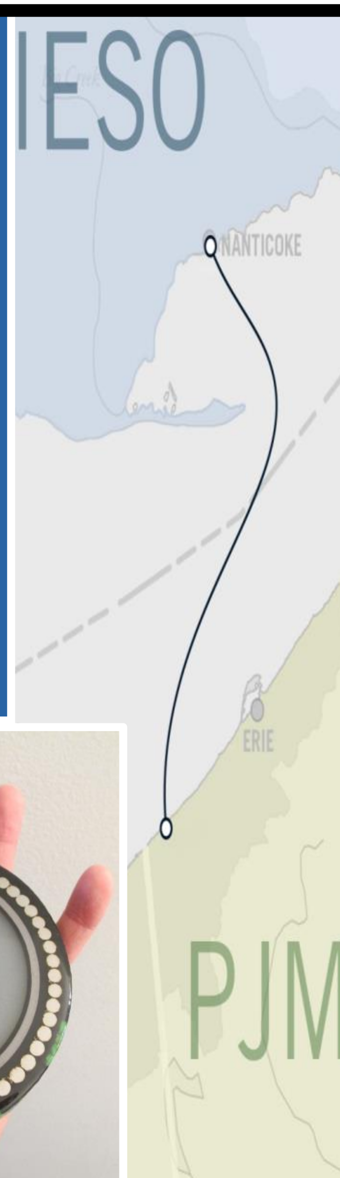
ATTACHMENT 3

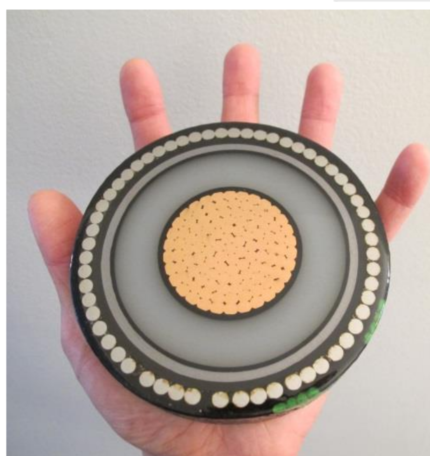
Lake Erie Connector – Environmental Assessment

Lake Erie Connector Project

Environmental Assessment

January 2016





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LAKE ERIE CONNECTOR PROJECT
ENVIRONMENTAL ASSESSMENT

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1.0 INTRODUCTION

ITC Lake Erie Connector LLC (the Applicant) is proposing to construct and operate the Lake Erie Connector Project (Lake Erie Connector or the Project), an approximately 72.4-mile (116.5 km), 1,000-megawatt (MW), +/-320-kilovolt (kV), high-voltage direct current (HVDC), bi-directional electric transmission interconnection to transfer electricity between Canada and the United States (U.S.). For purposes of permits being issued in the U.S., the Project consists of an approximately 42.5-mile (68.4 km) HVDC transmission line that would be buried in the lakebed of Lake Erie from the U.S.- Canada border and be installed underground in Pennsylvania to a new converter station, called the Erie Converter Station, as well as approximately 2,082 ft (635 m) of underground 345-kV, alternating current (AC) cable between the Erie Converter Station and the nearby existing Penelec Erie West Substation. The Erie Converter Station will include equipment to change the AC of the existing aboveground transmission network to the direct current (DC) transmitted by the proposed Project, and vice versa. HVDC technology is used for the Project because it has many advantages over AC technology for long-distance power transmission. These advantages include the ability to control power flow and lower transmission losses.

This Applicant-Prepared Environmental Assessment (EA) provides details about the portion of the Project located in the U.S., an identification and evaluation of potential alternatives, and an analysis of the Project's potential effects on existing environmental resources.

The HVDC transmission line consists of two transmission cables, one positively charged and the other negatively charged, along with a fiber optic cable for communications between the converter stations located in Ontario, Canada, and Erie County, Pennsylvania. The majority of the on-land U.S. cable route uses existing roadway right-of-way (ROWs) to minimize impacts and additional land disturbance. The cable system will be buried on land using conventional open trenching methods, with trenchless techniques used in situations where conventional trenching is less appropriate because of the potential for adverse environmental impacts or other constraints. The interconnection to the existing PJM grid[1] will be by a 345-kV, AC, underground transmission line connecting the Erie Convertor Station to the existing Penelec Erie West Substation.

Section 2 of this EA provides an overall description of the Project's U.S. components. Section 3 discusses the alternatives considered when developing the Project concept and design, including alternatives relating to the selection of the converter station site and the transmission line route evaluation and selection processes.

Section 4 provides a characterization of the existing conditions for the following resource areas within the proposed Project area: water use and land use; geology and soils; water resources and quality; aquatic habitat and species; terrestrial habitat and species; protected and sensitive species; cultural resources; aesthetic and visual resources; climate, air quality and noise; public health and safety; infrastructure; and hazardous materials and waste; socioeconomics; and

[1] PJM Interconnection is the regional transmission organization that coordinates electricity movement in 13 U.S. states and the District of Columbia.

environmental justice.

Section 5 addresses potential adverse impacts from construction and operation of the Project for the above-listed resource areas. Land-based Project elements include the landfall site and the underground, on-land cable route, as well as proposed activities at the Erie Converter Station site and the underground AC transmission line connecting the Erie Convertor Station to the existing Penelec Erie West Substation. Within the lake, cable installation represents the greatest potential for adverse impacts to natural resources. Potential adverse effects during installation and operation will be limited to any disturbance needed for construction, maintenance, and repair activities; such disturbances are not expected to be significant, and in all cases, only small, localized and temporary effects would be anticipated, with the natural environment quickly returning to its existing conditions. For the underground portion of the Project, the predominant use of existing roadway ROWs for cable installation, in conjunction with the construction methods selected, has reduced significantly the potential for environmental impact. Other than the Erie Converter Station, no structures will be built aboveground.

Section 6 discusses potential cumulative effects in relation to other proposed or planned development actions that are currently under consideration within the Project area and general region. The Project will not create impacts or use resources that would influence the viability of any of these other development plans.

1.1 Purpose and Need

1.1.1 Project Purpose

The purpose of the Project is to develop a controllable HVDC submarine and underground bi-directional merchant transmission facility that will interconnect the Independent Electricity System Operator (IESO) market in Ontario to the PJM market in the U.S. to facilitate the transfer of electricity, improve availability, and diversify electric energy supply portfolios for both markets.

1.1.2 Project Need

The Project provides a new pathway for power transfers between the IESO and PJM grids. The Project will enhance power system reliability while providing improved access to markets and could be utilized to support energy and environmental policy goals. In addition, the Project will provide substantial public benefits of the types referenced in 25 Pa.Code §105.16. This includes enabling the development of energy resources by providing the ability to tap into clean energy generation in Canada to help support electric demand in Pennsylvania and more broadly in PJM makeup capacity lost as a result of coal and other fossil fuel plant retirements in the U.S., the creation or preservation of employment during construction and operation of the Project, provision of public utility services by improving the availability of the electric grid (PJM and IESO) and provision of economic benefits in Pennsylvania including tax revenues over the course of the Project's lifetime and the creation of construction and operations jobs.

1.1.2.1 Power System Reliability Benefits

By increasing transfer capability between Ontario and PJM and establishing a direct controlled intertie between the IESO and PJM wholesale electricity markets, the Project will augment power system availability in the Eastern Interconnection. The Project will provide a source of energy supply during all hours of operation. This new access to energy supply sources could help system operators at PJM and IESO avoid emergency control actions (e.g., voltage adjustments, shedding load) that would otherwise be needed to maintain the stability of their respective power systems when the systems are stressed and/or under very tight supply.

HVDC transmission with voltage source converter (VSC) technology to be used in the Project allows for immediate and automatic control of voltage through reactive power adjustment at the point of interconnection. Reactive power is critical to the reliable operation of power systems. From an operational perspective, having adequate reactive capability in appropriate locations on the grid is essential to mitigating potential for voltage concerns, including voltage collapse that can lead to a regional or system-wide blackout.

