will be prepared to identify procedures and contractors necessary to perform maintenance and emergency repairs to the Project components.

4.1.2.1 Cable Repair Procedures

While not anticipated, it is possible over the life of the Project that the cables may be damaged, either by human activity or natural processes. The Project will employ an ERRP that will detail the activities, methods, and equipment involved in repair and maintenance work for the cable system. Although the scope of work for each situation will be adjusted to fit the conditions of the failure, the typical procedure for repair of a failure within the underwater and underground sections of the Project is described below.

In the event of underground repair, the location of the fault will be identified and crews of qualified repair personnel will be dispatched to the work location. Pre-selected local contractors identified during the development of the ERRP will excavate around the location of the fault and along the cable for the extent of cable to be replaced. The length of cable replaced for underground failures will be determined on a site specific basis and designed to minimize the disturbance to environmental resources while ensuring proper function of the system. Once the portion of the cable that will be replaced is excavated, specialized jointing personnel will perform the removal of damaged cable and installation of the new cable section. Once complete, the cable will be backfilled using the same methods as original installation.

In the event of a failure in the underwater portion of the cable, the same basic steps of identifying the location of the fault, de-burial, removal of the damaged section, positioning of the replacement section, jointing and re-burial are still followed. Depending on the location of the fault, various equipment will be used to perform the necessary work. As part of the ERRP, appropriate vessels and qualified personnel will be identified prior to a failure to minimize the response time. Once the failure location is identified, a segment of cable equal to approximately 2.5 times the water depth will be excavated in preparation for cable replacement. After the new cable is in place, specialized jointing personnel will install the new section of cable. Once repairs are complete, the cable will be re-buried using similar methods as initial installation.

A goal of the ERRP is to minimize the outage time from a failure. The repair time will vary depending on the location of the fault, mobilization of specialized equipment and availability of replacement parts, but the majority of repairs will be performed within 14 days.

4.2 LAND USE

This section evaluates existing land uses along and adjacent to the underground portion of the Project, including the transmission cable route and aboveground facilities. This section also evaluates whether the Project preserves the natural landscape and minimizes changes or excessive conflict with any present or future planned uses. In addition, land use policies for the counties, as well as land use regulations and policies for the individual cities, towns, and villages traversed by the underground portion of the Project, have been reviewed and evaluated to determine whether the proposed transmission facilities "minimize conflict with any present or future planned land use." An assessment of the applicability of local ordinances and zoning for each town is provided in Exhibit 7 (Local Ordinances).

Section 4.2.5 provides a brief summary of land use for the underwater portions of the transmission cable route, and discusses the Project's consistency with Article 42 of the Executive Law entitled: *Waterfront Revitalization of Coastal Areas and Inland Waterways.* Local municipalities that border coastal areas and inland waterways prepare Local Waterfront Revitalization Plans (LWRP), in conjunction with the New York State Department of State (NYSDOS), for the preservation, enhancement, protection, development and use of the state's coastal and inland waterways. Projects which may impact coastal areas or inland waterways must be reviewed for consistency with those LWRPs that pertain to territory within the Project area. This section includes an evaluation of the 28 municipal LWRPs along the Project's transmission cable route, including both the underground and underwater portions of the transmission cable route.

4.2.1 Existing Land Use

The underground portions of the transmission cable corridor consist of the underground bypass routes to avoid Locks C12, C11, and C9 along the Champlain Canal and the approximate 69.9-mile underground route to avoid interference with activities associated with the Upper Hudson River PCB Dredging Project. In addition, CHPEI proposes to construct and operate a new HVDC converter station in the City of Yonkers, Westchester County (Yonkers converter station. The Project will also involve an interconnection to the existing Sherman Creek substation in Manhattan, in New York County. In total, the underground portions of the Project traverse six counties (Washington, Saratoga, Schenectady, Albany, Westchester, and New York) and 22 cities, towns and villages in New York State.

The majority of the underground portion of the cable route is proposed within existing CP and CSX railroad rights-of-way. A small portion of the underground cable route at the Lock C9 bypass traverses land owned by the New York State Canal Corporation (Canal Corp) in Washington County. Additionally, landfall connections at each of the lock bypasses, which will be constructed using HDD methods (see Section 4.1 for construction methods), will cross Canal Corp lands. The Canal Corp canal system includes 534 miles of canals connecting the Great Lakes, Lake Champlain, and other lakes in western New York State with the Atlantic Ocean. Today, the canal system and adjacent land is used primarily for recreational purposes, including boating, hiking and biking.

For the underground transmission cables, CHPEI will use easements from the CP and CSX railroads and the Canal Corp, within their existing rights-of-way. CHPEI will also use an approximate 3.5-acre parcel in Yonkers and a 0.5 acre parcel within the vicinity of the existing Sherman Creek substation site which is owned by Con Edison. Table 4.2-1 summarizes the communities that will be traversed by the underground portion of the transmission cable route.

Existing land use is classified based on review of aerial photographs, site visits to selected locations along the cable route, and resource data from the New York State Geographic Information System (GIS) Clearinghouse (2004) inventories. The study area for land use includes 600 feet on either side of the cable route centerline. Figure 4.2-1 shows the existing land uses within the study area for the underground portions of the transmission cable route. Table 4.2-2A summarizes the current land use in each of the communities along the underground portion of the cable route. Table 4.2-2B summarizes the percentage of land use class within the total study area. The following sections describe the existing land uses along the cable route and at the aboveground facility locations, by community.

The underwater portion of the transmission cable is located within Lake Champlain, the Champlain Canal, Hudson River, Harlem River, East River, and Long Island Sound. The transmission cable along these portions of the route will be placed primarily within deep open water areas of these water bodies, and will not interfere with existing navigational, recreational boating, fishing, or other water-dependent uses.

4.2.1.1 Washington County

There are four separate underground sections of the cable route in Washington County. The northernmost section bypasses Lock C12 along the Champlain Canal, and is located entirely within the Village of Whitehall. The Lock C12 bypass extends from approximate milepost (MP) 111.8 to 113.5 of the transmission cable corridor. The Lock C11 bypasses in the Town of Fort Ann between approximate MPs 119.2 and 119.6 of the Project route. The Lock C9 bypass is within the Town of Kingsbury and extends from approximately MP 128.4 to 128.9. The portion of the underground cable route along the CP railroad right-of-way begins in the Town of Kingsbury at approximate MP 131.7 and continues southeast through the Town and Village of Fort Edward to the county line between Washington and Saratoga Counties.

4.2.1.1.1 Village of Whitehall

The underwater cable comes ashore to circumvent Lock C12 on the Champlain Canal. At this point, the underground cable corridor follows the CP railroad right-of-way in a southerly direction for approximately 1.7 miles before returning to the Champlain Canal (Figure 4.2-1). The northern portion of this bypass segment is mostly forest mixed with open shrub/scrub/pasture land, with residential areas around Railroad Avenue, North Street, Northeast Street, and Neddo Street. The southern portion of the segment is more developed, with land use adjacent to the underground cable route consisting of mainly commercial/industrial/transportation along the east side of the CP railroad right-of-way, and residential land to the west.

4.2.1.1.2 Town of Fort Ann

In order to circumvent Lock C11 on the Champlain Canal, the underwater cables make landfall and follow the CP railroad right-of-way for approximately 0.4 miles in the Town of Fort Ann (Figure 4.2-1). Land use along this section of the underground cable route primarily includes forest and open shrub/scrub/pasture land to the west of the railroad right-of-way, but includes a small section of commercial/industrial/transportation land. Directly east of the corridor is the Champlain Canal. Land use east of the Canal consists of forest land and commercial/ industrial/transportation areas.

4.2.1.1.3 Town of Kingsbury

The underwater cables come ashore from the Champlain Canal to circumvent Lock C9 on the Champlain Canal in the Town of Kingsbury (Figure 4.2-1). This segment of the underground cable route is located along land owned by the Canal Corp. The land use on the east side of the proposed underground cable route in this segment includes forest and open scrub/shrub/pasture land. To the west of the underground cable route, there are small commercial/ industrial/transportation areas along the Champlain Canal. Where the cables enter the Champlain Canal at the southern end of the segment, there is an area of agricultural land directly to the west of the canal.

The cable route returns to land again in the Town of Kingsbury at approximate MP 131.7. At this point, the underground cable route continues on land within the CP railroad right-of-way and heads generally southwest, through the Town of Kingsbury to the Fort Edward town line (Figure 4.2-1). From the landfall to the town line, the primary land use consists of open shrub/scrub/pasture land. There are smaller parcels of agriculture and forest land. Near Rabideau and Newton Lanes, there are small residential and commercial/industrial/transportation areas.

4.2.1.1.4 Town/Village of Fort Edward

The underground cable route along the CP railroad right-of-way enters the Town of Fort Edward and travels southwest toward the Moreau town line at the Hudson River, where the transmission cable route enters Saratoga County (Figure 4.2-1). Near the Kingsbury town line the land use is almost entirely open shrub/scrub/pasture land. From north to south, the land use quickly becomes agricultural and then mixes with commercial/industrial/transportation/land use as the corridor travels further south. Near the Village of Fort Edward, which is crossed in the southwestern portion of the township, the land adjacent to the underground cable route becomes a mix of residential and commercial/industrial/transportation areas, with a few additional small forested areas and open spaces. Just north of the Moreau town line, there is an open space area associated with Rogers Island in the middle of the Hudson River.

4.2.1.2 Saratoga County

In Saratoga County, the underground portion of the cable route is located on land that is entirely within the CP railroad right-of-way. The proposed underground cable route crosses through the Towns of Moreau, Northumberland, Wilton and Greenfield, the City of Saratoga Springs and the Towns of Milton, Ballston, and Clifton Park.

4.2.1.2.1 Town of Moreau

The underground transmission cable route crosses the Hudson River (attached to the bridge trestle) and enters the Town of Moreau heading in a southwesterly direction along the CP railroad right-of-way to the Northumberland town line (Figure 4.2-1). After crossing the Hudson River from the north, the land use includes a mix of residential, commercial/ industrial/transportation, forest and open scrub/shrub/pasture land. Further south within the Town of Moreau, land use becomes primarily open scrub/shrub/pasture land, with residential areas to the east and along West River Road. In some areas, scrub/shrub/pasture is mixed with forested patches, along with small areas of residential or agricultural land. Land use in the study area near the Northumberland town line is dominated by agricultural land, with some small forested and residential areas off of Mott Road.

4.2.1.2.2 Town of Northumberland

The cable route enters the Town of Northumberland along the CP railroad right-of-way and heads in southwesterly direction to the Northumberland-Wilton town line (Figure 4.2-1). South of the Northumberland-Moreau town line, the land use alternates between open scrub/shrub/pasture land and forested land. Approaching Gansevoort Road from the north, the land becomes a mix of residential and commercial/industrial/transportation. At approximately MP 142 along the transmission cable corridor, there are two local parks: Bertha E. Smith Town Park to the east of the cable route and Gansevoort Town Park to the west (see Section 4.2.3). South of these parks, the area contains a mixture of forest land, agricultural land, open scrub/shrub/ pasture land, residential and commercial/industrial/transportation areas. Near the Northumberland-Wilton town line, the transmission cable corridor is located within 600 feet of the Fire Pond Tract of the Saratoga County Forest Preserve (see Section 4.2.3), and the land adjacent to the cable route is predominantly forested, with small residential areas at the edge of the study area along Pettis Road.

4.2.1.2.3 Town of Wilton

The underground transmission cable route enters into the Town of Wilton and heads in a southwesterly direction along the CP railroad right-of-way to the Wilton-Greenfield town line (Figure 4.2-1). Between the Wilton-Northumberland town line and Ballard Road, the land use is predominantly forested, with several small residential areas between Pettis Road and Ballard Road. There are also two agricultural areas along the eastern side of the cable corridor in this area. South of Ballard Road, the cable route abuts several parcels of land that are within the Wilton Wildlife Preserve and Park (see Section 4.2.3). This area has a mixture of land use types including forest, open scrub/shrub/pasture land, commercial/industrial/transportation areas and residential areas. Near State Route 50, there is an area of residential land located primarily to the southeast of the underground transmission cable route. Near the Wilton-Greenfield town line, the area adjacent to the cable route consists of a mixture of land uses, including forest, residential and agricultural lands that are interspersed with small commercial/industrial/transportation areas and open scrub/shrub/pasture land. Gaven Park (see Section 4.2.3) is located north of the underground cable route just west of Interstate 87.

4.2.1.2.4 Town of Greenfield

Within the Town of Greenfield, the proposed transmission cable corridor follows the existing CP railroad right-of-way from the Greenfield-Wilton town line in a southwesterly direction towards the City of Saratoga Springs (Figure 4.2-1). From the Greenfield-Wilton town line to Clinton Street, the majority of the land is forested, with some residential areas to the north and west of Daniels Road. From Clinton Street to the border with the City of Saratoga Springs, the current land use consists of open scrub/shrub/pasture interspersed with residential land along Clinton Street and Denton and Bloomfield Roads.

4.2.1.2.5 City of Saratoga Springs

Within the City of Saratoga Springs, the proposed transmission cable corridor follows the existing CP railroad right-of-way from the Town of Greenfield in a southerly direction to the Ballston town line (Figure 4.2-1). From the Saratoga Springs-Greenfield town line to State Route 9N, the current land use is primarily forest and open scrub/shrub/pasture land, with areas of commercial/industrial/transportation use along State Route 9N. This section of the study area traverses the eastern edge of the Saratoga Springs Golf and Polo Club. Current land uses between State Route 9N and State Route 29 (Washington Street) include commercial/industrial/transportation, open scrub/shrub/pasture and forest lands that are interspersed with small residential areas south of State Route 9N and north of State Route 29.

South of State Route 29 to County Road 43 (Geyser Road), the land use consists of forests, residential lands, and commercial/industrial/transportation with small areas of open scrub/shrub/pasture land. To the south of County Road 42, land use is primarily forest and open scrub/shrub/pasture land, interspersed with a small residential parcel on the east of the cable route centerline off Belmont Drive. Where the transmission cable corridor passes between the Saratoga Nursery and the Saratoga Spa State Park, forest is the dominant land use, with some residential and commercial/industrial/transportation areas along State Route 50. As the transmission cable corridor approaches the Milton town line from the north, the cable route is located in an area that is primarily forest, with several residential and commercial/industrial/transportation areas located along State Route 50 (Ballston Avenue) and a large residential area on Old Ballston Avenue. This section also contains scattered small areas of open scrub/shrub/pasture land.

4.2.1.2.6 Town of Milton

The underground transmission cable in the railroad right-of-way corridor enters the Town of Milton from the City of Saratoga Springs and travels generally south along the CP railroad right-of-way to the Milton-Ballston town line (Figure 4.2-1). Though the underground cable route does not enter the Town of Malta, it does lie near (within 600 feet of) the Malta town line for most of its length within the Town of Milton; therefore, some of the study area is actually within the Town of Malta. From the Milton-Saratoga Springs town line to Malta Avenue, the land use consists primarily of forest land, with residential areas located off of Saratoga Avenue to the north, and along Malta Avenue/County Road 63 to the south. Most of the area south of Malta Avenue to the Ballston town line includes forested land, with some commercial/industrial/transportation use and residential areas directly south of Malta Avenue and off the Columbia Avenue Extension. There are additional residential areas along the western edge of the study area. Between Malta Avenue and the Milton-Malta town line there is one park/recreational use parcel.

4.2.1.2.7 Town of Ballston

The underground transmission cable route crosses into the Town of Ballston from the Town of Milton and follows the CP railroad right-of-way in a southerly direction to the Clifton Park town line (Figure 4.2-1). From the Ballston-Milton town line, the current land use is a mixture of forest land, residential areas, and open scrub/shrub/pasture land, becoming predominantly forested further south until the corridor reaches State Route 67. There are small residential, agricultural and open scrub/shrub/pasture land parcels just off State Route 67. Just south of State Route 67, there is an area of mixed forest, open scrub/shrub/pasture and commercial/industrial/transportation land, before the corridor again becomes primarily forested; however there are several clusters of small residential and commercial/ industrial/transportation use areas along roads that intersect or pass near the transmission cable corridor. Along this stretch, the right-of-way is located to the west of Ballston Lake. At Whites Beach Road land use becomes a mixture of forest, open scrub/shrub/pasture and residential lands. About a half mile south of Whites Beach Road, land becomes mostly forested. In the area near Route 146A (Midline Road) and the Ballston-Clifton Park town line, the land use is a mixture of commercial/ industrial/transportation use, residential, forest, and open scrub/shrub/pasture land.

4.2.1.2.8 Town of Clifton Park

The transmission cable corridor enters the Town of Clifton Park from the Town of Ballston and heads in a southwesterly direction within the CP railroad right-of-way to the Town of Glenville in Schenectady County (Figure 4.2-1). Between the Clifton Park-Ballston town line and County Road 110 (Blue Barns Road), the current land use is primarily forest and open scrub/shrub/pastureland, with small residential areas off County Road 110 and a narrow corridor of commercial/industrial/transportation use parallel to the cable route. South of County Road 110, land use consists of a mixture of residential, commercial/industrial/transportation, open land, and forest, with land becoming predominantly forested to the south approaching the Glenville town line.

4.2.1.3 Schenectady County

In Schenectady County, the transmission cable corridor follows the CP railroad right-of-way south and west from the Town of Glenville and the City of Schenectady into the Town of Rotterdam. In Rotterdam, the Project route turns further south to follow the CSX railroad right-of-way.

4.2.1.3.1 Town of Glenville

The cable route enters the Town of Glenville from Saratoga County and follows the CP railroad right-of-way to the southwest. The corridor exits the Town of Glenville by crossing the Mohawk River to the City of Schenectady (Figure 4.2-1). In general, the transmission cable corridor in the Town of Glenville is chiefly mixed forest and open scrub/shrub/pasture land, with a few small pockets of residential areas off County Road 31 (Hetcheltown Road), County Road 29 (Maple Avenue Extension), and Glenridge Road. There are also two areas shown as parks/open space/recreation. Just north of County Road 16 (Alplaus Avenue), there is an area of commercial/industrial/transportation to the east and a residential area to the west of the transmission cable corridor. Near the Mohawk River, there are a few areas of commercial/industrial/transportation use off County Road 29 (Maple Avenue) and Freeman Bridge Road.

4.2.1.3.2 City of Schenectady

The transmission cable corridor crosses the Mohawk River and enters the City of Schenectady, traveling south and west along the CP railroad right-of-way to the Rotterdam town line (Figure 4.2-1). Besides a small forested riparian area along the Mohawk River, the area from the river to Bailey Street is mostly commercial/industrial/transportation. From Bailey Street to the Rotterdam town line, land use is a mixture of commercial/industrial/transportation, residential, forest, and open scrub/shrub/pasture land. The land generally becomes more forested approaching the Schenectady-Rotterdam line. There are two parcels of open space or recreational use land north of the transmission cable corridor, and Hillhurst Park is located just to the south of the right-of-way (see Section 4.2.3).

4.2.1.3.3 Town of Rotterdam

The cable route enters the Town of Rotterdam from the City of Schenectady and follows the CP railroad right-of-way generally west to the junction with the CSX railroad right-of-way. From this point, the cable route turns generally south to follow the CSX railroad right-of-way towards the Guilderland town line (Figure 4.2-1). Within the Town of Rotterdam north of County Road 89 (West Campbell Road), land use consists of mostly forest and commercial/industrial/transportation use lands. In this area, the transmission cable corridor passes to the south of the Rotterdam Square Mall. Between County Road 89 the CSX railroad right-of-way, the north side of the study area has forest, commercial/industrial/transportation use land, a narrow corridor of open scrub/shrub/pasture and a residential area off County Road 83. Along the CSX railroad right-of-way from the Rotterdam Junction to the rail yard just north of Interstate 90, the primary land use is commercial/industrial/transportation use, with two small residential areas at the junctions Route 387 and County Road 89 and Route 387 and County Road 83 (Princetown Road). The southern portion of the transmission cable corridor, from the rail yard near Interstate 90 to the Guilderland town line is mostly a mixture of forest, open scrub/shrub/pasture and residential land.

4.2.1.4 Albany County

The underground transmission cable corridor enters Albany County along the CSX railroad right-of-way from Schenectady County and travels generally south through the Towns of Guilderland and New Scotland, the Village of Voorheesville and the Towns of Bethlehem and Coeymans. In Coeymans, the cable route enters the Hudson River and continues underwater. After Coeymans, there are no more underground portions of the cable route until the connection to the Yonkers converter station in Westchester County.

4.2.1.4.1 Town of Guilderland

The underground transmission cable corridor enters the Town of Guilderland from Rotterdam and follows the CSX railroad right-of-way south to the New Scotland town line (Figure 4.2-1). From the Guilderland-Rotterdam town line to W. Lydia Street, the current land use consists of primarily forest with some open scrub/shrub/pasture land. From there to Route 20 (Western Turnpike), the east side of the land use study area is mostly forested. The west side of the cable route in this area contains mixed forest, residential, and agricultural land. Between Route 20 and Frenchs Mill Road, the west side of the study area is primarily forested adjacent to the Watervliet Reservoir. To the east, the current land use consists of forested, open scrub/shrub/pasture and residential areas off Fuller Station and Frenchs Mill Roads.

South of the Watervliet Reservoir area, land use is mostly forest, open scrub/shrub/pasture, commercial/industrial/transportation, and smaller areas of residential land. Industrial areas are primarily along the west side of the transmission cable corridor. Roger Keenholts Park (see Section 4.2.3) is located on the west side of the corridor to the south of the Watervliet Reservoir. Near County Road 201 (Depot Road), land use is more residential and commercial/industrial, mixed with open scrub/shrub/pasture and agricultural lands, particularly to the east of the Project corridor. Near the New Scotland town line, the land becomes predominantly forested.

4.2.1.4.2 Town of New Scotland and Village of Voorheesville

The underground transmission cable corridor enters the Town of New Scotland along the CSX railroad right-of-way from Guilderland, traveling south through the Village of Voorheesville to the Bethlehem town line (Figure 4.2-1). Several agricultural areas are present near the New Scotland-Guilderland town line. Within the Village of Voorheesville, land is mostly residential, with a few areas of forested, open, and commercial/industrial/transportation use land. The Project is near two areas of park, open space, or recreational use, including Jim Nichols Park (see Section 4.2.3). From the southern boundary of Voorheesville to Youmans Road the current land use consists chiefly of open scrub/shrub/pasture land. Between Youmans Road and Route 85 (New Scotland Road), there are two residential areas separated by forested land and open land. The northern residential area is along Youmans Road and the southern along Route 85. Just south of route 85 on the east side of the cable route is an area of commercial/industrial/transportation use land.

From Route 85 to the Bethlehem town line, land use is a mixture of forest, residential, commercial/industrial/transportation and open scrub/shrub/pasture. Residential areas are located primarily along County Road 308 (New Scotland South Road), Route 443 (Delaware Turnpike), and Waldemaier Road. Commercial/industrial/transportation land is associated with County Road 308, Bluebirds Way and Game Farm Road. In this portion of the route, the transmission cable corridor also abuts the Five Rivers Environmental Education Center (see Section 4.2.3).

4.2.1.4.3 Town of Bethlehem

The cable route enters the Town of Bethlehem from New Scotland and follows the CSX railroad right-of-way generally southeast to the Coeymans town line (Figure 4.2-1). From the Bethlehem-New Scotland town line to just south of State Route 196, the current land use is primarily a mixture of open scrub/shrub/pasture land and commercial/industrial/transportation use, including various rail lines and spurs. From State Route 196 to the Coeymans town line, the west side of the study area becomes forested and open land. The east side of right-of-way in this area has several residential developments off Route 9W and Route 396 (Maple Avenue) as well as large tracts of forested land.

4.2.1.4.4 Town of Coeymans

The underground transmission cable corridor enters the Town of Coeymans and follows the CSX railroad right-of-way from the Town of Bethlehem southeast to the Hudson River (Figure 4.2-1). From the Coeymans-Bethlehem town line to I-87, the west side of the study area consists almost entirely of forested land. The east side is mostly open scrub/shrub/pasture land. There is also a commercial/industrial/transportation area just to the southeast of the Coeymans-Bethlehem town line. Past I-87 the transmission cable corridor turns east towards the Hudson River. In this area, the current land use south of the right-of-way is mostly forested, open and residential land. North of the right-of-way, there is residential area off Route 144 (River Road). The remainder of this area is open scrub/shrub/pasture land with small plots of forest.

4.2.1.5 Westchester County

After entering the Hudson River in the Town of Coeymans, the cable route remains entirely underwater to Westchester County, where two of the cables make landfall in the City of Yonkers to connect to the proposed Yonkers converter station. Figure 4.2-2 shows the existing land use at the Yonkers converter station site.

4.2.1.5.1 City of Yonkers

The landfall is located near Wells Street and Alexander Street in the City of Yonkers (Figure 4.2-2). Most of the land use adjacent to the converter station site is commercial/industrial. However, there are several small waterfront recreation and urban parks in the vicinity of the site (see Section 4.2.3).

4.2.1.6 New York County

The two cables continuing to Long Island Sound and the converter station in Bridgeport, Connecticut will make landfall in Manhattan, in New York County, for an interconnection at the existing Sherman Creek substation. Figure 4.2-3 shows the existing land use in the vicinity of the Sherman Creek substation site.

4.2.1.6.1 New York City

The underwater cables in the Harlem River make landfall to connect to the Sherman Creek substation between Manhattan and the Bronx (Figure 4.2-3). Most of the area directly abutting the river, near the Sherman Creek substation, is classified as commercial/industrial land. Nearby, there are some open scrub/shrub areas, forested and/or open space parcels. Further away from the river (mainly west of 10th Avenue) the land is residential.

4.2.2 Consistency with State and Local Land Use Plans and Policies

Local land use plans and policies, including local park lands and recreational area policies, were investigated for the counties, cities, towns, and villages crossed by the underground portion of the cable route. Washington, Schenectady and Albany Counties do not have Master Land Use Plans. Saratoga County does not have a Master Land Use Plan, but it has a comprehensive *Green Infrastructure Plan* (see Section 4.2.2.3). Westchester County has a Westchester Open Space Plan and a Westchester Urban County Consortium Consolidated Plan (see Section 4.2.2.6). New York County has a Washington Heights and Inwood Planning and Land Use Study, a New York City Comprehensive Waterfront Plan, and a New York City Waterfront Revitalization Program (see Section 4.2.2.7).

Construction and operation of the underground portion of the cable will have a negligible affect on local or regional land use patterns or land use planning because it is located almost entirely within existing railroad rights-of-way. The proposed Project will provide a connection of renewable sources of power generation in central and eastern Canada and upstate New York to load centers in and around the New York City and southwestern Connecticut regions. A summary of land use planning along the underground portion of the cable route follows:

4.2.2.1 2009 New York State Open Space Conservation Plan

The *2009 New York State Open Space Conservation Plan* encourages various state and local stakeholders to take advantage of opportunities to implement conservation recommendations as these stakeholders develop strategies for achieving conservation goals. The conservation plan focuses on four major areas: responding to climate change; fostering green, healthy communities; connecting New Yorkers with nature and recreation; and safeguarding the state's natural and cultural heritage. The state conservation goals include measures to protect plant and animal habitats and the State's surface and ground water quality; combat global climate change; maintain an interconnected network of protected lands and waters for wildlife use; improve community quality of life and health; maintain critical natural resource industries; protect hunting, fishing, trapping and wildlife viewing habitats; provide outdoor recreation, open space, and education and research opportunities; and protect and enhance scenic, historic and cultural resources (NYSOSCP 2009). The conservation plan includes a list of over 100 regional priority conservation projects across the State, some of which are in the vicinity of the underground portion of the transmission cable route, as described below.

Conservation projects in Washington County include:

- **Project 63 – Washington County**

  Champlain Canal/Hudson River Corridor: From the Town of Waterford to the Town of Whitehall, the Champlain Canal is an underused resource. Most public ownership along its length is under jurisdiction of the Canal Corp. The conservation plan states that additional open space acquisition focus should include the completion of the Canal Recreationway Trail and recreational access.

Conservation projects in Saratoga County include:

- **Project 66 - Saratoga County**

  Karner Blue Butterfly Recovery Units: Three units in the county support the majority of the remaining local populations of Karner blue butterfly. The conservation plan states that acquisition and easements will be needed in conjunction with management agreements and other land protection tools to halt the decline of the Karner blue butterfly and to create the long-term self sustaining populations necessary to remove the species from the endangered list.

  Kayaderosseras and Fish Creek Corridor/Saratoga Lake: These waterbodies are major tributaries of the Hudson River and are important for recreation, fishing and watershed protection, as well as providing significant wetlands and natural habitat. Increased public access to the creeks and the lake are goals of the surrounding municipalities and Saratoga County's *Green Infrastructure Plan* (see Section 4.2.2.3). The conservation plan states that protection efforts can be undertaken by state, county and municipal jurisdictions or by other organizations, in the form of either fee or easement acquisitions.

  Mid-County Trail System: Saratoga County has a trail system that traverses four towns and a village in the center of Saratoga County and it has the potential to link some of the major residential population centers. The conservation plan states that protection of the wetlands and natural corridors along the trail and establishment of trail linkages into residential areas will advance recreational use and enjoyment.

  Agricultural Lands: Throughout Saratoga County, an active farmland conservation easement program has been created with assistance from the County Farmland Preservation and Open Space Fund. Important farmland protection projects have been initiated under the umbrella of a county-wide program (see Section 4.2.4). The conservation plan states that any reasonably viable farmland under consideration should be protected, whenever possible, by the purchase of an easement rather than fee simple acquisition, in order to enhance future use of the land for agriculture.

Conservation projects in Schenectady County include:

- **Project 54 - Schenectady County**

  Woodlawn Pine Barrens-Wetlands Complex: This area is situated northwest of the Albany Pine Bush Preserve. It includes several remnant features of the once more widely spread pine barren habitat, including sand plain and dune formations, pitch pine-scrub oak barrens and historic Karner blue butterfly habitat. The conservation plan states that this area is outside of the protection area designated by the Albany Pine Bush Commission, but its attributes have been noted to be worthy of protection.

Conservation projects in Albany County include:

- **Project 43 - Albany County and a small portion of eastern Schenectady County**

  Albany Pine Bush: This area supports a rare and endangered inland pine barren ecosystem. The Albany Pine Bush Preserve Commission established guidelines for much of this area in their management plan with the main objective of establishing an ecologically viable and manageable preserve.

- **Project 44 - Albany County**

  Black Creek Marsh/Vly Swamp: These adjacent wetland systems are located directly below the Helderberg Escarpment at John Boyd Thacher State Park. They support a significantly high biological diversity, including amphibian species diversity rivaling the New England region. The area also has multiple-use recreation and is noted by the National Audubon Society as one of the Important Bird Areas in New York State (see Section 4.8.2.3 for a discussion of Bird Conservation Areas [BCA]). The conservation plan states that certain additional parcels associated with this wetland complex and important buffer areas remain vulnerable to development activity and should be protected. Opportunities for protection should occur before there is residential subdivision and development pressure.

- **Project 46 - Albany County**

  Five Rivers Environmental Education Center: This education center is located between the suburban towns of Bethlehem and New Scotland. The conservation plan states that the entire area surrounding the education center remains vulnerable to subdivision and development activity, therefore opportunities for protection of public access, public use and buffer areas remain a priority.

- **Project 48 - Albany County**

  Helderberg Escarpment: This escarpment is the most prominent natural feature in Albany County, and is known for its geological and paleontological significance in addition to the outstanding scenic vistas. This area is characterized by karst geology, including cave formations, and is noted by the National Audubon Society as one of the Important Bird Areas in New York State. The conservation plan states that the southern extent of the escarpment is considered to be an integral part of this area and should also be given high priority for protection.

Conservation projects listed in Westchester County are not in proximity to the proposed Yonkers converter station.

Conservation projects in New York County include:

- **Project 9 - New York/Bronx Counties**

  Harlem River Waterfront: The conservation plan states that public access objectives for the Harlem River area are to provide pedestrians and cyclists with an opportunity to enjoy both banks of the river with the expansion of waterfront parks and creation of a continuous pathway in the city-wide greenway system.

- **Project 11 - New York/Bronx Counties**

  Manhattan Harlem River Greenway: The conservation plan states that four privately owned industrial lots along the Harlem River in the Inwood section of Manhattan would form a waterside promenade allowing fishing access.

The underground portion of the cable route will not affect the goals of the *2009 New York State Open Space Conservation Plan.*

4.2.2.2 Washington County

Washington County does not have a Comprehensive Plan or Master Plan; however, it does have an *Economic Development Strategic Plan* dated 2007 (Laberge Group 2007), which states that Washington County is committed to developing a prosperous and economically friendly environment while preserving rural qualities that make it unique.

The *Economic Development Strategic Plan* has goals that include:

- grow the agricultural and forestry industries;
- foster downtown revitalization;
- build tourism;
- provide efficient and cost effective infrastructure and energy; and
- promote and develop creative economics.

The underground portion of the cable route as presented in this Application will not affect the goals of the Washington County *Economic Development Strategic Plan*.

4.2.2.2.1 Village of Whitehall

The Village of Whitehall has a *Local Waterfront Revitalization Plan* dated 2004 that is considered to be its Comprehensive Plan (Laberge Group 2007). The *Local Waterfront Revitalization Program* is a comprehensive program for assessment of current problems and opportunities and to build a consensus on the desired future of the community's waterfront. The purpose of the *Local Waterfront Revitalization Program* is promotion of economic development and revitalization of the village's waterfront with assurance of protection and beneficial use of waterfront resources.

The Village of Whitehall *Local Waterfront Revitalization Program* has goals that focus primarily on the following topics:

- increase and improve public access to water resources;
- stimulate economic development in downtown Whitehall; and
- protect and enhance natural resources.

Because the underground portion of the proposed Project will be constructed mostly within a CP existing railroad right-of-way, the Project will have a negligible affect on existing or future land uses and planned development in the village. When exiting and reentering the Champlain Canal, HDD technology will be used to install the cables without disturbing shoreline areas. See Section 4.2.5.2 for further discussion of the consistency of the Project with LWRPs.

4.2.2.2.2 Town of Whitehall

The Town of Whitehall has not adopted a Comprehensive Plan to guide land use planning. Because the underground portion of the proposed Project will be constructed mostly within the existing CP railroad right-of-way, it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the town.

4.2.2.2.3 Town of Fort Ann

The Town and Village of Fort Ann, New York Joint Community Plan (Public Hearing Draft – February 13, 2008) entitled *Fort Ann: A Beautiful Place at the Crossroads of a Beautiful Region* has overall goals of preserving the quality of woodlands, water resources and farms, improving the roads and highways, and promoting managed commercial growth compatible with the town.
Goals of the Joint Community Plan include:

- create a framework that promotes orderly residential and commercial growth without compromising the rural and scenic character of the town;
- protect and enhance the natural resources and the historic sites within the town;

- promote development and rehabilitation of the town and village as a desirable commercial and residential location;
- protect and enhance the quality of the environment within the town; and
- promote and protect distinctive character within the communities of Fort Ann.

The underground portion of the proposed Project will be constructed primarily within the CP railroad right-of-way and it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the town. When exiting and reentering the Champlain Canal, HDD technology will be used to install the cables without disturbing shoreline areas.

4.2.2.2.4 Village of Fort Ann

The Town and Village of Fort Ann, New York Joint Community Plan (Public Hearing Draft – February 13, 2008) entitled *Fort Ann: A Beautiful Place at the Crossroads of a Beautiful Region* is discussed in Section 4.2.2.2.3.

In addition, the Village of Fort Ann has adopted *The Fort Ann Streetscape and Waterfront Revitalization Plan*, a Draft Master Plan Report dated April 2008, that presents the community's vision for revitalization of George and Ann Streets, guides the rehabilitation and interpretation of Locks 16, 17, and 18 of the Old Champlain Canal and provides guidance for appropriate water uses adjacent to the Champlain Barge Canal and Halfway Brook waterfront. *The Fort Ann Streetscape and Waterfront Revitalization Plan* recommendations include streetscape and parking improvements, trail projects, parks, buildings for canal history and visitor use, and interpretive areas.

In the Village of Fort Ann area, the proposed Project will be located within the Champlain Canal and will therefore have a negligible affect on existing or future land uses and planned development in the Village. See Section 4.2.5.2 for further discussion of the consistency of the underwater portions of the Project with LWRPs.

4.2.2.2.5 Town of Kingsbury

The Town of Kingsbury has not adopted a Comprehensive Plan to guide land use planning. A Comprehensive Plan draft was developed in 1973 but was not adopted (Laberge Group 2007). The underground portions of the proposed Project will be constructed within land owned by the Canal Corp and within portions of the existing CP railroad right-of-way; therefore, it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the town. When exiting and reentering the Champlain Canal, HDD technology will be used to install the cables without disturbing shoreline areas.

4.2.2.2.6 Town of Fort Edward

The Town of Fort Edward adopted the *Town of Fort Edward Master Plan* in May 2002. The overall goal of the *Town of Fort Edward Master Plan* is to create a balance of open space, farmland and appropriate development. The community is concerned with loss of character as a rural town with open countryside and closely settled villages and hamlets. The *Town of Fort Edward Master Plan* reviews goals including those listed below, and identifies follow-up projects that respond to concerns about open space protection, historic preservation, natural resource protection, and land use regulation updates.

Goals of the *Town of Fort Edward Master Plan* include:

- protect and enhance lands which are environmentally significant and/or sensitive, and minimize any adverse impacts man-made development may have on land, air, water quality, natural habitats, unique land formations, and scenic resources;
- preserve and enhance cultural and historic resources that reinforce a sense of identity and assure that new construction and additions to historic areas of the town are compatible with existing historical architecture and layout;
- conserve important open space lands and allow more intensive use of other parcels of land for residential, commercial, community facilities, and other uses in close proximity to villages and hamlets;
- preserve and enhance scenic resources within the town including natural and agricultural areas, historical resources, landscaped areas, street trees, and scenic views;
- enhance economic climate of the town and promote establishment of new business enterprises to improve the overall economic vitality of the area and enhance quality of life for town residences;
- improve recreational opportunities for citizens through public and private efforts; and
- encourage existing and future development that complements the existing scenic beauty in the town.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground and will not be visible or encroach on any additional land outside the existing right-of-way, it is consistent with this plan's concerns about open space protection, historic preservation and natural resource protection.

4.2.2.2.7 Village of Fort Edward

The Village of Fort Edward's 2006 *Master Plan* takes into account the facts of changing economic conditions, the importance and value of open space, and the needs and desires of a diverse population. The Village of Fort Edward's *Master Plan* reviews goals related to municipal, recreational and community resources; historic and cultural resources; housing; economic development; transportation; and land use and zoning.

Specific goals of the Village of Fort Edward's *Master Plan* include:

- preserve and enhance historical and cultural resources for the enjoyment of current residents and future generations;

- preserve and enhance existing residential neighborhoods of the village; and
- preserve and enhance the existing community character of the village.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground and will not be visible or encroach on any additional land outside the existing right-of-way, the Project is consistent with the Village of Fort Edward's *Master Plan*'s goals about preservation of historic resources and community character.

4.2.2.3 Saratoga County

The *Green Infrastructure Plan* for Saratoga County, adopted in November 2006, proposes a plan for a "Green Infrastructure Network" that is designed to protect and promote open space resources through the conservation of "unfragmented areas" of working farm and forest land, connections between natural areas, concentrated areas of historic resources and "Green Infrastructure Gateways." These "Gateways" are planned entrances to the "Green Infrastructure Network" that will serve as a focus area for economic development and tourism. The *Green Infrastructure Plan* outlines four green infrastructure theme areas: 1) Farmland Core Areas, 2) Natural System "Hubs," 3) Greenways and Trail Corridors, and 4) Heritage Hubs.

While the *Green Infrastructure Plan* does not outline any specific goals or recommendations relative to electric transmission projects, one of the major goals addressed in the plan is to prioritize implementation of projects that will not increase fragmentation of farmlands and natural lands and that will preserve existing open space corridors in the landscape. Because the Project will be constructed almost entirely within an existing railroad right-of-way, it will not increase the fragmentation of agricultural or natural lands in Saratoga County and will not affect areas designated for the preservation of historic resources.

Based on a review of the *Green Infrastructure Plan* mapping, the Project traverses a proposed "Core Farm Area" that incorporates southeast Moreau and northeast Northumberland. Animal agriculture is predominant and includes dairy farms, horse boarding and breeding operations and farms raising animals for meat. Flat valley land and rolling upland hills provide excellent soil for growth of animal feed, including corn, soybeans and grass for hay. This region also has small-scale horticulture operations and farm stands, providing a variety of fruit, vegetables, animals, and plants. In this region, farms tend to be larger than in other parts of the county. Because the proposed Project will be located entirely within the existing CP railroad right-of way, it will not increase fragmentation of the agricultural landscape in this area. The location of agricultural lands and lands enrolled in an Agricultural District are further described in Section 4.2.4.

Based on a review of the *Green Infrastructure Plan* mapping, the proposed Project also traverses proposed "Natural System Hubs" that incorporate northwest Northumberland, southeast Wilton, northwest Saratoga Springs, and southeast Milton. These areas are known as the "Karner Blue Butterfly Recovery Units Natural Hub." Goals within these areas include protection of Karner blue butterfly habitat that already exists and increase the habitat areas and connectivity within the recovery unit boundaries. The proposed Project does traverse the Wilton Wildlife Preserve and Park. The proposed Project also traverses the "Greenway Convergence Natural Hub" in eastern

Ballston. Because the proposed Project will be located entirely within the existing CP railroad right-of-way, it will not increase fragmentation of the proposed Natural System Hub in these areas.

For the reasons described above, the proposed Project is consistent with the goals of the Saratoga County *Green Infrastructure Plan*.

4.2.2.3.1 Town of Moreau

The Town of Moreau has a *Comprehensive Land Use Plan*, adopted on August 26, 2008, which provides a succinct description of existing conditions, outlines goals and objectives developed through the planning process, and presents findings and conclusions through the evaluation of existing conditions. The *Comprehensive Land Use Plan* recommends specific actions and implementation mechanisms, but does not specifically address or propose any recommendations regarding electric transmission corridors. Specific goals outlined in the *Comprehensive Land Use Plan* include the following:

- promote development patterns that foster a well-connected community, providing orderly transition from urban to rural land uses, and proactively preserving open space;
- enhance and revitalize the local economy with maintenance and promotion of an environment that is attractive to current and potential commercial, industrial, and agricultural development;
- protect natural resources, forests, wetlands, farmlands, waterways, and outstanding scenic resources; and
- continue to protect and preserve undeveloped open spaces, particularly farmlands and parcels used for or conducive to agriculture.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the Town of Moreau *Comprehensive Land Use Plan* and will not adversely affect existing land use and planned development.

4.2.2.3.2 Town of Northumberland

The *Town of Northumberland 2003 Comprehensive Land Use Plan* is in the form of a Final Draft dated July 2004. The plan was developed with the intent of preserving the agricultural character of the town, fostering a strong farm economy and preserving open space and viewsheds.

The goals of the *Town of Northumberland 2003 Comprehensive Land Use Plan* include:

- preserve and encourage agricultural uses within the town;
- preserve the rural, open-space character of the town;

- provide for the limited development of modest commercial areas within the town sufficient to meet the needs of residents;
- preserve and protect unique natural areas and plant and animal communities within the town;
- preserve and protect water quality of the town's streams, rivers, ponds, and wetlands;
- improve the visual quality of the town and protection of viewsheds and scenic vistas;
- preserve and protect existing historic sites and structures; and
- expand the scope of recreational opportunities available to town residents.

The proposed Project construction will be completely underground and entirely within the existing CP railroad right-of-way. The proposed Project will not be visible or encroach on any land outside the existing right-of-way and therefore is consistent with the goals of the *Town of Northumberland 2003 Comprehensive Land Use Plan*.

4.2.2.3.3 Town of Wilton

The Town of Wilton *Comprehensive Plan* was adopted December 2, 2004. The plan was developed with the intent of having a desirable mingling of suburban and rural character, emphasizing, valuing, and improving the quality of life in the town, sharing the sense of responsibility for the town's natural, agricultural, open space, and scenic resources, and having an effective balance of commercial and light industrial development.

The goals of the Town of Wilton *Comprehensive Plan* include:

- create a land use management system that protects and enhances the town's environmental quality, rural and suburban character, and unique resources and features to direct growth that benefits the community;
- conserve, improve, and protect the town's natural resources and open space including wildlife habitat;
- provide sufficient opportunities and facilities for both active and passive recreation activities; and
- recognize and protect historical and other cultural resources as a priority.

The proposed Project construction will be completely underground and entirely within the existing CP railroad right-of-way. The proposed Project will not be visible or encroach on any land outside the existing right-of-way, and therefore is consistent with the goals of the Town of Wilton *Comprehensive Plan*.

4.2.2.3.4 Town of Greenfield

The *Town of Greenfield Comprehensive Plan* was adopted by the Town Board on May 12, 2005. The intention of this plan is to guide future development in the Town of Greenfield while striving to remain a largely rural town with sizeable residential parcels. The applicable goals of the comprehensive plan include:

- expand the definition of home occupations;
- create a new zoning map reflective of the Town's vision;
- prohibit expansion of the existing commercial districts;
- prohibit the creation of additional or expansion of the existing industrial manufacturing zone;
- establish a procedure for lot line revisions;
- establish bike paths to connect the hamlets and parks with one another;
- protect Kayaderosseras Ridge from visual, drainage, and erosion impacts;
- develop additional parks, preferably large, town-wide parks; and
- discourage development of pocket parks.

The *Town of Greenfield Comprehensive Plan* does not address or make any recommendations regarding electric transmission projects. Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the *Town of Greenfield Comprehensive Plan* and will not adversely affect existing land use and planned development.

4.2.2.3.5 City of Saratoga Springs

The Saratoga Springs Comprehensive Plan was originally adopted on May 4, 1999, with first amendments adopted November 21, 2000 and a second amendment adopted July 17, 2001. The plan describes the city's goals for land use development, design and enhancement, and provides the justification for planning and regulatory policies that encourage desired development and efficient growth patterns to maximize the city's social and economic potential. The goals of the comprehensive plan include:

- enhance the vitality and success of the city's downtown core area;
- promote a broader mixture of uses in selected areas to encourage social, business and residential interaction and diversity;
- implement land use and design policies to enhance quality of life, protect sensitive environmental resources, and preserve traditional community character;
- support the city's sense of history and the "City in the Country" by preserving the quality of cultural and open space resources; and
- invest in infrastructure improvements and encourage public/private partnerships that support the plan's goals.

Since the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of *The Saratoga Springs Comprehensive Plan*, and will not adversely affect existing land use and planned development.

4.2.2.3.6 Town of Milton

The Town of Milton has a *Comprehensive Plan 2001* that is dated June 20, 2001. The overall vision of the *Comprehensive Plan 2001* is to maintain Milton's small-town feel. The Town of Milton *Comprehensive Plan 2001* includes the Milton Town Center Master Plan as an appendix.

Primary goals of the *Comprehensive Plan 2001* include:

- maintain Milton's small-town feel including a small, accessible government, opportunities for nearby passive recreation, and rural character;
- encourage mixed commercial and residential growth in the compact Milton Town Center
- preserve open spaces, farmland, and woodlots in the western part of town – these are key components of the town's rural character;
- ensure the protection of all of the town's important natural resources especially safeguarding the town's streams and abundant groundwater resources; and
- continue to develop and expand the town's active and passive recreational resources.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the town. Since the proposed Project will be completely underground and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the *Comprehensive Plan 2001*.

4.2.2.3.7 Town of Ballston

The Town of Ballston adopted a *Final Draft Comprehensive Plan* in December 2005. The plan was developed with the intent of achieving a balance between village, suburban, and rural land use perspectives and protection of the existing quality of life. The *Final Draft Comprehensive Plan* discusses the use of railroad corridors for the development of recreational trails. The *Final Draft Comprehensive Plan* recommends that any utility facilities be placed in visually unobtrusive locations.

The goals of the Town of Ballston *Final Draft Comprehensive Plan* include:

- encourage the conservation of farmland and significant open spaces and ensure the long-term viability of agriculture;
- create a network of open spaces to provide wildlife habitat and potential greenway/recreational trail corridors;

- expand town's active and passive recreational resources to meet the growing demand for these amenities; and
- protect and promote the Town's significant historic and cultural resources.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground, and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the Comprehensive Plan.

4.2.2.3.8 Town of Clifton Park

The *Town of Clifton Park Comprehensive Plan* was adopted by Town Board Resolution on April 17, 1995 and was amended in 1997, 1999, 2001, 2003 and 2006. The plan was developed to encourage a balance of land uses so that residential and economic vitality can be pursued and the unique rural and historic character of the town can be preserved. The *Town of Clifton Park Comprehensive Plan* seeks to enhance the quality of life for the town residents.

The goals of the *Town of Clifton Park Comprehensive Plan* include:

- preserve and enhance residential, historic, agricultural and rural nature of the town while encouraging managed economic growth;
- maintain a continuing planning process for the town with emphasis on quality of life and appropriate balance of land uses;
- address issues essential to support existing development and encourage future managed growth, while encouraging community diversity and quality of life; and
- ensure that future development takes into account environmental impacts on the town, especially related to water supply, water quality, open space, scenic viewsheds, and historic preservation.

The Town of Clifton Park adopted an Open Space Plan in 2003. The main open space concepts and goals include protection of wildlife nature preserves and watersheds, a farmland protection program, parkland and ballfields, town-wide trails and pathways, scenic roads, and cultural resources.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground, and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the Comprehensive Plan and the Open Space Plan.

4.2.2.4 Schenectady County

Schenectady County does not have a Comprehensive Plan or Master Plan. Schenectady County does have a *Schenectady County Agricultural and Farmland Protection Plan* dated September 2002 that recommends goals and actions that promote the maintenance and expansion of lands in active agricultural use in Schenectady County. The plan notes that Schenectady County's proximity to the Capital Region's urban areas presents challenges and opportunities to farms within the County.

Major goals established in the *Schenectady County Agricultural and Farmland Protection Plan* include:

- retain viable agricultural land resource (prime/important farmland) for agricultural purposes and ensure public policy is protecting, promoting, and sustaining agriculture;
- diversify and broaden the agriculture economic base and attract new people to farming ventures; and
- increase public recognition and support of agriculture and foster a better understanding of farm issues by non-farmers.

The proposed Project, as presented in this Application will not affect the goals of the *Schenectady County Agricultural and Farmland Protection Plan*. The proposed Project in Schenectady County will be constructed entirely within the CP and CSX existing railroad rights-of-way. The proposed Project will be completely underground and will not include any visible aboveground structures or encroach on any land outside the existing rights-of-way. Therefore, it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the town.

4.2.2.4.1 Town of Glenville

During 2004, the Town of Glenville developed a *Town of Glenville Town Center Master Plan* and a *Town of Glenville Freeman's Bridge Road Master Plan*. The area of focus for each of these plans is just west of the proposed Project.

The goals of the *Town of Glenville Town Center Master Plan* include:

- establish a critical mass of businesses and activity in the Town Center that further establishes the area as the focal point of the town, providing a unique shopping, recreational and cultural experience in the region;
- provide a traditional pattern of development that supports a diverse range of uses, public spaces and walkways, to give an integrated community center and civil focal point; and
- develop more efficient circulation patterns and enhance safety and access by providing a multifunctional street system.

The goals of the *Town of Glenville Freeman's Bridge Road Master Plan* include:

- establish a framework for land use decisions in the study area including identification of areas best suited to various types of land uses, as well as areas to be left undeveloped or developed for recreational purposes;
- promote a pattern of development that supports and encourages mixed-use and offers a variety of well designed public spaces and walkways streets; and

- promote vehicular circulation patterns that segregate commercial traffic from local automobile traffic and offer alternative routes that enhance safety by providing walkways, paths, trails, and dedicated street lanes for pedestrians and bicyclists.

The Town of Glenville Open Space Plan, adopted by the Town Board on May 7, 2008, includes goals and objectives such as the protection of natural and cultural features, land use development patterns that are consistent with the carrying capacity of natural resources, water quality, the rural character of western Glenville, buffers between developed areas in eastern Glenville, environmentally sensitive areas, scenic views, key entryways or gateways to the Town of Glenville, and the development of recreational facilities and opportunities.

Because the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground, and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the Open Space Plan. The proposed Project is not located in the areas addressed by the *Town of Glenville Town Center Master Plan* and the *Town of Glenville Freeman's Bridge Road Master Plan*.

4.2.2.4.2 City of Schenectady

The *City of Schenectady Comprehensive Plan 2020* was adopted by the city council on March 24, 2008. The plan outlines an overall vision for future conservation and development of the city. Four vision elements frame the goals and action plan for the next 15 years: quality city services efficiently delivered; great homes in safe and stable neighborhoods; a beautiful, clean and green community; and a quality workforce and growing businesses.

The goals of the *City of Schenectady Comprehensive Plan 2020* include:

- protect and promote historic resources;
- protect sensitive natural, scenic and environmental areas and permanently preserve open spaces;
- develop and maintain excellent park and recreation resources; and
- employ best practices and creative land use tools to shape development, improve design and aesthetics, preserve historic resources, and enhance urban character.

Since the proposed Project will be constructed entirely within the existing CP railroad right-of-way, will be completely underground, and will not be visible or encroach on any land outside the existing right-of-way, the proposed Project is consistent with the goals of the *City of Schenectady Comprehensive Plan 2020*.

4.2.2.4.3 Town of Rotterdam

The Town of Rotterdam Comprehensive Plan and Final Generic Environmental Impact Statement was adopted by the Town of Rotterdam Town Board on December 5, 2001. The main objective of the comprehensive plan is to preserve the town's character and identity while allowing for environmentally sound growth and development.

The goals of *The Town of Rotterdam Comprehensive Plan and Final Generic Environmental Impact Statement* include:

- protect critical sensitive areas, maintain water quality, and conserve land, air, water and energy resources by taking advantage of existing plans or ongoing planning activities such as watershed management plans and regional and local transportation plans;
- encourage responsible development that limits noise pollution and traffic congestion, provides pedestrian safety, discourages growth in environmentally sensitive areas, protects cultural resources, and provides quality community design;
- encourage local involvement in community actions; and
- enhance opportunities for recreational and cultural activities.

There will be no adverse effect on future land use or planned development in the Town of Rotterdam because the proposed Project will be constructed entirely within CP and CSX existing railroad rights-of-way. The proposed Project will be completely underground and will not be visible or encroach on any land outside the existing right-of-way.

4.2.2.5 Albany County

Albany County does not have a Comprehensive Plan or Master Plan. Albany County does have an *Albany County Agricultural and Farmland Protection Plan* dated 2004 that details ways to support farming and enhance agriculture in the county. The plan establishes a comprehensive strategy and presents ways that can be used at the private, town and county level to meet the goals for agricultural and farmland protection.

Major goals established in the *Albany County Agricultural and Farmland Protection Plan* include:

- retain viable agricultural land resources for agricultural purposes;
- increase marketing opportunities, competitiveness and profitability of farming and the agriculture industry in Albany County; and
- increase public recognition of the value of agriculture and farmland in Albany County.

The proposed Project will not affect the goals of the *Albany County Agricultural and Farmland Protection Plan*. The proposed Project in Albany County will be constructed entirely within an existing CSX right-of-way. The proposed Project will be completely underground and will not be visible or encroach on any land outside the existing right-of-way.

4.2.2.5.1 Town of Guilderland

The *Town of Guilderland Comprehensive Plan 2000* is dated August 7, 2001. The plan outlines the town's vision of itself as a distinctive suburban and rural community in the Capital District. Goals associated with the plan cover topics including: growth management; transportation and mobility; public utilities; business, employment and fiscal resources; housing; town character; agriculture; natural resources and open space; cultural resources; recreation; governance; and implementation.

The goals of *Town of Guilderland Comprehensive Plan 2000* include:

- create a land use pattern and management system that remediates adverse impacts of sprawl, discourages further sprawl, responds to community needs, and protects and enhances the town's resources, unique features and quality of life;
- preserve and enhance the town's identity, image and quality of life, and maintain and strengthen the distinction between the town's developed and rural/natural areas;
- protect important agricultural, natural, and open space resources, which contribute to the diversity, character, aesthetics, economy, and general health and welfare of the town.
- recognize the town's historic resources and preserve and enhance cultural opportunities in the community; and
- provide sufficient, well-located and affordable, active and passive recreational opportunities for all town residents.

The Rural Guilderland: Open Space and Farmland Protection Plan, dated July 2005, details that rural Guilderland is valued for the beautiful farmland, countryside and a natural setting that distinguish it from the town's more urbanized eastern area. A portion of the proposed Project is located in rural Guilderland. The vision statement notes that the existing character of rural Guilderland should be maintained to the highest extent possible. Further, it is noted that farms, hamlets, and traditional-style development should be interspersed throughout the natural foundation.

The Rural Guilderland: Open Space and Farmland Protection Plan's concepts for conservation include:

- protect significant natural resources;
- protect agricultural heritage;
- respect scenic roads; and
- protect cultural and historic heritage.

The Rural Guilderland: Open Space and Farmland Protection Plan's concepts for development include:

- create a rural greenway and rail system;
- preserve rural hamlets and enhance gateways;
- maintain roadside rural character; and
- allow for limited new development that is consistent with the rural character of the town.

The *Route 20 Land Use and Transportation Study-Towns of Guilderland and Princeton, New York*, dated November 2008, examines future land use and transportation along a 4-mile segment of Route 20 located northwest of the proposed Project between the northern end of the Watervliet Reservoir and Gifford Hamlet. A section of the proposed Project crosses the Route 20 corridor in proximity of the southeastern end of the Watervliet Reservoir. Goals of the *Route 20 Land Use and Transportation Study-Towns of Guilderland and Princeton, New York* include improving the transportation function and safety of the corridor and improving its aesthetics and economic potential.

In 2007 the Town of Guilderland developed the *Guilderland Hamlet Neighborhood Plan,* but the area of focus for this plan is outside of the proposed Project area.

Because the proposed Project will be constructed entirely within an existing CSX railroad right-of-way, there will be no adverse effect on future land use or planned development in the Town of Guilderland. The proposed Project will be completely underground and will not be visible or encroach on any land outside the existing right-of-way. Thus, the proposed Project is consistent with goals set forth in the *Town of Guilderland Comprehensive Plan 2000.*

4.2.2.5.2 Town of New Scotland

The Town of New Scotland *Comprehensive Land Use Plan and Generic Environmental Impact Statement* is dated May 1994. The plan outlines a program to provide orderly but limited growth and also retain the basic character of the community. The plan encourages preservation of environmental and cultural resources and also provides a basis from which to draw a capital improvements plan.

The goals of the Town of New Scotland *Comprehensive Land Use Plan and Generic Environmental Impact Statement* include:

- protect and enhance the current town character and high quality environment while accommodating a mix of residential, commercial, light industrial/manufacturing, agricultural, and office uses;
- improve the local economy and tax base by encouraging economic development and expand clean light industrial/manufacturing, commercial and office activities and jobs in balance with New Scotland's existing character; and
- promote a pattern of land use that provides sufficient space for activities of town residents while supporting efficient delivery of services and protection of existing neighborhoods.

Because the proposed Project will be constructed entirely within the CSX existing railroad right-of-way, will be completely underground, and will not be visible or encroach on any land outside the existing right-of-way, the Project is consistent with the goals of the Town of New Scotland *Comprehensive Land Use Plan and Generic Environmental Impact Statement*.

4.2.2.5.3 Voorheesville Village

Voorheesville Village has not yet developed a Comprehensive Plan. Since the proposed Project will be constructed entirely within an existing CSX railroad right-of-way, it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the village.

4.2.2.5.4 Town of Bethlehem

The Town of Bethlehem adopted the *Town of Bethlehem Comprehensive Plan and Generic Environmental Impact Statement* on August 24, 2005. The plan was developed with the intent of achieving a balance between urban, suburban, and rural land use perspectives; a balance between the need and desire for economic growth, for tax base expansion and diversification, and for stewardship of finite environmental resources and land; and a balance between short-term and long-term health, safety, and welfare of the community. The *Town of Bethlehem Comprehensive Plan and Generic Environmental Impact Statement* discusses the use of railroad corridors for the development of recreational trail networks. The *Town of Bethlehem Comprehensive Plan and Generic Environmental Impact Statement* recommends that any utility facilities be placed in visually unobtrusive locations.

The goals of the *Town of Bethlehem Comprehensive Plan and Generic Environmental Impact Statement* include:

- encourage compact, mixed-use commercial and residential development/redevelopment;
- expand public, private or non-profit active and passive recreational resources and community services available in town;
- manage and protect significant environmental systems;
- promote commercial and industrial growth in specifically designated locations;
- promote energy efficiency and conservation and the use of renewable energy in the town;
- recognize the town’s significant cultural resources, historic resources, and natural resources; and
- utilize flexible land use regulations and creative land development techniques to retain the economic value of rural land.

Since the proposed Project will be constructed entirely within an existing CSX railroad right-of-way, will be completely underground and will not encroach on any land outside the existing right-of-way or be visible, the Project is consistent with the goals of the Comprehensive Plan.

4.2.2.5.5 Town of Coeymans

The Town of Coeymans Comprehensive Plan was adopted in September 2006. The plan was developed with a vision to bring together the changing economic conditions, the importance of preserving open space, and the needs and desires of a diverse population. *The Town of*

Coeymans Comprehensive Plan notes the following: the town should continue to develop in a manner that will invite and attract new residents and business opportunities; the town is the only municipality in Albany County that has direct access to the Hudson River without a road or barrier between the town and the river; the town offers a variety of living types from rural to small urban Hamlet settings; the town will strive to preserve and enhance these assets and provide necessary amenities and services to existing and new residents, businesses and visitors at present and in the future.

The goals of the *Town of Coeymans Comprehensive Plan* include:

- preserve and enhance the town's existing rural, small town character, while accommodating a balanced mix of agricultural, recreational, residential, commercial, and industrial uses;
- encourage future development that minimizes negative impacts on natural resources, infrastructure, and neighboring uses, in order to safeguard the health, safety and welfare of the community;
- protect the community's visual character and aesthetics, especially along corridors and at prominent gateways;
- foster development of tourism resources in the town to strengthen the local economy and establish stewardship and preservation of the town's unique resources;
- preserve, enhance and promote the town's historical resources for the enjoyment of current residents and future generations; and
- promote the town's many water bodies and waterfront areas for recreational activities.

Because the underground portion of the proposed Project will be constructed within an existing CSX railroad right-of-way, will be completely underground, and will not be visible or encroach on any land outside the existing right-of-way, it is anticipated that the Project will not adversely affect existing or future land uses and planned development in the town. When entering the Hudson River, HDD installation will be used to avoid disturbing the shoreline area. The HDD is expected to exit the water at a depth sufficient to avoid impacts to intertidal and nearshore areas.

4.2.2.6 Westchester County

As stated previously, CHPEI is proposing a new HVDC converter station in the City of Yonkers. This section evaluates the consistency of work at the Yonkers converter station site with the land use goals and objectives of the:

- *Westchester Open Space Plan*
- *Westchester Urban County Consortium Consolidated Plan*
- *Yonkers Alexander Street Master Plan*
- *Alexander Street Urban Renewal Plan*
- *Yonkers Alexander Street Brownfield Development Plan*
- *City of Yonkers 5 Year Consolidated Plan*

Westchester Open Space Plan

The *Westchester Open Space Plan* seeks to preserve and acquire open space to preserve areas of scenic, recreational or other importance to the public. The plan states that the county may serve as facilitator for protection/preservation actions which may be undertaken by the state, Westchester municipalities, and private organizations (e.g., land trusts, foundations). In identifying lands to be acquired or otherwise protected, the county focuses on protecting the following types of resources: Open Space Character, Recreation, Waterfront Use, Environmental Resources, and Historic Resources. As the Yonkers converter station site is separated from the waterfront by railroad tracks and the Yonkers City Jail, waterfront use of the parcel is not likely, nor would preservation of the site in its existing use as a parking lot assist in preserving "open space, recreation, environmental resources, or historic resources". Accordingly, the Project is not inconsistent with the objectives of the *Westchester Open Space Plan*.

Westchester Urban County Consortium Consolidated Plan

The goals of the *Westchester Urban County Consortium Consolidated Plan* are to:

- establish housing and community development goals for the next five-year period (2009-2013);
- continue to provide decent housing to local residents;
- provide guidance on homelessness; and
- provide a suitable environment to expand economic development.

This plan does not discuss planning activities for specific geographic areas, and does not contemplate issues associated with electricity supply or electric infrastructure. Therefore, it is not applicable to the review of the proposed Project. However, given the characteristics of the land at the converter station site, the construction and operation of the converter station is not inconsistent with the goals of the Plan.

4.2.2.6.1 City of Yonkers

Yonkers Alexander Street Master Plan

The *Yonkers Alexander Street Master Plan* establishes the City of Yonkers' goals for redeveloping the Hudson River waterfront, including the City's vision for redeveloping the Alexander Street Master Plan Area.

The *Yonkers Alexander Street Master Plan* is a revitalization strategy to improve the overall character and vitality of the Alexander Street corridor. In doing so, the Master Plan aims to create additional public open space amenities, improve and enhance public parklands, enhance the use of and public access to the Hudson River, make transportation system improvements, expand residential housing opportunities, and add retail and other commercial uses to enhance the vibrancy of the area. This Plan is a blueprint that establishes a general land use pattern which defines what the City wants to happen. It is intended to guide the actions of the City of Yonkers and private developers who submit applications to redevelop the waterfront. The plan includes design and environmental sustainability guidelines.

Translating the principles and guidelines into a Master Plan results in a redeveloped waterfront and mixed-use district intended to:

- clean-up contaminated sites;
- create a new transit oriented residential neighborhood;
- ensure commercial retail and office uses; and
- create new public open space and parks, as well as public access, both physical and visual, to the Hudson River.

In addition to these four main land use goals, the *Yonkers Alexander Street Master Plan* aims to:

- provide additional public parking;
- improve access to public transit, especially the Yonkers and Glenwood Metro-North Railroad stations;
- preserve and adapt existing historic buildings, such as the City Jail and the Glenwood Power Station;
- orient new residential buildings perpendicular to the Hudson River to maintain upland view corridors – i.e., the “goal post” idea of space between narrow buildings;
- increase pedestrian access and links to upland neighborhoods and to the rest of Yonkers; and
- provide an esplanade/greenway system along the entire Hudson River water’s edge.

The Yonkers converter station for the proposed Project is located just inside the southeastern portion of the Yonkers Street Master Planning District. The Master Plan envisions the Alexander Street area as a predominately residential community with up to approximately 3,752 residential units in several building types. New residential development is expected to provide a mix of rental and home-ownership opportunities at various price levels, the details of which will be included in future development applications. It is expected that residential buildings will be constructed over time by one or more private development entities. The size of individual units, the mix within each new building, and the type (e.g., rental, condominium, co-operative, etc.) will depend on market conditions and will be reviewed by the Department of Planning and Development as individual development proposals are considered. The Master Plan assumes a gross residential unit size of 1,360 square feet.

With respect to the proposed Yonkers converter station location, the plan designates the specific site as a “development parcel” and provides general development guidelines, including uses, densities and heights for residential development. According to the guidelines, the site for the Yonkers converter station would be allowed to accommodate up to a 25 story high building with up to 250 residential units. Although the plan anticipates the area will convert to being predominantly residential, it does not make a prohibition against other types of uses such as this proposed infrastructure project (i.e., the plan does not discuss infrastructure or electricity needs).

The supporting document to this study, called the “Alexander Street Urban Renewal Plan” (discussed in further detail below), shows in fact that the site of the proposed Project is actually zoned as industrial and is thereby suitable for industrial uses. Existing land uses include: a railroad track and jail to the west of the site, a large commercial building to the east of the site, a trucking company to the north, and mixed uses to the south. These land uses will not be affected by the converter station, which will be mostly enclosed within a low profile structure. Locating a converter station at this site is in character with the industrial/commercial nature of the abutting land uses. Since the site is located in the southeastern portion of the District, as opposed to somewhere closer to the middle, it has a lower likelihood of negatively affecting the goals of the Master Plan.

Alexander Street Urban Renewal Plan

The *Alexander Street Urban Renewal Plan* is another component (along with the previously discussed *Yonkers Alexander Street Master Plan*) of a land use strategy and “blueprint” for the redevelopment of the Alexander Street Urban Renewal Area (URA), within which the Yonkers converter station is located. The URA is bounded by the Hudson River to the west, Wells Avenue to the south, the Metro-North Railroad right-of-way to the east, and the northern end of Trevor Park and JFK Marina Park to the north. The plan notes that this area warrants redevelopment to improve the overall conditions of the City of Yonkers.

By implementing the Urban Renewal Plan, the Yonkers Community Development Agency (CDA) intends to remove blighted conditions, relocate affected businesses and households (if any), encourage private investment, redevelop cleared sites, and generally improve the economy and conditions of the City of Yonkers as a whole.

The plan shows that the current designated land use at the site of the Yonkers converter station is “parking” and that the land is owned by Hudson View Associates. The plan states that the land use of the property to the east is for warehousing, the adjacent land use to the west is the Metro North Railroad and beyond that to the west is the Yonkers City Jail. To the north the land is industrial and currently used by a trucking company.

The zoning map attached to the plan indicates the site is zoned industrial and also shows that a portion of the site is designated as a URA.

The report concludes that the planning area is “underutilized for industrial development”. Specifically, it states that “while it is unlikely that industrial facilities would be built to a floor area ratio (FAR) of 7.5 as permitted in the City’s industrial district, this number still demonstrates the underutilization of the area”. The report states that even at an FAR of 2.0, the URA would have more than 3 million square feet of unused floor area. The reports concludes that “Numerous parcels are dedicated to surface parking lots and vehicle storage, further demonstrating the current underutilization of sites within the affected area and opportunities for redevelopment with greater economic potential.” As the site proposed for development is a parking lot, the proposed conversion of the site from parking to a converter station addresses the plan’s need for better utilization of this area.

Yonkers Alexander Street Brownfield Development Plan

The City of Yonkers wishes to facilitate the redevelopment and revitalization of its waterfront.

This Brownfield Opportunity Area (BOA) Plan focuses specifically on a portion of the waterfront along Alexander Street. The Draft BOA Plan was developed concurrently with the Urban Renewal Plan and Master Plan (discussed above) for the waterfront area. These three plans address the redevelopment of the Alexander Street waterfront area, and comprise the implementation strategy for revitalizing and redeveloping the BOA area.

The designation of the BOA Area is intended to facilitate the redevelopment and revitalization of Yonkers' waterfront. Although the BOA Area includes some parcels that may not undergo any major improvements or parcels that are not believed to be severely contaminated by hazardous materials, it is the intention of the City to create a new waterfront community that is connected both visually and physically to the surrounding neighborhoods. Therefore, the BOA Area includes parcels adjacent to those areas where major redevelopment and remediation is anticipated, in order to make these connections. The primary redevelopment area is the area with the highest level of contamination, and also the area where most redevelopment activity is expected to occur.

The BOA discusses historic structures that should be protected. Two of these are adjacent to the site: the Otis Elevator Company to the east, and the Yonkers City Jail, just across the railroad tracks to the west.

The Otis Elevator Company was founded in Yonkers in 1852 by Elisha Otis. The company expanded several times during the 1920s and 1930s, adding new buildings to a complex of four buildings north and south of Wells Avenue. The long, narrow red brick four- and five-story Otis Elevator building north of Wells Avenue and east of Atherton Street lies within the BOA Area. It was built in 1927 as a machine shop and has multi-paned, operable windows which contribute to the building's industrial appearance. This building, along with the 1917 Otis Elevator building, illustrates the industrial heritage of this area of Yonkers.

The City Jail (State and National Register of Historic Places [S/NR]-eligible) at 24 Alexander Street is a two-story red brick Classical Revival building constructed in 1927. The building continues to be used as a jail.

In summary, the proposed Yonkers converter station will not interfere with the use of these historic resources or the general redevelopment plans of the larger BOA. As a result, the Yonkers converter station will be consistent with the goals of the *Yonkers Alexander Street Brownfield Development Plan.*

City of Yonkers 5 Year Consolidated Plan

The City of Yonkers 5 Year Consolidated Plan is focused on delivering affordable housing within the municipality. Its specific goals are:

- provide decent housing by preserving the affordable housing stock, increase the availability of affordable housing, reduce discriminatory barriers, increase the supply of supportive housing for those with special needs, and transition homeless persons and families into housing;
- provide a suitable living environment through safer, more livable neighborhoods, greater integration of low and moderate income residents throughout the City, increased housing opportunities, and reinvestment in deteriorating neighborhoods.; and
- expand economic opportunities through more jobs paying self-sufficient wages, homeownership opportunities, development activities that promote long-term community viability, and the empowerment of low and moderate income persons to achieve self-sufficiency.

Because the scope of this plan is geographically broader than the specific area around the converter station site, it is unclear if the project will have a negative effect on the stated goals. Use of the site for a converter station is more in character with the existing industrial/commercial adjacent land uses than residential development.

4.2.2.7 New York County

The proposed interconnection work at Sherman Creek substation in Manhattan has been evaluated with respect to consistency with the land use goals and objectives of the:

- *New York City Comprehensive Waterfront Plan*
- *New York City Waterfront Revitalization Program*
- *Washington Heights and Inwood Planning and Land Use Study*

4.2.2.7.1 New York City

The interconnection work will be conducted at the existing Con Edison Sherman Creek substation and adjacent lands where the proposed step-down 345/138 kV AC transformer substation will be located. The Sherman Creek substation is located in the Inwood section of upper Manhattan. The site is bounded by West 201st Street to the north, the Harlem River to the east, and Academy Street to the south and west.

New York City Comprehensive Waterfront Plan

The *New York City Comprehensive Waterfront Plan* proposed by the Department of City Planning provides a framework to guide land use along the city's entire 578-mile shoreline in a way that recognizes its value as a natural resource and celebrates its diversity. The plan presents a long range vision that balances the needs of environmentally sensitive areas and the working port with opportunities for waterside public access, open space, housing, and commercial activity. The *New York City Comprehensive Waterfront Plan* identifies the following planning goals with respect to redeveloping the waterfront:

- promote economic development and enhance the city's tax base by providing opportunities for new uses, including housing for a range of income groups;
- enliven the waterfront by promoting people-attracting uses, open space, and public access to the waterfront;
- integrate new development with adjacent upland communities;
- consider land use, availability of services and infrastructure capacity in determining scale of redevelopment; and
- promote social and economic diversity on the waterfront.

With respect to the general location of the Sherman Creek substation, the Plan has the following four goals:

- upgrade Sherman Creek wetlands through interim cleanup; require that a portion of the natural edge be restored and maintained as a component of future development;
- develop street-end access, compatible with industrial uses, in the Sherman Creek area of the Harlem River waterfront;
- explore the potential for a rowing center at Sherman Creek, a use that is compatible with wetlands and shallow water depths, but would require limited dredging; and
- rezone the area north of Sherman Creek and south of 207th Street to accommodate recreational, residential and/or commercial uses.

As the interconnection work is minor and represents some upgrades and additional substation equipment and the development of a small transformer substation site adjacent to the existing facilities, it will not interfere with the above recreational and redevelopment goals of the Sherman Creek area. Accordingly, this work is consistent with the goals and objectives of the *New York City Comprehensive Waterfront Plan*.

New York City Waterfront Revitalization Program

The *New York City Waterfront Revitalization Program* is the city's principal coastal zone management tool. As originally adopted in 1982, this LWRP establishes the city's policies for development and use of the waterfront and provides the framework for evaluating the consistency of all discretionary actions in the coastal zone with those policies. The guiding principle of the WRP is to maximize the benefits derived from economic development, environmental preservation, and public use of the waterfront, while minimizing the conflicts among these objectives.

Through individual project review, the LWRP aims to promote activities appropriate to various waterfront locations. The program is designed to coordinate activities and decisions affecting the coast when there are overlapping jurisdictions or multiple discretionary actions. When a proposed project is located within the coastal zone and requires a local, state, or federal discretionary action, a determination of the project's consistency with the policies and intent of the LWRP.

See Section 4.2.5.2 for further discussion of the consistency of the Project with LWRPs, including a specific discussion of the applicability of the New York City LWRP’s 10 policies and an explanation of how the interconnection work at the Sherman Creek substation complies with those policies. The work at the Sherman Creek substation is consistent with the goals and objectives of the *New York City Waterfront Revitalization Plan*.

Washington Heights and Inwood Planning and Land Use Study

The *Washington Heights and Inwood Planning and Land Use Study* is a district-wide planning study that covers Washington Heights and Inwood, and the neighborhoods that make up “Northern Manhattan” and comprise Community District 12 (CD12). The Sherman Creek substation is located at the northeastern portion of this planning area.

The Washington Heights and Inwood Planning and Land Use Study focuses on six goals:

1. Identify trends in the community and best practices for balanced community development
   - provide information on who lives in CD12 and what their needs are; and
   - develop a framework of priorities and potential actions towards assisting CD12 in fulfilling its mission.

2. Foster development and preservation of affordable housing
   - encourage a mix of rental and ownership housing; and
   - preserve the existing affordable housing inventory.

3. Locate sites/areas—and actions—meeting community needs
   - include locations for housing, education and other community facilities; expansion of small business and economic activity; culture and recreation.

4. Preserve and strengthen district character and quality of life
   - highlight community assets and resources; and
   - safeguard against overdevelopment.

5. Locate buildings and areas of special architectural or historic interest
   - identify buildings and districts for protection through landmark designation; and
   - recommend alternative forms of protection or recognition.

6. Update zoning
   - implement contextual zoning where appropriate, and
   - reconcile existing zoning with actual land use and building form, while encouraging desired development patterns.

As the interconnection work at the Sherman Creek substation will be minor with some upgrades and additional substation equipment and the development of a small transformer substation site adjacent to the existing facilities, no impacts to the goals included in this study are anticipated. Specifically, the work will not affect: 1) balanced community development; 2) affordable housing; 3) community needs; 4) preservation of the area's character and quality of life; 5) architectural and historic resources; and 6) zoning initiatives.

The land use plan lays out recommended uses for areas within the district and at the site of the substation; the area is demarcated as a "contextual/preservation zone". As the interconnection work will be minor and largely within the boundaries of the existing facility, the context of the existing land uses and building types will not change in this area.

The land use plan also designates the Project site as a "potential redevelopment area" and provides the following recommendations with respect to land near the site:

- City should commit to constructing at least part of the finished open space including Sherman Creek Park at Academy Street; and

- Sherman Creek Park and esplanade should be part of an articulation of bulkhead/greenway plan for finishing the Manhattan Greenway plan through Inwood, i.e., begin plans and acquisition or easements where necessary.

The referenced park work involves improving and creating a walkway along the water both south and east of the site. As the interconnection work is minor and represents some upgrades and additional substation equipment and the development of a small transformer substation site adjacent to the existing facilities, it will not interfere with these proposed land uses along Sherman Creek.

4.2.3 State and Local Parks/Public Lands

The underground portion of the transmission cable route is adjacent to four state-maintained parks/public land areas:

- Wilton Wildlife Preserve and Park, in the Town of Wilton;
- Saratoga Spa State Park, in the City of Saratoga Springs;
- New York State Department of Environmental Conservation (NYSDEC) Saratoga Nursery, in the City of Saratoga Springs; and
- Five Rivers Environmental Education Center, in the Town of New Scotland.

4.2.3.1 Wilton Wildlife Preserve & Park

The mission of the Wilton Wildlife Preserve & Park is to conserve ecological systems and natural settings, while providing opportunities for environmental education and recreational experiences. The Wilton Wildlife Preserve & Park represents a partnership between the Town of Wilton, The Nature Conservancy, and the NYSDEC. Created in 1996, its goals are to protect and restore the endangered Karner blue butterfly, preserve open space, and provide recreational and environmental education opportunities. The goal of the Wilton Wildlife Preserve and Park is to protect 3,000 acres of land for these purposes. Efforts to achieve these goals are occurring east of Interstate (I)-87 from the Ballard Road area in the north to south of King Road in the south. Within this area, 10 parcels encompassing approximately 800 acres are currently protected. Four of the protected parcels are developed with trails for passive recreation uses (Wilton Wildlife Preserve & Park, 2010).

The underground transmission cable route directly abuts several of the parcels of the Wilton Wildlife Preserve & Park. Because the cables in this area will be underground entirely within the CP existing right-of-way, there will be no long term aesthetic impact or impacts to the public use and enjoyment of the preserve. Any construction impacts including noise or temporary impacts to public access will be short term.

4.2.3.2 Saratoga Spa State Park

Saratoga Spa State Park is a 2,200 acre park that surrounds mineral springs at the edge of the Adirondack Mountains. For centuries, the springs in the area were visited for their perceived healing power. By the beginning of the twentieth century, commercial pumping wells had lowered the water table so much that New York State enacted laws that limited the amount of pumping. In 1912, the state took ownership of the land and created a state reservation. Franklin Roosevelt, former Governor of New York, commissioned an architect to create a European-style spa on the property.

Today, Saratoga Spa State park has multiple recreational uses. There are several walking and hiking trails within the park as well as both groomed and un-groomed trails for cross-country skiing and snowshoeing in the winter. The grounds also include a golf course. The park is home to a museum of dance, an automobile museum and a performing arts center (NYSOPRHP 2010).

The underground transmission cable route directly abuts the western boundary of the Saratoga Spa State Park. In this area, the cables will be underground entirely within the existing CP railroad right-of-way. There will be no long term aesthetic impacts or impacts to the public’s use and enjoyment of the state park resulting from construction or operation of the Project. Any impacts during construction, such as noise or temporary impact to public access will be short-term. The Project will take precautions to avoid conflicts with the Saratoga Performing Arts Center during construction.

4.2.3.3 NYSDEC Saratoga Nursery

The NYSDEC nursery in the City of Saratoga Springs produces more than 1.5 million tree and shrub seedlings each year on 200 acres of land. Seedlings of more than 50 species are grown and sold or used in reforestation projects. The nursery also provides seedlings to schools so that students can learn about the importance of trees to the environment and become personally involved in establishing a grove (NYSDEC 2010a).

The cable route passes within 75 feet of the eastern boundary of the Saratoga nursery. In this area, the cables will be underground entirely within the CP existing right-of-way. There will be no long term aesthetic impact on the nursery from the proposed cable. Any construction impacts such as noise will be short term.

4.2.3.4 Five Rivers Environmental Education Center

The Five Rivers Environmental Education Center in New Scotland is comprised of more than 450 acres of fields, forests, and wetlands. The Center offers a variety of guided and self-guided tours on over 10 miles of trails. In the winter, the trails remain open for skiing and snowshoeing (NYSDEC 2010b).

There are two sections of the underground transmission cable route that closely approach the western boundary of the Five Rivers Environmental Education Center. The Project route passes within 150 feet of the boundary south of Bluebird Way, and the route directly abuts the Five Rivers Environmental Education Center in the Game Farm Road area. In this area, the proposed cables will be underground within the existing CSX right-of-way. There will be no long term aesthetic impact or impacts to the public's use and enjoyment of the center. Any construction impacts including noise or temporary impacts to public access will be short term.