HVDC transmission lines also can help to maintain the scheduled flow of energy independent of conditions on the connecting power systems. There are times during a system disturbance when the continued flow of energy may be essential to maintain stability, and the Project will provide this capability. By facilitating the exchange of energy between the power systems, the Project will provide operational and planning flexibility.

1.1.2.2 Market Efficiency Benefits

The wholesale electricity markets in Ontario and PJM operate to facilitate competitive wholesale power markets by providing clear price signals regarding the relative value of energy.

Because no direct connection between Ontario and PJM presently exists, transacting between these two electricity markets has been inefficient. Exporting energy from Ontario to PJM requires energy to either travel around the east side of Lake Erie through New York (through the New York Independent System Operator (NYISO) wholesale electricity market) into PJM or around the west side of the lake through the Midwest U.S. (through the MISO wholesale electricity market) into PJM. Either of these routes can result in power system congestion, as well as additional costs associated with transacting through these other markets before accessing PJM. Similar challenges are associated with transmitting energy from PJM to Ontario. The integration of the Project into the IESO and PJM wholesale electricity markets will improve market efficiency by enabling direct energy transactions.

1.1.2.3 Environmental Benefits

The Project may assist with meeting Renewable Portfolio Standards (RPS) in PJM states. PJM has recently estimated that PJM states would need approximately 22,000 MW of wind generation and 7,000 MW of solar generation to meet existing RPS needs by 2020, which is around three times as high as the current levels of renewable generation in PJM.[2] As a result, considering Ontario's generation supply mix, the Project provides the potential for exports of energy, capacity, and/or Renewable Energy Credits (RECs) that could be used to meet applicable RPS in

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[2] See *Introduction to the PJM Renewable Integration Study* (March 2014) at https://www.pjm.com/committees-and-groups/subcommittees/irs/pris.aspx

PJM states.

Moreover, the Environmental Protection Agency's proposed Clean Power Plan (CPP) will require reductions in carbon emissions from existing fossil fuel generation, beginning in 2022. The CPP was adopted by EPA as final rulemaking in October 2015. Under the CPP, States are required to develop and submit implementation plans for achieving carbon emission reductions from the power generation sector. Under those implementation plans, retirements of fossil fuel generation (particularly coal-fired generation) are likely.[3] The Project could make an important contribution to replacing that generation[4].

[3] *See* the March 2, 2015 "PJM Economic Analysis of the USEPA Clean Power Plan" for a discussion of capacity at risk of retirement.

[4] Additional pending regulatory proposals, if adopted, would cause retirement of significant coal fired generation in Pennsylvania and other parts of PJM much sooner than the CPP. EPA's December 3, 2015 proposed amendment to the Cross-States Air Pollution Rule (CSAPR) proposes major reductions in the NOx allowances for emissions during the summer ozone season starting in 2017. The EPA proposal would impose a 74% reduction for Pennsylvania NOx emissions, which would result in a significant curtailment of coal plant generation, particularly during summer peak electric demand periods.

2.0 PROJECT DESCRIPTION

This section provides a description of the facilities associated with the Project and the proposed construction or installation techniques. The Project has three distinct components: the converter stations, the underground cable systems, and the underwater cable systems, each of which is described below.

2.1 General Project Description

For purposes of permits being issued in the U.S., the Project consists of an approximately 42.5-mile, 1,000-MW, +/-320-kV, HVDC, bi-directional electric transmission interconnection to transfer electricity from the U.S.-Canada border, as well as approximately 2,082 ft of underground, 345 kV, AC cable between the proposed Erie Converter Station and the nearby existing Penelec Erie West Substation (Figure 2.1-1).

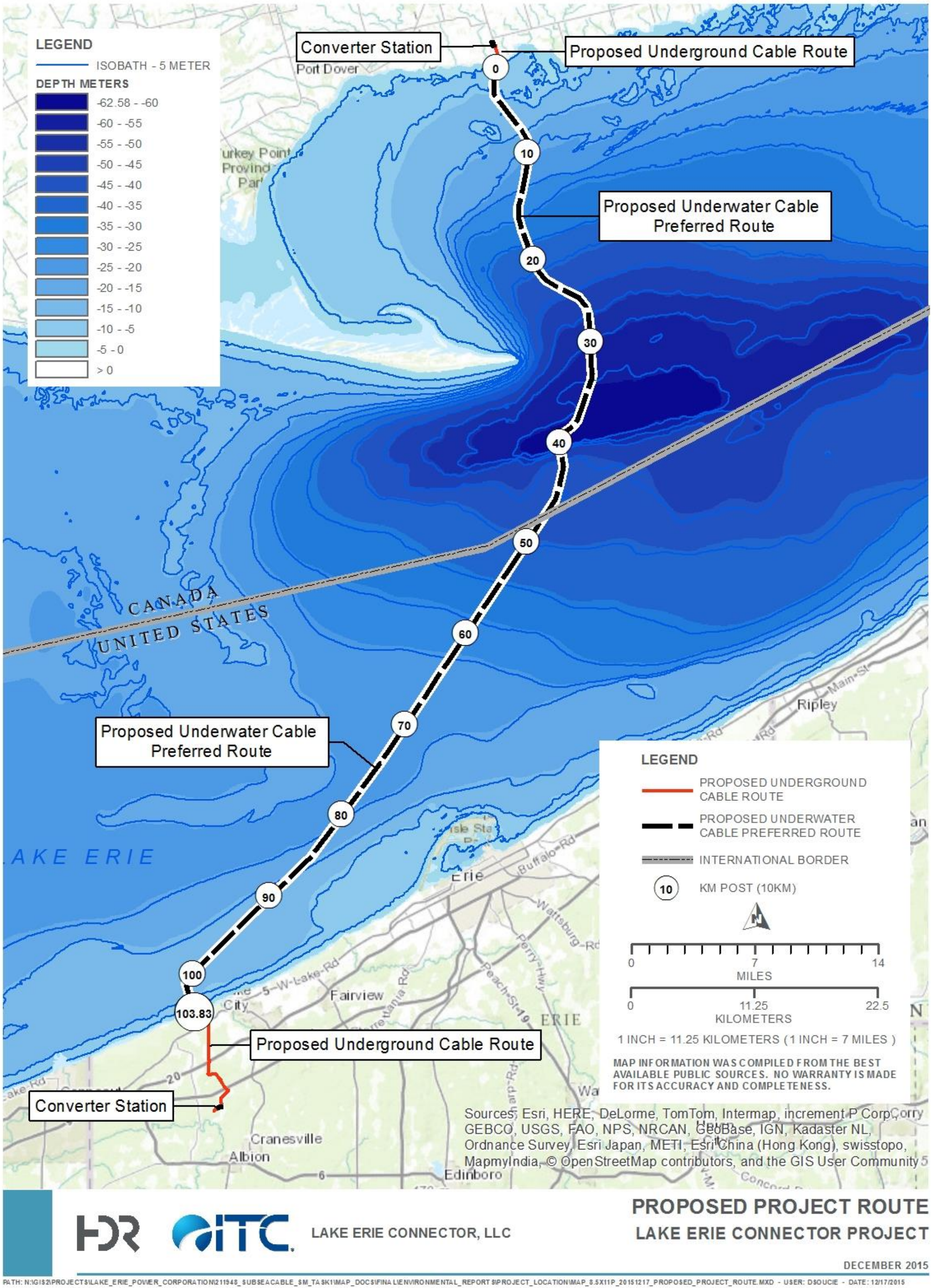
An HVDC electric power transmission system uses direct current (DC) for the bulk transmission of electrical power, in contrast with more common alternating current (AC) systems. For underwater cable projects, either high voltage AC (HVAC) or high voltage DC (HVDC) transmission is possible, each with its advantages and disadvantages, which are heavily dependent on the route length, voltage, and transmission capacity. The main advantage of HVDC transmission over HVAC is the ability to control power flow and lower transmission line losses. In addition, an HVAC cable system needs three cables to convey the electricity (not counting a separate communications line to facilitate control), whereas an HVDC cable system only needs two electric transmission cables. When connecting two different electrical systems, HVDC is typically selected as it is asynchronous and can adapt to almost any rated voltage and frequency.