4.2.3.5 Local and County Parks

The following local and county parks, recreational areas and open space areas are within 600 feet of the underground portion of the cable route:

- Bertha E. Smith Park, Northumberland;
- Gansevoort Park, Northumberland;
- Saratoga County Forest Land, Northumberland and Wilton;
- Gavin Park, Northumberland;
- Hillhurst Park, Schenectady;
- Roger Keenholts Park, Guilderland; and
- Jim Nichols Memorial Park, Village of Voorheesville, New Scotland

Bertha E. Smith Park, Northumberland

The Bertha E. Smith Park was deeded to the Town of Northumberland in 1976 to serve the youth of the town. Northumberland's Youth and Recreation uses the park for summer recreation programs, and other youth-oriented groups use the park throughout the year. The facilities include a baseball diamond, a basketball court, a playground, and a pavilion (Town of Northumberland – Town Parks 2010).

The cable route passes within 100 feet of the eastern boundary of the Bertha E. Smith Park. In this area, the cables will be buried within the existing CP right-of-way. There will be no long term aesthetic impact or impact to the public's use and enjoyment of the park. Any construction impacts including noise or temporary impacts to public access will be short term.

Gansevoort Park, Northumberland

Gansevoort Park is located in the Hamlet of Gansevoort in the Town of Northumberland. The park is situated between Leonard Street and Catherine Street and faces the Gansevoort Mansion. The property for the park was deeded to the town by the family of the Revolutionary War General Peter Gansevoort, who desired the land be used as a public park. The park hosted activities celebrating the town's Bicentennial in 1998 (Town of Northumberland – Town Parks 2010).

The cable route passes within 100 feet of the western boundary of the Gansevoort Park. In this area, the cables will be buried within the existing CP right-of-way. There will be no long term aesthetic impact or impact to the public's use and enjoyment of the park. Any construction impacts including noise or impacts to public access will be short term.

Saratoga County Forest Land, Northumberland and Wilton

The County of Saratoga owns and maintains forest lands in the Town of Northumberland that provide for recreation and protection of open space. These lands include the 123 acre Fire Pond tract on Pettis Road, 377 acres of reforested land bordered by Duncan, Colebrook, and Taylor Roads in the central portion of the town, and the 104 acre Kalabus woodlot located at the end of Gailor Lane in southern Northumberland. The county manages these tracts for production, but they are also used by residents for hiking, biking, and other recreational activities. Saratoga County also maintains forest land nearby the proposed underground cable route in the Town of Wilton, adjacent to the Wilton Mall (Town of Northumberland – County Forest Preserve 2010).

The cable route passes within approximately 500 feet of the northwest corner Fire Pond tract of the Saratoga County Forest and within approximately 600 feet of the southeast corner of the tract of county forest adjacent to the Wilton Mall. In these areas, the cables will be underground in the existing CP railroad right-of-way. There will be no long term aesthetic impact or impact on the public's use and enjoyment of either the Fire Pond tract or the tract adjacent to the Wilton Mall. Any construction impacts including noise or temporary impacts to public access will be short term.

Hillhurst Park, Schenectady

Hillhurst Park is located on Campbell Avenue in the City Schenectady and is managed by the City of Schenectady (City of Schenectady – Parks Department 2010). The proposed cable route passes within approximately 100 feet of Hillhurst Park. Because the Project consists of cables that will be buried underground, there will be no long term aesthetic impact or impact on the public's use and enjoyment of Hillhurst Park. Any construction impacts including noise or temporary impacts to public access will be short term.

Roger Keenholts Park, Guilderland

Roger Keenholts Park, named in honor of a town historian, was added to the town of Guilderland's park system in 1993 as the need for additional ball fields increased. Off Hurst and

French's Hollow Roads, the park is home to eight little league baseball fields, a Babe Ruth League baseball field and five softball fields (Town of Guilderland – Roger Keenholts Park 2010).

The proposed underground transmission cable route passes within approximately 40 feet of the eastern boundary of Roger Keenholts Park. Because the Project consists of cables that will be buried underground, there will be no long term aesthetic impact or impact to the public's use and enjoyment of the park. Any construction impacts including noise or temporary impacts to public access will be short term.

Jim Nichols Memorial Park, Village of Voorheesville, New Scotland

Jim Nichols Memorial Park is maintained by the village of Voorheesville. Located behind the Village Hall, the park offers recreational activities including basketball, tennis and horseshoes. The park also includes playground equipment (Village of Voorheesville 2010).

The proposed Project cable route passes within approximately 40 feet of the eastern boundary of Jim Nichols Memorial Park. Because the Project consists of cables that will be buried underground, there will be no long term aesthetic impact or impact to the public's use and enjoyment of the park. Any construction impacts including noise or temporary impacts to public access will be short term.

4.2.3.6 Public Lands in the Vicinity of the Proposed Converter Station, Yonkers

There are four parks and public recreation areas within 1,000 feet of the Yonkers converter station. These include: Yonkers Waterfront Park (Habirshaw Property), Pitkin Park, Esplanade Park, and Larkin Park. These parcels total approximately 5.5 acres of open public land in the vicinity of the converter station. All Project work at the Yonkers converter station will be conducted on the property, so there will be no long term impact on public access to these parks. Any construction impacts, such as additional noise or traffic delays, will be short-term in nature. Further information on potential visual impacts in the vicinity of the Yonkers converter station site is provided in Section 4.11.

4.2.3.7 Public Lands in the Vicinity of the Sherman Creek Substation New York City

There are five parks and public recreation areas within 1,000 feet of the Sherman Creek substation in New York City. These include Dyckman House Playground, Highbridge Park, and Sherman Creek Wetlands in the Borough of Manhattan, as well as Roberto Clemente State Park, and University Park in the Bronx. Work at the Sherman Creek substation will be within the existing enclosed substation and within a proposed small transformer substation site adjacent to the existing facilities. The landfall for the cable connection to the substation will be installed by HDD; therefore, no impacts to public access to these open space areas are anticipated. Any construction impacts, such as additional noise or traffic delays, will be short-term in nature. Further information on potential visual impacts in the vicinity of the Sherman Creek substation is provided in Section 4.11.

4.2.4 Agricultural Districts

Article 25-AA of the Agriculture and Markets Law authorizes the creation of local agricultural districts pursuant to landowner initiative, preliminary county review, state certification, and county adoption. These districts encourage improvement and continued use of agricultural land for the production of food and other agricultural products. An important benefit of the Agricultural Districts Program is the opportunity provided to farmland owners to receive real property assessments based on the value of their land for agricultural production rather than on its development value. The Agricultural Districts Law and the Agricultural and Farmland Protection programs have influenced municipal comprehensive plans and zoning regulations. County agricultural and farmland protection boards may develop protective plans in collaboration with county soils and water conservation districts. The Agricultural Districts Law protects farmers against local laws that may unreasonably restrict farm operations located within an agricultural district.

Mapping of the Agricultural Districts in Washington County, Saratoga County, and Albany County was obtained from the Cornell University Institute for Resource Information Sciences (Cornell IRIS), which maintains the county-produced Agricultural District maps on file under contract with the New York State Department of Agriculture and Markets. Mapping information on the Agricultural Districts is provided in Figures 4.2-1, 4.2-2, and 4.2-3. Distances that the proposed Project crosses through Agricultural Districts are presented on Table 4.2-3. Based on this information, the proposed Project will cross Agricultural Districts for an estimated 1.9 miles in Washington County, 7.1 miles in Saratoga County, and 0.8 miles in Albany County. The proposed Project does not cross Agricultural Districts in Schenectady, Westchester or New York counties. Overall, the underground portions of the proposed Project will cross an estimated 9.9 miles of land within Agricultural Districts.

The proposed Project is not anticipated to impact agricultural land uses in the Agricultural Districts, since along the majority of the underground route, installation will occur within existing railroad rights-of-way. At the Champlain Canal Lock C9 bypass, the underground transmission cables will be installed within Canal Corp land which is not agricultural. The transmission cable corridor along this segment does not appear to include active agricultural lands; the land use on the east side of this segment includes forested land and open scrub/shrub/pasture land. To the west, there are small commercial/industrial/transportation areas along the Champlain Canal.

4.2.5 Coastal Consistency

This section discusses the consistency of the Project with New York Coastal Zone Management Policies and with Article 42 of the Executive Law entitled: *Waterfront Revitalization of Coastal Areas and Inland Waterways.* Local municipalities that border coastal areas and inland waterways prepare LWRPs, in conjunction with the NYSDOS, for the preservation, enhancement, protection, development and use of the state's coastal and inland waterways. Projects which may impact coastal areas or inland waterways must be reviewed for consistency with those LWRPs that pertain to territory within the Project area. This section includes a review of consistency with coastal policies and LWRPs for both the underwater portions of the

Project and the underground portions of the Project potentially located in coastal or waterfront areas, such as the cable landfalls and aboveground facilities.

4.2.5.1 New York Coastal Zone Management Policies

The federal Coastal Zone Management Act (CZMA) requires that each Federal agency activity within or outside the coastal zone that affects any land or water use or natural resource of the coastal zone shall be carried out in a manner which is consistent to the maximum extent practicable with the enforceable policies of approved State management programs.

In New York State, the enforceable coastal policies are those in the New York State Coastal Management Program (CMP) and the enforceable policies of any LWRP. The assessment of compliance with the New York City Waterfront Revitalization Program is discussed below in Section 4.2.5.2. The following review shows that the underwater portions of the Project, the landfall to the Hudson River in the Town of Coeymans, construction and operation of the Yonkers converter station, and the interconnection work at the existing Sherman Creek substation are consistent with the CMP program.

There are 44 policies under the CMP. The consistency of the Project with each of these policies is described below.

Policy 1 - *Restore, revitalize, and redevelop deteriorated and underutilized waterfront areas for commercial, industrial, cultural, recreational, and other compatible uses.*

> The cable landfall in the Town of Coeymans will be constructed by the HDD and will not impact any deteriorated or underutilized waterfront areas. Construction and operation of the Yonkers converter station, and interconnection work at the Sherman Creek substation will provide a new industrial use and a new important source of electricity that will benefit development in the area. This work will not in any way interfere with CZMA's desire to restore, revitalize, and redevelop waterfront areas.

Policy 2 - *Facilitate the siting of water-dependant uses and facilities on or adjacent to coastal waters*

> The cable landfall in the Town of Coeymans will not interfere with new water-dependent uses in the area. Construction and operation of the Yonkers converter station and interconnection work are not immediately adjacent to coastal waters and will not prohibit new water-dependent uses in the area. Underwater portions of the Project will not result in any aboveground structures or facilities, and will not interfere with water-dependent uses of the waters along the Project route.

Policy 3 - *Further develop the state's major ports of Albany, Buffalo, New York, Ogdensburg, and Oswego as centers of commerce and industry, and encourage the siting, in these port areas, Including those under the Jurisdiction of state public authorities, of land use and development which is essential to, or in support of, the waterborne transportation of cargo and people.*

This policy is not applicable.

Policy 4 - *Strengthen the economic base of smaller areas by encouraging the development and enhancement of those traditional uses and activities which have provided such areas with their unique maritime identity.*

Neither the underwater cable corridor nor the landfall in the Town of Coeymans will interfere with policies to enhance traditional maritime uses. Construction and operation of the Yonkers converter station and interconnection work are located in industrial areas and will not interfere with policies to enhance traditional maritime uses.

Policy 5 - *Encourage the location of development in areas where public services and facilities essential to such development are adequate.*

This policy is not applicable.

Policy 6 - *Expedite permit procedures in order to facilitate the siting of development activities at suitable locations.*

This policy is not applicable.

Policy 7 - *Significant Coastal Fish and Wildlife Habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats.*

The cable landfall along the Hudson River in the Town of Coeymans will utilize HDD methods to install the cable. This method will be utilized to minimize disturbance to shoreline and nearshore coastal fish and wildlife habitats. The HDD is expected to exit the water at a depth sufficient to avoid impacts to shoreline, intertidal and nearshore areas. Construction and operation of the Yonkers converter station and interconnection work are located in previously disturbed areas where there is no wildlife habitat, and therefore this policy is not applicable.

The proposed underwater cable route intersects six Significant Coastal Fish and Wildlife Habitats (SCFWH): Esopus Estuary, Kingston Deepwater Habitat, Poughkeepsie Deepwater Habitat, Hudson rivermile 44-56, Haverstraw Bay, and the Lower Hudson Reach. In general, because the transmission cable will be installed primarily below the sediment and within deeper areas, the Project is not expected to result in adverse impacts to these habitats, and will avoid direct impacts to intertidal areas and tidal wetlands. Section 4.8.4 provides detailed information on SCFWHs along the Project route, including potential impacts and proposed mitigation methods.

Policy 8 *- Protect fish and wildlife resources in the coastal area from bio-accumulation of hazardous wastes and other pollutants which bi-accumulate in the food chain or which cause significant sublethal or lethal effect on those resources.*

Any hazardous materials used will be handled and stored in accordance with local, state and federal regulations, to minimize the potential for contamination of coastal waters. A SPCCP will be developed as part of the EM&CP to address such contingencies.

In addition, the cable route has been specifically sited to avoid sediments in the more heavily PCB contaminated reaches of the Upper Hudson.

Policy 9 *- Expand coastal use of fish and wildlife resources in coastal areas by increasing access to existing stocks, and developing new resources.*

This policy is not applicable.

Policy 10 *- Further develop commercial finfish, shellfish and crustacean resources in the coastal area by encouraging the construction of new, or improvement of existing on-shore commercial fishing facilities, increasing marketing of the state's seafood products, maintaining adequate stocks, and expanding aquaculture facilities.*

This policy is not applicable.

Policy 11 *- Building and other structures will be sited in the coastal area so as to minimize damage to property and the endangering of human lives caused by flooding and erosion.*

The underground and underwater transmission cable route, the Yonkers converter station, and the interconnection work at the Sherman Creek substation have been sited and designed to avoid damage to property and the endangering of human lives caused by flooding and erosion. The underground cables will be backfilled to restore pre-existing contours, resulting in no change in flooding or erosion characteristics. The underwater cables will have very small areas, over crossings of foreign utilities, where armoring will create a very slight elevation in bottom elevation. This will result in a negligible change in storage volume of Lake Champlain or in the cross sectional area of the canal or rivers, resulting in no change in flooding or erosion characteristics. Section 4.5.1 provides further detail on floodplains in the vicinity of the Project, including the aboveground facility sites.

Policy 12 *- Activities or development in the coastal area will be undertaken so as to minimize damage to natural resources and property from flooding and erosion by protecting natural features including beaches, dunes, barrier islands and bluffs.*

The transmission cable route is not expected to impact any beaches, dunes, barrier islands or bluffs because none exist along the route. In addition, the cable installations at shoreline crossing locations will use HDD methods that avoid disturbing the ground surface and do not alter flooding and erosion characteristics.

Construction and operation of the Yonkers converter station and interconnection work will be located at previously disturbed sites and will not affect the referenced shoreline resources.

Policy 13 *- The construction or reconstruction of erosion protection structures shall be undertaken only if they have a reasonable probability of controlling erosion for at least thirty years as demonstrated in design and construction standards and/or assured maintenance or replacement programs.*

This policy is not applicable.

Policy 14 *- Activities and development, including the construction or reconstruction of erosion protection structures, shall be under taken so that there will be no measurable increase in erosion or flooding at the site of such activities or development, or at other locations.*

This policy is not applicable.

Policy 15 *- Mining, excavation or dredging in coastal waters shall not interfere with the natural coastal processes which supply beach materials to land adjacent to such waters and shall be undertaken in a manner which will not cause an increase in erosion of such land.*

Installation of the underwater portions of the transmission cable, which will involve trenching, is not expected to interfere with natural coastal processes or increase erosion of adjacent lands.

Policy 16 *- Public funds shall only be used for erosion structures where necessary to protect human life, and new development which requires a location within or adjacent to an erosion hazard area to be able to function, or existing development; and only where the public benefits outweigh the long term monetary and other costs including the potential for increasing erosion and adverse effects on natural protective features.*

This policy is not applicable as public funds will not be used for this work.

Policy 17 *- Non-structural measures to minimize damage to natural resources and property from flooding and erosion shall be used whenever possible.*

The HDD installation measures for shoreline crossings, and cable burial by jetting serve to avoid project induced changes in flooding or erosion, and to minimize damage to natural resources and property.

This policy is not applicable to the construction and operation of the Yonkers converter station of interconnection work, as the sites are set back from the waterway and do not require erosion protection.

Policy 18 *- To safeguard the vital economic, social and environmental interests, and the safeguards which the state has established to protect valuable coastal resource areas.*

This work will not impair or reverse vital economic, social and environmental interest safeguards, including those established to protect valuable coastal resource areas. Construction and operation of the Yonkers converter station and interconnection work will be at existing previously disturbed sites and will not affect the policy goal of safeguarding vital economic, social and environmental interests. The proposed transmission cables will provide a new, important source of electricity that will benefit development in the area

Policy 19 - *Protect, maintain, and increase the level and types of access to public water-related recreation resources and facilities.*

Construction and operation of the Yonkers converter station and interconnection work are located on private industrial sites that are already disturbed and will not affect public access to the water.

Cables at the landfalls at all shoreline crossings will be installed using HDD methods which will result in no permanent impacts to public access to the waterbodies. Underwater cable burial will result in no permanent impacts to public access. During construction, to protect the safety of the public, access will be restricted around active in-water construction sites. This work will only occur on a small area of the overall waterbody and will be temporary in any one location, so impacts will be minor during the construction period.

Policy 20 - *Access to the publicly-owned foreshore and to lands immediately adjacent to the foreshore or the water's edge that are publically-owned shall be provided and it shall be provided in a manner compatible with adjoining uses.*

As indicated for Policy 19, no permanent changes in access will be cause by the project. However, temporary access restriction at active construction areas will be required for public safety along shorelines and in the water. This change in access will be temporary and localized.

***Policy 21* -** *Water-dependant and water-enhanced recreation will be encouraged and facilitated, and will be given priority over non-water related uses along the coast.*

This policy is not applicable.

Policy 22 - *Development, when located adjacent to the shore, will provide for water-related recreation, whenever such is compatible with reasonably anticipated demand for such activities, and is compatible with the primary purpose of the development.*

This work will not in any way interfere with CZMA's desire to provide for water-related recreation. Construction and operation of the Yonkers converter station and interconnect work sites are on industrial property and do not conflict with this goal.

Buried HVDC cables will allow water-related recreation to occur.

Policy 23 *- Protect, enhance and restore structures, districts, areas and sites that are of significance in the history, architecture, archaeology or culture of the state, its communities, or the nation.*

In general, the Project is unlikely to have a significant effect on standing historic structures, districts, areas or sites of significance within the Project's vicinity. With the exception of the Yonkers converter station, the Project's cables will be buried and will not have an effect on the viewshed. The converter station will be designed to match the character of the surrounding area, and is not expected to have an adverse impact on any historic properties in the vicinity.

A detailed analysis of archaeological sites, historic properties, and shipwrecks, including those resources listed in or eligible for inclusion in the National Register, along the Project route is provided in Section 4.10. It is anticipated that with appropriate mitigation, no adverse impacts on cultural resources will occur.

Policy 24 *- Prevent impairment of scenic resources of statewide significance.*

With the exception of the Yonkers converter station, the Project's principal components will be buried and will not have an effect on the viewshed. The Yonkers converter station will be designed to match the character of the surrounding area, which includes existing industrial land use, and is not expected to have an adverse impact on any scenic resources. A further discussion of Scenic Resources of Statewide Significance and other visual resources in the Project area is provided in Section 4.11.

Policy 25 *- Protect, restore or enhance natural and man-made resources, which are not identified as being of statewide significance, but which contribute to the overall scenic quality of the coastal area.*

With the exception of the Yonkers converter station, the Project's principal components will be buried and will not have an effect on the viewshed. The Yonkers converter station will be designed to match the character of the surrounding area, which includes existing industrial land use, and is not expected to have an adverse impact on any scenic natural or man-made resources. A further discussion of visual resources in the Project area is provided in Section 4.11.

Policy 26 *- Conserve and protect agricultural lands in the state's coastal area.*

This policy is not applicable.

Policy 27 - *Decisions on the siting and construction of major energy facilities in the coastal area will be based on public energy needs, compatibility of such facilities with the environment, and the facility's need for a shorefront location.*

The Project will provide needed electricity using an HVDC cable system that is buried on land and in the water, such that locations within the Coastal Area and with shoreline crossings are unavoidable.

Policy 28 - *Ice management practices shall not interfere with the production of hydroelectric power, damage significant fish and wildlife and their habitats, or increase shoreline erosion or flooding.*

This policy is not applicable.

Policy 29 - *Encourage the development of energy resources on the Outer Continental Shelf, in Lake Erie and in other water bodies, and ensure the environmental safety of such activities.*

This policy is not applicable.

Policy 30 - *Municipal, industrial, and commercial discharge of pollutants, including but not limited to toxic and hazardous substances, into coastal waters will conform to state and national water quality standards.*

This project does not involve the construction and operation of facilities with a need to or designed to discharge pollutants.

Policy 31 - *State coastal area policies and management objectives of approved local waterfront revitalization programs will be considered while reviewing coastal water classifications and while modifying water quality standards; however, those waters already overburdened with contaminants will be recognized as being a development constraint.*

Compliance with LWRPs is discussed below in Section 4.2.5.2. Water quality for waterbodies along the underwater portions of the Project route is discussed in Section 4.6.

Policy 32 - *Encourage the use of alternative or innovative sanitary waste systems in small communities where the costs of conventional facilities are unreasonably high, given the size of existing tax base of these communities.*

This policy is not applicable.

Policy 33 - *Best management practices will be used to ensure the control of stormwater drain runoff and combined sewer overflows draining into coastal waters.*

The proposed work will be constructed and operated in accordance with Best Management Practices (BMPs) to control stormwater (and combined sewer overflows draining into coastal waters). CHPEI will apply for and operate the facilities in accordance with any required SPDES stormwater permits.

Policy 34 *- Discharge of waste materials into coastal waters from vessels subject to state jurisdiction will be limited so as to protect Significant Fish and Wildlife Habitats, recreational areas and water supply areas.*

BMPs and environmental compliance monitoring will be employed on vessels during construction to manage the handling and proper disposal of waste materials, in order to prevent them from entering Coastal Waters. Sanitary wastes will be held in tanks, offloaded as needed and properly disposed of at approved facilities, and will not be discharged to Coastal Waters.

Policy 35 *- Dredging and filling in coastal waters and disposal of dredged materials will be undertaken in a manner that meets existing state permit requirements, and protects Significant fish and Wildlife Habitats, scenic resources, natural protective features, important agricultural lands, and wetlands.*

Installation of the underwater portions of the transmission cable will comply with existing state permit requirements and will be undertaken in a manner that protects SCFWHs, scenic resources, natural protective features, important agricultural lands, and wetlands (see Section 4.5). Where the cable is within the navigational channel, the Project must comply with the requirements of the NYSDEC, United States Army Corps of Engineers (USACE), and United States Environmental Protection Agency (USEPA). This may require that the navigational channel be dredged to a required depth and then the cable is laid below this depth so future dredging will not disrupt the cable. CHPEI will comply with all requirements for the disposal of any dredged material.

This policy is not applicable to the Yonkers converter station and Sherman Creek substation interconnect work.

Policy 36 *- Activities related to the shipment and storage of petroleum and other hazardous materials will be conducted in a manner that will prevent or at least minimize spills into coastal waters; all practicable efforts will be undertaken to expedite the cleanup of such discharges; and restitution for damages will be required when these spills occur.*

To the extent there is petroleum and other hazardous materials transported or stored on site, such transport and storage will be conducted in accordance with local, state and federal regulations in order to protect the aquatic resources in the area. Transport and storage procedures will be developed and detailed in the EM&CP.

Policy 37 *- Best Management practices will be utilized to minimize the non-point discharge of excess nutrients, organics and eroded soils into coastal waters.*

Soil erosion and sediment movement offsite will be minimized during construction and operation via erosion control measures and soil stabilization protocols, which will be implemented as necessary to protect the aquatic resources in the area. The details of the measures and protocols to be employed will be presented in the EM&CP.

Policy 38 *- The quality and quantity of surface water and groundwater supplies will be conserved and protected, particularly where such waters constitute the primary or sole source of water supply.*

Surface and groundwater resources (see Section 4.5) will be protected by implementing diligent management of any hazardous substances on the sites and erosion control measures to prevent sediment transport to the water way. The necessary protection measures will be detailed in the EM&CP.

Policy 39 *- The transport, storage, treatment and disposal of solid wastes, particularly hazardous wastes, within coastal areas will be conducted in such a manner so as to protect groundwater and surface water supplies, Significant Fish and Wildlife Habitats, recreation areas, important agricultural land, and scenic resources.*

Surface and groundwater resources, significant fish and wildlife habitats, recreation areas, important agricultural land, and scenic resources will be protected by implementing diligent management of any solid wastes, particularly hazardous substances during all construction activities. The details of the measures and protocols to be employed will be presented in the EM&CP.

Policy 40 *- Effluent discharges from major steam electric generating and industrial facilities into coastal waters will not be unduly injurious to fish and wildlife and shall conform to state water quality standards.*

This policy is not applicable.

Policy 41 *- Land use or development in the coastal area will not cause national or state air quality standards to be violated.*

The Project will not violate applicable air quality standards.

Policy 42 *- Coastal management policies will be considered if the state reclassifies land areas pursuant to the prevention of significant deterioration regulations of the Federal Clean Air Act.*

This policy is not applicable.

Policy 43 *- Land use or development in the coastal area must not cause the generation of significant amounts of acid rain precursors: nitrates and sulfates.*

The Project will not generate emissions that release nitrates or sulfates to the atmosphere during operation.

Policy 44 *- preserve and protect tidal and freshwater wetland and preserve the benefits derived from these areas.*

Detail on tidal and freshwater wetlands in the Project area is provided in Section 4.5, including information on minimization and mitigation of potential impacts along the underground portions of the Project route. Since the underground cables will be buried, any wetlands crossed will remain wetlands after construction. The cable crossings of shorelines will be undertaken using HDD methods to minimize impacts to any tidal wetlands in these areas. The HDD is expected to exit the water at a depth sufficient to avoid impacts to intertidal and foreshore areas.

The Yonkers converter station and the proposed Sherman Creek transformer substation will not result in any direct or indirect impacts to wetlands.

4.2.5.2 Waterfront Revitalization of Coastal Areas and Inland Waterways

The NYSDOS implements Article 42 of the Executive Law entitled: Waterfront Revitalization of Coastal Areas and Inland Waterways. Local municipalities that border coastal areas and inland waterways are encouraged to prepare LWRPs), in conjunction with NYSDOS, for the preservation, enhancement, protection, development and use of the state's coastal and inland waterway. Under the statute, LWRPs shall be reviewed and approved by the NYSDOS before they become effective. Projects which may impact coastal areas or inland waterways must be reviewed for consistency with all of the LWRPs that have been prepared. The NYSDOS has developed 44 policies to be implemented by LWRPs. In addition, several LWRPs have amended the policies and added new policies to protect natural resources unique to their specific areas. Project sponsors must review these policies to ensure that their project is consistent with the policies in the LWRP and will balance the need between natural resources, population growth and economic development.

There are 26 municipalities with LWRPs along the cable route from the Town of Essex along the Champlain Canal to New York City. These are listed below in order from the Canadian border to the New York-Connecticut border:

- Town of Essex
- Village of Whitehall
- Town of Schodack/Village of Castleton-On-The-Hudson
- Village of Athens
- Village of Tivoli
- Village of Saugerties
- Town of Redhook
- City of Kingston
- Town of Rhinebeck
- Town of Esopus
- Town of Poughkeepsie

- Town of Lloyd
- City of Beacon
- City of Newburgh
- City of Peekskill
- Town of Stony Point
- Village Haverstraw
- Village of Croton on the Hudson
- Village of Ossining
- Village of Nyack
- Village of Sleepy Hollow
- Village of Piermont
- Village of Dobbs Ferry
- New York City
- Town of Mamaroneck and Village of Larchmont
- City of Rye

Of the 44 state coastal policies, 29 pertain to and have been evaluated for this project, as presented in the previous section. After review of all 26 LWRPs, including the NYSDOS policies contained in those documents, as well as the local policies, it has been determined that this Project is consistent with the 29 relevant state policies within the context of all 26 LWRPs. Additional local policies that relate to the Project are evaluated on a case-by-case basis below.

4.2.5.2.1 Consistency with Local Waterfront Revitalization Plans

Town of Essex

The Town of Essex has identified Split Rock Mountain, Webb Royce Swamp, Essex "Station" and the Boquet River as significant fish and wildlife habitats. Split Rock Mountain, Webb Royce Swamp and Essex "Station" are adjacent to the coastal zone area and will not be affected by this Project. The Boquet River discharges into Lake Champlain and will not be affected by this Project.

Policy 5 *- Protect and restore ecological resources, including Significant Fish and Wildlife Habitats, wetlands and rare ecological communities (similar to NYSDOS Policy 7).*

> This Project in the Town of Essex involves the placement of HVDC cables in the bed of Lake Champlain and the Champlain Canal using water jetting and/or trenching to open up the benthic substrate, lay the cable and re-contour the bottom. There will be some temporary turbidity as discussed in Section 4.6. CHPEI will minimize impacts to native fish as described in Section 4.7. Additionally, Section 4.8 provides an assessment of wildlife habitats, and rare ecological communities and Section 4.5 provides information on wetlands in the Project area.

Policy 6 - *Protect and improve water resources (similar to NYSDOS Policy 38).*

Laying the cables in the bed of the lake and canal will cause some temporary and localized turbidity. CHPEI will minimize and mitigate impacts to protect water resources as described in Section 4.6.

Policy 6.3 - *Protect water quality when excavating or placing fill in navigable waters and in or near marshes, estuaries, and wetlands (a combination of NYSDOS Policies 34 and 35).*

Laying the cables in the bed of the lake and canal will cause some temporary and localized turbidity. CHPEI will minimize and mitigate impacts to protect water resources as described in Section 4.6. Section 4.5 addresses the existing freshwater and tidal wetlands in the Project area, including potential impacts and mitigation. In general, impacts to wetlands in the Project area are expected to be temporary. Where wetlands cannot be avoided, CHPEI will implement appropriate BMPs during construction to minimize and/or mitigate for any impacts to benefits derived from these resources.

Village of Whitehall

Policy 5.1 - *Protect Significant Coastal Fish and Wildlife Habitats (similar to NYSDOS Policy 7).*

CHPEI will work closely with NYSDOS, NYSDEC, New York Natural Heritage Program (NYNHP) and local municipalities to avoid or minimize disturbance to these areas.

Town of Schodack and Village of Castleton on the Hudson

Policy 7 - *The Town of Schodack and Village of Castleton on the Hudson note that habitat protection is vital to ensuring the survival of fish and wildlife populations. The town has adopted the Significant Fish and Wildlife Habitat "habitat impairment test" and defines "habitat destruction", "significant impairment" and "tolerance range".*

Policy 7A - *The Papscanee Marsh and Creek habitat shall be protected, preserved and where practicable restored so as to maintain its viability as a habitat.*

Papscanee Marsh and Creek are listed as a SCFWF with a significance rating of 48. This area will be avoided by the Project.

The Project will not destroy or cause significant impairment to any habitats in the Town of Schodack or Village of Castleton on the Hudson.

Policy 7B *- The Schodack and Houghtaling Islands and Schodack Creek habitat shall be protected, preserved and, where practicable, restored so as to maintain its viability as a habitat.*

The Schodack and Houghtaling Islands and Schodack Creek habitat are listed as SCFWF by the NYSDOS, with a significance rating of 77. A portion of this 1,800 acre parcel is an undeveloped state park.

This area will be avoided by the Project.

Village of Athens

All of the Village of Athens' policies were reviewed and found to be consistent with the assessment of NYSDOS listed policies described above.

Village of Tivoli

Policy 7 *- Significant Coastal Fish and Wildlife Habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats.*

Sections of North and South Tivoli Bay are within the Village of Tivoli. This is a SCFWH recognized by NYSDOS with a significance rating of 162.

This area will be avoided by the Project (see Section 4.8).

Policy 7A *- The locally significant habitats of Stony Creek and the Hudson River along Tivoli's waterfront will be protected, preserved and improved. The Hudson River Bluffs, Tivoli Bay, and Stony Creek should be protected from overdevelopment.*

This Project will avoid Tivoli Bay and Stony Creek and not induce development in the area (see Section 4.8).

Village of Saugerties

Policy 7 *- Significant Coastal Fish and Wildlife Habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats.*

The Esopus Estuary has been designated a SCFWH by the NYSDOS. It has a significance rating of 98. The boundary of the Esopus Estuary extends across the Hudson River. It is impossible to avoid the boundary area of the Esopus Estuary.

There is expected to be little or no impact to the Esopus Estuary as the proposed cable route will be sited on the east side of the Hudson River and will not result in a direct loss of habitat since impacts are temporary for a buried cable installation (see Section 4.8).

Policy 44A *- Preserve wetlands from development and pollution and encourage wildlife activity through enforcement of existing state regulations, establishment of wetland zones and undertaking measures to eliminate pollution sources. (similar to NYSDOS Policy 44).*

In general, any impacts to wetlands and wildlife are expected to be temporary. Information on exsing wetlands, potential impacts, and proposed mitigation is provided in Section 4.5. CHPEI will construct the Project in compliance with its wetland and waterways permits and approvals.

Town of Red Hook

Policy 7 *- Significant Coastal Fish and Wildlife Habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats.*

Policy 7A *- Protect the areas identified as significant habitat areas by the NYSDOS as well as the creeks, kills, wetland and cove areas draining into and adjacent to the Hudson River from alteration and/or pollutant discharge by residential, commercial, agricultural or industrial uses in order to maintain their viability as habitat areas.*

There are three significant habitats in the Red Hook LWRP area: The Esopus Estuary, the Flats and North and South Tivoli Bays. Impacts to these areas will be avoided or minimmized as described in Section 4.8.4.3.

Policy 23A *- Conserve, protect, preserve and, if appropriate, promote the adaptive reuse of places, sites, structures, views and features in the coastal area of the Town of Red Hook of special historic, cultural or archaeological significance or which by reason of association with notable people or events, or of the antiquity or uniqueness of architectural and landscape design particular significance to the heritage of the town.*

The construction of the buried cables will have no adverse affects on these resources.

Policy 38A *- Work to re-establish and maintain the Saw Killwater quality surveillance program.*

This local policy is not applicable as the project is not in proximity to this resource nor will it affect it.

City of Kingston

Policy 7 *- Significant Coastal Fish and Wildlife Habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats.*

See policy 7A.

Policy 7A *- The Rondout Creek habitat shall be protected, preserved and, where practical, restored so as to maintain its viability as a habitat.*

Rondout Creek is a SCFWH recognized by NYSDOS with a significance value of 70.

This SCFWH will be avoided by the Project.

Policy 7B *- The locally important habitat at Kingston Point Park, also known as K.E.4, shall be protected, preserved and, where practicable, restored so as to maintain its viability as a habitat.*

This mudflat freshwater wetland area will be avoided by the Project.

Another SCFWH recognized by NYSDOS is the Kingston Deep Water habitat with a significance rating of 110. This six mile long habitat extends from the City of Kingston to Rhinecliff and varies in depth from 30 to 50 feet.

A detailed discussion of potential impacts and mitigation for the Kingston Deepwater habitat is provided in Section 4.8.4.3. Cable installation is not expected to result in a change in overall depths in the Kingston Deepwater Habitat, and sediment deposition beyond the trench is expected to be negligible. BMPs will be employed during cable installation to mitigate any potential adverse impacts.

Town of Rhinebeck

Policy 7 *- Significant Coastal Fish and Wildlife Habitats will be protected, preserved and, where practical, restored so as to maintain their viability as habitats.*

There are three recognized SCFWHs in the Town of Rhinebeck's LWRP area.

Policy 7A *- The Vanderburgh Cove and Shallows Habitat shall be protected, preserved and, where practical, restored so as to maintain its viability as a habitat.*

Vanderburgh Cove and Shallows Habitat are SCFWHs recognized by NYSDOS with a significance rating of 20.

These areas will be avoided by the Project.

Policy 7B *- The Kingston Deepwater Habitat shall be protected, preserved and, where practical, restored so as to maintain its viability as a habitat.*

The Kingston Deep Water Habitat is recognized as a SCFWH by NYSDOS and has a significance rating of 110. This six mile long habitat extends from the City of Kingston to Rhinecliff and varies in depth from 30 to 50 feet.

A detailed discussion of potential impacts and mitigation for the Kingston Deepwater habitat is provided in Section 4.8.4.3. Cable installation is not expected to result in a change in overall depths in the Kingston Deepwater Habitat, and sediment deposition beyond the trench is expected to be negligible. BMPs will be employed during cable installation to mitigate any potential adverse impacts.

Policy 7C - *The Flats Habitat shall be protected, preserved and where practical, restored so as to maintain its viability as a habitat.*

The Flats Habitat is a SCFWH recognized by NYSDOS with a significance rating of 118. This area is a four and one half mile long ridge running down the middle of the Hudson River. It is less than 10 feet deep at mean low water (MLW). The navigational channel runs down the Hudson River to the west of this area.

The Project is not expected to cross this SCFWH (see Section 4.8.4.1).

Policy 7D - *Support efforts to protect and enhance the natural resources of Ferncliff Forest, Snyder Swamp and the Mudder Kill.*

These areas will not be affected by this Project.

Policy 7E - *Protect the creeks, freshwater tidal wetlands, and freshwater tidal cove areas draining into and adjacent to the Hudson River from alteration and/or pollutant discharge by residential, commercial, agricultural or industrial uses.*

These areas will not be affected by this Project.

Town of Esopus

Policy 7 - *Significant Coastal Fish and Wildlife Habitats will be protected, preserved, and where practical, restored so as to maintain their viability as habitats.*

There are four SCFWH in the Town of Esopus LWRP area.

Policy 7A - *The locally important Kingston and Poughkeepsie deepwater habitats shall be protected and preserved so as to maintain their viability as habitats.*

Since this LWRP was adopted, these two areas have been recognized as SCFWHs

The Kingston Deep Water Habitat is recognized by NYSDOS and has a significance rating of 110. This 6-mile long habitat extends from the City of Kingston to Rhinecliff and varies in depth from 30 to 50 feet.

The Poughkeepsie Deep Water Habitat is recognized by NYSDOS and has a significance rating of 110. This habitat extends 14 miles from the Village of West Park to the Hamlet of Marlboro. Depths range from 30 to 50 feet with one area, Crum Elbow, having depths exceeding 125 feet.

A detailed discussion of potential impacts and mitigation for these SCFWHs is provided in Section 4.8.4.3. Cable installation is not expected to result in a change in overall depths in either the Kingston or Poughkeepsie Deepwater Habitats, and sediment deposition beyond the trench is expected to be negligible. BMPs will be employed during cable installation to minimize any potential adverse impacts.

Policy 7B - *The locally important Rondout Creek Habitat shall be protected and preserved so as to maintain its viability as habitat.*

Since the adoption of this LWRP, the Rondout Creek has been designated a SCFWH by NYSDOS with a significance value of 70.

This significant habitat will be avoided by the Project.

Policy 7C - *The locally important Esopus Meadows Habitat shall be protected and preserved so as to maintain its viability as habitat.*

Since the adoption of this LWRP, Esopus Meadows Habitat has been recognized by the NYSDOS as a SCFWH with a significance rating of 71. Esopus Meadows is a shoal of approximately 350 acres.

This area will be avoided by the Project.

Policy 7D - *The other identified local habitat "the map turtle basking rocks" shall also be protected from the adverse impacts of use or development.*

This area will be avoided by the Project.

Town of Poughkeepsie

Policy 7 - *Significant Coastal Fish and Wildlife Habitats will be protected, preserved and, where practical, restored so as to maintain their viability as habitats.*

There are two SCFWHs in the Town of Poughkeepsie, the Poughkeepsie Deepwater Habitat and Wappinger Creek.

The Poughkeepsie Deep Water Habitat is recognized by NYSDOS and has a significance rating of 110. This habitat extends 14 miles from the Village of West Park to the Hamlet of Marlboro. Depths range from 30 to 50 feet with one area, Crum Elbow, having depths exceeding 125 feet.

Wappinger Creek is on the east side of the Hudson River between Poughkeepsie and Wappinger. It has a significance rating of 54.

This area will be avoided by the Project.

Town of Lloyd

Policy 7 - *Significant Coastal Fish and Wildlife Habitats will be protected, preserved and, where practical, restored so as to maintain their viability as habitats.*

See Policy 7A.

Policy 7A - *To preserve and protect the viability of the Poughkeepsie Deep Water Habitat and the Shortnose Sturgeon, which is considered an endangered species.*

The Poughkeepsie Deep Water Habitat is recognized by NYSDOS and has a significance rating of 110. This habitat extends 14 miles from the Village of West Park to the Hamlet of Marlboro. Depths range from 30 to 50 feet with one area, Crum Elbow, having depths exceeding 125 feet.

A detailed discussion of potential impacts and mitigation for these SCFWHs is provided in Section 4.8.4.3. Cable installation is not expected to result in a change in overall depths in the Poughkeepsie Deepwater Habitat, and sediment deposition beyond the trench is expected to be negligible. BMPs will be employed during cable installation to minimize any potential adverse impacts. Potential impacts and mitigation for shortnose sturgeon are described in Section 4.9.1.

Policy 7B - *Protect, preserve and enhance the wooded bluffs of the Hudson River shore, which is habitat to the bald eagle (an endangered species), the osprey (threatened) and peregrine falcon as well as many other bird species.*

The Project will avoid these areas.

Policy 8A - *Protect fish and wildlife resources in the waterfront area from any possible hazardous wastes and other pollutants which may be present anywhere within the waterfront area, including the Costantino Landfill.*

This Project will have no effect on the waterfront area from the disturbance of contaminated areas or the release of hazardous wastes or pollutants by the project.

Policy 18A - *Safeguard the vital economic, social and environmental interests of the Town of Lloyd and its citizens in the evaluation of any proposal for an additional Hudson River crossing – either a new bridge or second deck – which would impact the town*

This local policy is not applicable to this project.

Policy 35A *- Spoils from dredging of the navigational channel of the Hudson River, or of any areas of the river or the coastline which may require it, shall not be disposed of in the Poughkeepsie Deepwater Habitat.*

If any dredge spoil results from this Project, it will be disposed of in accordance with all state, federal and local requirements, and will not be disposed of in the Poughkeepsie Deepwater Habitat

City of Beacon

Policy 7A *- The Fishkill Creek Estuary and marsh shall be protected, preserved, and where practical, restored so as to maintain its viability as a habitat. This Significant Coastal Fish and Wildlife Habitat has a significance rating of 54 and consists of an 80 acre estuary. (West Point North map)*

This area will be avoided by the Project.

Policy 8A *- Prohibit the discharge of untreated effluent and pollutants from commercial and industrial facilities along Fishkill Creek.*

This local policy does not apply to this Project.

Policy 23A *- Encourage the restoration and adaptive reuse of large historic estates, such as the mill buildings on Fishkill Creek.*

The Project does not involve the opportunity to restore or reuse large historic estates.

Policy 35A *- Dredging shall not occur during fish spawning season and will not be carried out without a U. S. Army Corps of Engineers Section 10 and/or 404 permit, and/or DEC Part 608 and 663 permits.*

The Project will abide by specific conditions of issued USACE Section 10/404 and/or DEC Part 608 and 663 permits.

Policy 35B *- Spoils should not be deposited in wetlands or Significant Fish and Wildlife Habitats as identified in the LWRP inventory.*

Dredge spoil, as a result of this Project, will disposed of in accordance with all state, federal and local requirements.

Policy 35C *- Reclamation of spoils sites, including landscaping, shall be conducted where it is practical to do so.*

This project does not involve the use of spoil sites, so reclamation is not appropriate.

Policy 35D *- Groundwater contamination shall be avoided.*

The installation of the cables along the bottom of the Hudson River avoids areas of groundwater contamination.

Policy 35E *- Spoils site design will incorporate considerations for natural features, viewsheds, and shall, where feasible, conform to existing land form.*

Spoil site development is not a component of this project, and so this policy does not apply.

Policy 35F *- No deposition shall occur without testing of sample soils for toxicity.*

If dredging occurs within the limits of Beacon, dredge spoil will most likely be removed for proper disposal rather than deposited back in the trench.

Policy 35G *- Toxic or hazardous dredge spoils shall not be deposited within the waterfront boundary. The potential of worked out mines as dredge spoil sites will be investigated.*

Dredge spoil, as a result of this Project, will disposed of in accordance with all state, federal and local requirements.

Policy 44A *- Preserve and protect the Fishkill Creek Marsh to maintain its many intrinsic values.*

Fish Creek Marsh is recognized as a SCFWH and has a significance rating of 54 and consists of an 80 acre estuary.

This area will be avoided by the Project.

City of Newburgh

Policy 7A *- Activities that would adversely affect fish resident in or migrating through waters adjacent to Newburgh will be avoided.*

CHPEI will comply with this local policy by avoiding, mimizing or mitigating impacts to fisheries, as described in Section 4.7.

Policy 8A *- New developments or expansion of existing facilities will not be permitted if such facilities introduce hazardous wastes or other pollutants into the environment or if they are unable to aquire the necessary state, federal, and local permits.*

This Project does not anticipate introducing hazardous wastes or other pollutants into the environment since the cables do not contain these substances, and cables are the only project feature proposed for placement within the City of Newburgh.

Policy 18A *- Maintain and improve existing low and moderate income housing.*

This local policy is not applicable to this Project.

Policy 23A *- No changes in any exterior architectural feature, including, but not limited to, construction, alteration, restoration, removal, demolition, or painting, shall be made to identified resources except as hereinafter provided.*

This local policy is not applicable to this Project.

Policy 44 *- Preserve and protect tidal and freshwater wetlands and preserve the benefits derived from these areas. (similar to NYSDOS policy 44).*

In addition to avoiding most tidal wetland habitats as described in Section 4.5, this Project will specifically avoid Quaissaick Creek tidal wetland, which is noted as locally important.

City of Peekskill

Policy 7A *- Fish and wildlife habitats of local importance are of value to the city and its natural resource inventory and shall be protected, preserved and, where practical, restored so as to maintain their viability.*

This local policy refers to Camp Smith Marsh, Annsville Creek, Peekskill Hollow Brook and the McGregory Brook, as well as Nose and Bald Mountains north of the city.

These habitats of local significance are not in proximity to the project route and will not be impacted by this Project.

Town of Stony Point

Policy 7A *- The Iona Island Marsh shall be protected, preserved and, where practical, restored so as to maintain its viability as a habitat.*

The Iona Island Marsh has a significance value of 71. It is comprised of approximately 270 acres of freshwater, tidal and brackish wetlands.

This area is along the west side of the Hudson River and will be avoided by this Project.

Policy 7B *- The Haverstraw Bay habitat shall be protected, preserved and, where practical, restored so as to maintain its viability as a habitat.*

Haverstraw Bay is a significant habitat with a significance value of 166. The bay encompasses a six mile stretch of the Hudson River from Stony Point to Croton Point. Average depth at MLW is approximately 15 feet. Salinity in the area varies by year, but

Haverstraw Bay is an important habitat for fish nurseries. The navigational channel is located on the west side of the bay and maintained at approximately 35 feet in depth.

CHPEI will move its cable into the previously and periodically disturbed navigational channel to minimize impacts to Haverstraw Bay (see Section 4.8).

Policy 7C - *The Hudson River Mile 44 – 56 habitat shall be protected, preserved and, where practical, restored so as to maintain its viability as a habitat.*

This significant habitat runs from Cornwall Bay to Peekskill Bay. It is a 12-mile long deep water habitat reaching depths of up to 200 feet. The bay has strong currents and a rocky substrate. It is considered the southernmost extent of freshwater in the Hudson River and is an important spawning area.

Detailed information on potential impacts and mitigation are provided in Section 4.8.4.3. Cable installation is not expected to result in a change in overall depths, and sediment deposition beyond the trench is expected to be negligible. BMPs will be employed during cable installation to minimize any potential adverse impacts.

Policy 23A - *Stabilize and revitalize the historic residences and neighborhoods on River Road, Munn Avenue and Grassy Point Road.*

This Project is not located in or near these areas and will have no affect on these resources, and so this policy is not applicable.

Village of Haverstraw

Policy 7A - *The Haverstraw Bay Habitat shall be protected, preserved and where practical, restored so as to maintain its viability as habitat.*

Haverstraw Bay is a significant habitat with a significance value of 166. The bay encompasses a six mile stretch of the Hudson River from Stony Point to Croton Point. Average depth at MLW is approximately 15 feet. Salinity in the area varies by year, but Haverstraw Bay is an important habitat for fish nurseries. The navigational channel is located on the west side of the bay and is maintained at approximately 35 feet in depth.

CHPEI will move its cable into the previously and periodically disturbed navigational channel to minimize impacts to Haverstraw Bay (see Section 4.8).

Policy 8A - *Control the introduction of new industries or technology which could increase the presence of hazardous materials within the Haverstraw coastal area.*

This Project only involves the installation of HVDC cables wtihin the Village boundaries, without the potential to increase the presence of hazardous materials.

Policy 8B - *Encourage existing industrial productions or storage facilities to utilize the most current technologies available to minimize the potential threat from hazardous wastes or pollutants to the surrounding environment.*

This Project does not involve industrial or storage facilities.

Policy 23A - *Stabilize and revitalize the historic residences and neighborhoods on First Street and Hudson Avenue as well as other selected areas.*

This Project is not located in or near these areas and will have no affect on these resources, and so this policy is not applicable.

Policy 23B - *Preserve and protect underwater historic, archaeological and cultural resources in Haverstraw Bay.*

CHPEI proposes to place the underwater transmission cables within the existing navigational channel in Haverstraw Bay, which should minimize any potential impacts to underwater resources since these areas have been previously disturbed. Section 4.10 provides a detailed discussion of underwater historic, archaeological and cultural resources in the vicinity of the Project.

Village of Croton-on-Hudson

Policy 7A - *The quality of the Croton River and Bay Significant Fish and Wildlife Habitat and Haverstraw Bay Significant Fish and Wildlife Habitat shall be protected and improved for conservation, economic, aesthetic, recreational, and other public uses and values. Its resources shall be protected from the threat of pollution, misuse, and mismanagement.*

Croton River and Bay is a significant habitat with a significance value of 24. The bay is comprised of approximately 1,200 acres of submerged aquatic vegetation and mudflats and is located at the south eastern edge of Haverstraw Bay. Most of the Croton River has been diverted for public water supplies.

This area will be avoided by the Project.

Haverstraw Bay is a significant habitat with a significance value of 166. The bay encompasses a six mile stretch of the Hudson River from Stony Point to Croton Point. Average depth at MLW is approximately 15 feet. Salinity in the area varies by year, but Haverstraw Bay is an important habitat for fish nurseries. The navigational channel is located on the west side of the bay and maintained at approximately 35 feet in depth.

CHPEI will move its cable into the previously and periodically disturbed navigational channel to minimize impacts to Haverstraw Bay (see Section 4.8).

Policy 7B - *Materials that can degrade water quality and degrade or destroy the ecological system of the Croton River and Bay Significant Fish and Wildlife Habitat and the Haverstraw*

Bay Significant Fish and Wildlife Habitat shall not be disposed of or allowed to drain in or on land within the area of influence in the Significant Fish and Wildlife Habitats.

No materials will be disposed of or allowed to drain into the Croton River and Bay SCFWH or the Haverstraw Bay SCFWH. The project will be constructed with an SPCCP, which will be provided in the EM&CP.

Policy 7C - *Storage of materials that can degrade water quality and degrade or destroy the ecological system of the Croton River and Bay Significant Fish and Wildlife Habitat or Haverstraw Bay Significant Fish and Wildlife Habitat shall not be permitted within the area of influence of the habitat unless best available technology is used to prevent adverse impacts to the habitat.*

This Project will not require the storage of materials that could degrade water quality or degrade or destroy the ecological system of the Croton River Haverstraw Bay SCFWHs.

Policy 7D - *Restoration of degraded ecological elements of the Croton River and Bay and Haverstraw Bay Significant Fish and Wildlife Habitat and shorelands shall be included in any programs for cleanup of any adjacent toxic and hazardous waste sites.*

This local policy does not apply to the Project.

Policy 7E - *Runoff from public and private parking lots and from storm sewer overflows shall be effectively channeled so as to prevent oil, grease, and other contaminants from polluting surface and ground water and impact the Significant Fish and Wildlife Habitat.*

This local policy does not apply to the Project.

Policy 7F - *Construction activity of any kind must not cause a measurable increase in erosion or flooding at the site of such activity, or impact other locations. Construction activity shall be timed so that spawning of anadromous fish species and shellfish will not be adversely affected.*

Sediment and erosion control BMPs will be employed to minimize impacts outside of the construction area from erosion or stormwater. The buried cables will not measurably alter the riverbed elevation, thereby avoiding any possibility of increasing flooding or erosion. Construction activity will be timed to minimize impacts to fish spawning as described in Sections 4.7 and 4.8.

Policy 7G - *Such activities must not cause degradation of water quality or impact identified Significant Fish and Wildlife Habitats.*

This Project will be constructed with BMPs in place that will minimize the potential for water quality degradation, other than localized and temporary increases in suspended sediment concentrations around the water jetting device (see Section 4.6). Impacts to identified SCFWHs have either been avoided through cable routing or will be minimized through the selection of jetting as the preferred burial method (see Section 4.8).

Policy 44A *- Wetlands, waterbodies and watercourses shall be protected by preventing damage from erosion or siltation, minimizing disturbance, preserving natural habitats and protecting against flood and pollution.*

CHPEI expects to avoid any direct impacts to wetlands along the underwater portions of the transmission cable corridor (see Section 4.5) and will minimize siltation and other disturbances associated with the Project. Section 4.1 provides details on the proposed construction methods, which allow for rapid cable laying and burial with the least sediment disturbing methods possible.

Village of Ossining

Policy 7A *- The designated coastal habitat at the Croton River and Bay shall be protected, preserved and where practicable, restored so as to maintain its viability as habitat.*

Croton River and Bay is a significant habitat with a significance value of 24. The bay is comprised of approximately 1,200 acres of submerged aquatic vegetation and mudflats and is located at the southeastern edge of Haverstraw Bay. Most of the Croton River has been diverted for public water supplies.

This Project will avoid Croton Bay significant habitat.

Policy 7B *- The locally important coastal wildlife habitat at Crawbuckie Nature Area shall be protected and preserved so as to maintain its viability as a habitat.*

The Crawbuckie Nature Area is east of the Croton Bay significant habitat and will be avoided by this Project.

Village of Nyack

Policy 7A *- Protect the physical characteristics of the Hudson River along Nyack that support the varied fish populations found there. Nyack's LWRP notes that numerous species of fish are found in this area and implemented this local policy to protect them.*

This Project will not alter the physical characteristics of the Hudson River, other than temporary increases in suspended sediments, and a linear trench of fluidized sediments that will require some time to re-compact (see Section 4.6).

Village of Sleepy Hollow

Policy 7A *- Fremont Lake and associated wetlands/watercourses and adjacent upland areas shall be protected, preserved, and, where practical, restored so as to maintain its viability as a locally significant habitat.*

Fremont Lake and its associated wetlands/watercourses and adjacent upland areas are not near nor will they be affected by this Project.

***Policy 7B** - The Philipsburg Manor and Devries Field wetland/watercourse areas of the Pocantico River shall be protected, preserved, and, where practical, restored so as to maintain its viability as a locally significant habitat.*

These areas are not near nor will they be affected by this Project.

***Policy 7C** - The Upper Pocantico River and Gorey Brook watercourse areas shall be protected, preserved, and, where practical, restored so as to maintain its viability as a locally significant habitat.*

These areas are not near nor will they be affected by this Project.

***Policy 7D** - The Hudson River immediately adjacent and within 1,000 feet of the village's shoreline shall be protected, preserved, and, where practical, restored so as to maintain its viability as a locally significant habitat.*

Installation of the cables will either occur greater than 1,000 feet from the village's shoreline at this location or will involve only temporary disturbance to the riverbed, which will recover over time.

***Policy 7E** - The lands in state ownership associated with the Rockefeller State Park Preserve and Old Croton Aqueduct Trail shall be protected, preserved, and, where practical, restored so as to maintain its viability as a locally significant habitat.*

These areas are not near nor will they be affected by this Project.

***Policy 8A** - Control the introduction of new industries or technology which could increase the presence of hazardous materials within the Sleepy Hollow waterfront area.*

This Project only involves the installation of HVDC cables wtihin the Village boundaries, without the potential to increase the presence of hazardous materials.

***Policy 8B** - Encourage existing industrial production or storage facilities to utilize the most current technologies available to minimize the potential threat from hazardous wastes or pollutants to the surrounding environment.*

This Project does not involve industrial or storage facilities.

***Policy 18A** - Protect the vital economic, social, cultural, and environmental interests of the village in the evaluation of any proposal for new roads, road widening or infrastructure.*

This local environmental policy is not applicable to this Project.

Policy 18B *- To protect the social interests of the village, proposed actions must give full consideration to the impacts of such actions on the community and cultural resources of the village and the quality of life such resources support.*

With the cables being located in the bottom of the Hudson River, this Project will not impact the cultural resources of the village or the quality of life such resources support.

Policy 18C *- To protect the environmental interests of the village, proposed actions must give full consideration to the impacts of such actions on valuable and sensitive natural resources of the village.*

This Project will have negligible to minor impacts to certain resources (e.g., water quality, fisheries, benthos) of the Hudson River due to the temporary nature of the cable installation disturbance to the riverbed. Since the native sediments backfill the trench, the distrurbed area represents a small fraction of the total area of the riverbed, and the increased suspended sediments are localized and disperse quickly, the impacted resources will recover quickly.

Policy 23A *- Preserve and enhance the structures, areas, or sites within the Village of Sleepy Hollow that are currently listed on the state and/or national register of historic places.*

This local policy is not applicable to this Project since none of these resources will be altered or disturbed during cable installation.

Policy 23B *- Preserve and enhance the structures, areas, or sites within the Village of Sleepy Hollow that have been identified as being eligible for listing on the state and/or national register of historic places.*

This local policy is not applicable to this Project since none of these resources will be altered or disturbed during cable installation.

Policy 23C *- Encourage the restoration and adaptive reuse of historic buildings such as the Philipse Manor Train Station.*

This local policy is not applicable to this Project since none of these resources will be altered or disturbed during cable installation.

Village of Piermont

Policy 7A *- Protect the Piermont Marsh south of the pier and the Sparkill Creek by severely restricting it to passive recreational uses.*

Piermont Marsh is a SCFWH with a significance value of 74. It is a 725 acre tidal wetland located along the west side of the Hudson River. The Sparkill Creek empties into this wetland area.

This area will be avoided by the Project.

Policy 8A - *The intentional dumping of oil or other pollutants into waterways and catch basins can be harmful to fish and wildlife resources, and such actions will be prosecuted.*

CHPEI or its contractors will not intentionally dump oil or other pollutants into the Hudson River.

Policy 8B - *The Rockland County sewer outfall line should be extended to deeper, faster flowing water. The outfall line should be rebuilt to maintain its integrity.*

This local policy is not applicable to this project since it does not involve activities that require the use of the sewer, or otherwise warrant CHPEI involvement in this endeavor.

Policy 18A - *New development shall be designed to minimize impact on the availability of affordable housing and on the existing character and cultural resources of Piermont.*

The buried cables of this Project are consistent with this local policy.

Policy 23A - *The architectural review board shall review applications for building permits involving structures identified as being architecturally significant or structures adjacent to buildings or sites identified as historically or architecturally significant.*

This local policy is not applicable to this Project.

Policy 23B - *Place monuments and markers on structures and at sites important to the history of the Village of Piermont.*

This local policy is not applicable to this Project.

Policy 44A - *The Piermont Marsh should be protected from pollutants that would adversely affect the ecology of the marsh.*

Piermont Marsh will be avoided by this Project and indirect effects will be minimized by the construction methods selected, and the environmental protection measures to be employed during construction, such as implementation of an SPCCP for the vessels installing the cables.

Village of Dobbs Ferry

The numbering of the policies for Dobbs Ferry differ from the numbering of these policies by NYSDOS. All policies have been reviewed and it has been determined that this Project will be consistent with the policies that are applicable. Specific policies are as follows:

Policy 6.1 - *Protect locally significant coastal fish and wildlife habitats.*

> This Project will avoid or minimize impacts to SCFWHs to the greatest extent possible, both by the location of the cable corridor in the deeper waters of the Hudson River, and the use of water jetting to bury the cable, which allows for faster burial than conventional dredging and so the duration and extent of suspended sediments is reduced, and the initiation of recovery of the riverbed occurs sooner.

Policy 6.2 - *Support the restoration of Significant Coastal Fish and Wildlife Habitats wherever possible so as to foster their continued existence as natural, self-regulating systems.*

> While not directly related to this project, this project will not interfere with or prevent restoration activities.

Policy 10.5 - *Promote the efficient management of surface waters and underwater lands.*

> This Project will conform with this policy because of the selected location and proposed construction methods, thereby avoiding more ecologically sensitive areas and greater levels of impacts to these resources compared to other types of cable installation procedures.

New York City

New York City's LWRP policies differ in numbering sequence. All policies have been reviewed and it has been determined that this Project will be consistent with the policies that it might have an impact on.

Policy 1 - *Support and facilitate commercial and residential redevelopment in areas well-suited to such development.*

> The interconnection work is proposed to occur in the industrial zoned area of the Sherman Creek substation and therefore will not affect commercial or residential development in the area.

Policy 2 - *Support water-dependent and industrial uses in New York City coastal areas that are well-suited to their continued operation.*

> The aboveground interconnection work will be limited to the property of the existing Sherman Creek substation and adjacent lands and will not interfere with the LWRP's goal of fostering the continuation of water-dependent uses. Installation of buried cable in

the Hudson River will require the use of a port facility and marine construction equipment, personnel and vessels.

Policy 3 - *Promote use of New York City's waterways for commercial and recreational boating and water-dependent transportation centers.*

The aboveground interconnection work will be limited to the property of the existing Sherman Creek substation and adjacent lands and will not interfere with the LWRP's goal of promoting use of New York City's waterways for commercial and recreational boating and water-dependent transportation centers. The portions of the underwater transmission cable in New York City will not interfere with the use of waterways for commercial and recreational boating or other water-dependent uses as the cables will be buried.

Policy 4 - *Protect and restore the quality and function of ecological systems within the New York City coastal area.*

The Sherman Creek substation is located on previously disturbed industrial land. The underwater transmission cable and the connection to the Sherman Creek substation will not affect the quality and function of ecological systems within the New York City coastal area. The water jetting cable installation method allows for *in situ* backfilling of the trench following a brief period of disturbance. The benthic community, associated fish, and water quality will all recover following construction.

Policy 5 - *Protect and improve water quality in the New York City coastal area.*

The Project will be constructed in a manner that protects water quality (see Section 4.6). CHPEI will develop and implement a Storm Water Pollution Prevention Plan (SWPPP) for control of construction stormwater and will implement appropriate spill control, prevention and mitigation in order to ensure protection of water quality in the New York City area.

Policy 6 - *Minimize loss of life, structures and natural resources caused by flooding and erosion.*

The Sherman Creek substation interconnection will be sited and designed to avoid damage to property and the endangering of human lives caused by flooding and erosion. The underwater cable installation will not alter the riverbed elevation and will have no effect on flooding characteristics of the river. Section 4.5.1 provides more information on floodplains in the vicinity of the Project.

Policy 7 - *Minimize environmental degradation from solid waste and hazardous substances.*

Any solid waste or hazardous substance associated with construction or operation of the Project will be used, stored, and disposed of in accordance with local, state and federal requirements. CHPEI will implement appropriate spill control and clean-up in order to minimize environmental degradation from accidental spills of fuel, oil or other hazardous materials that may be used during construction.

Policy 8 *- Provide public access to and along New York City's coastal waters.*

The above ground interconnection work will be limited to the existing property of the existing Sherman Creek substation and adjacent lands. The connection to the Sherman Creek substation will be underground and will not interfere with the LWRP's goal of providing public access to and along New York City's coastal waters. The Hudson River shoreline crossing will involve cable installation via HDD methods, which do not alter public access.

Policy 9 *- Protect scenic resources that contribute to the visual quality of the New York City coastal area.*

The underwater transmission cables will not be visible. The proposed Sherman Creek transformer substation is located adjacent to an existing substation and is not anticipated to significantly change the visual characteristics of the site and/or the surrounding area. Therefore, the Project is not expected to affect visual quality of the New York City coastal area. Section 4.11 provides additional information on visual resources.

Policy 10 *- Protect, preserve and enhance resources significant to the historical, archaeological, and cultural legacy of the New York City coastal area.*

The proposed Sherman Creek transformer substation will be located adjacent to the Sherman Creek substation, an existing and disturbed industrial site, and therefore will not affect any historical, archaeological or cultural resources in the area. CHPEI will minimize any impacts to any underwater historical, archeological, and cultural resources along the underwater portions of the transmission cable route as described in Section 4.10.

Town of Mamaroneck and Village of Larchmont

Policy 7 *- Significant Coastal Fish and Wildlife Habitats, as identified on the coastal area map, shall be protected, preserved, and, where practical, restored so as to maintain their viability as habitats.*

The Premium River – Pine Brook wetlands complex occurs within the Town of Mamaroneck. It is 65 acres in size and recognized as a SCFWH by the NYSDOS with a significance value of 16. This Project will not affect this significant habitat.

Policy 7A *- The following locally important habitats designated as critical environmental areas:*

(1) The Hommocks Salt Marsh Complex including the East Creek area;
(2) The Larchmont Reservoir-Sheldrake-Leatherstocking freshwater wetland complex;
(3) The Premium Salt Marsh Complex shall be protected, preserved and where practical, restored so as to maintain its viability as a habitats.

This Project will not impact these coastal and inland habitats that are locally significant. The Project is located offshore in Long Island Sound.

Policy 44A *- Restore tidal and freshwater wetlands already damaged by erosion, siltation, and pollution.*

The Project in this area is located offshore in Long Island Sound and therefore this policy does not apply to this project since there is no nexus between the project and these resources.

Village of Mamaroneck

Policy 7a *- The following areas are identified in this Program as significant fish and wildlife habitats; and they will be protected, preserved and where practical, restored so as to maintain their viability as habitats.*

a. Delancey Cove
b. Greace Point Marsh
c. Ginsberg Hill (Fusco Property)
d. Guion Creek Salt Marsh
e. Kirstein Cove/Buttenweiser Is./Pops Rocks
f. Magid Pond
g. Otter Creek Salt Marsh
h. Van Amringe Mill Pond

This Project will be well offshore of these eight locally significant fish and wildlife habitats. The installation of the cables will have no affect on these shoreline and interior habitats.

City of Rye

Policy 7A *- The Marshlands Conservancy Habitat shall be protected, preserved and where practical, restored so as to maintain its viability as a habitat.*

The Marshlands Conservancy Habitat is a 250 acre parcel recognized as a SCFWH by NYSDOS with a significance rating of 42. It is located within Milton Harbor on the western side.

When the Project enters Long Island Sound, the cables will be well offshore and will not affect the Marshlands Conservancy Habitat.

Policy 7B *- Playland Lake and Manursing Island Flats shall be protected, preserved and where practical, restored so as to maintain its viability as a habitat.*

This Project will be off shore from the 220-acre Playland Lake and Manursing Island Flats and will have no impact on these SCFWHs.

4.2.5.2.2 Consistency with Harbor Management Plans

There are seven communities along the Project's transmission cable route that have Harbor Management Plans. These communities include the Town of Essex, Village of Whitehall, Village of Haverstraw, Village of Piermont, and Village of Dobbs Ferry. Additionally, the Project will cross the Town of Hempstead, which is one of the municipalities that shares coastline off of Hempstead Harbor; therefore CHPEI also reviewed the Hempstead Harbor Management Plan. The Harbor Management Plans were reviewed to ensure the Project is consistent with any applicable requirements.

Town of Essex

The Town of Essex has regulations governing the harbor and a Harbormaster.

- anchoring for more than 72 hours will require a permit from the Harbormaster. Lights must be displayed if the vessel is not in a designated anchorage;
- there is a public anchorage off the Hamlet of Essex and in Whallons Bay;
- permits for docks must be issued by the Harbormaster and must be in compliance with the zoning law. Permits will be issued only to persons with riparian property interests;
- Town Board shall have the power to establish standard contracts and contract terms and fees for the rental of public wharves, slips, docks, and moorings; and
- there is a ferry dock and what appear to be commercial docks and marinas located with access to the navigational channel.

Installation of the HVDC cables in Lake Champlain will be consistent with the Town of Essex's Harbor Management Plan. Local permits and approvals are not required per Public Service Law §130.

Village of Whitehall

The Harbor Management Plan is found in Section IV of the LWRP. It consists mainly of plans to develop the harbor to increase recreational use. Details include the following:

- there is a marina at Lock C12 and a Village of Whitehall marina just north and west of the marina at Lock C12; and
- criteria are established for private docks. The Village of Whitehall also adopts the Canal Corp regulations for docks in Appendix D of the LWRP.

Installation of the HVDC cables in the Champlain Canal will be consistent with the Town of Whitehall's Harbor Management Plan.

Village of Haverstraw

The Village of Haverstraw's Harbor Management Plan is found in Appendix A of the LWRP. The village asserts jurisdiction 1,500 feet east of their shoreline. The navigational channel is approximately 3,000 feet east of the village's shoreline.

There are two piers in the Village of Haverstraw: Emeline and Christine. There is a ferry from Haverstraw to Ossining at the Keahon property and two private marinas. Tilcon rock quarry operates a dock that is parallel to the shoreline. Barges are anchored offshore and brought into the dock for loading. The harbor management plan presents the following details:

- anchorage is limited to recreational vessels; and
- the Harbor Management Plan establishes four zoning districts in the coastal area: SP special purpose; WD waterfront development; PI planned industrial; and R-1 first residence. The plan lists potential development sites.

Installation of the HVDC cables in the Hudson River will be consistent with the Village of Haverstraw's Harbor Management Plan.

Village of Piermont

The Village of Piermont has a section in their LWRP called Harbor Management Needs. Information includes the following:

- the marinas and piers are becoming inaccessible due to shallow water. Shallow water is a result of siltation that has occurred in the last 30 years after the Tappan Zee Bridge was built;
- dredge spoil in this area, at the time of the LWRP's adoption, was approved as a landfill cover for the Town of Clarkstown landfill; and
- the plan also calls for the removal of several sunken barges and a sunken ferry in the harbor area.

Installation of the HVDC cables in the Hudson River will be consistent with the Village of Piermont's harbor management plan.

Village of Dobbs Ferry

This Harbor Management Plan is spread throughout the LWRP. It deals mainly with development options for the harbor. Details include the following:

- water depth off of the Village of Dobbs Ferry is from 1 to 5 feet. The Hudson River navigational channel is 200 feet off shore. A great deal of dredging would be necessary to establish a marina or dock off the Village of Dobbs Ferry; and

- upstream development is believed to be increasing the sediment loads in Wickers Creek and the Saw Mill River leading to increased siltation along the Dobbs Ferry coastline.

Installation of the HVDC cables in Hudson River will be consistent with the Village of Dobbs Ferry's Harbor Management Plan.

Village of Sleepy Hollow

The Village of Sleepy Hollow's Harbor Management Plan is found in Sections II and IV of the village's LWRP. This harbor management plan calls for increased access to and usage of the waterfront. Water-dependent uses of the waterfront are also encouraged. To this end the Village of Sleepy Hollow adopted zoning laws that include a waterfront redevelopment district.

Installation of the HVDC cables in Hudson River will be consistent with the Village of Sleepy Hollow's harbor management plan.

Town of Mamaroneck and Village of Larchmont

The Town of Mamaroneck and Village of Larchmont state in the LWRP that the village and its waterfront clubs should study the benefits of adopting a Harbor Management Plan for Larchmont Harbor. It also recommends limiting the size of docks and recommends a feasibility study for a cooperative harbor maintenance program.

Installation of the HVDC cables off shore in Long Island Sound will be consistent with the Town of Mamaroneck and Village of Larchmont's harbor management plan.

Hempstead Harbor Management Plan

Hempstead Harbor is located on Long Island Sound along the northern shore of Long Island. There are eight different municipalities that share the coastline along Hempstead Harbor: the Village of Sands Point; Port Washington; the Village of Flower Hill; the Village of Roslyn; the Village of Roslyn Harbor; Glenwood Landing; the Village of Sea Cliff; and the City of Glen Cove. These municipalities are in two towns: The Town of North Hempstead and the Town of Oyster Bay; however, the Project is only within the jurisdiction of the Town of Hempstead.

The following goals have been established by the Hempstead Harbor Management Plan:

Goal 1: Ensure efficient and safe navigation and operating conditions in Hempstead Harbor.

Goal 2: Protect Hempstead Harbor's water-dependent uses, and promote the siting of new water-dependent uses at suitable locations, without impacting important natural resources.

Goal 3: Redevelop vacant and underutilized waterfront land on Hempstead Harbor with appropriate uses.

Goal 4*:* Increase water-related recreational opportunities within Hempstead Harbor and along the harbor's shoreline, and increase public access to the waterfront.

Goal 5*:* Protect and enhance Hempstead Harbor's natural environment and open space resources, including surface water quality, wetlands, coastal fish and wildlife habitats, upland natural areas, and important viewsheds.

Goal 6*:* Preserve important historical resources along the waterfront of Hempstead Harbor.

Goal 7*:* Improve linkages between the Hempstead Harbor waterfront and adjacent downtown areas.

Goal 8*:* Engage in a collaborative effort among the municipalities surrounding Hempstead Harbor, by means of innovative inter-municipal planning and community development techniques that link environmental protection, economic prosperity, and community well-being, so as to ensure effective long-term community, regional, and watershed vitality.

Goal 9*:* Recognize and build upon the unique characteristics and circumstances of Hempstead Harbor and its watershed in developing approaches to the following concepts: revitalizing existing communities and promoting livable neighborhoods; preserving open space and critical environmental resources; encouraging sustainable economic development; improving partnerships, service-sharing arrangements, and collaborative projects; and heightening public awareness.

Installation of the HVDC cables will be off shore in Long Island Sound. The Project will not interfere with the nine goals of Hempstead Harbor's Harbor Management Plan listed above. This Project will be consistent with Hempstead Harbor's Harbor Management Plan.

4.2.6 Potential Impacts and Mitigation

This section addresses the potential impacts on existing and future land uses from construction and operation of the Project, along with any proposed mitigation for impacts to land use. Most of the Project is located underwater, with minor potential impact to public or private property, open space, or any existing or planned land uses. Along the underground portions of the Project route, impacts to land use have been minimized by routing the Project along existing disturbed railroad rights-of-way to the extent possible. Underwater portions of the Project are not expected to result in any significant impacts to land use, since water-dependent uses, navigation and other coastal uses will not be affected.

4.2.6.1 Impact Assessment

Land Use

The underground portion of the transmission cable corridor will be constructed almost entirely within the existing CP and CSX railroad rights-of-way. CHPEI will coordinate closely with CP and CSX prior to finalizing the location of the proposed cable to ensure each railroad's future development plans are considered. Close coordination with the railroad companies during the equipment delivery and installation stages of the Project will assist in avoiding or minimizing conflict with ongoing railroad operations.

Only one underground segment will be outside of the railroad rights-of-way, in the Town of Kingsbury, where the proposed cable route through the Champlain Canal makes landfall to bypass Lock C9. This bypass segment will utilize land owned by the NYCC. Lock bypasses at Lock C11 and C12 will be located along the existing CP railroad right-of-way. From the Town of Kingsbury to the Town of Rotterdam, the underground portions of the cable route will follow existing CP right-of-way. From the Towns of Rotterdam to Coeymans, the underground cable route follows within the CSX railroad right-of-way, before entering the Hudson River.

Outside of the larger population centers such as the City of Saratoga Springs, the City of Schenectady and the Town of Rotterdam, underground portions of the cable route traverse sparsely populated areas and land uses that consist primarily of forest land, commercial/industrial/transportation, and open space. Minimal clearing of trees and vegetation will be required. Nearby residences may experience temporary disturbance and traffic inconvenience associated with construction activities, primarily at locations where the existing rights-of-way cross public roadways that will be used by construction vehicles to access the right-of-way. These effects will be temporary and, in general, most disturbances will last only a brief period of a few days or a week at any particular location.

To minimize potential construction effects to adjacent landowners, CHPEI will provide timely information to adjacent property owners and/or tenants regarding the planned construction activities and schedule, and will coordinate with New York State Department of Transportation (NYSDOT) county officials in Washington, Saratoga, Schenectady, Albany, Westchester and New York Counties, and local police departments, as applicable, to develop and implement traffic control measures that ensure safe and adequate traffic operations along roadways used by construction vehicles.

Agricultural Lands

The Project traverses approximately 9.9 miles of designated Agricultural Districts in Washington, Saratoga and Albany counties. Construction of the underground portions of the proposed Project in Washington County will take place in a segment (an approximately 0.5 mile segment) that is owned by the Canal Corp east of Lock C9. The land use on the east side of this segment includes forested land and open scrub/shrub/pasture land. To the west, there are small commercial/industrial/transportation areas along the Champlain Canal. Where the Project does not parallel existing railroad rights-of-way, some minor impact to agricultural land will occur in any actively farmed areas. Typically, plows or other heavy farm equipment could not operate immediately above the buried cable. However, because the parcel for the proposed C9 Lock bypass is owned by the Canal Corp, CHPEI does not anticipate that the cable will interfere with active or commercial farming in the vicinity.

Other than the C9 bypass, construction of the underground segments in Washington, Albany and Saratoga Counties will take place entirely within the existing railroad rights-of-way when traversing land in Agricultural Districts. Where installation work is within the existing rail rights-of-way, it is not anticipated that any agricultural operations will be disrupted. It is not anticipated that any land within the existing railroad right-of-way is currently used for agriculture. Although farm equipment may not operate directly above the cable trench, the Project is not inconsistent with any immediately adjacent agricultural activity up to the edge of the corridor. During construction, CHPEI will minimize potential effects on adjacent agricultural land by limiting impacts such as vegetation clearing and ground disturbance to the construction corridor.

State and Local Parks/Public Lands

Table 4.2-4 summarizes the list of parks by community and distance from the centerline of the cable route.

No adverse impacts to state and local parks or public lands are anticipated as a result of the proposed Project. Besides the C9 bypass, the underground portions of the cable corridor will occur entirely within the existing CP and CSX railroad rights-of-way. Although the Project is located near some parks and other public lands, no direct impacts to public lands will occur along the railroad rights-of-way. The proposed route for the C9 bypass will be located within lands owned by the Canal Corp east of the Champlain Canal. These lands will be temporarily affected by construction within the transmission cable corridor.

Because the transmission cables will be entirely underground with no visible aboveground structures, there will be no permanent visual impacts to these public lands. Vegetation clearing along the railroad rights-of-way could cause minor impacts by removing some vegetation that serves as visual screening for the railroad. These impacts are expected to be minor and temporary, since natural revegetation will be permitted to occur within most of the construction corridor and any additional work spaces. Additional temporary impacts to adjacent public lands might occur if any recreational users are bothered by any unwanted noise, traffic, or disturbance due to construction along the railroad right-of-way. Since construction will generally move quickly along the construction corridor, any impacts from noise or traffic which may affect public access will be short-term. CHPEI will minimize impacts to adjacent public lands by using appropriate BMPs to prevent erosion or sedimentation outside of the work limits and by limiting vegetation clearing to the extent possible.

Because the Yonkers converter station site and the Sherman Creek substation site are both within existing urban and developed environments, the proposed Project is not expected to adversely affect land uses or visual aesthetics adjacent to aboveground facilities. As discussed in Section 4.2.2, the Project will be consistent with local open space and public land planning.

4.2.6.2 Mitigation

The Project will not adversely affect local or regional land uses, land use planning or any federal, state or local public lands. The proposed Project will provide additional and reliable transmission of electricity, which will support the continued land use patterns. The Project does not conflict with existing comprehensive county or town plans or LWRPs. Mitigation for land use impacts is built into the siting of the cable corridor and the selection of various construction methods.

4.3 GEOLOGY, TOPOGRAPHY, AND SOILS

This section provides an overview of the geologic setting for the Project within New York State and specifically describes the existing surficial geology, topography and soils present along the underground portion of the transmission cable corridor, the Yonkers converter station site, and the Sherman Creek substation site. This section also discusses the potential impacts to geology and soils that may result from the construction and operation the Project, along with the methods that will be used to avoid, minimize and mitigate for those potential impacts. Section 4.6 describes the existing conditions along the underwater portion of the Project, specifically describing bathymetry and sediment physical and chemical characteristics to be encountered, and plans for confirmatory underwater geotechnical investigations. Potential impacts and mitigation along the underwater portion of the Project are also presented in Section 4.6.

4.3.1 Existing Conditions

4.3.1.1 Geologic Setting

The underground and underwater portions of the Project are located in the Champlain section of the St. Lawrence Valley province to the north, extending south to the Hudson Valley section of the Valley and Ridge province, and finally to the Embayed section of the Coastal Plain province.

During the last continental glaciation, glaciers modified the regional topography by smoothing off hilltops, scouring out some valleys and filling in others, then leaving a mantle of unconsolidated material over the land surface in the Project area. This occurred during the last continental glaciation, advancing through the region approximately 20,000 years ago, and ending approximately 14,000-12,000 years ago. The retreat of glacial ice and the formation of glacial lakes in the Project area valleys contributed to the deposition of unconsolidated material that will be encountered during the proposed construction (NYSMGS 1991).

4.3.1.2 Topography

The topography along the underground transmission cable corridor is generally flat to gently sloping at proposed valley bottom locations. The underground cable corridor follows anthropogenically disturbed corridors along railroad or canal rights-of-way that have been altered by factors such as soil fill and grading for the railroad embankment. The approximate range of topographic elevations (above mean sea level) along the proposed underground cable corridor are 98 feet at the Champlain Canal Lock C12 bypass, 100 feet at the Lock C11 bypass, 140 feet at the Lock C9 bypass, and from 114 to 130 feet along the railroad rights-of-way. The elevation at the Yonkers converter station site is 8 feet, and at the Sherman Creek substation the elevation ranges from 8 to 10 feet (GoogleEarthWin 2010).

4.3.1.3 Soils

Table 4.3-1 presents the soils that exist along the underground transmission cable corridor and at the Yonkers converter station and Sherman Creek substation sites. Existing soils include native soils and urban fill and urban land.

The native soils formed from parent material related to glacial tills, glacial lake sediments, outwash and outwash delta deposits and more recent alluvium. Drainage along the underground route ranges from poorly to excessively drained. Hydric soils, those soils formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper zone, are present intermittently along the Project route. Frequent flooding, where the soils are temporarily covered with flowing water more than 50 times in 100 years, is present but not common along the Project route (USDA NRCS 2010a; USDA NRCS 2010b).

The underground portions of the Project corridor are located within or immediately adjacent to the existing CP and the CSX rights-of-way, and a small portion of land owned by the Canal Corp. There are also short traverses at the Yonkers converter station and the Sherman Creek substation sites.