In the U.S., the Project would consist of one 1,000-MW HVDC transmission line and an HVDC converter station with ancillary aboveground facilities. In Canada, the Lake Erie Connector facilities include another HVDC converter station (the Haldimand Converter Station), which would be located near a Point of Interconnection (POI) at the existing Nanticoke TS switchyard in Haldimand County near the Hamlet of Nanticoke, Ontario. The Haldimand Converter Station lies within part of the Ontario Independent Electricity System Operator (IESO) grid and would convert 500-kV AC power to +/- 320-kV DC power or vice-versa. The Haldimand Converter Station would connect to the IESO grid at a POI 0.8 mi. (1.3 km) away, at the existing Nanticoke TS switchyard in the Hamlet of Nanticoke.

The HVDC transmission line consists of two transmission cables, one positively charged and the other negatively charged, along with a fiber optic cable for communications between the converter stations. In the U.S., the transmission line elements of the Project consist of:

- HVDC underwater (from the U.S./Canada border to landfall in Erie County) - 35.4 mi (57.0 km);
- HVDC underground (from landfall to the Erie Converter Station) - 7.1 mi (11.4 km); and
- HVAC underground (from Erie Converter Station to Erie West Substation) - 2,082 ft (635 m).

Figure 2.1-1 Proposed Project route.



The cables would make landfall in Springfield Township in Erie County, Pennsylvania, and in the landward segment would be installed primarily along existing roadways to a new HVDC converter station (Erie Converter Station) to be constructed in Conneaut Township in Erie County, Pennsylvania. The Erie Converter Station would convert +/- 320-kV DC power to 345 kV AC power or vice-versa and connect to a nearby POI at the existing Penelec Erie West Substation that is part of the PJM grid. The 345 kV AC underground cables between the Erie Converter Station and the nearby Erie West Substation would be approximately 2,082 ft (635 m) in length.

The U.S. portion of the Project, including the Erie Converter Station facility, underground cable system, and underwater cable system are further described in the following sections, along with general information about installation methods for each component of the U.S. portion of the Project.

2.2 Erie Converter Station Description

2.2.1 General Facility Location and Description, Erie Converter Station

The proposed Erie Converter Station site location and layout is shown in Figure 2.2-1. The selected location and layout of the Erie Converter Station is intended to be close to the existing Penelec Erie West Substation, avoid wetland effects, and minimize other environmental and community effects.

An area of approximately six acres (2.4 hectares) is required for the Erie Converter Station with its surrounding equipment and access ways. In addition to the permanent area occupied by the Erie Converter Station facilities, additional area will be occupied by related construction period and post-construction stormwater management facilities. Additional area will be temporarily disturbed during construction for material laydown and staging and to support construction efforts. The total disturbed area associated with the Erie Converter Station site is approximately 21.4 acres (8.7 hectares). The Erie Converter Station would have a main building, which would house HVDC converter modules; a service building to contain the control and protection equipment, cooling equipment, and auxiliary distribution panels; and a storage building. The HVDC converter modules will convert the AC power to DC power using Voltage Source Converter (VSC) technology which utilizes Insulated Gate Bipolar Transistors (IGBTs). The main building (converter hall) would be approximately 370 ft by 110 ft (110 m by 35 m) with a building footprint of 1 acre (0.4 hectares) and a height of approximately 60 ft (18 m) (Figure 2.2-2). The indoor design of the HVDC converter modules would reduce audible sound and protect the equipment from exposure. The primary equipment installed outside of the buildings is anticipated to include circuit breakers, disconnects, surge arrestors, transformers, cooling equipment, and metering units. The facility will also have an emergency generator. Security fencing will prevent unauthorized access and provide for public safety.

A driveway will provide access to the site from nearby roadways. The driveway would be approximately 20 ft (6.1 m) wide, with an approximate maximum 3-ft (0.9 m) shoulder. Culverts will be installed to maintain appropriate conveyance of stormwater flows without adverse impact to upstream or downstream properties.

The Erie Converter Station will interconnect with the existing electrical power systems at the nearby existing Penelec Erie West Substation POI (Figure 2.2-3) through underground AC cables (discussed further in Section 2.3).

Figure 2.2-1 Preliminary Erie Converter Station site location and layout.

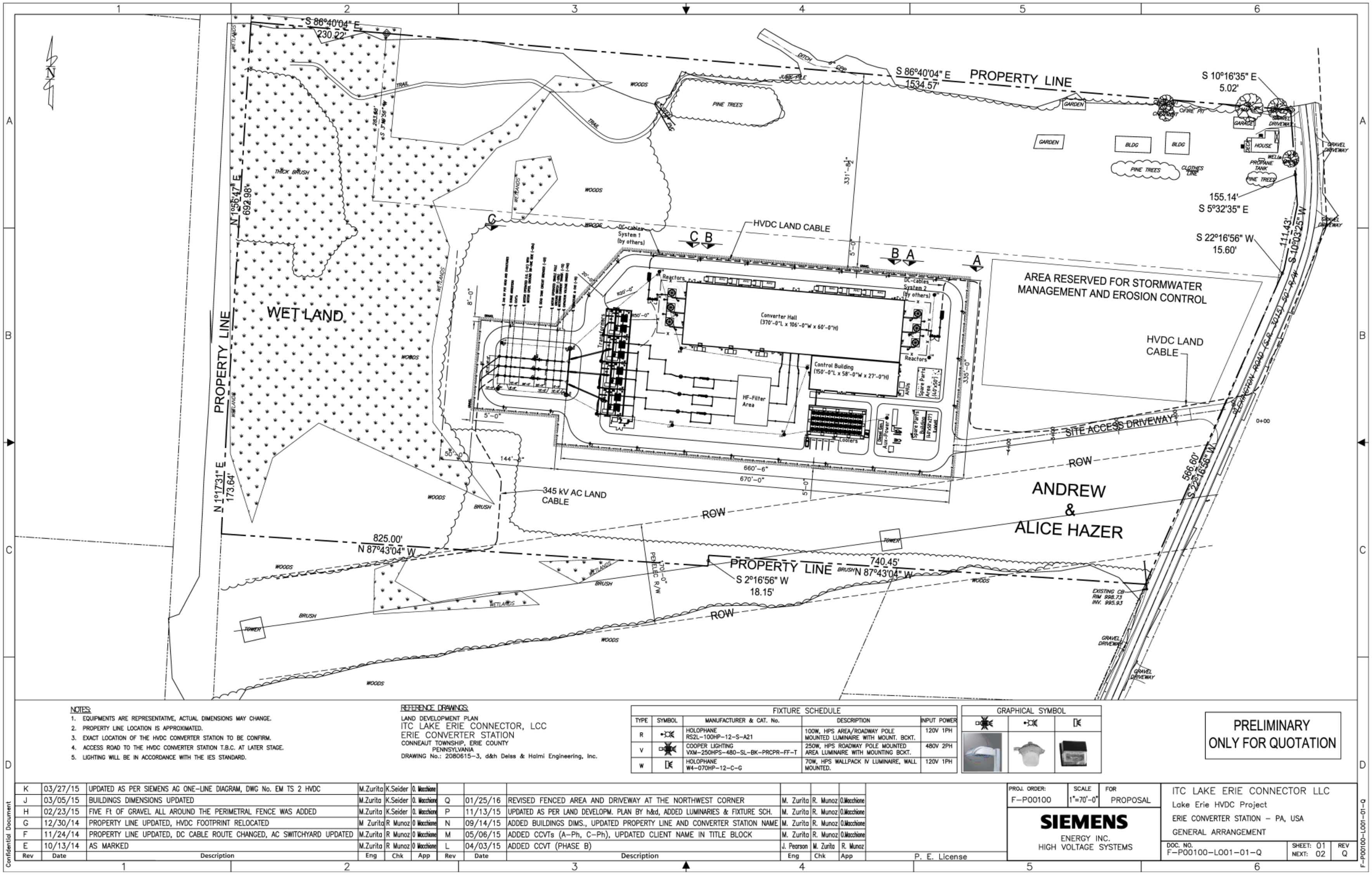
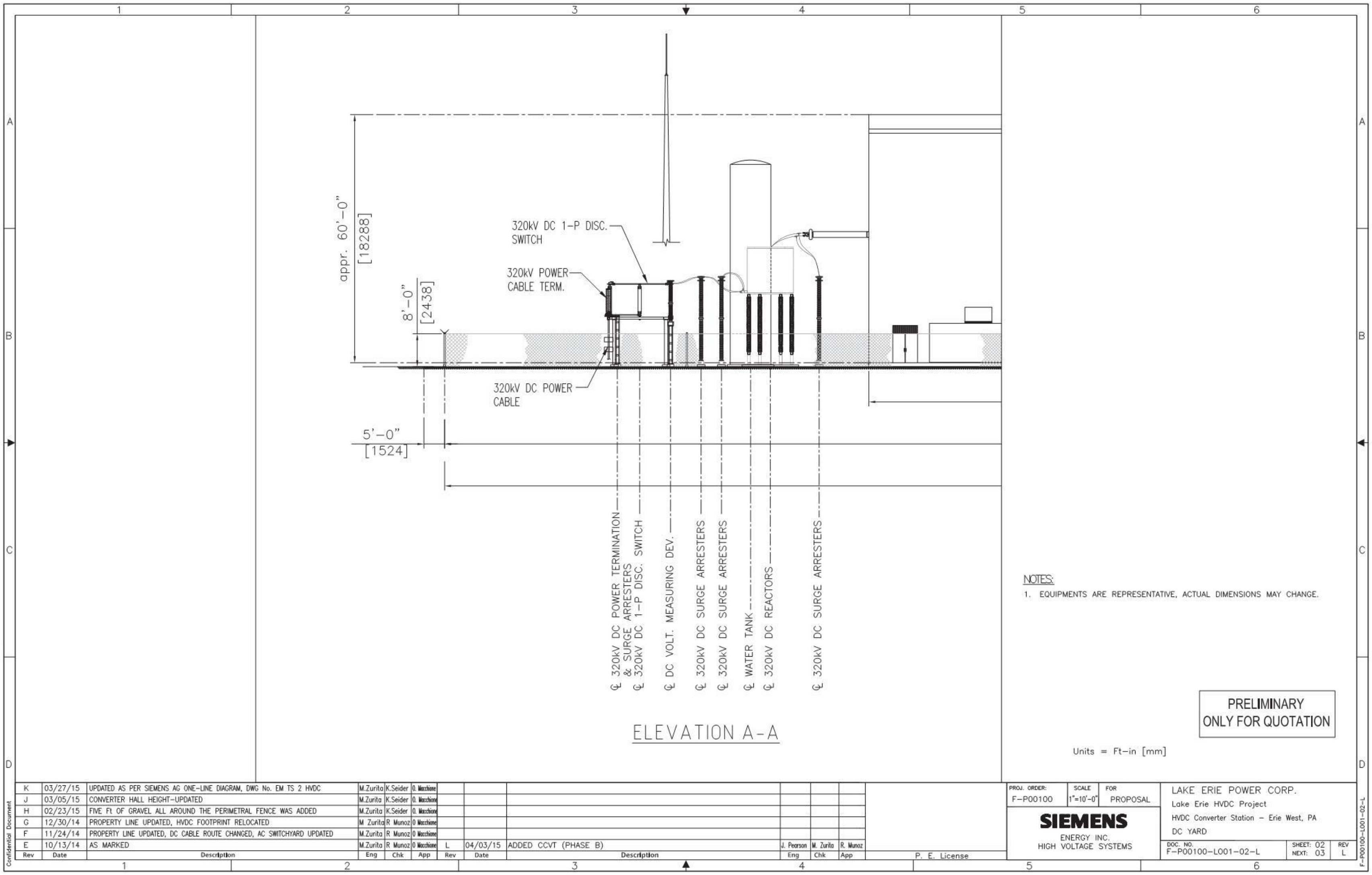