Along the Canal Corp land, the soils are anticipated to be primarily native soils, based on soils mapping. Along the railroad rights-of-way, some mapped soil types may not reflect actual field conditions due to previous rights-of-way development. At several locations, including the Yonkers converter station and Sherman Creek substation sites, the material is urban land (USDA NRCS 2010b).

Agricultural protection districts identified along the proposed underground transmission cable corridor are discussed in Section 4.2.

4.3.1.4 Surficial Geology

Table 4.3-2 summarizes surficial material that will be encountered along the underground transmission cable corridor. A description of the material to be encountered during construction is presented below (NYSMGS 1989; NYSMGS 1990; NYSMTC 1999a).

- Lacustrine beach deposits contain well sorted sand and gravel. The material is well drained, stratified, permeable, and may contain wave-winnowed gravel deposits. The thickness is variable 3 to 15 feet.

- Lacustrine delta is a sand and fine to coarse gravel deposit, stratified, generally well sorted. The thickness is generally 10 to 50 feet.

- Marine beach deposits contain well sorted sand and gravel that is permeable and well drained. The thickness is 3 to 15 feet.

- Recent alluvium contains oxidized fine sand to gravel and may be overlain by silt. The material is permeable and is generally 3 to 30 feet thick.

- Till is a variable texture material from silt to boulders. The material is poorly sorted and sand rich. The material will have variable permeability and a thickness of 3 to 150 feet.

- Limited kame deposits will be encountered. The material will be fine to coarse gravel or sand. Sorting, texture, and permeability will be variable laterally and may be firmly cemented with calcareous cement. Thickness will generally vary from 30 to 90 feet.

- Outwash sand and gravel contains stratified fine to course gravel with sand.

Where bedrock is known to be exposed or generally within 3 feet of the surface it is presented on Table 4.3-2.

4.3.1.5 Bedrock Geology

Table 4.3-3 summarizes areas where bedrock may be encountered along the transmission cable corridor during trench excavation or HDD. A description of the bedrock is presented below.

Mixed gneiss is present as a hybrid rock of mangeritic to charnockitic gneiss. Gneiss is a common bedrock in the northern portion of the Project area. Other metamorphic rock sequences that may be encountered in the northern portion of the route include: biotite-quartz-plagioclase paragneiss, amphibolite, migmatite, calcitic and dolomitic marble, Inwood marble, and pyroxene-hornblende-quartz-plagioclase gneiss (NYSMTC 1999b).

To the south along the Hudson River Valley, bedrock in the area includes: biotite-quartz-fieldspar paragneiss and hornblend granite and granite gneiss; the metasedimentary Austin Glen formation containing limestone clasts; and, the metamorphosed Schenectady Formation composed of greywacke, sandstone, siltstone, and shale (NYSMTC 1999b).

Mixed within these formations along the Project route is the Potsdam sandstone. Potsdam sandstone contains up to 97 percent silica and can be a valuable mineral resource. No recent or active mines were identified along the transmission cable corridor.

Canajoharie Shale is a fine-grained rock originating from mud. This shale is black and is common in the Champlain and Hudson River Valleys. Normanskill shale is also found in the Hudson River Valley, but is a minor mudstone and sandstone (NYSMTC 1999b).

In the Yonkers converter station area, gneiss bedrock is present. This area has been mapped as Fordham Gneiss (NYSMTC 1999b) and more recently as potentially containing Yonkers Gneiss, a metavolcanic (with biotite and/or quartz feldspar) bedrock (Brock and Brock 2001).

At Sherman Creek West and Sherman Creek East substations, Inwood marble is present in the area. This bedrock contains beds of dolomitic and dolomitic-calcite marble, and tight folding may be present (Brock and Brock 2001).

No natural gas bearing formations were identified along the corridor.

4.3.1.6 Seismic Hazard

During an earthquake, seismic waves travel out from an earthquake epicenter through the surrounding rock. Ground motion is higher closer to the epicenter. In general, ground motion decreases away from the epicenter, though the amount of ground motion at the surface is related to more than just distance from the epicenter. Some natural materials can amplify ground motion; that is, ground motion is typically less on solid bedrock and greater on thick deposits of clay, sand, or artificial fill.

Seismic hazards can be assessed based on peak ground acceleration. During an earthquake, a particle attached to the earth will move back and forth irregularly. The horizontal force a structure must withstand during an earthquake is related to ground acceleration. Peak ground acceleration is the maximum acceleration experienced by a particle during an earthquake.

The United States Geological Survey (USGS) produces ground motion hazard maps at a given level of probability. Peak horizontal acceleration values are represented as a factor of “g”. The factor “g” is equal to the acceleration of a falling object due to gravity. These USGS Seismic Hazard Maps (USGS 2008) were reviewed for the Project area with the results detailed below.

- There is a 2 percent probability of exceedance of an 8 to 10 percent “g” event in 50 years for the middle Hudson River Valley Project area; there is a higher risk in the Champlain Valley area for a 20 to 30 percent “g” event; and, in the lower Hudson/New York City area a 10-20 percent “g” event.

- There is a 10 percent probability of exceedance of a 2 to 3 percent “g” event in 50 years for the middle Hudson River Valley Project area; there is a higher risk in the Champlain Valley area of a 5 to 10 percent “g” event; and, in the lower Hudson/New York City area a 4 to 5 percent “g” event.

These percent “g” values are relatively higher in the Champlain Valley and New York City areas than most areas of the northeastern United States, but relatively lower than regions of the central (New Madrid) or western United States. As a result, the overall seismic hazard for the Project area is considered moderate.

4.3.2 Potential Impacts and Mitigation

4.3.2.1 Geologic Resources

Along the underground transmission cable corridor, initial clearing operations will include the removal of soils in the immediate trench area. Typically, the trench will be up to 9 feet wide at the top and approximately 3.5 feet deep to allow for the proper depth and separation required for the burial of the cables.

Where impacts may occur, the EM&CP will specify the avoidance, minimization, and mitigation measures for disturbed soils along the transmission cable corridor. Specifically, erosion controls such as hay bales and silt fencing will be used during construction to minimize stormwater run-on and run-off and erosion of soils and surficial geologic materials, both at the trench and at the soil stockpiles. Where soil compaction occurs, tractor and disc harrow (or similar) will be used to prepare the soil for restoration. Gullied, rilled, or rough sites will be smoothed and shaped to permit the use of equipment for plantings.

Since the underground portion of the route is located primarily along existing transportation rights-of-way and the surface soils will be re-established and seeded post-construction, loss of agricultural soils is not anticipated.

The underground transmission cable corridor is located in geologic materials that can be easily worked with standard construction techniques. The installation of cable vaults will result in the excavation and offsite recycling of some of this surficial material. It is likely that much of the excavated material will be suitable for reuse as fill with local recyclers.

Bedrock that may be encountered during trenching will be removed using one of the following techniques:

- Conventional excavation with a backhoe;
- Hammering with a pointed backhoe attachment followed by backhoe excavation; or,
- Blasting followed by backhoe excavation.

Blasting techniques are addressed in Section 4.1, Construction Methods.

Upon completion of the installation of the underground transmission cable, the surface of the right-of-way disturbed by construction activities will be graded to match the original topographic contours and to be compatible with surrounding drainage patterns, except at those locations where permanent changes in drainage will be required to prevent erosion that could lead to possible exposure of the cable.

HDD entry pits will be backfilled and the disturbed ground surface will be similarly graded. Segregated topsoil will be returned or replaced and soils that have been compacted by construction equipment traffic will be disked if necessary.

Cable right-of-way easements have the potential to result in certain restrictions on geologic resources, such as sand and gravel mines or silica mining from the Potsdam sandstone. However, no known mines were identified along the Project route. Underground portions of the Project's route are proposed along existing transportation corridor routes, such as rail and canal infrastructure property, thereby minimizing impacts to undeveloped geologic resources.

In summary, the potential impact to geologic resources from the installation and operation of the underground transmission cable is considered minor.

4.3.2.2 Seismic Hazard

Earthquakes and related seismic hazards are not anticipated to have an impact on the Project. No known active faults with the potential for surface fault rupture were identified. Seismic related ground shaking during the lifetime of the Project is probable.

To meet the known seismic conditions in the vicinity of the Project, all Project facilities will be built to meet or exceed the seismic design provisions of the State of New York, as well as relevant local building codes.

4.4 VEGETATION AND NATURAL COMMUNITIES

This section provides a description of the upland vegetation cover types that have the potential to occur along the underground cable corridor, and the aquatic vegetation that may occur along underwater portions of transmission cable corridor. It also describes any significant natural communities potentially impacted by the Project. Potential impacts to upland and aquatic vegetation and any significant natural communities are discussed, along with proposed mitigation.

Portions of the Project evaluated as part of the underground route include: 1) the underground bypass routes to avoid Locks C12, C11, and C9 along the Champlain Canal in Washington County; 2) the approximate 69.9-mile underground bypass in Washington, Saratoga, Schenectady and Albany Counties, to avoid interference with activities associated with the Upper Hudson River PCB Dredging Project; 3) the Yonkers converter station area in Westchester County; and 4) the existing Sherman Creek substation in New York County. Included is a brief list of some of the common or typical plant species that may be found in each existing upland cover type. Vegetation community descriptions are based on the New York Natural Heritage Program's *Draft Ecological Communities of New York State* (Edinger et al. 2002). Wetland vegetation cover types and communities are described in Section 4.5.

Aquatic vegetation occurs along portions of the New York shoreline of Lake Champlain, in the narrower southern end of the lake and down the length of the Champlain Canal and the Hudson River. In the marine and estuarine portions of the route, macroalgae species occur in hard substrate areas where there is adequate salinity and water quality. The distribution of submerged aquatic vegetation is depth limited based on water clarity and the subsequent depth of the photic zone. In addition, two invasive species, Eurasian watermilfoil and water chestnut, have had a substantial negative effect on the distribution of native submerged aquatic vegetation (SAV) species.

4.4.1 Terrestrial Vegetation

Upland vegetation communities were identified on the basis of aerial photography and field observations. CHPEI has conducted environmental field investigations, including ecological community mapping, along 67 percent of the underground cable route, which includes approximately 46.2 miles along the CP railroad right-of-way and an additional 2.1 miles at the Champlain Canal Lock C12 and C11 bypasses. Field reconnaissance at the Yonkers converter station site was conducted on September 9, 2009. A desktop analysis of the vegetation conditions at the Sherman Creek substation site was also conducted. Field observations for the remaining underground portions of the cable corridor will be conducted in the spring of 2010. Additional information from these delineations will be provided as part of the supplemental information to be submitted in July 2010.

4.4.1.1 Existing Vegetation

The upland vegetation cover types listed above can be categorized into three major groups, including: open uplands, forested uplands, and terrestrial cultural communities. Open uplands are defined as communities with less than 25 percent canopy cover of trees. Open upland communities include grasslands, meadows, and shrublands. Forested uplands are communities with greater than 60 percent canopy cover of trees. Forested upland communities occur on substrates with less than 50 percent rock outcrop or shallow soil over bedrock. Terrestrial cultural communities have been either created and maintained by human activities, or modified by human influence to such a degree that the physical conformation of the substrate or the biological composition of the resident community is substantially different from the character of the substrate or community that existed prior to human influence (Edinger et al. 2002).

Open upland vegetative cover types that have been observed in the vicinity of the Project corridor include successional old field and successional shrubland. Observed forested uplands include Appalachian oak-hickory forest, Appalachian oak-pine forest, successional northern hardwoods, and successional southern hardwoods. Observed terrestrial cultural communities include cropland/row crops, pastureland, mowed roadside/pathway, unpaved road/path, railroad, rip-rap/erosion control roadside, brushy cleared land, and urban vacant lot. Each of these 14 communities is described below.

Ecological communities mapped during field investigations are provided in Figure 4.4-1. Mapping for portions of the Project corridor that have not yet been surveyed in the field, including the segment along the CSX railroad right-of-way and the Champlain Canal Lock C9 bypass, will be provided as part of the supplemental information to be submitted in July 2010.

4.4.1.1.1 Successional Old Field

Successional old field is a meadow dominated by forbs and grasses that occurs on sites that have been cleared and plowed (for farming or development), and then abandoned. Characteristic herbs within this community include goldenrods (*Solidago altissima, S. nemoralis, S. rugosa, S. juncea, S. canadensis,* and *Euthamia graminifolia*), bluegrasses (*Poa pratensis, P. compressa*), timothy (*Phleum pratense*), quackgrass (*Agropyron repens*), smooth brome (*Bromus inermis*), sweet vernal grass (*Anthoxanthum odoratum*), orchard grass (*Dactylis glomerata*), common chickweed (*Cerastium arvense*), common evening primrose (*Oenothera biennis*), oldfield cinquefoil (*Potentilla simplex*), calico aster (*Aster lateriflorus*), New England aster (*Aster novae-angliae*), wild strawberry (*Fragaria virginiana*), Queen-Anne'slace (*Daucus corota*), ragweed (*Ambrosia artemisiifolia*), hawkweeds (*Hieracium* spp.), dandelion (*Taraxacum officinale*), and ox-tongue (*Picris hieracioides*). Shrubs may be present, but collectively they have less than 50 percent cover in the community. Characteristic shrubs include gray dogwood (*Cornus foemina* ssp. *racemosa*), silky dogwood (*Cornus amomum*), arrowwood (*Viburnum recognitum*), raspberries (*Rubus* spp.), sumac (*Rhus typhina, R. glabra*), and eastern red cedar (*Juniperus virginiana*) (Edinger et al. 2002).

4.4.1.1.2 Successional Shrubland

Successional shrubland occurs on sites that have been cleared (for farming, logging, development, etc.) or otherwise disturbed. This community has at least 50 percent cover of shrubs. Characteristic shrubs within this community include gray dogwood (*Cornus foemina* ssp. *racemosa*), eastern red cedar (*Juniperus virginiana*), raspberries (*Rubus* spp.), hawthorne (*Crataegus* spp.), serviceberries (*Amelanchier* spp.), choke-cherry (*Prunus virginiana*), wild plum (*Prunus americana*), sumac (*Rhus glabra, R. typhina*), nanny-berry (*Viburnum lentago*), arrowwood (*Viburnum recognitum*), and multiflora rose (*Rosa multiflora*) (Edinger et al. 2002).

4.4.1.1.3 Pitch Pine-Oak Forest

Pitch pine-oak forest is a mixed forest that typically occurs on well-drained, sandy soils of glacial outwash plains or moraines. It also occurs on thin, rocky soils of ridgetops. The dominant trees are pitch pine (*Pinus rigida*) mixed with one or more of the following oaks: scarlet oak (*Quercus coccinea*), white oak (*Q. alba*), red oak (*Q. rubra*), or black oak (*Q. velutina*). The proportions of pines and oaks are variable within this community type. The shrublayer is well-developed with scattered clumps of scrub oak (*Quercus ilicifolia*) and a nearly continuous cover of low heath shrubs such as blueberries (*Vaccinium pallidum, V. angustifolium*) and black huckleberry (*Gaylussacia baccata*). The herbaceous layer is relatively sparse. Characteristic species are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), and Pennsylvania sedge (*Carex pensylvanica*) (Edinger et al. 2002).

4.4.1.1.4 Appalachian Oak-Hickory Forest

Appalachian oak-hickory forest is a hardwood forest that occurs on well-drained sites, usually on ridgetops, upper slopes, or south- and west-facing slopes. The soils are usually loams or sandy loams. The dominant trees include one or more of the following oaks: red oak (*Quercus rubra*), white oak (*Q. alba*), and black oak (*Q. velutina*). Mixed with the oaks are one or more of the following hickories: pignut (*Carya glabra*), shagbark (*C. ovata*), and sweet pignut (*C. ovalis*). Common associates are white ash (*Fraxinus americana*), red maple (*Acer rubrum*), and Eastern hop hornbeam (*Ostrya virginiana*). There is typically a subcanopy stratum of small trees and tall shrubs including flowering dogwood (*Cornus florida*), witch hazel (*Hamamelis virginiana*), shadbush (*Amelanchier arborea*), and choke cherry (*Prunus virginiana*). Common low shrubs include maple-leaf viburnum (*Viburnum acerifolium*), blueberries (*Vaccinium angustifolium, V. pallidum*), red raspberry (*Rubus idaeus*), gray dogwood (*Cornus foemina* ssp. *racemosa*), and beaked hazelnut (*Corylus cornuta*). Characteristic ground layer herbs are wild sarsaparilla (*Aralia nudicaulis*), false Solomon's seal (*Smilacina racemosa*), Pennsylvania sedge (*Carex pensylvanica*), tick-trefoil (*Desmodium glutinosum, D. paniculatum*), black cohosh (*Cimicifuga racemosa*), rattlesnake root (*Prenanthes alba*), white goldenrod (*Solidago bicolor*), and hepatica (*Hepatica americana*) (Edinger et al. 2002).

4.4.1.1.5 Appalachian Oak-Pine Forest

Appalachian oak-pine forest is a mixed forest that occurs on sandy soils, sandy ravines in pine barrens, or on slopes with rocky soils that are well-drained. The canopy is dominated by a mixture of oaks and pines. The oaks include one or more of the following: black oak (*Quercus velutina*), chestnut oak (*Q. montana*), red oak (*Q. rubra*), white oak (*Q. alba*), and scarlet oak (*Q. coccinea*). The pines are either white pine (*Pinus strobus*) or pitch pine (*P. rigida*); in some stands both pines are present. Red maple (*Acer rubrum*), hemlock (*Tsuga canadensis*), beech (*Fagus grandifolia*), and black cherry (*Prunus serotina*) are common associates occurring at low densities. The shrub layer is predominantly ericaceous, usually with blueberries (*Vaccinium angustifolium, V. pallidum*) and black huckleberry (*Gaylussacia baccata*). The ground layer is relatively sparse, and species diversity is low (Edinger et al. 2002).

4.4.1.1.6 Pine-Northern Hardwood Forest

Pine-northern hardwood forest is a mixed forest that occurs on gravelly outwash plains, delta sands, eskers, and dry lake sands in the Adirondacks. The dominant trees are white pine (*Pinus strobus*) and red pine (*P. resinosa*). These are mixed with scattered paper birch (*Betula papyrifera*) and quaking aspen (*Populus tremuloides*). In some stands there is a mixture of other northern hardwoods and conifers such as yellow birch (*Betula alleghaniensis*), red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and red spruce (*Picea rubens*). Characteristic shrubs are blueberries (*Vaccinium angustifolium, V. myrtilloides*), sheep laurel (*Kalmia angustifolia*), wild raisin (*Viburnum cassinoides*), and shadbush (*Amelanchier canadensis*). Characteristic herbs are bracken fern (*Pteridium aquilinum*), wintergreen (*Gaultheria procumbens*), trailing arbutus (*Epigaea repens*), cow-wheat (*Melampyrum lineare*), Canada mayflower (*Maianthemum canadense*), bunchberry (*Cornus canadensis*), star flower (*Trientalis borealis*), bluebeads (*Clintonia borealis*), painted trillium (*Trillium undulatum*), spreading ricegrass (*Oryzopsis asperifolia*), and Pennsylvania sedge (*Carex pensylvanica*). Mosses and lichens may be common to abundant, especially the mosses *Pleurozium schreberi*, *Brachythecium* spp., and *Dicranum polysetum* (Edinger et al. 2002).

4.4.1.1.7 Successional Northern Hardwoods

Successional northern hardwoods are a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed. Characteristic trees and shrubs include any of the following: quaking aspen (*Populus tremuloides*), bigtooth aspen (*P. grandidentata*), balsam poplar (*P. balsamifera*), paper birch (*Betula papyrifera*), or gray birch (*B. populifolia*), pin cherry (*Prunus pensylvanica*), black cherry (*P. serotina*), red maple (*Acer rubrum*), white pine (*Pinus strobus*), with lesser amounts of white ash (*Fraxinus americana*), green ash (*F. pensylvanica*), and American elm (*Ulmus americana*). Northern indicators include aspens, birches, and pin cherry (Edinger et al. 2002).

4.4.1.1.8 Successional Southern Hardwoods

Successional southern hardwoods are a hardwood or mixed forest that occurs on sites that have been cleared or otherwise disturbed. Characteristic trees and shrubs include any of the following: American elm (*Ulmus americana*), slippery elm (*U. rubra*), white ash (*Fraxinus americana*), red maple (*Acer rubrum*), box elder (*Acer negundo*), silver maple (*A. saccharinum*), sassafras (*Sassafras albidum*), gray birch (*Betula populifolia*), hawthorns (*Crataegus* spp.), eastern red cedar (*Juniperus virginiana*), and choke-cherry (*Prunus virginiana*). Certain introduced species are commonly found in successional forests, including black locust (*Robinia pseudo-acacia*), tree-of-heaven (*Ailanthus altissima*), and buckthorn (*Rhamnus cathartica*). Any of these may be dominant or co-dominant in a successional southern hardwood forest. Southern indicators include American elm, white ash, red maple, box elder, choke-cherry, and sassafras (Edinger et al. 2002).

4.4.1.1.9 Cropland/Row Crops

Cropland/row crops are agricultural fields planted in row crops such as corn, potatoes, and soybeans. This community also includes vegetable gardens in residential areas (Edinger et al. 2002).

4.4.1.1.10 Cropland/Field Crops

Cropland/field crops are agricultural fields planted in field crops such as alfalfa, wheat, timothy, and oats. This community includes hayfields that are rotated to pasture (Edinger et al. 2002).

4.4.1.1.11 Pastureland

Pastureland is agricultural land permanently maintained (or recently abandoned) as a pasture area for livestock (Edinger et al. 2002).

4.4.1.1.12 Pine Plantation

Pine plantation is a stand of pines planted for the cultivation and harvest of timber products, or to provide wildlife habitat, soil erosion control, windbreaks, or landscaping. Pine plantations may be monocultures with more than 90 percent of the canopy cover consisting of one species, or they may be mixed stands with two or more co-dominant species (in which case more than 50 percent of the cover consists of one or more species of pine). Pines typically planted in New York include white pine (*Pinus strobus*), red pine (*P. resinosa*), Scotch pine (*P. sylvestris*), pitch pine (*P. rigida*), and jack pine (*P. banksiana*). Ground layer vegetation is usually sparse because of the dense accumulation of leaf litter. Speedwell (*Veronica officinalis*) is a characteristic ground layer plant (Edinger et al. 2002).

4.4.1.1.13 Spruce/Fir Plantation

Spruce/fir plantation is a stand of softwoods planted for the cultivation and harvest of timber products, or to provide wildlife habitat, soil erosion control, windbreaks, or landscaping. Spruce/fir plantations may be monocultures with more than 90 percent of the canopy cover consisting of one species, or they may be mixed stands with two or more co-dominant species (in which case more than 50 percent of the cover consists of one or more species of spruce or fir). Softwoods typically planted in New York include Norway spruce (*Picea abies*), white spruce (*P. glauca*), balsam fir (*Abies balsamea*), and Douglas fir (*Pseudotsuga menziesii*). Ground layer vegetation is usually sparse because of the dense accumulation of leaf litter. Speedwell (*Veronica officinalis*) is a characteristic ground layer plant (Edinger et al. 2002).

4.4.1.1.14 Mowed Lawn with Trees

Mowed lawn with trees is residential, recreational, or commercial land in which the groundcover is dominated by clipped grasses and forbs. It is shaded by at least 30 percent cover of trees. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing (Edinger et al. 2002).

4.4.1.1.15 Mowed Lawn

Mowed lawn is residential, recreational, or commercial land, or unpaved airport runways in which the groundcover is dominated by clipped grasses and there is less than 30 percent cover of trees. Ornamental and/or native shrubs may be present, usually with less than 50 percent cover. The groundcover is maintained by mowing (Edinger et al. 2002).

4.4.1.1.16 Mowed Roadside/Pathway

Mowed roadside/pathway is a narrow strip of mowed vegetation along the side of a road, or a mowed pathway through taller vegetation (e.g., meadows, old fields, woodlands, forests), or along utility right-of-way corridors (e.g., power lines, telephone lines, gas pipelines). The vegetation in these mowed strips and paths may be dominated by grasses, sedges, and rushes; or it may be dominated by forbs, vines, and low shrubs that can tolerate infrequent mowing (Edinger et al. 2002).

4.4.1.1.17 Herbicide-sprayed Roadside/Pathway

Herbicide-sprayed roadside/pathway is a narrow strip of low-growing vegetation along the side of a road, or along utility right-of-way corridors (e.g., power lines, telephone lines, gas pipelines) that is maintained by spraying herbicides (Edinger et al. 2002).

4.4.1.1.18 Unpaved Road/Path

Unpaved road/path is a sparsely vegetated road or pathway of gravel, bare soil, or bedrock outcrop. These roads or pathways are maintained by regular trampling or scraping of the land surface. The substrate consists of the soil or parent material at the site, which may be modified by the addition of local organic material (woodchips, logs, etc.), or sand and gravel. A characteristic plant of this community is path rush (*Juncus tenuis*) (Edinger et al. 2002).

4.4.1.1.19 Railroad

Railroad is a permanent road having a line of steel rails fixed to wood ties and laid on a gravel roadbed that provides a track for cars or equipment drawn by locomotives or propelled by self-contained motors. There may be sparse vegetation rooted in the gravel substrate. The railroad right-of-way may be maintained by mowing or herbicide spraying (Edinger et al. 2002).

4.4.1.1.20 Paved Road/Path

Paved road/path is a road or pathway that is paved with asphalt, concrete, brick, or stone. There may be sparse vegetation rooted in cracks in the paved surface (Edinger et al. 2002).

4.4.1.1.21 Roadcut Cliff/Slope

Roadcut cliff/slope is a sparsely vegetated cliff or steep slope along a road that was created by blasting or digging during road construction (Edinger et al. 2002).

4.4.1.1.22 Rip-rap/Erosion Control Roadside

Rip-rap/erosion control roadside is a sparsely vegetated slope along a road that is covered with coarse stones, cobbles, or gabions placed for erosion control (Edinger et al. 2002).

4.4.1.1.23 Brushy Cleared Land

Brushy cleared land is land that has been clearcut or cleared by brush-hog. There may be a lot of woody debris such as branches and slashings from trees that were logged. Vegetation is patchy, with scattered herbs, shrubs, and tree saplings. The amount of vegetative cover depends on soil fertility and the length of time since the land was cleared (Edinger et al. 2002).

4.4.1.1.24 Junkyard

Junkyard is a site that has been cleared for disposal or storage of primarily inorganic refuse, including discarded automobiles, large appliances, mechanical parts, etc (Edinger et al. 2002).

4.4.1.1.25 Urban Vacant Lot

Urban vacant lot is an open site in a developed, urban area that has been cleared either for construction or following the demolition of a building. Vegetation may be sparse, with large areas of exposed soil, and often with rubble or other debris. Characteristic trees are often naturalized exotic species such as Norway maple (*Acer platanoides*), white mulberry (*Morus alba*), and tree-of-heaven (*Ailanthus altissima*), a species native to northern China and introduced as an ornamental. Tree-of-heaven is fast growing and tolerant of the harsh urban environment; it can dominate a vacant lot and form dense stands (Edinger et al. 2002).

4.4.1.2 Unique, Sensitive, or Protected Plant Communities

The potential presence of unique, sensitive and/or protected plant species and communities was initially determined through a review of available publications, aerial photography and databases maintained by the NYSDEC (NYSDEC 2009a) and United States Fish and Wildlife Service (USFWS) (USFWS 2009). CHPEI conducted a preliminary review of the agency database information by searching for protected species and natural community occurrences in Washington, Saratoga, Schenectady, Albany and Westchester Counties. CHPEI has also conducted environmental field investigation and mapped ecological communities observed in the field along the CP railroad right-of-way and at the Lock C12 and C11 bypasses (see Section 4.4.1).

Table 4.4-1 lists the significant natural communities with the potential to occur in the Project area, based on the NYNHP-mapped occurrence areas along the transmission cable corridor. Significant natural communities are defined by the NYNHP as either rare natural communities, or the best examples of more common natural communities. The Project is located within the vicinity of NYNHP-mapped significant deep emergent marsh and floodplain forest communities. Deep emergent marsh is ranked as S5, indicating this community is secure, or relatively common, in New York State. Floodplain forest has the NYNHP rank S2, indicating it is a rare community in the state. These communities are briefly described in Table 4.4-1; further information on wetlands in the Project area is provided in Section 4.5.

CHPEI has initiated consultation with the NYSDEC, NYNHP and USFWS regarding the potential for protected species and/or communities to occur in the vicinity of the Project Appendix B. It is expected that further consultation with these agencies will provide more specific information on species occurrences and habitats in the immediate vicinity of the Project, which will allow CHPEI to further refine the list of plant communities with potential presence in the Project area. Additional information from consultations will be provided as part of the supplemental information to be submitted in July 2010.

Individual federal and/or state-listed plant species that have the potential to occur in the vicinity of the Project are discussed in Section 4.9.

4.4.1.3 Potential Impacts and Mitigation

Vegetation clearing and excavation activities within the construction corridor will result primarily in temporary impacts to vegetative communities along the proposed transmission cable corridor. Impacts are anticipated to be minor given that most equipment staging and access will be from the railroad track or from the access road adjacent to the track. Further details on underground construction methods are provided in Section 4.1.

Table 4.4-2 provides a summary of affected communities that were observed along the CP railroad right-of-way (including the Champlain Canal Lock C11 and C12 bypasses), along with the estimated total impacts to vegetative communities. The vegetation affected along the CSX railroad right-of-way and the Champlain Canal Lock C9 bypass will be determined once field investigations are completed in the spring of 2010. Additional information from these field surveys will be provided as part of the supplemental information to be submitted in July 2010. The Yonkers converter station and the Sherman Creek substation and adjacent lands are both located within paved areas in largely urban environments therefore impacts to upland vegetation from construction and operation of the aboveground facilities will be avoided.

Most of the vegetation that will be impacted along the underground portions of the Project corridor consists of previously disturbed herbaceous and/or shrubby cover within the existing railroad rights-of-way. Previous vegetation management along the railroad corridor and associated utility lines along the railroads have resulted in primarily early successional vegetation. Herbaceous vegetation and successional shrubs within the areas impacted by construction are expected to recover quickly following restoration and stabilization of construction corridor. Permanent changes to vegetation cover are not anticipated except in a select few areas where forested cover may be converted to a shrub community as part of the CHPEI Vegetation Management Plan. During operation of the Project, activities associated with this plan will be restricted to vegetation clearing on an as-needed basis to conduct repairs or maintenance along the transmission cables and/or selective cutting to prevent the establishment of large trees directly over the cables. The use of herbicides for construction and maintenance of the cables is not anticipated at this time. CHPEI will develop a Vegetation Management Plan as part of the EM&CP. Any vegetation management activities currently conducted by the railroads within the right-of-way will continue following the construction and operation of the underground transmission cable.

The Project has been designed to minimize impacts to forested communities, to the extent possible, by routing the underground portions of the Project along existing railroad rights-of-way. This alignment places the Project mostly along the forest edge in areas where forested communities occur, which reduces the amount of impact to the canopy vegetation and minimizes additional fragmentation of forested habitats. Where forested areas cannot be avoided, some larger trees may be cleared in the outer portion of the construction corridor, away from the railroad bed. This may result in some long-term impact to forest vegetation, as mature woody vegetation will take a longer time to become re-established than herbaceous vegetation and successional shrubs. Forested areas existing within the construction corridor will go through a series of successional stages before a mature canopy is developed. To minimize impacts to forested communities, CHPEI will avoid cutting mature trees where feasible. CHPEI will also limit the removal of stumps and roots that are not in the footprint of the excavated trench, except where removal is required for safe construction, to allow resprouting and assist in the recovery of woody species.

Weather permitting, the re-establishment of vegetation within the construction corridor will begin as soon as possible following construction and any final surface grading in the construction corridor. Initial revegetation will be conducted by seeding with annual rye grass, or other suitable cover, which will assist in stabilizing soils and rapidly establishing vegetation to prevent colonization with any invasive exotic plant species.

Temporary erosion and sediment control devices will be installed prior to ground disturbance, where needed, and will be maintained through construction until vegetation cover is established or any permanent erosion controls are installed. Revegetation success within disturbed areas could be also be affected if heavy vehicles and equipment cause soil compaction, affecting plant growth and water permeability. Soil compaction is not expected to be an important factor along the underground portions of the Project route, because most vehicles and equipment will either be mounted on the track, or operating from existing access roads or fill associated with the railroad embankment. If initial seeding is unsuccessful, any disturbed areas will be re-seeded, if required, until sufficient vegetation cover is established.

Following backfilling, final grading and erosion control seeding of the construction corridor, disturbed areas will generally be allowed to revegetate naturally. As noted above, permanent changes to vegetation cover are not anticipated except in a select few areas where forested cover may be converted to a shrub community as part of the CHPEI Vegetation Management Plan. CHPEI will develop a Vegetation Management Plan as part of the EM&CP.

The Project is located in or near NYNHP-mapped significant deep emergent marsh and floodplain forest communities. Impact minimization and mitigation for these and other wetland communities is described in Section 4.5. CHPEI will continue to consult with the NYSDEC, NYNHP and USFWS regarding the potential for significant natural communities to occur in the vicinity of the Project. Additional information will be provided in the EM&CP.

4.4.2 Aquatic Vegetation

4.4.2.1 Existing Submerged Aquatic Vegetation and Macroalgae

4.4.2.1.1 Lake Champlain

Historically there have been numerous species of aquatic vegetation present in Lake Champlain along shoreline areas and in shallow embayments. Native milfoils, pondweeds (*Potamogeton* spp.*) Nymphoides peltatum*, and water celery (*Vallisneria americana*) are commonly found SAV species. In recent decades, the two invasive species, water chestnut (*Trapa natans*) and Eurasian watermilfoil (*Myriophyllum spicatum*) have become dominant, particularly at the southern end of the lake (World Lake Database 2010). The water celery is a native perennial submerged macroyphyte species with a summertime active growth period and a rapid growth rate. The blooming period also occurs during the summer, and while seed and vegetative spread rate is moderate. Water celery has been adapted to grow in fine-, medium-, and coarse-textured soils, and the minimum temperature tolerance is -33°F (USDA 2010). For the majority of the cable route in the lake, water depths exceed those that support SAV; it is only in the narrow southern end of the lake that the cables are likely to occur in proximity to SAV. During aquatic field studies on sediments and benthos planned for the spring and summer of 2010, areas of SAV along the cable route will be evaluated. Results of aquatic field studies will be provided as part of the supplemental information to be submitted in July 2010.

Eurasian watermilfoil and water chestnut, two non indigenous plant species, are known to crowd out native species and impede recreational activities, such as fishing, boating and swimming, by forming dense monotypic stands (LCBP 2005). These two species are presently in Lake Champlain and are two of the 13 priority aquatic nuisance species listed for the Lake Champlain Basin. Eurasian watermilfoil and water chestnut can cause significant negative ecological and economic impacts and have a high potential of expanding their ranges throughout the Lake Champlain Basin, causing even greater impacts. Management activities, including education and outreach efforts, are ongoing for each of these species (LCBP 2005).

Water chestnut

Water chestnut, an annual aquatic plant native of Europe, Asia, and Africa, was first documented in Lake Champlain in the early 1940s in shallow bays in the southern end on both the Vermont and New York shores. It is generally assumed that water chestnut seeds hitchhiked to Lake

Champlain on boats traveling through the Champlain Canal from the Mohawk or Hudson River, where it had been previously established. Water chestnut displaces other aquatic plant species, is of little food value to wildlife, and forms dense mats that alter habitat and interfere with recreational activities. Currently, extensive growth of water chestnut in southern Lake Champlain severely restricts boat traffic and other recreational uses. Populations of water chestnut also exist in several inland lakes in the southern portion of Vermont (LCBP 2005). Figure 4.4-2 shows the status of water chestnut infestation in Lake Champlain.

Eurasian watermilfoil

The Eurasian watermilfoil is a perennial, submerged aquatic plant native to Europe, Asia, and parts of Africa. It was first discovered in New England in 1962 when it was reported in St. Albans Bay of Lake Champlain. This invasive plant is now widely distributed throughout North America. The aquarium trade likely played a role in its initial introduction and spread. A 1976 survey of Lake Champlain showed Eurasian watermilfoil present in all areas of the lake, and estimated that several thousand acres of the lake were infested. Eurasian watermilfoil continues to occupy an extensive range throughout the lake. New infestations of Eurasian watermilfoil are discovered nearly every year. Fragments attached to trailered boats are the likely cause of these overland introductions. Eurasian watermilfoil can proliferate in high densities in lakes causing impairments to water recreation such as boating, fishing and swimming and a reduction in native species (LCBP 2005).

4.4.2.1.2 Champlain Canal

The Champlain Canal connects the southern end of Lake Champlain to the Hudson-Mohawk watershed, which is, in turn, connected to the Great Lakes drainage basin by the Erie Canal System (Lake Champlain Sea Grant 2006). The present-day Champlain Canal is 60 miles long and runs between the Erie Canal at Waterford in the south and the southernmost point of Lake Champlain at Whitehall to the north (Malchoff 2005). The Champlain Canal likely provided access for numerous aquatic nuisance species into the Lake Champlain Basin, including water chestnut (Malchoff 2005; Lake Champlain Sea Grant 2006). In the extreme south lake segment of Lake Champlain, this invasive plant is present in over 25 percent of open water coverage and management to prevent the spread is by mechanical harvesting. As a result, this invasive aquatic plant is expected in great abundance in the Champlain Canal, forming dense mats and out competing native aquatic plants. Similar to the water chestnut, Eurasian watermilfoil fragments can attach to trailered boats and spread. Since Eurasian watermilfoil is abundant in Lake Champlain it is also expected to be abundant in the Champlain Canal where it may occur in high densities that exclude native aquatic plants.

4.4.2.1.3 Hudson River Estuary

There are two predominant species of rooted aquatic plants in the Hudson River Estuary, the native submerged water celery and the exotic floating-leafed water chestnut. Plant coverage averaged over the entire upper and lower tidal freshwater and brackish study area is about 6 percent of the river bottom for water celery and 2 percent for water chestnut, although the distribution of both plants varies greatly among the reaches of the tidal freshwater Hudson River

(Findlay et al. 2006). Beds of both species vary in size from 30 square meters (m^2) to a maximum of about 100 ha (1 million m^2). Bed size distributions for water celery are strongly log-normal with far more small beds than large. Due to light limitations, plants are generally found in water shallower than 3 meters, although beds can be deeper in the most upriver sections (Findlay et al. 2006). Other submerged aquatic plants found in the Hudson River include the native clasping leaved pondweed (*Potamogeton perfoliatus*) and slender naiad (*Najas flexilis*) and the non-native curly pondweed (*Potamogeton crispus*) and Eurasian watermilfoil (Findlay et al. 2006; New York Sea Grant 2010). Figure 4.4-3 depicts the aquatic vegetation beds identified from the upper to lower Hudson River.

Upper Freshwater Zone

This zone is defined as rivermile 155 to 129, from Troy Dam to New Baltimore. This section of the Hudson River is confined to a narrow channel that has been greatly modified for ship passage. Much of the river width is a dredged shipping channel and the shorelines are often stabilized and backfilled, leaving little subtidal habitat aside from a narrow nearshore band. SAV is mostly confined to long, thin strips (linear SAV features) that parallel the shoreline. This limited area of nearshore but undredged SAV habitat is typically 3 to 6 meters deep. Water clarity is generally much greater than downriver. Salt water never reaches this far upriver, but tidal amplitude is equal to or greater than downriver (Findlay et al. 2006).

Lower Freshwater Zone

This zone is defined as rivermile 129 to 60, from New Baltimore to Newburgh. This zone is largely freshwater although the most downriver portion can be slightly brackish during periods of low river discharge in dry years. This zone includes four geomorphic sections of the Hudson River estuary: bifurcating channel-shoal, meander segment, narrow river, and wide river. The uppermost lower freshwater section is bifurcating channel-shoal, and extends to around Kingston. This part of the Hudson River has many shallow areas and islands in the channel and numerous tributaries with deltaic deposits. Maximum depths are as much as 15 to 17 meters, and the channel ranges from 0.3 to 1.0 kilometers (km) wide. The flats, numerous backwaters, stream mouths, and side channels of this uppermost section support a wide variety of SAV beds (Findlay et al. 2006).

From Kingston to Staatsburg, the river meanders with broad flats associated with bends. The channel is typically 0.6 to 1.0 km wide with maximum depths of 22 to 31 meters. Several tributaries have created shallow sediment deposits, including a large sediment flat downstream of the mouth of Rondout Creek. Several of the largest SAV beds in the Hudson River are in this reach (Findlay et al. 2006). From Staatsburg to Wappingers Creek the Hudson River is narrow; there are few broad flats and shallows for large SAV beds, and only two study sites were in this section. The river is commonly 0.8 to 1.2 km wide with maximum depths from 29 to 42 meters (Findlay et al. 2006). From Wappingers Creek to slightly below Newburgh, the river is often called Newburgh Bay because of its large width (1.0 to 1.4 km) and shallower depth (maximum 15 to 18 meters). Slightly brackish water reaches into this section during dry years. Turbidity is relatively high, and only one SAV study site was located in the area (Findlay et al. 2006).

Brackish Zone

This zone is defined as rivermile 60 to 33 or Newburgh to Hastings. The Hudson River in this zone is consistently brackish during summer flow conditions, with salinity levels varying in response to tides and river discharge. This zone is in two different morphological segments: Hudson Highlands and wide estuary. From below Newburgh to Peekskill, the river is narrow (0.5 to 0.8 km), deep (maximum 28 to 48 meters), turbulent, and mostly a steep-sided rock channel with minimal shallows. Large rock formations in the channel and broad bends create shallow backwaters supporting SAV (Findlay et al. 2006). Below Peekskill the river emerges into a broad (1.0 to 1.5 km) and shallow (maximum depth about 13 meters) estuary section, Haverstraw Bay. Large flats extend from shore to the navigation channel, and shoreline features provide protected shallow waters. Despite the shallow water, SAV beds are not common in this reach of the Hudson, perhaps because of the generally high turbidity (Findlay et al. 2006).

Further downstream from Hastings, the salinity gradually increases until reaching marine conditions where SAV is composed of seagrasses which can survive the higher salinities, or macroalgae. Marine vegetation is described in the following section.

4.4.2.1.4 Long Island Sound

Because of its abundant nutrients, temperature range, and its sheltered geographic location, Long Island Sound supports a rich algal flora. There are more than 200 species of macroalgae in Long Island Sound, but not all of them are present at the same time (LISS 2001) nor are they uniformly spread throughout the Sound. Some are present year-round or nearly so, such as sea lettuce (*Ulva* spp.), knotted wrack (*Ascophyllum nodosum*), rockweed (*Fucus vesiculosus*), oarweed (*Laminaria digitata*), and Irish moss (*Chondurs crispus*). In general, the macroalgae are categorized as green, brown, or red. The plant pigments absorb various frequencies of light, and the limited light available in coastal waters determines the depth at which the algae can be found. In general, greens are closest to shore, browns in the intertidal zone and subtidal zone, and reds at greater depths and farthest from shore (LISS 2001). Macroalgae, which often attaches to rocks or other hard surfaces during some part of its life, provides habitat, food, and shelter for a number of aquatic organisms, and is therefore very important to the ecology of Long Island Sound.

Ulva is primarily found in marine environments, but can also be found in brackish water, particularly estuaries. They are usually seen in dense groups, attached to rocks in the middle to low intertidal zone and as deep as 10 meters in calm, protected harbors (Monterey Bay Aquarium Research Institute [MBARI] 2010). Knotted wrack is an intertidal algae conspicuous due to its ability to float with the changing water surface. The plants are held to the substratum by discoid holdfasts which in dense populations frequently coalesce. Reproduction is sexually, through the union of eggs and sperms produced in the conceptacular cavities of ripe receptacles. Receptacles are initiated in April to June, and gamete release also occurs during that time period. Knotted wrack is primarily a mid to low intertidal species. The upper limits of distribution are controlled by its ability to resist desiccation and high temperatures. Where present, this species dominates the mid-intertidal zone (Doty et al. 1987). Rockweed is a large brown algae found intertidally on the middle-shore zone. This species is attached to rocky substrates by means of a discoid holdfast in a wide range of exposures. It is often associated with knotted wrack (Marine Life Information Network 2010).

Oarweed is normally restricted to subtidal habitats. This is a large plant, often reaching the water surface at low water, but the holdfast remains underwater at all times. Exceptions occur at very exposed sites where scattered small individuals may be found in the lower intertidal zone and may also be found in intertidal pools on exposed coasts. Horizontal distribution of oarweed is determined to a large extent by substratum type and salinity. In very sheltered sites the species can occur on an unstable substratum of gravel and small stones, but it is absent from muddy and sandy bottoms. In exposed sites, oarweed is restricted to hard rock substrata. This specie is absent from sites with salinities of less than approximately 20 parts per thousand (Doty et al. 1987). Irish moss extends from the littoral fringe to 20 meter below mean low water (MLW), depending on wave action, transparency, and other topographic conditions. Where present, this species is usually most abundant near MLW to the mid-subtidal zone, with varying densities and morphologies occurring throughout this gradient. Irish moss grows from a discoid holdfast on massive and stable outcrops (ledges), with substantially reduced populations on smaller rocks and sand/or sediment-covered rocks. This species grows most abundantly on semi-exposed coastal sites and is common in estuarine habitats, particularly where strong tidal currents occur (Doty et al. 1987).

Eelgrass, *Zostera marina*, is the only true marine SAV found in Long Island Sound. This SAV is a kind of seagrass, characterized as having linear, grass-like leaves and an extensive root and rhizome system. The ecological importance of eelgrass is derived from its productivity and the substantial habitat it creates. Eelgrass may form extensive meadows or patchy beds interspersed with bare areas, and the location of these beds can shift over time. In Long Island Sound, eelgrass is found at depth between 1.8 and 12 feet below MLW (Coastal Habitat Restoration 2003).

Historical information indicates that eelgrass was once common along the entire coastline of the Long Island Sound and in sheltered bays, harbors, rivers, and creeks (Figure 4.4-4). Beginning in 1931, eelgrass experienced a massive die-off all along the North Atlantic Ocean, where some areas were believed to have lost at least 90 percent or more of existing eelgrass populations (Coastal Habitat Restoration 2003). The wasting disease, *Labyrinthuyla macrocystis*, a fungus that attacks the leaf surfaces of eelgrass, was originally thought to be the primary cause of the catastrophic decline, but current research showed bacteria fungi, commercial harvesting of fishery organisms, pollution, and competing species might have also contributed to the decline of eelgrass beds (Coastal Habitat Restoration 2003). After the dramatic decline of eelgrass from 1931 to 1932, populations rebounded somewhat in the eastern Long Island Sound. Currently, eelgrass beds occur from the Rhode Island border at Stonington west to Clinton, Connecticut (Figure 4.4-5) (Coastal Habitat Restoration 2003), with none found in the New York waters of western Long Island Sound.

4.4.2.2 Potential Impacts and Mitigation

Aquatic plants in a lake or pond grow in an area known as the littoral zone, the shallow transition zone between dry land and the open water area of the lake. In the main body of the lake, the proposed construction activities in Lake Champlain will be within the deeper portions of the lake and generally a considerable distance from the shoreline; hence potential impacts to aquatic macrophytes in the northwest arm and main sections of Lake Champlain are expected to be negligible with no direct impacts occurring.

The southern section of Lake Champlain and the Champlain Canal are both narrow and shallow, thus limiting the amount of open water workspace for construction activities. The re-suspended sediment and turbidity from construction activities could potentially adversely affect aquatic vegetation through reduced photosynthesis by covering the leaf surface with fine silts or clay or reducing light penetration through the water column. The increase in turbidity and re-suspended sediments will be short-term and localized, and will be similar to periodic storm events and anthropogenic activities (e.g., boating, swimming, invasive plant removal) that occur within the lake and canal.

Direct impacts from water jetting, trench excavation and/or disturbance to the bottom from vessel anchors could affect the invasive Eurasian watermilfoil and the water chestnut that currently dominate the southern lake sections of Lake Champlain and the Champlain Canal. Currently there are BMPs implemented (i.e., mechanical and hand harvest, biological and drawdown controls) to control the spread of these invasive aquatic nuisance plant species, particularly the dense water chestnut mats in the southern lake sections of Lake Champlain where it has restricted boat traffic. Consultations with state agencies will be conducted prior to development of the EM&CP and BMPs will be implemented to minimize direct and indirect impacts to native species SAV beds. BMPs will also be employed to minimize the potential to cause further spread of invasive aquatic plant species.

Non-burial installation may be used where surficial geology, foreign pipeline or cable crossings, unavoidable bedrock areas and/or potential contaminated sediments do not permit cable burial (see Section 4.1). Non-burial installation will require the use of a protective covering, such as rip-rap or articulated concrete mats. At this time, impacts to SAV from non-burial installation are not anticipated. If any impacts to SAV are associated with non-burial installation, these areas will be identified and addressed in the EM&CP.

At landfall locations, HDD will be used for cable installation to avoid shallow water as the cable enters the river, avoiding or minimizing direct disturbance of any SAV beds that may be present. Construction activities will cause a slight increase in turbidity. However, the expected increase in turbidity from construction activities will be similar to periodic storm events and anthropogenic activities (e.g., boating, swimming, invasive plant removal) that occur within the Hudson River. Consultations with state agencies will be conducted prior to development of the EM&CP, and BMPs will be implemented to minimize impacts to SAV beds, as well as minimizing the amount of turbidity from construction activities.

During cable installation using HDD methods, there is the chance of a frac-out of drilling fluid. Frac-out refers to the inadvertent release of drilling fluid from the drill hole upwards through the sediment overburden with a release at the sediment water interface. In the event of a frac-out, the gelatinous drilling fluid will flow outward from the point of discharge and cover the bottom. Depending on currents or wave action, some of the deposited drilling fluid can become suspended or more dispersed. Drilling fluid is composed primarily of bentonite clay and water, if suspended, it may have similar adverse effects on SAV photosynthesis as described above for suspended sediments.

There are no SAV (i.e., eelgrass) in the Harlem River or the western portion of Long Island Sound, but the nearshore water of the Long Island Sound contains several species of macroalgae. The macroalgae in Long Island Sound have limited distribution since most species prefer calm, protected, and low energy zones. The macroalgae in Long Island Sound are also limited to the intertidal and lower littoral zones, as well as possessing a holdfast for growth on hard surface. The proposed cable route will be located in the deeper waters of Long Island Sound and will avoid construction through hard substrates. Therefore, the potential impacts from construction activities to SAV and macroalgae in Long Island Sound are expected to be negligible.

During the installation and construction of the cables, a number of vessels, including tugs, barges, cranes, and workboats will be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials; thus, the potential exists for an oil spill. BMPs and a SPCCP will be employed throughout construction and will be implemented in the case of a spill to limit the impacts from oil and fluid spills. The waters of the proposed cable route are also frequented by various vessels on a daily basis; therefore, the introduction of vessels to the area during the construction period will not significantly change the probability for an oil or fluid spill compared to the existing conditions.

During Project operation, the only potential impact to SAV will occur in the event of cable damage. In this instance, the cable will be excavated on either side of the repair location and cut, a replacement cable will be spliced in, and the cable will be reburied (see Section 4.1.2.1). The Project will employ an ERRP that will detail the activities, methods, and equipment involved in repair and maintenance work for the cable system. The impacts to any SAV in the vicinity will be similar to those described for the original installation, but much smaller in duration and extent. Because the cable does not contain a coolant fluid like certain other electric cables, there is no potential for fluid release in the event of a damaged cable.

4.5 WETLANDS AND WATER RESOURCES

This section provides a description of the surface and groundwater resources in the Project area. An overview of existing surface water resources, major watersheds, and state and federal regulations pertaining to surface waters along the entire transmission cable corridor is provided in Section 4.5.1. This section also includes an analysis of the existing freshwater resources, estuarine wetlands, and associated water quality along the underground portions of the Project route, including potential impacts and proposed mitigation methods. Portions of the Project evaluated as part of the underground route include: 1) the underground bypass routes to avoid Locks C12, C11, and C9 along the Champlain Canal in Washington County; 2) the approximate 69.9-mile underground bypass in Washington, Saratoga, Schenectady, and Albany Counties, to avoid interference with activities associated with the Upper Hudson River Polychlorinated Biphenyls (PCB) Dredging Project; 3) the Yonkers converter station area in Westchester County; and 4) the existing Sherman Creek substation in New York County.

A more detailed discussion of existing water quality and potential impacts for the underwater portions of the Project within Lake Champlain, the Champlain Canal, the Hudson River, East River, Harlem River, and Long Island Sound, is provided in Section 4.6 of this application. Existing groundwater resources for the entire Project route are described in Section 4.5.3, along with potential impacts and proposed mitigation.

4.5.1 Surface Waters and Freshwater Wetlands

Surface waters in the Project area include freshwater streams, rivers, lakes and ponds, freshwater tidal and brackish estuarine waters and wetlands, and the marine waters of Long Island Sound. Further information on the major surface waters traversed by the underwater portions of the Project corridor, including Lake Champlain, the Champlain Canal, the upper and lower Hudson River, Harlem River, East River, and Long Island Sound, is provided in Sections 4.6 and 4.7.

The Clean Water Act (CWA) regulates activities within jurisdictional waters of the United States, which include navigable waterways and their tributaries, bordering wetlands, and any other bordering or isolated waters with a significant nexus to other waterways, such that the use, degradation or destruction of those waters could affect interstate or foreign commerce. The USACE administers permitting and compliance under Section 404 of the CWA, which regulates discharge of dredged or fill material into waters of the United States. Construction of a transmission cable within navigable waterways, such as the Hudson River, Champlain Canal and Lake Champlain, additionally requires authorization from the USACE under Section 10 of the Rivers and Harbors Act of 1899. In accordance with Section 401 of the CWA, applicants under Article VII of the New York Public Service Law involving activities in jurisdictional Waters of the United States also must obtain a Water Quality Certificate (WQC) from the NYSPSC, indicating that the proposed activity will not violate water quality standards. Information on waterways and wetlands under federal jurisdiction is provided in Sections 4.5.1.1 and 4.5.1.3.

Freshwater wetlands in New York State are regulated under the Freshwater Wetlands Act (FWA), Article 24 of the Environmental Conservation Law and 6 New York Code of Rules and Regulations Part 663 (6 NYCRR Part 663). State jurisdictional wetlands in general must be at least 12.4 acres; however, New York State also has jurisdiction over smaller wetlands if they are deemed to have unusual local importance. In accordance with the FWA, the NYSDEC also regulates activities within the 100-foot Adjacent Area outside of the wetland boundary. Further information on existing state-regulated freshwater wetland areas is provided in Section 4.5.1.

The presence of wetlands and waterbodies in the Project area was initially determined through a review of available USGS 7.5-minute topographic mapping, NYSDEC wetlands mapping, National Wetlands Inventory (NWI) mapping, and/or aerial photography. NWI and NYSDEC wetlands along the Project route are depicted in Figure 4.5-1.

CHPEI retained HDR|DTA Engineering, Inc. (HDR|DTA) and TRC Environmental Corporation (TRC) to conduct environmental field investigations, including the identification of waterbodies and delineation of wetlands along the underground portion of the proposed transmission cable route. To date, field investigations have been conducted along 67 percent of the underground cable route. Surveys of wetlands and water resources were conducted between October 27 and December 3, 2009, for approximately 46.2 miles along the CP right-of-way and an additional 2.1 miles at the Lock C12 and C11 bypasses. The Wetland Delineation Report, including detailed information on wetlands and watercourses identified during field investigations is provided in Appendix C. Field reconnaissance at the Yonkers converter station site was conducted on September 9, 2009 (see Section 4.5.2). The remaining underground portions of the transmission cable corridor will be delineated in the spring of 2010, the information from which will be submitted in July 2010.

4.5.1.1 Existing Waterbodies

The existing waterbodies traversed by the Project are within the Lake Champlain, upper Hudson River, Mohawk River, lower Hudson River and Atlantic Ocean/Long Island Sound Basins. The underground portions of the proposed transmission cable corridor are primarily in the upper Hudson, Mohawk, and lower Hudson River Basins. The Yonkers converter station and the landfall connection to the converter station are also in the lower Hudson River Basin. The canal lock bypass segments and the northernmost portion of the underground route along the CP railroad right-of-way are in the Lake Champlain Basin. The Sherman Creek substation is within the Atlantic Ocean/Long Island Sound Basin in New York.

The underwater cable will be primarily buried in the bottom sediments of Lake Champlain, the Champlain Canal, the Hudson River, Harlem River, East River, and Long Island Sound. Detailed information on water quality, sediments, bathymetry, fisheries, and other environmental characteristics of these resources is provided in Sections 4.6 and 4.7 of this application. The remaining freshwater waterbodies that have been identified along the underground portion of the proposed transmission cable corridor are listed in Table 4.5-1. Waterbodies on this table were initially identified based on USGS 7.5-minute topographic mapping and aerial photography. Waterbodies crossed along the CP railroad right-of-way were confirmed during field surveys based on the presence of defined bed and banks and/or an observable ordinary high water mark (OHWM) caused by to erosion, destruction of terrestrial vegetation, or other defined features.

4.5.1.1.1 Water Quality

Freshwater and saline surface waters are classified by the NYSDEC under regulation 6 NYCRR Part 701 according to their designated best uses. New York State Water Quality Standards promulgated under 6 NYCRR Part 703 sets the required water quality criteria that must be met to support each of the best use, such as maximum coliform or minimum dissolved oxygen levels. Best uses include drinking water supply, primary and secondary contact recreation, fishing, and fish, shellfish and wildlife propagation. Table 4.5-1 lists the water quality classifications of waterbodies crossed along the underground portions of the transmission cable corridor. More detailed information on water quality in Lake Champlain, the Champlain Canal, Hudson River, East River, Harlem River and Long Island Sound is provided in Section 4.6.

Waterbodies that do not meet the criteria associated with their use classification are considered to be impaired. The NYSDEC maintains the Waterbody Inventory and Priority Waterbodies List (WI/PWL), a database that contains information on water quality, the ability of waters in New York State to support their use classifications, and known or suspected sources of contamination. The WI/PWL list is used to prepare the New York State Water Quality Report (Section 305(b) Report) and the 303(d) list of impaired waters, which are part of state water quality assessment requirements under the CWA. Major sources of water quality impairment in New York State include industrial and municipal point sources, nonpoint sources such as agricultural runoff, contaminated sediments, and stream bank erosion.

Based on the New York State WI/PWL (NYSDEC 2003; NYSDEC 2007a; NYSDEC 2008a; NYSDEC 2009b) and the Final 2008 303(d) list (NYSDEC 2008b), waterbodies along the underground transmission cable corridor with water quality impairments include Woods Creek and the Hudson River (main stem). Woods Creek and other minor tributaries to the Champlain Canal are listed as impaired due to dissolved oxygen and oxygen demand, excess nutrients (phosphorus), and pathogens. Municipal wastewater from Whitehall is a known source of contamination; agricultural runoff and stream bank erosion are suspected contributors. The main stem of the upper Hudson River is impaired due to sediments contaminated by PCBs, which is the focus of an ongoing dredging and cleanup project. Further information on PCBs in the Hudson River is provided in Section 4.6.

Several other waterbodies are included in the WI/PWL as having stress or minor impacts to water quality, although they are not considered impaired. North Fork Snook Kill, Snook Kill, Geyser Brook, tributaries to the Mohawk River, the Mohawk River Main Stem, Poentic Kill, Normanskill, Vly Creek and Coeymans Creek are waters crossed by the underground transmission cable corridor that may have minor water quality issues caused by factors such as urban runoff, agricultural runoff, erosion and/or municipal discharges.

4.5.1.1.2 Federal and State Designations

Three of the waterbodies along the proposed transmission cable corridor are included in the Nationwide Rivers Inventory (NRI). The NRI is a listing of river segments in the United States that are considered to possess one outstandingly remarkable natural or cultural values, which are judged to be of more than local or regional significance (NPS 2008). Kayaderosseras Creek and

Normanskill are both listed on the NRI for stream segments crossed by the underground transmission cable corridor. Kayaderosseras Creek is crossed along the CP railroad right-of-way near Ballston Spa. The Project corridor crosses Norman's Kill along the CSX railroad right-of-way near Albany. Both of these streams are listed on the NRI for outstanding recreational value, due to their proximity to urban centers in Albany, Saratoga and Schenectady, and their diversity of flow gradients, which includes Class IV rapids (NPS 2008).

The underwater cable corridor crosses several NRI-listed segments of the Hudson River, in portions of Ulster, Columbia, Dutchess and Greene Counties. NRI segments of the Hudson are designated for their exceptional historic value, hydrologic value as free-flowing, sparsely developed areas of the Hudson River Corridor, and significant fish habitat.

No river segments along the Project route are protected as New York State Wild, Scenic and Recreational Rivers (NYSDEC 2010c).

4.5.1.1.3 Fisheries

Freshwater rivers, streams, lakes and ponds along the underground portion of the cable corridor support both warmwater and coldwater fisheries. Some of these streams are designated as coldwater trout streams or trout spawning areas under New York State Water Quality Standards, including North Branch Snook Kill, tributaries to Delegan Brook, tributaries to Putnam Brook, Geyser Brook, tributaries to Alplaus Kill, tributaries to the Mohawk River, tributaries to Normanskill, and Vly Creek. While these water quality designations do not necessarily mean that trout habitat is present, it is likely that some waterbodies crossed by the Project do support coldwater fish communities. Coldwater fisheries typically require cool, clean water below 72°F. Most other perennial waterbodies along the Project route contain warmwater fisheries. Smaller intermittent and ephemeral streams identified along the transmission cable corridor are unlikely to have significant fish populations. Detailed information on fisheries along the underwater transmission cable route is provided in Section 4.7.

Species typical of warmwater fish communities that may be present in streams crossed by the proposed underground transmission cable route include largemouth bass (*Micropterus salmoides*), brown bullhead (*Ameiurus nebulosus*), fallfish (*Semotilus corporalis*), creek chub (*Semotilus* atromaculatus), golden shiner (*Notemigonus crysoleucas*), fathead minnow (*Pimephales promelas*), yellow perch (*Perca flavescens*), trout-perch (*Percopsis omniscomaycus*), pumpkinseed (*Lepomis gibbosus*) and northern pike (*Esox lucius*). Coldwater fisheries may have resident brook trout (*Salvelinus frontalis*), lake trout (*Salvelinus namaycush*), brown trout (*Salmo trutta*) and/or rainbow trout (*Oncorhynchus mykiss*) (NYSDEC 2010d), as well as other cold water tolerant species such as smallmouth bass (*Micropterus dolomieu*).

Ballston Lake and the surrounding area in Saratoga County are mapped by the NYSDEC as a warm water fish concentration area. Although the underground transmission cable corridor does not cross Ballston Lake itself, several tributaries to Ballston Lake are crossed just upstream. Ballston Lake is listed by the NYSDEC as a location for carp (*Cyprinus carpio)* fishing (NYSDEC 2010e).

4.5.1.2 Existing Floodplains

Most of the Project will be located along existing waterways in Lake Champlain, the Champlain Canal, Hudson River, East River, Harlem River and Long Island Sound. Where underground bypass routes are required, the Project will cross floodplains associated with major river and stream crossings. The Federal Emergency Management Agency (FEMA) is responsible for mapping and delineating floodplains and determining the flood risk for susceptible areas. A 100-year floodplain is determined based on the area with approximately 1 percent or greater probability of flooding per year and corresponds to the FEMA Zone A.

CHPEI reviewed FEMA Flood Insurance Rate Mapping (FIRM) for Saratoga, Albany and Westchester Counties, as well as the individual FIRMs for the Towns of Fort Ann, Kingsbury, Whitehall, Fort Edwards and Rotterdam, the Villages of Fort Ann and Fort Edwards, and the City of Schenectady.

In Washington County, the portions of the Champlain Canal Lock C12, C11 and C9 bypasses will be located in the floodplain of the Champlain Canal/Barge Canal. The Lock C9 bypass will also cross floodplain associated with Woods Creek. The portions of the underground bypass routes along the CP and CSX railroad rights-of-way will cross FEMA-mapped floodplains associated with the Champlain Canal, the Hudson River, North Branch Snook Kill, Snook Kill, Putnam Brook, Geyser Brook, Kayaderosseras Creek, Mourning Kill, Ballston Lake, the Mohawk River, Poentic Kill, Normanskill, an unnamed tributary to Normanskill and Black Creek.

The underground connection to the Yonkers converter station will cross bordering floodplain along the Hudson River at the landfall location. The Yonkers converter station site itself is not located in a mapped floodplain. Portions of the Sherman Creek East substation site and the underground connection to the substation are located in floodplain associated with the Harlem River in New York City.

4.5.1.3 Existing Freshwater Wetlands

Freshwater wetlands in the vicinity of the Project were initially identified based on USGS 7.5-minute topographic mapping, NWI mapping, NYSDEC freshwater wetlands mapping and aerial photography (Figure 4.5-1). Wetlands crossed along the CP railroad right-of-way were also field delineated according to the Federal Routine Determination Method presented in the USACE Wetlands Delineation Manual (USACE 1987). The Wetland Delineation Report, including detailed information on wetlands and watercourses identified during field investigation, is provided in Appendix C. Most wetlands and waterbodies that have been identified in the Project area regulated are under both federal USACE and NYSDEC jurisdiction; however, because the NYSDEC primarily regulates mapped wetlands at least 12.4 acres in size, some smaller wetlands along the Project corridor may not be jurisdictional under the New York FWA. Both USACE jurisdictional and New York State jurisdictional wetlands have been considered by the CHPEI in the assessment of impacts to wetland resource areas.

Under the New York FWA, wetlands are classified into one of four classes, with Class I representing the most beneficial and Class IV representing the least beneficial. These classifications are made based on a variety of criteria, including but not limited to special ecological associations, threatened or endangered species, hydrology of adjacent waterbodies, the presence or absence of invasive species, wildlife, cultural significance, aesthetics and landscape features. The underground transmission cable corridor crosses NYSDEC wetlands in all four classes.

4.5.1.3.1 Wetland Community Types

The *Classification of Wetlands and Deepwater Habitats of the United States* (Cowardin et al. 1979) describes a hierarchical method of classification for wetlands and waterbodies. Under the Cowardin classification, all wetlands and deepwater habitats belong to one of the following major systems: marine, estuarine, riverine, lacustrine, or palustrine. Vegetated freshwater wetlands and small ponds are classified as part of the palustrine system. Within the palustrine system, vegetated wetlands may be dominated by emergent, scrub-shrub, or forested vegetation; all others are generally classed as open water wetlands. Palustrine wetland communities in New York State are described in further detail by Edinger et al. (2002).

Table 4.5-2 provides a list of the wetlands that have been identified along the transmission cable corridor. Along the CP railroad right-of-way, where field delineation has been conducted, wetland boundaries from the field data have been used to calculate potential impacts to wetlands from construction of the Project. In other locations, such as along the CSX railroad right-of-way and at the Lock C9 bypass, NYSDEC wetland maps (Exhibit 2 Figure 2.1-3) have been used to estimate potential wetland impacts. Wetland mapping will be updated once field delineations are completed along the CSX railroad right-of-way in the spring of 2010 which will be provided as part of the supplemental information to be submitted in July 2010.

Palustrine Emergent Wetlands

The palustrine emergent (PEM) wetland cover type is characterized by erect, rooted, herbaceous hydrophytes, excluding mosses and lichens (Cowardin et al. 1979). Freshwater emergent wetlands observed or likely to occur along the transmission cable corridor consist of shallow emergent marshes, deep emergent marshes, and sedge meadows. Wetlands in disturbed, human-impacted environments may consist primarily of reedgrass/purple loosestrife marshes. PEM wetlands may occur as a single dominant wetland cover type, or may be co-dominant with other wetland types. In such cases, emergent wetlands may naturally grade into shrub swamps or else they may exist within maintained areas, such as rights-of-way, that are located directly adjacent to unmaintained forested or shrub swamps.

Shallow emergent marshes occur on mineral soils or deep muck soils that are permanently saturated and seasonally flooded. Water depths range from 6 inches to 3.3 feet during flood stages (Edinger et al. 2002). Characteristic vegetation of shallow emergent marshes within the Project area includes bluejoint grass (*Calamagrostis canadensis*), smartweeds (*Polygonum* spp.), cattails (*Typha* spp.), sedges (*Carex* spp.), goldenrods (*Solidago* spp.), spotted joe-pye-weed (*Eupatorium maculatus*), reed canary grass (*Phalaris arundinacea*), scouring rush (*Equisetum* *hyemale*), sensitive fern (*Onoclea sensibilis*), and soft rush (*Juncus effusus*). Invasive species observed within the shallow emergent marshes include common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*).

Deep emergent marshes occur on mineral soils or fine-grained organic soils with water depths ranging from 6 inches to 6.6 feet (Edinger et al. 2002). Emergent vegetation observed within deep emergent marshes in the Project survey area includes cattails, bur-weeds (*Sparganium* spp.), bulrushes (*Scirpus* spp.), and bluejoint grass. Common reed and purple loosestrife have also been observed within some the deep emergent marshes along the transmission cable route.

Reedgrass/purple loosestrife marshes consist of disturbed marshes where common reed or purple loosestrife has become dominant (Edinger et al. 2002). This community commonly occurs within ditches along the rail bed, as well as within other disturbed areas adjacent to the railroad rights-of-way.

Palustrine Scrub-Shrub Wetland

The scrub-shrub (PSS) wetland cover type includes areas that are dominated by saplings and shrubs that are less than 20 feet tall (Cowardin et al. 1979). PSS wetlands observed in the Project area are classified by Edinger et al. (2002) as shrub swamps, dominated by silky dogwood (*Cornus amomum*), gray dogwood (*Cornus foemina ssp. racemosa*), red osier dogwood (*Cornus sericea*), honeysuckle (*Lonicera* spp.), and speckled alder (*Alnus incana* ssp. *rugosa*). Other vegetation observed includes willows (*Salix* spp.), meadowsweet (*Spirea latifolia*), highbush blueberry (*Vaccinium cormybosum*), winterberry (*Ilex verticillata*), spicebush (*Lindera benzoin*), elderberry (*Sambucus canadensis*), gray birch (*Betula populifolia*), wild raisin (*Viburnum cassinoides*) and northern arrowwood (*Viburnum recognitum*). Some PSS wetlands were dominated by invasive species, including dense stands of honeysuckle (*Lonicera* spp.) and/or buckthorn (*Frangula alnus* and/or *Rhamnus cathartica*). PSS wetlands may occur as a single dominant wetland cover type, or as co-dominant with PEM or forested wetlands when these other plant community types exist within areas of the wetland.

Palustrine Forested Wetland

Forested wetland (PFO) cover types are dominated by trees and shrubs that have developed a tolerance to a seasonal high water table. In order to be characterized as forested, a wetland must be dominated by trees and shrubs that are at least 6 meters tall (Cowardin et al. 1979). Forested wetlands typically have a mature tree canopy, and depending upon the species and density, can have a broad range of understory and groundcover community components. Forested wetland communities along the transmission cable route include primarily red maple-hardwood swamps and floodplain forests (Edinger et al. 2002). PFO wetlands may occur as a single dominant wetland cover type or as co-dominant wetland type when PSS or PEM areas also exist within the wetland.

Red maple-hardwood swamps occur in poorly drained depressions, usually on inorganic soils. Red maple (*Acer rubrum*) is either the only dominant tree species, or is co-dominant with one or more hardwoods (Edinger et al. 2002). Hardwood species observed along the transmission cable corridor in red maple swamps include green ash (*Fraxinus pennsylvanica*) and black ash (*Fraxinus nigra*), American elm (*Ulmus americana*), northern red oak (*Quercus rubra*), and white pine (*Pinus strobus*). Shrubs species commonly observed within red maple-hardwood swamps in the Project survey area include dogwoods, honeysuckles, speckled alder, and American hornbeam (*Carpinus caroliniana*). The herbaceous layer typically includes sensitive fern, cinnamon fern (*Osmunda cinnamomea*), tussock sedge (*Carex stricta*), goldenrods, reed canary grass, and royal fern (*Osmunda regalis*). Invasive species observed within red maple-hardwood forests included honeysuckle, buckthorn, and reed canary grass.

Floodplain forests typically occur on mineral soils on low terraces of river floodplains and river deltas (Edinger et al. 2002). Tree species observed within this community type in the Project survey area include green ash, cottonwood (*Populus deltoides*), red maple, silver maple (*Acer saccharinum*), American elm, box elder (*Acer negundo*), shagbark hickory (*Carya ovata*), burr oak (*Quercus macrocarpa*) and swamp white oak (*Quercus bicolor*). Shrubs included dogwoods, speckled alder, honeysuckle, American hornbeam, and buttonbush (*Cephalanthus occidentalis*). Sensitive fern, cinnamon fern, goldenrods, ostrich fern (*Matteuccia struthiopteris*), horsetails (*Equisetum* spp.), and sedges are characteristic of the herbaceous layer. Invasive honeysuckles and buckthorn were commonly observed in floodplain forests along the transmission cable route.

Palustrine Open Water

Besides vegetated wetlands, a few scattered small ponds are located along the transmission cable route, adjacent to the railroad right-of-way. These wetland areas are characterized by a vegetation cover of less than 30 percent, although there may often be emergent or shrubby vegetation bordering the open water areas. Ponds along the transmission cable route may also have submerged vegetation, including such plants as pondweeds (*Potamogeton* spp.), water milfoils (*Myriophyllum* spp.), naiad (*Najas flexilis*), water lobelia (*Lobelia dortmanna*) and bladderworts (*Utricularia* spp.) (Edinger et al. 2002). Pond substrates may be silt, mud, cobble or sand.

4.5.1.3.2 Buffer Zones

In addition to wetlands, the FWA also provides protection for a 100-foot Adjacent Areas to provide a buffer zone to freshwater wetlands. For most wetlands along the transmission cable route, the Adjacent Area largely consists of the railroad bed, embankment and disturbed area alongside the railroad. Other ecological communities that may be within the Adjacent Area are described in detail in Section 4.4.

4.5.1.4 Potential Impacts and Mitigation

Construction and operation of the Project will result primarily in temporary impacts to wetlands and waterbodies along the underground portions of the transmission cable route, including the CP and CSX railroad rights-of-way and Champlain Canal lock bypasses. This may include both direct impacts, where the edge of the cleared construction corridor traverses a wetland or riparian area, and indirect impacts from vegetation clearing and ground disturbance in adjacent uplands.

In some instances, permanent conversion of forested wetland to scrub-shrub wetland may occur in those areas where vegetation management is needed during operation. CHPEI will develop a Vegetation Management Plan as part of the EM&CP. Freshwater wetlands and water resources were not identified at the Yonkers converter station site or the Sherman Creek substation site; therefore, these aboveground facility sites will not be evaluated further in this section.

The construction sequence along the proposed underground transmission cable route will typically consist of site preparation and vegetation clearing within the construction corridor, followed by the excavation of a trench approximately 3 feet deep and up to 9 feet wide. Erosion and sediment controls will be installed, as needed, prior to construction. During construction spoil will be stored within the construction corridor immediately adjacent to the trench, or within designated extra work areas. Construction equipment will typically operate from the railroad track, or from the access road adjacent to the track. Once a trench is excavated, the cable will be laid and the trench will be backfilled with native spoil material. Any excess spoil will be removed from the right-of-way and disposed of properly offsite. Following construction, CHPEI will conduct final grading to restore original contours, as needed, and will seed disturbed areas with a temporary seed mix to stabilize soils and establish vegetation cover. Further details on construction methods are provided in Section 4.1. Potential impacts and mitigation for water quality and fisheries of the major waterbodies affected by underwater cable construction are detailed in Sections 4.6 and 4.7, respectively.

4.5.1.4.1 Waterbodies

Waterbody crossings along the railroad rights-of-way will typically be constructed by trenching across the waterbody, followed by the restoration of the bed and banks. Intermittent and ephemeral streams may be dry or may have very low flow at the time of crossing. For these crossings, CHPEI will excavate an open cut through the stream without any isolation of the stream flow. Where perennial or other significant stream flows are present, CHPEI may use a dry-ditch method to isolate the work area from the flow of water. These dry-ditch crossings will typically be completed by installing cofferdams upstream of the work area, and either pumping water around the construction area, or diverting the stream flow into one or more flume pipes. In some cases, large waterbodies may be crossed by the HDD method, which allows installation without trenching or other surface disturbance. Alternately, where a large waterbody is crossed by a railroad bridge, the cables may be placed aboveground along the railroad trestle.

During construction, potential short-term effects on water quality may be caused by localized increases in turbidity and downstream sedimentation resulting from trenching and disturbance within the waterbody. Sediment may also be introduced into waterbodies due to runoff of sediment-laden stormwater from adjacent construction areas and/or soil stockpiles. Increased turbidity has the potential to reduce light levels in aquatic habitats and may result in temporary changes to water chemistry, including effects on pH and dissolved oxygen. Reduced dissolved oxygen levels result if lowered light levels decrease the oxygen production of photosynthetic organisms, and/or biochemical oxygen demand is increased by sedimentation. Fish and other mobile organisms are expected to avoid localized areas that are temporarily impacted by construction, but less mobile or sessile aquatic organisms may be adversely affected by changes in water quality.

Water quality impacts will be minimized by using construction techniques like HDD in some areas and by immediately restoring and stabilizing the streambed and banks once construction is completed. At crossings with significant stream flows, the use of dry-ditch crossing methods instead of open cut methods reduces potential impacts from turbidity and sedimentation, because disturbed sediments within the construction area do not become re-suspended. Long-term impacts on water quality or on aquatic organisms are not anticipated. Water quality and other stream attributes should return to pre-construction conditions within a short period after restoration of the bed and banks.

To avoid increases in erosion and sedimentation into waterbodies from land disturbance in nearby construction areas, CHPEI will install temporary and permanent erosion control measures along the construction corridor and adjacent to soil stockpiles, as needed, and will manage construction stormwater in accordance with the SWPPP for the Project. A SWPPP will be prepared prior to construction as part of permitting and compliance under the SPDES.

Some disturbance or clearing of riparian vegetation adjacent to waterbodies within the construction corridor may be required to conduct trenching and cable installation activities. Clearing of vegetation along stream banks has the potential to reduce the bank stability and increase erosion. Adverse impacts will be minimized through the use of temporary and permanent erosion control measures, and by restoring, stabilizing and seeding stream banks as soon as possible once construction is completed.

Impacts to surface water quality can also result from accidental leaks or spills of oil, petroleum and/or other hazardous materials during refueling or maintenance of vehicles and equipment. Spills or leaks of oil, fuel or hazardous materials have the potential to impact waters outside of the immediate construction area, if these substances are carried by surface waters, stormwater runoff, or groundwater. Additionally, although use of the HDD methods usually avoids impacts at waterbody crossings, HDDs require the use of drilling fluid, and occasionally this can result in the potential for an inadvertent release of drilling fluid to surface waters (frac-out).

To minimize impacts from accidental leaks and spills, construction crews will have onsite sufficient supplies of absorbent and barrier materials to contain and clean up hazardous materials in the event of a spill. To reduce the likelihood of a spill, CHPEI will avoid storing hazardous materials, chemicals or lubricating oils, refueling vehicles and equipment, or parking vehicles overnight within 100 feet of the edge of a waterbody or wetland, unless no reasonable alternative is available.

Impacts from operation of the transmission cables will be limited to periodic maintenance and/or repair activities. Trenching or excavation may be occasionally required near waterbodies to conduct repairs. These activities will be conducted in accordance with the ERRP and any applicable state, federal and local permits and conditions.

4.5.1.4.2 Floodplains

Although temporary clearing, ground disturbance and construction activity will occur within floodplains, since the transmission cables will be installed belowground, no impacts to flood storage are anticipated. No permanent aboveground alterations or new impervious surfaces that could potentially impact flood storage, infiltration, or flooding hazard will be associated with the underground transmission cable. The new proposed Yonkers converter station will not be located within floodplain, and upgrades to the Sherman Creek substation will be within the existing footprint and will not result in any new fill or other impacts that will affect flood storage capacity. The proposed 0.5 acre transformer substation that will be located near the existing Sherman Creek substation will likely be outside mapped floodplains; if within floodplain, it will be designed to avoid impacts to flood storage.

4.5.1.4.3 Freshwater Wetlands

Based on the field delineations, approximately 11.32 acres of wetland will be temporarily impacted within the construction corridor along the underground portions of the Project route. Of the 11.32 acres, approximately 1.4 acres has been identified as forested wetland. Based on NYSDEC freshwater wetlands mapping, an additional 0.3 acre of wetland impact is estimated along the CSX railroad right-of-way. Field delineations for those areas not previously field surveyed will be conducted in the spring of 2010 and will be included with the supplemental information to be submitted in July 2010. Wetlands identified along the transmission cable route are listed in Table 4.5-2, including the estimated acreages affected. No fill or permanent alteration to wetlands will result from the Project and it is anticipated that wetland hydrology, vegetation, and water quality will return to pre-construction conditions in most areas following restoration of the construction area. However, in a select few areas, forested wetland cover may be converted to a scrub-shrub community as part of the CHPEI Vegetation Management Plan. During operation of the Project, activities associated with this plan will be restricted to vegetation clearing on an as-needed basis to conduct repairs or maintenance along the transmission cables and/or selective cutting to prevent the establishment of large trees directly over the cables. The use of herbicides for construction and maintenance of the cables is not anticipated at this time. CHPEI will develop a Vegetation Management Plan as part of the EM&CP. Any vegetation management activities currently conducted by the railroads within the right-of-way will continue following the construction and operation of the underground transmission cable.

The construction sequence in wetlands will generally be similar to upland construction, and will include site preparation, vegetation clearing, installation of erosion and sediment controls, trenching, backfilling, and corridor restoration. During construction, wetlands will be temporarily impacted by vegetation clearing and alteration of wetland habitats within the construction corridor. Land disturbance within and adjacent to wetlands may also result in temporary, localized changes to wetland hydrology and water quality. Localized increases in turbidity within the wetland may occur due to ground disturbance within the wetland.

Erosion and sediment-laden stormwater runoff from disturbed areas or spoil piles in immediately adjacent uplands have the potential to affect water quality in wetlands. To minimize these impacts, CHPEI will install and maintain erosion control barriers between upland construction areas and wetlands as necessary to prevent sedimentation into wetlands. CHPEI will manage construction stormwater in accordance with the SWPPP for the Project. A SWPPP will be prepared prior to construction as part of permitting and compliance under the SPDES.

During construction, spoil will be stored within the construction corridor immediately adjacent to the trench or within designated extra work areas. To the extent possible, CHPEI will avoid storing spoil within wetlands; however, due to the space constraints along the railroad right-of-way, it is anticipated that some spoil storage in wetland areas may be required. In these areas, soil will be temporarily stockpiled on construction matting or geo-textile fabric to be used to backfill the trench. Any excess spoil will be removed from the right-of-way and disposed of properly offsite. CHPEI will segregate topsoil in wetlands, except when standing water or saturated soils are present, to prevent the mixing of topsoil with subsoil. This facilitates wetland revegetation by maintaining physical and chemical characteristics of the surface soil and preserving the native seed bank.

If heavy vehicles and equipment operate within wetlands, soils could be impacted by compaction and rutting, which may affect hydrology and interfere with revegetation success. Potential impacts to wetland soils are variable depending on the site-specific conditions present at the time of construction, including the water levels, the degree of soil saturation, and the bearing capacity of the soils. In general, CHPEI anticipates that construction equipment will operate primarily from the railroad bed, railroad access road, embankment or other upland areas. If any construction equipment needs to operate within saturated wetlands that are likely to be affected by soil compaction or rutting, based on conditions at the time of construction, CHPEI will use equipment mats or low-ground-pressure tracked vehicles to minimize impacts to wetland soils. If dewatering is required within the excavated trench, water will be discharged to a well-vegetated upland area, a properly constructed dewatering structure, or a filter bag.

Original surface hydrology in disturbed wetland areas will be re-established by backfilling the trench and grading the surface to original contours, as needed. CHPEI will seed the right-of-way to establish temporary cover and stabilize soils. Wetlands will then be allowed to revegetate naturally. Wetlands will be backfilled with native wetland soils that were segregated during construction to speed recruitment of existing native wetland vegetation from the seed bank. Emergent wetland vegetation is expected to return quickly following construction and woody species will return more slowly. Forested wetlands, where not maintained, are expected to go through several stages of successional vegetation before returning to the pre-construction vegetation cover type. To assist in the recovery of woody species, CHPEI will avoid removing roots and stumps in cleared areas outside of the cable trench, unless required for safety, in order to allow resprouting of woody species.

Prior to construction, CHPEI will obtain permits from USACE under Section 10 for the Rivers and Harbors Act and Section 404 of the CWA. Additional mitigation for impacts to wetlands, if required, will be determined during the permit application process in consultation with USACE and NYSDEC. The Project will be constructed in accordance with state and federal permits and any applicable permit conditions.

4.5.2 Tidal and Estuarine Wetlands

Tidal and estuarine wetlands along the transmission cable route were identified on the basis of USGS 7.5-minute topographic mapping, NWI mapping, NYSDEC tidal wetlands mapping (Figure 4.5-1) and aerial photography. Tidal and estuarine wetlands include fresh, brackish and saline wetlands that occur primarily along the lower Hudson River, Harlem River, East River, and Long Island Sound.

4.5.2.1 Existing Estuarine/Tidal Wetlands

Tidal and estuarine wetlands in New York are regulated under the Tidal Wetlands Act and its implementing regulations (6 NYCRR 661). The NYSDEC (NYSDEC 2010f) classifies tidal wetlands into the following categories:

- **Coastal shoals, bars and mudflats**, defined as the tidal wetland zone that at high tide is covered by saline or fresh tidal waters, at low tide is exposed or is covered by water to a maximum depth of approximately one foot, and is not vegetated.
- **Littoral Zone**, defined as the tidal wetland zone that includes all lands under tidal waters which are not included in any other category.
- **Formerly Connected**, defined as the tidal wetland zone in which normal tidal flow is restricted by man-made causes. *Phragmites* spp. is the dominant vegetation.
- **Vegetated Coastal Shoals, Bars, and Mudflats**, defined as the tidal wetland zone that at high tide is covered by saline or fresh tidal waters, at low tide is exposed or is covered by water to a maximum depth of approximately one foot, and is vegetated.
- **Broad-Leaf Vegetation**, defined as the vegetated tidal wetland zone that includes all lands that generally receive a daily flushing from fresh tidal water. This area is generally lower than the graminoid vegetation area and is characterized by broad leaf emergent vegetation.
- **Intertidal Marsh**, defined as the vegetated tidal wetland zone lying generally between average high and low tidal elevations in saline waters. The predominant vegetation in this zone is low marsh cordgrass (*Spartina alterniflora*).
- **Fresh Marsh**, defined as the tidal wetland zone primarily in the upper tidal limits of the tidal zone. Species normally associated with this zone include narrow-leaved cattail (*Typha angustifolia*), tall brackish water cordgrass (*Spartina pectinata*), and the more typically emergent fresh water species.
- **Graminoid Vegetation**, defined as the tidal wetland zone that includes all lands that receive at least periodic flushing from fresh water. This area is generally higher than the broad leaf vegetation area. The lower elevated portions of this area may receive daily flushing and the higher elevations periodic flushing from storm tides. It is characterized by graminoid vegetation such as cattail.

- **High Marsh**, defined as the normal upper most tidal wetland zone usually dominated by salt meadow grass and spike grass. This zone is periodically flooded by spring and storm tides and is often vegetated by low vigor (*Spartina alterniflora*) and seaside lavender (*Limonium carolinianum*). Upper limits of this zone often include black grass (*Juncus gerardi*) and chairmaker's rush (*Scirpus* spp.) marsh elder (*Iva frutescens*) and groundsel bush (*Baccharis halimifolia*).

- **Swamp Shrub**, defined as all land that receives periodic inundation from tidal fresh waters. Characterized by shrubs such as alder (*Alnus* spp.), buttonbush (*Cephalanthus occidentalis*) and bog rosemary (*Andromeda glaucophylla*).

- **Swamp Tree**, defined as all land that receives periodic inundation from tidal fresh waters and is characterized by trees such as red maple (*Acer rubrum*) and willows (*Salix* spp.)

- **Fern Marsh**, defined as all land that receives periodic inundation from tidal fresh waters. Characterized by ferns such as cinnamon fern (*Osmunda cinnamomea*) and sensitive fern (*Onoclea sensibilis*).

- **Dredged Spoil**, including all areas of fill material.

- **Dead Tree Area**, defined as areas where dead trees are dominant

- **Default Area**, including all areas awaiting classification into one of the above categories.

In addition to the above categories, all tidal wetlands have an Adjacent Area that extends 300 feet or up to an elevation of 10 feet from the landward edge of the tidal wetland (NYSDEC 2010f).

Tidal wetlands in New York are mapped as part of the New York State Official Tidal Wetlands Inventory. Figure 4.5-1 depicts the mapped tidal wetlands along the transmission cable route. In general, tidal wetlands in the Project area occur along the Hudson River south of the CSX railroad landfall in Albany County, the Harlem River, East River, and Long Island Sound. Tidal wetlands along the Hudson River north of Poughkeepsie are freshwater (NYSDEC 2010g). Further south, tidal wetlands may be freshwater to brackish. Conditions depend on the location of the salt front, which fluctuates based on the variable flow volume of the Hudson River (see Section 4.6 for a more complete description of the Hudson River Estuary).

The landfall for the transmission cables south of Albany (from the Hudson River to the CSX railroad) crosses mapped tidal wetland areas containing broad-leaved and graminoid vegetation. The proposed transmission cable corridor also crosses the Adjacent Area to these freshwater wetlands and subtidal open water within the Hudson River. The presence of mapped unmapped tidal wetlands at this landfall will be investigated when wetland delineation is completed along the CSX railroad corridor in the spring of 2010. CHPEI has proposed the use of the HDD method to construct landfalls from the proposed underwater cable route, which is expected to avoid impacts to freshwater tidal wetlands at this location.

The underwater corridor in the Hudson River, East River, and Harlem River and Long Island Sound is almost entirely located along tidal areas mapped by the NYSDEC as open water or littoral zone. In general, CHPEI intends to avoid direct impacts to vegetated and intertidal wetlands, such as mudflats and saltmarsh, along the underwater cable route by constructing within the subtidal zone and using HDD methods at all landfall locations. The underwater cable route along the Hudson River north of Yonkers travels within 150 feet of areas of mapped freshwater broad-leaved vegetation, coastal shoals, bars and/or mudflats, from approximate MPs 204 to 208, 210 to 213 and 216 to 217. No significant areas of marsh or mudflat are present at the landfall connections to the Yonkers converter station or the Sherman Creek substation; mapped NYSDEC tidal wetlands crossed in those areas are littoral zone and Adjacent Area. The Yonkers converter station and the Sherman Creek substation are both located within mapped Adjacent Area that contains generally urban existing land use. However, an area of coastal shoals, bars and mudflats is located along the Hudson River just south of the Sherman Creek substation site.

The Hudson River National Estuarine Research Reserve is an important tidal wetland research facility located along the underwater cable route in the lower Hudson River. The research facility consists of four tidal wetland sites on the Hudson River Estuary including Stockport Flats in Columbia County, Tivoli Bay in Dutchess County, and Piermont Marsh and Iona Island in Rockland County. These areas provide critical habitat for a number of natural communities and serve as an important spawning and nursery ground for anadromous and freshwater fish.

4.5.2.2 Potential Impacts and Mitigation

The Project has been designed to avoid impacts to tidal and estuarine wetlands to the extent feasible by installing the underwater portions of the transmission cables within the deeper subtidal zones and by using HDD construction methods for all landfall locations. The proposed transmission cable corridor is located near the Hudson River National Estuarine Research Reserve but the cables will be located within the subtidal zone in this area; therefore, no adverse impacts to important vegetated wetland or intertidal habitats are anticipated.

In addition, CHPEI has proposed to cross freshwater tidal habitats between the Hudson River and the CSX railroad right-of-way using the HDD method, avoiding surface impacts to tidal wetlands at this location. Other cable landfall locations at the Yonkers converter station and the Sherman Creek substation will also be installed using the HDD method.

Although use of the HDD method for cable installation will generally reduce surface impacts to any wetland habitats that may be crossed, there is the chance of a frac-out during HDD operations. Depending on currents or wave action, some of the deposited drilling fluid can become suspended or more dispersed, with potential impacts on water quality in any nearby tidal or estuarine wetlands.

Impacts to tidal wetlands adjacent to the underwater transmission cable corridor in the Hudson River could also occur if any water quality impacts are associated with underwater cable installation. Water jetting or trenching techniques will result in the resuspension of sediments, with temporary localized increases in turbidity. In any areas where sediments are contaminated, this could result in pollutants entering the waterbody. Where tidal wetlands are located near the cable construction, any re-suspended contaminated sediments could enter the adjacent wetlands. Water quality could also be affected in the event of an accidental spill or leak from barges or vessels. An SPCCP will be developed for the Project which will contain BMPs to minimize risk of a spill or leak during construction and mitigation methods to be implemented in the case of a spill, to limit the potential water quality impacts. Impacts to water quality from underwater cable installation techniques, as well as proposed mitigation, is discussed in further detail in Section 4.6.

Prior to construction, CHPEI will obtain permits from the USACE under Section 10 for the Rivers and Harbors Act and Section 404 of the CWA. Additional mitigation for temporary impacts to wetlands, if required, will be determined during the permitting process in consultation with USACE and NYSDEC. The Project will be constructed in accordance with state and federal permits and permit conditions.

4.5.3 Groundwater

4.5.3.1 Existing Groundwater Resources

Along the underground portion of the Project route, groundwater is found in unconsolidated deposits of sand and gravel (surficial geology) and bedrock formations (see Section 4.3 for geologic resources). Aquifer recharge occurs from precipitation directly on the land, by seepage from the tributary streams, rivers, and lakes flowing across the aquifer, by subsurface flow from the till on the sides of the valleys, and by seepage from bedrock and deposits of low permeability adjacent to the aquifers.

In New York State, to enhance regulatory protection in areas where groundwater resources are most productive and most vulnerable, the New York State Department of Health (NYSDOH) identified 18 Primary Water Supply Aquifers (also referred as Primary Aquifers). These are defined as “highly productive aquifers presently utilized as sources of water supply by major municipal water supply systems”. No primary water supply aquifers were identified along the Project route.

The transmission cable route and aboveground facility locations were evaluated for the presence of sole-source aquifers. As defined by USEPA, a sole source aquifer is one which supplies at least 50 percent of the drinking water consumed in the area overlying the aquifer. These areas have no alternative drinking water source which could physically, legally, and economically supply all those who depend upon the aquifer for drinking water. No sole source aquifers were identified along the Project route or at aboveground facility locations.

4.5.3.2 Potential Impacts and Mitigation

Groundwater resources will not be adversely affected as a result of the Project. If groundwater is encountered during construction, de-watering methods will be incorporated to minimize impacts including discharging to well-vegetated upland areas and using properly constructed dewatering structures or filter bags. Site restoration techniques, such as soil compaction (addressed in Section 4.3), will prevent any localized impacts to groundwater recharge.

HDD will be used for transmission cable installation at some locations. This common technology is used to minimize environmental impacts for sensitive resource areas. As HDD is a trenchless method for installing conduit cable products, it is a preferred technology at many locations because surface disruption and earth removal is minimized. Dewatering and the subsequent management of groundwater is typically not required with this installation technique.

As part of the HDD process, pre-planning is an initial step. As part of pre-planning, locations will be assessed for the potential to encounter contaminated groundwater. If contaminated groundwater has been confirmed or is suspected during any initial geotechnical investigations completed prior the HDD installation work, all groundwater will be containerized and tested. Based on actual conditions, the groundwater may be treated prior to discharge back into the ground, or shipped offsite for treatment.

During the HDD process, drilling fluid will be used. Excess drilling fluid will be containerized in a lined pit or containment pond, or trailer mounted portable tank. Fluid will not be allowed to percolate to groundwater. The Project will be constructed with an agency approved SPCCP which will be detailed further in the EM&CP, and the necessary materials will be maintained on site to handle small spills or releases in order to prevent impacts to groundwater resources.

At some locations, the blasting of bedrock may be required. Bedrock blasting is likely to increase bedrock fracturing near the blasting zone. Impacts in area close to a blasting zone have the potential to affect groundwater flow or temporarily increase turbidity in a nearby groundwater well. All blasting activity will be performed by licensed professionals according to strict guidelines designed to control energy release. Charges will be kept to the minimum required to break up the rock. Where appropriate, mats made of heavy steel mesh or other comparable material or trench spoil will be utilized to prevent the scattering of rock and debris. These activities will strictly adhere to all industry standards applying to controlled blasting and blast vibration limits.

4.6 PHYSICAL AND CHEMICAL CHARACTERISTICS OF MAJOR AQUATIC SYSTEMS

A marine survey to collect route specific bathymetric, side scan sonar and geotechnical data is planned for spring 2010. Once the 2010 study is completed the data will be reviewed and compared against the historic data to see if there are any substantial differences. Such differences will be assessed and presented in follow-up reports. In addition to the marine survey, water quality modeling will be conducted in 2010 to evaluate the potential short term impacts of cable installation. This information will be provided in the July 2010 supplement. The following sections describe readily available historic data for water quality, bathymetry, and sediment physical and chemical characteristics along the proposed transmission cable route. This historic data was used to assess the potential impacts associated with cable installation.

4.6.1 Water Quality

The majority of the Project falls within waters under the jurisdiction of the State of New York, which classifies freshwater and marine water bodies on their highest and best uses based on historic and current water quality. Uses are classified for recreational and commercial purposes as well as for fish health. Recreational uses include swimming, fishing, and boating. Commercial uses include shellfishing. Standards are based on a number of factors including total coliform, fecal coliform, and dissolved oxygen.

The majority of New York State waters support all intended uses (i.e., recreation, fishing). However, there are waterbodies that are affected by some level of water quality impact, use impairment, or are otherwise threatened by various activities. The NYSDEC Division of Water maintains an extensive inventory/database of these waters. The WI/PWL provides summaries of general water quality conditions, tracks the degree to which the waterbodies support (or do not support) a range of uses, and monitors progress toward the identification and resolution of water quality problems, pollutants, and sources.

Industrial and municipal point sources continue to be relatively minor sources of water use impairment, with their impact on water quality diminishing significantly in the past 30 years. The water quality problems and issues that are of greatest significance in New York State can be summarized as follows:

- Nonpoint sources (i.e., agricultural);
- Contaminated sediments (including priority organics (e.g., PCBs), pesticides and heavy metals in bottom sediments, and atmospheric deposition); and
- Streambank erosion (second most frequently cited source of water quality impact/impairment in rivers and streams).

Basin-wide assessments have been completed for the following drainage basins within the Project study area; Lake Champlain, upper Hudson, lower Hudson River and Atlantic Ocean/Long Island Sound (NYSDEC 2008b).

Water quality varies along the proposed underwater transmission cable route since it is located within a number of large waterbodies, including the freshwater of Lake Champlain and Champlain Canal and estuarine waters of the Hudson River. The Project then extends through the Harlem River, East River and western end of Long Island Sound. Each waterbody has different physical factors, including water flows and circulation patterns, which are important forcing actions that are closely coupled with water quality.

Along the Project route, several agencies monitor water quality conditions; however there is a great deal of variability in the scope and duration of these monitoring programs. In addition, most historic sampling programs analyzed chemical constituents covering a broad range of conventional pollutants and toxic contaminants using water quality grab samples that sparsely populate the spatial and temporal scales of interest. A summary of historical water quality data collected along the proposed route is shown in Table 4.6-1. Water quality concentrations are compared against state water quality standards.

4.6.1.1 Lake Champlain

Lake Champlain is one of the largest freshwater lakes in the United States. It is an ecologically diverse system that serves as a major recreational hub and a drinking water source. Like many large lakes, it receives municipal and industrial wastes as well as runoff from agricultural and urban areas, all of which contribute to recognized water quality problems within the lake and watershed. The Lake Champlain Basin Program, the Vermont Center for Clean and Clear, and the Vermont Department of Health, among others, use data generated through the Long-Term Water Quality and Biological Monitoring Program to identify water quality issues of concern and assess progress in reducing lake pollution (NYSDEC 2008b).

In July 2009, the NYSDEC Bureau of Watershed Assessment and Management Division of Water published the Lake Champlain Basin WI/PWL. Based on a review of historic water quality data and a water quality sampling program, NYSDEC listed Lake Champlain as an impaired water body, meaning that it frequently does not support appropriate uses based on its water quality classification. For Lake Champlain, shoreline waters (i.e., up to 30 foot depth contour) are generally classified as Class A and waters beyond the shoreline are Class AA. The waters between Crown Point Bridge and the Champlain Canal are designated as Class B. For Class A, AA and B waters, the minimum daily average dissolved oxygen concentrations should not be less than 5.0 milligrams per liter (mg/l), and at no time should the dissolved oxygen concentration be less than 4.0 mg/l.

Both Class A and Class AA waters are a source of water supply for drinking, culinary or food processing purposes, primary and secondary contact recreation, and fishing. These waters should be suitable for fish, shellfish, and wildlife propagation and survival. Class B waters have the same standards as Class A and Class AA, except they are not expected to be a water supply source for drinking or culinary/food processing purposes.

Lake Champlain and Champlain Canal have been sampled by USGS on a limited basis. No discharge (i.e., flow through the lake) data are available in the USGS's on-line database. Statistics for results at Ticonderoga (Lake Champlain), Crown Point (Lake Champlain), Whitehall (Champlain Canal) and Port Henry (Lake Champlain) are reported in Table 4.6-2. Generally water quality is good, with dissolved oxygen concentrations frequently approaching saturation, ranging between 7.9 and 8.4 mg/l. Lake Champlain stratifies in the spring and summer. The warmer, less dense, upper layer (epilimnion) of the Lake typically extends down about 33 feet in the Main Lake during the summer. Below this layer, there is a sharp transition in temperature called the “metalimnion” or “thermocline,” to the much colder waters below, called the “hypolimnion.”

The Lake Champlain Long-Term Water Quality and Biological Monitoring Program has conducted sampling annually since 1992. The project is conducted jointly by the Vermont Department of Environmental Conservation (VTDEC) and NYSDEC. The sampling network consists of 15 lake stations and 21 tributary stations (VTDEC et al. 2009). Station locations are shown in Figure 4.6-1. Discrete depth samples are taken and then composited to form vertically averaged samples. During seasons of thermal stratification, composite samples are collected from the epilimnion (i.e., top most layer) and hypolimnion (i.e., bottom layer). Sampling parameters include:

- Dissolved oxygen
- Total suspended solids (TSS)
- Secchi depth
- Temperature
- Conductivity
- Chlorophyll-a
- Inorganics
- pH
- Total organic carbon (TOC)
- Dissolved organic carbon
- Various forms of phosphorus and nitrogen
- Various forms of phytoplankton and zooplankton

Also, vertical profiles are collected at some lake sites using a multi-probe sonde unit for:

- Dissolved oxygen
- Temperature
- pH
- Specific conductance
- Total dissolved solids
- Turbidity
- Reduction/oxidation (redox) potential

In general, water quality results reveal mesotrophic conditions and phosphorus levels that are typically at or below the in-lake criterion (Tables 4.6-3 and 4.6-4). However, in the southern end of the lake, water quality results reveal eutrohphic conditions and phosphorus levels that are typically above the in-lake criterion. Averages, maxima and minima for 2008 are tabulated at all lake stations for temperature, chlorophyll-a, dissolved oxygen, Secchi depth, and total phosphorus in Table 4.6-3. Data for net phytoplankton, total nitrogen, alkalinity, chloride and dissolved phosphorus are shown in Table 4.6-4.

In general, TSS values varied throughout Lake Champlain from 1992 – 2005 (Figure 4.6-2). In the northern and middle segments of Lake Champlain TSS values collected at five sampling stations were below 5 mg/l (Lake sampling stations 7 through 46). However, TSS values from two sampling stations in the south lake segment ranged from less than 5 mg/l to almost 20 mg/l (Lake sampling stations 2 and 4). Time series for yearly average TSS measurements are shown on a station-by-station basis in Figure 4.6-3. Secchi depths frequently average between 3 meters to 6 meters, especially in the middle third of the lake (Lake sampling stations 7 through 46), and are often lower in the other two thirds (Lake sampling stations 2, 4, 50, 51) (Figures 4.6-4). Time series for yearly average Secchi depth measurements are shown on a station-by-station basis in Figure 4.6-5.

The NYSDEC Rotating Intensive Basin Studies (RIBS) Routine Network monitoring program collects samples from the Richelieu River in Rouses Point, Clinton County near the Route 2 Bridge. Sampling typically includes macroinvertebrate community analysis, sediment assessment, macroinvertebrate tissue analysis and toxicity testing, in addition to water chemistry. The most recent monitoring was conducted during 2003 and 2004. Biological samples, specifically macroinvertebrates, collected at this site and chemically analyzed for selected metals and polycyclic aromatic hydrocarbons (PAHs) showed none in concentrations above established guidance values. Water column chemistry indicated no contaminants to be present in concentrations that constitute parameters of concern and toxicity testing detected no significant mortality or reproductive effects on the test organism (LCBP 2009a).

4.6.1.2 Champlain Canal

South of the Town of Whitehall, New York the proposed underwater transmission route will generally extend along the Champlain Canal to its confluence with the upper Hudson River at Fort Edward. To avoid conflicts with the Upper Hudson River PCB Dredging Project, the transmission cables will exit the Champlain Canal and will be buried within a railroad right-of-way for a distance of approximately 69.9 miles. The cable will re-enter the Hudson River, which is discussed in the next section, downstream from the City of Albany, in the Town of Coeymans.

The Champlain Canal's surface water quality classification is Class C. The best usage of Class C waters is fishing and the waters should be suitable for fish, shellfish, and wildlife propagation and survival. The water quality should be suitable for primary and secondary contact recreation, although other factors may limit the use for these purposes. For Class C waters, the minimum daily average dissolved oxygen concentrations should not be less than 5.0 mg/l, and at no time should the dissolved oxygen concentration be less than 4.0 mg/l.

Short-duration hydrologic events in the Lake Champlain Watershed influence the transport of suspended sediment through the Champlain Canal. Discrete water quality data were collected in the canal by the USGS on a limited basis. No discharge (i.e., flow through the canal) data are available in this USGS report. Statistics for results at Whitehall (Champlain Canal) are reported in Table 4.6-2. In general, water quality is good, with dissolved oxygen concentrations frequently approaching saturation.

As part of the RIBS, the NYSDEC performed TSS and turbidity sampling on the Champlain Canal during the spring and summer of 2009. Samples were collected vertically and horizontally at the cross section and then composited for analysis. Values are relatively low through the spring and early summer, followed by a sharp rise in late summer (Table 4.6-5). TSS and turbidity appear to be generally well correlated at this location. Additional sampling with a broader range of parameters will be occurring in spring 2010.

4.6.1.3 Hudson River

The proposed underwater transmission route follows the Hudson River south to the New York City region. Water quality within the Hudson River varies based on land use. Although the establishment of water quality regulations such as the CWA has led to gradual improvements to water quality, the surface waters are impaired in areas where bathymetry and/or shoreline alterations have affected the natural flows and flushing (USACE 2009). The most notable water quality problem in the Hudson River is reflected in the PCB contaminated sediments. This contamination is primarily the result of historic PCB discharges from the Fort Edward area associated with GE manufacturing facilities.

In the freshwater portion of the Hudson River, surface water quality classifications include Class A, B and C waters. As the proposed cable route enters the estuarine waters of the lower Hudson River, at the border of Rockland and Westchester Counties, surface water quality classifications are Class SB. At the Bronx county border the Hudson River surface water quality classification is Class I. The best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. Dissolved oxygen for Class SB waters shall not be less than a daily average of 4.8 mg/l, however there are times when dissolved oxygen can be less than 4.8 mg/l, but it shall not fall below 3.0 mg/l. The Hudson River in Westchester and the Bronx is on NYSDEC's list of impaired waterbodies, known as the 303(d) list (NYSDEC 2008b). The causes of the impairment are PCBs and other toxics. The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. Dissolved oxygen for Class I waters should not be less than 4.0 mg/l at any time. The dissolved oxygen standard for Class C waters, which applies to the relevant section of the Hudson River, is 5.0 mg/l (NYSDEC 2008b).

The Hudson River is a tidal estuary from its confluence with upper New York Bay to the Federal Dam at Troy. Hudson River tides are semi-diurnal, with two highs and two lows occurring within a 25-hour period. The mean tidal range is 1.37 meters at the Battery, 0.80 meters at West Point, and 1.56 meters at Albany (Cooper et al. 1988).\ The mean tidal amplitude at Albany increased from 1890 to 1950 from approximately 0.8 meters to its present-day amplitude as a result of navigation channel dredging which increased the river's cross-sectional area (Cooper et al. 1988).

The principle source of water quality data for the Hudson River is the USGS. The USGS collects and provides water quality data in non-tidal water bodies throughout all 50 states. Each state publishes an annual report of water level, discharge and water quality data for selected monitoring stations. The Hudson River section of the Project extends from just south of Albany to the Harlem River, and USGS sampling extends from Fort Edward to the most downstream sampling by USGS at Hastings-on-Hudson. Summary data are presented in Table 4.6-6. Flows vary widely in response to precipitation and snowmelt. Consequently, suspended solids are often elevated during times of high runoff.

Freshwater flow is probably the single most important factor in determining physical, chemical, and biological processes within the Hudson River estuary. Freshwater flows can have a dominant effect on transport, dilution, mixing, and water quality. Under low flow conditions, saline water and associated marine species reach far up river while under high flow conditions, freshwater and freshwater organisms are found downstream. Sediment deposition and re-suspension, mobilization of chemicals including toxins, and the inflow of allochthonous detritus are all influenced by freshwater flows. Under low flow conditions, the Hudson River is generally well mixed vertically and there is only about a 10 percent difference in salinity found between the surface and bottom waters. Under high-flow conditions, freshwater overrides the salt layer and salinity differences of up to 20 percent can be established (Busby and Darmer 1970).

The major portion (about 75 percent under normal summer conditions) of freshwater flow enters the Hudson River estuary at its head at Troy. Flow at this location is gauged from the USGS Station at Green Island. Freshwater flows reaching this point are regulated by a series of dams, locks, and water supply reservoirs in the upper Hudson and Mohawk sub-basins. Over 70 percent of the remaining flow enters the estuary via tributaries near the upper end of the estuary. Abood et al. (1991) has presented relationships for determining the freshwater flow at Poughkeepsie and Manhattan from the Green Island flow.

The oscillating flows of water due to tides are ordinarily far greater than the freshwater flow. The tidal flow generally ranges from about 200,000 to 300,000 cubic feet per second (cfs) but may be as much as 494,000 cfs (Busby 1966). Consequently, freshwater flows can be masked by the much larger tidal oscillations.

Based on data from 1946 through 2007, the median annual freshwater input at Green Island is 9,790 cfs. On a seasonal basis, flows at Green Island are greatest in April, when snows melt and soils are moisture saturated. During this month, the median flow is 27,900 cfs (Table 4.6-7) with a daily range of 4,800 to 132,000 cfs. Flows decrease during the summer as the dry soils and vegetation absorb more of the precipitation. By August median flow is 5,200 cfs with a range of daily flows from 1,650 to 44,500 cfs. Flows increase again through the fall as vegetation growth and transpiration slow and the ground begins to freeze.

The Hudson River Estuary can be divided into four salinity zones: polyhaline (18 to 30 parts per thousand [ppt]), mesohaline (5 to 18 ppt), oligohaline (0.5 to 5 ppt), and freshwater tidal (<0.5 ppt). Salinity zones in the Hudson are determined by a combination of hydrographic factors, primarily the tidal surge of saline water upriver from the ocean and the magnitude of freshwater flow into the upper estuary. Under an average runoff regime the salt front (0.5 ppt) reaches Newburgh by late summer/early fall. During conditions of high freshwater runoff, usually during spring, the salt front may be pushed downriver as far as the Bronx. Under low flow conditions, vertical mixing of salt water and freshwater is high, with only a 10 percent difference between surface and bottom water salinity. This differential may be as high as 20 percent under high flow conditions (Limburg and Moran 1986).

The most temporally extensive source of water temperature data is from the Poughkeepsie Water Works (PWW) located just north of the city of Poughkeepsie, New York (rivermile 76). A summary of the PWW data from 1974 through May 8, 2008 is provided in Figure 4.6-6.

Adequate dissolved oxygen levels are critical to the survival of fish and other aquatic organisms. Dissolved oxygen concentrations are determined by several factors, including the degree of tidal mixing, photosynthesis rates, temperature, microbial decomposition of organic matter, and organism respiration levels. Photosynthesis, a high degree of tidal mixing, and relatively low temperatures generally result in an increase in dissolved oxygen concentrations, while higher organism respiration rates, microbial decomposition of organic material, chemical oxidation, and high air and water temperatures generally depress dissolved oxygen levels. Seasonal variation in dissolved oxygen levels in the section of the Hudson River between Catskill and Albany typically range from high dissolved oxygen concentrations in the spring (generally between 10.0 and 12.0 parts per million (ppm) to lowest dissolved oxygen concentrations in the summer (generally between 7.0 and 8.0 ppm), while dissolved oxygen concentrations during the fall range between (8.0 and 12.0 ppm) (Dynegy 2006).

pH is a measure of hydrogen ion concentration and is an important biological parameter. Aquatic organisms in the Hudson River generally have a high tolerance to naturally occurring pH ranges between 6.4 and 8.2 (Cooper et al. 1988). The regional pH for the Hudson between Catskill and Albany (rivermile 112 to 150) has historically averaged 7.0.

Haverstraw Bay, the widest portion of the Hudson River is the northern reach of what is generally regarded as the "lower Hudson River," and as such, exhibits estuarine habitat characteristics, with a strong semi-diurnal tide, and seasonally variable salinities that generally remain below 10 ppt. The bay extends approximately 6 miles from Stony Point to Croton Point, in the Towns of Stony Point, Haverstraw, and Clarkstown, in Rockland County; and the Town of Cortlandt, in Westchester County.

Tidal mixing of riverine and oceanic water is maximized in Haverstraw Bay, and the presence of the "salt front" promotes trapping of nutrients and plankton. Turbidity is relatively high in this portion of the Hudson River Estuary; however, extensive beds of SAV occur in tidal shallows along the bay shores.

In 2000 and 2001, NYSDEC conducted the Hudson River Biocriteria Project to develop indicators of biological conditions for the Hudson River Estuary. The goal of the project was to develop one or more biological indicators that could be used to assess the ecological condition of the estuary through long-term monitoring. Water samples were collected for nutrient analysis and TSS using a peristaltic pump or a Nisken bottle lowered to approximately 1 meter from the bottom. In addition, *in situ* water column profiles were performed at each station to measure the basic water quality parameters of dissolved oxygen, salinity, conductivity, temperature, and turbidity. Water clarity was measured with a Secchi disk (Llanso et al. 2003).

Sampling sites in the Hudson River (Troy to The Battery) had mean and median water depths between 8 and 9 meters, a maximum of 40.5 meters, and a minimum of 0.6 meters, reflecting a wide range of sampling depths. Mean bottom dissolved oxygen (8.6 to 8.8 mg/l) and temperature (19.4 to 21.7°C) were typical of late summer conditions of well-mixed temperate systems. The surface-to-bottom stratification of the water column was insignificant. Tidal flow in the Hudson River keeps the water column well mixed vertically (Strayer and Smith 2000); therefore low dissolved oxygen was not a problem (Llanso et al. 2003).

Salinities throughout the oligohaline and mesohaline portions of the estuary were lower in 2000 than in 2001. In September 2000, mean bottom salinities were 10.9 practical salinity units (psu) (range 8 to 13) between rivermiles 15 to 21, and 3.8 psu (range 1 to 12) between rivermiles 22-43, with most measurements in this last transitional zone below 5.0 psu. In September 2001, mean bottom salinities over the same rivermile zones were 13.4 psu (range 8 to 16) and 8.4 psu (range 6 to 12), respectively. Lower salinities in 2000 were probably caused by high water flows. Turbidity was generally low in both years except for higher readings (40 to 176 nephelometric turbidity units [NTU]) at many of the mesohaline sites below rivermile 24, at one site in Stony Point Bay south of Peekskill (316 NTU), and at 11 sites in the Newburgh area between rivermile 58 and 66 (50 to 562 NTU).

Water quality parameter concentrations, summarized in Table 4.6-8 generally appeared to be typical of what would be expected in large tidal estuaries. Nitrate (the predominant form in the analysis of nitrate-nitrite) was predominately detected in the lower portion of the estuary, from Newburgh to the river mouth. Nitrate concentrations increased with the salinity gradient. Likewise, nitrite and total Kjeldhal nitrogen (TKN) were largely undetected in the upper estuary but measured in the mesohaline zone. Orthophosphate and total phosphate were detected at most sites in keeping with their non-limiting role in estuaries. Nutrient concentrations were high at many sites in the vicinity of Nyack and Yonkers, possibly indicating pollution sources in this region. Highest concentrations for nitrate (0.7 to 0.9 mg/l), and total phosphate (0.25 to 0.96 mg/l) occurred at sites near Nyack and Yonkers. Most nitrite (0.05 to 0.15 mg/l) and TKN (1.5 to 6.2 mg/l) detections occurred in the lower portion of the estuary, from Yonkers to the river mouth, and orthophosphate concentrations were highest (0.15 to 0.18 mg/l) at Yonkers and along Manhattan. Water column ammonia was detected at eight sites in concentrations ranging from 0.2 to 3.8 mg/l. TSS were highest (110 to 520 mg/l) at 12 sites in Yonkers, two in Poughkeepsie, one each in Newburgh and Kingston, and two additional sites further upstream (Llanso et al. 2003).

4.6.1.4 Harlem River and East River

After leaving the Hudson River, the next segment of the proposed transmission cable route turns east through the Harlem River and East River before entering Long Island Sound.

NYSDEC surface water quality classifications for the Harlem River and East River are Class I. The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. Dissolved oxygen for Class I waters should not be less than 4.0 mg/l at any time. The Harlem and East Rivers are on NYSDEC's list of impaired waterbodies, known as the 303(d) list (NYSDEC 2008b). The causes of the impairment are PCBs and other toxins.

The City of New York annually collects water quality data in the waters surrounding the five boroughs, to allow for assessments of trends and improvements in the water quality of New York Harbor (NYCDEP 2008). Measurements are collected at near-surface and near-bottom for a set of stations on a weekly or biweekly basis. Water quality data collected in recent decades for key constituents are summarized in Table 4.6-9. Five major indicators of water quality are used to assess the state of water quality in the harbor: dissolved oxygen, TSS, Secchi transparency, chlorophyll-a, and fecal coliform. The trends from the 2008 data and earlier described below represent averages of all stations in this region, including stations in Flushing Bay and Western Long Island Sound that are not adjacent to the underwater transmission cable route (Figure 4.6-7).

For the inner harbor area (which includes the section of the Hudson from the New York City-Westchester County boundary to the Harlem River confluence – Figure 4.6-8, fecal coliform, an indicator of sewage-related pollution, showed low averages that met the monthly geometric mean criterion of 200 counts/100 milliliters (ml) for Class SB. However, episodes of combined sewer and stormwater overflows can cause exceedences and beach closings. Fecal coliform concentrations have been on the decline since the 1970s (NYCDEP 2008). In 2008, summer dissolved oxygen values averaged 7.4 mg/l and bottom values averaged 6.6 mg/l, well above the New York State Class SB criterion of 5 mg/l and the State Class I criterion of 4 mg/l. These dissolved oxygen standards have been met since the late 1980s. Chlorophyll-a averaged 7.2 micrograms per liter (µg/l) in 2008, with a focal point being the Gowanus Canal which had monthly summer averages of approximately 20 µg/l. Long-term chlorophyll concentrations are generally stable.

Secchi depth an indicator of water clarity, averaged 4.9 feet from 1986-2008 (Table 4.6-9). Average summer values have remained fairly constant in the inner harbor since measurement began in 1986. These values represent averages of all stations in the inner harbor area, including upper New York Bay and the lower East River. The lowest values of Secchi depth generally occur in Flushing Creek and the Harlem River which transport substantial solids during wet weather periods. The highest Secchi depth readings generally occur along or near the centerline of the upper East River and Long Island Sound. Since 1986, Secchi depth has varied between 3.9 and 5.9 feet.

For the upper East River and western Long Island Sound, fecal coliform monitoring sites were in compliance with water quality standards for Class SB in 2008. The geometric mean for all stations in this region was 22 counts/100 ml. Due in part to upgrades in wastewater treatment facilities and the abatement of combined sewer overflows (CSOs), fecal coliform concentrations have sustained a downward trend for the past two decades. Average dissolved oxygen concentrations in this region are relatively low. While summer dissolved oxygen values met the

5 mg/l standard in the surface waters, average bottom waters showed below-standard concentrations. Multiple instances of hypoxia (defined by New York City Department of Environmental Protection [NYSDEP] as less than 3.0 mg/l) occurred at several stations, particularly in August. The long-term trend for dissolved oxygen is upward since the 1980's. Chlorophyll-a averages for this region are generally less than 10 µg/l, except at the head of certain embayments where nonpoint source runoff originates. Generally, over the long term chlorophyll-a concentrations are steady, in the range of 6 to 16 µg/l, with a slight decline since the mid-1990's overall.

4.6.1.5 Long Island Sound

The final segment of the proposed transmission cable route is within Long Island Sound and continues in a northeasterly direction to the state boundary with Connecticut, with landfall further east at Bridgeport.

Numerous sources contribute to water quality issues in Long Island Sound. These sources include municipal and industrial discharges, urban storm runoff, combined and separate sewer overflows, contaminated sediments, oil and hazardous material spills, nonpoint source runoff, and thermal discharges.

Seasonal dissolved oxygen levels in Long Island Sound have been the focus of considerable study. Hypoxia in the bottom waters of the western sound have caused fish and crustacean kills and have induced finfish to avoid the area. Excessive algal blooms in the sound have been attributed to nitrogen loads from wastewater treatment plant discharges, CSOs and stormwater and urban runoff. The most significant pollutant loadings to western Long Island Sound are the New York City water pollution control plants on the upper East River.

NYSDEC surface water classifications for the upper East River and Western Long Island Sound range between the following classes: Class I, Class SB and Class SA. The best usages of Class I waters are secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The best usages of Class SB waters are primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival. The best usages of Class SA waters are shellfishing for market purposes, primary and secondary contact recreation and fishing. These waters shall be suitable for fish, shellfish, and wildlife propagation and survival.

The Interstate Environmental Commission (IEC) conducts weekly summer sampling to document hypoxic conditions in the New York waters of western Long Island Sound. Sampling and analysis at a network of 21 stations (Figure 4.6-9 and Table 4.6-10) includes *in situ* measurements of dissolved oxygen, temperature, salinity, and Secchi depth (water clarity).

The distributions of dissolved oxygen concentration for 2007 and 2008 are shown as pie charts in Figure 4.6-10. Time series of average 2008 dissolved oxygen concentrations in surface and bottom waters are shown in Figure 4.6-11. In some areas of western Long Island Sound, low or zero dissolved oxygen concentrations were found from mid-July through mid-September. By September 23, 2008 dissolved oxygen less than 5 mg/l was no longer present at any sampling stations. Dissolved oxygen concentrations of at least 5 mg/l are considered to be protective of most marine aquatic life. Secchi depth measurements in 2007-2008 varied between 0.5 and 3.4 meters.

Temperature is an important parameter in terms of its effects on algal growth, and shellfish harvest, including lobster. Research on bacterial inspections and the stress response in lobsters indicates that there is a threshold temperature of 20.5°C. Spatial profiles of temperature for the summer months of 2008 are presented in Figure 4.6-12. Bottom temperatures for 2008 varied between 14.0°C to 22.8°C in July; 19.5°C to 24.3°C in August; and 20.5°C to 24.1°C in September.

Surveys were conducted from June 29 to September 14, 2009. Results for 2009 surveys are shown in Table 4.6-11. Lowest average dissolved oxygen concentrations are observed in western Long Island Sound in the bottom waters. On one occasion bottom dissolved oxygen dropped below 1.0 mg/l, at station B3M. The observed temperature and salinity appear to follow long-term trends. Secchi depths in 2009 vary from 1.4 to 3.2 meters, indicative of fairly clear waters.

In 1985, the USEPA, New York, and Connecticut formed the Long Island Sound Study (LISS), a bi-state partnership consisting of federal and state agencies, user groups, concerned organizations, and individuals dedicated to restoring and protecting the Sound. Yearly sampling of offshore stations includes analysis of the following indicators of water quality (USEPA 2009):

- Dissolved oxygen
- Chlorophyll-a
- Nitrogen
- Phosphorus
- Carbon
- Silicon
- Secchi depth
- Temperature
- Salinity
- TSS
- Coliforms
- Enterococci

Long Island Sound is monitored year-round on a monthly basis for the above parameters. Seventeen primary stations are sampled, supplemented by an additional 25 to 30 stations during summer months.

Water temperature is an important factor affecting the extent and duration of hypoxia in Long Island Sound. The annual average surface and bottom temperature have trended upward in recent years. The temperature difference, delta-T, between surface and bottom waters creates a density gradient enhancing the stratification of water layers and reducing vertical mixing. Thus, higher temperature difference yields increased hypoxia. Maximum temperature differences in Long Island Sound, which occurred during the June 2008 survey, are portrayed in Figure 4.6-13.

Minimum winter temperatures, maximum summer temperatures, maximum delta-T values, and hypoxic surface areas for 1991-2008 are summarized in Table 4.6-12.

Salinity varies from 23 ppt in western Long Island Sound to 35 ppt in the eastern portion of the sound. Salinity statistics for bottom waters in 2008 are shown in Table 4.6-13. Station A4 is the westernmost station, and the stations are sorted in the easterly direction. Bottom water salinity data measured from 1991-2008 are shown in Figure 4.6-14. Salinity data collected in 2008 for surface waters are consistently lower than bottom counterparts and are shown in Table 4.6-14. Surface water salinities for the seven tabulated stations are shown in Figure 4.6-15, with most stations ranging from 26 to 28 ppt.

Secchi disk measurements were collected for the 17 annually-sampled stations. The 2008 average Secchi depth is 2.43 meters, with a range of 1.1 meters to 5.0 meters. Data are shown for the period January through September 2008 in Figure 4.6-16, revealing a slight decline in Secchi depth during the spring and summer timeframe.

Results for 2009 surveys are shown in Table 4.6-15. Surveys were conducted from January 12 through September 2, 2009. Two stations, A4 and B3, are identical to those sampled in the IEC sampling effort (Connecticut DEP station B3 is the same as IEC station B3M.) Since the LISS results in Table 4.6-15 include winter and spring sampling, these results differ at stations A4 and B4 compared to those shown for the IEC results. The lowest 2009 dissolved oxygen bottom concentration measured for the stations tabulated was 1.5 mg/l on August 18, 2009. TSS varied from 3.0 to 11.0 mg/l.

Low dissolved oxygen levels in portions of LIS has been attributed to wastewater discharges and CSOs. CSOs are a mixture of sanitary sewage and stormwater runoff that are released during or after precipitation events. Despite some improvements in recent decades, CSOs are a major source of water quality degradation in Long Island Sound. However, long term CSO control plans are being developed and implemented by cities in New York. In addition, stormwater discharges are also a source of water quality degradation. As a result, municipalities are required to comply with stormwater management plans.

4.6.2 Bathymetry

Bathymetry is an important factor to consider during underwater cable laying and burial. Steep or abrupt submarine bathymetry can exacerbate cable installation issues and engineering costs. In addition, extreme changes in bathymetry can affect underwater cable design and life-span performance. Information regarding bathymetry found along the proposed Project route was obtained and compiled from the National Oceanic and Atmospheric Administration (NOAA) Navigational Charts for Lake Champlain, the Canal Corp canal system, the Hudson River, the Harlem River, the East River, and Long Island Sound.

The bathymetry of the study area comprises a wide range of lacustrine, riverine, and marine environments. Sediment composition and geologic characteristics are foremost in having shaped bathymetric contours over time.

4.6.2.1 Lake Champlain

As the proposed transmission cable corridor crosses the United States/Canadian border, it enters into Lake Champlain from the Richelieu River and travels south passing to the west of Isle La Motte. Water depths in this portion of Lake Champlain range from approximately 6 to 50 feet, and the cable corridor takes advantage of gradual changes in water depth. As the cable corridor approaches the south end of Isle La Motte, the corridor becomes constrained to the middle and eastern shore of Lake Champlain in order to avoid Schuyler Reef, Valcour and Schuyler Islands, and areas with steep changes in bathymetry near plateaus, rises, troughs, and basins.

Continuing south of Isle La Motte, the proposed transmission cable corridor follows the 100- and 150-foot depth contours on the west side of Grand Isle, which avoids Providence and Stave Islands, and continues in water depths between 50 and 150 feet, passing Juniper Ridge and Juniper Trough. In this area, the width of the proposed transmission cable corridor is limited in order to avoid the changes in bathymetry due to the presence of the ridge and trough. At the southern end of Baldwin Deep, the proposed transmission cable corridor is constrained in width by Thompson Point to the east and Split Rock Point to the west. Water depths in this area range from 200 to 350 feet. The cable corridor continues in these water depths until the northern portion of Folger Trough, and then takes advantage of the shallow water depths ranging from 12 to 50 feet from Basin Harbor through South Lake. From Putnam Station, New York to the beginning of the Champlain Canal at the Elbow in Whitehall, New York, water depths range from 12 to 20 feet.

The waters of Lake Champlain reach their greatest depth, over 400 feet, in the area between Charlotte, Vermont and Essex, New York. The average depth of the Lake is only 64 feet and some parts of the Lake are very shallow. However, water depths along the underwater transmission cable route vary from 10 feet to approximately 300 feet. Throughout Lake Champlain there are basins, troughs and plateaus. In addition, the cable route was sited to avoid steep changes in slope, to the extent possible.

Rocky shorelines and reefs are found around the islands in Lake Champlain. The Chazy Reef is located on Isla La Motte. The cable route has been sited around reefs and rocky outcrops in Lake Champlain.

4.6.2.2 Champlain Canal

There is little existing data regarding water depths along the Champlain Canal. In general, water depths along the underwater transmission cable route are approximately 12 feet (New York State Canal Corp 2010).

4.6.2.3 Hudson River

Hudson River water depths along the cable route vary. In general, water depths range from approximately 7 feet near shore to 116 feet in the channel throughout this portion of the underwater transmission cable route. The median depth is approximately 50 feet. The upper-estuary from Poughkeepsie north to the Troy Dam constitutes the majority of the tidal freshwater river. In general, the natural depths are greatest in the southern portion of this area, with depths decreasing towards the northern end of the estuary. A shipping channel is maintained to 32 feet MLW by dredging as far north as the port of Albany, and to 15 feet MLW from Albany to the Troy Dam. Historically, the upper part of the river from the Troy Dam south to the City of Hudson was a network of shoals, islands, and channels.

The mid-estuary begins north of Haverstraw and Tappan Zee Bays at the Town of Stony Point (rivermile 40). North of the City of Peekskill at rivermile 44, the river passes into the Hudson Highlands where it narrows to an average width of about 1,800 feet. The Hudson Highlands area of the river is a deep (49 to 197 feet) and turbulent mixing zone with little shoal area and steep rocky shorelines. Moving upstream beyond the Hudson Highlands into the Town of Cornwall at rivermile 56, the Hudson River widens to an average width of 5,800 feet in an area called Newburgh Bay. The average mid-channel depth of Newburgh Bay is about 40 feet. There are wider shoal areas along the shoreline, especially on the eastern shore, supporting growth of SAV. North of the Village of Wappingers Falls (rivermile 67), the river narrows again and increases in depth to as much as 125 feet (USFWS 1997).

There are two distinct sections of the river within the lower estuary. The first, from the Battery at rivermile 0 to the New York-New Jersey state line at rivermile 22, is fairly narrow, with an average width of about 5,000 feet, an average depth of about 40 feet. There is only a narrow band of shallow subtidal flats along the shoreline. The northern section of the lower estuary area from the state line north to Stony Point, rivermile 22 to about rivermile 41, includes the Tappan Zee, and Haverstraw and Croton Bays, and is known as the wide bays region. In this section, the river is much wider (to 3.5 miles wide) and shallower (6 to 12 feet), except for the 40 foot deep channel. In Haverstraw Bay the channel is maintained by dredging at a depth of 9.8 meters (32 feet).

4.6.2.4 Harlem and East River

Water depths range from approximately 14 to 27 feet along the portion of the proposed transmission cable route within the Harlem River extending from the Hudson River confluence to the East River confluence. The proposed transmission cable route continues northeast in the East River through Hell Gate towards Long Island Sound, passing west of North Brother Island in water depths ranging from 20 to 80 feet.

4.6.2.5 Long Island Sound

At the confluence of the East River and Long Island Sound, the proposed transmission cable route continues north, avoiding areas of abrupt changes in bathymetry near Stepping Stones and Execution Rocks. Water depths along this portion of the transmission cable corridor range from approximately 20 to 105 feet. The proposed transmission cable corridor passes Execution Rocks to the south so as to minimize the number of turns in the cable corridor.

East of Execution Rocks, and for the rest of the Project corridor in Long Island Sound, water depths range from 30 to 100 feet. East of Execution Rocks the proposed transmission cable route continues in a northeasterly direction to the state boundary with Connecticut.

4.6.3 Sediment Physical and Chemical Characteristics

A review of existing information regarding sediment type, sediment quality, and sediment contaminant sources in the vicinity of the proposed underwater transmission cable route was conducted for the proposed Project (Table 4.6-16, Table 4.6-17). Maps of historic sampling locations can be found in Appendix D.

Most historic sampling programs analyzed chemical constituents covering a broad spatial and temporal scale using cores and/or sediment grabs. Concentrations of contaminants found in the sediment can be compared against the effects range-median (ER-M) concentration, which corresponds to the median (50th percentile) concentrations associated with adverse biological effects. Alternatively, effects range-low (ER-L) concentrations have a 10 percent probability (10th percentile) of inducing adverse biological effects. Generally speaking, ER-M concentrations cause observable adverse effects in organisms and biological communities, while ER-L concentrations are those where biological effects begin to be observed. The ER-L and ER-M concentration standards for common analytes are shown in Table 4.6-18

4.6.3.1 Lake Champlain

Lake Champlain's sediment composition has been studied and documented by the Lake Champlain Basin Program (LCBP), a partnership among multiple federal and state agencies within New York and Vermont. In general, Lake Champlain sediment types vary from dark gray mud (i.e., silt, clay, and organic material) to diatomaceous muds and clays (LCRC 2004). Due to changes in bathymetry, shifts in sediment type (i.e., sand to rock) are common, especially in near-shore zones and around islands. In the near-shore zone, bottom sediments may consist of mud and a higher content of debris and organic matter.

Sediment type tends to vary with water depth throughout the Lake. Surficial sediments range from muds to silt and clay with patches of sand and gravel. In the northern portion of the lake, as part of the NYSDEC RIBS, sampling at a Richelieu River station found the sediment to be predominantly silt and clays, with 96 percent less than 0.0625 mm diameter (LCBP 2009a).

Recent bottom surveys have identified sedimentary slumps near Diamond Island and Whallon's Bay in Lake Champlain. Slumps are a form of a mass wasting event that occurs when loosely consolidated materials or rock layers move a short distance down a slope. These slumps vary in size from 55 yards wide by 110 yards long by 20 yards thick, to 440 yards wide by 600 yards long by 20 yards thick, respectively. They are found in depths of approximately 130 feet (Manley and Manley 2009). Although the proposed transmission cable corridor avoids these slumps, there may be other slumps within Lake Champlain that have not yet been identified.

The Lake Champlain Sediment Toxics Assessment Program has documented contaminant levels within sediments on the lake bottom (LCBP 2009b). Initial surveys in 1991 collected samples from 30 sites throughout the lake and analyzed them for common contaminants such as trace elements, PCBs, chlorinated hydrocarbon pesticides (dichloro-diphenyl-trichloroethane [DDT], etc.), and PAHs. The surveys identified the presence of contaminants in sediment, water, and biota at elevated levels (LCBP 2009b). The program prioritized PCBs and mercury as persistent contaminants found lakewide and arsenic, cadmium, chromium dioxins/furans, lead nickel, PAHs, silver zinc, copper, and persistent chlorinated pesticides as persistent contaminants in localized areas. The program also identified three locations for more intensive surveys and clean-up actions: Outer Malletts Bay, Inner Burlington Harbor, and Cumberland Bay.

Contaminants of concern identified within Cumberland Bay were PCBs, PAHs, copper, and zinc (LCBP 2009b). Since remediation of Wilcox Dock in Cumberland Bay by the NYSDEC in 2001, subsequent monitoring has indicated a significant decline in PCBs in both sediment and water (LCBP 2009b). Restoration activities included the removal of contaminated sediment and the restoration of affected wetlands and shoreline areas.

An assessment of mercury sources to Lake Champlain was conducted in 2006 by the Ecosystems Research Group of Norwich, Vermont, Dartmouth College, United States Geological Service, and the Vermont Agency of Natural Resources. This study found that 59 percent of mercury enters the Lake from the surrounding watershed, with atmospheric deposition accounting for 40 percent, and 1 percent from wastewater treatment effluent discharged directly to the Lake (VTDEC 2009).

4.6.3.2 Champlain Canal

The Champlain Canal contains both areas of bedrock, through which portions of the canal were cut, and areas where glacial silts and clays are exposed (USEPA 2000). Coarse-grained sediments such as sand, gravel/cobble, and transitional areas are found in the channel, with finer-grained silt and clay sediments found almost wholly outside of the channel in the shallow, slower-moving waters immediately adjacent to shore (USEPA 2004).

Along the underwater sections of the proposed cable route, the Canal Corp conducted grain size analysis on two stations. One station located mid-way between Lock C11 and C9 was predominantly very fine sand and silt (80 percent passing 0.075 mm). A second station located immediately south of Lock C9 was characterized as fine sand (26.6 percent medium sand, 51.7 percent fine sand, 21.6 percent silts/clays) (New York State Canal Corporation 2010).

No published studies of sediment quality in the Champlain Canal were identified during an extensive literature review. However, chemical analysis data from 39 samples collected at 23 stations sampled in the Champlain Canal were obtained from the Canal Corp (Table 4.6-16). Samples were analyzed for total metals, PCBs, PAHs, and pesticides, with two samples collected at the Whitehall stations near Lock 12 being analyzed for dioxin/furan congeners. Along the in-water segment of the proposed route the following samples were collected:

- Two samples were collected during 1997 between Locks C12 and C11;
- Three samples were collected during 1991, 1994, and 1995 between Locks C11 and C9; and
- Three samples were collected during 1998 immediately south of Lock C9.

The sediment samples were analyzed for total metals, PCBs, pesticides, and TOC. Generally, analyte concentrations reported were either below detection limits or were well below ER-L concentrations. The only exception was a sample taken south of Lock C9 during 1998, in which mercury was detected marginally greater than the ER-L concentration (0.23 ppm) after dredging. Other samples taken at this Lock C9 station recovered mercury below ER-L concentrations.

4.6.3.3 Hudson River

The Hudson River Benthic Mapping Project, funded by the NYSDEC, produced a comprehensive data set consisting of high-resolution multi-beam bathymetry, side-scan sonar, and sub-bottom data, as well as over 400 sediment cores and 600 grab samples. Overall, the benthic mapping project identified regional sediment distributions within the Hudson River, although within each region there are small-scale variations in sediment distribution which can actually determine the sediment type encountered (Bell et al. 2006 and Nitsche et al. 2007). Based on the results of the Benthic Mapping Project, the distribution of sediment texture throughout the Hudson can be divided into eight sections with unique sediment characteristics:

1. Albany/Troy – artificial straightened, gravel and sand;
2. Catskill – fluvial influenced, sand and muddy sand;
3. Poughkeepsie – bedrock bound, sandstone and shale;
4. Newburgh Bay – tide dominated, mud;
5. Hudson Highland Gorge – bedrock bound, muddy sediments;
6. Tappan Zee/Haverstraw Bay – tide dominated, muddy sediments with sand and gravel in the main channel;
7. Palisades - bedrock bound, muddy; and
8. Upper Bay – tide dominated; sand with large variations in grain size.

In addition to these large-scale characteristics, local variations are significant determinants in benthic habitats and contaminant distribution. The leading determinants of local sediment variation are:

1. Local bedrock morphology, including peninsulas and islands that modify the river flow through the processes of scour and erosion;
2. Tributary input, which sometimes results in local gravel and sand deposits near tributary mouths, such as Twaalfskill Creek and the Harlem River;
3. Local hydrodynamics, including effects from tidal ebb and flood current asymmetries; and
4. Human impact, including dredging, dredge spoil, bridges and piers.

As part of the NYSDEC Biocriteria Project, sediment samples were collected from the Troy Dam to the Battery (i.e., southern tip of Manhattan) (Llanso et al. 2003). Sediment samples were collected with a Young grab, which samples a surface area of 0.044 m^2 to a depth in the sediment of 10 centimeters (cm). Three samples were collected at each site. The first sample was processed for benthos and the other two samples were used for sediment chemistry. Grabs with shallow penetration (< 7 cm) were used for sediment chemistry only.

Sediments were mostly muds (median = 73 percent silt-clay) with concentrations of organic matter that were greater than 2 percent for most sites in 2000 (range 0.1 to 7.9 percent), but less than 2 percent for all sites sampled in 2001. Muddy substrates predominated in the lower portion of the estuary below Kingston. Sandy (< 10 percent silt-clay) and mixed substrates predominated in the upper portion of the estuary, between Kingston and Troy.

Sediment samples were also collected for the Contamination and Assessment Reduction Project (CARP), which was a collaborative effort between state, Federal, and non-governmental organizations (NGOs) to develop sediment fate and transport models within the New York/New Jersey Harbor (HydroQual 2007). Sediments were collected to characterize sediment type and quality. CARP results indicate that the sediment in the Hudson River appears to become progressively dominated by silts and clays from Alsen to New York City. In Alsen, New York, 72 percent of the sediment sample was sand and the rest clay and gravel. Near Ossining, New York, sediment shifts towards being clay/silt dominated (clay 40 percent silt 37 percent, sand 20 percent, gravel 3 percent). Near Piermont, New York, over 90 percent of the sediment sample was comprised of clay (40 percent) and silt (53 percent). North of the George Washington Bridge, fines represented 97 percent of the sediment sample.

The proposed transmission cable corridor traverses the mud-dominated central section and fluvial sand-dominated sediments in the freshwater section of the Hudson River Estuary. As the proposed transmission cable route continues south of Coeymans, New York, the dominant sediment type in the Hudson River is gravel and glacial sand within the channel, which shifts to silt and sand as the corridor approaches Coxsackie, New York (Bell et al. 2006 and Nitsche et al. 2007).

From Coxsackie south toward Newburgh, New York, the river is characterized by shoals, sandbars, sediment waves, and scoured areas where tributaries enter the Hudson River. The dominant sediment type within this portion of the proposed transmission cable route is mud and sand (Bell et al. 2006). The corridor will avoid depositional areas near tributary mouths, as debris could impact cable installation. From Newburgh, New York to the Harlem River, the predominant sediment types are mud and sand.

The Hudson River PCBs Site (USEPA Identification Number NYD980763841) includes a 200 rivermile stretch of the Hudson River from the Village of Hudson Falls to the Battery in New York City. The site is divided into the upper Hudson River (the length of the river between Hudson Falls and the Federal Dam at Troy) and the lower Hudson River (the length of the river between the Federal Dam at Troy and the Battery). The upper Hudson River region includes areas that have been and may continue to be sources of PCB contamination to the river, including General Electric Company's Hudson Falls and Fort Edward plants, which discharged

PCB contaminated liquids, used as an insulating fluid in the manufacture of electrical capacitors, into the Hudson River. This material accumulated behind the dam in Fort Edward until the dam was demolished in 1973, resulting in the material settling in river sediments up to 200 miles away. In addition, five remnant deposits of PCB-contaminated soils were exposed after the river water level dropped following removal of the Fort Edward Dam.

A Record of Decision (ROD) by the USEPA in 1984 presented a remedy that included in-place containment of the remnant deposits and an interim "No Action" with regard to the PCB-contaminated river sediment. In 1989, the USEPA announced its decision to reassess this strategy, and a ROD issued in 2002 selected the dredging of approximately 2.65 million cubic yards of PCB-contaminated sediment from the upper Hudson River, including approximately 341,000 cubic yards from the Champlain Canal (in river portion). The USEPA concluded that the contaminated sediments in the upper river are a major source of PCBs to the entire river environment. Much of the area directly affected by the PCB contamination and that is currently undergoing a dredging cleanup operation will be avoided through an underground transmission cable route bypass.

PCBs are not the only contaminant of concern in the Hudson River Estuary. High concentrations of DDT have been identified in some Hudson River tributaries. The sources of this harmful pesticide are difficult to pinpoint, but may be related to old agricultural practices. Airborne mercury, a byproduct of coal combustion, is deposited along the estuary and can accumulate to harmful levels in fish and other aquatic biota.

Cadmium is another contaminant of concern in the Hudson River Estuary. During 1952-1979, a nickel-cadmium battery manufacturing facility located in Cold Spring, New York, discharged over 179,000 kilogram (kg) of cadmium-enriched waste into Foundry Cove, a freshwater intertidal wetland. This site was considered the most heavily cadmium-polluted location in the world, with sediment cadmium concentrations of 500 to 225,000 ppm (Knutson et al. 1987). Foundry Cove was designated a Super Fund site by the USEPA in 1983. A $91 million sediment remediation and habitat restoration project was conducted at the site in 1994. Following completion of the remediation/restoration project, sediment cadmium concentrations ranged from 10 to 100 ppm (Junkins and Levinton 2003).

Treated sewage effluent is discharged into many Hudson River tributaries by towns and villages. Many older municipalities have aging sewage treatment systems with clay pipes, along with inadequate pump stations and treatment plants. This decaying infrastructure permits raw sewage to enter the estuary under conditions of heavy rainfall (Cooper et al. 1988). In the lower estuary, CSOs discharge during storm events, contributing a pulse of nutrients and other contaminants.

Based on Llanso et al. 2003 study, sediment ammonia concentrations were generally low (Table 4.6-19), with higher concentrations (50-150 milligrams per kilogram [mg/kg]) at five sites near Yonkers (rivermile 15-20), six sites in the Newburgh region (rivermile 57-70), and six additional sites upstream. In addition, samples were analyzed for metals, PAHs, PCBs, pesticides, TOC, volatile solids, percent silt-clay, and ammonia (Table 4.6-19). Concentrations were highest for mercury and silver, which were found to be most often in excess of ERM values. Both metal and PAH contamination occurred throughout the river, but PAHs were most prevalent at sites in

Yonkers, Newburgh Bay, Poughkeepsie, and Kingston. PAH concentrations were mostly below ERM concentrations, and often below the ERL value. PCBs were present at 71 sites at concentrations that exceeded the ERL value. Fifteen of these sites had high concentrations in excess of the ERM value. High PCB sites were generally scattered throughout the river, but some were concentrated in the Yonkers region. Pesticides were largely undetected and present only at two sites north of Poughkeepsie at concentrations that exceeded the ERM value (Llanso et al. 2003).

Sediment cores were taken in the lower Hudson River as part of efforts to develop sediment fate and transport models within the New York/New Jersey Harbor (HydroQual 2007). During 1999 and 2001, 15 surficial sediment grabs of the top 10 cm were taken at the following stations (from north to south) in this section of the Hudson River and analyzed for contaminants:

- Alsen, New York (just south of the Rip Van Winkle Bridge);
- Ossining, New York;
- Piermont, New York; and
- New York City, north of the George Washington Bridge at the mouth of the Harlem River (11 samples taken).

In Alsen, New York, the CARP sampling data detected concentrations of dioxin and furans at concentrations of less than 0.2 parts per billion (ppb). A few metals were detected at levels that did not exceed the ER-L. Pesticides were identified, including dichloro-diphenyl-dichloroethylene (DDE), dichloro-diphenyl-dichloroethane (DDD), DDT, chlordane, dieldrin, and endrin, with some levels exceeding the ER-L but none exceeding the ER-M. Seventeen (17) PAHs were detected, all of which were below 100 ppb and none exceeding their ER-L values. For PCBs, 165 of the 209 congeners were recovered and total PCB concentration was 626 ppb.

In Ossining, New York, dioxin and furan compounds were detected, but all at levels less than 1 ppb. Metals, including arsenic, cadmium, chromium, copper, lead, mercury, nickel, and zinc, were detected. No metals reported concentrations above the ER-M, and only copper, lead, mercury, and zinc were above the ER-L values. Pesticides were reported, including DDE, DDD, DDT, chlordane, dieldrin, and endrin, with most exceeding the ER-L but none exceeding the ER-M. PAHs results were similar to those reported at the Alsen Station, although with slightly higher concentrations. For PCBs, 165 of the 209 congeners were recovered, and total PCB concentration was 836 ppb.

In Piermont, New York, dioxin and furan compounds were detected at levels less than 1 ppb in most cases. Metals were also detected, with mercury nearing the ER-M and arsenic, copper, lead, nickel and zinc exceeding the ER-L. Pesticides including DDE, DDD, DDT, chlordane, dieldrin, and endrin were reported at higher concentrations than the upstream stations, all of which exceeded the ER-L but not the ER-M. Twenty-one (21) PAHs were detected, many with concentrations between 100-300 ppb, and only fluorine exceeded the ER-L values. The total concentration of all 165 PCB congeners reported was 1,069 ppb.

At the site in the Hudson River north of the George Washington Bridge, dioxins and furans were recovered at concentrations greater than 1 ppb. Arsenic, cadmium, chromium, copper, lead, nickel, and zinc were recovered at concentrations greater than the ER-L and in most samples, mercury and silver exceeded the ER-M value. Most of the pesticides detected consistently exceeded the ER-L, but only total DDT exceeded the ER-M values. Many of the PAHs detected had concentrations between 100-400 ppb and several exceeded the ER-L values. Total PCBs had a concentration of 4,577 ppb, significantly higher than the other stations sampled in the Hudson River as part of the CARP.

4.6.3.4 Harlem River and East River

The Harlem River is scoured daily by tidal action, and sediments tend to be a mixture of sand, gravel, and cobble. Near the confluence with the East River, the Harlem River has soft bottom substrate, with frequent shoals along the banks. Due to swift currents and blasting to create the navigation channel, areas of the East River have exposed bedrock and coarser substrates. Cable installation in the East River may require use of alternate burial techniques, such as the use of concrete mats or rip-rap over the cables.

Existing sediment quality information for the Harlem and East Rivers was obtained from the USACE study area reports, USFWS, and from the CARP dataset. Within New York City, there are four primary contaminants of concern: mercury, PCBs, dioxin, and DDT (pesticide). In and around New York City, the major sources of contaminated sediments include industrial discharges, wastewater treatment plant discharges, CSOs, stormwater runoff, non-point source discharges, atmospheric deposition, and chemical and oil spills (USFWS 1997). The Harlem and East Rivers are urban mixed with residential, commercial, and industrial development, and have degraded sediment quality due to the point sources located along the shorelines, particularly the many CSO outfalls.

Sediment samples were collected from the East River by the USEPA Regional Environmental Monitoring and Assessment Program (REMAP) sampling during 1993-1994 and 1998 (as cited in Steinberg et al. 2004), and from the Harlem and East Rivers through the CARP during 2000. In the East River, concentrations of mercury were above the ER-M during 1993-1994 and remained above this level during the 1998 sampling. Similarly, concentrations of lead at some stations were also found to be higher than the ER-M. Concentrations of cadmium, nickel, and dioxin never exceeded the ER-M during the 1993-1994 or the 1998 REMAP sampling.

Through the CARP program, 14 sediment samples were collected and analyzed from the Harlem River and 14 samples were collected from the East River (Appendix D).

In the Harlem River, dioxin and furan compounds were detected, in most cases at levels less than 1 ppb. At most sample locations, metals were also detected, with arsenic, cadmium, chromium, copper, lead, nickel and zinc exceeding the ER-L but not the ER-M. However, in two samples collected at Spuyten Duyvil and Willis Ave. Bridge, lead exceeded the ER-M. All of the samples collected exceeded the mercury ER-M. Five samples exceeded the ER-M for silver, four at Spuyten Duyvil and one at the Willis Ave Bridge, and all samples exceeded the ER-L. Pesticides were reported at levels that generally exceeded the corresponding ER-L values, but chlordane (two samples), dieldrin (one sample) and Total DDT (nine samples) exceeded established ER-M concentrations. PAHs were found in concentrations mostly between 100-2,400 ppb, with one station exceeding the ER-L values. The total concentration of PCB congeners detected ranged from 455 ppb near the 207th Street Bridge to 5,408 ppb at Sputen Duyvil.

In the East River, dioxin and furan compounds were found at levels below 1 ppb. Metals were also detected, with levels that exceeded the ER-L in the majority of samples. Cadmium levels for four samples collected near Riker's Island had concentrations that exceeded the ER-M. Copper concentrations exceeded the ER-M in four samples at Riker's Island and one near Ward's Island, with levels in the remaining samples exceeding the ER-L. Lead concentrations exceeded the ER-M at nine samples near Riker's and Ward's islands. For all samples, mercury and silver levels exceeded their respective ER-M levels. Five samples exceeded the nickel ER-M and five samples exceeded zinc ER-M value, with the remaining samples all exceeding the ER-L concentrations for these two metals. Pesticides were generally reported at levels about the established ER-L values, with a higher occurrence of exceedences of ER-M concentrations than was reported in the Harlem River. PAHs were detected at concentrations of 100-6,400 ppb, often exceeding ER-M values. The total concentration of PCB congeners detected ranged from 726 ppb near the Bronx River to 5,107 ppb near Riker's Island.

4.6.3.5 Long Island Sound

In Long Island Sound, the distributions of sediment type and TOC reveal several broad trends that are largely related to sea-floor geology, bathymetry, and the effects of modern tidal- and wind-driven currents (Poppe et al. 2000). Lag deposits of gravel and gravelly sand dominate the surficial sediment texture in areas where bottom currents are the strongest and where glacial till crops out at the sea floor. Sand is the dominant sediment type in areas characterized by active sediment transport and in shallow areas affected by fine-grained winnowing. Silty sand and sand-silt-clay mark transitions within the basin from higher- to lower-energy environments, suggesting a diminished hydraulic ability to sort and transport sediment. Clayey silt and silty clay are the dominant sediment types accumulating in the central and western basins (Appendix D; Poppe et al. 2000).

Major cities and rivers have introduced contaminants into Long Island Sound from multiple sources, including sewage effluent, disposal of dredged material, industrial discharges, urban and agricultural runoff, and atmospheric deposition (USGS 2009). Many contaminants adsorb to organic sediment particles and are deposited on the seafloor. Historic sediment data were obtained from the Environmental Impact Statement (EIS) for the Designation of Dredged Material Disposal Sites in Central and Western Long Island Sound, Connecticut and New York (USEPA and USACE 2004). The primary contaminants of concern are heavy metals, PCBs, and oil by-products (USACE 2004).

The distribution of metal contaminants in surface sediments has been measured and mapped as part of a USGS study of the sediment quality and dynamics of Long Island Sound (Mecray et al. 2000). Surface samples from 219 stations were analyzed and mapped for trace (Ag, Ba, Cd, Cr, Cu, Hg, Ni, Pb, V, Zn and Zr) and major (Al, Fe, Mn, Ca, and Ti) elements, grain size, and *Clostridium perfringens* spores (a species of bacteria that serves as a conservative indicator of sewage-derived pollution in marine systems). This study supplements the USGS's regional analysis of Long Island Sound that was initially presented in Poppe et al. (1998) as well as subsequent reports (Buchholtz ten Brink et al. 2000; Mecray and Buchholtz ten Brink 2000; Varekamp et al. 2000).

Concentrations of metals generally increase from eastern Long Island Sound to western Long Island Sound, due to the muddy sediments of the central and western basins, increased proximity to pollutant sources and the natural movement of sediments and contaminants within the Sound, although higher than average levels are found in some urbanized harbors and tributaries (Brownawell et al. 1992; Mecray and Buchholtz ten Brink 2000). Overall, concentrations of lead, copper, zinc, and mercury in Long Island Sound have been found to be higher in the upper approximate 30 cm of sediment, reflecting the effects of industrialization (Cochran et al. 1991; Varekamp et al. 2000). Mercury concentrations decline in the upper 10 to 15 cm of sediment, apparently the result of a reduction in mercury sources in recent decades (Varekamp et al. 2000). Similar to the mercury findings, the USGS study conducted during 1996-1997 found that in most depositional areas metal concentrations in sediment cores decrease near the surface (Buchholtz ten Brink et al. 2000.

Within western Long Island Sound, the average concentrations of six metals (copper, mercury, nickel, lead, silver and zinc) exceeded their ER-L. The average mercury concentration in samples from western Long Island Sound also slightly exceeded the ER-M. Average concentrations of six metals (silver, cadmium, copper, mercury, lead, and zinc) exceeded the average background concentration for the depositional environments of Long Island Sound (USEPA and USACE 2004).

In central Long Island Sound, average concentrations of four metals (copper, nickel, silver, and mercury) exceeded the ER-L while, none exceeded the ER-M. Average concentrations of silver, cadmium, copper, and mercury exceeded the average background concentration for depositional environments of Long Island Sound (USEPA and USACE 2004).

4.6.4 Marine Disposal Areas, Dumping Grounds, Disposal Sites, and Spoil Areas

The USACE designates disposal and spoil areas for dumping this dredged material. Disposal areas are established where existing depths indicate that the deposition of dredged materials are not likely to cause shoaling sufficient to create a danger to surface navigation (NOAA 2009a,b). Disposal areas are charted, and soundings and depth curves are retained. Spoil areas are usually near and parallel to dredged channels, and are typically a hazard to navigation, even for shallow-draft vessels. Spoil areas are charted, although soundings and depth curves are omitted (NOAA 2009a, b).

Code of Federal Regulations (33 CFR § 205) previously established marine dumping grounds in waters of the United States. These regulations were subsequently revoked, and the use of designated dumping grounds has been discontinued. These areas are no longer considered to be a danger to navigation.

The United States Coast Pilot (NOAA 2009 a, b) categorizes disposal areas, dumping grounds, disposal sites, and spoil areas as artificial obstruction to navigation. These areas are described below according to their proximity to municipalities and geographic features, as applicable.

4.6.4.1 Lake Champlain

Fort Montgomery. A spoil area is located north of the Village of Rouses Point, New York. The spoil area is situated along the western shoreline of Lake Champlain, near Fort Montgomery.

4.6.4.2 Hudson River

Coeymans. A spoil area is located upstream from the Town of Coeymans along the left shoreline of the bank of the Hudson River.

Coxsackie Creek. A spoil area is located along the left shoreline of the Hudson River, at the mouth of Coxsackie Creek, near the Town of Stuyvesant.

Green Flats. In the Green Flats section of the river, the transmission line will pass near a disposal area along the left shoreline near the Hamlet of Malden on Hudson.

Riverdale. A dumping ground is located along the left shoreline of the Hudson River near the Riverdale section of the Bronx.

4.6.4.3 Long Island Sound

Shippan Point. A dumping ground is located in the Sound south of Shippan Point in the City of Stamford, Connecticut.

Norwalk Islands. A dumping ground is charted in the Sound south of the Norwalk Islands, located off the coast of Norwalk, Connecticut.

Western Long Island Sound Alternative. A disposal site in the western Long Island Sound that is currently in operation. This site is located 2.7 nautical miles (5 kilometers) north of Lloyd Point, New York and 2.5 nautical miles (4.6 kilometers) south of Long Neck Point, Connecticut, in water depths of 79 to 118 feet (24 to 36 meters) (USEPA 2004).

Bridgeport Alternative. A historical disposal site last used in 1977. This site is located 3 nautical miles (5.6 kilometers) southeast of Kensie Point, Connecticut.

4.6.5 Potential Impacts and Mitigation

The underwater transmission cable route will be aligned to avoid disposal areas, dumping grounds, and spoil areas. Therefore, the Project is not expected to have any impact on these areas. In general, potential impacts to water quality along the underwater transmission cable route will be closely associated with sediment type and sediment contaminants. Re-suspension may cause contaminants adsorbed to sediment particles to disassociate, thereby becoming more readily available in the water column and to aquatic organisms. Due to the varied sediment characteristics and quality along the underwater transmission cable route, potential water quality impacts due to re-suspension of sediments and contaminant will be dependent on local sediment characteristics. The underwater transmission cable route was sited to avoid areas of higher contamination concentrations (i.e., Upper Hudson River PCB Dredging Project). No permanent or long-term impacts on water quality from cable installation are expected. In addition, no impacts will occur during cable operation unless cable repair is required.

As the majority of the underwater transmission cable route is either riverine or tidal (Hudson River, Harlem and East Rivers, and Long Island Sound), the existing water quality typically experiences periods of naturally occurring increases in suspended sediments (i.e., storm events). In general, no long-term or permanent impacts to sediment characteristics, sediment quality, bathymetry, or water quality are expected during the cable installation and impacts are not anticipated during cable operation.

Once the cable is buried the bathymetry will return to pre-installation conditions through redeposition of the disturbed material into the trench. Even in cases where less than 100 percent of the disturbed sediment settles in the trench, the hydrodynamic regime at any given location along the underwater transmission cable route will not be changed so it can be expected that in time natural sedimentation will complete the refilling of the trench. Where bottom conditions do not permit burial in the substrate, the cable will be laid on the bottom and protected by laying concrete mats or rip-rap over the cables for protection. The mats will alter local hydraulic conditions such that some sediment deposition or scouring may occur around the irregularity in the bottom formed by the mats. However, the overall change in bottom topography will be small because the mats will extend only a short height above the bottom. Functional benthic habitat will develop, but it may differ from the habitat prior to cable installation.

The volume of the cable is extremely small relative to the sediment layer and bottom hydrography of the water bodies involved, and the effect of the cable on bathymetry will be immeasurable relative to natural levels of fluctuation due to currents, storms, navigational traffic, and other pre-existing factors.

4.6.5.1 Impact Assessment

The potential impacts of each installation technique are discussed below.

Water jetting

The sediment is fluidized to a trench depth of approximately 4 feet in a linear path approximately 2 feet wide, with an additional 6 to 8 foot width disturbed along the surface by the water jetting device skids, wheels or support frame. Four parallel trenches will be created for a cumulative disturbance width of 50 feet for direct physical disturbance of sediments and the associated benthic habitat. For a limited portion of the Project route, specifically between the Yonkers converter station and the Sherman Creek substation, the cable construction corridor will be approximately 80 feet to accommodate the 345 AC cable system. From Sherman Creek on the Harlem River to landfall in Bridgeport, the Project corridor is reduced in width to approximately 14 feet as there are only two HVDC cables being installed along this portion of the route.

During water jetting, any sediment disturbance and re-suspension will be localized and limited to the area around the water jetting device. Sediment re-suspension will depend on sediment density, size and shape, as well as the hydrodynamic forces of the surrounding water. Dispersion of sediments during cable installation will be influenced by horizontal advection, dominated by local tidal currents in the Hudson River through Long Island Sound reach, and settling rates. In general, coarse sediment particles, such as sand, settle more readily than finer sediments, such as silts and clays, so only the finest-grained sediments persist in the water column in areas of the lowest current velocity or turbulence. Because the underwater cable route has been selected to be preferentially located in areas with high sand content sediments, sediments re-suspended during cable installation are expected to settle quickly. Potential increases in turbidity and suspended sediment concentrations will therefore be minimal and comparable to increases associated with natural processes (e.g., wind, waves).

Contaminants adsorbed to sediments will either resettle in the trench or in adjacent areas, thus the aquatic organisms will be exposed to similar levels of contaminants as before the installation process. It is also possible that the jetting forces may cause release of contaminants from sediments, and possibly temporarily increase bioavailability. However, many contaminants have an affinity for silt, clay, and organics within the sediments, and will become re-adsorbed quickly, settling out along with these sediment particles.

Mechanical Plow Installation

As with water jetting, mechanical plowing disturbs the sediment along a linear trench with the majority of the material falling back into the trench while some material will settle adjacent to the trench on undisturbed substrate. Contaminants, if present, will be redistributed in the near vicinity of the trench, with some surface contaminants becoming buried in the trench.

Conventional Dredging

In areas where the cable crosses a navigation channel or is aligned in the federal navigation channel (such as Haverstraw Bay) and at landfall locations, conventional bucket dredging will be used to pre-dredge in order to achieve authorized cable burial depths, remove accumulated sediment in an existing maintained channel, and for HDD exit pits. The dredged material will be placed in scows and either replaced in the trench or pits or removed for placement at a permitted location. Dredging may result in sediment re-suspenion as the bucket is brought to the surface. The associated plume will travel varying distances depending upon sediment type and hydrodynamics. Impacts will be similar to the deposited sediments suspended by water jetting. The mechanical plow will then install the cables in the pre-dredge area, in which case there will be no additional impact. Placement of imported backfill when dredge spoil is not used, will create some additional increases in suspended sediment, the magnitude of which will be dependent on the method of placement and the type of imported backfill used.

Concrete Mat/Rip-Rap Protection

In areas where the cable cannot be buried, primarily areas of rocky substrate or at utility crossings, articulated concrete mats or rip-rap will be used to cover the cables to provide protection. The mats or rip-rap will have a minor effect on near bottom hydrodynamics, which may be similar to the conditions found in rocky bottom areas. The mats or rip-rap may alter local hydrodynamic conditions such that some sediment deposition or scour may occur around the irregularity in the bottom formed by the mats or rip-rap.

Horizontal Directional Drilling

Potential impacts due to the temporary disturbance of bottom sediments will be further minimized by HDD techniques. As in water jetting, HDD is less disruptive than conventional dredging and HDD allows avoidance of shoreline trenching. HDD will be used where the cables enter and leave a waterbody to avoid disturbance to the shallow water interface between land and water. A temporary sheetpile cofferdam with an exit pit will be constructed, within which the connection will be made between the buried cables and cables extending offshore through the directionally drilled conduit. The cofferdam will be approximately 16 feet by 30 feet with a dredged entry/exit pit typically 8 feet deep. Driving sheetpile minimally disturbs the substrate and will only create a small amount of suspended sediment. Dewatering and dredging within the cofferdam will remove the substrate along with associated aquatic life. The dredged material will be stored in a scow for replacement after the connection is made. The cofferdam will greatly reduce turbidity associated with dredging and subsequent replacement and recontouring of the substrate. Removal of the sheetpiles will create localized turbidity in a very small area.