Figure 2.2-2 Converter site representative figure (SHEET 1 of 3).



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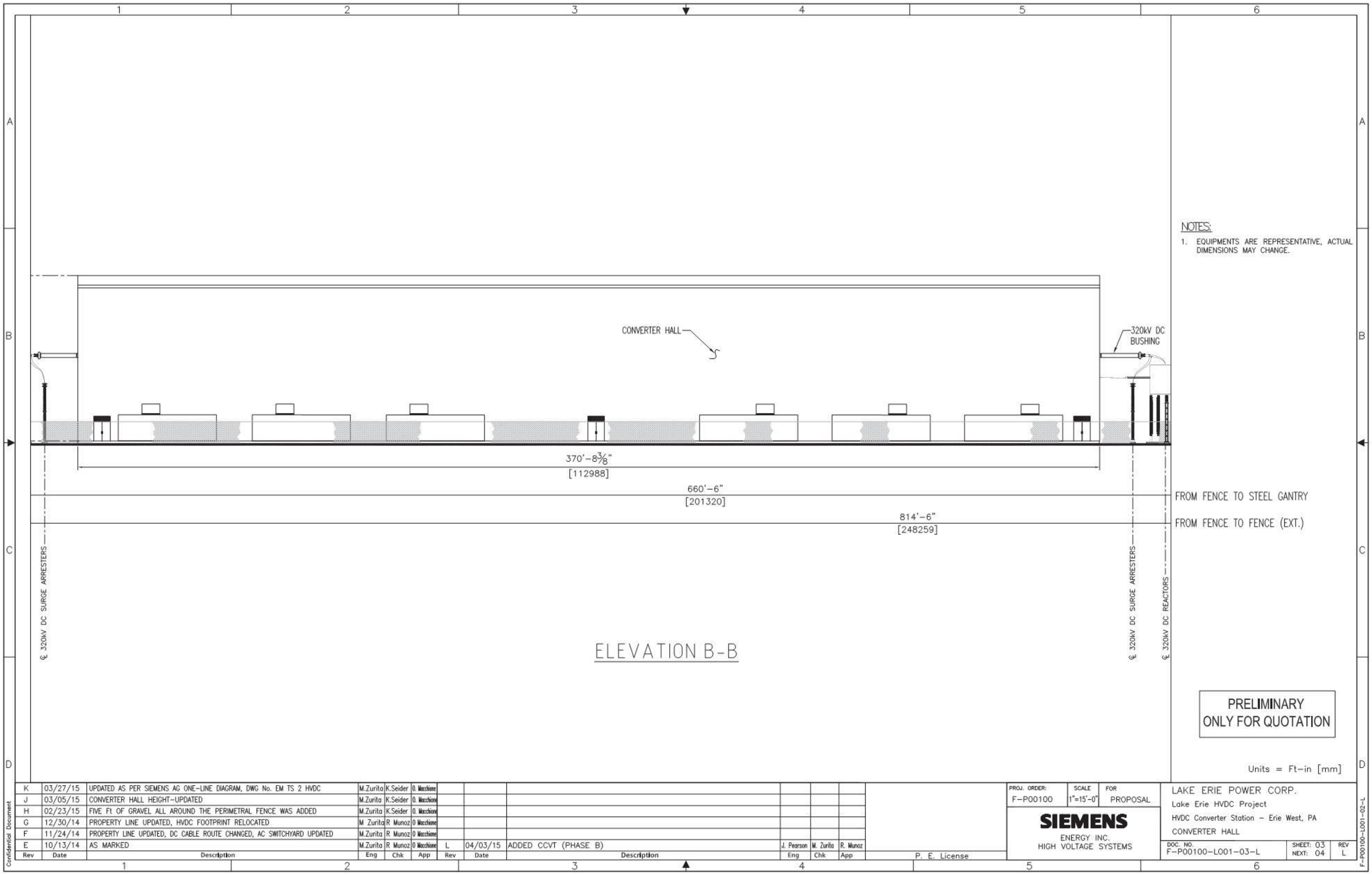
NOTES:
1. EQUIPMENTS ARE REPRESENTATIVE, ACTUAL DIMENSIONS MAY CHANGE.
CONVERTER HALL
320kV DC BUSHING
370'-8 3/8"
[112988]
660'-6"
[201320]
FROM FENCE TO STEEL GANTRY
814'-6"
[248259]
FROM FENCE TO FENCE (EXT.)
℄ 320kV DC SURGE ARRESTERS
℄ 320kV DC SURGE ARRESTERS
℄ 320kV DC REACTORS
ELEVATION B-B
PRELIMINARY
ONLY FOR QUOTATION
Units = Ft-in [mm]
K 03/27/15 UPDATED AS PER SIEMENS AG ONE-LINE DIAGRAM, DWG No. EM TS 2 HVDC M.Zurita K.Seider O. Macchione
J 03/05/15 CONVERTER HALL HEIGHT-UPDATED M.Zurita K.Seider O. Macchione
H 02/23/15 FIVE Ft OF GRAVEL ALL AROUND THE PERIMETRAL FENCE WAS ADDED M.Zurita K.Seider O. Macchione
G 12/30/14 PROPERTY LINE UPDATED, HVDC FOOTPRINT RELOCATED M Zurita R Munoz O Macchione
F 11/24/14 PROPERTY LINE UPDATED, DC CABLE ROUTE CHANGED, AC SWITCHYARD UPDATED M.Zurita R Munoz O Macchione
E 10/13/14 AS MARKED M.Zurita R Munoz O Macchione
L 04/03/15 ADDED CCVT (PHASE B) J. Pearson M. Zurita R. Munoz
Rev Date Description Eng Chk App
Confidential Document
P. E. License
PROJ. ORDER: F-P00100
SCALE 1"=15'-0"
FOR PROPOSAL
SIEMENS
ENERGY INC.
HIGH VOLTAGE SYSTEMS
LAKE ERIE POWER CORP.
Lake Erie HVDC Project
HVDC Converter Station – Erie West, PA
CONVERTER HALL
DOC. NO. F-P00100-L001-03-L
SHEET: 03 NEXT: 04
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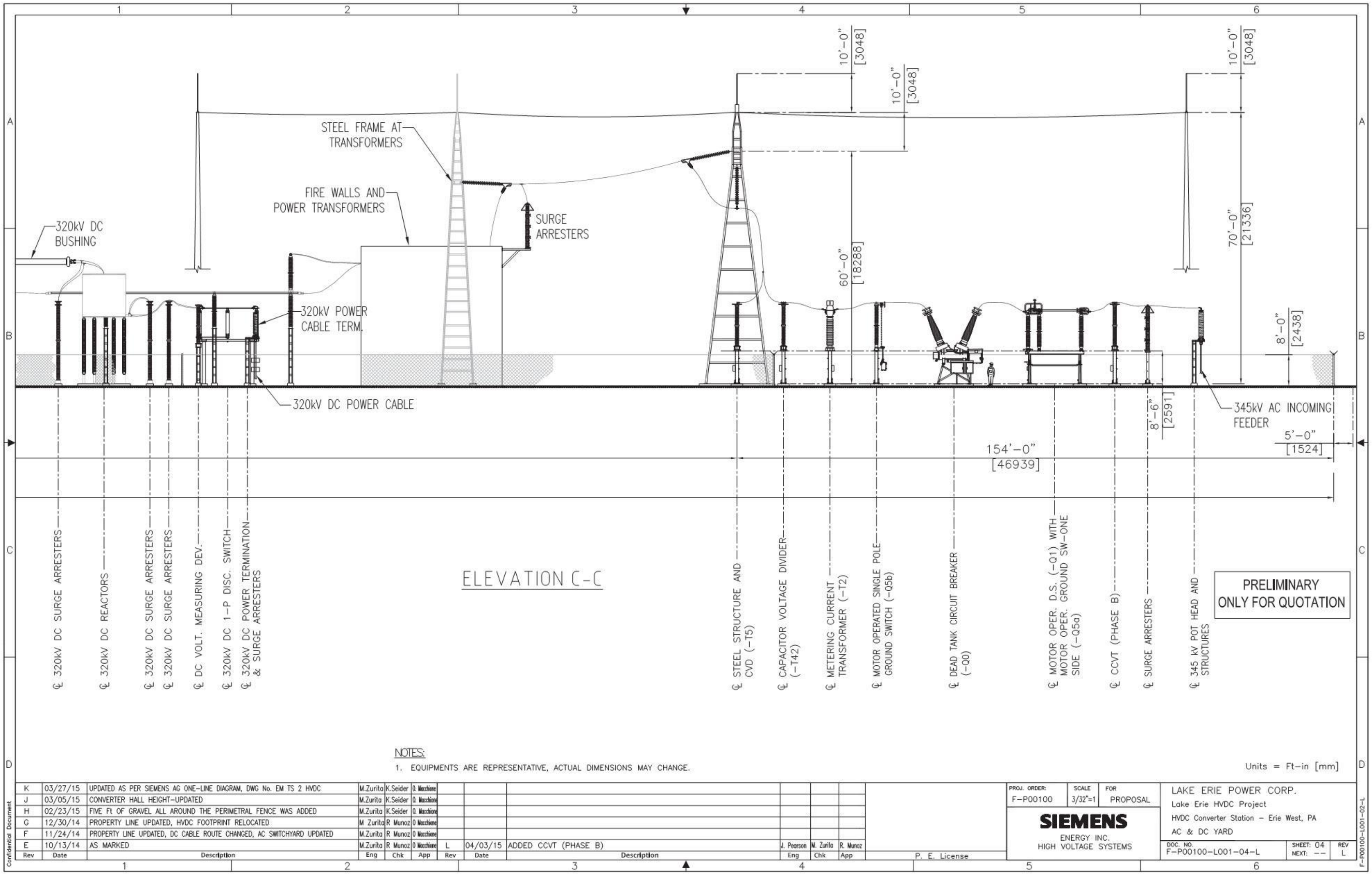
F-P00100-L001-02-L

(SHEET 3 OF 3)