If a cofferdam is not used at the in-water exit pit, potential impacts during directional drilling will include the release of drilling fluids and sediment disturbance at the exit hole. Additionally, frac-out may occur at the HDD entry and exit location resulting in drilling fluid release. Frac-out refers to the inadvertent release of drilling fluid from the drill hole upwards through the sediment overburden, with a release at the sediment water interface. In the case of a frac-out during HDD construction, gelatinous drilling fluid will flow outward from the point of discharge and cover a small area of the bottom. Depending on currents or wave action, some of the deposited drilling fluid could become suspended or dispersed. In the unlikely event of drilling fluid break-through (frac-out), the bentonite slurry will settle in a cohesive mass that can be removed from the waterbody floor. Potential frac-out of drilling fluid to the waterbody will be minimized through monitoring of drilling fluid volume, development and implementation of a drilling fluid loss response plan, and the use of appropriate bentonite drilling fluids that solidify upon contact with water.

Vessel Positioning

While it is anticipated that the majority of the cable installation will be performed using dynamically positioned vessels, certain activities will require anchored, spud moored, or jack-up vessels. Traditionally, conventional dredging is performed from spud barges, and it may be necessary to use these barges to support the work at the HDD exit hole. In these instances the anchoring, spudding, or jack-up will result in localized re-suspension of sediments as the legs are lowered and raised during vessel movements. Jack-up legs are likely to have pads that range in size from approximately 80 to 300 square feet.

Cable Repair during Operation

During Project operation, the only potential impact to water quality and bottom sediments will occur in the event of cable damage. In this instance, a jet plow may be used to un-bury a length of the cable on either side of the repair location. The cable will then be cut and the ends brought to the surface. The damaged section of cable will be cut out and a new, slightly longer piece of cable will be spliced in and the cable lowered to the seafloor. The cable will then be reburied. The impacts are similar to those described for the original installation, but much smaller in duration and extent. Because the cable does not contain a coolant fluid like certain other electric cables, there is no potential for fluid release in the event of a damaged cable.

4.6.5.2 Mitigation

In the development of compensation for the adverse effects of a proposed action on the environment, the first and most desirable approach is to maximize the avoidance of impacts in all aspects of a project. Avoidance can entail elements such as location, timing, design and evaluation of alternatives. The second most desirable approach is to minimize impacts where there are unavoidable impacts. CHPEI has incorporated impact avoidance and minimization in all major aspects of the Project as described below.

Underwater cable

The Project is designed to primarily utilize a underwater cable route to avoid many potentially adverse impacts associated with a cable route located primarily on land. A protected underwater cable has extremely low maintenance requirements, thus there are no reoccurring impacts on water quality and aquatic resources.

HVDC cable technology

The use of HVDC light cable minimizes effects on aquatic substrate because the cable is small (5½-inch diameter cable) and thus avoids distortion of the bottom profile in a way that would alter physical conditions in the substrate. In addition, the cable does not contain any fluids that could escape into the aquatic environment.

Installation

Cable burial using water jetting or mechanical plow as the primary installation and burial method establishes the depth needed for cable protection without the use of conventional dredging over the vast majority of the route. This approach produces much a much smaller sediment disturbance footprint, much less dispersal of suspended solids (and any potential sediment contaminants) since the turbidity plume is small compared to conventional dredging.

Horizontal Directional Drilling

The use of HDD to install the cables at shoreline crossing locations avoids disturbance of the sensitive habitats associated with the shallow water/land interface when the cable must enter and leave the water. With HDD, impacts to shoreline habitats, such as macrophyte beds, wetlands, mudflats and riparian vegetation can be avoided or minimized.

Cable routing

The cables have been placed to avoid sensitive in-water habitats in most locations. Generally the cables are placed in moderately deep to deep water which avoids productive shallows. The larger ships and barges used for cable installation require a substantial depth to operate (generally greater than 12 feet), thus there is a convergence of habitat protection needs and installation needs. The proposed cable route avoids submerged and floating aquatic vegetation beds which contain higher densities of benthic life than open water areas in the Hudson River. The cable route also avoids, to the extent possible, SCFWHs in the Hudson River, where most of those in proximity to the route are associated with shoreline areas. Where the cables pass through these habitats, they are positioned to minimize adverse affects within the habitat area. For additional information regarding SCFWHs refer to Section 4.8.4.1.1.

The transmission cable route will be aligned to avoid disposal areas, dumping grounds, and spoil areas. Therefore, the Project is not expected to have any impact on these areas.

Substrate selection

Sand is the preferred substrate for the burial techniques used during installation. The cables are routed through sand to the extent possible, but in some locations, other avoidance factors may take precedence. This preference coincides with the substrate type that generally contains low levels of contaminants compared to silty and organic substrates. The selection of sand minimizes the potential for the dispersal of contaminants and adverse effects on water quality.

The use of Project planning and design factors to avoid adverse impacts has reduced Project impacts on water quality. CHPEI will continue consultations with resource agencies and incorporate other approaches, as feasible, to avoid or minimize impacts.

The Project will also be designed and installed in a manner protective of aquatic resource and resources relative to accidental or unanticipated events. The Project will have spill control measures in place, will have personnel trained in and responsible for compliance with permit conditions and requirements, which will be spelled out in detail in the EM&CP.

4.7 FISHERIES

4.7.1 Shellfish and Benthic Resources

4.7.1.1 Existing Shellfish and Benthic Resources

Benthic and shellfish communities interact with many of the trophic levels in freshwater, estuarine and marine environments. Through their diverse life histories they regulate plankton abundance, process sediments, provide food for higher trophic levels and can be the foundation of important commercial fisheries that generate significant economic activity in certain areas. Their occurrence within and on substrates makes them a pathway for the movement of contaminants through aquatic ecosystems. Because of their bottom oriented life histories, they are a component of aquatic environments likely to be directly affected by cable installation, thus they are of primary importance in assessing project impacts.

Grain size, sediment compaction, substrate characteristics, and currents are among the important factors in habitat selection for benthic invertebrates. As a result of these habitat selection parameters, their distribution can be highly variable over small distances. Major differences occur over the length of the route based on salinity, such as may be observed in the Hudson River, as well as differences between lacustrine and riverine conditions. The benthic community may also differ depending on depth, as the deep water fauna of Lake Champlain or the main river channel, will be distinct from shallow embayments and shoreline areas.

A marine survey to collect route specific data on benthic communities along the underwater transmission cable route is planned for spring 2010. Additional site specific benthic data will be provided as part of the supplemental information to be submitted in July 2010. The following sections describe readily available historic data along the route. This historic data has been used to characterize the shellfish and benthic resources and assess the potential impacts associated with cable installation.

4.7.1.1.1 Lake Champlain

Lake Champlain is one of the largest freshwater lakes in the United States. Its benthic invertebrate community, which includes native mussels, aquatic snail, crustaceans, oligochaetes and insects, supports a diverse ecosystem within the Lake Champlain Basin complex. Fourteen native freshwater mussels have been identified in the system, eight of which are listed in Vermont as threatened or endangered but are not found along the underwater transmission cable route (LCBP 2009c).

No comprehensive studies documenting benthic communities have been conducted within Lake Champlain. One study, conducted in the late 1960's, concluded that several of the most abundant species were located in various embayments of the lake (Henson and Potash 1970). Macrobenthos in Mallets Bay consisted of the amphipod *Gammarus limnaeu*s, the isopod *Asellus intermedius*, the chironomid *Chironomus anthracinus*, and snails of the species Amnicola. In Shelburne Bay, the same amphipod was collected, along with three species of burrowing mayflies; *Hexagenia occulta, Chironomus fumidus*, and *Pontoporeia affinis*. Among the 10 bays sampled, spread throughout the lake, 53 species of Chironomidae were identified, and each bay was found to be dominated by a different species (Henson and Potash 1970).

Within the Lake Champlain basin, 12 invasive mollusks and six invasive crustaceans have been identified (Table 4.7-1) (Lake Champlain Basin Program et al. 2005). The invasive non-native zebra mussel (*Dreissena polymorpha*) arrived in Lake Champlain in the early 1990s and has since colonized the entire basin system, although the closely related quagga mussel (*Dreissena bugensis*) has yet to be detected (LCBP 2009c). Zebra mussels are filter feeders that consume large quantities of plankton. The result has been increased water clarity and subsequent aquatic plant growth in shallow areas of the lake which has dramatically altered the lake's native benthic community. The VTDEC and the NYSDEC, with funding provided by the Lake Champlain Basin Program and the two states, have been conducting the Long-Term Water Quality and Biological Monitoring Project for Lake Champlain which is evaluating the Lake's phytoplankton and zooplankton communities as well as the spread of zebra mussel since 1992.

4.7.1.1.2 Champlain Canal

The benthic community within the Champlain Canal has not been extensively studied, but is likely to be similar to the benthic community associated with shallower areas of Lake Champlain. Recently, Asian clams (*Corbicula fluminea*) were discovered in the Champlain Canal between Locks C8 and C9 (Vermont Agency of Natural Resources Department of Environmental Conservation 2008, Lake Champlain Basin Program 2009). It is expected that native and zebra mussels are present within the Canal, along with some of the more common aquatic insect larvae and crustaceans.

Benthic samples will be collected within in the Champlain Canal during the 2010 route specific marine survey.

4.7.1.1.3 Hudson River

The benthic macroinvertebrates of the Hudson River form a well documented and diverse community that includes approximately 300 species of annelids, mollusks, crustaceans and insects (Levinton & Waldman 2006). The first systematic survey of the Hudson's benthic community was done by Townes (1937). In the 1970's Ristich et al. (1977) and Weinstein (1977) surveyed the benthos from Poughkeepsie to Manhattan. In the 1980's Simpson et al. (1984, 1985 and 1986) and Bode et al. (1986) surveyed the benthic community in the main channel of the Hudson from Troy to New Hamburg. Since 1990, Strayer et al. (1994, 1996, 1998), and Strayer and Smith (1996, 2000 and 2001) have studied the community from Troy to Newburgh (Strayer in Levinton & Waldman 2006).

Benthic community structure and population density varies widely and is determined by many factors such as water quality and sediment type as well as the presence or absence of aquatic vegetation and human alterations. Benthic communities vary in distribution in the Hudson depending on bottom type, salinity, and SAV and location along the river. For example, freshwater snails, clams, chironomids, and insects are present north of Poughkeepsie, whereas there is mixture of freshwater and marine organisms between Stony Point and Poughkeepsie, and a typically estuarine benthos from Stony Point south which are dominated by estuarine worms and crustaceans. The predominant crustaceans in the lower Hudson estuary include grass shrimp (*Palaemonetes* spp.), sand shrimp (*Crangon septemspinosa*), and blue crab (*Callinectes sapidus*) (Levinton and Waldman 2006). Benthic community density peaks near Manhattan, Kingston, Albany, and in deep troughs along the River (Strayer in Levinton & Waldman 2006).

The benthic macroinvertebrate community has undergone substantial change in recent years, since the invasion of the Hudson Estuary by the non-native zebra mussel in the early 1990s. Deep-water benthic macroinvertebrates, which depend on phytoplankton deposited from upper water layers as a primary food source, declined 33 percent; however, in shallow littoral areas, benthic macroinvertebrate density increased by 25 percent, presumably due to an indirect positive effect of increased water clarity and increased macrophyte/algal production resulting from zebra mussel filter-feeding (Strayer et al. 1998). Native suspension-feeding bivalves (Unionidae: *Elliptio complanata*, *Anodonta implicata*, and *Leptodea ocracea*) have also declined in the Hudson due to the decrease in phytoplankton. Since 1992, native unionid (clam) densities have declined by 56 percent, and recruitment of young-of-year (YOY) unionids has declined by 90 percent (Strayer and Smith 1996; Strayer et al. 1998).

Historically, extensive oyster beds occurred in the lower Hudson River as far north as Haverstraw Bay. Exactly how far up the Hudson River the oyster beds extended is difficult to determine. According to Ingersoll's *The History and Present Condition of the Oyster Industry* (1882), Rev. Samuel Lockwood said that 5 miles above Teller's Point, near Sing-Sing, is the uppermost point "where they ever flourished." In the same work, Captain Metzgar mentioned Rockland Lake as the northern limit and "all the way it was almost continuous oyster bottom". Despite the extent and magnitude of this habitat type, overharvesting and degraded water quality resulted in near extinction of oysters in the lower Hudson River during the early 20th Century. Currently there is considerable interest in restoration of oyster beds in the Hudson River, and a NYSDEC-sponsored restoration effort is underway.

An introduced bivalve, the Atlantic rangia (*Rangia cuneata*), native to the United States Gulf coast, has become established in the lower Hudson River Estuary and is abundant in the Tappan Zee and Haverstraw Bay. Prior to 1955, this species was unknown from East coast estuaries, but has become widespread in the Hudson and other mid-Atlantic waters within the past several decades. Potential vectors of introduction include ballast water, bait buckets, and oyster restoration program (using Gulf coast shells or live oysters). Atlantic rangia were first reported in the Hudson in 1988 (Strayer 2006). The long-term ecological significance of the Atlantic rangia's introduction to the Hudson River is poorly understood; however, the potential effects of a successful benthic suspension feeder on trophic dynamics, native bivalves, and plankton communities in a large, shallow bay may be significant.

Very recently, another invasive benthic species has appeared in the Hudson River Estuary - the Chinese mitten crab (*Eriocheir sinensis*). Three specimens have been collected from the mid-lower estuary since June 2007. Native to eastern Asia, the Chinese mitten crab is an important food in its native waters and supports a large aquaculture industry. The Chinese mitten crab is highly prolific and omnivorous, competing aggressively with native macrocrustacean populations where it has become established. Burrowing activity by Chinese mitten crabs has led to damage to native vegetation and increased shoreline erosion. NYSDEC has issued a "Mitten Crab Alert, seeking assistance from the public in reporting any additional sightings or collections" in New York waters (Dey 2008).

Below is a summary of some representative surveys on the benthic communities within the Hudson River and includes a discussion on riverwide surveys as well as site specific surveys.

Riverwide Surveys

Simpson et al. (1985) sampled the benthic community from 16 stations from Glenmont, New York to New Hamburg, New York in the main channel of the Hudson River. Samples were collected using a Petite Ponar grab sampler and a diver-operated Hess sampler; 117 species of macroinvertebrates were identified. The fauna was dominated by tubificid worms, clams, snails and chironomids with the family Chironomidae (non-biting midges) representing the most diverse group with 40 taxa recorded. The common oligochaete worm, *Limnodrilus hoffmeisteri*, was the most abundant species, contributing 54 percent of the total number of specimens collected and 74 percent of 79 percent of the total biomass. The study noted that the most diverse benthic communities were correlated to the most heterogeneous substrates with various sized sands mixed with silt (Simpson et al. 1985, and Simpson et al. 1984).

In 2000 and 2001, NYSDEC conducted the Hudson River Biocriteria Project to develop indicators of biological conditions for the Hudson River Estuary. The goal of the project was to develop one or more biological indicators that could be used to assess the ecological condition of the estuary through long-term monitoring. A total of 278 benthic samples were collected from the Troy Dam to the Battery (i.e., southern tip of Manhattan) (Figure 4.7-1) (Llanso et al. 2003). Benthic samples were collected with a Young grab (0.044 m^2 surface area to a depth of 10 cm) and washed through a 0.5 mm sieve. Based on cluster analysis of species abundances, samples were classified into three habitats according to salinity; tidal freshwater (Albany to Peekskill), oligohaline (Peekskill to Yonkers), and mesohaline (Yonkers to the Battery). The tidal freshwater was further divided into two sediment classes; sand or mixed sediments, and mud.

The number of benthic invertebrate species per sample ranged from 1 to 27, and the mean increased with the salinity gradient and in freshwater sands (Table 4.7-2). Species richness averages were typical of estuarine benthic communities of low salinity habitats. Species were categorized as infauna or epifauna. Total abundance varied widely among sites, with densities ranging from 68 to 39,600 individuals per m^2 (Table 4.7-3). Mesohaline and freshwater sand habitats had higher mean densities than oligohaline and freshwater mud habitats (Llanso et al. 2003).

Biomass was on average higher at oligohaline sites, where clam beds were found. High biomass values in tidal freshwater sands resulted from the presence of zebra mussels. Sites with high densities of organisms were numerically dominated by tubificid oligochaetes. Oligochaetes were dominant in freshwater sites while polychaetes were dominant in mesohaline sites (Table 4.7-3). Crustaceans (mostly amphipods and isopods) were abundant in oligohaline and freshwater sites, and molluscs were particularly important in the clam beds of the oligohaline salinity zone (Table 4.7-3). A complete list of species by habitat is provided in Table 4.7-3 (Llanso et al. 2003).

In 1998 and 1999 the NYSDEC Benthic Mapping Project conducted the initial phase of the project and mapped 40 miles of the Hudson River Estuary (about one third of the area of the estuary). This phase included four areas; 1) a reach north of and including the Tappan Zee Bridge, 2) Newburgh Bay, 3) the reach from Kingston to Saugerties, and 4) the reach from the City of Hudson to the south end of Schodack Island. In each reach benthic grabs and Sediment Profile Imaging (SPI) were used to assess and describe the benthic community. In addition, remote sensing techniques were used to characterize bathymetry and sediment types. The survey has identified historic bands of now inactive oyster beds in the area of the Tappan Zee and Haverstraw Bay. Recently, active mussel beds have been discovered at the base of the Tappan Zee Bridge (NYSDOT 2007).

Site Specific Surveys

A total of 126 samples were collected at 14 stations (n=3) located in the Hudson River just off Athens, New York using a 0.05 m^2 Ponar grab in August and November of 2001, and April of 2002. Seven stations were located in shallow water (10 feet or less) and seven stations were located in deep water (14 - 22 feet). Fluctuations in density and species composition were observed between sampling months (August and November 2001 and April 2002). Within the channel, the macroinvertebrate community was typical of a low-salinity estuarine habitat and included segmented worms, small crustaceans, insect larvae, and clams. Arthropods, particularly insect larvae, dominated the collections in terms of numbers of different taxa, although amphipods (*Gammarus* spp.) and isopods (*Cyathura polita*) also were common in the samples (USACE 2003). Mollusks (clams and snails) were the next most diverse group, followed by annelids, particularly oligochaetes (segmented worms). Overall, arthropods were the numerically dominant major taxon, followed by annelids, mollusks, platyhelminthes (flatworms) and rhynchocoels (ribbon worms). In general, the survey found the macroinvertebrate community to be composed of species that were broadly adaptable to changing environmental conditions (e.g., salinity, temperature, dissolved oxygen, etc.) and tolerant of environmental perturbations and pollution (USACE 2003).

Menzie (1981) studied the chironomid (non-biting midge) fauna of a vegetated tidal embayment of Haverstraw Bay. The dominant chironomid species inhabiting the beds and adjacent shallow unvegetated areas was *Crictopus sylvestris*. Additional numerically dominant taxa included *Dicrotendipes, Tanytarsus, Polypedilum,* and *Parachironomus* species. Chironomid density in vegetated areas was 16 times that of adjacent non-vegetated areas, and Menzie estimated that the chironomid standing crops in the vegetated areas would represent 14 to 25 percent that of Haverstraw Bay, representing an important prey resource for juvenile and forage fishes, including alewife, which forage in shallows at night, and predatory invertebrates such as damselfly larvae (*Enallagma durum*), and gammarid amphipods, which are in turn consumed by fish.

In 2000, a benthic sampling program was conducted to determine if there were any unique or special physical habitats or aquatic life conditions along the route across Haverstraw Bay for the proposed Millennium Pipeline. Samples were collected using a 0.1 m^2 Smith-McIntyre Grab at seven stations along the proposed route, a 2.1 mile stretch from Bowline Point, Haverstraw, to Veterans Administration hospital property on the eastern shore. One reference sample was collected in the navigational channel approximately 1 mile south of the proposed cable route, Table 4.7-4) lists a summary of macroinvertebrates collected and analyzed (LMS 2001).

In addition, grass shrimp (*Palaemonetes pugio*), sand shrimp (*Crangon* spp.), opossum shrimp (*Neomysis americana*), and blue crab (*Callinectes sapidus*) are abundant in Haverstraw Bay's open waters and tidal shallows. The two shrimps and the mysid species are critical food resources for many juvenile and adult finfish, including weakfish, striped bass, and white perch. Larval life stages of blue crab, zoea and megalopae, require relatively high salinities and are abundant in this portion of the lower Estuary.

An eight month survey of epibenthic fauna of Croton Bay, New York was conducted in 1974. Thirty nine genera were collected including amphipods, isopods, decapods, chironomids, gastropods, polychaetes, barnacles and mussels. Although sampling stations were not located along the proposed cable route, the epibenthic organisms collected from Croton Bay are representative of the fauna present in similar habitats of a large portion of the Tappan Zee and Haverstraw Bays (Crandall 1977). Species abundance and diversity varied over the eight month study Amphipods were present in great numbers during all sampling periods. The three most abundant amphipod species were *Gammarus tigrinus, G. daiberi* and *Corophium lacustre*. The mud crab, *Rhithropanpeus harrisii*, was the only crab collected and was numerous in bay traps from June to October. Oligochaetes were present during all sampling periods as well as the polychaete *Hypaniola gayis* (Crandall 1977).

The benthic community of the Hudson River near Ossining, New York was sampled at monthly intervals between May 1972 and April 1973. Samples were collected using a Peterson grab at six stations; one southern Haverstraw Bay, four off of Ossining, and one north of Tappan Zee (Williams et al. 1975). Among all stations sampled, the copepod order Harpacticoida was collected at the highest average densities. Snails of the species *Amnicola* and the mollusk *Congeria leucophaeta* were the other most densely collected species, while all others made up less than 3 percent of the total collected. Seasonal fluctuations in species abundance and diversity were observed, in general the number of taxa and individuals observed during the spring seemed to be attributable to high levels of freshwater run-off which is typical in a tidal estuary.

4.7.1.1.4 Harlem River and East River

Both the Harlem and East Rivers have undergone significant modifications as a result of channelization, bulkheading, upland filling and urbanization along their shorelines. The majority of benthic invertebrate species found in these habitats are tolerant of highly variable conditions, with salinity ranging from estuarine to marine concentrations. Biological surveys of these areas have found the benthic community to be comprised of both suspension and deposit feeders, including polychaetes, crustaceans and bivalves.

In 2002, Energy & Environmental Analysts, Inc. (EEA) collected six ponar grab samples in the Harlem River along the bulkhead between the 3rd Ave Bridge and the Willis Avenue Bridge and between Piers 6 and 9 on the East River (EEA 2002). Samples were dominated by polychaete worms. In both locations, *Streblospio bendicti* and Capitellidae were the dominant organisms. Review of the benthic invertebrate data revealed that both pollution indicative and pollution sensitive species were enumerated (i.e., slight contamination by pollutants of the sediment was evident, although not concentrated enough to displace the pollution sensitive species).

The benthic community south of the Third Avenue Bridge, in the Hell Gate at east 91st street, was sampled as part of the EIS for the City of New York Comprehensive Solid Waste Management Plan. *Streblospio benedicti* comprised the majority of the individuals collected (16,952 out of 22,801), indicating a pollution altered environment. Oligochaeta were collected in the next highest numbers, although not nearly as frequently as *S. benedicti* (1,738 and 1,637, respectively) (NYC Department of Sanitation 2005).

Numerous surveys of the benthic community in the waters surrounding Manhattan have been conducted. Although these surveys were not conducted along the proposed underwater transmission cable route, they provide an indication of the likely existing benthic community in these water bodies. Hazen and Sawyer Engineers (1981) conducted a survey of East River benthos near the Brooklyn shore south of Newtown Creek. Forty four species were collected in the survey with polychaetes being the dominate group found living in sand and mud bottoms. Tunicates were the dominate organisms living on hard bottom areas and clams were dominant in the soft substrates. Dense populations of the tube building polychaete, *Sabellaria vulgaris*, were found near rocky ledges. *Mytilus edulis*, the blue mussel, was found attached between the worm casings (Hazen and Sawyer 1981). A total of 33 taxa at an average density of 624 organisms per m^2 were collected from the East River during field sampling using a Ponar Grab with species represented from the Annelida, Arthropoda and Molluska phyla (HydroQual 2001). The crustaceans in the Arthropod group, however, occurred infrequently among the stations and in relatively low numbers compared to annelids and mollusks (HydroQual 2001).

A survey of the benthic community living in the seabed under piers and between piers was conducted by EEA (1989). Sediment samples for benthos were collected using a standard Ponar Grab from inter-pier areas off South Manhattan piers 13 and 17. The infaunal community living in the seabed below piers was significantly more abundant ($p<0.001$) and contained more species ($p < 0.001$) than the community measured in samples collected from the open seabed. Important benthic species that were high in abundance were the polychaetes, *Polydora sp., Glycera sp., Eteone heteropoda, Nereis succinea, Heteromastus sp., Pectinaria gouldii,* amphipods, *Microdeutopus gryllotalpa, Unciola serrata, Paracaprella tenuis, Corophium insidiosum, Jassa marmorata*, the isopod *Edotea triloba*, mollusks *Mya arenaria, Crepidula fornicata*, mussels, and the tunicate *Molgula manhattensis* (Woodhead et al. 1999).

Samples taken within the East River near the west end of Long Island Sound were analyzed using a multi-metric benthic index of biotic integrity during 1993-1994 and 1998 as part of the investigations under the REMAP (Adams and Benyi 2003). Results indicated that along this portion of the cable route, in the East River, the existing benthic community is moderately to highly impacted, likely by urban runoff and combined sewer discharges.

4.7.1.1.5 Long Island Sound

Benthic species diversity generally increases from west to east across the sound, and species densities tend to be highest in the eastern and central basins (Pellegrino and Hubbard 1983). However, even along the proposed cable route, species diversity, and abundance in the western portion of the Sound may vary widely. Pellegrino and Hubbard (1983) conducted a sound wide survey with 413 sampling stations distributed in Connecticut waters of Long Island Sound as part of the Connecticut Coastal Energy Impact Program. The goal of this study was to create a base line data source to be used in assessing the impact of energy related environmental activities within the Sound. In this study, the benthic community in the western and central basins was dominated by the mollusks, *Mulinia lateralis, Nucula annulata*, and the *polychaete*, *Nephtys incisa*, whereas in the eastern portion of the Sound species were more varied among the regions.

Reid (1979) recognized three infaunal assemblages in the central and western basins of the Sound. The three groups consisted of a muddy, deep-water assemblage distributed throughout much of the central and western basins, a shallow sandy assemblage along much of the north shore of Long Island, New York, except in the western portions of the Sound, and a transitional shallow-water assemblage in the western portion of the Sound, especially along the Connecticut shore. The three groups were each comprised of a mixture of species with species richness lower in the muddy, deep-water and shallow sandy groups than in the transitional group (Reid 1979). The proposed cable route occurs mostly in habitat that would likely host the muddy, deep-water group. This group was dominated by the bivalves *Mulinia lateralis, Pitar morrhuana, Nucula annulata*, and *Yolida limatula*. Other frequently occurring species were the polychaete, *Nephtys incisa*, and the gastropods, *Nassarius trivittatus* and *Acteocina canaliculata*.

The Connecticut Department of Environmental Protection (CTDEP) conducts the Long Island Sound Trawl Survey (LISTS) annually to measure the abundance and distribution of finfish and select macroinvertebrates, including lobster, within the Sound. The annual trawl survey dates back to 1984 and is conducted from New London to Greenwich, Connecticut, in Connecticut and New York waters from 5 to 46 meters in depth over mud, sand, and transitional sediment types using a stratified-random sampling design (Gottschall et al. 2009). Forty-one species of invertebrates were collected during the 2008 survey including several clam and crab species, lobster, mussels, oysters and shrimp. Table 4.7-5 lists the invertebrate species collected in 2008.

4.7.1.1.6 Commercially and Recreationally Important Shellfish

Shellfish and other benthic resources of Lake Champlain, the Champlain Canal, and the Hudson River are not harvested for commercial or recreational purposes, either because of a lack of harvestable species or contamination. In the estuarine portion of the Hudson River, Harlem and East Rivers, and western Long Island Sound, NYSDEC has designated the shellfish lands in Westchester, Bronx, Kings, New York and Queens Counties as uncertified areas and shellfish shall not be taken for use as food (NYSDEC 2010). In addition waters in western Long Island Sound to the New York/Connecticut border are designated as uncertified.

Historically, shellfish populations in the Hudson River, Harlem River, East River and Long Island Sound were significantly higher than the current population, especially the eastern oyster

(Levinton 2006). However, the Hudson River and Long Island Sound offer important habitat to several species of shellfish, including mollusks, such as the razor clam or Atlantic jackknife (*Ensis directus*), blue mussels (*Mytilus edulis*), hardshell clams (*Mercinaria mercinaria*), and eastern oyster (*Crassostrea virginica*), and crustaceans such as the blue crab (*Callinectes sapidus*), Portly spider crab (*Libinia emarginata*), and American lobster (*Homarus americanus*).

Within the Hudson River Estuary there is a recreational and commercial fishery for blue crabs. NYSDEC observed fishing activity was distributed around four major areas; Piermont, the Tappan Zee Bridge, Stony Point and Poughkeepsie. In 2001, the number of bushels of blue crabs collected in July, August and September ranged from 76 to 102 (NYSDEC 2002).

Both commercial and recreational blue crab fisheries exist in the lower Hudson River, with efforts concentrated during the late summer and early fall. In shallow waters, crabs are primarily harvested with crab pots (traps) or trotlines. Dredges and scrapes are used by the commercial fishers later in the season to capture overwintering crabs buried in sediments. Relative to the overall New York, New Jersey and Delaware blue crab fishery, New York landings are small, and the Hudson River landings represent only a minor percentage of total landings in New York State. Although average PCB concentration in crab tissues is relatively low (<1 ppm), concentrations of PCBs (and other toxins) in the crab hepatopancreas (a.k.a. "mustard, liver, or tomalley") are higher (>5ppm). The NYSDOH has issued a consumption advisory for blue crabs in the Hudson River.

The hard clam (or northern quahog) is found throughout the New York Bight and Long Island Sound area from the littoral zone to the deepest channels (USACE 1999). Hard clams depend on coastal wetlands for the detrital food chain that supports their growth. Abundance tends to be highest in protected areas of estuaries (Stanley 1985). Hard clams are capable of living on a variety of substrates but prefer heterogeneous substrates such as a mud and sand mixture (Roegner and Mann 1991). Growth to maturity requires several years, and reproductive age is dependent on size (Stanley 1985). The hard clam is the most extensively distributed commercial clam in the United States, with the fishery located primarily along the Mid-Atlantic Bight (Stanley 1985).

The eastern oyster is found at depths ranging from the intertidal zone to 130 feet or greater (Grosslein and Azorovitz 1982), but typically lives in the shallow waters of estuaries, lagoons, and nearshore areas of bays (Stanley and Sellers 1986). Oysters are distributed in salinity ranges between 5 and 30 ppt. Oysters prefer hard substrates such as shell, rock, firm sand, or mud, where they settle in large groups, or bars. Oyster beds often provide hard substrate in areas where it is lacking, creating settlement areas for oyster spat as well as other epibenthic species (Kennedy 1991).

The American lobster is of particular importance in the deep waters of the Sound and is one of the most valuable commercial fishery species. American lobsters are found from nearshore areas to the waters of the continental slope (USFWS 1997). This species is found among rocks and other hard substrate that it uses for refuge. However, this range is divided between inshore and offshore groups, with some overlap occurring (Grosslein and Azarovitz 1982). Lobsters prefer rocky or cobbled areas, but are found on other substrates as well. In inshore areas, lobsters frequent areas of sand with overlying boulders (MacKenzie and Moring 1985). Seasonal distribution is related to water temperature.

Most lobsters are caught in shallow inshore waters, at depths of 15 to 100 feet. In the Long Island Sound, lobster landing peaked in the late 1990s before severe lobster die-offs in 1999 and 2002 reduced the harvest to early 1980s levels. The die-offs were attributed to warmer water temperatures and impaired water quality that stressed the lobsters and made them susceptible to disease (EPA 2008).

4.7.1.2 Potential Impacts and Mitigation

Benthic invertebrate and shellfish resources will be directly affected by cable installation as a result of the disturbance of the substrate during cable burial. The dispersal of sediments, some of which may contain chemical contaminants, can affect the resources in the near vicinity of the disturbance. The interaction between the cable installation process and benthic and shellfish resources involves aspects which apply throughout the underwater transmission cable route. Also, many mitigation actions are designed into the installation process and the route selection. Potential impacts to threatened and endangered species found along the route are discussed in Section 4.9.

Section 4.1 describes the construction equipment, installation procedures and temporal aspects of cable burial as well as the various methods of installation that will be used along the route. The impacts to the benthic community found along the underwater transmission cable route will depend on factors such as substrate and sediment type, water depths, as well as hydrodynamics. In most soft bottom habitats, impacts are expected to be temporary and localized. Many of the existing benthic species are relatively tolerant to burial or smothering as a number of the infaunal species are deposit feeders and can burrow. In addition the tube dwelling organisms may be able to survive burial by extending their tubes or constructing new tubes at the surface. As the majority of the underwater transmission cable route is tidal, the existing benthic community typically experiences periods of naturally occurring increases in suspended sediments (i.e., storm events). The potential impacts of each installation technique are discussed below.

Water jet installation

Over a majority of the underwater transmission cable route, the sediment will be fluidized to a trench depth of approximately 4 feet in a linear path approximately 2 feet wide, with an additional 6 to 8 foot width disturbed along the surface by the water jetting device skids, wheels or support frame. Four parallel trenches will be created for a cumulative disturbance width of 50 feet for direct physical disturbance of sediments and the associated benthic habitat. For a limited portion of the underwater transmission cable route, specifically between Yonkers and Sherman Creek substation, the underwater cable construction corridor will be approximately 80 feet wide to accommodate the AC cable system. From the Harlem River to landfall in Bridgeport, the Project corridor is reduced in width to approximately 14 feet as there are only two HVDC cables being installed along this portion of the underwater transmission cable route.

During water jetting, benthic communities found along the trench will be impacted by several mechanisms. Trenching activities may dislodge invertebrates from and on the sediments and put them into suspension where some will sink into the trench and some may be displaced to the substrate adjacent to the trench. The high pressure of the jetted water will result in mortality of soft bodied benthos that are directly contacted by the jetted water. More mobile benthos may sense sediment movement (vibration) as the water jetting device approaches and move away from the approaching water jetting device. Approximately 80 percent of the disturbed substrate will sink back into the trench, thus most invertebrates in the path of the cable will be lost through burial. Sediment which falls on undisturbed substrate adjacent to the trench may bury some invertebrates and shellfish, but others may be able to tolerate the sediment deposition depending on the depth at any given location. Other species, such as clams and mussels can also use their muscular foot to reposition themselves upwards through relatively thinly deposited sediments. Contaminants adsorbed to sediments will either resettle in the trench or in adjacent areas, thus the benthic organisms will be exposed to similar levels of contaminants as before the installation process. It is also possible that the jetting forces may cause release of contaminants from sediments, and possibly temporarily increase bioavailability.

Water jetting and the associated re-suspension of sediments, although minor, will have an adverse localized effect on the pelagic larval stage of benthic species. Given that the increased turbidity occurs near and immediately down current of the water jetting, only a very small number of larvae within the system will be affected at any one time. In addition, the water used in the jetting process will be withdrawn from the water adjacent to the jetting vessel or the water jetting device, depending on the equipment selected.

Mechanical Plow installation

As with the water jet technique, during mechanical plow installation the substrate is disturbed along a linear trench with the majority of the material falling back into the trench while some material will settle adjacent to the trench on undisturbed substrate. Most benthic life will be buried in the trench with the sediment and some individuals will settle along the trench. Contaminants, if present, will be redistributed in the near vicinity of the trench, with some surface contaminants becoming buried in the trench.

Conventional dredging

In areas where the cable crosses a navigation channel or is aligned in the federal navigation channel (such as Haverstraw Bay) and at landfall locations, conventional bucket dredging will be used to pre-dredge in order to achieve authorized cable burial depths, remove accumulated sediment in an existing maintained channel, and for HDD entry and exit pits. The dredged material will be placed in scows and removed for placement at a permitted location. This dredging will cause the loss of all benthic life removed by the dredge over the width of the bottom area prepared for cable installation. In addition, dredging may result in sediment re-suspension as the bucket is brought to the surface. The associated plume will travel varying distances depending upon sediment type and hydrodynamics. Impacts will be similar to the deposited sediments suspended by water jetting. The mechanical plow will then install the cables in the pre-dredge area, in which case there will be no additional impact to benthic life.

Concrete Mat Protection

In areas where the cable cannot be buried, primarily along rocky substrates or at existing utility crossings, articulated concrete mats will be used to cover the cables to provide protection. The impact of this technique will be to bury the existing substrate and associated benthic life and to create a new hard surface substrate on the exposed surface of the mats. In areas of hard bottom, the mats will create similar habitat, and in soft bottom areas the mats will, in essence, create small artificial patch reefs. The surface of the mats will develop an epibenthic community over time as well as provide structure that is important for some benthic species and fish, thus the impact to functional habitat will be localized. The mats will have a minor effect on near bottom hydrodynamics, which may be similar to the conditions found in rocky bottom areas.

Horizontal Directional Drilling

HDD will be used where the cables enter and leave a waterbody to avoid disturbance to the shallow water interface between land and water. A sheetpile cofferdam with an entry/exit pit will be established nearshore within which the connection will be made between the buried cables and cables extending offshore through the directionally drilled conduit. The cofferdam will be approximately 16 feet by 30 feet with a dredged entry/exit pit typically 8 feet deep. Driving sheetpile minimally disturbs the substrate and will only create a small amount of suspended sediment. Dewatering and dredging within the cofferdam will remove the substrate along with associated aquatic life. The dredged material will be stored in a scow for replacement after the connection is made. The cofferdam will contain all turbidity associated with dredging and subsequent replacement and re-contouring of the substrate. Removal of the sheetpiles will create localized turbidity in a very small area. If a cofferdam is not used then the entry/exit pit will be conventionally dredged and the associated impacts will be similar to those described above for conventional dredging.

If a cofferdam is not used at the entry/exit pit, potential impacts during directional drilling will include sediment disturbance at the exit/entry hole and may include the release of drilling fluids. Sediment disturbance at the entry/exit hole will be limited to the area surrounding the drill head. Directional drilling operations will minimize the potential breakthrough of drilling fluids to the waterbody through monitoring of drilling fluid volume, development and implementation of a drilling fluid loss response plan, and the use of appropriate bentonite drilling fluids that solidify upon contact with water. In the unlikely event of drilling fluid frac-out, the bentonite slurry will settle in a cohesive mass that is easily removed from the waterbody floor. Frac-out refers to the inadvertent release of drilling fluid from the drill hole upwards through the sediment overburden with a release at the sediment water interface. In the case of a frac-out during HDD construction, gelatinous drilling fluid will flow outward from the point of discharge and cover the bottom. Depending on currents or wave action, some of the deposited drilling fluid could become suspended or more dispersed. Drilling fluid, composed primarily of bentonite clay and water, if suspended, may have similar adverse effects on fish respiration and feeding as those described above for jetting induced suspended sediments.

Vessel Positioning

While it is anticipated that the majority of the cable installation will be performed using dynamically positioned vessels, certain activities will require anchored, spud moored, or jack-up vessels. Traditionally, conventional dredging is performed from spud barges, and it may be necessary to use these barges to support the work at the HDD entry/exit hole. In these instances the anchoring, spudding, or jack-up will result in localized and small area mortality effects on benthos. Jack-up legs are likely to have pads that range in size from approximately 80 to 300 square feet.

Spills and Unintentional Releases

Although unanticipated, there is the potential that fuel, lubricants, or hydraulic fluids could accidentally be released into the water in the event of equipment failure or human error. The Project will be constructed with an agency approved SPCCP and other BMPs which will be detailed further in the EM&CP, and the necessary materials will be maintained on site to handle small spills or releases. For larger releases, a specialized cleanup contractor will likely be retained for immediate response. In the event that a hydrocarbon based liquid is accidentally released to the aquatic environment, and assuming rapid response, there will be little effect on benthos, other than during the spawning period when pelagic larvae could be adversely affected through toxicity effects.

Cable Repair during Operation

During Project operation, the only potential impact to benthic resources will occur in the event of a need to repair a section of the cable. In this instance, a jet plow may be used to unbury a length of the cable on either side of the repair location. The cable will then be cut and the ends brought to the surface. The damaged section of cable will be cut out and a new, slightly longer piece of cable will be spliced in and the cable lowered to the seafloor. The cable will then be reburied. The impacts are similar to those described for the original installation, but much smaller in duration and extent. Because the cable does not contain a coolant fluid like certain other electric cables, there is no potential for fluid release in the event of a damaged cable.

Electromagnetic Field

During Project operation, the cables will produce electromagnetic field (EMF). Very little is known about the effects of EMF on benthic infauna and epifauna. Given the relative primitiveness of these species, and the negligible mobility of many benthos, it is unlikely that the Project will have anything other than negligible impacts on benthos from the EMF produced by the cables. In addition, EMF calculations demonstrated that all field levels evaluated for the edge of right-of-way will be less than 200 milligauss (mG), this value is well below the maximum magnetic field allowable and is substantially well below guidelines for the sea floor (see Section 4.13).

Thermal Effects

The cables will produce heat during operation, that will be dissipated at depth, such that in the top 6 inches of the sediment, where most benthic infauna occur, there will be a negligible temperature increase, and one that will not have adverse effects on benthos. This effect will be further reduced on the sediment surface, since the movement of the overlaying water will result in further, rapid heat dissipation.

4.7.1.2.1 Impact Assessment

There will be a temporary loss of benthic invertebrates along the cable route where it is buried in the substrate or covered by concrete mats. Because the cables occupy a narrow linear corridor, the area of disturbance is generally a small portion of the waterbodies through which it passes. Exceptions to this are the narrow southern end of Lake Champlain and the Champlain Canal between Whitehall and Lock C8. In these areas the footprint for cable installation may occupy more than 10 percent of the width of the waterbody. In all locations there is a substantial area of undisturbed substrate that represents a source of organisms to recolonize the disturbed areas.

Suspended sediments may have either positive or negative effects on growth in bivalves, depending on the type and concentration of the particulates, as well as the bivalve species (Bricelj et al. 1984). For example, while three-week growth rates of juvenile hard clams were not significantly affected by sediment concentrations (with 10 percent organic matter) up to 25 mg/l, there was a significant reduction in growth and condition at 44 mg/l (Bricelj et al. 1984). On the other hand, growth enhancement by the addition of silt to an algal diet has been reported in mussels, surf clams and oysters.

The recovery of the habitat after cable burial limits the impacts to benthic life to a short-term effect, and because the need for maintenance of the cables (removal from the substrate) occurs very rarely, there will be no recurring effects on the substrate. The rate of recovery will vary by substrate type, benthic community composition and potentially many other factors. Many benthic species, via planktonic larvae, have evolved reproductive strategies focused on colonizing newly created or recently disturbed substrates. Other mobile benthic species will colonize the disturbed sediments from adjacent undisturbed areas. Studies which have investigated benthic recovery after disturbance in freshwater, estuarine, and marine environments support the position that recolonization is rapid. Functional habitat can develop within weeks in some communities and full functionality can return on the order of one year (NJDEP 1984; LMS 1984; EEA, 1989a, 1989b).

Full recovery of the benthic community is contingent upon reestablishment of the physical habitat conditions that were present before the cable installation. The forces that shape the physical aspects of benthic substrates, primarily currents and sedimentation, operate on a scale far greater than the localized effect of cable installation. The disturbance related to installation will have no influence on these forces, thus they will begin to reshape the disturbed substrate immediately after installation is completed. Because the cable occupies a small volume of the substrate (5½-inch diameter cable), and will in most instances be buried well below the sediment surface it will not interfere with the actions of these forces in reshaping the substrate. Important substrate factors for benthic organisms are the grain size distribution (sediment composition) and compaction within the substrate. The original conditions in the substrate are expected to become restored because the substrate is the parent material and the forces acting on the sediments are unchanged.

In areas where conventional dredging is employed, typically for deeper burial areas such as at crossings of a navigation channel, there will be more substantial alteration of the benthic habitat compared to jetting, since the construction will involve sediment removal, cable-laying, and then backfilling. Depending on the nature of the backfill, the sediment surface characteristics could be altered since it is unlikely that exactly the same grain size composition will be created as existed prior to cable installation. Depending on currents and erosional forces, backfill will be used that is anticipated to remain in place. However, whatever the backfill characteristics are, they are likely to become colonized over time with benthic organisms. Given the small amount of anticipated conventional dredging, any modified substrate characteristics is unlikely to have anything but a negligible to minor effect on benthic species.

The loss of ecological functionality in the benthic community from cable installation disturbance will be localized and short term. The disturbance will not generate changes that could precipitate widespread ecosystem impacts because there are no structures remaining in the waterbody that could influence hydrodynamics or sedimentation, other than in those small areas where concrete mats will be employed. Contaminants, if present, may be redistributed locally, but the Project will add no contaminants nor influence the forces that control the fate or transport of existing contaminants. A minor redistribution of contaminants will not alter the average exposure of benthic organisms to contaminants that are already present.

Throughout the Project route there are populations of non-indigenous, invasive species, with greater abundances of such species in the freshwater portion of the Hudson River and Lake Champlain. Benthic invertebrate and aquatic plant invasives have had documented adverse impacts on these ecosystems. The disturbance of substrates should not alter the distribution or abundance of invasives because the cable installation process does not create a unique mechanism for the dispersal of invasives. The ships and equipment used in cable installation will not generate disturbances greater than those caused by ship wakes and prop wash or the effects of major storms and high water events in riverine areas.

4.7.1.2.2 Mitigation

In the development of compensation for the adverse effects of a proposed action on the environment, the first and most desirable approach is to maximize the avoidance of impacts in all aspects of a Project. Avoidance can entail elements such as location, timing, design and evaluation of alternatives. CHPEI has incorporated impact avoidance in all major aspects of the Project as described below:

Underwater cable

The selection of a underwater cable avoids many potentially adverse impacts associated with a route sited on land. With regard to benthic invertebrates and shellfish, it permits options for locating the cable to avoid concentrations of benthic life while placing the cable in an environment that can recover quickly from disturbance. A protected underwater cable has extremely low maintenance requirements, thus there are no reoccurring impacts on aquatic resources.

HVDC light cable

The use of HVDC light cable minimizes effects on aquatic substrate because the cable is small (5½-inch diameter cable) and thus avoids distortion of the bottom profile in a way that will alter physical conditions in the substrate. In addition, the cable does not contain any fluids that could escape into the aquatic environment.

Water jetting

Cable burial using a water jet system establishes the depth needed for cable protection without the use of conventional dredging over the vast majority of the route. This approach produces much less dispersal of suspended solids, turbidity plumes and contaminants compared to conventional dredging.

Horizontal Directional Drilling

This technique avoids disturbance of the sensitive habitats associated with the shallow water/land interface when the cable must enter and leave the water. With HDD, impacts to shoreline habitats, such as macrophyte beds, wetlands, mudflats and riparian vegetation can be avoided or minimized.

Cable routing

The underwater transmission cables can be placed to avoid sensitive in-water habitats in most locations. Generally the underwater cables are located in moderately deep to deep water which avoids productive shallows. The ships and barges used for cable installation require a substantial depth to operate, thus there is a convergence of habitat protection needs and installation needs. The underwater cable route avoids, to the extent possible, SCFWHs in the Hudson River. Where the cables pass through these habitats, they are positioned to minimize adverse affects within the habitat area by being placed in the deeper water areas that are less productive and do not support submerged and floating aquatic vegetation nor the diversity of fish, wildlife and avifauna compared to the shallow water areas of these habitats. Additional information on wildlife in SCFWH areas is provided in Section 4.8.4.3. In Long Island Sound, the underwater cable route avoids managed shellfish beds and preferred lobster fishing areas.

Substrate selection

Sand is the preferred substrate for the burial techniques used during installation. The cable is routed through sand to the extent possible, but in some locations, other avoidance factors may take precedence. This preference coincides with the substrate type that generally contains low levels of contaminants compared to silty and organic substrates. The selection of sand minimizes the potential for the dispersal of contaminants and adverse effects on benthic life.

The use of project planning and design factors to avoid adverse impacts has reduced Project impacts on benthic invertebrates and shellfish to a practical minimum. CHPEI will continue consultations with resource agencies and incorporate other approaches, as needed, to avoid or minimize impacts. Other approaches that have been employed on some projects in the past to avoid or minimize impacts to aquatic life, but are not exclusive to benthic life, include restrictions on the timing of installation to avoid fish migration, spawning and the seasonal presence of threatened and endangered species; the application of BMPs to conventional dredging; and BMPs applied to staging areas and equipment handling for use in the aquatic environment.

The Project will also be designed and installed in a manner protective of benthic habitats and resources relative to accidental or unanticipated events. The Project will have spill control measures in place, will have personnel trained in and responsible for compliance with permit conditions and requirements, which will be spelled out in detail in the EM&CP.

4.7.2 Finfish

This section describes finfish in four areas; Lake Champlain, the Champlain Canal, the Hudson River (south of Albany) (the fish species of the Harlem River are similar to those in the adjacent Hudson and East Rivers), the East River, and Long Island Sound. Fish species present in streams crossed along the 69.9-mile underground cable segment are described in Section 4.5.1.1.3.

4.7.2.1 Existing Finfish

4.7.2.1.1 Lake Champlain

Lake Champlain is a large, heterogeneous lake, comprised of four distinct basins separated by a combination of geographic features and causeways constructed over shallow bars. Habitats, trophic state, watershed use, and fish fauna vary among these basins (FTC 2009). The native fish fauna is similar to that of the Great Lakes, although there are fewer species found in Lake Champlain. Currently there are 70 species of fish identified in Lake Champlain (Table 4.7-6.). Table 4.7-6 also indicates whether the species is native to Lake Champlain. Threatened and endangered fish species are discussed in Section 4.9.1.

The coldwater predator population is dominated by lake trout (*Salvelinus namaycush*), Atlantic salmon (*Salmo salar*), steelhead (*Oncorhynchus mykiss*), and brown trout (*Salmo trutta*). Coolwater species include yellow perch (*Perca flavescens*) and walleye (*Sander vitreum*).

Coregonid species are limited to lake whitefish (*Coregonus clupeaformis*) and lake herring/cisco (*Coregonus artedi*). Major forage species are rainbow smelt (*Osmerus mordax*) and yellow perch with alewives (*Alosa pseudoharengus*) rapidly increasing in abundance since 2002. Important warmwater sport fishes include largemouth and smallmouth bass (*Micropterus salmoides* and *M. dolomieu*), northern pike (*Esox lucius*), pumpkinseed (*Lepomis gibbosus*), and white and black crappies (*Pomoxis annularis* and *P. nigromaculatus*) (FTC 2009). The NYSDEC and Vermont Fish and Wildlife Department (VTFWD) stock rainbow, lake, and brown trout in the Lake Champlain basin waters and the USFWS stock young Atlantic salmon (LCBP 2009).

Lake Champlain - Migratory Species

Lake Champlain supports a number of anadromous fish species: sea lamprey, alewife, Atlantic salmon, brown trout, and steelhead; and a catadromous fish species; American eel.

Sea Lamprey

Sea lamprey was first noted in Lake Champlain in 1929. This non-native invasive species were thought to have entered Lake Champlain from the Hudson River Estuary through the Champlain Canal or possibly from the St. Lawrence River through the Richelieu River. However, recent studies showed that sea lamprey may be native to Lake Champlain and existed in the lake for approximately 10,000 years (NYSDEC 2010h). Similar to salmon, sea lamprey spend the early stages of their life in streams and rivers, middle stages of their life in saltwater or in large freshwater lake, return as breeding adults to spawn in the freshwater streams and river, and die shortly after spawning. Sea lamprey in Lake Champlain takes approximately six years to complete its life cycle (NYSDEC 2010h).

Spawning takes place during the spring on redds (nests) built by both males and females, with tens of thousands of eggs laid in gravel stream bottoms, which are provided oxygen by the flowing water. The worm-like larval lamprey (ammocoetes) drift downstream with the current and prefer silt/sand stream bottoms and banks in slower moving stretches of water, filter-feeding on algae, detritus and microscopic organisms. This life stage of the sea lamprey in Lake Champlain usually lasts three to four years (NYSDEC 2010h). During the mid to late summer of their third or fourth year, the ammocoetes transform into juvenile sea lamprey and begin life as parasite fish, moving into deeper water to seek host fish on which to feed (NYSDEC 2010h).

Sea lamprey attack mostly lake trout, but a wide range of fish species are also known to be attacked by this species in Lake Champlain (FTC 2009). The Lake Champlain Sea Lamprey Control Alternatives Workgroup (Workgroup) was established by the Secretary of Interior in 2006. The Workgroup reports to the Secretary of Interior and 1) provides advice regarding the implementation of sea lamprey control methods and alternatives to lampricides, 2) recommend priorities for research to be conducted and demonstrate projects to be developed and funded by state and federal agencies, and 3) assist state and federal agencies with the coordination of alternative sea lamprey control research in Lake Champlain and the Great Lakes (FTC 2009).

Alewife

Alewife was presumably introduced into Lake St. Catherine, Vermont, by anglers in 1997 and was later found to make its way into Lake Champlain (Missisquoi Bay) in 2002. This species presents a new challenge for fishery management. This species has been found in great abundance in the lake and could exert major influences on the lake's fish communities by preying on the larvae of many native fish species, and the zooplankton community, and this species contains high levels of thiaminase which could result in early mortality syndrome (EMS) for lake trout and Atlantic salmon that consume alewives thus potentially impeding the establishment of reproducing populations of these two salmonid species (FTC 2009).

Alewife spawn once a year with the annual spawning runs beginning during spring or early summer and may last for up to two months. Spawning lasts only a few days for each wave of arriving fish, after which the spent fish move rapidly downstream. Alewives are broadcast spawners and produce eggs 0.80 to 1.27 mm in diameter which are semi-demersal to pelagic and slightly adhesive. Spawning typically occurs in ponds, lakes and sluggish stretches of water. Incubation ranges between two to five days depending on water temperature (20 to 22ºC) (Fay et al. 1983a).

Atlantic salmon

Lake Champlain supports indigenous populations of landlock and/or sea-run Atlantic salmon. This was the first species to show declines as a result of harvest and habitat changes, primarily from stream sedimentation and damming. Sustained stocking began in 1972 with current fall spawning runs and river and lake fisheries maintained by annual stocking of approximately 240,000 salmon smolts and 450,000 salmon fry. In recent years, "wild" adults have been collected from the spawning run in the fall and stripped of eggs to supplement the eggs from domestic broodstock, to periodically replace broodstock, and to develop a Lake Champlain specific strain (FTC 2009).

Brown trout/Steelhead

Although not endemic, both species are considered to be an important component of the current Lake Champlain fish community, providing a diversity of fishing opportunities and a potential management tool for a changing forage base. Steelhead stocking began in 1972 while brown trout stocking began in 1977. Approximately 78,000 steelhead and 68,000 brown trout were stocked annually into the lake in the mid 2000s. However, steelhead stocking in New York was suspended in 2007 because of the potential to introduce the fish disease Viral Hemorrhagic Septicemia (VHS). Future steelhead stocking will be depend upon alternate hatcheries being able to raise Champlain's steelhead allotment (FTC 2009).

American eel

American eel enters Lake Champlain from the Richelieu River as yellow eels and spend approximately 10 to 20 years in the lake before returning to the Atlantic Ocean for spawning (FTC 2009). During late winter and early spring, young eels (elvers and glass eels) begin their upstream migration before their pigmentation is complete. They are active at night and burrow or rest in deep water during the day (Facey and Van Den Avyle 1987). The Richelieu River connects northern Lake Champlain to the St. Lawrence River, which supported a commercial eel fishery until it was closed in 1998 before harvest drastically declined (FTC 2009). An eel ladder was constructed at the dams on the Richelieu River in Quebec along with a 10-year American eel stocking program that was implemented in 2005 to enhance eel recruitment into the lake. Between 2005 and 2008, approximately 2.8 million elvers from the Atlantic coast were transferred to the upper Richelieu River (FTC 2009).

Lake Champlain - Ichthyoplankton Seasonal Cycles

A general goal for Lake Champlain fish management is to provide for fish community based on enduring populations of naturally reproducing fish and on the wise use of stocked fish (FTC 2009). Several fish species offer the best available social, cultural, and economic benefits and contribute to a healthy environment. For salmonids, brown trout and Atlantic salmon migrate up streams and tributaries during the fall to spawn on well oxygenated gravel beds, lake trout spawn at the nearshore water of the lake, and rainbow trout/steelheads migrate up streams and tributaries during the spring to spawn. In addition to naturally spawn population, all of these salmonid species are also stocked in the lake to enhance the fishery (FTC 2009).

Similar to salmonids, lake sturgeon migrate up streams to spawn during the spring from May-June. Eggs have been collected in the Lamoille, Winooski, and Missiquoi rivers, and larvae have been collected with driftnets in the Lamoille and Winooski rivers (FTC 2009). Walleye also migrate up streams to spawn during the spring. Spawning typically occurs after ice out when water temperature reaches 5°C. This is an important recreational fish species where millions of fry and hundred thousands of fingerlings have been stocked into the lake between 1988 and 2007 (FTC 2009). Yellow perch spawning is closely associated with aquatic vegetation. Spawning typically occurs after ice-out, at the end of April or early May (Krieger et al. 1983). Esocids (pike and pickerel) spawning conditions are similar to yellow perch occurring during the spring, after ice-out and are closely associated with aquatic vegetation (Inskip 1982; Cook and Solomon 1987).

Centrarchids (sunfish and bass) are nest builders. Largemouth bass prefer gravel substrate for spawning (Stuber et al. 1982) with red constructed at water depths averaging 0.3-0.9 meter. Spawning begins in the spring, usually between May to June when water temperatures reach 12-15.5°C (Stuber et al. 1982). Smallmouth bass also spawn in the spring, usually from mid-April to July. Spawning takes place on rocky shoals, river shallows, or backwaters with the water temperature reach 12.8-21.0°C (Edwards et al. 1983).

Lake Champlain - Commercial and Recreational Species

Commercial fishing on Lake Champlain was historically dominated by the use of shoreline seines and set lines to capture lake whitefish, walleye, yellow perch, and lake trout (FTC 2009). Additional fish species harvested included basses, bullhead, catfish, eels, northern pike, pickerel, rock bass, smelt, Atlantic salmon, and lake sturgeon. A commercial fishery for yellow eel by electroshocking and baited pots was authorized in Vermont in 1982 but no fishing took place after the 1980s (FTC 2009). With the exception of lake sturgeon and lake whitefish, the harvesting of the walleye and yellow perch fisheries to their declines and extirpations are unknown. Up to 60,000 lake whitefish were harvested annually, until the fishery was closed in 1912 (FTC 2009). Lake sturgeon harvests averaged over 100 fish annually prior to 1913, but declined to less than 15 fish per year in the 1950s and 1960s (Halnon 1963 *as cited in* FTC 2009).

Other species of commercial and sport fishing importance were rainbow smelt, walleye, and yellow perch. Unlike smelt in the Great Lakes, Lake Champlain smelt do not generally ascend rivers to spawn, but spawn offshore in depths around 50 feet or greater and is a popular species during ice fishing (FTC 2009).

Lake Champlain has been stocked by various non-native and native game species to benefit private citizens as well as state agencies. Non-native species that have been deliberately stocked include Chinook salmon (*Onchorhynchus tshawytscha*), kokanee salmon (*O. nerka*), cutthroat trout (*O. clarkii*), grayling (*Thymallus thymallus*), brown trout, rainbow trout, American shad, black crappie, largemouth bass, and carp. Native species stocked in the lake include brook trout, lake trout, Atlantic salmon, brown bullhead, walleye, yellow perch, rainbow smelt, lake whitefish, rock bass, and channel catfish (Langdon et al. 2006 *as cited in* FTC 2009). Majority of the non-native stocked species failed to establish new populations, except for carp, largemouth bass, and black crappie. Limited brown trout and steelhead stocking began again in the 1970s and persists to add diversity to the recreational fishery (FTC 2009).

The current fishery in Lake Champlain is almost entirely based on angling. Commercial licenses are still permitted in Quebec, but the commercial fishery has not been active since 2004. Popular sports fisheries include the four salmonid species, walleye, yellow perch, basses, and pikes. Summer bass tournaments are known to bring substantial revenues to the area and ice fishing, mainly for yellow perch, walleye, and smelt, is popular especially in bays where the water remains ice-covered for several months after the main lake is open. As a result of sea lamprey predation on existing salmonid fishery, charter fishing has declined since the mid 1990s (FTC 2009).

The current commercial harvest in the United States waters of Lake Champlain consists only of the sale of fish caught by angling, or licensed harvest and sale of bait fish with the majority of fish sold being yellow perch, with smelt and panfish also marketed. Few records of catch or sale of fish exist. The 1991 estimated data suggests between 200,000 and 745,000 pounds of fish were sold.

4.7.2.1.2 Champlain Canal

The present-day Champlain Canal is 60 miles long and runs between the Erie Canal at Waterford in the south and the southernmost point of Lake Champlain at Whitehall to the north. With its completion in 1823 the canal connected previously unconnected drainages – including the Hudson-Mohawk and the Champlain. There are 11 locks on the canal, which has a minimum depth of 12 feet; a twelfth lock is situated at Troy and joins the Hudson River to both the Champlain and Erie canals (Malchoff et al. 2005).

A total of 58 fish species were identified in the Champlain Canal (Table 4.7-7) (Carlson 2009). Over the years, the Champlain Canal has served as a pathway, allowing fish species to travel between Lake Champlain and the Hudson River and vice versa. The most notable species is the white perch, which is now considered an aquatic nuisance species in the Lake Champlain basin.

Champlain Canal - Migratory Species

Champlain Canal supports a number of anadromous fish species; Atlantic salmon, brown trout; and a catadromous fish species; American eel. For further species descriptions please refer to Section 4.7.2.1.1 (Lake Champlain-Migratory Species).

Champlain Canal - Ichthyoplankton Seasonal Cycles

The ichthyoplankton and seasonal spawning cycles of Centrarchidae, Esocidae, and Percidae are similar to those identified in Lake Champlain. Common carp generally spawn from May to June and is closely associated with vegetation (Edwards and Twomey 1982). Ictaluridae (catfish and bullhead) spawn in late spring and early summer, when water temperature reaches approximately 21°C. Redds are typically built with suitable cover (e.g., logs) (McMahon and Terrell 1982; Stuber 1982).

Champlain Canal - Commercial and Recreational Species

No commercial fisheries exist in the Champlain Canal. Recreational angling consists of chain pickerel, northern pike, common carp, bullhead, channel catfish, white perch, largemouth and smallmouth bass, bluegill, pumpkinseed, black and white crappie, and yellow perch.

4.7.2.1.3 Hudson River

The Hudson River fish fauna comprises a mixture of freshwater, diadromous, estuarine, and marine species depending upon location along the length of the river between Albany and the mouth. A total of 210 fish species have been reported from the Hudson River drainage. Of the 210 species, 128 species are found in the main channel of the tidal portion of the Hudson River (Federal dam in Troy to the mouth); the remaining 81 species are confined to tributaries of the lower Hudson River or reported from the upper Hudson River or Mohawk River systems (Daniels et al. 2005). For the 128 species found in the tidal portion of the river, 49 are primarily marine species and 80 species are either resident freshwater or diadromous species (Daniels et al. 2005). Table 4.7-8 presents the verified fish species in the lower and upper (upstream of the Federal dam at Troy) Hudson River from 1970 to 2003.

Hudson River - Migratory Species

Sturgeons

Two sturgeon species occur in the Hudson River. Sturgeons are long-lived, slow growing species that have suffered serious historical declines because of their value as a high-quality food fish and an important source of shortnose sturgeon caviar. The Atlantic sturgeon is protected over much of its range through fishery management efforts and the shortnose sturgeon is a federally and state listed endangered species (see Section 4.9 for more details on these species). Sturgeons use large rivers and estuaries almost exclusively during the first five years of their lives. Spawning migration occurs in late winter to early summer (USFWS 1997). Atlantic sturgeon in the Hudson River are associated with the Highlands and Haverstraw Bay/Tappan Zee stretches of the river, which can be fresh or brackish depending on yearly rainfall, and utilize the mid-estuary region above Stony Point (usually oligohaline) for spawning. Shortnose sturgeon in the Hudson River, spawn primarily in the upper freshwater reaches from Coxsackie to Troy. Juvenile sturgeons of both species utilize the Hudson River Estuary exclusively (USFWS 1997).

River herring

Seven species of true herring occur in the waters of the Hudson River Estuary. These anadromous fish are species that spend most of their adult lives at sea but return to freshwater to spawn. Estuarine herring species include: alewife and blueback herring, collectively known as river herrings; American shad; and the less common hickory and gizzard shad. The marine non-anadromous herring species are Atlantic menhaden and Atlantic herring. The herring family is represented in large numbers with the two marine species dominating the biomass components in the marine ecosystem and the Alosids dominating the biomass in the freshwater ecosystem (USFWS 1997).

Striped bass and white perch

The striped bass and white perch, known as temperate river bass, share a number of physical and morphological similarities and are difficult to tell apart during their early life stages. In general, the striped bass is strongly anadromous and highly migratory, while the white perch is more or less restricted to estuarine waters and seldom found in open marine waters (USFWS 1997). Striped bass spawn in the tidal section of the Hudson River from Troy to New York City. The Hudson River is one of two major East Coast spawning areas for striped bass, contributing significantly to the adult population that summers along coastal New England (USFWS 1997).

Sea lamprey

The sea lamprey is a parasitic anadromous fish that spends its egg and larval life stages entirely in freshwater. At transformation, the process during which the lamprey's body changes into that of a parasite, it moves out to sea and lives on a host fish. After two years at sea, the lamprey returns to freshwater to spawn and then dies (USFWS 1997).

American eel

American eel is the only catadromous species that spawns in salt water but the young migrate to freshwater to complete their growth and development to the adult stage, in the Hudson River Estuary. American eel are marketed for human consumption, as well as bait for various recreational and commercial fisheries. This species is also an important food source for larger marine and freshwater fishes and is a predator on species such as crabs and clams. American eel spend a considerable amount of time hidden in the substrate (gravel or mud) or under rocks. Young migrants have a propensity for working their way upstream over or around small obstructions, sometimes traveling overland on rainy nights (USFWS 1997).

Atlantic tomcod

The Atlantic tomcod, not a true anadromous fish species, is fast-growing and short-lived, seldom living past Age 2. This inshore coastal fish moves upstream into brackish waters to spawn. In the Hudson River, this species spawns between November and February in the tidal waters between West Point and Poughkeepsie, New York (USFWS 1997). Due to their short life span and abundance in estuarine systems, as well as sensitivity to environmental stresses, the Atlantic tomcod stock is an excellent measure of environmental health (USFWS 1997). The bay anchovy is a small, delicate, estuarine-spawning, schooling fish that occurs in great numbers in the lower Hudson River Estuary, moving between brackish and saltwater in response to spawning and growth needs (USFWS 1997). This species is often the dominant fish in the Hudson River Estuary and is well suited to the area as planktonic feeders, with detritus from sewage supplementing their main food source. Bay anchovy is an important prey item for striped bass, bluefish, weakfish, white perch, and many piscivorous birds (USFWS 1997).

Hudson River - Ichthyoplankton Seasonal Cycles

The Hudson River Estuary is one of New York’s outstanding natural resources, providing crucial nursery and spawning grounds for a wide variety of fish species including freshwater, estuarine migrants, and diadromous species, fish species that spend portions of their life cycle partially in freshwater and partially in saltwater. The largemouth and smallmouth bass, collectively referred to as black bass, are two important Hudson River species with an important recreational fishery, including local and regional fishing tournaments.

In the Hudson River, black bass congregate in five known wintering sites from late October to early April (Nack et al. 1993). These concentrations, located in Coxsackie Cove, Catskill Creek, Esopus Creek, Rondout Creek, and Wappingers Creek, provide a unique opportunity to study seasonal movements. Result of the 1987 and 1998 radio-tagging survey (Nack et al. 1993) showed black bass exhibited movement out of the wintering sites and dispersal up and down the Hudson River to nesting sites from early April to late May. Spawning for black bass typically takes place from May to June. Overall, bays and coves were the habitats selected by most nesting radio-tagged largemouth bass, while creek mouth and shallow, exposed shoreline were the least preferred nesting sites (Nack et al. 1993).

Estuarine fishes are resident species of tidal waters where salinities range from tidal fresh to marine, or from 0.5 to 30 ppt (Table 4.7-9). The species in this group are known to stray into nontidal freshwater or, at the other extreme, into the coastal region of the marine environment (USFWS 1997). In general, estuarine fishes spawn in salinities greater than 5 ppt, and are not known for mass spawning migrations as are many of the anadromous fish that use the estuarine area as migration pathways. Most estuarine species begin spawning in late spring and continue throughout most of the summer, with an optimum spawning salinities between 5 to 20 ppt (USFWS 1997). Estuarine fishes generally exhibit a seasonal onshore and offshore movement pattern, i.e., upstream and toward shore during the spring and summer, and downstream to deeper waters during the fall and winter (USFWS 1997). The spawning zone for many of the fish species in the Hudson River Estuary range from freshwater to estuarine to marine conditions. The eggs of many of the species are demersal or bottom nesting with majority of the spawning taking place from March to August.

The early-mid 1970s (1971-1977) ichthyoplankton collections in the vicinity of Bowline Point Generating Station recorded a total of 19 species. Fish collected were dominated by bay anchovy, Atlantic tomcod, striped bass, white perch, and Alosids (alewife and blueback herring). Seasonal shifts in abundance of the dominant species were observed, with Atlantic tomcod peaking in early spring, followed by white perch, Alosids, and striped bass in late spring-early summer, and bay anchovy from mid-late summer (LMS 1978).

In an entrainment study conducted at the Bowline generating station in 1987, bay anchovy dominated entrainment samples by several orders of magnitude relative to other species (EA 1989). In this study, as well as in successive entrainment monitoring studies at Bowline, the dominant life stage of entrained bay anchovy was post-yolk sac larvae. Bay anchovy eggs typically peak in entrainment samples from Haverstraw Bay in late June - mid July. Very few yolk sac anchovy larvae are observed in entrainment collections, as this life stage only lasts 12-18 hours. Post-yolk sac anchovy larvae are entrained from late June - late August. Juvenile anchovies are primarily entrained in August (Mirant Bowline LLC 2003). Additional species collected as egg, yolk sac or post-yolk sac life stages, albeit in relatively low densities, included winter flounder, windowpane flounder, and bluefish. Post-yolk sac and juvenile striped bass larvae were the next most abundant taxon/life stage observed in the 1987 entrainment study.

Striped bass have historically not been entrained as eggs at Bowline; this reflects the distance of the plant from their upriver spawning grounds. However, by the time striped bass have reached the post-yolk sac larval stage, they have drifted downriver and are susceptible to entrainment at Bowline, primarily during the month of June. Juvenile striped bass have historically been entrained during July. White perch early life stage distribution is similar to that of striped bass, although there is a slightly more upriver bias to their distribution in the Hudson during mid-summer (Mirant Bowline LLC 2003).

Alosids spawn further upriver than striped bass/white perch and entrainment of significant numbers of eggs or larvae in Haverstraw Bay reflects either unusually high flow events resulting in downstream transport of eggs/larvae, or an atypical downriver spawning concentration in some years. Historically, alosids have only been entrained in low numbers in mid-May (eggs) or late May – early June (yolk sac and post yolk sac larvae).

In an impingement study conducted at the Lovett Generating Station in 1979, an estimated total of 90,021 fish were impinged during a one-year period. Highest rates of impingement occurred during November and December, and the dominant species impinged was white perch (64 percent of total). Additional numerical dominants included Atlantic tomcod, bay anchovy, blueback herring, gizzard shad, and spottail shiner (LMS 1980). Impingement collections from 1996-1999 were dominated by bluefish, although total impingement numbers were relatively low, overall, during this period. Additional species impinged during this time included red hake

(*Urophycis chuss*), winter flounder, windowpane flounder summer flounder, and Atlantic butterfish (*Peprilus triacanthus*) (Normandeau Associates 1997b; 1998; 2002).

Bay anchovy dominated entrainment collections at Lovett in 1997 by several orders of magnitude. Entrained anchovy were approximately equally distributed among -egg, post-yolk sac larvae and juvenile life stages. A total of 50 post yolk larvae and 17 juvenile striped bass larvae, were also entrained, along with a single juvenile bluefish, during this study (EA 1998).

Hudson River - Commercial and Recreational Species

Commercial fishermen in the eighteenth and nineteenth centuries harvested a wide variety of finfish species from the Hudson River. Among the species most heavily exploited were American shad, Atlantic sturgeon, and striped bass. Atlantic sturgeon was valued for both their roe and flesh, while shad would be taken in great numbers during the spring spawning run and salted for later consumption. Striped bass was abundant and could be found throughout the harbors, East and Harlem rivers, and up the Hudson River as far up as Stony Point (Waldman et al. 2006). As a result of widespread PCB contamination in the Hudson River, several of the important commercial fisheries are closed today and commercial fisheries effort is at an all-time low for that area (Waldman et al. 2006). The section below describes recent trends and status of the major commercial fishery species in the Hudson River.

Striped Bass

Prior to 1982, few restrictions were in place for taking of striped bass in state and coastal marine waters. With the collapse of the Chesapeake Bay striped bass stock in the mid-1970s, the Emergency Striped Bass Act was passed in 1979 and the first striped bass fisheries management plan was developed in 1981. Marine commercial harvest were limited by severely reduce quotas to less than 20 percent and harvest season, size limits, and allowable gears were also enforced. That combined with regulations on size, bag limit, and season of the recreational striped bass fisheries lead to the rebound of this species where they return to the rivers to spawn, production estimates were up, and adult age structure was stabilized (Waldman et al. 2006).

Atlantic Sturgeon

A small Atlantic sturgeon fishery persisted in the Hudson River through the 1980s, made up of a small group of fishermen taking a few fish each year for their caviar and meat. Due to the restrictions of the striped bass management along the Atlantic coast, the Atlantic sturgeon became targets by fishermen to make up for lost income. Few Atlantic sturgeons were surviving to return to the Hudson River, since the commercial fishery shifted to targeting spawning adults. By 1997, New York's stock assessment showed harvest and fishing rates were severely over the limit that the population could handle. By 1998, the entire United States Atlantic coast was closed for Atlantic sturgeon harvest and the interstate management plan set a 40-year time limit for the coast-wide moratorium based on the life history of the animal (Waldman et al. 2006).

American Shad

The Hudson River American shad population has gone through collapse and re-growth cycles several times over the past century. The CWA of 1972 prevented sewage dumping and the Hudson River slowly started to clear up, along with re-gaining its fisheries through the 1980's. Just as the case with Atlantic sturgeon, the recovery effort for striped bass caused a shift in fishermen focus to American shad. Starting in 1991, the Hudson River American shad stock began to decline, showing classic signs of over-fishing. American shad are smaller at any given age, and fewer older shad are returning to spawn (Waldman et al. 2006). To address this concern, the Hudson River American Shad Recovery Plan is being implemented to maintain monitoring programs, reduce mortality, reduce bycatch, characterize and restore critical spawning and nursery habitat, undertake ecosystem studies, and ultimately restore American shad abundance to historical levels (Kahnle and Hattala 2010).

Recreational Fishing

The NYSDOH conducted a Hudson River angler survey in 1996. The survey included 172 miles of the Hudson River from Hudson Falls to the Tappan Zee Bridge at Tarrytown. A similar angling survey was conducted between 1991 and 1992, but was limited to within the New York City area. In both surveys, the most important finfish species caught by anglers were white perch, striped bass, white catfish, and American eel. Finfish species kept by anglers were white perch, white catfish, striped bass, carp, largemouth and smallmouth bass, bluefish, and American eel (NYSDOH 1996). Table 4.7-10 lists the finfish species caught by anglers during the 1991-1992 and 1996 angler surveys.

With the Hudson River water quality returning to levels not seen for many decades, the striped bass population continued to increase, and angling in the length of the tidal river grew in popularity. The area below the federal dam has become especially attractive for recreational fishermen that target striped bass and other anadromous fish species that aggregate there in large numbers (Waldman et al. 2006). The striped bass fishery in the Hudson River and New York Harbor has now become so popular that several, mainly springtime charter boat operations were launched and annual tournaments are now being held (Waldman et al. 2006).

Another fishery in the Hudson River that supports charter boats and tournaments are black basses (largemouth and smallmouth bass). These species occur in the freshwater and low salinity reaches of the Hudson River. Recruitment in the Hudson River is low but growth is rapid, the fastest in New York State (Waldman et al. 2006). The American shad population in the Hudson River has rebounded which has stimulated a new sport fishery. Anglers have learned that in addition to aggregating below the federal dam, American shad can also be found by targeting particular types of habitat and tidal stages throughout much of the tidal freshwater portion of the Hudson River (Waldman et al. 2006).

4.7.2.1.4 East River

A number of fish composition studies have been conducted throughout the East River between 1982 and 1987. Several of these studies consisted of year-long monthly sampling efforts in support of a variety of waterfront development projects; Riverwalk Studies, Hunters Point, and East River Landing Area (LMS 1985; LMS 1986; Parish and Weiner 1987). However, due to the strong tidal currents in the East River and the difficulties of maintaining effective and proper gear deployment under that condition, the overall fish data in the East River is limited. All of the studies conducted between 1983 and 1987 yielded similar results. As many as 57 species (Table 4.7-11) were collected with winter flounder, Atlantic tomcod, striped bass, and grubby representing the dominant species.

The fish occurring in the East River are part of the larger community inhabiting the lower Hudson River Estuary and also of the community inhabiting the western reaches of the Long Island Sound. More than 50 species of fish have been recorded in the East River, with marine species comprising approximately 70 percent of the total number, and estuarine and migratory species each comprising approximately 15 percent of the rest of the species (Woodhead 1993). Nearly all of the species occurring in the East River are found in both the Hudson River Estuary and Long Island Sound. The dominant fish species in the East River are the same as those in the neighboring waterbodies, and the species distribution among different ecological groups is also similar (Woodhead 1993).

East River - Ichthyoplankton Seasonal Cycles

Entrainment studies were conducted for the Ravenswood Generating Station from September 1991 to September 1992 and from February 1993 to January 1994. For the 1991 to 1992 survey period, a total of 24 species and four composite taxa (such as family level identification) were identified. A combined total of 11,311 fish eggs and larvae, plus an additional 132 juveniles were collected and when scaled to operating volume, a total of approximately 181.4 million fish eggs and larvae were estimated to have been entrained (LMS 1993). For the 1993 to 1994 survey period, a total of 30 species and five composite taxa were identified. A combined total of 25,236 fish eggs and larvae and 288 juveniles were collected and when scaled to operating volume, a total of approximately 256.4 million fish eggs and larvae plus 2 million juveniles were estimated to have been entrained. Total species diversity for both years combined was 35 species plus eight composite taxa (Normandeau Associates 1994). Many of the differences between years is explained by low numbers of rare species, year class strength, or that the East River is on the edge of range for early life stages of some species. Significantly more ichthyoplankton were estimated to be entrained in 1993 to 1994 compared to the 1991 to 1992 sample year, 256.4 million fish eggs and larvae compared to 181.4 million. However, the dominant species present were similar for both years with 7 out of 10 species dominant both years (Table 4.7-12).

In 1993, most of the eggs collected from February through August with the large peak in April. Fourbeard rockling comprised 64.3 percent of the eggs and 39 percent of all life stages combined, while winter flounder eggs were the second most abundant in 1993 (19.6 percent), collected from February to May. Larval life stages were collected from July through early October, peaking in April, May and August in 1991-1992 and April, July, and September in 1993. Larval life stages were dominated by grubby, collected from February to May, and bay anchovy, collected from June through October but peaking from July to September (Normandeau Associates 1994).

4.7.2.1.5 Long Island Sound

Since 1984, the CTDEP has been conducting the LISTS annually to provide independent fishery monitoring of important fish species in Long Island Sound. Surveys are conducted from April through November to establish seasonal patterns of abundance and distribution. The surveys are conducted from New London to Greenwich, Connecticut including New York waters from 5 to 46 meters in depth (CTDEP 2009). Table 4.7-13 shows the fish species observed during the LISTS from 1984 to 2008. A total of 98 species of finfish have been identified in LISTS, averaging 58 species per year with a range of 49 to 70 species. The recreational, commercial, and prey species of importance collected by the CTDEP include; bay anchovy, black sea bass, bluefish, butterfish, Atlantic cod, cunner, spiny and smooth dogfish, American eel, summer and winter flounder, haddock, red and silver hake, river herring, Atlantic and Spanish mackerel, American sandlance, scup, shad, silverside, skate, tautog, and weakfish (CTDEP 2009).

The top 10 finfish species in order by numbers sampled during the LISTS from 1984 to 2008 were; butterfish, scup, winter flounder, windowpane, bluefish, weakfish, little skate, Atlantic herring, fourspot flounder, and red hake (CTDEP 2009). The spring (April-June) and fall (September-October) data from 1984 to 2008 were used to calculate the geometric mean count per tow for 38 finfish species. Results of the spring indices of abundance showed (in order) winter flounder, windowpane, little skate, fourspot flounder, red hake, silver hake, Atlantic herring, northern searobin, alewife, and tautog as the top 10 finfish (CTDEP 2009). Results of the fall indices of abundance showed (in order) scup, butterfish, weakfish, striped searobin, summer flounder, smooth dogfish, American shad, moonfish, and Atlantic menhaden as the top 10 finfish (CTDEP 2009).

In descending order of abundance, results of the most recent LISTS spring survey (2008) placed scup as the most abundant, followed by butterfish, American sand lance, silver hake and winter flounder. Results of the most recent LISTS fall survey (2008) yielded butterfish, scup, weakfish, and bluefish in decreasing order of abundance. The 2008 fall LISTS survey for these top four species yielded 95.2 percent of the total finfish catch. Moonfish, windowpane flounder and winter flounder were the fifth, sixth, and seventh most abundant species by count during the 2008 fall LISTS survey (CTDEP 2009).

Long Island Sound - Migratory Species

Several migratory species important to the fisheries and ecology of Long Island Sound have been collected during LISTS surveys. The migratory fish species collected include anadramous species such as blueback herring, alewife, American shad, hickory shad, white perch, and striped bass; catadromous species such as American eel; and oceanic/coastal migratory species such as bluefish and Atlantic sturgeon. Recaptures of tagged striped bass released by NYSDEC surveys showed movement of juvenile fish from the Hudson River to the East River and into Long Island Sound. Juvenile striped bass tagged in western bays of Long Island Sound also move to the East River and into the Hudson River (Woodhead 1993). The movements of the YOY appear principally restricted to the Hudson Estuary, though some have been caught in Long Island Sound. The movements of the one and two-year-old bass are more extensive. A number of these juveniles migrate from the Hudson River into the western Long Island Sound, and also from Long Island Sound to the Hudson River. It is unclear whether there are regular patterns in timing and direction of juvenile fish migrations. Similar to striped bass, Atlantic sturgeon and bluefish exhibit coastal migration patterns and movement from the Hudson River into Long Island Sound via the East River. Alosids move into freshwater to spawn during the spring. The juvenile populations of the Alosids leave the Hudson Estuary and Long Island Sound in great numbers as YOY fish and move into the deeper water of the Atlantic before returning as adults to spawn.