STEEL FRAME AT TRANSFORMERS
FIRE WALLS AND POWER TRANSFORMERS
SURGE ARRESTERS
320kV DC BUSHING
320kV POWER CABLE TERM.
320kV DC POWER CABLE
345kV AC INCOMING FEEDER
10'-0" [3048]
60'-0" [18288]
70'-0" [21336]
8'-0" [2438]
8'-6" [2591]
5'-0" [1524]
154'-0" [46939]
ELEVATION C-C
320kV DC SURGE ARRESTERS
320kV DC REACTORS
320kV DC SURGE ARRESTERS
320kV DC SURGE ARRESTERS
DC VOLT. MEASURING DEV.
320kV DC 1-P DISC. SWITCH
320kV DC POWER TERMINATION & SURGE ARRESTERS
STEEL STRUCTURE AND CVD (-T5)
CAPACITOR VOLTAGE DIVIDER (-T42)
METERING CURRENT TRANSFORMER (-T2)
MOTOR OPERATED SINGLE POLE GROUND SWITCH (-Q5b)
DEAD TANK CIRCUIT BREAKER (-Q0)
MOTOR OPER. D.S. (-Q1) WITH MOTOR OPER. GROUND SW-ONE SIDE (-Q5a)
CCVT (PHASE B)
SURGE ARRESTERS
345 kV POT HEAD AND STRUCTURES
PRELIMINARY ONLY FOR QUOTATION
NOTES:
1. EQUIPMENTS ARE REPRESENTATIVE, ACTUAL DIMENSIONS MAY CHANGE.
Units = Ft-in [mm]
K 03/27/15 UPDATED AS PER SIEMENS AG ONE-LINE DIAGRAM, DWG No. EM TS 2 HVDC M.Zurita K.Seider O. Macchione
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L 04/03/15 ADDED CCVT (PHASE B) J. Pearson M. Zurita R. Munoz
Rev Date Description Eng Chk App
P. E. License
PROJ. ORDER: F-P00100
SCALE 3/32"=1
FOR PROPOSAL
SIEMENS
ENERGY INC.
HIGH VOLTAGE SYSTEMS
LAKE ERIE POWER CORP.
Lake Erie HVDC Project
HVDC Converter Station - Erie West, PA
AC & DC YARD
DOC. NO. F-P00100-L001-04-L
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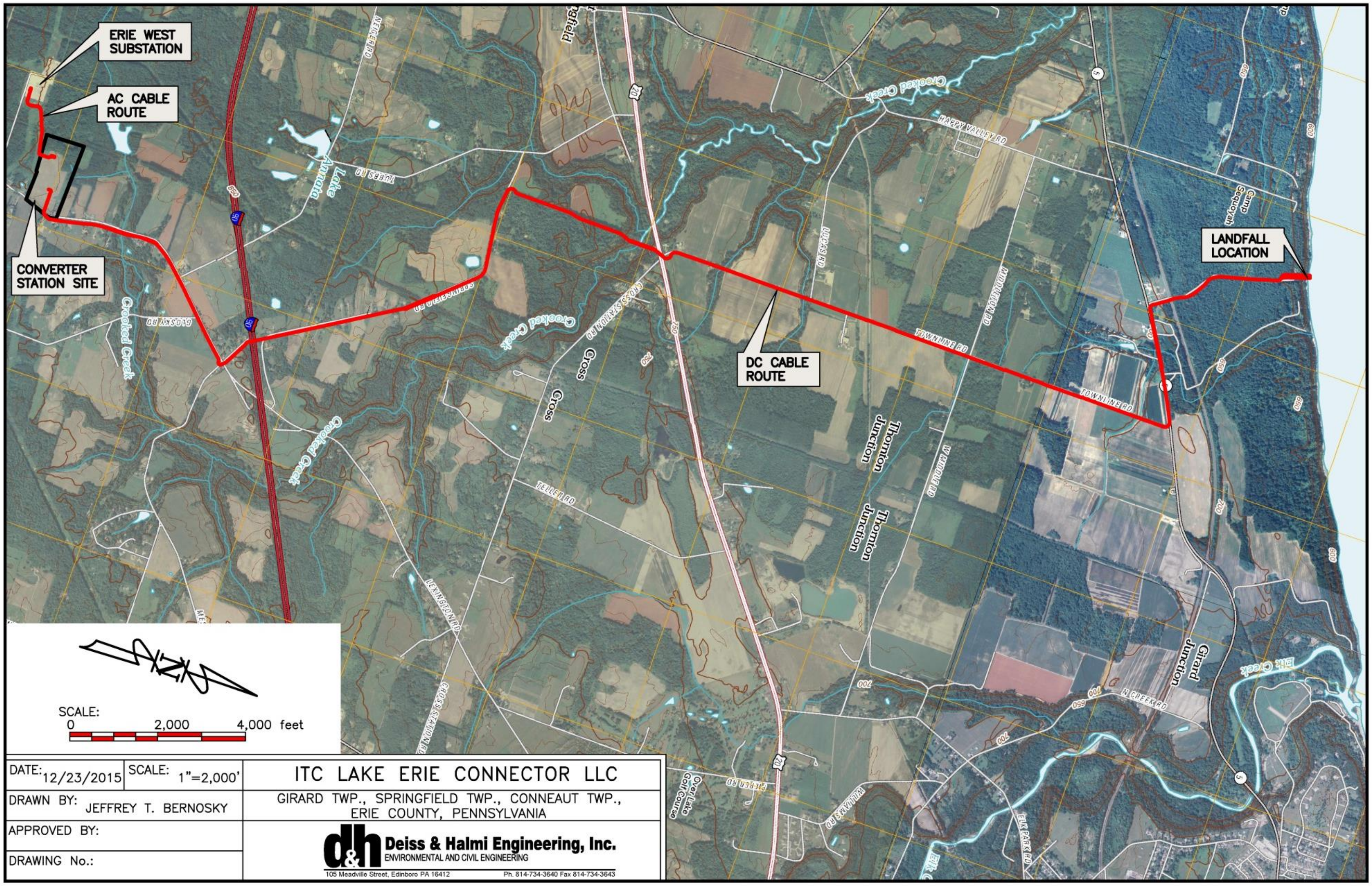
Confidential Document

Figure 2.2-3 Underground Project routing.



2.2.2 Construction Methods, Erie Converter Station

This section describes site preparation and general construction methods for the Erie Converter Station.

Erosion and sedimentation control measures will be installed and construction-phase stormwater management best practices will be implemented in accordance with erosion and sedimentation control plans and a National Pollutant Discharge Elimination System (NPDES) stormwater permit approved by the Erie County Conservation District and the Pennsylvania Department of Environmental Protection (PADEP), and grubbing and clearing of wooded construction areas will commence. The Erie Converter Station site will be prepared for staging and laydown activities early in the construction process. Two access roadways will be completed to facilitate equipment deliveries and construction worker movement and parking areas.