Long Island Sound - Ichthyoplankton Seasonal Cycles

Ichthyoplankton in Long Island Sound and adjacent waters are abundant. In 2004 and 2005, an entrainment and impingement mortality monitoring study was performed to determine the numbers of organisms entrained and impinged at the Glenwood Power Station. Twenty species of fish were collected in the entrainment sampling. Using the full flow calculation baseline, approximately 247 million eggs and larvae were entrained at the power station. Bay anchovy, menhaden, gobies, Atlantic silversides and winter flounder comprised approximately 90 percent of the entrainment samples. Using the full flow calculation, approximately 26 species or 16,000 fish were estimated to be impinged annually. Winter flounder, mummichog, striped killifish, Atlantic menhaden, weakfish, and tautog comprised approximately 87 percent of the impingement sample (NYSDEC 2009c).

During 1999 to 2001, 64 species of finfish were collected by entrainment and impingement sampling at the Charles Poletti Power Plant on the East River, New York. Heimbuch et al. (2007) looked at 10 representative species; Atlantic menhaden, black sea bass, blueback herring, cunner, spotted hake, striped bass, tautog, weakfish, windowpane, and winter flounder to assess the potential effects of entrainment and impingement on fish stock in New York/New Jersey Harbor Estuary and Long Island Sound. Results of the composite samples collected from March through July showed the number of eggs ranged from 0 for black sea bass, blueback herring, and striped bass to 25,720 for Atlantic menhaden; the number of larvae ranged from 0 for blueback herring to 15,246 for winter flounder; and the number of Age 0 fish ranged from 0 for black sea bass, blueback herring, striped bass, and tautog to 315 for cunner (Heimbuch et al. 2007). The number of Age 0 fish collected by trawling during August through November ranged from 0 for cunners and tautogs to 1,024 for Atlantic menhaden (Heimbuch et al. 2007). In addition, Atlantic menhaden, cunner, tautog, and windowpane eggs comprised over 91 percent of the collection while; Atlantic menhaden, cunner, tautog, windowpane, and weakfish larvae represented over 97 percent. Winter flounder eggs and larvae represented 83 percent and 90 percent respectively of the collections in Long Island Sound (Heimbuch et al. 2007).

Long Island Sound - Commercial and Recreational Species

Commercial harvests in Long Island Sound are limited to lobster pots and leased shellfish beds (CTDEP 2010). Finfish harvests are limited to the eastern end of the Long Island Sound, as well as the open waters of the Mid-Atlantic Bight and Northeastern United States (Chang 1990).

The CTDEP, Bureau of Natural Resources, Marine Fisheries Division, conducted an angler participation survey of the Long Island Sound in 2008. The three principal modes of marine recreational fishing include shore, private/rental boat, and charter/guided trips. An estimated

506,796 marine anglers made 1,906,933 trips. The estimated catch was 8,017,988 fish and creeled catch was 1,652,241 fish, with five popular species; bluefish, striped bass, scup, summer flounder, and tautog comprised approximately 90 percent of the estimated total catch for 2008 (CTDEP 2009).

The CTDEP, Bureau of Natural Resources, Marine Fisheries Division has conducted the LISTS from 1991 to present, encompassing an area from New London to Greenwich, Connecticut and includes waters from 5 to 46 meters in depth in both Connecticut and New York State waters. Results of the 2008 LISTS indicated the presence of the six important recreational fish species; bluefish, scup, striped bass, summer flounder, weakfish, and winter flounder. Other recreational fish species captured in the 2008 LISTS include black sea bass, cunner, red and silver hake, pollock, and tautog (CTDEP 2009). The section below describes trends of some of the important recreational finfish species.

Bluefish

LISTS surveys from 1986 through 1999, showed an increase in bluefish during the fall with abundance peaking in 1999. Since the peak in 1999, bluefish abundance dropped and varied around the mean of 24.7 fish per tow (fish/tow) for the next five years. In 2005 and 2006 abundance was below average at 18.89 fish/tow and 15.66 fish/tow, respectively. A substantial increase to 30.66 fish/tow was documented in 2007 with most of that coming from an increase in snapper abundance (93 percent). Like weakfish, the overall bluefish index is dominated by YOY individuals that make up about 70 percent of the bluefish catch (CTDEP 2009).

Scup

Scup abundance indices for the fall have increased by nearly an order of magnitude since about 1998. Since 1998, the fall scup index has ranged from 103.3 fish/tow (in 1998) to 537.7 fish/tow (in 1999), averaging 315 fish/tow and six times the pre-1998 average. Another very strong YOY index was recorded in 2005 and again for the 2007 and 2008 seasons. These three cohorts are the second, third, and eighth highest respectively in the time series. In 2008, all indices at Age 0 through Age 9 are well above the 1984 to 2007 mean (CTDEP 2009).

Striped Bass

Similar to scup, striped bass abundance in recent years has been highly variable. Four of the highest abundances were recorded during the spring of 1999, 2002, 2005, and 2007. Abundance during the first six years of the survey was relatively low, averaging only 0.03 fish/tow. Indications of a stock recovery first appeared in 1990 and during the next five years a moderate upward trend in abundance was observed. However, in 1995 a 97 percent increase started the trend toward high abundance. Each year thereafter abundance increased in Long Island Sound until 2000 and 2001 when LISTS started to observe decreases in abundance and erratic indices from one year to the next. Three of the highest fall annual indices were produced in 2004 (0.77 fish/tow), 2006 (0.47 fish/tow), and 2008 (0.44 fish/tow). Average fall abundance is 0.19 fish/tow for the time series and 0.35 fish/tow over the last 10 years (CTDEP 2009).

Summer Flounder

Summer flounder rebounded from record low abundances in the early and mid-1990s and have shown above average fall survey abundance (1.86 fish/tow) for 11 out of the last 13 years. Summer flounder fall abundance peaked at 6.12 fish/tow in 2002, decreased 45 percent in 2003 to 3.39 fish/tow and then decreased another 42 percent in 2004 to 1.95 fish/tow. Although the preferred fall index has declined sharply since 2002, abundance still remains about three times above the average of the first 12 years of the survey (1984-1995) (CTDEP 2009).

Weakfish

Weakfish abundance has been highly variable over the last four years. After a time-series low of 1.50 fish/tow in 2006, weakfish rebounded to a time-series high of 63.96 fish/tow in 2007 and then again dropped abruptly in 2008 to 9.11 fish/tow. Age 0 weakfish usually dominate the overall index and have been very abundant in the fall over the last 10 years, except in 2006 and 2008. The Age 0 catches between 1999 and 2004 ranged from 30.93 fish/tow (1999) to 63.31 fish /tow (2000) and were unprecedented in the time series. The average catch/tow of Age 0 fish prior to 1999 was 7.12 fish/tow (CTDEP 2009).

Winter Flounder

Winter flounder generally has seen a decreasing trend in abundance since 1996. LISTS has seen lower than average catches in 15 of the last 17 years. The overall winter flounder spring (April-June) index for 2008 (22.34 fish/tow) is the highest since 2002. However, abundance is still low and is approximately one third (36 percent) of the long-term mean of 62.29 fish/tow. Average catches for the first 10 years of the survey were 94 winter flounder per standard tow. From 1992 through 1995, abundance varied at or below average levels. However, 1996 showed a more than two-fold increase, to 110.62 fish/tow. Since 2001 abundance generally has declined to the current low level (CTDEP 2009).

4.7.2.2 Potential Impacts and Mitigation

The construction of the proposed Project will cause a temporary, localized disturbance to benthic habitats, which could directly harm demersal fish species that remain within the construction footprint. Indirect effects may also occur, such as a minor reduction in benthic prey, increased suspended sediments, or behavioral avoidance that forces fish into suboptimal habitat. Jetting and/or plowing could potentially cause mortality of benthic infaunal and epifaunal organisms (e.g., polychaete and oligachaete worms, crabs, mysids, and sand shrimp) within the narrow, linear construction corridor, thus temporarily reducing the availability of food sources for the fish species. However, within Lake Champlain, the Hudson River, and Long Island Sound, the area disturbed represents a small fraction of the bottom; therefore this temporary and localized loss of benthic prey will have only a minor adverse effect on the food intake of benthic feeding fish. In addition, recruitment and re-colonization of the benthic infaunal communities is expected to occur following construction since soft bottom benthic species have adapted to naturally occurring bottom disturbances, through reproductive mechanisms involving planktonic larval recruitment. Studies conducted on offshore sand borrow areas off the outer New Jersey coast indicated that benthic communities were re-established within 8 to 9 months, i.e., within one annual recruitment period after dredging (USACE 1999).

Further, given the narrow disturbance corridor, bottom feeding finfish are likely to temporarily relocate to adjacent areas unaffected by construction. Any pelagic piscivorous (fish feeding) species might leave the immediate construction area because of the noise and small suspended sediment plume it produces, but will resume feeding in the cable route as soon as the dredge leaves and forage on fish that had re-occupied the construction area. CHPEI will work closely with state and federal agencies to establish a construction window to minimize potential direct and indirect impacts to fish species that will also minimize the duration of overall construction timeframes. Since the magnitude of impacts is not only related to the size of the area impacted, but also the duration of impacts, it is important to complete the construction in a relatively rapid manner.

The construction activities along the underwater cable route may have a short term benefit to some fish species. Brinkhuis (1980) conducted a literature assessment on the biological effects of sand and gravel mining in the Lower Bay of New York Harbor and found that during dredging, and immediately after an area has been dredged, fish are attracted to the area to feed on infaunal organisms that are dislodged from the bottom. Within the marine portions of the cable route, species that may be attracted to feed during and after cable installation will be mostly juvenile and adult stages of flounders, skates, and opportunistic species (e.g., striped bass) that can avoid the construction activities.

In areas where conventional dredging is employed, typically for deeper burial areas such as at crossings of a navigation channel, there will be more substantial alteration of the benthic habitat compared to jetting since the construction will involve sediment removal, cable-laying, and then backfilling. Depending on the nature of the backfill, the sediment surface characteristics could be altered since it is unlikely that exactly the same grain size composition will be created as existed prior to cable installation. Depending on currents and erosional forces, backfill will be used that is anticipated to remain in place. However, whatever the backfill characteristics are, they are likely to become colonized over time with benthic organisms. Given the small amount of anticipated conventional dredging, any altered prey abundance or modified substrate characteristics are unlikely to have anything but a negligible to minor effect on fish species.

A long term alteration of the bottom will occur with the placement of rip-rap or concrete mats along the cable route, which will result in the mortality of benthic biota and other immobile or slow-moving benthic organisms located in the immediate area of placement. Given the anticipated short segments where rip-rap or concrete mats will be placed (primarily foreign utility crossings), this alteration represents an almost negligible loss of soft bottom benthic habitat and associated benthic species. The rip-rap or concrete mats will provide additional new hard bottom habitat for epibenthic organisms to colonize, essentially functioning as small patch reefs. In these areas, the rip-rap or concrete mats will provide areas of shelter, structure, or cover typically sought by some fish species such as rock bass in the Hudson River or Tautog in Long Island Sound (Johnson and Stickney 1989; Ogden 2005).

In addition to the benthic disturbance, underwater cable installation will result in a temporary and localized increase in suspended sediments, which could potentially lead to gill abrasion and cause impaired respiration of fish species in or adjacent to the underwater cable route. Turbidity may also hinder the predation efficiency of sight feeding fish in or adjacent to the cable route. However, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed by the flow of the river and tidal currents along the cable route, resulting in minor impacts on fish species in or adjacent to the cable route. In areas where deposition of suspended sediments could impact demersal fish eggs, such as winter flounder in Long Island Sound, it may be possible to avoid construction during the early spring, to reduce the potential adverse impacts associated with sediments covering these eggs.

Because of the number of anadromous fish species in the Hudson River, extensive areas of elevated suspended sediments, at certain times of the year (primarily spring and fall) have the potential to adversely affect fish migrations. If the underwater cable installation creates suspended sediment concentrations that have a negative effect on respiration, fish may not attempt to pass through these areas of the water column. Fortunately, water jetting generally creates only localized increases in turbidity, often restricted to near bottom areas of the water column, and given the depth and width of the Hudson, no blockage of fish passage is expected during cable installation.

During the installation of the cables, a number of vessels, including tugs, barges, cranes, and workboats will be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials which theoretically have the potential to be accidentally released to the water. BMPs and a SPCCP will be employed throughout construction and spill response procedures will be implemented in the case of a spill, to limit the impacts from oil and fluid spills. With proper training and procedures implemented, the possibility of all but the smallest of spills is remote.

In order to avoid the river reach associated with the Hudson River PCB Dredging Project, the proposed underground cable route will exit the Champlain Canal (via HDD techniques) and follow a 69.9-mile on-land railroad right-of-way bypass route before entering the Hudson River south of Albany (see Exhibit 2 for the route description). By avoiding cable installation in this portion of the Hudson River, CHPEI has attempted to minimize the potential for resuspending sediments with higher levels of PCB contamination, thereby reducing the potential for harmful effects on fish from bioaccumulation of PCBs.

Cable installation in the water will occur on a continuous basis, which will require nighttime lighting on the construction vessels. Some species of fish are attracted to light at night, while other species avoid illuminated areas. Fish that are attracted to the vessels may experience areas of increased suspended sediments resulting from the jetting if they move towards the illuminated area around the vessels. Adverse effects due to this behavior will be minimized by the separation distance between the water jetting device on the bottom and the illumination at the surface. In addition, most fish will avoid areas around the water jetting device and vessels due to elevated noise levels, which may partly compensate for any attraction behaviors exhibited by fish.

With use of HDDs at shoreline crossings, there is a chance of frac-out of drilling fluid into water bodies (see Section 4.1 for description of frac-out). Depending on currents or wave action, some of the deposited drilling fluid could become suspended or more dispersed. Drilling fluid, composed primarily of bentonite clay and water, if suspended, may have similar adverse effects on fish respiration and feeding as those described above for jetting induced suspended sediments. Drilling fluid is recognized as non-toxic by the EPA, and in the event that drilling fluid additives are necessary, none will be used that have toxic effects.

During operation of the Project, the cables will produce EMF and generate heat which is dissipated into sediments. EMF calculations demonstrated that all field levels evaluated for the edge of right-of-way will be less than 200 mG, this value is well below the maximum magnetic field allowable and is substantially well below guidelines for the sea floor (see Section 4.13). Certain benthic feeding fish have sensory mechanisms for detecting prey in the sediments. Given the small area of the seafloor occupied by the cables and affected by the weak EMF, the potential interference with this feeding will have a negligible effect on foraging success of these benthic feeding fish. The heat produced by the cables will primarily be dissipated in the sediments, well below the sediment water interface which is the biologically productive zone in the sediments. Hence, there will be negligible thermal effects on benthic prey populations of benthic feeding fish.

4.7.3 Essential Fish Habitat

4.7.3.1 Existing Essential Fish Habitat

The Magnuson-Stevens Fishery Conservation and Management Act (Public Law 94-265), as amended by the Sustainable Fisheries Act of 1996 (Public Law 104-267), set forth several new mandates for the United States Department of Commerce (USDOC) NOAA, National Marine Fisheries Service (NMFS), Regional Fishery Management Councils (Councils), and other federal agencies to identify, protect, and conserve the habitat of important marine, estuarine, and anadromous finfish as well as certain mollusks and crustaceans. Although the concept of essential fish habitat (EFH) is similar to “critical habitat” under the Endangered Species Act of 1973, measures recommended to protect EFH are advisory, rather than prescriptive (NOAA 2009a).

The Councils, with assistance from NMFS, are required to delineate “essential fish habitat” for all managed species. EFH is defined as “those waters and substrate necessary to fish for spawning, breeding, feeding, or growing to maturity” (NOAA 2009a). The regulations further clarify EFH by defining “waters” to include aquatic areas that are used by fish (either currently or historically) and their associated physical, chemical, and biological properties; “substrate” to include sediment, hard bottom, and structures underlying the water; and, areas used for spawning, breeding, feeding and growth to maturity” to cover a species’ full life cycle. Prey species are defined as being a food source for one or more designated fish species, and the presence of adequate prey is one of the biological properties that can make a habitat essential (NOAA 2009a).

The EFH assessment provided in this section is a summary of the EFH-designated species and life history stages listed in the 10-minute by 10-minute area of latitude and longitude waters along the Atlantic coast of NOAA's Guide to EFH Designations in the Northeast United States (Figure 4.7-2). The full EFH assessment will be completed in coordination with NMFS and adjoining state agencies along the proposed cable route.

4.7.3.1.1 Hudson River

The EFH designated species and life history stages in the Hudson River are represented by species in the Hudson River/Raritan/Sandy Hook Bays as part of the EFH designation for major estuaries, bays and rivers along the northeast United States coast. EFH designated species in the Hudson River are also included in NOAA's 10-minute by 10-minute square encompassing Atlantic Ocean waters from the Hudson River and Bay down through the New York/New Jersey Harbor areas (NOAA 2009a). The compiled NOAA data also include EFH designated skate species in the New York Bight region of the Atlantic waters (NOAA 2009a). A total of 13 finfish, two sharks, and three skates are currently designated as EFH species within the waters of the Hudson River. Each EFH designated species and the corresponding designated life stages are presented in Table 4.7-14.

A brief species description of EFH designated species in the Hudson River is provided below.

Atlantic sea herring

Adult Atlantic sea herring migrate south into southern New England and mid-Atlantic shelf waters in the winter after spawning in the Gulf of Maine, on Georges Bank, and Nantucket Shoals. Juvenile and adult herring are abundant in coastal and mid-shelf waters from southern New England to Cape Hatteras in the winter and spring. In the spring, adults return north, but juveniles do not undertake coastal migrations. Larval herring are limited almost exclusively to Georges Bank and the Gulf of Maine waters. Larvae typically metamorphose the following spring into YOY juveniles. In the Hudson-Raritan Estuary (HRE), Atlantic herring prefer water depths greater than -25 feet MLW. Atlantic herring in the New York Bight generally prefer water depths greater than -60 feet MLW (Stevenson and Scott 2005).

Bluefish

Bluefish spawn offshore in open ocean waters. Eggs in the Mid-Atlantic Bight are generally collected between April through August in temperatures greater than 18 °C and normal shelf salinities (greater than 31 ppt). Larvae distribution is similar to eggs in preference of water temperature (greater than 18°C) and salinity (greater than 30 ppt), and are typically collected between April through September. Juveniles move inshore in early- to mid-June, arriving when temperatures reach approximately 20°C. Juvenile bluefish are found in estuaries, bays, and coastal ocean waters in the Mid-Atlantic Bight and South Atlantic Bight in many habitats. Typically they are found near shorelines, including the surf zone, during the day and in open waters at night. Like adults, they are active swimmers and feed on small forage fishes, which are commonly found in nearshore habitats. They remain inshore in water temperatures up to 30°C and return to the continental shelf in the fall when water temperatures reach approximately 15°C. Juvenile bluefish are associated mostly with sand, but are also found over silt and clay bottom substrates. They usually occur at salinities of 23 to 33 ppt, but can tolerate salinities as low as 3 ppt. Adults are generally oceanic but are found near shore as well as offshore. Adults usually prefer warm water (at least 14 to 16°C) and full salinity (Fahay et al. 1999).

Atlantic butterfish

Butterfish are fast-growing, short-lived, pelagic fish that form loose schools, often near the surface. Juveniles and adults are common in inshore areas, including the surf zone, and occur in sheltered bays and estuaries in the Mid-Atlantic Bight during the summer and fall. Juveniles and adults are eurythermal and euryhaline, and are frequently found over sand, mud, and mixed substrates. Smaller juveniles often aggregate under floating objects. Juvenile and adult butterfish in the HRE are typically found at depths ranging from -10 to -75 feet MLW with water temperatures ranging from 8 to 26°C, salinities ranging from 19 to 32 ppt, and dissolved oxygen ranging from 3 to 10 milligram per liter (mg/l) (Cross et al. 1999).

Scup

Scup spawn along the inner continental shelf from Delaware Bay to southern New England between May and August, mainly in bays and sounds in and near southern New England. Scup spawn in the HRE during July. YOY juveniles are commonly found from the intertidal zone to depths of about -100 feet MLW in portions of bays and estuaries where salinities are above 15 ppt. Juvenile scup appear to use a variety of coastal intertidal and subtidal sedimentary habitats during their seasonal inshore residency, including sand, mud, mussel beds, and eelgrass beds. Adults move inshore during early May and June between Long Island and Delaware Bay. Adults are found inside bays and sounds, but like juveniles, do not penetrate low salinity areas. Adults are often observed or caught over soft, sandy bottoms and in or near structured habitats, such as, rocky ledges, wrecks, artificial reefs, and mussel beds. Adults move offshore once water temperatures fall below 7.5 to 10°C in the fall (Steimle et al. 1999a).

Black sea bass

Black sea bass are usually strongly associated with structured, sheltering habitats such as reefs and wrecks. Spawning occurs on the continental shelf, beginning in the spring off Cape Hatteras and progressing into the fall in the New York Bight and off southern New England. When larvae reach 10 to 16 mm total length, they tend to settle and become demersal on structured inshore habitat such as sponge beds. In the Mid-Atlantic Bight, recently settled juveniles move into coastal estuarine nursery areas between July and September. The estuarine nursery habitat of YOY black sea bass is relatively shallow, hard bottom with some kind of natural or man-made structure including amphipod tubes, eelgrass, sponges, and shellfish beds with salinities above 8 ppt. Black sea bass do not tolerate cold inshore winter conditions. Following an overwintering period presumably spent on the continental shelf, older juveniles return to inshore estuaries in late spring and early summer. They are uncommon in open, unvegetated, sandy intertidal flats or beaches. Like juveniles, adult sea bass are very structure oriented, especially during their summer coastal residency. Unlike juveniles, adults only enter larger estuaries and are most abundant along the outer Atlantic coast. Larger fish tend to be found in deeper water than smaller fish (Steimle et al. 1999b).

Red hake

Red hake spawn offshore in the Mid-Atlantic Bight in the summer, primarily in southern New England. The distribution of eggs is unknown because they cannot be distinguished from other hakes. Larvae dominate the summer ichthyoplankton in the Mid-Atlantic Bight and are most abundant on the mid-and outer continental shelf. Larvae are transported into coastal waters and settle to the bottom in the fall. Juveniles seek shelter and commonly associate with scallops, surf clam shells, and seabed depressions. Juveniles and adults make seasonal migrations in response to changes in water temperatures. In the Mid-Atlantic Bight, red hake are commonly found in coastal waters in the spring and fall and move offshore or into deeper inshore water to avoid warm, summer temperatures. Juveniles in the HRE avoid depths less than -30 feet MLW and exhibit a preference for salinities above 27 ppt, temperatures above 5°C, and dissolved oxygen concentrations of 10 to 11 mg/l (Steimle et al. 1999c).

Cobia

Cobia is a southern species that overwinters near the Florida Keys and migrates in the spring and summer to the mid-Atlantic states to spawn. Adults are rarely found as far north as Massachusetts. Habitat preference of this species is high salinity bays, estuaries, and seagrass habitats. Cobia prefers temperatures greater than 20°C and salinities greater than 25 ppt (Richards 1967). One YOY juvenile was caught off Cliffwood Beach, New Jersey, with a beach seine within 100 feet of shore in 1999 (USACE 2000).

Atlantic mackerel

Atlantic mackerel overwinter in deep water on the continental shelf from Sable Island Bank (Canada) to Chesapeake Bay and in spring move inshore and northeast. This pattern in reversed in the fall. In general, juveniles are found in some inshore bays and estuaries as well as offshore at salinities greater than 25 ppt. Adults are commonly found in open sea although occasionally in open bays with lower salinity limits of approximately 25 ppt. The geographical and seasonal distribution of juveniles and adults is generally similar, although juveniles tend to be distributed further inshore than adults in the spring and fall (Studholme et al. 1999).

King and Spanish mackerel

King and Spanish mackerels are highly migratory epipelagic, neritic fish that migrate north from Florida as far as the Gulf of Maine in the summer and fall. King mackerel spawn in coastal waters of the Gulf of Mexico and off the South Atlantic coast. Thus, only a few adults of this species will be expected to inhabit Mid-Atlantic Bight coastal waters. In contrast, Spanish mackerel spawn as far north as Sandy Hook and Long Island in late August to late September (Godcharles and Murphy 1986).

Summer Flounder

Summer flounder exhibit strong inshore-offshore movements. Planktonic larvae and post-larvae derived from offshore fall and winter spawning migrate inshore, entering coastal and estuarine nursery areas to complete transformation. Juveniles are distributed inshore and occupy many estuaries during spring, summer, and fall. Some juveniles remain inshore for an entire year before migrating offshore, while others move offshore in the fall and return the following spring. Juvenile summer flounder utilize several different estuarine habitats such as marsh creeks, seagrass beds, mud flats, and open bay areas. As long as other conditions are favorable, substrate preferences and prey availability are the most important factors affecting distribution. Some studies indicate that juveniles prefer mixed or sandy substrates, others show that mud and vegetated habitats are used. Adult summer flounder inhabit shallow, inshore, and estuarine waters during warmer months and migrate offshore in the fall. Adults are reported to prefer sandy habitats, but can be found in a variety of habitats with both mud and sand substrates (Packer et al. 1999).

Winter flounder

Winter flounder spawning occurs from late winter through early spring, peaking south of Cape Cod in February and March. Eggs are found inshore in depths of -1 to -13.5 feet MLW and have been collected in plankton nets offshore, e.g., on Georges Bank at depths of -400 feet MLW or less during March to May. Eggs are adhesive and demersal and are deposited on a variety of substrates, but sand is the most common; they have been found attached to vegetation and on mud and gravel. Larvae are negatively buoyant and non-dispersive; they sink when they stop swimming. Thus, recently settled YOY juveniles are found close to spawning grounds and in high concentrations in depositional areas with low current speeds. YOY juveniles migrate very little in the first summer, move to deeper water in the fall, and remain in deeper cooler water for much of the following year. Habitat utilization by YOY is not consistent across habitat types and is highly variable among systems and from year to year. Several field and lab studies suggest a “preference” for muddy/fine sediment substrates where they are most likely to have been deposited by currents. Adult winter flounder prefer temperatures of 12 to 15°C, dissolved oxygen concentrations greater than 2.9 mg/l, and salinities above 22 ppt, although they have been shown to survive at salinities as low as 15 ppt. Mature adults are found in very shallow waters during the spawning season (Pereira et al. 1999).

Windowpane

Windowpane is a shallow water mid and inner-shelf species found primarily between Georges Bank and Cape Hatteras on fine sandy sediment. Spawning occurs on inner shelf waters, including many coastal bays and sounds, and on Georges Bank. Juveniles and adults are similarly distributed. They are found in most bays and estuaries south of Cape Cod throughout the year at a wide range of depths (less than -5 to -130 feet MLW), bottom temperatures (3 to 12°C in the spring and 9 to 12°C in the fall), and salinities (5.5 to 36 ppt). Juveniles that settle in shallow inshore waters move to deeper offshore waters as they grow. Adults occur primarily on sand substrates off southern New England and Mid-Atlantic Bight (Chang et al. 1999).

Sand tiger shark

The sand tiger shark is a common littoral shark found in temperate and tropical waters from Gulf of Maine to Florida. It ranges from the surf zone, in shallow bays, and around coral and rocky reefs down to at least 191 meter depth on the outer continental shelf. Female tends to give birth in warm-temperate waters. Reproduction features ovophagy or uterine cannibalism, and limit the litter size to one or two pups. Juveniles are commonly found in estuaries of the eastern United States and are susceptible to runoff and pollution (Compagno 1984).

Sandbar shark

The sandbar shark is an abundant, coastal-pelagic shark of temperate and tropical waters that occurs inshore and offshore. It is found on continental and insular shelves and is common at bay mouths, in harbors, inside shallow muddy or sandy bays, and at river mouths, but tends to avoid sandy beaches and the surf zone. Sandbar sharks migrate north and south along the Atlantic coast, reaching as far north as Massachusetts in the summer. Sandbar sharks bear live young in shallow Atlantic coastal waters between Great Bay, New Jersey, and Cape Canaveral, Florida. The young inhabit shallow coastal nursery grounds during the summer and move offshore into deeper, warmer water in winter. Late juveniles and adults occupy coastal waters as far north as southern New England and Long Island (Compagno 1984).

Clearnose skate

Clearnose skate occurs along the eastern United States coast from the Nova Scotian Shelf to northeastern Florida as well as in the northern Gulf of Mexico from northwestern Florida to Texas. Juvenile clearnose skate in the Long Island Sound and HRE were taken most often during September and October, but is a relatively rare species in the Long Island Sound and HRE. Juveniles have a depth range of 5 to 7 meters, temperature preference between 16 to 22°C, and a salinity preference between 22 to 30 ppt. Adults exhibits similar season distribution and environmental preference as juveniles (Packer et al. 2003a).

Little skate

Little skate occurs from Nova Scotia to Cape Hatteras and is one of the most dominant members of the demersal fish community of the northwest Atlantic. Juveniles and adults have similar habitat preference, and can be found over sandy and gravelly bottoms and also over mud. During the spring and fall seasons, little skate in the Long Island Sound are most abundant on transitional and sand bottoms. The spring, summer, and all depth preference for juveniles and adults in Long Island Sound range between 9 to 27 meters. Salinity preference is near full saline water or 32 ppt and temperature preference is 2 to 15°C (Packer et al. 2003b).

Winter skate

Winter skate occurs from the south coast of Newfoundland and the southern Gulf of St. Lawrence to Cape Hatteras. Juveniles and adults exhibits similar habitat preference, and can be found over sand and gravel bottoms. This species tends to be nocturnal and remains buried in depressions during the day and are more active at night. Juveniles and adults have a depth preference between 5 to 8 meters, temperature preference of 4 to 13°C during the spring, fall, and winter and 16 to 21°C during the summer, and salinity preference between 23 to 32 ppt (Packer et al. 2003c).

4.7.3.1.2 New York City-Long Island Sound

The EFH designated species and life history stages from New York City to Long Island Sound are represented by species in Long Island Sound as part of the EFH designation for major estuaries, bays and rivers along the northeast United States coast. The EFH designated species and life history stages from New York City to Long Island Sound are also represented by species designated in seven 10-minute by 10-minute squares encompassing the Atlantic Ocean waters within the Hudson River estuary, East River, waters along the north and south shore of Long Island into Long Island Sound, and eastward to Bridgeport, Connecticut (NOAA 2009a). The compiled NOAA data also include EFH designated skate species in the New York Bight region of the Atlantic waters (NOAA 2009a). A total of 18 finfish, one shellfish, three sharks, and three skates are currently designated as EFH species within the waters of East River and Long Island Sound. Each EFH-designated species and the corresponding designated life stages are presented in Table 4.7-15.

Many of the EFH designated fish species overlap with those identified in the Hudson River. Brief species description of overlapped EFH designated species are provided in Section 4.7.3.1.1. Brief life history descriptions of the additional New York City -Long Island Sound EFH designated species are provided below.

Atlantic salmon

The Atlantic salmon's historic range encompassed the North Atlantic Ocean and its freshwater tributaries from Ungava Bay in Canada to Russia's White Sea. In eastern North America, this species ranged as far south as Connecticut. The Atlantic salmon is an anadromous species, typically spending 2 to 3 years in freshwater, migrating to the ocean where it also spends 2 to 3 years, and then returning to its natal river to spawn. Eggs typically hatch in late March or April, and grow from alevin to parr. Parr prefer areas with adequate cover, water depths ranging from 10 to 60 centimeter, water velocities between 30 and 92 centimeter per second, and water temperature near 16°C. After 2 to 3 years in the river, parr goes through smoltification and prepares its migration to the ocean and life in salt water. Upon entering salt water, the postsmolts grow rapidly and have been documented to move in small schools and loose aggregations close to the surface. Decreasing nearshore temperatures during the fall appear to trigger offshore movements (Fay et al. 2006).

Pollock

Pollock is a gadoid species inhabiting both sides of the North Atlantic. Juvenile pollocks have been reported over a wide variety of substrates, including sand, mud, or rocky bottom and vegetation. Inshore subtidal and intertidal zones are utilized by less than Age 2 juveniles as important nursery areas. Age 2+ juveniles move offshore, inhabiting depths between 427 to 492 feet). Juveniles have an inshore preference during the summer as the Northeast Fisheries Science Center (NEFSC) bottom trawl survey captured juvenile pollock off the coast of Rhode Island, Long Island, and Massachusetts. Adults showed little preference for bottom type and inhibit a wide range of depth ranging from 115 to 1,198 feet, with majority found within the 449 foot depth contour between depths of 328 to 410 feet. Similar to juveniles, adult pollock in the NEFSC bottom trawl surveys showed a nearshore preference during the summer and an overall distribution further south during the winter and spring than in the summer and fall (Cargnelli et al. 1999).

Atlantic cod

Cod are typically found on or near the bottom along rocky, pebbly, or gravelly substrates, and are tolerant of a wide range of oceanic salinities. Mortality occurs at salinities < 2.3 ppt. In general, they prefer depths between -130 and -430 feet MLW, avoid finer sediments, and remain near the bottom during the day and may move up into the water column at night. They migrate north and east to Nantucket Shoals in the summer. Adult cod in the Mid-Atlantic Bight are associated with temperatures below 10°C (Lough 2004).

Ocean pout

The ocean pout is a bottom dwelling, cold-temperate species found on the Atlantic continental shelf of North America between Labrador and the southern Grand Banks and Virginia. Ocean pout eggs are demersal and laid in gelatinous masses in a sheltered place on the bottom of the seafloor, such as rocky crevices, where they are guarded by one or both parents until hatch. Collection of the benthic larval ocean pout is rare. Available data suggest that larvae are widely distributed north and south of Cape Cod across the continental shelf. Overall, this species has a relatively short larval stage, so hatchlings are thought to remain near the nest shelter. Juveniles occur in shallow coastal waters around rocks and attached algae, and in rivers with saline bottom waters. Juveniles are demersal and found in depths ranging from 3 to 656 feet, with a preference of 66 to 246 feet. Adults occur from the intertidal across the continental shelf and on the upper continental slope to about 246 feet on Georges Bank and in the Gulf of Maine (Steimle et al. 1999d).

American plaice

American plaice is an Arctic-boreal to temperate-marine pleuronectid (righteye) flounder that inhabits both sides of the North Atlantic on the continental shelves of northeastern North America and northern Europe. This species occurs in estuaries and rivers where it ranges from highly abundant to rare. Juveniles from the NEFSC bottom trawl surveys from the Gulf of Maine to Cape Hatteras occurred at depths ranging from 36 to 1,312 feet in both spring and autumn. Juveniles from the Massachusetts inshore trawl survey occurred at depths ranging from 20 to 279 feet, with majority occurring between 151 to 213 feet during both spring and autumn. Adult American plaice prefer a soft bottom substrate and are frequently found on find sand or gravel bottoms and in some areas, their distribution has been correlated with mud substrates. In general, adult American plaice are found in deep water from 295 to 591 feet and do not normally occur in water less than 82 to 115 feet (Johnson 2004).

Dusky shark

The dusky shark is a large, highly migratory species that is common in warm and temperate continental waters throughout the world. Although nursery areas are in coastal waters, dusky sharks do not prefer areas with reduced salinities and tend to avoid estuaries. Dusky sharks are viviparous. Females move inshore to drop their young then return to deeper water (Compagno 1984).

4.7.3.2 Potential Impacts and Mitigation

Trenching activities associated with cable installation may cause a temporary and localized period of elevated suspended sediments within the Hudson River and Long Island Sound. However, the increase in turbidity will be minor and will not create a barrier to fish movement. The majority of the fluidized sediments are expected to refill the cable trench and not be dispersed through the habitat. Some finer grain sediments (silts and clay) that become suspended will travel further distance from the jet plowing activity, but will be similar to temporary spikes of turbidity from storm events, although to a much more localized extent. BMPs will be implemented to ensure the construction activities will not severely degrade water quality, particularly in the areas of the Hudson River where re-suspension of existing contaminants may occur. BMPs (i.e., construction during non-migratory season) will also be implemented to ensure impacts from construction activities to migratory species are avoided or minimized.

During the installation and construction of the cables, a number of vessels, including tugs, barges, cranes, and workboats may be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials thus the potential for an oil spill. Additionally, frac-out may occur at the HDD entry and exit location resulting in drilling fluid spills. BMPs will be employed throughout construction with the appropriate spill response plans implemented which will limit the impacts from oil and fluid spills. The waters of the proposed cable route are also frequented by various water vessels on a daily basis and the introduction of vessels to the area during the construction period will not change the potential for an oil or fluid spill compared to existing conditions.

Underwater noises during construction activities could potential cause physical damage and interrupt social behavior for fish species. There are many sources of ambient noise in the environment. Natural sources include wind, wave/tidal action, cracking ice, and marine life. Anthropogenic or human-generated noise may include recreational and commercial ship traffic, dredging, construction, oil drilling and production, and geophysical surveys (EIA 2008). The installation of the underwater cables will result in a certain level of noise from service vessels and equipment. Underwater noise from construction activities will be short-term and will not involve pile driving. Noise associated with the construction activities may temporarily result in fish species avoiding the construction area during periods when work is being done. Overall, impacts to EFH designated species from underwater noise will be negligible.

Construction of the Project could potentially affect small, larval EFH designated bottom fish species, particularly summer, winter, and windowpane flounders that occupy the nearshore estuarine waters. Demersal EFH designated species (flounders) may remain in the sediment to seek shelter from construction activities. The overall direct impact or mortality of an individual finfish species will be limited, since most fish will move away from the construction operation as it approaches, thus having negligible impact to the overall populations.

The construction of the Project will cause a temporary, short term disturbance to benthic habitats. Disturbance of river bottoms and the seabed from trenching during installation of the cable will affect the local benthic communities within the footprint of the cable right-of-way. Jetting and/or plowing could potentially cause mortality of benthic infaunal and epifaunal organisms (e.g., polychaete and oligochaete worms, crabs, mysids, and sand shrimp), thus limiting the availability of food sources for the EFH designated species. However, the EFH designated species are expected to feed in surrounding, unaffected areas, and therefore be relatively unaffected by the temporary and localized reductions in available benthic food sources. Recruitment and re-colonization of the benthic infaunal communities is expected to occur immediately following construction. Studies conducted on offshore sand borrow areas off the outer New Jersey coast indicated that benthic communities were re-established within 8 to 9 months, i.e., within one annual recruitment period after dredging (USACE 1999). Additionally, the Project area is a small portion of this type of habitat in the region, thus the overall impact on the EFH designated species will be minor.

Brinkhuis (1980) conducted a literature assessment on the biological effects of sand and gravel mining in the Lower Bay of New York Harbor and found that during bottom disturbance, and immediately after an area has been disturbed, fish are attracted to the area to feed on infaunal organisms that are dislodged from the bottom. Species attracted to feed in the Project area will be mostly juvenile and adult stages of flounders and opportunistic species (e.g., striped bass) that can avoid the construction activities.

In areas where conventional dredging is employed, typically for deeper burial areas such as at crossings of a navigation channel, there will be more substantial alteration of the benthic habitat compared to jetting since the construction will involve sediment removal, cable-laying, and then backfilling. Depending on the nature of the backfill, the sediment surface characteristics could be altered since it is unlikely that exactly the same grain size composition will be created as existed prior to cable installation. Depending on currents and erosional forces, backfill will be used that is anticipated to remain in place. However, whatever the backfill characteristics are, they are likely to become colonized over time with benthic organisms. Given the small amount of anticipated conventional dredging, any altered prey abundance or modified substrate characteristics are unlikely to have anything but a negligible to minor effect on fish species.

Additionally, the placement of rip-rap or concrete mats along the Project route could cover, disturb, injure, or kill benthic biota and other immobile or slow-moving benthic organisms, thus having small areas of affected food availability for EFH designated species. The rip-rap or concrete mats will provide additional new habitat for epibenthic organisms to colonize, and therefore the EFH designated species will be relatively unaffected by the temporary and localized reductions in available benthic food sources. Also, the rip-rap or concrete mats will provide areas of shelter, structure, or cover typically sought by fish for protection from predators

(Johnson and Stickney 1989; Ogden 2005) and beneficial for some of the EFH designated species.

Construction will typically occur twenty four hours per day seven days per week, requiring the use of lights on construction vessels. Nighttime lighting may be an attractant to some EFH species, causing them to move into the construction area. If the jetting has increased suspended sediments, attracted fish may experience impaired respiration from clogging of gills. However the suspended sediments will be bottom oriented and the attractive lighting will be at the surface, so this effect is likely to be negligible. Lights may also be an attractant to certain fish prey items, which could also cause EFH species to be attracted to the vessels.

4.8 WILDLIFE

This section describes the existing wildlife species typical of the terrestrial and/or aquatic habitats along the transmission cable route. This section also describes the potential impacts to wildlife and wildlife habitats that may result from the construction and operation of the Project, along with the methods that will be used to avoid, minimize and mitigate for those impacts.

Portions of the Project that may be associated with terrestrial wildlife habitats include: 1) the underground bypass routes to avoid Locks C12, C11, and C9 along the Champlain Canal in Washington County; 2) the approximate 69.9-mile underground bypass in Washington, Saratoga, Schenectady and Albany Counties, to avoid interference with activities associated with the Hudson River PCB Dredging Project; 3) the Yonkers converter station area in Westchester County; and 4) the existing Sherman Creek substation in New York County. The remainder of the Project in the State of New York is located within the aquatic habitats of Lake Champlain, the Champlain Canal, Hudson River, Harlem River, East River, and Long Island Sound.

4.8.1 Non-Avian Terrestrial Wildlife

This section provides a discussion of the existing non-avian wildlife with the potential to occur along underground portions of the Project, including mammals, reptiles and amphibians and invertebrates. The wildlife described in this section include terrestrial and semi-aquatic species that may be found using upland, wetland, and small freshwater aquatic habitats along the primarily underground portions of the Project route. Because avifauna may occur along both terrestrial and aquatic portions of the Project, they are separately discussed in Section 4.8.2.

4.8.1.1 Existing Wildlife

Terrestrial habitats along the underground transmission cable route are within the Lower New England-Northern Piedmont Ecoregion. This ecoregion is characterized by limestone bedrock and topography that is dominated by lakes and low mountains (NYSDEC 2010i). Habitats include a variety of forests, woodlands, shrublands and wetlands, along with agricultural pastures, croplands, urban and suburban environments.

Information provided on the existing non-avian wildlife and wildlife habitat is based on available publications and the data contained in the NYSDEC New York Nature Explorer database (NYSDEC 2009a), which includes the county-level occurrence data from the New York State Herp Atlas, along with information on rare plants, animals and natural communities. CHPEI has also conducted environmental field investigations along portions of the underground cable route paralleling the CP railroad right-of-way and at the Yonkers Converter substation. During field investigations, biologists noted the wildlife and wildlife habitats that were observed, and mapped the ecological communities (Edinger et al. 2002) present along the surveyed portions of the transmission cable corridor. Section 4.4 provides further information on terrestrial communities along the Project route and Section 4.5 describes the wetland community types.

4.8.1.1.1 Upland Habitats

Upland habitats along the underground transmission cable route include successional old fields, shrublands, hardwood and mixed pine forests, agricultural lands, rights-of-way, urban and suburban residential lands, and other disturbed or human-dominated environments. Because the transmission cables will be installed underground along existing, maintained railroad rights-of-way, forested habitat along the construction corridor most commonly exists as successional or shrubby forest edge.

Forested habitats adjacent the Project route typically have a canopy consisting of oak, hickory, maple, ash, aspen, birch, elm, and/or box elder, sometimes mixed with white pine or pitch pine. Some characteristic mammal species for these forested communities include Eastern chipmunk (*Tamias striatus*), gray squirrel (*Sciurus carolinensis*), gray fox (*Urocyon cinereargenteus*), fisher (*Martes pennanti*), American black bear (*Ursus americanus*), hoary bat (*Lasiurus cinereus*), moose (*Alces alces*), Virginia opossum (*Didelphis virginiana*), smoky shrew (*Sorex fumeus*), masked shrew (*Sorex cinereus*), woodland vole (*Microtus pinetorum*), and white-footed mouse (*Peronyscus leucopus*) (NYSDEC 2007b; Smithsonian National Museum of Natural History 2010). Dry or moist upland forests may host reptiles and amphibians such as red-bellied snake (*Storeria occipitomaculata*), dusky salamander (*Desmognathus fuscus*), Eastern newt (*Notophthalmus viridescens*), redback salamander (*Plethodon cinereus*), and wood frog (*Rana sylvatica*) (NYSDEC 2007b). Forest edges near clearings, agricultural areas, rights-of-way and wetlands typically support species such as white-tailed deer (*Odocoileus virginianus*), coyote (*Canis latrans*), red fox (*Vulpes vulpes*), Eastern pipistrelle (*Pipistrellus subflavus*), long-tailed shrew (*Sorex dispar*), red bat (*Lasiurus borealis*), Eastern cottontail (*Sylvilagus floridanus*), gray treefrog (*Hyla versicolor*) and milk snake (*Lampropeltis triangulum*).

Old fields, successional shrubs and agricultural habitats are common along the underground portions of the cable route. Wildlife inhabiting these areas may include white-tailed deer, eastern cottontail, woodchuck (*Marmota monax*), deer mouse (*Peromyscus maniculatus*), meadow vole (*Microtus pennsylvanicus*) and racer (*Coluber constrictor*). Near residential and suburban areas, wildlife tolerant of human disturbance like raccoon (*Procyon lotor*), woodchuck, gray squirrel, white-tailed deer, coyote, striped skunk (*Mephitis mephitis*), big brown bat (*Eptesicus fuscus*), American toad (*Bufo americanus*) and common garter snake (*Thamnophis sirtalis*) are often predominant.

Urban and industrial landscapes, such as the downtown Schenectady area, the Yonkers converter station site and the existing Sherman Creek substation, do not typically have a high diversity of wildlife. Wildlife present may include species well-adapted for foraging and/or living in human-dominated environments, particularly introduced species like house mouse (*Mus musculus*) and Norway rat (*Rattus norvegicus*).

4.8.1.1.2 Wetlands and Freshwater Habitats

Wetland habitats identified along the underground portions of the transmission cable route include deep and shallow marshes dominated by emergent vegetation, wet meadows, shrub swamps, shrubby wet ditches, floodplain forests, riparian edges, and forested wetlands. Open water areas such as rivers, small streams, ponds, pools, and lakes also occur in the vicinity of the Project. Wetlands and freshwater waterbodies along the underground transmission cable corridor may provide habitat for a variety of terrestrial and semi-aquatic wildlife species.

Emergent marshes, wet meadows and pond edges are often associated with vegetation such as cattails (*Typha* spp.), sedges (*Carex* spp.), rushes (*Juncus* spp.), bulrushes (*Scirpus* spp.), and spike rushes (*Eleocharis* spp.). These wetlands may support mammals such as Northern short-tailed shrew (*Blarina vervicauda*), star-nosed mole (*Condylura cristata*), meadow vole, moose, beaver (*Castor canadensis*), and muskrat (*Ondatra zibethicus*). Both beaver and muskrat signs were noted during field investigations along portions of the Project route. A variety of amphibians are typical of these wetland and aquatic habitats, including bullfrog (*Rana catesbeiana*), green frog (*Rana clamitans*) and Northern leopard frog (*Rana pipiens*). Common garter snake, smooth green snake (*Liochlorophis vernalis*), northern water snake (*Nerodia sipedon*), and copperhead (*Agkistrodon contortrix*) are typically associated with these open wetland and aquatic habitats; deeper areas near lakes and ponds may also support painted turtle (*Chrysemys picta*), common map turtle (*Graptemys geographica*), and snapping turtle (*Chelydra serpentina*).

Forested wetlands are dominated by species such as red maple, cottonwood, oaks, ashes, elms, and box elder. Wildlife in forested wetlands are often associated with areas of pools and sphagnum moss, thickets, damp leaf litter, floodplains and/or river bottoms. Species using these habitats include ermine (*Mustela erminea*), pickerel frog (*Rana aplustris*), gray treefrog and red-bellied snake. Seasonal or vernal pools in forested areas support a distinct community of breeding amphibians, which may include spring peeper (*Pseudacris crucifer*), spotted salamander (*Ambystoma maculatum*) and wood frog. Vernal pool habitat is also critical to several New York State-listed species of special concern, particularly blue-spotted salamander (*Ambystoma laterale*) and Jefferson salamander (*Ambystoma jeffersonianum*) (see Section 4.9 for further information on state-listed species).

Water shrew (*Sorex palustris*), Northern two-lined salamander (*Eurycea bislineata*) and northern slimy salamander (*Plethodon glutinosus*) are frequently found in habitats immediately adjacent to streams and/or in riparian areas. River otters (*Lontra canadensis*) are known to inhabit the Hudson River Valley (NYSDEC 2010j), and may be present along both underground and underwater portions of the cable route.

4.8.1.2 Potential Impacts and Mitigation

CHPEI has minimized impacts to terrestrial wildlife habitats by routing the cable underwater to the extent possible. Where underground bypass routes are required, CHPEI has sited the transmission cable corridor along existing railroad rights-of-way. The only portions of the underground cable routes that do not parallel the railroad right-of-way are the Lock C9 bypass and the short habitat crossings associated with landfalls from the underwater cable route. To further minimize impacts, CHPEI has proposed to use the HDD method at all landfall locations. Where the HDD method is used, surface impacts to wildlife habitats between the drill entry and exit points will be avoided.

In most areas, use of previously disturbed railroad corridor for the installation of the underground transmission cables will generally reduce the potential impacts to wildlife. In areas where forested communities occur, routing the Project along the railroad right-of-way reduces the amount of impact to the canopy vegetation and avoids new fragmentation of forested habitats. Fragmentation has been demonstrated to reduce the size of the habitat available to forest-dwelling wildlife by isolating patches of otherwise suitable forested habitat. Since the Project will not result in any new corridors through forested habitat, no significant increase in fragmentation of forested habitats will result.

In a select few areas within the railroad rights-of-way, forested cover may be converted to a shrub community as part of the CHPEI Vegetation Management Plan. During operation of the Project, activities associated with this plan will be restricted to vegetation clearing on an as-needed basis to conduct repairs or maintenance along the transmission cables and/or selective cutting to prevent the establishment of large trees directly over the cables. CHPEI will develop a Vegetation Management Plan as part of the EM&CP. Any vegetation management activities currently conducted by the railroads within the right-of-way will continue following the construction and operation of the underground transmission cable.

Impacts to terrestrial wildlife habitats along the underground transmission cable corridor are expected to be temporary. During construction, wildlife may be disturbed by noise, vegetation clearing, lighting and construction activities within the impact corridor and any additional work spaces. Mobile animals are expected to be temporarily displaced from the construction area and immediately adjacent areas, moving into similar habitats nearby for the duration of construction. These species will then return to the area once construction and restoration of disturbed areas are completed. Smaller and less mobile organisms, such as turtles, amphibians and small mammals, could experience direct mortality from vehicles and equipment within the construction corridor. CHPEI has initiated discussions with NYNHP, NYSDEC, and USFWS for additional information and recommendations relating to wildlife impacts during construction and operation of the Project.

Upon completion of construction activities, CHPEI will conduct initial restoration, including soil stabilization and temporary seeding of disturbed areas. Once erosion control vegetation cover has been established, the construction corridor will be allowed to re-vegetate naturally. As described above, only limited vegetation management will be conducted by CHPEI for repairs or other maintenance of the cables and for selective cutting to prevent the establishment of large trees directly over the cables. See Section 4.4 for additional information on vegetation impacts and mitigation. Since the Yonkers converter station and the Sherman Creek substation are both located in urban environments, no significant impacts to wildlife or wildlife habitats are anticipated from construction at aboveground facilities.

4.8.2 Avifauna

This section provides a discussion of the existing birds potentially occurring along both underground and underwater portions of the transmission cable route. This includes avifauna that may be using upland terrestrial, wetland, freshwater aquatic, coastal and marine habitats along the route.

Information provided on existing birds and avian habitats is based on publications and the data contained in the NYSDEC New York Nature Explorer database (NYSDEC 2009a), which includes the county-level distributions of birds recorded in the New York State Breeding Bird Atlas, along with information on rare plants, animals and natural communities. CHPEI has also conducted environmental field investigations along portions of the underground cable route paralleling the CP railroad and at the Yonkers Converter substation. During field investigations, biologists noted the wildlife and wildlife habitats that were observed, and mapped the ecological communities (Edinger et al. 2002) that are present along surveyed portions of the underground transmission cable corridor. Section 4.4 provides further information on terrestrial communities along the cable route and Section 4.5 describes the wetland community types.

4.8.2.1 Terrestrial and Freshwater Aquatic Avifauna

The majority of the Project route is located underwater within Lake Champlain, the Champlain Canal and freshwater portions of the Hudson River and Hudson River Estuary. These large freshwater waterbodies are used seasonally by waterfowl and provide fishing and hunting habitat for raptor species such as osprey (*Pandion haliaetus*) and bald eagle (*Haliaeetus leucocephalus*). Brackish estuarine, saline, coastal and marine habitats adjacent to the underwater cable corridor in the lower Hudson River estuary, East River, Harlem River, and Long Island Sound, may be used by waterfowl and shorebirds as well as coastal and marine seabirds. Underground portions of the transmission cable route provide potential habitat for a variety of resident and migrant birds, including various species of passerines, raptors, wading birds, and game birds that use upland, wetland and/or riparian habitats.

4.8.2.1.1 Upland Habitats

Upland habitats along the terrestrial portions of the underground transmission cable corridor include successional old fields, shrublands, hardwood and mixed pine forests, agricultural lands, rights-of-way, urban and suburban residential lands, and other disturbed or human-dominated habitats. Because the transmission cables will be installed mostly along existing, maintained railroad rights-of-way, forested habitats within the construction corridor most commonly exist as successional or shrubby forest edge.

Forested habitats along the transmission cable route typically have a canopy consisting of oak, hickory, maple, ash, aspen, birch, elm, and/or box elder, sometimes mixed with white pine or pitch pine. Year-round residents and wintering bird species in forested habitats typically include black-capped chickadee (*Poecile atricapillus*), hairy woodpecker (*Picoides villosus*), pileated woodpecker (*Dryocopus pileatus*), white-breasted nuthatch (*Sitta carolinensis*), wild turkey (*Meleagris gallopavo*), and blue jay (*Cyanocitta cristata*) (NYSDEC 2007b).

The community of breeding birds consists of both year-round residents and migrant birds that arrive in the spring at the beginning of the breeding season; for most songbirds in New York this is typically April, May or early June. Breeding birds characteristic of forested habitats along the transmission corridor include barred owl (*Strix varia*), Eastern screech-owl (*Megascops asio*), ruffed grouse (*Bonasa umbellus*), broad-winged hawk (*Buteo platypterus*), black-and-white warbler (*Mniotilta varia*), black-throated green warbler (*Dendroica virens*), American redstart

(*Setophaga ruticilla*), blue-gray gnatcatcher (*Poliptila caerulea*), Eastern wood-pewee (*Contopus virens*), ovenbird (*Seiurus aurocapilla*), great crested flycatcher (*Myiarchus crinitus*), least flycatcher (*Empidonax minimus*), red-bellied woodpecker (*Melanerpes carolinus*), red-eyed vireo (*Vireo olivaceus*), wood thrush (*Hylocichla mustelina*) and scarlet tanager (*Piranga olivacea*) (NYSDEC 2007b).

Many bird species nest at the interface of forested habitats and open shrubby habitats. Typical bird species found along open or shrubby forest edges adjacent to old fields, agricultural areas, and/or rights-of-way include blue-winged warbler (*Vermivora pinus*), brown thrasher (*Toxostoma rufum*), Eastern towhee (*Pipilo erythrophthalmus*), field sparrow (*Spizella pusilla*), rose-breasted grosbeak (*Pheucticus ludovicianus*), black-billed cuckoo (*Coccyzus erythropthalmus*), and gray catbird (*Dumetella carolinensis*).

Old fields, scrubby succesional areas, and agricultural habitats are common along the terrestrial portions of the underground Project route. Species such as indigo bunting (*Passerina cyanea*), red-tailed hawk (*Buteo jamaicensis*), killdeer (*Charadrius vociferus*), American robin (*Turdus migratorius*), brown-headed cowbird (*Molothrus ater*), barn swallow (*Hirundo rustica*), and common grackle (*Quiscalus quiscula*) are expected to use these areas. Grassland habitats without dense woody vegetation may support killdeer, Eastern meadowlark (*Sturnella magna*), Eastern bluebird (*Siala sialis*), and bobolink (*Dolichonyx oryzivorus*).

Some birds are well-adapted to residential suburban environments, foraging in lawns, gardens, tree-lined streets and city parks. Black-capped chickadee, downy woodpecker (*Picoides pubescens*), blue jay, American robin, gray catbird, house wren (*Troglodytes aedon*), American crow (*Corvus brachyrhynchos*), Eastern screech owl, Northern flicker (*Coloptes auratus*), mourning dove (*Zenaida macroura*), and Northern mockingbird (*Mimus polyglottus*) are often found in residential areas.

Urban and industrial environments, such as downtown Schenectady, the Yonkers converter station site, and the existing Sherman Creek substation, do not typically support a high diversity of wildlife. Some species, however, such as rock pigeon (*Columba livia*) and house sparrow (*Passer domesticus*), are well-adapted to living in human-dominated environments. Chimney swifts (*Spizella passerina*) often nest on rooftops and can be seen frequently foraging over urban areas.

4.8.2.1.2 Wetlands

Wetland habitats identified along the terrestrial portions of the underground transmission cable corridor include deep and shallow marshes dominated by emergent vegetation, shrub swamps, shrubby wet ditches, floodplain forests, riparian edges, and forested wetlands. Open water areas such as rivers, small streams, ponds, pools and lakes also occur in the vicinity of the Project. Wetlands and freshwater habitats along the transmission corridor may support a variety of terrestrial and semi-aquatic wildlife species.

Emergent wetland habitats along the transmission cable corridor include persistent emergent marshes, wet meadows, pond edges and freshwater tidal marshes. A number of avian species of special concern such as American bittern (*Botaurus lentiginousus*), least bittern (*Ixobrychus exilis*) and pied-billed grebe (*Podilymbus podiceps*) are associated with persistent emergent wetlands (see Section 4.9). Other characteristic species that may be present in cattail marshes and other similar wetlands include red-winged blackbird (*Agelaius phoeniceus*), swamp sparrow (*Melospiza georgiana*) and Virginia rail (*Rallus limicola*). Wet meadows, moist thickets, and shrub swamps are likely to be used by species such as American woodcock (*Scolopax minor*), willow flycatcher (*Empidonax traillii*), green heron (*Butorides virescens*), yellow warbler (*Dendroica petechia*), and common yellowthroat (*Geothlypis tricha*).

Forested wetlands in the Project area typically have a canopy of red maple, cottonwood, oaks, ashes, elms and/or box elder. Some bird species that use upland forested habitats, such as great crested flycatcher, also may breed in forested wetlands. Additional species that prefer forested wetland habitats include veery (*Catharus fuscescens*), wood duck (*Aix sponsa*) and Northern waterthrush (*Seiurus noveboracensis*).

4.8.2.1.3 Freshwater Aquatic Habitats

The underwater cable route traverses freshwater habitats within Lake Champlain, the Champlain Canal, and the Hudson River. Smaller freshwater habitats and riparian areas occur along streams, rivers and ponds crossed by the underground portion of the Project route. Certain terrestrial species, such as warbling vireo (*Vireo gilvus*), ruby-throated hummingbird (*Archilochus colubris*), Easterm phoebe (*Sayornis phoebe*), and yellow warbler, frequently nest in riparian areas near waterbodies. Belted kingfisher (*Megaceryle alcyon*), spotted sandpiper (*Actitis macularius*) and tree swallow (*Tachycineta bicolor*) are likely to be found foraging along or over open water areas, ponds, lakes and rivers.

Large numbers of waterfowl travel through Lake Champlain and the Hudson River Valley during migration, particularly in the fall. Open water areas that do not freeze completely in the winter also provide important habitat for concentrations of wintering waterfowl. The New York State Ornithological Association has been conducting winter waterfowl counts in New York annually since 1955. Wintering waterfowl species that may be observed in the Lake Champlain area include Canada goose (*Branta canadensis*), American black duck (*Anas rubripes*), mallard (*Anas platyrhynchos*), bufflehead (*Bucephala albeola*), common goldeneye (*Bucephala clangula*), common merganser (*Mergus merganser*), and hooded merganser (*Lophodytes cucullatus*). Canvasback (*Athaya valisineria*), hooded merganser, ring-necked duck (*Athaya collaris*), greater scaup (*Athaya marila*), and lesser scaup (*Athaya affinis*) are known to winter in the Hudson River Valley.

Within some freshwater areas of the Hudson River Estuary below the Troy dam, tidal fluctuations expose intertidal mudflats. Freshwater tidal mudflats can provide foraging habitat for significant numbers of shorebirds during migration, including species such as least sandpiper (*Calidris minutilla*), semipalmated sandpiper (*Calidris pusilla*), pectoral sandpiper (*Calidris melanotos*), greater yellowlegs (*Tringa melanoleuca*), killdeer, spotted sandpiper, and short-billed dowitcher (*Limnodromus griseus*), among others (Yozzo et al. 2005). In general, the underwater transmission cable corridor is located in permanently submerged portions of the Hudson River Estuary, so direct impacts to intertidal flats are not expected. Freshwater intertidal mudflats may by crossed by the transmission cable corridor the landfall connecting to the CSX railroad right-of-way, adjacent to the Hudson River south of Albany. CHPEI has proposed the use of the HDD method to cross from the Hudson River to the railroad right-of-way, which will avoid any impacts to intertidal mudflats at this location.

4.8.2.2 Coastal and Marine Avifauna

Coastal and marine habitats occur in the vicinity of the underwater transmission corridor in the estuarine waters of the Hudson, East and Harlem Rivers, and around Long Island Sound. Because the cable is underwater, away from vegetated and/or intermittently exposed, intertidal habitats, the Project does not directly impact any brackish estuarine wetlands or coastal beaches. Avifauna inhabiting freshwater tidal marshes and mudflats along the Hudson River Estuary are also discussed above in Section 4.8.2.1.

Coastal and brackish estuarine marshes occur adjacent to the underwater transmission cable route, particularly in the lower Hudson River and Long Island Sound. These wetlands are likely to support many species similar to those occurring in freshwater marshes (See Section 4.8.2.1.2) such as least bittern, red-winged blackbird, Virginia rail and song sparrow (*Melospiza melodia*), along with savannah sparrow (*Passerculus sandwichensis*) and clapper rail (*Rallus longirostris*).

Intertidal mudflats and beaches in the estuary and around Long Island Sound may provide habitat for a variety of shorebirds, terns and gulls. In general, these habitats are not crossed by the underwater transmission cable route, but may occur in adjacent shoreline areas. The shoreline at the landfall for the cable connection to the Yonkers converter station consists of a narrow strip of cobble and gravel shore reinforced by rip-rap, below a retaining wall. Some muddy areas may be exposed at low tides. Gulls, such as herring gull (*Larus argentatus*) and great black-backed gull (*Larus marinus*), may use this kind of habitat as a resting and foraging. The rocky shoreline and rip-rap could potentially provide marginal habitat for purple sandpiper (*Calidris maritima*) in the winter; and mudflats can be used by migrating shorebirds such as least sandpiper (*Calidris minutilla*) and semipalmated plover (*Charadrius semipalmatus*). Additionally, the area just south of the Sherman Creek substation is mapped by the NYSDEC as intertidal mudflats (see Section 4.5), which could support migrating shorebirds.

Because the coastal areas near the Yonkers converter station and the Sherman Creek substation are located within a highly urbanized landscape, with much of the shoreline armored with rip-rap or sheetpiling, shorebird habitat is minimal. CHPEI has proposed the use of the HDD method at both sites to cross from the Hudson River to the aboveground facilities, which will avoid any impacts to shoreline or intertidal habitats at these locations.

In the summer, breeding birds such as herring gull, great black-backed gull, common tern (*Sterna hirundo*), least tern (*Sterna antillarum*), and roseate tern (*Sterna dougallii*) forage in and around Long Island Sound. In the winter, concentrations of waterfowl and waterbirds in Long Island Sound include species such as common loon (*Gavia immer*), red-throated loon (*Gavia stellata*), great cormorant (*Phalacrocorax carbo*), greater scaup, common eider (*Somateria mollissima*), American black duck, long-tailed duck (*Clangula hymalis*), surf scoter (*Melanitta perspicillata*), white-winged scoter (*Melanitta fusca*), bufflehead, and red-breasted merganser

(*Mergus serrator*). A few seabirds such as Northern gannet (*Morus bassanus*) and Wilson's storm-petrel (*Oceanites oceanicus*) are also occasionally found in offshore areas of Long Island Sound.

4.8.2.3 Bird Conservation Areas

Under the New York State BCA Program, the NYSDEC designates certain public lands as BCAs, to integrate bird conservation into planning and management of state lands (NYSDEC 2010k). Seven BCAs are located along Lake Champlain or the Hudson River in the vicinity of the proposed corridor for the underwater transmission corridor. Additionally, the Black Creek Marsh BCA is located near the underground bypass route in Albany County.

1) Valcour Island BCA is part of the Lake Champlain Islands Management Complex administered by the NYSDEC. It is designated as a BCA because it supports the largest great blue heron rookery in New York State, with approximately 550 nests. The area also provides breeding and migratory habitat for shorebirds, waterfowl and songbirds (NYSDEC 2010l). The Project route passes less than 0.5 miles from Valcour Island BCA, between approximate MPs 28 and 31.

2) Lake Champlain Marshes BCA includes wetland complexes within six Wildlife Management Areas (WMAs) along the western shore of Lake Champlain. This BCA contains large emergent marshes, forested wetlands and shrub swamps as well as upland grasslands, forests and shrublands. The BCA designation is primarily due to the diversity of bird species using area, the importance of the marshes as a migratory stopover supporting concentrations of waterfowl and wading birds, and the presence of habitat for variety of rare, threatened or endangered species (RTE) and state species of special concern (NYSDEC 2010l). Habitats present in the BCA are used by RTE and special concern species such as American bittern, least bittern, osprey, upland sandpiper (*Bartramia longicauda*), black tern (*Chlidonias niger*), northern harrier (*Circus cyaneus*), short-eared owl (*Asio flammeus*), pied-billed grebe, vesper sparrow (*Pooecetes gramineus*) and grasshopper sparrow (*Ammodramus savannarum*) (NYSDEC 2010l). The Project route passes within approximately 1.5 miles of the Lake Champlain Marshes BCA between approximate MPs 32 and 35.

3) The Crown Point BCA is located at the Crown Point State Historic Site at the tip of the Crown Point peninsula. Due to the geography, the peninsula serves as a corridor that concentrates migrant birds, particularly during spring migration (NYSDEC 2010l). The Project route passes less than 0.25 miles from the Crown Point BCA between approximate MPs 74 and 76.

4) Black Creek Marsh BCA provides wetland habitats that are used by a variety of waterfowl and wading birds during the breeding season and as a migratory stop-over. The BCA includes the Black Creek WMA, along with adjacent conservation easements (NYSDEC 2010l). Listed threatened and endangered species of special concern that use habitats within Black Creek Marsh BCA include pied-billed grebe, American bittern, least bittern, short-eared owl, northern harrier, and common nighthawk (*Chordeiles*

minor). This BCA is located just west of the underground portion of the transmission cable route in Albany County. The Project route passes less than 0.25 miles from the Black Creek Marsh BCA near approximate MP 188.

5) Schodack Island BCA is located on a peninsula in the Hudson River, with boundaries that coincide with the boundaries of the Hudson River Estuarine Sanctuary. The primary importance is as a breeding area for cerulean warbler (*Dendroica cerulean*) and bald eagle (*Haliaeetus leucocephalus*).; however, a diversity of habitats, including freshwater tidal marsh, mudflats, upland forests, old fields, and successional shrublands, support a variety of bird species. There is also a heron rookery at the site (NYSDEC 2010l). The Project route passes within approximately 500 feet of the Schodack Island BCA between approximate MPs 201 and 207.

6) Tivoli Bay is a large freshwater tidal marsh within a largely undeveloped area along the Hudson River, which contains emergent marshes, mudflats, open water and vegetated shallows. The area is primarily important for waterfowl during spring and fall migration, and is used by osprey and bald eagles. Marshes and adjacent upland habitats also support a diverse community of migrating and breeding birds. Bald eagle, osprey and least bittern are among the state-listed threatened and endangered or species of special concern occurring in this BCA (NYSDEC 2010l). Tivoli Bay is part of the Hudson River National Estuarine Research Reserve (see Section 4.5). The Project route passes less than 500 feet from the Tivoli Bay BCA between approximate MPs 236 and 240.

7) Constitution Marsh BCA is a mixed freshwater and brackish tidal marsh on the Hudson River's east shore. The site provides important wetland habitats, and also serves as a migratory stop-over and wintering habitat for waterfowl, with high concentrations of American black duck. A number of state-listed threatened and endangered or species of special concern are present at the BCA, including least bittern, pied-billed grebe, osprey, Northern harrier, bald eagle, and peregrine falcon (*Falco peregrinus*) (NYSDEC 2010l). The Project route passes within approximately 0.5 miles of the Constitution Marsh BCA between approximate MPs 283 and 285.

8) Iona Island/Doodletown BCA is an important freshwater to brackish tidal wetland area that has been designated as part of the Hudson River National Estuarine Research Reserve. It is also considered SCFWH area (see Section 4.7) and a National Natural Landmark. The area provides important habitat for marshbirds, shorebirds and waterfowl, and upland habitats that support a variety of songbirds (NYSDEC 2010l). The Project route passes within approximately 0.25 miles of the Iona Island/Doodleton BCA between approximate MPs 291 and 294.

4.8.2.4 Potential Impacts and Mitigation

Temporary impacts to birds and bird habitats may result from construction and operation of the Project. The installation of the transmission cables below ground avoids the direct bird mortality from collision and electrocution that has been frequently associated with overhead transmission wires and tower structures. CHPEI has further avoided impacts to potential bird nesting areas in terrestrial habitats by selecting a route that is primarily underwater. Where underground bypass routes are required, CHPEI has minimized habitat impacts by siting the cable corridor parallel to existing disturbed railroad rights-of-way to the extent possible. The only portions of the underground cable route that do not parallel the railroad right-of-way are the Lock C9 bypass and the short habitat crossings associated with landfalls from the underwater cable route. To further minimize habitat impacts, CHPEI has proposed to use the HDD method at all landfall locations. Where the HDD method is used, surface impacts to shoreline habitats between the drill entry and exit points will be avoided.

Use of a previously disturbed railroad corridor for the installation of the underground transmission cables will generally reduce the potential impacts to bird habitats. In areas where forested communities occur, routing along the railroad right-of-way reduces the amount of impact to the canopy vegetation and avoids new fragmentation of forested habitats. Fragmentation has been demonstrated to reduce the size of the habitat available to forest-dwelling bird species by isolating patches of otherwise suitable forested habitat, and may also encourage colonization by brown-headed cowbird (*Molothrus ater*), a brood parasite that can reduce breeding success rate for other species. Since the proposed Project will not result in any new corridors through forested habitat, no significant increase in fragmentation of forested habitats will result.

Construction and operation of the Project are not anticipated to result in any permanent alteration of terrestrial habitats along the underground transmission cable corridor except in a select few areas where forested cover may be converted to a shrub community as part of the CHPEI Vegetation Management Plan. During operation of the Project, activities associated with this plan will be restricted to vegetation clearing on an as-needed basis to conduct repairs or maintenance along the transmission cables and/or selective cutting to prevent the establishment of large trees directly over the cables. The use of herbicides for construction and maintenance of the cables is not anticipated at this time. CHPEI will develop a Vegetation Management Plan as part of the EM&CP. Any vegetation management activities currently conducted by the railroads within the right-of-way will continue following the construction and operation of the underground transmission cable. See Section 4.4 for additional information on vegetation impacts and mitigation.

During construction, birds inhabiting the railroad rights-of-way and the immediately adjacent habitats may be disturbed by construction activities, noise, lighting and vegetation clearing. Most birds along the underground routes will be temporarily displaced from habitats within the immediate construction footprint and will move into similar habitats nearby for the duration of construction. These birds will then be expected to return once construction and restoration of the disturbance area are completed.

If vegetation clearing along the underground portion of the transmission cable corridor is conducted during the breeding season, which for most species occurs in the spring and/or early summer, direct impacts to bird nests within the construction corridor could occur. Noise and disturbance also have the potential to result in parental abandonment of eggs or young in nests immediately adjacent to the construction area. CHPEI will continue to consult with NYNHP, NYSDEC, and USFWS, to determine if any additional impact avoidance, minimization, or mitigation is appropriate for bird species that may nest within the construction footprint.

Waterfowl, gulls and terns using aquatic habitats along the underwater portions of the transmission route in Lake Champlain, the Champlain Canal, the Hudson River, Harlem River, East River, and/or Long Island Sound, could also be disturbed and displaced from foraging habitats due to noise from underwater cable installation techniques, HDDs and increased vessel traffic. Generally, these birds will be expected to avoid the construction area and move to similar habitats nearby; however, adverse impacts could occur if disturbances result in increased stress, increased travel time to foraging areas from roosts or nest sites, or lower foraging success. Additional long-term impacts could occur if any adverse impacts on water quality or the aquatic food web result in the degradation of the aquatic habitat and a lower availability of food resources. See Section 4.6 for additional information on water quality, including potential impacts and mitigation.

If any sensitive breeding sites for freshwater, coastal, or marine species occur near underwater cable installation activities, excessive noise and activity can result in nest abandonment and/or lowered breeding success. Established colonial breeding areas such as heron rookeries and tern colonies may be particularly sensitive to human disturbances. Bald eagle or osprey nests adjacent to the underwater transmission cable route could also affected by disturbance (see Section 4.9) from the underwater cable installation. CHPEI has initiated consultations with the NYNHP, NYSDEC, and USFWS for additional information on sensitive species and recommendations regarding impacts to birds and wildlife along the proposed transmission cable route. CHPEI will continue to consult with these agencies to determine if any established heron rookeries, tern colonies, or raptor nests are located near the transmission cable corridor.

In general, CHPEI does not anticipate adverse impact to bird habitats in shoreline areas, freshwater or brackish tidal marshes, and/or intertidal habitats, since little of this habitat occurs within the impact area, or selected construction methods will avoid direct disturbance to these areas. CHPEI has proposed the HDD method for crossing habitats at the landfall locations near the Yonkers converter station and the Sherman Creek substation as well as at other shoreline crossings in the Champlain canal and Hudson River, which will avoid impacts to the shoreline or intertidal habitats at those locations. Since the Yonkers converter station and the Sherman Creek substation are both located in urban environments, no significant impacts to avian habitats are anticipated from construction at aboveground facilities.

4.8.3 Non-Endangered Species Act Marine Mammals

4.8.3.1 Existing Marine Mammals

Threatened and endangered species are covered in Section 4.9.2.4, while other non-ESA marine mammals with the potential to occur in the Project area are covered in this section. The non-ESA listed cetaceans and pinnipeds are protected under the Marine Mammal Protection Act (MMPA) of 1972 which gives the NMFS responsibility for the management and conservation of those species. Projects that have the potential to adversely affect these species need to seek Incidental Harassment Authorization from NMFS.

Table 4.8-1 lists the non-ESA listed cetaceans and pinnipeds known to occur in the coastal waters of Long Island, Staten Island and the greater New York City area. Detailed species profile information for the cetaceans and pinnipeds in the New York-Long Island Sound waters is provided below.

The Riverhead Foundation for Marine Research and Preservation (RFMRP) has operated the marine mammals and sea turtles rescue program since 1996. The program provides a record of the occurrences of various species in Long Island Sound and surrounding waters (Figure 4.8-1). On average, 150 animals are recovered each year with rescues occurring during every month of the year all around Long Island, Staten Island and New York Harbor, and into the Hudson River. From 1996 through 2007, a total of 1,888 animals were recovered, including 1,190 (63 percent) pinnipeds, 417 (22 percent) sea turtles, and 281 (15 percent) cetaceans (RFMRP 2008).

Cetacean stranding records in the coastal areas of Long Island, Staten Island, and the greater New York City area are comprised of seven species: common dolphin (*Delphinus delphis*), bottlenose dolphin (*Tursiops truncatus*), harbor porpoise (*Phocoena phocoena*) (a federal and state species of special concern, discussed further in Section 4.9), striped dolphin (*Stenella coeruleoalba*), Atlantic white-sided dolphin (*Lagenorhynchus acutus*), Risso's dolphin (*Grampus griseus*), and pilot whale (*Globicephala melas*) (RFMRP 2008). The large whale strandings and ship strikes in this region are comprised of three threatened and endangered species: fin whale (*Balaenoptera physalus*), sei whale (*B. borealis*), and humpback whale (*Megaptera novaeangliae*) (RFMRP 2010) (These three species are covered in Section 4.9.2.4). Pinniped stranding occurs in all coastal areas in this region, with an increase in the western portions of Long Island and Staten Island in recent years. The pinniped strandings in this region are comprised of four species: harp seal (*Phoca groenlandicus*), harbor seal (*P. vitulina*), gray seal (*Halichoerus grypus*), and hooded seal (*Cystophora cristata*) (RFMRP 2008).

4.8.3.1.1 Cetaceans

Bottlenose dolphin (*Tursiops truncates)*

The coastal morphotype of bottlenose dolphin is continuously distributed along the Atlantic coast south of Long Island, New York, around the Florida peninsula, and along the Gulf of Mexico coast. On the Atlantic coast, Scott et al. (1988 *as cited in* Waring et al. 2009) hypothesized a single coastal migratory stock ranging seasonally from as far north as Long Island, to as far south as central Florida, citing stranding patterns during a high mortality event in 1987-88 and observed density patterns. More recent studies demonstrate that the single coastal migratory stock hypothesis is incorrect, and there is instead a complex mosaic of stocks (Waring et al. 2009). In general, the primary habitat of the coastal morphotype of bottlenose dolphin extends from Florida to New Jersey during summer months and includes waters less than 20 meters deep, including estuarine and inshore waters (Waring et al. 2009). Stranding reports from 2006 to 2007 for the coastal waters of Long Island, Staten Island, and the New York City area showed a total of seven bottlenose dolphin standings occurred (RFMRP 2008) and the waters along the north shore of Long Island was visited by approximately 200 bottlenose dolphin near Cold Spring, Huntington, Northport, Hempstead, Oyster Bay, Smithtown, and Rye, New York during the summer of 2009 (Durham et al. 2009).

Aerial surveys to estimate the abundance of coastal bottlenose dolphins were conducted during the winter (January to February) and summer (July to August) of 2002. The surveys employed a stratified design so that most effort was expended in waters shallower than 20 meters deep where a high proportion of observed bottlenose dolphins were expected to be of the coastal morphotype. The survey included the region from the Georgia/Florida state line to the southern edge of Delaware Bay and the summer survey included the region between Sandy Hook, New Jersey to Fort Pierce, Florida. An additional aerial survey was taken during the summer of 2004 between central Florida and New Jersey, concentrating the effort in the shallow (0 to 20 meter) depth stratum. Results of the surveys estimate the population of the coastal morphotype of bottlenose dolphin at approximately 17,466 individuals (Waring et al. 2009; NOAA 2010a).

Bottlenose dolphins are long-lived, reaching up to 40 years of age or more. Sexual maturity varies according to population and ranges from 5 to 13 years for females and 9 to 14 years for males. Gestation lasts about a year and calves are weaned at 18 to 20 months. On average, calving occurs every 3 to 6 years; spring and summer or spring and fall calving peaks have been described for most of this species (OBIS 2010a; NOAA 2010a).

The coastal morphotype bottlenose dolphins are typically found in groups of 2 to 15 individuals and are often associated with pilot whales and other cetacean species. They are generalists and feed on a variety of prey items, foraging individually and cooperatively. Benthic invertebrates and fish are the primary prey. This species uses high frequency echolocation to locate and capture prey, as well as ‘fish whacking’, where they strike a fish with their flukes and knock it out of the water (NOAA 2010a).

Common dolphin (*Delphinus delphis*)

In waters off the northeastern United States coast, common dolphins are associated with Gulf Stream features and prefer waters altered by underwater geologic features where upwelling occurs (Waring et al. 2009; NOAA 2010d). They occur from Cape Hatteras northeast to Georges Bank (35° to 42°N) during the period from mid-January to May and move onto Georges Bank and the Scotian Shelf from mid-summer to autumn (Waring et al. 2009).

The total number of common dolphins off the United States and Canadian Atlantic coasts is unknown. The best abundance estimate for the western North Atlantic stock of common dolphin is 120,743 individuals. This is the sum of the estimates from two 2004 United States Atlantic surveys (Waring et al. 2009). Overall, this species is abundant worldwide, with a population estimate at approximately 3.9 million individuals (NOAA 2010d).

Males become sexually mature between 3 to 12 years and females between 2 to 7 years. Breeding usually takes place between June and September, with a 10 to 11 month gestation period (NOAA 2010d). Females give birth to a single calf and lactation lasts approximately four months. Reproduction occurs every two to three years (NOAA 2010d; OBIS 2010b).

Herds range in size from about 10 to over 10,000 individuals, and association with other marine mammal species is not uncommon (NOAA 2010d; OBIS 2010b). Common dolphins are capable of diving to at least 650 feet (200 meters) for prey during the night, and usually rest during the day (NOAA 2010d). Diets of common dolphin consist of epipelagic schooling fish and cephalopods (e.g., squid) (NOAA 2010d; OBIS 2010b).

Pilot whale (*Globicephala macrorhynchus*)

In the western North Atlantic, pilot whale ranges from Cape Hatteras into the Caribbean and the Gulf of Mexico (Waring et al. 2009; OBIS 2010c). These whales often occur in groups of 25 to 50 individuals and are among the cetaceans that most frequently mass-strand, perhaps due to their strong social bonds (NOAA 2010e; OBIS 2010c). The total number of pilot whales off the eastern United States and Canadian Atlantic coasts is unknown. The sum of the estimates from the two 2004 United States Atlantic surveys place the population at 31,129 individuals, including long-finned pilot whales (Waring et al. 2009; NOAA 2010e).

This species is polygynous; males have more than one mate and are often found in groups with a ratio of one mature male to about every eight mature females. Males generally leave their birth school, while females may remain in theirs for their entire lifetime (NOAA 2010e). Gestation lasts approximately 15 months while lactation lasts for at least two years. The last calf born to a mother may be nursed for as long as 15 years. The calving interval is five to eight years, but older females do not give birth as often as younger females (NOAA 2010e).

The primary prey is squid, but they may also feed on octopus and fish. Feeding can take place in deep water of 1000 feet (305 meters) or more. Pilot whales are known to travel abreast in a long line, forming ranks, when swimming and looking for food. A single line can be over one kilometer (more than 0.5 mile) long (NOAA 2010e; OBIS 2010c).