When site preparation is completed, the foundations and building construction will commence. Site fencing will be installed to limit access to only construction personnel. The Erie Converter Station will contain buildings, structures, and electrical equipment to be installed on concrete slabs or a gravel base. Construction will include 12 to 18 months of site work and equipment installation, followed by 4 to 6 months of testing and commissioning work inside the Erie Converter Station buildings.

The AC interconnections with the existing Penelec Erie West Substation will be completed prior to commissioning and testing of the Erie Converter Station.

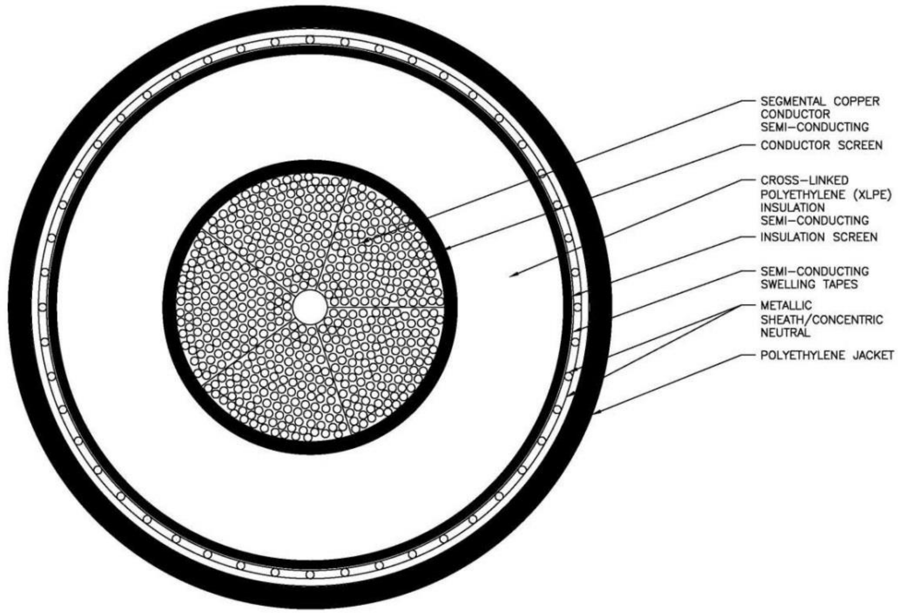
2.3 Underground Cable Description

2.3.1 General Facility Location and Description, Underground Cable

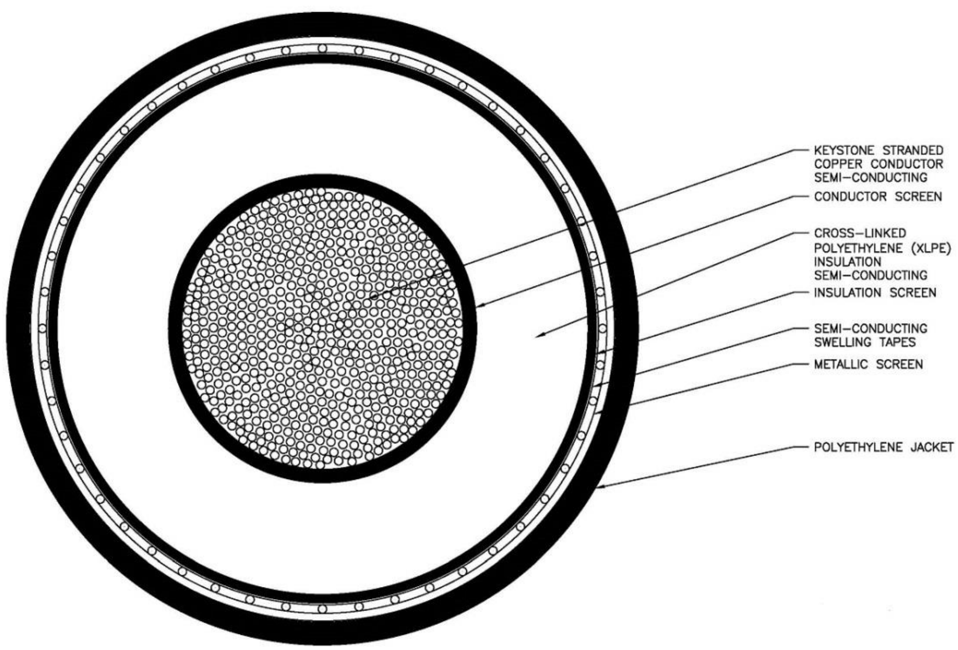
The underground cable section (Underground Segment) involves that portion of the HVDC line that is not buried in the lakebed of Lake Erie as well as the underground AC cables that will connect the Erie Convertor Station to the existing Penelec Erie West Substation. The underground HVDC transmission line will consist of two high-voltage cables, along with a fiber optic communications cable, all of which will be underground. The underground cable route will extend approximately 7.1 miles (11.4 km) from the proposed Erie Converter Station site in Erie County to the Lake Erie landfall, which is located on a private property located west of Erie Bluffs State Park. The Applicant holds a purchase option agreement with respect to property of the proposed landfall location. The majority of the proposed transmission cable route follows existing road ROWs in order to minimize environmental disturbance. Plans of the proposed underground segment are included in Appendix A.