Striped dolphin (*Stenella coeruleoalba*)

This species occurs in the United States off the Pacific coast, in the northwestern Atlantic, and in the Gulf of Mexico. In general, this species prefers highly productive tropical to warm temperate waters (52-84°F [10-26°C]) that are oceanic and deep. These dolphins are often linked to upwelling areas and convergence zones (NOAA 2010f; OBIS 2010d).

Striped dolphins are abundant and widespread throughout the world as well as in offshore United States waters. Recent abundance estimates of the United States stocks are approximately 68,500 to 94,500 individuals. The worldwide population of this species is estimated at approximately 1.13 million individuals (NOAA 2010f). Striped dolphins are usually found in tight, cohesive groups averaging between 25 and 100 individuals, but herds can be into the thousands (NOAA 2010f; OBIS 2010d). Surface behavior is often characterized as sociable, athletic, energetic, active, and nimble with rapid swimming (NOAA 2010f).

Striped dolphins are thought to be polygynous. Males become sexually mature between 7 to 15 years and females 5 to 13 years. Interval between births is usually 3 to 4 years. Females give birth during the summer or autumn, after a gestation period of approximately one year. Lactation usually lasts 12 to 18 months (NOAA 2010f). Striped dolphins are capable of diving up to at least 2,300 feet (700 meters). Diet consists of various species of relatively small, closely-packed, midwater, benthopleagic and/or pelagic shoaling/schooling fish (e.g., myctophids and cod) and cephalopods (e.g., squid and octopus) (NOAA 2010f; OBIS 2010d).

Risso's dolphin (*Grampus griseus*)

Off the northeast United States coast, Risso's dolphins are distributed along the continental shelf edge from Cape Hatteras northward to Georges Bank during spring, summer, and autumn. In winter, the range is in the Mid-Atlantic Bight and extends outward into oceanic waters. In general, the population occupies the mid-Atlantic continental shelf edge year round and is rarely seen in the Gulf of Maine. This species is known to be associated with strong bathymetric features, Gulf Stream warm-core rings, and the Gulf Stream north wall (Waring et al. 2009).

Total numbers of Risso's dolphins off the United States and Canadian Atlantic coasts are unknown. The two 2004 United States Atlantic surveys estimates the total number for Risso's dolphins is 20,479 individuals, with the estimate from the northern United States Atlantic at 15,053 and from the southern United States Atlantic at 5,426 (Waring et al. 2009). The Risso's dolphin population worldwide is estimated at approximately 300,000 individuals (NOAA 2010g).

Not much is known about the reproduction of Risso's dolphin. Breeding and calving may occur year-round, and the gestation period is approximately 13 to 14 months. The peak of the breeding and calving season may vary geographically (especially in the North Pacific), with most animal births occurring from summer to fall in Japanese waters, and from fall to winter in California waters (NOAA 2010g). Risso's dolphins are capable of diving to at least 1,000 feet (300 meters) and holding their breath for 30 minutes, but typically make shorter dives of 1 to 2 minutes (NOAA 2010e). Their diet consists of fish (e.g., anchovies), krill, and cephalopods (e.g., squid, octopus and cuttlefish) and they feed mainly at night when their prey is closer to the surface (NOAA 2010g; OBIS 2010e).

White-sided dolphin (*Lagenorhynchus acutus*)

This species inhabits waters from central West Greenland to North Carolina (about 35°N) and perhaps as far east as 43°W. White-sided dolphin exhibits seasonal movements, moving closer inshore and north in the summer, and offshore and south in the winter (Waring et al. 2009; NOAA 2010h).

The total number of white-sided dolphins along the eastern United States and Canadian Atlantic coasts is unknown. In 2007, the best available abundance estimate for white-sided dolphins in the western North Atlantic stock was 63,368 individuals (Waring et al. 2009). Atlantic white-sided dolphins are highly social and playful animals. They have been seen traveling in small groups of a few individuals and in large aggregations of up to 500 animals. Older immature individuals are not generally found in reproductive herds that have mature females and young. White-sided dolphins are commonly observed engaging in acrobatic activities, such as lobtailing and breaching (NOAA 2010h; OBIS 2010f).

Females reach sexual maturity at around 6 to 12 years and males at around 7 to 11 years. Females typically give birth to a single calf about every other year. The breeding season is from May to August, though most calves are born in June and July. Calves are born in summer with a peak in June and July after a gestational period of 10 to 12 months, and lactation may last 18 months. Stranded females show evidence that lactation and pregnancy overlap (NOAA 2010h; OBIS 2010f). White-sided dolphins dive to feed on prey. Diet consists of fish (e.g., mackerel, herring and hake), squid and shrimp. They are often seen in association with long-finned pilot whales, humpback whales, and fin whales while feeding (NOAA 2010h; OBIS 2010f).

4.8.3.1.2 Pinnipeds

Harbor seal (*Phoca vitulina*)

This species is found from the Canadian Arctic to southern New England, New York and occasionally in the Carolinas (NOAA 2009b; Waring et al. 2009). Western North Atlantic stock harbor seals are year-round inhabitants of the coastal waters of eastern Canada and Maine, and occur seasonally from the southern New England to New Jersey coasts from September through late May (Waring et al. 2009). A general southward movement from the Bay of Fundy to southern New England waters occurs in autumn and early winter. A northward movement from southern New England to Maine and eastern Canada occurs prior to pupping season, which takes place from mid-May through June along the Maine coast (Waring et al. 2009). Stranding reports from 2006 to 2007 for the coastal waters of Long Island, Staten Island, and the New York City area showed a total of 16 harbor seal standings occurred (RFMRP 2008).

Harbor seals live in temperate coastal habitats and can be found commonly in bays, rivers, estuaries, and intertidal areas (OBIS 2009b), with movements associated with tides, weather, season, food availability, and reproduction. This species uses rocks, reefs, beach, and drifting glacial ice as haul out and pupping sites. Haul out on land is needed for rest, thermal regulation, social interaction, to give birth, and to avoid predators. Studies have shown that seals in groups tend to spend less time scanning for predators than those that haul out alone (NOAA 2009b).

Coast-wide population aerial surveys were conducted along the Maine coast during May/June 1981, 1986, 1993, 1997, and 2001. The 2001 observed count was 38,014 individuals and was 28.7 percent greater than the 1997 count. The overall Western North Atlantic Stock in 2001 was approximately 99,340 individuals (Waring et al. 2009). Increased abundance of seals in the Northeast region of the United States has also been documented during aerial and boat surveys of overwintering haul-out sites from the Maine/New Hampshire border to eastern Long Island and New Jersey (Waring et al. 2009).

Harbor seals are generalist feeders, taking a wide variety of fish, cephalopods, and crustaceans from surface, mid-water, and benthic habitats. Although primarily a coastal species, dives over 500 meters have been recorded (NOAA 2009b; OBIS 2009b). In United States waters, breeding and pupping normally occurs in waters north of the New Hampshire/Maine border and females give birth during the spring and summer (Waring et al. 2009). Pupping season varies with latitude. Pups are nursed for an average of 24 days and are ready to swim immediately after birth (NOAA 2009b).

Gray seal (*Halichoerus grypus*)

The Western North Atlantic stock of gray seal ranges from North Labrador down to New England and occasionally as far south as Virginia (MarineBio 2009; SNMNH 2009; Waring et al. 2009). In the mid 1980s, small numbers of animals and pupping were observed on several isolated islands along the Maine coast and in Nantucket-Vineyard Sound, Massachusetts (Waring et al. 2009). Stranding reports from 2006 to 2007 for the coastal waters of Long Island, Staten Island, and the New York City area showed a total of 18 gray seal standings occurred (RFMRP 2008).

Current estimates of the total Western Atlantic gray seal population are not available; although estimates of portions of the stock are available for select time periods. For the Canadian population, the 1993 survey estimated the population at 144,000 individuals, the 1997 survey estimated the population at 195,000 individuals, and the 2004 survey had an estimated range between 208,720 to 223,220 individuals, depending on the model used (Waring et al. 2009). The gray seal population in United States waters is also increasing. Maine coast-wide surveys conducted during the summer documented 597 individuals in 1993 and 1,731 individuals in 2001 (Waring et al. 2009). Gray seal numbers are increasing in Massachusetts at Muskeget Island off the coast of Nantucket, and at Monomoy Island, off the coast of Chatham, Cape Cod. Pup counts on Muskeget have increased from 0 in 1989 to 1,023 in 2002. No gray seals were recorded at haul out sites between Newport, Rhode Island and Montauk Point, New York (Barlas 1999), although, more recently small numbers of gray seals have been recorded in this region (Waring et al. 2009).

Gray seals feed on a wide variety of benthic and demersal prey items in coastal areas. They also feed on schooling fish in the water column, and occasionally take seabirds. Prey species taken include: sand lance, whiting, saury, smelt, various kinds of skates, capelin, lumpfish, pollock, cod, haddock, saithe, plaice, flounder, salmon, and a variety of cephalopod and molluscan invertebrates. This species can dive to about 30 to 70 meters while feeding and cannibalism by adult males on pups has also been reported (MarineBio 2009; OBIS 2009c).

Gray seals are usually solitary or found in small dispersed groups. Resting at the surface in a vertical “bottle” position, treading water with only the head and upper neck exposed, is commonly observed (OBIS 2009c). The maximum depth of dives for this species is approximately 300 meters, lasting up to 30 minutes, with most dives up to 60 meters or less and ranging from 1 to 10 minutes (MarineBio 2009; OBIS 2009c).

Gray seals gather together for hauling out, breeding, and molting. Many, but not all gray seals disperse from their rookeries during the non-breeding season and gather again at traditional sites to haul-out for the annual molt (OBIS 2009c). They are usually quite gregarious at haul-outs with groups of 100 or more being common, and they will share haul-outs with harbor seals (OBIS 2009c). The breeding season varies between populations, generally taking place between mid-December and early February in Canada (MarineBio 2009; OBIS 2009c). Breeding territories also vary by population in the Atlantic and are established on rocky islands and coasts, in caves, sandy islands and beaches (MarineBio 2009). Females reach sexual maturity at 3 to 5 years and males at 4 to 6 years, although males may not attain territorial status until 8 to 10 years of age (MarineBio 2009). Females usually give birth at the rookery about a day after coming ashore and pups nurse for about 17 to 18 days before they are weaned and left to fend for themselves.

Harp seal (*Phoca groenlandica*)

Harp seal occurs throughout much of the North Atlantic and Arctic Oceans, and vagrants are known to reach New England and New York (Waring et al. 2009; OBIS 2010g). The largest stock is located off eastern Canada and is divided into two breeding herds. In recent years, numbers of sightings and strandings have been increasing off the east coast of the United States from Maine to New Jersey. These extralimital appearances usually occur from January to May, when the western North Atlantic stock of harp seals is at its most southern point of migration (Waring et al. 2009; NOAA 2010b). Stranding reports from 2006 to 2007 for the coastal waters of Long Island, Staten Island, and the New York City area showed a total of 26 harp seal standings occurred (RFMRP 2008).

Harp seals are highly migratory. Breeding occurs at different times for each stock between mid-February and April. Adults assemble north of their whelping patches to undergo the annual molt. The migration then continues north to Arctic summer feeding grounds. In late September, after a summer of feeding, nearly all adults and some of the immature animals of the western North Atlantic stock migrate southward along the Labrador coast, usually reaching the entrance to the Gulf of St. Lawrence by early winter (Waring et al. 2009; NOAA 2010b).

Aerial surveys and mark-recapture methods have been used to calculate the population size. The methods involve surveying the whelping concentrations and estimating total population adult numbers from pup production. Results of the 2004 survey estimated the population size at approximately 5.5 million individuals (Waring et al. 2009). Based on the increased number of stranded harp seals in United States waters, the population appears to be increasing in the United States, but the magnitude of the suspected increase is unknown (Waring et al. 2009).

During extensive seasonal migrations, large groups of harp seals may feed and travel together. When molting in late spring, harp seals aggregate in large numbers of up to several thousand seals on the pack ice (NOAA 2010b; OBIS 2010g). Females give birth to pups near the southern limits of their range from late February to mid-March. Harp seal pups are abruptly weaned from their mothers when they weigh approximately 80 pounds (36 kg). Adult females leave their pups on the ice where they remain without eating for approximately six weeks. After pups are weaned and left alone, adult harp seals begin mating. Adult females undergo a period of suspended development known as “delayed implantation” during which embryos do not attach to the uterine wall for three months or more. This allows all females to give birth during the limited period of time when pack ice is available (NOAA 2010b).

Harp seals are modest divers compared to other pinnipeds. The average maximum dive is to about 1,200 feet (370 meters), with lasting approximately 16 minutes (NOAA 2010b; OBIS 2010g). Their diet consists of a variety of crustaceans and fishes. Capelin, arctic and polar cod are preferred prey fish, and the preferred invertebrate is krill (NOAA 2010b; OBIS 2010g).

Hooded seal (*Crystophora cristata*)

Hooded seals are found in the Arctic Ocean and in high latitudes of the North Atlantic. The four major breeding and molting grounds are: Gulf of St. Lawrence, off the coast of Newfoundland and Labrador, Davis Strait, and the Norwegian Sea, near Jan Mayen Island (NOAA 2010c; OBIS 2010h). Hooded seals are abundant in these areas during the mating season, which begins in late winter and lasts through April before individuals disperse for the summer and fall. This species is migratory and can wander long distances, occasionally found as far south as Florida, California, and the Caribbean (NOAA 2010c).

In 2005, surveys were conducted to assess population sizes in the main hooded seal habitats. The estimated number of hooded seal pups was 15,200 in Greenland and 116,900 in the Northwest Atlantic. Using these data, the total population of hooded seals was estimated to be 592,100. Data on pup production over many years indicate that population size has been increasing since the 1980s, but not enough information is available to make reliable assertions of population growth (NOAA 2010c).

The hooded seal is an unsocial species and is more aggressive and territorial than other seals, migrating and remaining alone for most of the year except during the mating season. Females mature in about 3 to 6 years and males in 5 to 7 years. They gather in the spring at their usual breeding grounds for 2 to 3 weeks and produce offspring, after which time they linger in the area to molt, then begin their annual period of migration for the remainder of the year (NOAA 2010c). Mating usually occurs in the water (OBIS 2010h). Hooded seal pups are weaned between 3 to 5 days, the shortest time of any known mammal. After they are weaned, pups begin to find food alone, mainly feeding on crustaceans, and improve their swimming and diving skills. There are limited data and observations for juvenile hooded seal, because they appear to spend a great amount of time in the water and in remote areas (NOAA 2010c; OBIS 2010h).

Hooded seals are deep divers and are capable of long dives. The maximum recorded depth reached is over 3,280 feet (1,000 meters) and the longest dive has been nearly one hour. Typical dives while foraging are to depths of 325 to 1,950 feet (100 to 600 meters) and last around 15 minutes (NOAA 2010c; 2010h). Their diet is poorly known, but appears to consist primarily of squid, starfish, mussels, and fish such as Greenland halibut, redfish, cod, capelin, and herring (NOAA 2010c; OBIS 2010h).

4.8.3.2 Potential Impacts and Mitigation

Trenching activities associated with underwater cable installation may cause a temporary and localized period of increased turbidity. However, the increase in turbidity is expected to be minor and will not affect the ability of marine mammals to navigate the area. Turbidity also has the potential to hinder the predation efficiency of sight feeding mammals in or immediately adjacent to the cable route. In general, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed by the flow of the river and tidal currents along the cable route. Since marine mammals are generally expected to be in low densities in the Project area and turbidity will be of short duration, any impacts to marine mammals resulting from turbidity will be negligible. Most marine mammals are expected to move away from the construction activity as it approaches.

The construction of the Project will cause a temporary, short term disturbance to the benthic habitat from jetting, trenching and/or vessel anchors. Disturbance of the seabed from trenching during installation of the cable will affect the local benthic communities within the footprint of the cable construction corridor. Jetting and/or plowing could potentially cause mortality of sessile benthic infaunal organisms (e.g., polychaete and oligachaete worms), thus limiting the availability of food sources for some marine mammals such as bottlenose dolphin and gray seal. However, the marine mammals are expected to feed in surrounding, unaffected areas, and therefore be relatively unaffected by the temporary and localized reductions in available benthic food sources. Recruitment and recolonization of the benthic infaunal communities is expected to begin immediately following construction. Studies conducted on offshore sand borrow areas off the outer New Jersey coast indicated that benthic communities were re-established within 8 to 9 months, i.e., within one annual recruitment period after dredging (USACE 1999).

The temporary loss of benthic prey resources caused by underwater cable installation will have minor impacts on marine mammals that feed on more motile epifaunal organisms (e.g., crabs, mysids, and sand shrimp) or fish, since these organisms will re-occupy the trenched area starting immediately after construction and continuing through several years. For this reason, most of the marine mammal species in the Project area will probably continue to feed there even after trenching, to feed on dislodged benthos. The activities in the Project area may have a short term benefit to some marine mammals. Brinkhuis (1980) conducted a literature assessment on the biological effects of sand and gravel mining in the lower Bay of New York Harbor and found that during dredging, and immediately after an area has been dredged, fish are attracted to the area to feed on infaunal organisms that are dislodged from the bottom.

Placement of rip-rap or concrete mats at utility crossings will cause small changes in substrate characteristics, with the extent depending on the native sediments. Non-burial areas are likely to occur where rocky and bedrock substrates exist and the mats will represent a comparable habitat structure. In mud and sand substrates the mats will create small patch reefs. The rip-rap or concrete mats will provide additional new habitat for epibenthic organisms to colonize and provide areas of shelter, structure, or cover typically sought by fish for protection from predators (Johnson and Stickney 1989; Ogden 2005), which may attract marine mammal species.

During the installation and construction of the underwater cables, a number of vessels, including tugs, barges, cranes, and workboats will be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials; therefore, the potential exists for an accidental spill. Additionally, frac-out during HDD operations, which occurs when fractures in the underlying sediments cause a loss of pressure down the drill hole, can result in the inadvertent release of drilling fluid. BMPs will be employed throughout construction process and an appropriate spill response will be implemented in the case of an accidental spill, to limit the impacts from oil and fluid spills. Since waters of the proposed cable route are frequented by various vessels on a daily basis, the introduction of construction vessels will not significantly change the likelihood of an oil or fluid spill, compared to existing conditions.

Underwater noises during construction activities could potentially cause physical damage and interrupt social behavior for marine mammal species. There are many sources of ambient noise in the environment. Natural sources include wind, wave/tidal action, cracking ice, and marine life. Anthropogenic or human-generated noise may include recreational and commercial ship traffic, dredging, construction, oil drilling and production, and geophysical surveys (EIA 2008).

Marine mammals rely on sound for many aspects of their lives, including reproduction, feeding, predator and hazard avoidance, communication, and navigation (Weilgart 2007). There is considerable variation among marine mammals in both absolute hearing range and sensitivity. Their composite range is from ultrasonic (frequencies greater than 20 kilohertz [kHz]) to infrasonic (frequencies less than 20 Hertz [Hz]). Harbor porpoise have a wide hearing range and the highest upper-frequency limit of all odontocetes studied. They have a hearing range of 250 Hz–180 kHz with maximum sensitivity between 16 and 140 kHz (USACE 2008). Direct hearing measurements, for the most part, are not available for cetacean species, but it is generally believed that a whale's hearing range is related to the range of sound it produces (LGL and JASCO Research 2005).

Pinniped hearing has been measured for air and water. In water, hearing ranges from 1 to 180 kHz with peak sensitivity around 32 kHz. In air, hearing capabilities are greatly reduced to 1 to 22 kHz. This range is comparable to human hearing (0.02 to 20 kHz). Harbor seals have the potential to be affected by both in-air and in-water noise (USACE 2008).

Behavioral responses of marine mammals to sound vary greatly and depend on a number of factors. An individual's hearing sensitivity, tolerance to noise, exposure to the same noise in the past, behavior at the time of exposure, age, sex, and group composition all affect how it may respond. Sometimes it is difficult to know whether observed changes in behavior are due to sound or to other causes. Not all changes in behavior are cause for concern. Observations suggest that marine mammals tend over time to become less sensitive to those types of noise and disturbance to which they are repeatedly exposed (Richardson et al. 1995).

Displacement from critical feeding and breeding grounds has been documented in a number of marine mammal species exposed to seismic noise, as well as changes in diving and foraging behavior where cetaceans have been observed to avoid and feed less, mysticetes observed to spend more time at the water surface, and smaller odontocetes observed to swim faster (Weilgart 2007). From 1996 to present, the RFMRP cetacean and pinneped strandings and sightings in the nearshore waters of Long Island Sound have occurred mostly in the open Atlantic open section, or the southern shores of Long Island, with cetacean (Figure 4.8-1) and pinneped (Figure 4.8-2) strandings and sightings in the Hudson River and Long Island Sound being uncommon. Underwater noise from construction will be short-term, temporary, and will not involve pile driving. Due to the limited presence of cetaceans and pinnepeds in the Hudson River and Long Island Sound, potential direct impacts and underwater noise impacts to marine mammals are expected to be negligible.

Transiting vessels associated with cable installation have the potential to collide with cetaceans and pinnepeds in the Long Island Sound. The presence of cetaceans and pinnepeds in Long Island Sound is typically limited and the vessels used by CHPEI will operate at slow speeds during construction, limiting the potential for collision with marine mammals. Additionally, CHPEI will continue to consult with state and federal agencies and will implement appropriate BMPs to minimize potential impacts on marine mammals and ensure that proper mitigation measures are taken during construction.

4.8.4 Wildlife Protected Areas and Conservation Lands

This section describes Wildlife Management Areas (MWAs), Game Lands, Marine Protected Areas and any other designated lands that are protected primarily for the conservation of fish or wildlife habitat.

4.8.4.1 Marine and Aquatic Protected Areas

The Project route does not pass through any SCFWHs within Lake Champlain or the Champlain Canal. The cable route intersects six SCFWHs (Figure 4.8-3) as determined by the NYSDOS Division of Coastal Resources within the Hudson River south of Albany. From north to south, the proposed cable crosses the following significant habitats: Esopus Estuary, Kingston Deepwater Habitat, Poughkeepsie Deepwater Habitat, Hudson rivermile 44-56, Haverstraw Bay, and the lower Hudson Reach. These intersected SCFWHs are discussed in further detail below. Additionally, 23 SCFWHs are located adjacent to the cable route within the Hudson River. These adjacent SCFWHs are discussed in Section 4.8.4.1.2.

4.8.4.1.1 Significant Coastal Fish and Wildlife Habitats Crossed by the Project

Esopus Estuary

Esopus Estuary, containing one of the primary freshwater tributaries of the Hudson River, was designated a SCFWH in 1987 (Figure 4.8-3 Sheet 1 of 4). The estuary is a 700-acre area including freshwater tidal wetlands and littoral zone areas, and a deepwater section of the Hudson River. The littoral zone of the Hudson River adjacent to the mouth of Esopus creek is an important spawning ground for shad and also serves as a spawning, nursery, and feeding area for striped bass, white perch, herring, smelt, and most resident freshwater species. The adjacent deepwater area of the Hudson is a prime post-spawning and wintering habitat for the shortnose sturgeon (a federally listed endangered species). Recreational fishing is popular in this designated habitat and several black bass (smallmouth and largemouth) fishing tournaments are held annually each summer (NYSDOS 2004).

The tidal marshes and shallow water of Esopus Estuary provides resting and feeding areas for migrating waterfowl, including black duck and mallard. As a result, this area receives significant hunting pressure from residents of the lower Hudson Valley region. Additionally, the extensive and varied freshwater tidal wetland at the mouth of adjacent Esopus Creek is important to many species of waterfowl throughout the year. Osprey (listed as threatened in New York State) are known to congregate at the mouth of the creek during spring migration (mid-April through May) and forage in the shallows waters of the area. Several rare plant species have also been reported in the Esopus Estuary area (NYSDOS 2004).

Kingston Deepwater Habitat

Kingston Deepwater Habitat, the northernmost extensive section of deepwater habitat in the Hudson River, was designated a SCFWH in 1987 (Figure 4.8-3 Sheet 2 of 4). The significant habitat area is a nearly continuous deepwater section of the Hudson ranging from depths of 30 feet to greater than 50 feet. These deepwater areas provide wintering and habitat for shortnose sturgeon (a federally listed endangered species) as well as habitat for a variety of other fish species, including Atlantic sturgeon. This deepwater section is significant since it provides habitat for an abundance of upriver marine species during periods of low freshwater flows, occurring primarily in the summer. During the spring spawning run of shad, commercial drift netting takes place in the shallower waters near the surface (NYSDOS 2004).

Poughkeepsie Deepwater Habitat

The Poughkeepsie Deepwater Habitat was designated a SCFWH in 1987 (Figure 4.8-3 Sheet 2 of 4). This area is relatively deep with depths from 30 feet to greater than 50 feet, including a small area which exceeds 125 feet in depth. These deepwater areas provide wintering habitat and spawning grounds for shortnose sturgeon. Other fish species occurring in high abundance in this area are bay anchovies, silversides, bluefish, weakfish, and hogchokers (NYSDOS 2004).

Haverstraw Bay

Haverstraw Bay was designated a SCFWH in 1987 (Figure 4.8-3 Sheet 3 of 4). The area is the most extensive area of shallow (less than 15 feet deep) estuarine habitat in the lower Hudson River which deepens to a navigation channel (dredged to about 35 feet). The area produces a predominantly brackish water habitat where the freshwater mixes with salt water from the Atlantic. The area is a major spawning, nursery, and wintering area for various estuarine fish species, most notably bay anchovy, Atlantic menhaden, and blue claw crab. Shortnose sturgeon regularly occur in the area. The area also contributes to recreational and commercial fisheries. Significant numbers of waterfowl may occur in Haverstraw Bay during spring (March-April) and fall (September-November) migrations, but the extent of their use in this area is not well documented (NYSDOS 2004).

Hudson Rivermile 44-56

Hudson rivermile 44-56 was designated a SCFWH in 1987 (Figure 4.8-3 Sheet 3 of 4). This is an extensive area of deep, turbulent river channel with strong currents and rocky substrates. The area is the southernmost extent of essentially freshwater in the Hudson River estuary during fish spawning periods. Because of this, the area supports a major striped bass commercial and recreational fishery as well as a major spawning area for the species. Other anadromous fish such as white perch favor this area for reproduction. It is also considered a potentially important nursery area for shortnose sturgeon (NYSDOS 2004).

Hudson rivermile 44-56 is also a SCFWH for the concentration of wintering bald eagles (see Section 4.9 for information on federal and state threatened and endangered species). This section of the Hudson River rarely freezes and the upwellings along the river shoreline bring fish concentrations near the surface, providing a dependable prey base for the eagles. Bald eagles have been reported in this area since 1981 with as many as 12 birds occurring here at one time. Winter residence generally extends from December through March, with Iona Island being a primary roosting area. Other roosting areas for the eagles include undisturbed woodlands along both sides of the river, especially near sheltered coves (NYSDOS 2004).

Lower Hudson Reach

The Lower Hudson Reach was designated a SCFWH in 1992 (Figure 4.8-3 Sheet 4 of 4). The Lower Hudson Reach is one of only a few large tidal river mouth systems in the northeastern United States; therefore it provides a unique range of salinity and other estuarine features. Salinity in this brackish environment ranges from 3.8 ppt to 18.7 ppt depending on the location of the saltfront, which varies with the seasons. Concentrations of wintering striped bass and winter flounder are found in the area. Striped bass are known to spawn above river's salt front between West Point and Kingston from April to mid-June, with the semi-bouyant eggs found in greatest concentration from mid-May to early June and larvae transforming to juvenile between late June and early July (NYSDOS 2004).

In addition to striped bass, significant numbers of summer flounder, white perch, Atlantic tomcod, Atlantic silversides, bay anchovy, hogchokers, American shad, blue crabs, and American eel have been found. This area of the river may also be important for bluefish and weakfish YOY, Atlantic sturgeon and shortnose (adult only) sturgeon. Animals of the lower trophic levels are also present in substantial numbers in the Lower Hudson Reach, including copepods, rotifers, mysid shrimps, nematodes, oligochaetes, polychaetes, and amphipods. Mid-winter aerial survey between 1986 and 1990 showed an average of 1,619 canvasback, 281 scaup, and lesser numbers of mergansers, mallards, and Canada geese overwinter in the Lower Hudson Reach (NYSDOS 2004).

4.8.4.1.2 Significant Coastal Fish and Wildlife Habitats Within 1-mile Radius of the Project

The following 23 SCFWHs are found within a 1 mile radius of the proposed cable route typically located along shorelines. These areas are not discussed in detail as they will not be crossed by the proposed cable route.

- Norman's Kill
- Papscanee Marsh and Creek
- Shad and Schermerhorn Islands
- Hannacroix Creek
- Schodack and Houghtalin Islands and Schodack Creek
- Mill Creek Wetlands
- Coxsackie Creek
- Vosburg Swamp and Middle Ground Flats
- Stockport Creek and Flats
- Rogers Island
- Catskill Creek

- Ramshorn Marsh
- Roeliff-Jansen Kill
- Inbocht Bay and Duck Cove
- Germantown-Clermont Flats
- North and South Tivoli Bays
- The Flats
- Vanderburgh Cove and Shallows
- Esopus Meadow
- Constitution Marsh
- Croton River and Bay
- Piermont Marsh
- North and South Brother Islands

4.8.4.2 Terrestrial Wildlife Management Areas and other Conservation Lands

CHPEI has identified two protected lands that are adjacent to the underground transmission cable corridors and that have wildlife conservation and/or recreational activities associated with wildlife as a primary function: Wilton Wildlife Preserve and Five Rivers Environmental Education Center (see Section 4.2 for more detailed descriptions of these areas). These public lands abut the railroad right-of-way; however, since CHPEI anticipates that the underground cable corridor will remain within the existing railroad-right-of-way, no direct impacts to these lands are expected.

Wilton Wildlife Preserve and Park is a set of parcels protected through a partnership between the NYSDEC, the Town of Wilton and The Nature Conservancy. The Wilton Wildlife Preserve and Park is adjacent to the Project on both sides of the railroad right-of-way between approximate MPs 145 and 148 of the underground transmission cable corridor. The main goals of the park are passive recreation, the preservation and restoration of habitat for Karner Blue Butterfly (see Section 4.9), open space protection, and education (Wilton Wildlife Preserve and Park, Inc. 2010).

Five Rivers Environmental Education Center is designed as an outdoor nature museum that offers opportunities for wildlife observation, recreation and educational programs. This center abuts the east side of the railroad right-of-way between approximate MPs 191 and 193, within the Town of New Scotland in Albany County.

4.8.4.3 Potential Impacts and Mitigation

4.8.4.3.1 Marine and Aquatic Protected Areas

Potential impacts from the cable installation will be limited to the temporary disturbance of bottom habitat along the underwater cable route, during water jetting, trenching and/or anchoring of vessels. The temporary disturbance of bottom sediments during cable installation may result in increased turbidity and re-suspension of any sediment contaminants, but these impacts should be short lived and localized to areas of bottom disturbance.

Potential impacts due to the temporary disturbance of bottom sediments will be minimized by using water jetting methods and HDD techniques. Water jetting fluidizes the sediments along the directed route, allowing the cable to embed itself (i.e., sink) within the substrate. Fluidized sediments are contained largely within the confines of the trench wall, allowing the trench to backfill immediately.

During the installation and construction of the cables, a number of vessels, including tugs, barges, cranes, and workboats may be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials with the potential for a spill. Additionally, a frac-out may occur at the HDD entry or exit location resulting in potential drilling fluid release. BMPs will be employed throughout construction and an appropriate spill response will be implemented in the case of a spill, to limit the impacts from any potential oil and fluid spills. The waters of the proposed cable route are frequented by various vessels on a daily basis; therefore, introduction of construction vessels to the area during the construction period will represent only a minimal increase in the potential for an oil or fluid spill compared to existing conditions.

Construction of the Project will cause a temporary, short term disturbance to the benthic habitat. Disturbance of the river bottom and seabed from trenching during installation of the cable will affect the local benthic communities within the footprint of the trenched area. Mechanical plowing and/or water jetting could potentially cause mortality of benthic infaunal organisms (e.g., polychaete and oligochaete worms), limiting the availability of food sources for the finfish species. Additionally, the placement of rip-rap or concrete mats at discrete locations along the underwater cable route could cover, disturb, injure, or kill benthic biota and other immobile or slow-moving benthic organisms, affecting available food source for finfish. However, the finfish are expected to feed in surrounding, unaffected areas. The rip-rap or concrete mats will provide additional new habitat for epibenthic organisms to colonize, and therefore the finfish species will be relatively unaffected by the temporary and localized reductions in available benthic food sources. Also, the rip-rap or concrete mats will provide areas of shelter, structure, or cover typically sought by fish for protection from predators (Johnson and Stickney 1989; Ogden 2005), which may be beneficial for the finfish species.

Potential direct impacts to intersected SCFWHs are discussed below. Indirect impacts to the SCFWHs adjacent to the proposed underwater cable route are likely to be temporary and localized. Temporary and localized degradation of water quality may occur in the vicinity of the water jetting device, but the effects on water quality and turbidity within the habitat will be minimal because cable installation will occur some distance from the SCFWHs. Turbidity plumes are not expected to extend over long distances and are not expected to result in any type of barriers to fish movement. Additionally, cable installation may temporarily disturb the substrate within the Hudson River; however, this disturbance is expected to occur over a short time period in any one location given the speed at which water jetting occurs and will be localized to the immediate area of the water jetting device or conventional dredge trenching operations. No losses of habitat or permanent impacts are expected from the underwater cable installation, other than at utility crossings where concrete mats or rip-rap will be placed for short distances over the cables.

Esopus Estuary

There is expected to be negligible or no impact to the Esopus Estuary as the proposed cable route will be sited on the east side of the Hudson River and will not result in a direct loss of habitat. Additionally there will be no dredging or filling within wetlands. Potential temporary impacts to water quality may occur depending on sediment type during cable installation. Cable installation also has the potential to result in localized turbidity plumes, which may result in fish avoidance. These plumes will not extend over long distances and will be located east of the Esopus Estuary; therefore, they will not present a barrier to fish movement. BMPs will be used during cable installation to mitigate any potential adverse impacts.

Kingston Deepwater Habitat

There are expected to be minor temporary impacts to the Kingston Deepwater Habitat during cable installation. Slight temporary degradation to water quality may occur; however, the effects on water quality and turbidity within the deepwater area will be minimal. Cable installation is not expected to result in a change in overall depths in the Kingston Deepwater Habitat, as fluidized sediments will refill in the trench. Sediment deposition beyond the trench is expected to be negligible. BMPs will be employed during cable installation to mitigate any potential adverse impacts.

Poughkeepsie Deepwater Habitat

A slight temporary degradation to water quality within the area may occur during cable installation. The effects on water quality and turbidity within the deepwater area of the habitat will likely be minor. Any suspended solids resulting from cable installation that settled within the deepwater trench will be minor and will not likely result in any significant alteration of the bathymetric profile. BMPs will be employed during cable installation to mitigate any potential adverse impacts.

Hudson Rivermile 44-56

A slight degradation to water quality during cable installation may occur, but will not result in substantially degraded water quality. Potential temporary increases in turbidity and sedimentation exist during cable installation, depending on sediment type. BMPs will be employed during cable installation to mitigate any potential adverse impacts.

Haverstraw Bay

The cable will remain in the deep portion of the maintained channel throughout this significant habitat area, with no dredging, filling, or bulkheading anticipated from construction activities. A slight degradation to water quality may occur, but BMPs will be employed, and any impacts are not expected to result in substantially degraded water quality. Cable installation is not expected to affect the hydrologic conditions within Haverstraw Bay or the Hudson River.

Lower Hudson Reach

Temporary and localized increases in turbidity may occur as a result of cable installation. BMPs will be employed to control turbidity. The temporary impairment of water quality may occur at the location of the cable installation; however, this will be temporary and localized, and will not result in any major alterations of habitat.

4.8.4.3.2 Terrestrial Wildlife Management Areas and other Conservation Lands

Since CHPEI intends to construct the underground portion of the Project within existing easements for the railroad right-of-way, the Project will not result in any direct impact to lands protected as part of the Wilton Wildlife Preserve and Park or the Five Rivers Environmental Education Center. During construction, some noise may be audible in adjacent parcels, which has the potential to temporarily disturb wildlife and recreational users in lands adjacent to the construction corridor. This impact will be localized to the immediate area adjacent to the right-of-way and will last only during active construction. CHPEI will implement appropriate BMPs in order to avoid any offsite impacts to habitats outside of the construction corridor, such as limiting the clearing of woody vegetation to the minimum required for construction, installing erosion and sediment controls adjacent to the construction corridor, as needed, stabilizing soils as soon as possible following the completion of construction activities, and implementing spill prevention, control and mitigation measures.

4.9 THREATENED AND ENDANGERED SPECIES

The ESA, which is administered jointly by the USFWS and the fisheries division of the NOAA, protects species listed as threatened or endangered in the United States at the federal level. NOAA has primary responsibility for most marine species, while USFWS administers the ESA with regard to most other terrestrial and freshwater species. These agencies additionally review candidate species, which are species that have known conservation threats and have been proposed for listing under the ESA, but which have not yet been afforded a final listing status. In New York State, threatened, endangered, and species of special concern are listed under §182.6 of 6 NYCRR, some of which have overlapping listing with the federal ESA listing.

This section describes the federal and state threatened, endangered, special concern, protected and candidate species that may occur in terrestrial and/or aquatic habitats within or near the Project area. This section also describes the potential impacts to threatened, endangered, candidate and special concern species that may result from the construction and operation of the Project and the methods that will be used to avoid, minimize and mitigate for impacts to these species and their habitats.

Portions of the Project route with terrestrial habitats that may be used by threatened and endangered species include: 1) the underground bypass routes to avoid Locks C12, C11, and C9 along the Champlain Canal in Washington County; 2) the approximate 69.9-mile underground bypass in Washington, Saratoga, Schenectady and Albany Counties, to avoid interference with activities associated with the Upper Hudson River PCB Dredging Project, 3) the Yonkers converter station area in Westchester County, and 4) the existing Sherman Creek substation in New York County. The remainder of the Project in the State of New York is located within the aquatic habitats of Lake Champlain, the Champlain Canal, Hudson River, Harlem River, East River, and Long Island Sound.

The potential presence of threatened, endangered, candidate and special concern species and/or habitat for these species was determined through a review of available publications and databases maintained by the NYSDEC and the USFWS. Additionally, CHPEI has initiated consultation with the NYSDEC, NYNHP, USFWS, and NMFS regarding the potential for protected species and/or habitats to occur in the vicinity of the Project. Consultation will continue with these agencies to address potential concerns over the possibility for take, and the need for a formal Biological Assessment will be addressed with the United States Department of Energy (USDOE) through the Presidential Permit process.

4.9.1 Fish Species

4.9.1.1 Existing Conditions

Endangered species programs are designed to identify endangered and threatened populations; to determine why these populations are declining; identify known and potential threats; and provide protection before existing populations of these species become extirpated. Threatened and endangered species can be protected at the federal or state level or in some instances both. The mission of the NYSDEC's Endangered Species Program is to perpetuate and restore native animal life within New York State for the use and benefit of current and future generations, based upon sound scientific practices and in consideration of social values, so as not to foreclose these opportunities to future generations (NYSDEC 2009d). This section summarizes the state and federal listed threatened and endangered fish species in Lake Champlain, Hudson River, and Long Island Sound that occurs or may potentially occur within the underwater transmission cable route.

In addition to the threatened and endangered fish species listed in Table 4.9-1, the NYSDEC online Natural Heritage Program – Natural Explore Database identified several threatened, endangered, and species of special concern fish species within the county and watershed of the proposed Project route. The fish species identified by the NYSDEC Natural Explorer Database include round whitefish (*Prosopium cylindraceum*) (endangered), lake chubsucker (*Erimyzon sucetta*) (threatened), banded sunfish (*Enneacanthus obesus*) (threatened), mud sunfish (*Acantharchus pomotis*) (threatened), and ironcolor shiner (*Notropis chalybaeus*) (special concern) (NYSDEC 2009d and 2010m). Due to the specific habitat requirement and utilization, as well as historical captured data, these fish species are not expected to occur within the proposed Project Area. CHPEI will consult with agencies (i.e., USFWS, NMFS, and NYSDEC) to ensure the threatened, endangered, and species of special concern fish species located within the underwater transmission cable route are identified and the proper mitigation measures are implemented.

Below are the species and habitat descriptions for the threatened and endangered fish species known to occur in the Project Area.

4.9.1.1.1 Lake Champlain

Lake Sturgeon (*Acipenser fulvescens*)

Lake sturgeon is listed as a threatened species in the State of New York. Lake sturgeon is New York State's largest completely freshwater fish. However, this species can also occur in the brackish waters of Hudson Bay and the St. Lawrence River. Lake sturgeon prefer clean sand, gravel, or rock bottom areas where food is abundant (Stegemann 1994). Lake sturgeons were so abundant that they were once considered a trash fish. Commercial fishermen found them to be a nuisance because their tough skin would ruin nets (Stegemann 1994). But as the value of their eggs for caviar, skin for leather, swim bladder for isinglass, and delicious meat became known, the Great Lake fishery exploded and within a relatively short time, the population levels plummeted (Stegemann 1994).

Mature adults average between 3 and 5 feet in length and 10 to 80 pounds in weight, but can occasionally grow as large as seven plus feet and 300 plus pounds (Stegemann 1994). Female lake sturgeon reach sexual maturity between 14 to 23 years old, and may live up to 80 years. Once sexual maturity is reached, females will only spawn every four to six years. Male lake sturgeon reach sexual maturity at eight to 19 years old (Stegemann 1994). Spawning takes place during the spring from May to June. Prior to spawning, this species congregates in deep holes near the spawning site and perform "staging" displays that include rolling near the bottom and then leaping out of the water. Spawning usually takes place in areas of clean, large rubble such as along the windswept rocky shores and in the rapids in streams. Eggs are scattered by currents and sticks to rock and logs (Stegemann 1994). The preferred diet of lake sturgeon includes leeches, snails, clams, other invertebrates, small fish, and even algae (Stegemann 1994).

The population of lake sturgeon in Lake Champlain has declined due to overharvest and loss of access to spawning habitats from dam construction. Spawning adults, as well as lake sturgeon eggs have been documented in historic spawning grounds in the Missisquoi, Lamoille, and Winooski rivers, along the eastern side of Lake Champlain (FTC 2009).

Mooneye (*Hiodon tergisus)*

The mooneye, is listed as a threatened species in the State of New York. The mooneye is a medium-size freshwater fish that reaches 11 to 15 inches in length and one to two pounds in weight (NYSDEC 2009e). Males typically reach sexual maturity in three years, and females often do not reach sexual maturity until five years old (NatureServe 2009). Spawning occurs during the spring, where sexually mature adults migrate into medium to large-size rivers from March through May to deposit eggs (NYSDEC 2009e; NatureServe 2009). Eggs are usually deposited over rocks in swift water areas (NYSDEC 2009e), and most larvae are collected from near-surface waters at night (NatureServe 2009).

This species prefers clear water habitat of large streams, low and moderate gradient rivers, and deep and shallow sections of lakes (NatureServe 2009; NYSDEC 2009e). Adults and juveniles prey mainly on aquatic and terrestrial insects and also crustaceans, mollusks, and small fishes (NatureServe 2009; NYSDEC 2009e). While the exact cause the species population decline is not known, siltation and competition with introduced species are possible factors (NYSDEC 2009e).

Eastern Sand Darter (*Ammocrypta pellucidum)*

The eastern sand darter is listed as a threatened species in the State of New York. The eastern sand darter is a small freshwater fish, averaging 2.5 inches in length (NYSDEC 2009e). While, little information is available on the biology of the eastern sand darter, spawning is thought to occur beginning in May and possibly continue into the fall (NYSDEC 2009e). The spawning behavior of captive specimens has shown spawning to occur during both day and night. Eastern sand darter eggs are translucent, spherical, and slightly adhesive, and are buried singly in the substrate (NatureServe 2009).

The eastern sand darter will frequently bury itself in the sandy bottom, leaving only its eyes exposed. This behavior helps the fish to hide from predators, maintains its position in a fast-flowing stream section, and ambush prey (NatureServe 2009; NYSDEC 2009e). This species has a strong benthic association with preference within small creeks to large rivers and lake shores with slow to medium current, and lakes and lake-like expansions of rivers with fine sandy substrate, particularly sandy areas depauperate of flora and other fauna so that both competitors and predators may be lacking (NatureServe 2009). The eastern sand darter appears to be a visual feeder, preying mainly on midge larvae; it also eats other dipteran larvae, mayfly naiads, oligochaetes, and cladocerans (NatureServe 2009; NYSDEC 2009e). Feeding intensity increases between February and June and declines between September and November (NatureServe 2009).

The major cause of decline in eastern sand darter populations appears to be the loss of clean sandy substrate due to siltation. On some streams, the construction of dams led to population fragmentation. Additionally, the impoundments created with the construction of the dams act as settling basins which aggravate siltation problems. Stream pollution and channelization have also caused loss of eastern sand darter habitat (NYSDEC 2009e).

4.9.1.1.2 Hudson River

Shortnose Sturgeon (*Acipenser brevirostrum*)

The shortnose sturgeon is listed as federal and New York State endangered. The shortnose sturgeon is the smallest of New York's sturgeons, rarely exceeding 3.5 feet in length and 14 pounds in weight (Gilbert 1989; Stegemann 1994). It is restricted in range to the Atlantic seaboard in North America and occurs in estuaries and large coastal rivers. In New York State, shortnose sturgeon is found in the lower portion of the Hudson River from the southern tip of Manhattan upriver to the Federal Dam at Troy (Stegemann 1994).

The shortnose sturgeon is semi-anadromous. Spawning occurs between April and May when adult sturgeon migrate up the Hudson River from their mid-Hudson overwintering area to spawn in freshwater sites north of Coxsackie. Sexually mature males spawn every other year and females every third year (Gilbert 1989; Stegemann 1994). Eggs are deposited on the bottom and the newly-hatched fry are poor swimmers and drift with the currents along the bottom. As they grow and mature, the fish move downriver into the most brackish waters of the lower Hudson River (Stegemann 1994). Shortnose sturgeon use their barbels to locate food and diets include sludge worms, aquatic insect larvae, plants, snails, shrimp, and crayfish (Stegemann 1994).

A combination of factors is responsible for the decline in shortnose sturgeon populations. During the 1800s and early 1900s, large tidal rivers, such as the Hudson River, served as dumping grounds for pollutants that resulted in major oxygen depletion. Dam construction that eliminated upstream breeding grounds and demands for sturgeon meat and caviar also contributed to the decreases in shortnose sturgeon populations (Gilbert 1989; Stegemann 1994).

A mark-and-recapture experiment performed in 1979 and 1980 was used to estimate the shortnose sturgeon population in the Hudson River. As a result of this work adult spawning population was estimated at 13,000 fish. Subsequent survey work on shortnose sturgeon indicates that the population may be significantly larger (NMFS 1998). In a mark-and-recapture study that replicated Dovel's (1979 *as cited in* NMFS 1998) methods, the estimated adult shortnose population size was 38,024. This number suggests a two to four fold increase in adult shortnose sturgeon abundance in the Hudson River over the past decade (NMFS 1998).

Atlantic Sturgeon (*Acipenser oxyrinchus)*

The Atlantic sturgeon, is federally listed as a candidate species and listed as protected by the state of New York. The Atlantic sturgeon is an anadromous species growing up to 14 feet long and weighing more than 800 pounds. This species can live up to 60 years, with maturation in the Hudson River at 11 to 21 years of age. Spawning in the mid-Atlantic waters typically occur between April to May. Spawning adults migrate upstream and spawning takes place in flowing water between the salt front and the fall line of large rivers. Spawning interval ranges from one to five years for males and two to five years for females (NMFS 2010). Post spawning, males may remain in the river or lower estuary until the fall and females typically exit the river within four to six weeks. Forage prey consists of benthic invertebrates (i.e., mussels, worms, and shrimp). Juveniles migrate downstream and inhabit brackish waters for a few months, until approximately 30 to 36 inches in length, before moving into coastal waters (NMFS 2010). Within the Hudson River Estuary, spawning locations for Atlantic sturgeon remain poorly delineated. Juveniles typically remain within the Hudson River Estuary for two to eight years before emigrating along the Atlantic coast and its estuaries (NYSDEC 2010n).

The 2006-2008 Atlantic sturgeon tag and recapture program in the Hudson River showed that the preferred bottom habitat for this species are dynamic and depositional mud, followed by dynamic and depositional sand, and then dynamic gravel (NYSDEC 2010n). Commercial harvest from the 1950s through the mid-1990s severely decimated this population. Habitat degradation and loss continues to be a threat as this species is dependent on both estuarine and freshwater habitat. Bycatch mortality, impacts from dredging activities, and access impediments to available habitats by locks and dams are other threats to the Atlantic Sturgeon (NMFS 2010).

4.9.1.1.3 Long Island Sound

There are no threatened and endangered finfish species or species of special concern identified in Long Island Sound. However, Atlantic sturgeon migrate up and down the mid-Atlantic seaboard, including the waters of Long Island Sound.

4.9.1.1.4 Potential Impacts and Mitigation

The juvenile and adult life stages of the threatened and endangered fish species in the Project area are highly mobile species that will generally be able to avoid direct impacts from any construction related activities. Cable-laying and jetting creates vibrations transmitted through the sediments that could startle demersal species, resulting in movement away from the construction zone. Within the water column, noises associated with vessel operation and jetting may similarly cause individuals within the water column to move short distances away during construction.

The construction of the underwater transmission cables will cause a temporary, short term disturbance to the benthic habitat, which supports benthic prey items for several of the threatened and endangered fish (e.g., sturgeon). Jetting and/or plowing will cause some mortality of benthic infaunal organisms (e.g., polychaete and oligachaete worms), thus temporarily reducing the availability of benthic food sources within the narrow linear construction corridor. However, the threatened and endangered fish are expected to feed in surrounding, unaffected areas, and therefore impacts will be minor due to the temporary and localized reductions in available benthic food sources.

In addition to the benthic disturbance, underwater cable installation will result in a temporary and localized increase in suspended sediments, which could potentially lead to gill abrasion and cause impaired respiration of fish species in or adjacent to the cable route. Turbidity may also hinder the predation efficiency of sight feeding fish in or adjacent to the cable route. However, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed by the flow of the river and tidal currents along the cable route, resulting in minor impacts on threatened and endangered fish species in or adjacent to the cable route.

During the installation of the proposed cables, a number of vessels, including tugs, barges, cranes, and workboats will be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials and therefore have the potential for spills. BMPs and a SPCCP will be employed throughout construction and implemented in the case of a spill to limit the impacts from oil and fluid spills. Additionally, frac-out may occur at the HDD entry and exit location resulting in drilling fluid spills. Frac-out refers to the inadvertent release of drilling fluid from the drill hole upwards through the sediment overburden, with a release at the sediment water interface. In the case of a frac-out during HDD construction, gelatinous drilling fluid will flow outward from the point of discharge and cover a small area of the bottom. Depending on currents or wave action, some of the deposited drilling fluid could become suspended or dispersed. Drilling fluid, composed primarily of bentonite clay and water, if suspended, may have similar adverse effects on fish respiration and feeding as will jetting induced suspended sediments in areas of fine sediments. Drilling fluid is recognized as non-toxic by the EPA, and in the event that drilling fluid additives are necessary, none will be used that have toxic effects.

In areas where conventional dredging is employed to excavate the trenches, typically for deeper burial areas such as at crossings of a navigation channel, there will be more substantial alteration of the benthic habitat compared to jetting since the construction will involve sediment removal, cable-laying, and then backfilling. Depending on the nature of the backfill, the sediment surface characteristics could be altered since it is unlikely that exactly the same grain size composition will be created as existed prior to cable installation. Depending on currents and erosional forces, backfill will be used that is anticipated to remain in place. However, whatever the backfill characteristics are, they are likely to become colonized over time with benthic organisms. Given the small amount of anticipated conventional dredging, any altered prey abundance or modified substrate characteristics are unlikely to have anything but a negligible to minor effect on the threatened and endangered fish species.

A long term alteration of the bottom will occur with the placement of rip-rap or concrete mats at discrete locations along the underwater cable route, which will result in the mortality of benthic biota and other immobile or slow-moving benthic organisms located in the immediate area of placement. Given the anticipated short segments where rip-rap or concrete mats will be placed (primarily at utility crossings), this alteration represents an almost negligible loss of soft bottom benthic habitat and associated benthic species. The rip-rap or concrete mats will provide additional new hard bottom habitat for epibenthic organisms to colonize, essentially functioning as small patch reefs. In these areas, the rip-rap or concrete mats will provide areas of shelter, structure, or cover typically sought by some fish species such as rock bass in the Hudson River or Tautog in Long Island Sound (Johnson and Stickney 1989; Ogden 2005).

In order to avoid the river reach associated with the Upper Hudson River PCB Dredging Project, the cable route will exit the Champlain Canal (via HDD techniques) and follow an underground railroad right-of-way bypass route for 69.9 miles before entering the Hudson River south of Albany (see Exhibit 2 for the route description). By avoiding cable installation in this portion of the Hudson River, CHPEI has attempted to minimize the potential for resuspending sediments with higher levels of PCB contamination, thereby reducing the potential for harmful effects on threatened and endangered fish from bioaccumulation of PCBs.

Cable installation in the water will occur on a continuous basis, which will require nighttime lighting on the construction vessels. Some species of fish are attracted to light at night, while other species avoid illuminated areas. Fish that are attracted to the vessels may experience areas of increased suspended sediments resulting from the jetting if they move towards the illuminated area around the vessels. It is unknown if the threatened and endangered fish species occurring in the Project area will avoid or be attracted to nighttime lights. Adverse effects, such as gill abrasion and impaired respiration, due to this behavior will be minimized by the separation distance between the water jetting device, where the greatest increase in suspended sediments will occur near the bottom, and the illumination at the surface. In addition, most fish will avoid areas around the water jetting device and vessels due to elevated noise levels, which may partly compensate for any attraction behaviors exhibited by fish. Furthermore, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed by the flow of the river and tidal currents along the cable route, resulting in minor impacts on threatened and endangered fish species in or adjacent to the underwater cable route.

During operation of the Project, the cables will produce EMF and generate heat, which is dissipated into sediments. Further information on potential EMF and heat impacts to aquatic organisms is described in Section 4.7. A detailed discussion of EMF is provided in Section 4.13. Certain benthic feeding fish (sturgeon) have sensory mechanisms for detecting prey in the sediments. Given the small area of the seafloor occupied by the cables and affected by the weak EMF, the potential interference with this feeding will have a negligible effect on foraging success of sturgeon or other benthic foraging species. The heat produced by the cables will primarily be dissipated in the sediments, well below the sediment water interface which is the biologically productive zone in the sediments. Hence, there will be negligible thermal effects on benthic prey populations of benthic feeding fish.

CHPEI will work closely with state and federal agencies to establish a construction window or other mitigation measures to minimize any potential direct and indirect impacts to threatened and endangered fish along the cable route.

Lake sturgeon, mooneye, and eastern sand darter are the three threatened species identified in Lake Champlain. Due to the rocky bottom or flowing water habitat utilization and preference, lake sturgeon and mooneye, are not expected to occur in the vicinity of the proposed cable route which is being sited in soft bottom areas of the lake, thus construction impacts are expected to be negligible. In addition, the eastern sand darter has a strong demersal habitat preference in which they will frequently burrow into the sand to seek shelter and as an ambush predator. Eastern sand darters are typically found in small creeks to large rivers, but have been observed to be present along lake shores with slow moving currents or lake-like sections of larger rivers with fine sandy substrate (NatureServe 2009). Due to the stream and river preference of this species, its occurrence along the underwater cable route within Lake Champlain is expected to be low and all impacts will be negligible.

There are no threatened and endangered finfish species identified in the Champlain Canal.

In the Hudson River, sturgeon make seasonal movements up and down the River. At certain times of the year (primarily spring and fall), extensive areas of elevated suspended sediments will have the potential to adversely affect their movements. If highly concentrated, the sturgeon may not attempt to pass through these areas of the water column. Fortunately, water jetting generally creates only localized increases in turbidity, often restricted to near bottom areas of the water column, and given the depth and width of the Hudson, no blockage of sturgeon passage is expected during underwater cable installation. Spills, concrete or rip-rap placement, and conventional dredging are likely to have negligible impacts on sturgeon given either the low probability of occurrence or the very small area of the overall available habitat that will be affected. Construction noise, nighttime lighting and temporary loss of benthic prey will have a minor impact on sturgeon, because while this will occur along the length of the river, at any one moment the area of the river effected is very small, and sturgeon will avoid the work area or find sufficient unaffected areas of the river to inhabit and forage in.

There are no threatened and endangered finfish species or species of special concern identified in Long Island Sound. However, Atlantic sturgeon migrate up and down the mid-Atlantic seaboard, including the waters of Long Island Sound. Potential impacts to Atlantic sturgeon in Long Island Sound will be direct habitat disturbance from construction activities. The trench area will be backfilled with the existing sediment, thus allowing all benthic fauna and infauna to recolonize after construction following a period of recovery. The construction footprint is small in comparison to adjacent unaffected areas where displaced Atlantic sturgeon could relocate to seek shelter and forage.

4.9.2 Wildlife

4.9.2.1 Non-Avian Terrestrial Wildlife

This section provides a discussion of the existing federal and state threatened, endangered, candidate, and special concern wildlife species potentially occurring along underground portions of the transmission cable route, including mammals, reptiles, amphibians and invertebrates. Species described in this section include both terrestrial and semi-aquatic species that may be found using upland, wetland, and freshwater aquatic habitats along the underground portions of the transmission cable route.

4.9.2.1.1 Existing Conditions

CHPEI conducted a preliminary review of the potential threatened, endangered, candidate and special concern species with the potential to occur along the underground portions of the transmission cable route by searching the NYSDEC (NYSDEC 2009a) and USFWS (USFWS 2009) databases for species occurrences in Washington, Saratoga, Schenectady, Albany and Westchester Counties. Since the Sherman Creek substation site in New York County is within a highly urbanized area of New York City, CHPEI determined that no habitat for any protected non-avian terrestrial wildlife occurs at that location.

Table 4.9-2 provides a summary of the non-avian terrestrial threatened, endangered, candidate and special concern species that have the potential to occur in the Project area, based on this preliminary review. Federally-listed species that were identified include: Indiana bat (*Myotis sodalis*), bog turtle (*Glyptemys muhlenbergii*) and Karner blue butterfly (*Plebejus melissa samuelis*). CHPEI also considered New England cottontail (*Sylvilagus transitionalis*), which is a federal candidate species known to occur in Westchester County. Federally listed threatened, endangered and candidate species are described in further detail below.

Areas that have been mapped by NYNHP for occurrences of federal and state threatened, endangered, candidate, and special concern species along the Project route are depicted in Figure 4.9-1. Besides the federally-listed and candidate species, there are 22 additional New York State threatened, endangered or special concern species that have been recorded in the counties crossed by the underground portions of the Project. Several of these species have been assessed as unlikely to occur in the Project area (Table 4.9-2), based on a lack of habitat along the transmission cable route near known occurrence records or a lack of confirmed records in the last century. The Project crosses one NYNHP-mapped area for frosted elfin (*Callophrys irus*), a state-listed threatened species, which is discussed in further detail below. The remaining species listed in Table 4.9-2 may occur or have potential habitat along the proposed transmission cable corridor, based on preliminary assessment; however, it is expected that further consultation with NYNHP and NYSDEC will refine the list of species with the potential to occur within the Project area, and until that occurs, the full list of state listed species is not described or assessed in this section. NYSDEC and USFWS will refine this list of species with the potential to occur within the Project area.

Indiana Bat (*Myotis sodalis*)

Indiana bat is a federal and New York State endangered species that may be resident within the Hudson River Valley throughout the year. In the winter, Indiana bats hibernate in large colonies in caves and mines, which are called hibernacula. Hibernation can begin as early as September and can extend to late May (NYSDEC 2010o). In the spring, the bats emerge and travel to wooded or semi-wooded habitats for the summer (USFWS 2004). These summer habitats may be many miles from the winter hibernacula (NYNHP 2009a). The bats mate in the fall prior to hibernation; after the spring emergence, females group to form small maternity colonies, where they give birth to young. These colonies are located in the crevices or under loose bark in large dead or living trees. Roost trees may be in upland areas or floodplain forests (USFWS 2004).

Occasionally man-made structures, such as sheds or bridges may be used as roosts (USFWS 2004).

The historic and potential range for Indiana bat includes the entire corridor along the Hudson River Valley (NYSDEC 2010o). Hibernacula for Indiana bats have been known to occur in Albany County until recently, but USFWS now considers Indiana bats to be extirpated from the area, or present only in very low numbers (USFWS 2010). The USFWS has therefore determined that it is "unlikely that they would be present and impacted by any specific proposed projects in Albany, Rensselaer, Saratoga, Schenectady and Schoharie Counties" (USFWS 2010). Summer habitat for Indiana bats, however, has the potential to occur along underground portions of the Project route in Washington County, due to the presence of known hibernacula in nearby Warren and Essex Counties (NYNHP 2009a).

No caves or mines that could be used as hibernacula have been identified along the transmission cable route. Indiana bat roosts and maternity colonies may be associated with a variety of forested communities types identified along the underground transmission cable corridor, including Appalachian oak-hickory, beech-maple mesic, floodplain and hemlock-northern hardwood forests (NYNHP 2009a). Although much of the habitat within the immediate vicinity of the underground bypass routes consists of disturbed open lands and secondary forest, lacking suitable trees for bat roosts, a few areas do have large shagbark hickories (*Carya ovata*) and/or other large trees that could support summer bat colonies.

Bog Turtle (*Glyptemys muhlenbergii*)

Bog turtles are small, semi-aquatic turtles that are listed as threatened in the United States and endangered in New York State. Primary habitats for bog turtles include open wet meadows and calcareous bogs, which can be isolated or part of a larger wetland complex (NYNHP 2009b). Frequently, these habitats are dominated by sedges (*Carex* spp.) and mosses (*Sphagnum* spp.) (NYSDEC 2010p). Adult bog turtles hibernate in a burrow or muskrat lodge from September to mid-April (NYSDEC 2010p). In the early summer, females lay eggs in a tussock. Once hatched, the young will typically spend the winter within the nest (NYSDEC 2010p).

Bog turtles historically occurred throughout the Hudson River Valley corridor. However, known extant populations are limited to the southern counties along the Hudson River. Therefore, although suitable bog turtle habitat associated with open-canopy red-maple hardwood swamps, sedge meadows and/or fens may be present along the proposed transmission cable corridor in Washington, Saratoga, Schenectady and/or Albany Counties, no recent records suggest that bog turtles are likely to occur. Bog turtles do occur within Westchester County; however, the Yonkers converter station site is within a largely urban environment and no suitable habitats exist in the area. Therefore, it is unlikely that bog turtles are present within the Project area.

Karner Blue Butterfly (*Plebejus melissa samuelis*)

Karner blue butterfly is a federal and New York State endangered species occurring in scattered populations in New Hampshire, New York, and the upper Midwest. In New York, Karner blues are found in the Hudson Valley sand belt extending from near Albany to Glens Falls (NYSDEC 2010q). The species is highly specialized on the larval host plant, wild blue lupine (*Lupinus perrenis*). Two generations occur per year. One generation hatches from overwintering eggs and emerges from May to June. These adults lay eggs to produce the second generation, which emerges from mid-July to mid-August (NYSDEC 2010q). Natural habitat for Karner blue butterflies includes pine barrens, oak savannahs and openings in oak woodlands (NYNHP 2009c). Within their restricted range, Karner blue butterflies now also occur in man-made openings along rights-of-way, at airports and in sandy old fields (NYNHP 2009c) wherever wild blue lupine is present.

Potential habitat for Karner blue butterfly could occur along the underground cable route in Saratoga, Schenectady and Albany Counties. The transmission cable corridor crosses areas mapped by NYNHP for Karner blue butterflies in Saratoga County from approximate MPs 144 to 146 and 154 to 155 (Figure 4.9-1).

New England Cottontail (*Sylvilagus transitionalis*)

New England cottontail is a species of special concern in New York State and a candidate for federal status under the ESA. In New York, populations are limited to scattered locations in Columbia, Dutchess, Putnam, and Westchester Counties (NYNHP 2009d). Habitat for New England cottontail includes thickets, early successional forests with a dense shrub layer, disturbed areas, and marshes (NYNHP 2009d).

Although New England cottontail is found in Westchester County, the Yonkers converter station site is within a predominantly urban environment. Therefore, CHPEI does not anticipate any habitat for New England cottontail in the Project area.

Frosted Elfin (*Callophrys irus*)

Frosted elfin is a state-listed threatened species of butterfly that occurs in the upper Hudson River Valley, Long Island, and parts of western New York. In the upper Hudson River area, it feeds on wild blue lupine associated with pine barrens, oak savannahs, dry oak forests, and disturbed grasslands within rights-of-way and airports (NYNHP 2009e). Habitat requirements are similar to the Karner blue butterfly and the two species may co-occur. The underground transmission cable corridor crosses areas mapped by the NYNHP for occurrences of frosted elfin (*Callophrys irus*) and Karner blue butterfly in Saratoga County between approximate MPs 144 and 146 in the Town of Wilton (Figure 4.9-1).

4.9.2.1.2 Potential Impacts and Mitigation

Where underground routing is proposed, CHPEI has minimized impacts to terrestrial habitats by siting the underground transmission cables along a previously disturbed corridor along existing railroad rights-of-way, to the extent possible. The only portions of the underground cable route that do not parallel the railroad right-of-way are the Lock C9 bypass and the short habitat crossings associated with landfalls from the underwater cable route. To further minimize habitat impacts, CHPEI has proposed to use the HDD method at all landfall locations. Where the HDD method is used, surface impacts to habitats between the drill entry and exit points will be avoided.

Use of a previously-disturbed corridor for the underground transmission cables will generally reduce potential impacts to habitat for terrestrial federal and state threatened, endangered, candidate, and special concern species. CHPEI has initiated consultations with the NYNHP, NYSDEC, and USFWS for information and recommendations regarding threatened, endangered, candidate and special concern species along the underground transmission cable route. Based on the results of those consultations, CHPEI may conduct species-specific surveys or implement additional methods to minimize or mitigate any impacts to listed species, as necessary.

Based on a low likelihood of occurrence, CHPEI does not anticipate any impacts to bog turtle or New England cottontail along the underground cable corridor. Summer habitat for Indiana bat could occur along the cable corridor in Washington County, due to presence of existing winter hibernacula in adjacent counties. Impacts to Indiana bat could occur if occupied roost trees within the impact area are cleared, or if construction activities result in the disturbance of the roosts immediately adjacent to the construction area. Although a few large trees have been noted along the underground cable bypass route, most areas with the exception of the Lock C9 bypass, are located along existing, disturbed railroad rights-of-way. In general, there is limited availability of suitable summer roost trees within and adjacent to the impact area. CHPEI will continue to consult with USFWS for recommendations regarding avoidance of any potential impacts to Indiana bat. If vegetation removal and tree clearing for the Project is conducted in the summer months, outside of the Indiana bat hibernation period (October 1 through March 31), CHPEI will coordinate with USFWS prior to clearing any large trees that could support Indiana bats.

Habitat for Karner blue butterfly and frosted elfin is known to occur in the vicinity of the underground transmission cable corridor. These species use similar open habitats with patches of wild blue lupine, the larval host plant. Maintenance of the appropriate habitat for these butterflies requires periodic disturbance; therefore, disturbance from construction of the Project is unlikely to result in any long-term impacts to the habitat for these species, and could result in a benefit, if the cleared areas are colonized by wild blue lupine. Vegetation clearing, trenching, and spoil stockpiling could result in the loss of individuals, if wild blue lupine plants with eggs and/or larvae occur within the impact footprint. CHPEI will continue to consult with USFWS and NYNHP for recommendations on avoidance, minimization and mitigation of impacts to Karner blue butterfly and frosted elfin, if appropriate.

Temporary impacts to state-listed species may occur due to disturbance, noise and vegetation clearing within the construction corridor. Smaller and less mobile organisms, such as salamanders, turtles, and invertebrates could be impacted by direct mortality from vehicles and equipment moving within the construction corridor. In general, mobile animals such as mammals and snakes are expected to be displaced from the construction area and move into similar habitats nearby. These species will then return to the area once construction and restoration of disturbance area are completed.

Habitats for terrestrial state-listed threatened, endangered and special concern wildlife species within the construction corridor and any additional workspaces will be temporarily impacted by vegetation clearing, ground disturbance and construction activity. Upon completion of construction, CHPEI will conduct initial restoration activities, such as soil stabilization and temporary seeding of disturbed areas. Once vegetation cover has been re-established, any areas that are disturbed for the cable installation will be allowed to re-vegetate naturally. Initially, the construction corridor may provide some new habitat for state-listed species that may use disturbed, open areas and clearings, such as Eastern box turtle and tawny crescent. Some temporary loss of habitat may occur for species associated with woodlands due to tree clearing along the edge of the construction corridor in forested areas. Forested areas within the construction corridor are expected to go through a series of successional stages before the redevelopment of a mature canopy. To minimize impacts to forested communities, CHPEI will avoid cutting mature trees where feasible. Unless required for safety, CHPEI will limit the removal of stumps and roots that are not in the footprint of the excavated trench, to facilitate the recovery of woody species. CHPEI will develop a Vegetation Management Plan as part of the EM&CP.

Because the cable will be buried, no permanent aboveground impacts to habitat of listed species will result. Only limited but periodic vegetation management will be conducted by CHPEI along the transmission cable corridor during operation for repairs or other maintenance work and for selective cutting to prevent the establishment of large trees directly over the cables. See Section 4.4 for additional information on vegetation impacts and mitigation. Since the Yonkers converter station and the Sherman Creek substation are both located in urban environments, no significant impacts to habitats for terrestrial threatened, endangered and special concern species are anticipated from construction at aboveground facilities.

4.9.2.2 Avifauna

This section provides information the federally and state-listed threatened, endangered, candidate and special concern bird species may be present in the vicinity of the proposed transmission cable route in New York State. Listed bird species may be present in a variety of habitats, including terrestrial, freshwater aquatic, coastal, estuarine, and marine habitats along the Project route.

4.9.2.2.1 Existing Conditions

CHPEI conducted a preliminary review of the potential threatened, endangered, candidate and special concern bird species with the potential to occur along the underground and underwater transmission cable corridors, by searching the NYSDEC (NYSDEC 2009a) and USFWS (USFWS 2009) databases for occurrence records in counties crossed by the Project. Table 4.9-3 provides a summary of the avian species that have the potential to occur in the Project area, based on this preliminary review. Species that use only terrestrial habitats have been included only if records indicate possible occurrences in counties crossed by the underground portions of the Project route (Washington, Saratoga, Schenectady, Albany and Westchester Counties). Since the Sherman Creek substation site in New York County is within a highly urbanized area of New

York City, CHPEI determined that no terrestrial habitat for any protected bird species is likely to occur at that location; however, species that may occur in nearby coastal habitats were assessed.

Consultations with the NYNHP, NYSDEC and USFWS have been initiated by CHPEI. It is expected that further consultation with these agencies will provide more specific information on species occurrences and habitats in the immediate vicinity of the Project, which will allow CHPEI to further refine the list of threatened, endangered, candidate and special concern species potentially present in the Project area.

Two federally listed bird species, roseate tern (*Sterna dougallii*) and piping plover (*Charadrius melodus*), have the potential to occur in coastal areas along certain portions of the underwater transmission cable corridor. Additionally, although bald eagles (*Haliaeetus leucocephalus*) are no longer listed under the ESA, they are still afforded federal protection under the Bald and Golden Eagle Protection Act (BGEPA). Federally listed avian threatened, endangered and candidate species are described in further detail below.

Areas that have been mapped by NYNHP for occurrences of federal and state threatened, endangered, candidate, and special concern species along the Project route are depicted in Figure 4.9-1. Besides the federal threatened, endangered and candidate species, an additional 30 New York State threatened, endangered and special concern species may occur in counties crossed by the underground and/or underwater portions of the transmission corridor. Several of these species are unlikely to occur in the Project area (Table 4.9-3), due to lack of habitat along the transmission cable route within the species' distribution. The remaining species may occur or have potential habitat along the proposed transmission cable route, based on preliminary assessment. Henslow's Sparrow (*Ammodramus henslowii*), a state-listed threatened species with a NYNHP-mapped occurrence area along the transmission cable corridor, is discussed in further detail below.

Roseate Tern (*Sterna dougallii*)

Roseate terns are federally listed as endangered in the northeastern United States, and are also listed as endangered in New York State. Roseate terns in the northeastern United States breed in only a few scattered colonies on sandy beaches along the Atlantic coast, and winter primarily in northern South America (NatureServe 2009). The primary breeding colony in New York is Great Gull Island in Long Island Sound (NYSDEC 2010r). Birds arrive at the breeding grounds in late April or early May and remain until late July, when they begin staging for migration to the wintering grounds in late summer (Spendelow 1995). Roseate terns feed offshore on small schooling fish such as sand lance.

Recent occurrences of roseate terns have been documented in Queens and Nassau counties. CHPEI does not anticipate any direct impacts to sand beach habitat from construction of the Project, nor have any breeding colonies for roseate tern been identified in the immediate vicinity of the underwater transmission cable route. However, roseate terns may use various areas within and around Long Island Sound for foraging, roosting and staging from spring through late summer/early fall.

Piping Plover (*Charadrius melodus*)

Piping plovers are small shorebirds that forage invertebrates on beaches, sand dunes, and on tidal wrack (NYSDEC 2010s). Atlantic coast populations of piping plover are federally listed as threatened; inland populations in other parts of the United States are federally endangered. Piping plovers are also listed as endangered by New York State. Plovers on the Atlantic coast breed on sandy beaches from North Carolina to Canada, arriving on the breeding grounds in March and departing by early September (NYSDEC 2010s). They winter primarily in coastal areas from North Carolina to Texas (NYSDEC 2010s). In New York, breeding is mostly along on coastal beaches of Long Island.

No suitable habitat for breeding piping plovers occurs along the underwater transmission cable route. The tidal area at the landfall for cables connecting to the Yonkers converter station is also unlikely to support foraging piping plovers. Although some mud and wrack may be exposed during low tide below the rip-rap slope at this location, which could be used by feeding shorebirds, the habitat is marginal and within a largely urban landscape; therefore, it is unlikely that this particular area will be used for foraging. CHPEI has also proposed to use the HDD method for landfalls at the Yonkers converter station and Sherman Creek substation sites, avoiding impacts to coastal habitats at those locations.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are protected under the federal Bald and Golden Eagle Protection Act, and are listed as threatened in New York State. Bald eagles are a large piscivorous raptor, mostly occurring in undisturbed areas near large lakes, reservoirs, or major rivers (NYNHP 2009f). Nests require large, tall trees, usually near water, and they are often used for multiple years. In New York, bald eagles are present throughout the state, except on Long Island, and they occur during both breeding and non-breeding seasons. Breeding birds may be present in the Lake Champlain area and near other large rivers, lakes and impoundments along both the underwater and underground portions of the transmission cable corridor. The Hudson River Valley provides important wintering habitat for concentrations of eagles in New York State, particularly along the lower Hudson River (NYNHP 2009f).

Henslow’s Sparrow (*Ammodramus henslowii*)

Henslow’s sparrow is a state-listed threatened species of passerine that breeds in tall, dense grasslands, fields and wet meadows without woody vegetation. In New York State, it occurs in the Hudson River Valley and central and western parts of the state. The decline of the species is largely attributable to the regeneration of forests and the decrease in grasslands and hayfields (NYNHP 2009g). Although records from recent decades exist, the latest Breeding Bird Atlas (2000-2005) failed to confirm Henslow’s sparrow breeding in either Saratoga or Schenectady County (NYNHP 2009g). The transmission cable corridor crosses an area mapped by the NYNHP for occurrences of Henslow’s sparrow (prior to 1977) in Albany County between approximate MPs 191 and 194 (Figure 4.9-1).

4.9.2.2.2 Potential Impacts and Mitigation

Temporary impacts to listed birds and bird habitats may result from construction and operation of the Project. The installation of the transmission cables below ground avoids the direct bird mortality from collision and electrocution that has been frequently associated with overhead transmission wires and tower structures. CHPEI has further minimized impacts to potential bird nesting areas in terrestrial habitats by installing the cable underwater, where feasible. Where underground bypass routes are required, CHPEI has minimized habitat impacts by siting the transmission cable corridor parallel to existing disturbed railroad rights-of-way to the extent possible. The only portions of the underground cable route that do not parallel the railroad right-of-way are the Lock C9 bypass and the short habitat crossings associated with landfalls from the underwater cable route. To further minimize habitat impacts, CHPEI has proposed to use the HDD method at all landfall locations. Where the HDD method is used, surface impacts to habitats between the drill entry and exit points will be avoided.

Along the underground portions of the transmission cable route, state-listed bird species within the construction corridor, additional workspaces, and immediately adjacent habitats may be impacted by disturbance, noise and vegetation clearing during construction activities. Most birds along the underground routes will be temporarily displaced from habitats within the immediate construction footprint but are expected to move into similar habitats nearby for the duration of construction. These species will then be expected to return to the area once construction and restoration of disturbed areas are completed. If vegetation clearing of the underground transmission cable corridor is conducted during the nesting season direct impacts to bird nests within the construction corridor could occur. Disturbance can also result in parental abandonment of eggs or young in nests built in habitats immediately adjacent to the construction area. If construction is scheduled during the breeding season, CHPEI will continue to consult with NYNHP, NYSDEC, and USFWS, to determine if any additional impact avoidance, minimization, or mitigation, is appropriate for state-listed threatened, endangered, candidate, and special concern species that may nest along the underground portions of the Project route.

The transmission cable corridor crosses an area mapped by the NYSDEC for Henslow's sparrow; however, the associated records are prior to 1977, which may suggest that the species no longer occurs in the area. If Henslow's sparrow does occur within or adjacent to the underground cable route, construction and operation of the Project is not expected to result in any long-term impact to habitat for the species. Grassland habitats, like those required by Henslow's sparrows, will be expected to return quickly within the construction corridor following initial restoration. Direct impacts to Henslow's sparrow, as with other passerine species, could occur if vegetation clearing activities occur during the breeding season and result in the disturbance of destruction of active nests within or immediately adjacent to the impact area. CHPEI will continue to consult with USFWS, NYNHP and NYSDEC regarding the possible presence of Henslow's sparrow within the Project area.

To the extent feasible, CHPEI has tried to minimize the permanent alteration of terrestrial habitats that may be associated with state-listed bird species along the transmission cable corridor. Following the construction and restoration of the right-of-way, disturbed areas will be allowed to revegetate naturally. This may initially create some new habitat for species that use early successional habitats, such as vesper sparrow and yellow-breasted chat. Some temporary loss of habitat may occur for species associated with woodlands, due to tree clearing along the edge of the construction corridor in forested areas. Forested areas within the construction corridor are expected to go through a series of successional stages before the redevelopment of a mature canopy. To minimize impacts to forested communities, CHPEI will avoid cutting mature trees where feasible. Unless required for safety, CHPEI will limit the removal of stumps and roots that are not in the footprint of the excavated trench, to facilitate the recovery of woody species.

During operation of the Project, only limited vegetation management will be conducted by CHPEI along the underground transmission cable corridor, primarily to ensure that large woody vegetation does not grow over the cable(s), or in the event that repairs or other maintenance of the cables is required. CHPEI will develop a Vegetation Management Plan as part of the EM&CP. Any periodic vegetation management that is currently conducted by the railroads will continue. This means that over time, natural revegetation within the disturbance area will generally result in a habitat that resembles the pre-construction habitat.

Coastal species, including bald eagle and roseate tern, could be disturbed and displaced from foraging habitats due to noise from underwater cable installation methods, HDDs and/or increased construction vessel traffic. Although roseate terns may be present feeding within Long Island Sound, are not expected to have a significant effect on foraging terns away from any breeding colony. Since similar habitats are available nearby, avoidance of the construction area will generally not result in adverse impacts to listed species; however, adverse impacts could occur if disturbances result in increased stress, increased travel time to foraging areas from roosts or nest sites, or lower foraging success. Additional long-term impact could occur if any impacts on water quality or the aquatic food web resulted in a degradation of the aquatic habitat or a lower availability of food resources (see Section 4.6).

The transmission cable route does not cross any sand beaches and no tern colonies or piping plover breeding areas adjacent to the Project route have been identified. However, CHPEI will continue to consult with USFWS, NYNHP and NYSDEC regarding any potential impacts to these federally-listed species or nearby tern colonies.

Adverse impacts to bald eagles could occur if either aboveground or underwater construction results in disturbance to nesting, foraging or wintering birds from noise, construction activity and/or vehicle traffic. According to NYNHP, a 500-meter buffer zone may be appropriate to avoid disturbances to nesting eagles (NYNHP 2009f). Disturbances may also affect concentrations of wintering eagles on the lower Hudson. CHPEI will consult with NYNHP and USFWS for recommendations to minimize disturbance to breeding and wintering eagles along the Project corridor and to determine if any known bald eagle nests are located in the vicinity of the Project. Any mitigation measures will be developed in conjunction with NYSDEC, NYNHP, and the USFWS.

4.9.2.3 Plants

This section provides a discussion of the existing federal and state threatened, endangered, candidate, and special concern plant species potentially occurring along underground portions of the Project route. Species described in this section include both terrestrial and semi-aquatic species that may be found using upland, wetland, and freshwater aquatic habitats along the primarily terrestrial portions of the Project routes. A discussion of unique, sensitive or rare plant communities or species assemblages is provided in Section 4.4, Vegetation.

4.9.2.3.1 Existing Conditions

CHPEI conducted a preliminary review of the potential threatened, endangered, candidate and special concern plant species with the potential to occur along the underground portions of the transmission cable corridor, by searching the NYSDEC (NYSDEC 2009a) and USFWS (USFWS 2009) databases for species occurrences in Washington, Saratoga, Schenectady, Albany and Westchester Counties. One federally-listed threatened species, small whorled pogonia (*Isotria medeoloides*), has been historically recorded in Washington County. State-listed species with NYNHP-mapped occurrence areas along the underground transmission cable route have been included in Table 4.9-4, along with their known habitat associations. Figure 4.9-1 depicts the general locations of occurrences mapped by NYNHP for state-listed species along the underground transmission cable route.

Small whorled pogonia is a federally-listed threatened and New York State endangered orchid, inhabiting semi-open second-growth deciduous forests or older hardwood stands of beech, birch, maple, oak, and hickory that have an open understory. Occasionally it occurs in pine or hemlock woods. Typically it prefers acidic and mesic soils, often on slopes near small streams (NatureServe 2009, USFWS 2008). The last documentation of the species in Washington County was in 1875 (NYSDEC 2009a), and the USFWS considers the species to be extirpated from New York (USFWS 2008); therefore, CHPEI considers this species as unlikely to occur within the Project area.