The underground HVDC transmission cables will be constructed with a central copper conductor insulated with extruded solid dielectric polymer rated at +/- 320-kV HVDC. The diameter of each underground HVDC transmission cable is approximately 5 inches (130 mm) and weighs approximately 22 pounds per ft (lb/ft) (33.4 kilograms/meter [kg/m]) (see Figure 2.3-1).

Figure 2.3-1 Typical AC (top) and HVDC (bottom) transmission cable cross sections.



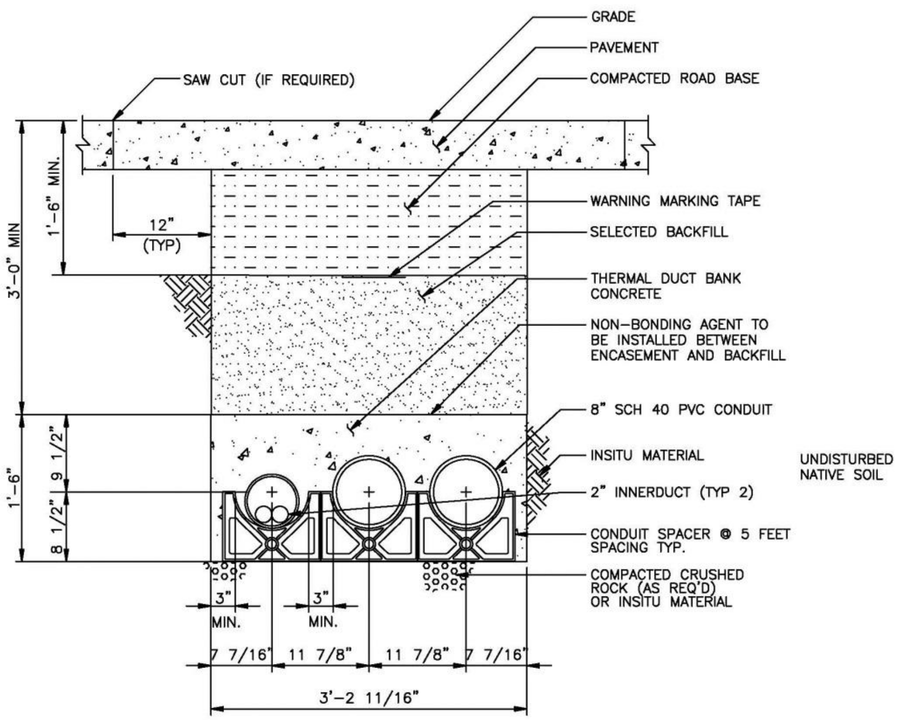
DETAIL A
345KV WEST ERIE INTERCONNECTION
SCALE: NTS



DETAIL D
± 320KV DC 2500 SQ MM LAND CABLE
SCALE: NTS

For the underground portions of the HVDC transmission line route, the two cables within the transmission system would typically be installed along with a fiber optic cable in a concrete-encased PVC conduit duct bank with a minimum 3 ft (0.9 m) of cover. In selected areas, low thermal resistivity material, such as well-graded sand, stone dust, or fluidized thermal backfill (controlled density low strength concrete) may be used to encase the PVC conduit. A marker tape would then be placed 1 ft to 2 ft (0.3 m to 0.6 m) above the cables in the trench. The top 1 ft to 2 ft (0.3 m to 0.6 m) of the trench will be backfilled to match the surrounding area. A representative cross section of a typical duct bank is provided in Figure 2.3-2.

Figure 2.3-2 Typical duct bank cross section.



Note: Figure is representative.

Where the duct bank cannot be installed by trenching, such as significant water crossings, railroad crossings, and certain highway crossings, the transmission line conduits will be installed by horizontal directional drill (HDD) or cased auger boring (Jack & Bore).

The majority of the underground HVDC transmission system in the U.S. will be installed within existing roadway ROWs. Limited portions of the cable will be located on private property. The cables would be installed outside the improved roadway surface, or under the pavement where necessary or appropriate. The Applicant will coordinate the exact locations of the cables with Pennsylvania Department of Transportation (PennDOT) and the townships. Construction activities, including traffic management and paving restoration will be coordinated with the PennDOT, the respective townships, and adjacent property owners, as appropriate, to minimize traffic disruption during installation. Construction activity will generally be conducted during daytime hours, unless night construction is requested by state or local officials to avoid significant impacts to traffic or equipment deliveries, or unless required by a particular construction technique. The Applicant will coordinate surface restoration procedures with

PennDOT, the appropriate townships, and (as applicable) the owners of private lands on which the underground transmission line is located.

The interconnection to the existing PJM grid will be by a 345 kV, AC, underground transmission line connecting the Erie Convertor Station to the existing Penelec Erie West Substation. The AC cables would measure approximately 2,082 ft (635 m) in length. This line would consist of six 345 kV AC cables with solid dielectric polymer insulation. The cables would be placed underground at an approximate depth of 3 ft to 6 ft (1 m to 2 m).

2.3.2 Construction Methods, Underground Cable

All construction activities will be conducted in accordance with an Erosion and Sedimentation Control Plan (E&SCP) and Post Construction Stormwater Management Plan (PCSM Plan) for the Erie Converter Station, and an E&SCP and a Site Restoration Plan for the underground segment cable route, all approved by the Erie County Conservation District, under delegation from PADEP. The E&SCP and PCSM Plan are required by the both the Conneaut Township Stormwater Management Ordinance and the PADEP 25 Pa. Code Chapter 102 regulations, and will be implemented under the requirements of an National Pollution Discharge Elimination System Permit for Stormwater Discharge Associated with Construction Activities (NPDES Permit). Proposed construction methods, erosion and sedimentation control plans, and wetland and stream crossing methods are summarized in the following sections.

2.3.2.1 Construction Access and Temporary Workspace

The temporary construction work areas for cable installation would be primarily in roadway ROWs. A typical temporary construction area in the roadway ROW would be approximately 15 ft to 38 ft (4.6 m to 12 m) wide. Transportation of construction equipment and materials over weight-posted roads will be coordinated with PennDOT, applicable local townships, and law enforcement authorities depending on the location.

Excavated soils would be temporarily stockpiled within the worksite or transported to an offsite location if onsite storage is not possible, with topsoil placed separately from excavated subsoils. At wetland and stream crossings, soil stockpiles will be stored in temporary upland workspaces away from the wetland area. Prior to construction, erosion and sedimentation control best management practices (BMPs) will be implemented along wetland boundaries in these areas to prevent the movement of sediment from work areas and stockpile areas along the roadway.

It is anticipated that most of the work along roadways will be performed with one lane of the road closed over a work area length of a few hundred feet. The work area location will move as various sections are completed. There may be more than one work area if simultaneous crews are to be used. Traffic control will be provided in accordance with PennDOT standards.

In some instances it may be necessary to close the work area road to through traffic. Such closures would be undertaken in coordination with and the approval of the respective township (and PennDOT if applicable). Although through traffic will be limited in such cases, the contractor will be required to provide access to private driveways at all times.