Because many plant populations are not well documented, it is possible that additional plant species occurrences may be identified during field studies. CHPEI has initiated consultations with the NYNHP, NYSDEC and USFWS, for further information and recommendations regarding threatened and endangered species. It is expected that consultation with these agencies will allow CHPEI to further refine the list of species with potential presence in the Project area. The evaluation of project impacts on state listed plant species will be expanded, if necessary, following agency responses to consultation requests. Until then, only the small whorled pogonia is discussed in this section.

4.9.2.3.2 Potential Impacts and Mitigation

CHPEI will coordinate with NYNHP, NYSDEC and USFWS to avoid, minimize or mitigate any impacts to federal or state-listed threatened or endangered plant species. Direct impacts to listed plant species could occur during construction if individual plants are located within any areas affected by vegetation clearing and ground disturbance in the construction corridor or additional workspaces. To avoid direct impact to listed plant species, CHPEI will coordinate with NYNHP, NYSDEC and/or USFWS to determine if any species-specific surveys are needed for listed plant species along the Project route. If populations of threatened or endangered plant species are identified within the construction corridor, CHPEI will determine appropriate mitigation, which may include, but will not be limited to, measures such as: delineation and avoidance of plant populations, scheduling construction outside of the growing season for annual plants, relocation of individual plants to suitable habitat outside of the construction corridor.

Small whorled pogonia has historically occurred in Washington County and suitable secondary growth forests may occur along the transmission cable corridor. It is possible, however, that the species is extirpated from the state (USFWS 2008). CHPEI will consult with USFWS regarding the need for any species-specific surveys for small whorled pogonia along the underground transmission cable route.

4.9.2.4 Marine Mammals and Sea Turtles

4.9.2.4.1 Marine Mammals

Table 4.9-5 lists the federal and state endangered and threatened marine mammals known to occur in the coastal waters of Long Island, Staten Island, and the greater New York City area. Several of the species are listed and protected under the federal ESA. These RTE marine mammal species are transients, visiting the nearshore marine waters of the Project area as nursery ground and feeding habitat before migrating to other locations. Additionally, one federal and state special concern species, harbor porpoise (*Phocoena phocoena*), has the potential to occur within the Project area.

Fin Whale (*Balaenoptera physalus*)

In the western North Atlantic, fin whales are a federal and New York State endangered species. Fin whales are common in summer from Cape Hatteras north; distributed from the coasts of Canada, Newfoundland, and Cape Cod in the north to the Gulf of Mexico and the shores of Florida and the Greater Antilles in the south. In summer fin whales are concentrated between shore and the 1800 m curve from 41°N to 57°N. They tend to be nomadic and migrate to subtropical waters for mating and calving during the winter and to high latitudes and cold currents for feeding in the summer, with the New England waters represent a major feeding ground for this species (Waring et al. 2009).

The best abundance estimate available for the western North Atlantic fin whale stock is 2,269 individuals. This August 2006 estimate is recent and provides an estimate when the largest portion of the population was within the study area (Waring et al. 2009). The worldwide population estimate for this species is approximately 11,000 individuals (NOAA 2009c).

Fin whales can be found in social groups of two to seven whales and in the North Atlantic, or occasionally in groups of up to 100 on feeding grounds during migration (NOAA 2009c). New England waters represent a major feeding ground for this species (Waring et al. 2009). This species are often seen feeding in large groups that include humpback and minke whales and

Atlantic white-sided dolphins (NOAA 2009c). Primary prey include krill, small schooling fish (e.g., herring, capeline, and sand lance), and squid (NOAA 2009c; OBIS 2009d).

Little is known about the social and mating systems of fin whales. Males become sexually mature at 6 to 10 years of age and females at 7 to 12 years of age. Breeding may occur throughout the year, although the peak period occurs from November or December until about March. The gestation period lasts about 12 months and the calf weighs about two tons at birth, with birth given in tropical and subtropical areas during mid-winter (NOAA 2009c).

Humpback Whale (*Megaptera novaeangliae)*

In the Western North Atlantic, humpback whales are a federal and New York State endangered species. Humpback whales feed during spring, summer, and fall over a geographic range encompassing the eastern coast of the United States, the Gulf of St. Lawrence, Newfoundland/Labrador, and western Greenland (Waring et al. 2009).

The overall North Atlantic population (including the Gulf of Maine), derived from genetic tagging data collected on the breeding grounds, was estimated to be 7,698 individuals, including 4,894 males and 2,804 females (Waring et al. 2009). The worldwide population estimate for this species is approximately 56,600 individuals with the Gulf of Maine stock appears to be on an increase (NOAA 2009d).

Humpback whales pass through New England waters in April and May during their northward migration and on their southward migration, they pass through New England waters from October through December (Waring et al. 2009). During winter, whales from most Atlantic feeding areas (including the Gulf of Maine) mate and calve in the West Indies, where spatial and genetic mixing among subpopulations occurs (Waring et al. 2009). In New England waters, feeding is the principal activity of humpback whales, and their distribution in this region has been largely correlated to prey species and abundance (Waring et al. 2009).

Humpback whales are seen singly, in pairs, or in small groups of 12 or more. They reach sexual maturity at about nine years of age, when males reach approximately 33 feet long and females reach approximately 36 feet long. Breeding occur throughout the year, with the gestation period lasting 11 to 12 months. In the Atlantic, the shallow waters of the Caribbean Sea provide wintering and breeding areas. Calving occurs at two-year intervals, but some females give birth every year (NOAA 2009d; OBIS 2009e).

Humpback whales are generalists, eating krill, copepods, fish, and cephalopods. When in New England waters, this species typically become piscivorous feeding on herring, sand lance, and other small fishes. Humpback whales rarely feed in winter, foraging during summer in areas of prey concentration such as upwelling regions (NOAA 2009d; OBIS 2009e).

Sei Whale *(Balaenoptera borealis)*

Sei whales are a federal and New York State listed endangered species. Sei whales can be found in the Atlantic, Indian, and Pacific oceans. During the summer, they are commonly found in the

Gulf of Maine and on Georges and Stellwagen banks in the Western North Atlantic (NOAA 2009e; Waring et al. 2009). Sei whales do undergo seasonal migrations, although not as extensive as those of some other large whales and may exhibit seasonal migration toward the lower latitudes during the winter and higher latitudes during the summer (NOAA 2009e; OBIS 2009f).

Sei whales are usually seen as singles or pairs, but sometimes thousands may gather if food is abundant. They are fast swimmers up to 35 miles per hour (OBIS 2009f). Sei whales are shallow divers and only remain submerged for 5 to 20 minutes (NOAA 2009e). This species typically feed on plankton (e.g., copepods and krill), small schooling fish, and cephalopods (e.g., squid) by both gulping and skimming (NOAA 2009e). They prefer to feed at dawn and may exhibit unpredictable behavior while foraging and feeding prey (NOAA 2009e).

Breeding occurs between November and March, with the peak in January. The gestation period lasts 10.5 to 12 months. Calves are dependent on milk from the mother for about nine months and are weaned when they reach 24 to 27 feet in length. Both sexes become sexually mature at about 8 to 10 years of age and breeding occurs at intervals of three years (NOAA 2009e; OBIS 2009f).

Harbor porpoise (*Phocoena phocoena*)

Harbor porpoise occur in relatively discrete regional populations throughout northern temperate and subarctic coastal and offshore waters of the Northern Hemisphere. They are commonly found in bays, estuaries, harbors, and fjords less than 200 meters (650 feet) deep (NOAA 2009f). In the north Atlantic, they range from west Greenland to Cape Hatteras, North Carolina (NOAA 2009f). For the Gulf of Maine/Bay of Fundy stock, harbor porpoises are concentrated in the northern Gulf of Maine and southern Bay of Fundy region during summer months (July to September) and are generally found in waters less than 150 meters deep (Waring et al. 2009). During the fall (October to December) and spring (April to June), harbor porpoises are widely dispersed from New Jersey to Maine, with lower densities farther north and south, and can be seen from the coastline to deep waters (greater than 1,800 meters) with majority of the population found over the continental shelf (Waring et al. 2009). Stranding reports from 2006 to 2007 for the coastal waters of Long Island, Staten Island, and the New York City area showed a total of three harbor porpoise standings occurred (RFMRP 2008).

Estimates of the population size of harbor porpoises in the Gulf of Maine and Bay of Fundy region were conducted during the summers of 1991, 1992, 1995, 1999, 2002, 2004, and 2006. The best current abundance estimate for the Gulf of Maine and Bay of Fundy region harbor porpoise was based on the 2006 survey results, with the stock population at approximately 89,054 individuals (Waring et al. 2009).

Most harbor porpoise groups are small, generally consisting of no more than five or six individuals. However, during feeding or migration, they can aggregate into large, loose groups of 50 to several hundred animals. Harbor porpoises sometimes lie at the surface for brief periods between submergences and the reason for this behavior is unknown (OBIS 2009a). This species reaches sexual maturity at 3-4 years of age, with geographic and density-dependent variation.

Gestation lasts approximately 10.6 months with most calves being born from spring through mid-summer (OBIS 2009a). The main prey items for the harbor porpoise appear to vary regionally. In general, this species eats a wide variety of fish and cephalopods and small, non-spiny schooling fish (i.e., herring and mackerel) are most common prey in many areas. They also feed on a wide variety of benthic and/or demersal species (OBIS 2009a). The main threats to the harbor porpoise include: fisheries bycatch, entanglement in fishing gear, harvest, and organochlorine contamination (OBIS 2009a).

4.9.2.4.2 Sea Turtles

Table 4.9-6 lists the federal and state endangered and threatened sea turtles known to occur in the coastal waters of Long Island, Staten Island, and the greater New York City area. Several of the species are listed and protected under the federal ESA. The RFMRP has operated the marine mammals and sea turtles rescue program since 1996. Their program provides a record of the occurrences of various species that occur in Long Island Sound and surrounding waters (Figure 4.9-2). These RTE sea turtle species are transients, visiting the nearshore coastal waters of the Project area as nursery ground and foraging habitat before migrating to other locations.

Leatherback Sea Turtle (*Dermochelys coriacea)*

Leatherback sea turtles are a federal and New York State listed endangered species. Leatherback sea turtles are commonly known as pelagic animals, but also forage in coastal waters (NOAA 2009g). Leatherback turtles occupy large, open bays in the northeastern United States from June to November; the southern migration to Maryland and Virginia occurs in nearshore waters from August to November (NMFS 2001). Although considered an oceanic species, leatherback turtles are sometimes found in waters as shallow as 60 meters (NMFS 1993).

Females reach sexual maturity at about 4 feet of carapace length (about 10 years old) and size at maturity for males is unknown. Female leatherback sea turtles may nest at 2 to 3 year intervals. Nesting locations in the Atlantic are scattered throughout the Gulf of Mexico, Caribbean, and southeast United States, with the largest assemblages found in the United States Virgin Islands, Puerto Rico, and Florida. A small number of leatherback sea turtles were reported to nest in Texas and Georgia (NOAA 2009g).

The preferred food of the leatherback sea turtle include jellyfish, comb jellies, salps, and other related animals, with jellyfish as their primary food source (USACE 1994). However, organisms such as larval fishes and decapod crustaceans have also been known to be ingested by the leatherback sea turtles (Pritchard et al. 1983). This species follow the migration of jellyfish along the Gulf Stream, at water depths greater than 200 feet, into the Gulf of Maine in late summer, and then return to southern waters by winter. In some years, they are locally common south of Long Island, New York and in central and eastern portions of the Gulf of Maine. Winter area for the leatherback sea turtle is the Gulf of Mexico and along the Florida coast (NOAA 2009g).

Kemp's Ridley Sea Turtle (*Lepidochelys kempii)*

The Kemp's ridley sea turtles are a federal and New York State listed endangered species. Kemp's ridley sea turtles are found primarily in the Gulf of Mexico, but occurs along the Atlantic coast of the United States and Canada as well from Florida to New England (NOAA 2010i; OBIS 2010i). Adult Kemp's ridley sea turtles primarily occupy neritic zones that typically contain muddy or sandy bottoms where prey can be found. Juveniles of many species of sea turtles have been known to associate with floating sargassum seaweed, utilizing the sargassum as an area of refuge, rest, and/or food (NOAA 2010i).

The primary range of adult Kemp's ridley sea turtle is the Gulf of Mexico, although an unknown portion of the population, made up of juveniles, can be found at inshore bays and estuarine habitats from Cape Hatteras to Cape Cod Bay from July to November (NMFS 2001). The Kemp's ridley sea turtle migrates along the Atlantic coast to New England as the Gulf Stream warms to approximately 15°C, arriving in the New York Harbor in late June or July (Morreale and Standora 1990). As the water warms, Kemp's ridley sea turtles continue to move up the coast or into Long Island Sound and forage throughout the fall (USACE 1994).

Kemp's ridley sea turtles nest in large aggregations between April and June in Rancho Nuevo, on the northeastern coast of Mexico in southern Tamaulipas. Mating has been observed just offshore of the nesting beaches. Females typically nest every two years, laying an average of 2.5 clutches each containing approximately 100 eggs. Age at maturity is estimated to be 7 to 15 years (OBIS 2010i). Their diet consists mainly of swimming crabs, but may also include fish, jellyfish, and an array of mollusks (NOAA 2010i).

Loggerhead Sea Turtle (*Caretta caretta)*

Loggerhead sea turtles are a federal and New York State listed threatened species. In the Atlantic, loggerhead sea turtles range extends from Newfoundland to as far south as Argentina. During the summer, nesting occurs primarily in the subtropics. Although the major nesting concentrations in the United States are found from North Carolina through southwest Florida, minimal nesting occurs outside of this range westward to Texas and northward to southern Virginia (NOAA 2010j; OBIS 2010j). Adult loggerheads are known to make extensive migrations between foraging areas and nesting beaches. During non-nesting years, adult females from United States beaches are distributed in waters off the eastern United States and throughout the Gulf of Mexico, Bahamas, Greater Antilles, and Yucatán (NOAA 2010j).

Loggerhead sea turtles are found along the continental shelf and in large bays from July to November as far north as Cape Cod Bay (NMFS 2001). Loggerheads can be found in a variety of habitats such as coral reefs, rocky bottoms, shellfish beds, and boat wrecks, and are common in waters less than 50 meters (Shoop and Kenney 1992). Juvenile and subadult loggerheads are known to migrate into Long Island Sound in June and remain until November (Morreale and Standora 1990).

Loggerhead sea turtles reach sexual maturity at around 30 to 40 years of age (NOAA 2010j; OBIS 2010j). In the southeastern United States, mating occurs in late March to early June and females lay eggs between late April and early September. Females lay three to five nests, and sometimes more, during a single nesting season. The eggs incubate approximately two months before hatching sometime between late June and mid-November (NOAA 2010j; OBIS 2010j).

Loggerhead sea turtles eat a wide variety of prey items, including invertebrates. This species feed primarily on shellfish and crabs on the seafloor, but also scavenge fish or fish parts as available (e.g., from fisheries discards). Pelagic stage loggerheads feed on the assemblage of species found with sargassum rafts, especially coelenterates and gastropods (OBIS 2010j). Diets of loggerheads in the Long Island Sound and Raritan Bay consist primarily of spider, rock, and horseshoe crabs (Burke et al. 1990).

Green Sea Turtle (*Chelonia mydas)*

Green sea turtles are a federal and New York State listed threatened species. In United States Atlantic and Gulf of Mexico waters, green sea turtles are found in inshore and nearshore waters from Texas to Massachusetts, the United States Virgin Islands, and Puerto Rico. Green sea turtles have occasionally been seen in nearshore waters from Massachusetts to Virginia from July to November (NMFS 2001) and like the loggerhead and Kemp's ridley, green sea turtles move southward in late fall as water temperatures decline in Long Island Sound (USACE 1994).

This species use three types of habitat: oceanic beaches (for nesting), convergence zones in the open ocean, and benthic feeding grounds in coastal areas. After emerging from the nest, hatchlings swim to offshore areas, where they are believed to live for several years (NOAA 2010k; OBIS 2010k). The green sea turtle is an herbivore that feeds on seagrasses or algae (Burke et al. 1992). Green sea turtles in the western Atlantic, including Long Island Sound, feed primarily in areas of extensive seagrasses (USACE 1994). However, studies have shown that green sea turtles are opportunistic feeders that utilize available animal food sources supplied by man, thus indicate feeding of jellyfish or sponges may occur on rare occasions (Hildebrand 1982).

Sexual maturity is estimated anywhere between 20 and 50 years, at which time females begin returning to their natal beaches every 2 to 4 years to lay eggs (NOAA 2010k). The nesting season varies depending on location. In the southeastern United States, females generally nest between June and September, while peak nesting occurs in June and July. Eggs are laid in clutches, approximately 100 to 115 eggs per clutch and incubation lasts approximately two months before hatching (NOAA 2010k; OBIS 2010k).

4.9.2.4.3 Potential Impacts and Mitigation

Underwater trenching activities associated with cable installation may cause a temporary and localized period of increased turbidity. However, the increase in turbidity is expected to be minor and will not affect the ability of marine mammals and sea turtles to navigate the area. Turbidity also has the potential to hinder the predation efficiency of sight feeding mammals in or immediately adjacent to the underwater cable route. In general, the suspended sediments from construction activities are expected to settle quickly out of the water column or be dispersed by the flow of the river and tidal currents along the underwater cable route. Since marine mammals and sea turtles are generally expected to be in low densities in the Project area and turbidity will be of short duration, any impacts to marine mammals and sea turtles resulting from turbidity will be negligible. Most marine mammals and sea turtles are expected to move away from the construction activity as it approaches.

The construction of the proposed Project will cause a temporary, short term disturbance to the benthic habitat which supports benthic prey items for several of the threatened and endangered species. Disturbance of the seabed from trenching during installation of the cable will affect the local benthic communities within the footprint of the cable construction corridor. Jetting and/or plowing could potentially cause mortality of sessile benthic infaunal organisms (e.g., polychaete and oligachaete worms), thus limiting the availability of food sources for some marine mammal and sea turtle species. However, the marine mammals and sea turtles are expected to feed in surrounding, unaffected areas, and therefore be relatively unaffected by the temporary and localized reductions in available benthic food sources. Recruitment and recolonization of the benthic infaunal communities is expected to begin following construction. Studies conducted on offshore sand borrow areas off the outer New Jersey coast indicated that benthic communities were re-established within 8 to 9 months, i.e., within one annual recruitment period after dredging (USACE 1999).

The temporary loss of benthic prey resources caused by the Project will have only minor effects on marine mammal and sea turtle species that feed on more motile eipfaunal organisms (e.g., crabs, mysids, and sand shrimp) or fish, since these organisms will re-occupy the trenched area after construction. In addition, the construction corridor represents a narrow linear disturbance, whereby these species can easily forage in adjacent areas. For this reason, most of the marine mammal and sea turtle species in the Project area will probably continue to feed in the area following cable installation.

During the installation of the proposed cables, a number of vessels, including tugs, barges, cranes, and workboats will be employed. Each of these vessels contains fuel, hydraulic fluid, and potentially other hazardous materials with the potential for a spill. The Project will be constructed with an SPCCP that will address measures for preventing, controlling and cleaning up spilled fluids. For larger spills, CHPEI will engage a firm with rapid response capability for containing and cleaning up the spilled material. Given the low probability of a spill, the potential adverse effect on marine mammals and sea turtles is minor. Additionally, frac-out may occur at the HDD entry and exit location and cause the release of drilling fluid, but no marine mammals or sea turtles are expected to occur at HDD locations. BMPs will be employed throughout construction with the appropriate spill response plans implemented which will limit the impacts from oil and fluid spills.

Marine mammals rely on sound for many aspects of their lives, including reproduction, feeding, predator and hazard avoidance, communication, and navigation (Weilgart 2007). There is considerable variation among marine mammals in both absolute hearing range and sensitivity. Their composite range is from ultrasonic (frequencies greater than 20 kHz) to infrasonic (frequencies less than 20 Hz). Direct hearing measurements, for the most part, are not available for cetacean species, but it is generally believed that a whale’s hearing range is related to the range of sound it produces (LGL and JASCO Research 2005).

Behavioral responses of marine mammals to sound vary greatly and depend on a number of factors. An individual's hearing sensitivity, tolerance to noise, exposure to the same noise in the past, behavior at the time of exposure, age, sex, and group composition all affect how it may respond. Sometimes it is difficult to know whether observed changes in behavior are due to sound or to other causes. Not all changes in behavior are cause for concern. Observations suggest that marine mammals tend over time to become less sensitive to those types of noise and disturbance to which they are repeatedly exposed (Richardson et al. 1995).

Displacement from critical feeding and breeding grounds has been documented in a number of marine mammal species exposed to seismic noise, as well as changes in diving and foraging behavior where cetaceans have been observed to avoid and feed less, mysticetes observed to spend more time at the water surface, and smaller odontocetes observed to swim faster (Weilgart 2007). From 1996 to present, the RFMRP cetacean and pinneped strandings and sightings in the nearshore waters of Long Island Sound have occurred mostly in the open Atlantic open section, or the southern shores of Long Island, with cetacean and pinneped strandings and sightings in the Hudson River and Long Island Sound being uncommon (see Figures 4.8-1 and 4.8-2). Because of their infrequent occurrence in the Hudson River or LIS, construction noises are likely to affect few whale individuals.

Certain types of underwater noise during construction activities can potentially cause physical damage and interrupt social behavior for marine mammal and sea turtle species. However, other than a remote possibility of blasting, this Project does not include those types of underwater construction activities that create physically harmful levels of noise, such as pile driving. In addition to construction, anthropogenic or human-generated noise may include recreational and commercial ship traffic, dredging, oil drilling and production, and geophysical surveys (EIA 2008). In comparison to sea turtles, the potential for underwater noise to adversely affect cetaceans is of greater concern. Underwater noise is suspected of interfering with the vocalizations of whales which they use for locational purposes. Elevated underwater noise levels cause avoidance behaviors which can prevent feeding in areas of elevated noise levels or potentially result in separation of individuals due to differing levels of avoidance response. However, given the low occurrence of listed marine mammals in the Project area, coupled with the lack of construction activities that create high sound levels, underwater noise is likely to have negligible effects on marine mammals and only minor effects on sea turtles.

The hearing capabilities of sea turtles are poorly known. Direct hearing measurements have been made in only a few species. These experiments indicate that sea turtles generally hear best at low frequencies and that the upper frequency limit of their hearing is likely about 1 kHz. McCauley et al. (2000 *as cited in* LGL and JASCO Research 2005) observed the responses of a caged green turtle and a loggerhead turtle to the approach and retreat of an operating seismic airgun. Those animals noticeably increased their swimming activity above a source level of approximately 166 decibels (dB). Above 175 dB their behavior became more erratic, possibly indicating an agitated state. The turtles spent increasingly more time swimming as the airgun level increased. The point at which the turtles showed the more erratic behavior likely indicates the point at which avoidance would occur for unrestrained turtles. To be conservative, it is assumed here that 170 dB represents the threshold at which pulsive sounds elicit a disturbance response in sea turtles.

From 1996 to present, the RFMRP sea turtle stranding and sighting in the nearshore waters of Long Island Sound occurred mostly in the open Atlantic open section, or the southern shores of Long Island, with sea turtle stranding and sighting in the Hudson River and Long Island Sound being uncommon (Figure 4.9-2). Underwater noise from construction will be short-term, temporary, and will not involve pile driving. Due to the limited presence of sea turtle in the Hudson River and Long Island Sound, potential direct impacts and underwater noise impacts to sea turtles are expected to be negligible.

Sea turtles and whales are slow swimming species and transiting vessels associated with cable installation have the potential to collide with them in the Long Island Sound. The probability of collision is minimized by the limited presence of whales in Long Island Sound and only slightly more common occurrence of some of the sea turtle species. Further, the increased number of vessels from project construction is minimal compared to the number and variety of vessels already operating in the Hudson River, East River and Long Island Sound for commercial transport, fishing, and recreation on a daily basis. The majority of the vessels utilized by CHPEI will travel at slow speed during construction, thus limiting the potential of collision with sea turtles and whales. In particular, the larger vessels will travel slowly, while smaller construction vessels, such as crew or supply vessels have greater maneuverability to avoid whales or sea turtles. CHPEI will continue to consult with state and federal agencies, as well as BMPs will be implemented to minimize any potential impacts on sea turtles and ensure the proper mitigation measures are taken during construction.

4.9.2.5 Other Freshwater Aquatic Species

This section details freshwater aquatic species, other than fish that occur on federal and/or state-listed threatened, endangered, candidate or special concern species lists for the counties crossed by the transmission cable route. A preliminary review of these species was conducted by searching the NYSDEC (NYSDEC 2009a) and USFWS (USFWS 2009) databases for occurrences in counties along the underwater portions of the proposed transmission cable route. These aquatic species and their habitat requirements are listed in Table 4.9-7.

Dwarf Wedgemussel (*Alasmidonta heterodon*)

The dwarf wedgemussel is a federal and New York State endangered species that has been recorded in Dutchess and Orange Counties. The species typically inhabits areas where fine sediment accumulates over a cobble substrate, in shallow, cool water in either small or large rivers (NYNHP 2009h). In New York, dwarf wedgemussel is primarily distributed in the Delaware River Basin and along the Neversink River in Orange County (NYNHP 2009h). It is also possible in the Housatonic River drainage in Dutchess County (USFWS 2009). Although habitat may exist within the Project area, the Hudson River does not support any known extant populations. Therefore, CHPEI considers the species unlikely to occur within the Project area.

Four aquatic species listed in New York State have been recorded in counties crossed by the underwater transmission cable corridor: brook floater (*Alasmindonta varicosa*), spiny softshell turtle (*Apalone spinifera*), extra-striped snaketail (*Ophiogomphus anomalus*) and pygmy snaketail (*Ophiogomphus howei*). Brook floater is a state threatened mussel species that prefers gravelly riffle habitats along small rivers and creeks (NYNHP 2009i). Although brook floater may occur within tributaries to the Hudson River, it is not expected to occur in the deeper habitats of the Hudson River along the underwater cable route.

The spiny softshell turtle is a primarily aquatic turtle with recently confirmed occurrences in Washington and Albany County. The turtle is listed as a species of special concern. Based on the species' habitat preferences for large rivers, it has the potential to occur in the Hudson River. Microhabitats within and along the Hudson River main channel may also support aquatic life stages of extra-striped snaketail and pygmy snaketail (see habitat requirements in Table 4.9-7).

4.9.2.5.1 Potential Impacts and Mitigation

Based on NYNHP data, habitat requirements, and known species distributions, CHPEI does not anticipate encountering federal or state-listed threatened or endangered freshwater mussel species. CHPEI has initiated consultation with NYNHP, NYSDEC and USFWS, and will continue to assess the potential for spiny softshell turtle, extra-striped clubtail and/or pygmy snaketail to occur within the Project area along the Hudson River. In general, aquatic species like spiny softshell are expected to move away from and avoid the underwater transmission cable corridor during ongoing construction activities, and return to the area once construction is completed. If construction activities occur during seasons when dragonfly nymphs are present, direct impacts may occur from construction and localized sedimentation from underwater construction methods.

4.10 HISTORIC AND ARCHAEOLOGICAL RESOURCES

This section of the application discusses historic and archaeological resources within the Project's vicinity. The Project's proposed alignment includes portions of the Lake Champlain region, the Champlain Canal corridor, the Hudson River Valley, the New York City metropolitan area, the Long Island Sound region, and the southern New England coastline. Waterways in and around these areas have served as important conduits for transportation, communication, and trade throughout the prehistoric and historic periods. As such, a variety of historic and archaeological resources have been previously reported in the vicinity of the Project.

4.10.1 Prehistoric and Historic Contexts

There is a long and detailed body of research regarding the prehistoric and historic occupations of these regions, including archaeological investigations and historical studies. This discussion of historic and archaeological resources begins with a summary of the prehistoric and historic cultural contexts to provide an overview of the resources potentially located in the vicinity of the Project.

4.10.1.1 Prehistoric Period

Rivers, lakes, estuaries, and coastal areas in the vicinity of the Project have been used by Native American groups since the end of the Pleistocene epoch. During the Wisconsinan glaciation, the proposed transmission cable corridor was blanketed by continental glaciers that once extended as far south as Long Island. Glacial retreat at the end of the Pleistocene exposed a landscape that had been significantly modified by ice. The postglacial environment that confronted the first Americans was vastly different than that of the present day, and Paleoindian groups entering the eastern New York region would likely have encountered a mosaic of rapidly changing environments. Paleoenvironmental reconstruction suggests that the extent of environments along the proposed transmission cable corridor may have ranged from spruce parkland and tundra in the north to grasslands along the Atlantic Coastal Plain, near present-day New York City (Carr and Adovasio 2002). The Pleistocene megafauna that initially inhabited this environment (mastodon, mammoth, bison) became extinct at the end of the Late Glacial episode and were replaced by modern species, including elk, moose, and caribou (Carr and Adovasio 2002).

Archaeological evidence suggests that Paleoindian hunter-gatherers entered the eastern New York region at least 11,300 years ago (Laub 2002). Seasonal changes in resource availability meant that Paleoindian groups developed resource procurement strategies that required seasonal migration. Despite this migratory pattern, it is probable that these groups returned to known occupation sites that were located close to critical resources, such as water and lithic raw materials. Intact archaeological sites in the Northeast and in the New England-Maritimes suggest that Paleoindian populations favored rich ecological zones associated with swamps, rivers, and postglacial lakes (Pasquariello and Loorya 2006). Archaeologically, Paleoindian artifact assemblages within the Northeast are dominated by lithic technologies, particularly fluted projectile points, utilized flakes, and smaller bifacial tools, such as scrapers and burins (Carr and Adovasio 2002). Paleoindian populations also relied heavily on perishable technologies, such as textile, bone, and wooden tools. However, differential preservation of archaeological materials typically makes these technologies far less visible in the artifact assemblages from known sites in the region.

In general, Paleoindian sites are uncommon in the Northeast. A number of factors contribute to the lack of sites from this period. While several fluted points have been recovered along the proposed transmission cable corridor, the age of Paleoindian deposits, subsequent landscape modifications, and associated ground disturbance make the likelihood of encountering intact Paleoindian sites relatively low. Other significant factors that affect the visibility of intact sites include the low population densities during the Paleoindian period, the nature of material culture types common to hunter-gatherer groups, and the general environmental conditions in the region at the end of the Wisconsinan glaciation. The paleoenvironmental landscape was also significantly altered by natural environmental conditions precipitated by a host of processes, including isostatic rebound, post-glacial eustatic sea level rise, and concomitant changes in characteristics of alluvial environments. These and other natural processes have further obscured the relationship between the paleoenvironmental environment and the modern landscape.

A warming climate and a greater ecological diversity following glacial retreat prompted changes in subsistence strategies and technologies (Ritchie 1965). The Archaic period (10,000 to 3,000 years ago) saw the emergence of mixed deciduous-coniferous forests and the appearance of essentially modern faunal assemblages in the Northeast (Quinn et al. 1999). Technological developments, such as smaller projectile points, indicate a trend towards hunting strategies that relied on smaller, locally available fauna, such as white-tailed deer, turkey, waterfowl, and black bear. Seasonal availability of game animals, aquatic resources, and wild plant foods continued to make hunting and foraging successful resource procurement strategies, particularly in coastal areas. These strategies contributed to a population growth throughout the Northeast during the Archaic period (Fagan 2000).

Although the Early Archaic is poorly understood in New York, sites from this period have been identified in the upper Hudson River drainage and in the southeastern portion of the state. Projectile points associated with the Early Archaic have been found along the Hudson River Valley, but single-component sites have not been excavated in this region.

Within the Project area, the Middle Archaic is characterized by an adaptive strategy that relied on a combination of hunting, fishing, and gathering (Pasquariello and Loorya 2006). Middle Archaic sites are typically associated with rivers, swamps, lakes, estuaries, and coastlines. The proximity of these sites to existing waterways suggests that Middle Archaic populations were exploiting seasonal fish runs and bird migrations along the Eastern Flyway (Pasquariello and Loorya 2006). The emergence of ground and polished stone tools during the Middle Archaic indicate that techniques to process nuts and edible plants were also becoming better refined during this stage (Ritchie 1965).

The Late Archaic saw the fluorescence of a number of cultural manifestations across the Northeast. In the vicinity of the Project, Late Archaic sites from the Laurentian Tradition and the Lamoka phase have been identified. While the relationship between these two phases in New York is somewhat unclear, it is apparent that by the Late Archaic cultural diversity was expanding rapidly (Quiggle 2008). The settlement patterns that developed in resource-abundant areas suggest the use of seasonal base camps to augment migratory resource procurement strategies. This semi-sedentary pattern is represented by an increase in the number house structures, storage pits, and larger quantities of organic food remains (Quinn et al. 1999; Ritchie 1965). While typical Late Archaic sites in the vicinity of the Project continue to be relatively small, they are found on all landforms and environmental areas.

Archaeologists have long recognized a Terminal Archaic period that bridges the Archaic and Woodland periods in the Northeast (Ritchie 1965). Characteristics of the Terminal Archaic include the use of steatite cooking vessels and the appearance of Orient Fishtail projectile points. Orient Fishtail points are typically found throughout the Long Island, southern New England, and the Hudson River Valley, although morphological correlates have been identified throughout the Northeast (Justice 1987).

The most significant technological development to occur during the Woodland period (3,000 years ago, AD 1550) was the widespread manufacture and use of ceramic vessels. Ceramic vessels appeared in isolated areas in eastern North America during the Late Archaic, but became only regionally significant in the Northeast approximately 3,000 years ago (Quinn et al. 1999). Ceramic manufacture reflects increasingly sedentary settlement patterns and a growing dependence on domesticated plants, although evidence for cultigens is somewhat lacking for much of the Northeast during the Early Woodland period.

While a variety of cultural manifestations continued to appear throughout the Woodland period, a regional assessment indicates that Middle Woodland populations continued a shift toward more sedentary communities. Marine resources, particularly shellfish, became increasingly important during the Middle Woodland, and researchers have identified an increase in coastal and riverine settlements during this period (Pasquariello and Loorya 2006).

Maize, bean, and squash agriculture became an important source of subsistence during the Late Woodland period (Quiggle 2005). Major sociopolitical changes accompanied the widespread adoption of cultivation practices, including increased territorialization and changes in residence patterns. These changes led to the emergence of an identifiable Iroquoian Tradition within western, central, and northern New York State by AD 1300. At the time of European contact, people speaking closely related Eastern Algonquian dialects occupied southern New England, eastern Long Island, and sections of the Hudson River Valley, near present-day Albany (Pasquariello and Loorya 2006; Ritchie 1965).

Large, nucleated semi-permanent Iroquoian settlements were originally located along floodplains, river terraces, or coastlines. However, by the 1300s, Iroquoian communities began to relocate villages to defensible upland areas. In many cases, these villages were protected by stockade walls erected as an additional fortification. Conversely, Algonquian-speaking populations in the Project's vicinity generally occupied small, decentralized camps. Both Algonquian and Iroquoian communities were oriented around maize, bean, and squash cultivation in fields near settlements. Temporary upland camps and task-specific activity sites augmented the resources available in the lowland areas surrounding villages.

In contrast to their Iroquoian and Algonquian-speaking neighbors, southeastern New York was occupied by people speaking a Munsee dialect of the Delaware language at the close of the Late Woodland. The Munsee cultural area stretched along the "Lower Hudson River Valley and across western Long Island across southeastern New York and northern New Jersey to northwestern Pennsylvania above the Forks of the Delaware" (Grumet 1995). Sixteenth century Munsee, Iroquoian, and Algonquian-speaking populations apparently shared many common life-ways typical of Late Woodland peoples in the Northeast. However, there is little archaeological evidence to indicate that Munsee communities cultivated plants prior to European arrival in the Americas. The lack of arable soils, dearth of archaeological evidence of agriculture, and the abundant marine resources in the region all suggest that the Munsee's primary resource procurement strategy emphasized hunting, fishing, and gathering practices (Grumet 1995). Archaeological evidence indicates that semi-sedentary Late Woodland Munsee communities were located along major drainages and coastlines, but it does not appear that they built fortified villages.

4.10.1.2 Historic Period

Ephemeral contact between Native Americans and Europeans along the Atlantic Coast of North America may have begun as early as the 1490s. Unverified evidence from archival records indicates that European fishing fleets may have made landfall along the coast of Newfoundland and the Gulf of St. Lawrence toward the end of the 15th century (Grumet 1995). In 1524, Italian explorer Giovanni da Verrazzano made the first documented contact with Native Americans along the Atlantic seaboard. Shortly after Varrazzanno's encounter, French explorer Jacques Cartier traveled inland along the St. Lawrence River to present-day Montreal and made contact with St. Lawrence Iroquoian groups that occupied the region. Hostilities between Native Americans and the French limited trade relations and stifled European attempts to establish a colony in the region during the 1500s (Grumet 1995). Notwithstanding these difficulties, archaeological evidence indicates that European trade items were obtained by indigenous coastal groups from European fishing and whaling fleets and made their way inland through trading intermediaries during the 16th century (Quiggle 2008).

The 17th century was a period of tremendous social and political upheaval across the entirety of Northeastern North America. Sustained contact in the vicinity of the Project began with Samuel de Champlain's exploration of the region in 1609 (LCMM 2009a). The same year, Dutch explorer Henry Hudson navigated the river that now bears his name north to the present-day City of Albany (Grumet 1995). European settlers that soon followed these explorers encountered an indigenous population wracked by epidemic diseases brought from the Old World. Waves of epidemics killed thousands of Native Americans living in the Northeast during the early contact period. These epidemics were compounded by internecine hostilities fostered by competition for access to European trade goods (Quiggle 2006). Warfare among indigenous populations would kill thousands of Native Americans and force others to flee the region during the 17th century (Grumet 1995).

Territorial expansion also caused conflict between Native Americans and European settlers pushing inland up the Hudson, Connecticut, and St. Lawrence River valleys. Regional conflicts such as the Pequot War ravaged both Indian and colonial communities. European settlers and their Indian allies also attacked other settlements in the Northeast in an attempt to wrest political control of the region (Grumet 1995). These conflicts were primarily motivated by access to trade goods and Old World rivalries that spread to the colonies. Defenses sprang up at sites along the Champlain Valley as the French and British struggled for control of waterways that provided transportation for furs and other trade items (LCMM 2009b). In the southeast of the region, New York City passed through Dutch hands twice before finally falling to the English in 1673 (Grumet 1995). Similar struggles for military control over important waterways and ports would continue throughout most of the seventeenth and eighteenth centuries.

Despite widespread conflict, the European powers were able to gain a tentative foothold in the region. By the 18th century, farms dotted the Hudson River Valley, and cities such as Kingston, Albany, and New York had become important English strongholds in the New World. The Champlain Valley remained a contested area throughout this period, and the French attempted to solidify control over the important transportation route provided by Lake Champlain through construction of a series of defenses at Crown Point (LCMM 2009b). In 1754, French attacks on a British fort along the Connecticut River reignited large-scale regional conflict. The Champlain and Lake George regions became hotbeds of military activity during the French and Indian War, as the colonial powers and their Indian allies fought a bloody and protracted battle for control of the continent. After the fall of Fort William Henry, France was able to exercise military control over the region through its naval forces on Lake Champlain and the French forts at Ticonderoga, Crown Point, and Chimney Point (LCMM 2009b). This control was short-lived, as the British returned with a large naval flotilla in 1759. British troops and warships attacked French ships on Lake Champlain and the garrisons at Crown Point and Ticonderoga. Undersupplied and outnumbered, France lost control of its major fortifications in the region by 1760. The 1763 Treaty of Paris ended the French and Indian War and brought a temporary peace to the Champlain Valley (LCMM 2009b).

The Eastern Seaboard was again the scene of conflict during the American Revolution. From Lake Champlain to Long Island, the entire State of New York was embroiled in the struggle for American independence. At the outset of the conflict, American forces under Ethan Allen and Benedict Arnold captured the British fortifications at Ticonderoga and Crown Point in a daring surprise attack. Subsequent victories in the region gave the Americans control of the lake and access to Canada. Despite these early successes, the attempt to invade Canada ultimately failed, and the American Army was forced to retreat overland in early 1776 (LCMM 2009c). The Americans were able to command Lake Champlain with a small naval force that included captured British vessels and ships built at local American shipyards on the lake. This control ended in 1776, with the British defeat of the American naval forces at the Battle of Valcour Island. Notwithstanding this naval success, the British were unable to dislodge the American forces from the redoubts at Ticonderoga and Mount Independence during the 1776 campaign. Consequently, the British again returned to the Champlain Valley in 1777 (LCMM 2009c). British General John Burgoyne was able to secure the undefended Mount Defiance above the American garrisons and fired a fusillade from cannons stationed on the high ground. The American forces were forced to retreat and to relinquish control of Lake Champlain throughout the remainder of the war (LCMM 2009c).

In the south, New York became an occupied city after the fledgling American Army fled north following the Battle of Long Island (Pasquariello and Loorya 2006). North of New York, present-day Westchester County was known as the “Neutral Ground” that separated the British and American forces. Despite this moniker, Westchester County was the scene of the battles of Pelham and White Plains in 1776 (Pasquariello and Loorya 2006). The region was home to both Tory sympathizers and revolutionaries, and it remained a hotbed of partisan activity throughout the war.

Early in the conflict, both the American and British forces recognized the strategic importance of controlling traffic on the Hudson River. The Americans attempted to block the British fleet from gaining access to the interior by constructing an iron chain across the river near Fort Montgomery (USMA 2009). When this attempt failed, General George Washington sought to establish fortifications upstream from Fort Montgomery at a high plateau with commanding views of the river valley. In 1779, an American military garrison was established at West Point, near the present-day village of Highland Falls, New York. The fortifications included a 150-ton iron “Great Chain” strung across the Hudson to control river traffic. Although the Great Chain was never tested by the British fleet, the garrison nearly fell into British hands toward the end of the conflict (USMA 2009). In 1780, Benedict Arnold was given commend of West Point. Arnold’s attempt to pass detailed plans of the fortifications to the British was discovered, and Arnold narrowly escaped down the Hudson on a British sloop. Today, the garrison at West Point is home to the United States Military Academy (USMA), and is the oldest continuously occupied military outpost in the United States (USMA 2009).

A critical American victory took place upriver from West Point near Albany, New York. In 1777, American forces defeated Burgoyne’s army at the Battle of Saratoga, giving the Americans an important strategic victory. Often called the turning point of the American Revolution, the victory at Saratoga also convinced the French to ally themselves with the Americans (NPS 2008). With the assistance of the French, the American forces were able to defeat the British at the Battle of Yorktown in 1781. The conflict was formally ended with signing of the Treaty of Paris in 1783.

The 19th century was characterized by increased economic growth throughout the region. The War of 1812 brought further conflict to the Champlain Valley, as British and American forces again sought control of Lake Champlain. The defeat of the British Royal Navy in 1814 essentially ended the era of naval fleets on the lake and brought a sustained peace to the region (LCMM 2009d). While raw materials such as timber, potash, and iron were becoming economically important, growth in the Champlain Valley was complicated by the difficulty in transporting raw goods and bulk materials south to processing and manufacturing centers (LCMM 2009e). The construction of the Champlain Canal between 1817 and 1823 provided a vital link between communities in the north and manufacturing centers along the Hudson River and the Atlantic seaboard (HAA 2009). The canal underwent several realignments and improvements throughout the 1800s to accommodate increased traffic and larger vessels.

Brick manufacturing, quarrying, iron smelting, and ice cutting became important industrial activities along the Hudson River Valley during the 19th century, fueled in part by the successes of the Erie and Champlain Canals that connected distant markets (Pasquariello and Loorya

2006). The growth of the railroads decreased the significance of the canal system, but brought new economic benefits to the region. Although the northern sections of Manhattan had remained sparsely populated and primarily agrarian throughout the 18th century, the influx of immigrants into the New York City region provided an important stimulus for the growth of the city during the 19th century. Commercial shipping and manufacturing supported New York City's rise as a regional and national economic center, and similar activities along the coastline of Long Island Sound allowed for the development of cities such as Stamford, Connecticut.

The Champlain Canal was replaced by the modern Barge Canal in the early 20th century. Although the Barge Canal was an attempt to revitalize the canal system, commercial traffic peaked in the 1890s and has continued to decrease. Today, Lake Champlain and the Champlain Valley remain popular recreation destinations. South of the canal, the Central New York region is centered on the capital city of Albany. The lower Hudson River Valley experienced increased suburban growth and development following World War II.

The New York City region continues to be one of the largest population centers in the United States, with an increasing dependence on the financial and service sectors. While the western section of the Long Island coastline is characterized by urban and suburban development associated with New York City, the eastern portion of the coast has become a tourist destination.

4.10.2 Existing Historic and Archaeological Resources

Although previous studies have identified several historic and archaeological resources in the Project's vicinity, the varying levels of analyses and investigation conducted for these studies have resulted in vastly different degrees of reporting and evaluation. At one end of this spectrum, resources within the proposed transmission cable corridor include "historic properties" that have been listed in or determined to be eligible for inclusion in the National Register of Historic Places (National Register). These historic properties include significant buildings, structures, sites, districts, and individual objects that meet the National Register Criteria for Evaluation (36 CFR § 60.4).

A smaller subset of historic properties within the vicinity of the Project has been designated as National Historic Landmarks (NHL) by the Secretary of the Interior. These NHL properties are considered significant historic places that possess exceptional value or quality in illustrating or interpreting the heritage of the United States.

Resources in the Project's vicinity also include properties listed in or eligible for inclusion in the New York State Register of Historic Places (State Register), established under Section 14.09 of the New York State Preservation Act of 1980 (Section 14.09). All historic properties within the State of New York listed in or nominated for inclusion in the National Register are concurrently listed in the State Register.[1]

Other sites reported in the vicinity of the cable transmission route and aboveground facilities have not been subject to the same level of study or evaluation as properties listed in or

[1] The State Register also includes a limited number of properties that have not been listed on the National Register. However, none of these properties occur within the vicinity of the Project.

determined eligible for inclusion in the State or National Registers. The nature and quality of available data regarding these unevaluated sites often varies significantly. In several instances, documentation regarding the integrity or geographical boundaries of these sites has not been collected or is not presently available. Several archaeological sites recorded during the early 20th century fall into this category, as do many of the shipwrecks reported along waterways that comprise the majority of the transmission cable corridor. Many of these resources may potentially be eligible for inclusion in the National Register. However, in other instances, the integrity of these reported sites may be compromised or their geographical extent inaccurately reported. In either case, there is insufficient information currently available regarding these sites to make a recommendation or determination regarding their eligibility.

In addition to the resources discussed above, designated New York City Landmarks have also been identified within the general vicinity of the Project. New York City Landmarks and Landmark Districts are designated by the City of New York Landmarks Preservation Commission (LPC) to preserve important physical elements of New York City. Many of these Landmarks and components of Landmark Districts also share distinction as historic properties listed in or determined eligible for inclusion in the National Register.

Other related resources within the vicinity of the Project include National Heritage Areas. National Heritage Areas are designated by Congress and administered through a partnership between the NPS and local coordinating entities. The goal of the National Heritage Program is to expand on traditional approaches to conservation by supporting large-scale, community centered initiatives that engage citizens in the preservation and planning process. While these National Heritage Areas contain historic resources listed in or eligible for inclusion in the National Register, the heritage areas themselves are not considered historic properties as defined in 36 CFR § 800.16(l). In addition to the National Heritage Areas, the Project's proposed alignment is encompassed within several New York State Heritage Areas, including the Mohawk Valley Heritage Corridor and the "RiverSpark" (Hudson-Mohawk) Heritage Area. Similar to the National Heritage Areas, State Heritage Areas also contain properties listed in or eligible for inclusion in the National Register, but the areas themselves are not considered historic properties.

Federal, state, and local statutes governing the protection of historic properties have applicability to the proposed Project. Section 106 of the National Historic Preservation Act (NHPA) of 1966, as amended (Section 106), establishes the statutory responsibilities of federal agencies to consider the effects of their undertakings on historic properties listed in or eligible for inclusion in the National Register. Because the Project will require federal permits, Section 106 and its implementing regulations at 36 CFR § 800 are applicable to the entire undertaking. 36 CFR 800 defines the procedures for identifying historic properties in consultation with federally recognized Indian tribes, the applicable State Historic Preservation Office (SHPO), and other parties, including the public.

In addition to Section 106, portions of the Project to be approved by the NYSPSC are subject to the provisions of Section 14.09. Section 14.09 requires state agencies to consult with the SHPO if it appears that any project may cause any change, beneficial or adverse, to historic properties listed in or eligible for inclusion in the National or State Registers of Historic Places.

The LPC serves as the city's expert agency for historic resources and is typically consulted prior to authorizing projects that require discretionary action by city agencies. Pursuant to the New York City Landmarks Law of 1965, the LPC is also the agency responsible for regulating construction and improvements at New York City Landmark sites and districts.

The consultation procedures required pursuant to these applicable statutes will be coordinated during the permitting process. The consultation process, identification, and assessment requirements described in 36 CFR 800 provide the opportunity to address the requirements of Section 14.09 and requirements promulgated by the LPC. Accordingly, CHPEI anticipates that the Section 106 process will guide the identification of historic properties and the assessment of Project effects.

CHPEI anticipates that the USDOE will serve as the lead federal agency for purposes of consultation pursuant to Section 106. Consequently, the USDOE remains largely responsible for the findings and determinations made through the Section 106 process. As provided in 36 CFR § 800.2(c)(4), the USDOE may authorize CHPEI to act as the agency's non-federal designee for purposes of consultation under Section 106.

The Section 106 process requires identification of historic properties within the Project's Area of Potential Effects (APE), through consultation with the SHPO, Indian tribes, and other stakeholders. Although the APE for this undertaking has not yet been established, CHPEI anticipates that will include all areas along the transmission cable corridor where ground-disturbing activities will be conducted. The APE will also likely include areas outside the transmission cable corridor, including the converter station sites, the AC cable alignment, transmission interconnection sites, laydown areas, and other locations that may be affected by Project construction and operations. Additionally, the APE will take into account standing historic properties (i.e., buildings, structures, individual objects, and districts) that may be indirectly affected by the undertaking.

Section 106 requires identification of historic properties in consultation with the parties discussed above. CHPEI has initiated preliminary studies to identify resources that may be affected by Project construction and operation. Details of these preliminary identification efforts are described in this section of the Article VII application. CHPEI anticipates that additional studies to identify historic resources and to assess the Project's effects on such properties will be developed in consultation with the SHPO, Indian tribes, the LPC, and other stakeholders. These studies will include geophysical investigations developed in conjunction with preparation of final design plans. As necessary, appropriate measures to avoid, minimize, or mitigate the adverse effects on these resources will be developed and implemented in consultation with the appropriate parties.

4.10.2.1 Documentary Research to Identify Known and Potential Historic and Archaeological Resources

In support of this application, documentary research was conducted to identify a wide variety of previously reported historic and archaeological resources within the vicinity of the proposed Project. The results of this research are presented in the sections below. The information collected during this phase of investigation will form the basis for additional consultation activities with the SHPO, Indian tribes, non-governmental organizations (NGOs), the LPC, and other stakeholders whose interests may potentially be affected by construction or operation of the Project. Additional cultural resource studies will be developed in consultation with these parties, and CHPEI anticipates that field investigations and other activities developed through the consultation process will begin in the spring of 2010

Hartgen Archaeological Associates, Inc. (HAA Inc.) conducted documentary research to identify known and potential cultural resources in the vicinity of the proposed Project. Several agencies were contacted to obtain information regarding cultural resources in the Project's vicinity, including the New York State Office of Parks, Recreation and Historic Preservation (NYSOPRHP). The NYSOPRHP maintains an inventory of cultural resource studies and previously reported cultural resources within the proposed transmission cable corridor, including terrestrial and underwater archeological sites and other historic properties. HAA, Inc. also consulted the New York State Museum (NYSM) site files maintained by the NYSOPRHP. These site files provide information on archaeological sites previously reported to the NYSM.

As a component of this research, HAA, Inc. also obtained data from the NYDEC associated with the Benthic Mapping Program for the Hudson River. The high-resolution, 2-meter sun-illuminated bathymetric maps generated by this survey were utilized to assist HAA, Inc. in identifying the locations of shipwreck sites and anomalies in the Hudson River Estuary, extending from Troy to New York City. At the request of CHPEI, the Lake Champlain Maritime Museum (LCMM) also conducted a review of bathymetric data and site files associated with ongoing cultural resources studies in Lake Champlain. Based on these records, the LCMM was able to supplement the research conducted by HAA, Inc. and provide additional information regarding the location, nature, and character of shipwrecks and other submerged resources along the Lake Champlain portion of the Project. Other sources consulted to locate and identify reported shipwrecks included NOAA navigation charts, USGS topographic quadrangles, academic reports, historic manuscripts, and studies previously conducted along the waterways that comprise a majority of the Project's route.

In addition to these sources, HAA, Inc. also contacted the LPC to identify resources in the New York City region that may potentially be affected by the Project. The LPC serves as the City's expert agency for historic resources and is typically consulted prior to authorizing projects that require discretionary action by City agencies. Consequently, the LPC maintains an archival library that contains terrestrial archeological site information and data on above-ground resources, such as buildings, structures, and landscapes that have been designated as New York City Landmarks and Landmark Districts. However, the LPC does not maintain data on underwater resources, and could not provide any cultural resource information relevant to submerged resources along the Project's proposed alignment.

The documentary research conducted by HAA, Inc. and supported by the LCMM focused on specific study areas to identify previously reported archaeological sites, historic properties, and archaeologically sensitive areas that could potentially be affected by construction or operation of the Project. To better characterize the archaeological and historic sensitivity of the Project's route, this research also identified resources that are outside of the proposed transmission cable corridor but are in the general vicinity of the Project. The results of this documentary research were compiled into four maps series that provide coverage of the Project's entire alignment, from the United States/Canadian border to Long Island Sound. The maps and associated tables presented in Appendix E (1A through 4B) of this application provide available information regarding:

- Identified terrestrial archaeological sites, including properties that are listed in or considered eligible for inclusion in the National Register as well as those sites that have been reported but have not been subjected to additional investigation or evaluation;

- Standing historic properties, including buildings, structures, districts, and individual objects that have previously been listed in or evaluated as eligible for inclusion in the National Register;

- Shipwrecks, submerged sites, or anomalies identified through existing NOAA charts, NYSOPRHP and NYSM site files, studies conducted by the LCMM, and bathymetric data provided by the NYSDEC; and

- The locations of previous cultural resource studies, including a summary of the results of these investigations.

The information presented in Appendix E (1A through 4B) contains detailed and sensitive information regarding the location, nature, and character of reported archaeological sites, historic properties, and shipwrecks located within the Project's vicinity. Consequently, these maps and associated tables are presented in a confidential appendix to this application. General, publicly available information regarding the location of National Register properties and New York City Landmarks and Landmark Districts was obtained from the New York State GIS clearinghouse. As required by the Article VII regulations, the location of these resources within a 3-mile radius of the Project has been included in Exhibit 2 of this Application.

The study area and the results of the documentary research conducted for each section of the Project's route are discussed below.

4.10.2.1.1 Lake Champlain

The Lake Champlain section of the transmission cable corridor begins at the United States/Canadian border and extends south to the northern entrance of the Champlain Canal at Whitehall. The Lake Champlain section extends across a region that was a contested front during the American Revolution. Several well-known historic sites exist within the general vicinity of the Project's route through Lake Champlain, including Fort Crown Point and Fort Ticonderoga. Shipwrecks associated with the military history of the region are also known to exist beneath the waters of Lake Champlain. Many of these resources have been mapped and studied through the ongoing efforts of the LCMM.

For this section of the Project route, HAA, Inc. reviewed NYSOPRHP and NYSM site files and other available documentation for a study area that included portions of Lake Champlain within the State of New York and the lake's immediate shoreline. During the siting phase, the LCMM provided supplementary information regarding shipwrecks and other submerged archaeological resources within 1,000 feet of either side of a proposed centerline for the underwater transmission cable route. Based on the information provided by the LCMM and HAA, Inc., CHPEI was able to make minor adjustments to the Project's proposed alignment to avoid a majority of the historic properties, unevaluated resources, and reported shipwrecks along this section of the Project's route.

Information regarding the identified shipwrecks, archaeological sites, and historic properties that have previously been reported within the study area is summarized in Table 4.10-1. Information providing additional details regarding the nature of these resources and their location relevant to the Project's alignment is presented in Appendix E (1A through 4B).

A review of information also identified 32 cultural resource studies that have previously been conducted within the Lake Champlain portion of the transmission cable route. The geographical extent and the results of these previous investigations are summarized in Appendix E (1A through 4B) of this application document.

4.10.2.1.2 Champlain Canal

To the extent practicable, the underwater transmission cables will follow the Champlain Canal south from Whitehall to a point north of the canal's confluence with the Hudson River in Fort Edward. CHPEI expects that an underground bypass will be necessary to circumvent Lock C12 at Whitehall and Lock C11 at Fort Ann. These bypass sections will likely extend for a combined total of approximately 2.1 miles along an existing railroad right-of-way.

The Champlain Canal section of the Project is closely associated with the development of the Canal Corp canal system. As in other parts of the state, the opening of the canal provided the impetuous for community growth and economic development during the late 19th and early 20th centuries. Several prehistoric sites have also been reported in the vicinity of the Champlain Canal section of the Project route, and historic buildings and structures associated with the canal are known to exist in the area.

For this section of the Project route, HAA, Inc., reviewed NYSOPRHP and NYSM site files and other available documentation for a study area that included the entire width of the Champlain Canal and the canal's immediate shoreline.

Information regarding the identified shipwrecks, archaeological sites, and historic properties that have previously been reported within the study area is summarized in Table 4.10-2. Information providing additional details regarding the nature of these resources and their location relevant to the Project's alignment is presented in Appendix E (1A through 4B).

A review of information also identified 16 cultural resource studies that have previously been conducted within the Champlain Canal portion of the Project route. The geographical extent and the results of these previous investigations are summarized in Appendix E (1A through 4B) of this application document.

4.10.2.1.3 Railroad Right-of-Way Bypass

In order to circumvent the Upper Hudson River PCB Dredging Project, extending from Fort Edwards south to the Town of Coeymans south of Albany, the cable route was located on land. Accordingly, the transmission cables will exit the Champlain Canal north of Fort Edward (north of Lock C8) and will be buried within railroad rights-of-way for a distance of 69.9 miles. The cables will enter the Hudson River in the Town of Coeymans, downstream from the City of Albany.

This underground section of the cable route is generally constrained by the existing railroad right-of-way. As such, HAA, Inc. reviewed NYSOPRHP and NYSM site files and other available documentation for a study area that included 500 feet on either side of the cable corridor centerline for this portion of the Project's route.

Information regarding the identified archaeological sites and historic properties that have previously been reported within the study area is summarized in Table 4.10-3. Information providing additional details regarding the nature of these resources and their location relevant to the Project's alignment is presented in Appendix E (1A through 4B).

A review of information also identified 10 cultural resource studies that have previously been conducted within the underground portion of the railroad right-of-way bypass route. The geographical extent and the results of these previous investigations are summarized in Appendix E (1A through 4B) of this application.

4.10.2.1.4 Hudson River

The underwater transmission cables will enter the Hudson River in the Town of Coeymans, downstream from the City of Albany. South of Coeymans, the proposed route follows the Hudson River to the New York City metropolitan area. This section of the underwater transmission cable route has a rich history associated with the prehistoric occupation of the region and the early colonial settlements that eventually gave rise to present-day New York City. Several nationally significant historic properties exist along this section of the project, including the USMA at West Point and the Stony Point Battlefield.

For this section of the cable route, HAA, Inc. reviewed NYSOPRHP and NYSM site files and other available documentation for a study area that included the entire width of the Hudson River and the river's immediate shoreline. The NYSDEC also provided high resolution bathymetric data that was reviewed to identify the locations of potential shipwrecks along the Hudson River. The bathymetric images revealed the presence of several anomalies on the river bottom that may indicate the presence of sunken vessels or other significant cultural deposits. Where possible, the information presented in the bathymetric images was also compared with other sources to corroborate the locations of shipwrecks and other underwater sites such as historic bridge structures. Based on the information compiled from the bathymetric images, CHPEI made minor adjustments to the cable alignment to avoid, to the extent practicable, all shipwrecks and anomalies along the Hudson River section of the route.

Information regarding the identified shipwrecks, archaeological sites, and historic properties that have previously been reported within the study area is summarized in Table 4.10-4. Information providing additional details regarding the nature of these resources and their location relevant to the underwater cable route is presented in Appendix E (1A through 4B).

A review of information also identified 67 cultural resource studies that have previously been conducted in the vicinity of the underwater portion of the Hudson River route. The geographical extent and the results of these previous investigations are summarized in Appendix E (1A through 4B) of this application.

4.10.2.1.5 Harlem River, East River, and Long Island Sound

Two of the transmission cables (one bipole system) will terminate approximately 320 miles south of the United States/Canadian border at an HVDC converter station in Yonkers. The Yonkers converter station will be connected to approximately 6.6 miles of double-circuit 345 kV AC cable which will terminate at a new step-down 345/138 kV AC transformer substation adjacent to and tied into the existing Con Edison Sherman Creek substation, near the intersection of West 201st Street and 9th Avenue, in the Borough of Manhattan.

A second set of transmission cables (one bipole system) parallels the first set from the Canadian border to Yonkers and then continues downstream in the Hudson River past the Yonkers converter station landfall site and enters the Harlem River and then the East River. From the East River, the transmission cables enter Long Island Sound and travel east across the New York/Connecticut state line towards a landfall location in Bridgeport, Connecticut.

As the cable route follows these waterways through the New York City metropolitan area, it traces a route through one of the most historically significant regions on the East Coast. Archaeological sites, buildings, structures, and other resources known to exist within the Project's vicinity are associated with the prehistoric occupation and early European settlement in United States. Other resources reflect the military history and the diverse heritage of the New York City area, including Fort Schuyler, the Triborough Bridge, and other remnants of the city's growth and development. The maritime history of the region is visible in its historic resources, including the Execution Rocks Lighthouse and the State University of New York Maritime College.

For this section of the underwater transmission cable route, HAA, Inc. reviewed NYSOPRHP and NYSM site files and other available documentation for a study area that included the entire width of the Harlem River and the East River, as well as the immediate shorelines of these waterways. The study area for the Long Island Sound portion included 1,000-foot-wide buffer on either side of the Project's centerline.

Information regarding the identified shipwrecks, archaeological sites, and historic properties that have previously been reported within the study area is summarized in Table 4.10-5. Information providing additional details regarding the nature of these resources and their location relevant to the cable route is presented in Appendix E (1A through 4B).

A review of information also identified 10 cultural resource studies that have previously been conducted in the vicinity of this section of the cable route. The geographical extent and the results of these previous investigations are summarized in Appendix E (1A through 4B) of this application document.

4.10.3 Potential Impacts and Mitigation

4.10.3.1 Impact Assessment

The Project has the potential to effect archaeological sites, historic properties, and shipwrecks, including those resource listed in or eligible for inclusion in the National Register. The proposed transmission cable corridor will be located along historically significant waterways in New York that have been designated as archaeologically sensitive by the NYSOPRHP. This corridor follows sections of waterways where historic shipwrecks have been reported and which may potentially include deposits associated with adjacent archaeological and historic sites located along the shorelines. To the extent practicable, existing shipwreck data, archaeological site information, and other resources have been reviewed to site the transmission cables in locations that will not directly affect these resources. However, there are instances along the Project's proposed route where avoidance is not practical and where the transmission cable corridor will intersect with reported historic resources. In particular, the proposed transmission cable route travels through the boundary of the Crown Point NHL, the Fort Ticonderoga NHL, and the boundaries of other historic properties along the lower Hudson River that extend into the waterway.

Underground sections of the proposed transmission cable corridor intersect with reported archaeological sites that extend through the railroad right-of-way. Although most of these sites have not been evaluated for inclusion in the National Register, they may potentially meet the criteria for eligibility.

A significant number of both prehistoric and historic archaeological sites have been identified along the Project's route, including several properties that are listed in or considered eligible for inclusion in the National Register. Construction of the Project has the potential for ground disturbance that may affect the integrity and character-defining features of archaeological sites, including shipwrecks, located within the transmission cable corridor.

The transmission cables will also be located in the vicinity of historic buildings and structures, including historic canalways and their associated infrastructure. These historic properties include locks along the Champlain Canal, districts that encompass portions of the canal itself, and historic bridges along the Hudson River and the Harlem River. The Project facilities are also located within National Heritage Areas and New York State Heritage Areas, including the Mohawk Valley Heritage Corridor and the "RiverSpark" (Hudson-Mohawk) Heritage Area.

In general, the Project is unlikely to have a significant effect on standing historic structures within the Project's vicinity. With the exception of the converter station, the Project's principal components will be buried and will not have an effect on the viewshed. The converter station will be designed to match the character of the surrounding area, and is not expected to have an adverse impact on any historic properties in the vicinity.

4.10.3.2 Mitigation

In the development of mitigation for any adverse effects of a proposed action on cultural resources, the first and most desirable approach is to maximize the avoidance of impacts in all aspects of a project. Impact avoidance has been incorporated in all major aspects of the Project. Selection of the railroad right-of-way route in order to bypass the Upper Hudson River PCB Dredging Project avoids or minimizes impacts on cultural resources, since much of this corridor has been previously disturbed. Use of buried HVDC cable eliminates aboveground components of an overhead transmission line that can adversely affect historic properties, as well as requires a narrower right-of-way. The Project will not require the construction of poles or towers that can mar the viewshed and indirectly affect the integrity and character of historic properties.

The installation of underwater cables will also avoid ground disturbance associated with installing towers or poles, including the disturbance caused by construction vehicles, and wire-pulling equipment. Additionally, underwater cables do not require vegetation management activities that require clearance along a right-of-way. The ground-disturbance associated with clearing and maintaining a traditional, overhead transmission line right-of-way can cause damage to buried archaeological deposits along the entire right-of-way.

In the first instance, the selection of an underwater cable for this Project avoids many potential impacts that are associated with an overland route. The installation of the cables in existing waterways will significantly reduce the overall number of sites that could potentially be impacted by this Project. Prehistoric and historic period archaeological sites are generally found on landforms suitable for short or long-term habitation, resource procurement practices, defense, and agriculture. While waterways have served as important transportation routes and economic conduits, most archaeological sites and historic standing structures are located along shorelines or in terrestrial areas. Consequently, the selection of an underwater route avoids impacts to these landforms that have the highest potential for archaeological sites or historic standing structures.

Cable installation methods have been selected to minimize the extent of ground disturbance, both on land and in waterways. Underwater cable burial using water jetting entails use of focused, high-powered water jets to avoid widespread bottom disturbing activities along a majority of the underwater route. Similarly, HDD installation at locations where the cables must enter or exit the water will avoid disturbance to the topmost soil layers that generally have the highest potential to contain archaeological deposits.

The use of an underwater cable provides flexibility in cable siting that permits placement to avoid identified archaeological or historical resources. CHPEI's preferred approach is to avoid adverse effects to cultural resources by routing the transmission cable around identified historic properties, reported archaeological sites, shipwrecks, and anomalies identified in waterways. To this end, CHPEI incorporated screening studies into the siting process. The proposed underwater transmission cable route avoids a majority of identified resources along the Project's route.

The use of Project planning and design factors to avoid adverse impacts has reduced Project impacts to identified cultural resources. However, CHPEI recognizes that additional studies are required to identify previously unreported archaeological sites and historic properties along the proposed Project alignment. Additional studies are also necessary to determine the nature, integrity, and extent of archaeological deposits within the APE and to determine the Project's potential effects on properties listed in or eligible for inclusion in the National Register. As described above, CHPEI anticipates continuing consultation with the SHPO, Indian tribes, the LPC, NGOs and other stakeholders to determine the appropriate level of studies required to identify additional archaeological and historical resources that may be affected by the Project. At a minimum, CHPEI anticipates that these studies may include field investigations of select sections of the Project's route. In addition to these field activities, a comprehensive geophysical survey, including side-scan sonar and bathymetric imaging, will also be conducted as part of the preparation of final design plans. Based on the results of these studies, consultation with the parties described above will be required to develop measures to avoid, minimize or mitigate impacts to identified resources, as appropriate. If necessary, the underwater route may be further modified to avoid adverse effects to significant resources.

4.11 VISUAL AND AESTHETIC RESOURCES

This section includes a preliminary assessment of the visual and aesthetic resources within a 0.25 mile study area of the proposed aboveground HVDC converter station located in Yonkers, New York and the new Sherman Creek step-down 345/138 kV transformer substation in the Borough of Manhattan.

CHPEI identified a 0.25 mile study area around the sites for the assessment of visual resources due to the highly urban nature of the sites. This assessment also includes an inventory of historic resources, state and local parks/public lands, and lands of statewide significance in the study area. Additional information, including an analysis of the visual representation of the proposed converter station and substation facilities within the existing landscape (photosimulations), will be undertaken at a later date. Once analyzed, the proposed visual impacts and any proposed avoidance, minimization or mitigation measures will be developed. This information will be provided as part of the supplemental information to be submitted in July 2010.

4.11.1 Existing Conditions

The NYSDEC program policy provides a list of categories for Visual Resources of Statewide Significance to be investigated, as summarized in Table 4.11-1. National Register-listed properties are the only resource of statewide significance occurring within the Yonkers converter station study area and are listed below.

- Philipse Manor Hall, Warburton Ave. and Dock St.
- Halcyon Place Historic District
- US Post Office – Yonkers, 79 – 81 Main St.
- Bell Place-Locust Avenue Historic District, roughly bounded by Cromwell Pl., Locust Hill Ave., Baldwin Pl. & N. Broadway

Those places considered eligible for listing that may fall within the study area are not currently provided, as consultation with the State Historic Preservation Office is currently ongoing and the investigation is not fully complete. See Section 4.10 for additional information on Archaeological and Historic resources occurring within the Project area.

Local visual resources within the study area were also considered and include Habirshaw Park, Larkin Park, Esplanade Park, and Pitkin Park.

Additional information regarding resources within the study area for the proposed substation will be provided as part of the supplemental information to be submitted in July 2010.

4.11.2 Visual Setting

The land use in the general vicinity of the proposed converter station is largely commercial/industrial with some office buildings, and includes the Metropolitan Transportation Authority (MTA) Amtrak rail line and Yonkers Amtrak/Metro-North Station (south of site) and the Kawasaki Rail Car, Inc (directly north). Residential areas lie outward towards the perimeter of the study area. The viewscape in the immediate vicinity includes short range metropolitan multi-story buildings, city streetscapes and the elevated rail line. Habirshaw Park along the Hudson River waterfront is within walking distance, at approximately 1,000 feet. This park is not visible from the site due to the elevated railroad and numerous building blocking any view to the river. Similarly, Larkin, Esplanade and Pitkin Parks occur within the study area; however, due to the obstruction of intervening buildings, these parks and historic areas will not have views of the Project.

Because of the limited views in the area, potential locations for photosimulations to be provided are expected to have a partial or unobstructed view of the proposed facility when chosen. As a result, these locations are expected to be either adjacent to or extremely proximal to the site.

Additional information regarding resources within the study area for the substation will be provided as part of the supplemental information to be submitted in July 2010.

4.12 NOISE

This section describes the existing noise standards, construction activities that may result in elevated noise levels and potential impacts and mitigation for noise associated with the construction and operation of the Project. A detailed analysis that includes the measured existing noise levels in areas with potential noise impacts, the modeled noise impacts associated with operation of the proposed Yonkers converter station and Sherman Creek 345/138 kV AC transformer substation, the identification of any sensitive receptors, and the demonstration of compliance with operational noise regulations and standards will be provided as part of the supplemental information to be submitted in July 2010.

4.12.1 Existing Noise Standards

Sound is caused by differences in pressure that are detected by the ear. The magnitude of sound pressure is usually expressed in dBs. Noise is sound that is unwanted and/or interferes with the ability to hear. Sound levels are typically measured and expressed as an A-weighed sound level (dBA). The A-weighting scale was developed to mimic the response of the human ear to sounds. Noise impacts can be determined for a particular noise-sensitive receptor, such as a residence, school or other building, by comparison to the background sound levels in the existing noise environment at that location.

Noise is regulated primarily through local zoning regulations which differ from community to community. These regulations usually address maximum noise levels allowed at adjacent property lines during different times of day for different planning zones. All applicable zoning regulations will be adhered to during the operational phase of the Project.

Federal standards and guidelines include the United States Occupational Health and Safety Administration’s (OSHA) regulations that describe limits for noise exposure to protect worker health and safety, and the USEPA’s Information on Levels of Environmental Noise Requisite to Protect Public Health and Welfare with an Adequate Margin of Safety (USEPA 1974).

4.12.1.1 New York State Guidelines

The NYSDEC has issued a program guidance document entitled *Assessing and Mitigating Noise Impacts* (NYSDEC 2000). This guidance, which is premised on state statutory authority, has been adopted as a standard for evaluating potential noise impacts from numerous projects throughout New York. The guidance recommends that, to avoid citizen complaints, the A-weighted Sound Pressure Level (SPL) should not exceed ambient noise levels by more than 6 dBA at noise-sensitive receptors, and the addition of any noise source in a non-industrial setting should not raise the total future ambient noise level above a maximum of 65 dBA. Noise levels in industrial or commercial areas should not exceed 79 dBA.

Although the 6 dBA increase is to be used as a general guideline, the NYSDEC guidance states that other factors should also be considered. For example, in settings with very low ambient sound levels, a greater increase in sound may be acceptable.

4.12.1.2 City of Yonkers

The City of Yonkers zoning ordinance makes it unlawful for any person to make, continue, cause, permit or allow, verbally or mechanically, any noise disturbance. A noise disturbance is any sound that: 1) endangers the safety or health of any person; 2) disturbs a reasonable person of normal sensitivities; or 3) endangers personal or real property. The zoning ordinance identifies the maximum permissible sound level limits at the property line, which differ for residential, commercial, industrial and sensitive zones. Permissible maximum noise levels in residential zones are lowest from 10 p.m. to 7 a.m.

4.12.1.3 New York City Noise Standards and Criteria

Under the New York City Noise Control Code, construction activity is limited to weekdays between 7 a.m. and 6 p.m. The code also contains sound level standards for various sources of ambient noise and construction noise, and prohibits unnecessary noise near hospitals, schools and courthouses. Additional ambient noise standards for New York City are contained in Local Law No. 64. Under this law, noise levels emitted from a project are regulated based on the applicable land use zoning classification.

4.12.2 Potential Impacts and Mitigation

A detailed assessment of the Project's potential noise impacts will be prepared as part of the supplemental information to be submitted in July 2010. This analysis will include measurement of background noise levels and modeling of the operational noise associated with the proposed Yonkers converter station and the proposed Sherman Creek 345/138 kV AC transformer substation. The converter station will contain numerous sources of sound that will be included in the noise modeling assessment. While the operation of the converter station has the potential to raise local ambient noise levels, it is anticipated that operational noise levels in the vicinity of these facilities will be within applicable zoning regulations and will not be out of character with the surrounding noise. If required, noise from these facilities can be mitigated through acoustic-damping wall and roof materials, screening or enclosing equipment, use of specialized equipment designed to reduce noise, or the orientation of equipment away from the most sensitive sound direction. It is not anticipated that CHPEI will seek waiver of local requirements for operational noise levels.

Construction noise associated with the installation of the underground transmission lines, converter station and transformer substation will be temporary in nature. Construction in the vicinity of any single residence or business will last only a few days to a week as construction progresses along the transmission cable corridor. Underwater noise from the operation of vessels and installation of cables could impact aquatic organisms (see Sections 4.7, 4.8, and 4.9), although these impacts should be temporary in any one location. Underwater construction methods producing very high dB levels, such as pile driving or blasting are not anticipated. Sheetpile driving for cofferdam installation will likely involve pneumatic or vibratory methods, which will produce sound levels comparable to pile driving. Therefore, it is expected that noise levels will be below those levels that could cause temporary hearing impairments or physical injury to fish and wildlife for the vast majority of the cable route. Because the water jetting installation will produce a fairly constant noise, fish and other aquatic species could perceive the noise and avoid the area. CHPEI will consult with state and federal agencies to determine if limiting in-water work to certain periods will further mitigate the impact of certain noise producing activities.

Residents and businesses could be temporarily impacted by noise from construction activities associated with the installation of the land portions of the cables and the converter station. Construction of the Project will likely be conducted in compliance with all local zoning ordinances. However, given the need for certain installation activities to occur uninterrupted (e.g., HDDs), noncompliance with construction related noise requirements may occur. CHPEI will continue to evaluate the need for noise mitigation based on ongoing consultations with agency and stakeholder groups. See Exhibit 7 for waiver requests from local laws regulating construction related noise levels.

4.13 PUBLIC HEALTH

This section assesses the electromagnetic field (EMF) associated with the operation of the HVDC transmission cables. A complete report analyzing the potential EMF impacts for underwater and underground HVDC transmission cables is provided in Appendix H. An analysis of the HVAC line performance will be provided as part of the supplemental information to be submitted in July 2010.

CHPEI intends to connect renewable sources of power generation in central and eastern Canada and upstate New York to load centers in and around the New York City and southwestern Connecticut regions. The Project will include four underwater and underground HVDC transmission cables routed along existing waterways from HVDC converter stations in Canada to HVDC converter stations in New York City and Bridgeport, Connecticut. The four cables comprise two HVDC bipoles. Each bipole will utilize a second cable as the metallic return. One bipole pair will terminate in New York City. The other bipole pair will terminate in Bridgeport, Connecticut.

The portion of the new underground and underwater HVDC transmission facility located in the United States is approximately 385 miles long. Two cables (one bipole) will extend approximately 319 miles from the United States/Canadian border to a converter station in Yonkers, New York. The remaining two cables (the other bipole) will continue 66 miles further to a converter station in Bridgeport, Connecticut.

4.13.1 Electric and Magnetic Fields Overview

Electric power systems produce EMF which consists of two components, both electric fields and magnetic fields. An EMF is a physical field produced by electrically charged objects. It affects the behavior of charged objects in the vicinity of the field. Most objects are electrically neutral because positive and negative charges are present in equal numbers. When the balance of electric charges is altered, electrical effects occur, such as the static-electricity. Electrical effects occur both in nature and because of society’s use of electric power.

Voltage on any wire, whether an overhead phase conductor or lamp cords, produces an electric field in the area surrounding the wire. Specifically electric fields are produced by application of voltages to the conductors that comprise an electric power system, and magnetic fields are produced by currents that flow in these conductors.

Electric fields are invisible lines of force that repel or attract electrical charges. As with a magnet, if the charges are the same (i.e., either both positive and both negative), the charges repel each other. If the charges are different (i.e., one negative and one positive), there will be an attractive force between them. Electric fields are proportional to the operating voltage of the transmission line. The line voltage is controlled within a small range (usually ± 10 percent) and, hence, little variation is expected in the electric field levels.

Any object with an electric charge has a voltage (potential) at its surface and can create an electric field. When electrical charges move together (an electric current) they create a magnetic field, which can exert force on other electric currents. All currents create magnetic fields. Magnetic fields occur throughout nature and are one of the basic forces of nature. The strength of the magnetic field depends on the current (higher currents create higher magnetic fields), the configuration/size of the source, spacing between conductors, and distance (magnetic fields grow weaker as the distance from the source increases).

Magnetic fields can be static, i.e., unchanging in direction (caused by direct current [DC]) or changing in direction (caused by alternating current [AC]). Some electrical devices operate on a DC system while others operate on an AC system. The magnetic field from AC sources (such as typical overhead electrical transmission lines) differ from DC fields (like the Earth) because the field is due to ACs and changes direction at a rate of 60 cycles per second or 60 Hz in the United States and certain other countries.

The characteristics of magnetic fields can differ depending on the field source. A magnetic field near an appliance decreases rapidly with distance away from the device. The magnetic field also decreases with distance away from line sources, such as power lines. Electric transmission line magnetic fields attenuate at a rate that is inversely proportional to the distance squared, whereas magnetic fields from appliances attenuate at a rate proportional to the distance cubed. For electric transmission lines, magnetic and electric field levels are highest next to the transmission lines (typically near the center of the electric transmission line right-of-way) and decrease as the distance from the transmission right-of-way or corridor increases.

Electric fields are created by the voltage present in an electrical system; the higher the voltage, the stronger the electric field. Electric fields start and stop on electric charges therefore, barriers in the path of an electric field, will stop on charges of object resulting in a blockage of the charge. Obstructions such as row of trees, a building, or earth will act to shield or block electric fields. Since the Project transmission cables will both shielded and buried, the magnitudes of the electric field levels are assumed to be inconsequential or zero and are not further presented.

Conversely, magnetic fields are produced by the current flowing in an electrical system; the higher the current, the stronger the magnetic field. Magnetic fields cannot be shielded very much by most objects. They are not affected or blocked by the barriers that affect or block electric fields, Therefore, magnetic field lines do not stop on anything as they form continuous loops around the conductors carrying the current. CHPEI has calculated magnetic field impacts for both the underwater and underground HVDC transmission cables (Appendix H).

4.13.1.1 Electric and Magnetic Field Standards

Review of electric and magnetic field standards did not identify any Federal standards regarding limiting residential or occupational exposure to DC or low frequency (60 Hz) magnetic or electric fields. New York State standards were reviewed for both magnetic and electric field standards as well.

Applicable New York State magnetic and electric field standards are summarized below:

- The maximum magnetic field at the edge of a right-of-way for a major overhead transmission line is 200 mG, as set forth in the *Statement of Interim Policy on Magnetic Fields of Major Transmission Facilities*, issued and effective September 11, 1990. The interim policy established a magnetic field strength interim standard of 200 milligauss (mG), measured at one meter above grade, at the edge of the right-of-way, at the point of lowest conductor sag.

- The maximum electric field at the edge of a right-of-way for a major transmission line is 1.6 kV/m, as set forth in PSC Opinion 78-13, dated June 19, 1978. The opinion established an electric field strength interim standard of 1.6 kilovolts per meter (kV/m) for electric transmission lines, at the edge of the right-of-way, one meter above ground level, with the line at the rated voltage.

4.13.1.2 Potential Impacts and Mitigation

A computer model, C3CORONA, Version 3, the corona and field effects software program developed by the Bonneville Power Administration and the USDOE, was used to calculate magnetic fields at five locations. As described in Appendix H all field calculations were performed and compared to results with transmission line standards/guidelines for magnetic fields in New York State. Magnetic field levels were calculated at each of the five locations, at 5-foot increments along the 100-foot profile centered on the cable configuration, from a point -50 feet east of the cables to point +50 feet west of the cables. For each location, the levels were calculated at a height of 1 meter above ground and 1 meter above the surface of the water in waterways (Table 5 in Appendix H).

Results indicated that the Project**,** as described above will satisfy the requirements necessary to meet the *Statement of Interim Policy on Magnetic Fields of Major Transmission Facilities* which states that protective standards for the sea floor is 439 mG and that the human health exposure guideline is 833 mG. Calculations demonstrated that all field levels evaluated for the furthest locations on the profile will be less than 200 mG, and meet the protective requirements of New York State (Table 4 in Appendix H). This value is well below the maximum magnetic field allowable and is substantially well below the guideline for human health as well as for the seafloor, therefore no adverse EMF effects are anticipated along the Project’s underwater or underground transmission routes at the right-of-way edges. All magnetic field levels calculated are less than the Earth's magnetic field over North America which is in the range of 470 to 590 (DC) mG (Table 2 in Appendix H).

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