Temporary laydown areas will be required during installation. These areas will be utilized for the storage of equipment and materials. No grading or subsurface impacts are expected in these areas, though aggregate or crushed rock would be added. Six laydown areas have been identified (Table 2.3-1) and are shown in Appendix A. The temporary laydown areas will be restored to existing conditions upon completion of the Project.

Table 2.3-1 Laydown areas for the Project.

Laydown area	Location	Size (ac)
1	HDD Exit Area	0.8
2	US Route 5 and private access way	1.6
3	Norfolk-Southern Railroad and Townline Rd.	3.6
4	Private road (0.15 miles south of Ridge Road)	0.6
5	Springfield Rd and Trail	6.0
6	Springfield Rd. and I-90	0.8
Total		**13.4**

2.3.2.2 Cable Installation

Typical excavation equipment will be used to dig the trench (e.g., excavators, backhoes, loaders). A concrete-encased PVC duct bank will be installed in the trench and the cable will pulled into the duct bank. Due to weight restrictions for over-road hauling of cable reels, the underground cable will be delivered and installed in lengths of not greater than 2,500 ft (762 m). Cables will be spliced together in pre-cast concrete splice vaults, which will be installed and backfilled in advance of jointing operations to reduce the duration of open excavations. These vaults will be approximately 9 ft (2.7 m) wide by 30 ft (9.1 m) long by 9 ft (2.7 m) deep and installed with a minimum of 1.5 ft (0.5 m) of cover. Splicing vaults typically include permanent access by a pair of 3-ft (0.9 m) manhole access risers. Vaults will be designed for full road traffic loadings.

Approximately 20 splice vaults would be required on the U.S. side. The duct bank is constructed first by excavating a trench, installing conduit on spacers, and encasing the conduit with thermally acceptable concrete or similar material. The trench will be backfilled and restored. After the full duct bank segment (vault to vault) is complete, the cable will be pulled into the duct bank and spliced to the next cable segment. The standard construction sequence is summarized as follows:

- Initial clearing operations (as necessary) and install stormwater and erosion control measures.
- Excavate trench, install conduit and spacers.
- Backfill the trench 24 hours after encasement and install marking tape or tracer tape.
- Stabilize and restore areas over duct bank sections.
- Install splicing pits or vaults.
- Pull cable into duct bank segment.
- Splice cable to adjacent cable segments.
- Restore construction area to original conditions and install above- or at-grade markers indicating the location of underground HVDC transmission cables.

Construction of the underground cables, both HVDC and AC, would take approximately

6 months.

2.3.2.3 Wetland and Stream Crossing Methods

General procedures in locations to protect wetland and stream resources during construction will include:

- Complying with permit conditions received from the U.S. Army Corps of Engineers (USACE), PADEP, and other applicable agencies for stream crossing and wetland areas.
- Maintenance of narrow workspace corridors and minimizing intrusion into wetland areas.
- Stockpiling topsoil from wetland areas separately and replacing as cover in wetland areas, in order to preserve seed stock and provide the best success for wetland restoration.
- Completing work through wetland areas carefully but quickly, with restoration following as soon as is practicable.
- No assembly area, temporary equipment, or materials storage areas will be allowed within 50 ft (15 m) of the top of bank of a stream or edge of a wetland, except for materials and equipment associated with an excavation that will be within 50 ft of the stream or wetland. A sediment barrier will be located between the material and the stream or wetland.
- No vehicle repair or vehicle fueling will occur within 100 ft (30 m) of a stream or wetland area.

The Applicant will follow applicable soil erosion control and dewatering requirements as detailed in an erosion and sedimentation control plan and NPDES stormwater permit, which will include the following typical methods. Water removed from excavated trenches will be discharged to an upland vegetated area off the roadway through a “pumped water filter bag” surrounded by a compost filter sock ring that will overflow into existing roadway ditches or upland area. There will be no direct discharges to wetlands or water bodies. Appropriate spill prevention and containment measures for hydraulic fluids or fuels will be applied during construction. Construction crews will have spill response absorbent pads and spill response procedures in construction vehicles. A Preparedness Prevention Contingency Plan will be developed for materials handling and implemented during construction.

Except where expressly prescribed by permit, spoil from trench excavation will be stockpiled a minimum of 50 ft (15 m) from wetland edges or streams (except for materials and equipment associated with an excavation that will be within 50 ft of the stream or wetland), and spoil piles will be protected by appropriate erosion and sedimentation control BMPs where the potential exists for sediment transport to wetlands or streams. Disturbed upland areas will be re-graded to pre-existing contours and re-seeded with an upland conservation seed or appropriate mix to reduce erosion and sedimentation potential.

2.3.2.4 Jack & Bore Construction Method

Trenchless construction methods will be used at the Erie landfall location where the transmission line transitions from the underwater to underground segments and may be utilized in other locations where open trenching is less appropriate due to either physical constraints (e.g., roadway or railroad crossings) or environmental constraints (e.g., certain wetland and stream crossings). There are two types of trenchless installation that could be used in construction of the Project: Jack & Bore and HDD methods. The equipment used and the type of operation would vary depending on the length and depth of the installation.

Jack & Bore (open-face, cased auger borings) will typically be used for crossings less than 300 ft (91 m) with uniform, cohesive soils. An elevated water table can result in the need to dewater the jacking and receiving pits. Closed-face casing installation methods such as micro-tunneling may be required in certain areas with high water tables and non-cohesive soils to prevent running soil conditions.

Jack & Bore installations begin by excavating a launching and receiving pit on either side of an obstacle. The launching pit is typically 10 ft to 15 ft (3 m to 4.5 m) wide and 30 ft to 40 ft (9 m to 12 m) long. The receiving pit is typically about 10 ft wide by 10 ft long. Once the excavations are open, a hydraulic ram is used to push a steel casing through soil under the obstacle while removing soil inside the casing with an auger. A cutting head on the casing opens the hole; the auger is not advanced ahead of the casing or used for boring.

Depending on installation conditions, the steel casing will either be left in place or pushed out by a replacement casing of reinforced concrete pipe or other material. Once the permanent casing is in place, PVC conduits are installed into the casing on rolling spacers. The annular space between the conduits and the casing is filled using a thermally acceptable free-flowing grout before tying the casing installation into the open cut sections.

2.3.2.5 Horizontal Directional Drilling Construction Method

HDD is used for installing conduit ducts for cable or wire line products, as well as for installing pipelines. The technology avoids excavating a trench and is commonly used for a variety of situations, including crossing lakes, wetlands, rivers, and roads and railways. HDD will be used for longer crossings where open trenching is less appropriate, with the largest, most complex HDD operation occurring at the transition points between land and Lake Erie. HDD will allow for the avoidance or minimization of disturbance to the Lake Erie shoreline and near-shore areas.

HDD is accomplished by using a guided drill rig to open a pilot bore, then multiple reaming passes of the pilot bore to open the hole to the diameter required to install the pipe bundle into the borehole, typically 50 percent larger than the pipe bundle. Drilling fluid will primarily consist of a combination of water and bentonite clay (a naturally occurring nontoxic mineral). In some instances, additives to improve viscosity, improve hole integrity, and prevent or reduce potential fluid release may be added during drilling operations. These additives may include clays, organic fibers, modified starches, and non-reactive polymers. No petroleum-based additives will be used. All potential additives will be identified in the drilling plan submitted to and approved by the applicable environmental agencies.

Once the borehole is open and stable, a bundle of fused or welded pipe is pulled into the borehole. For this Project, the pipe will be HDPE heat fused into a single length before being pulled into the borehole.

The equipment used in an HDD operation includes an HDD drilling rig system, a drilling fluid collection and recirculation system, and associated support equipment. For each proposed HDD location, three separate drill holes would be required, one for each cable, including the fiber-optic cable. For the shoreline crossings, a single 14-inch (36-cm) to 18-inch (46-cm) pipe would be installed in each borehole as a casing pipe. Smaller, 10-inch (25-cm) to 12-inch (30-cm) pipe would be used for HDD installations on land, which have smaller-diameter cables. A minimum spacing of approximately 33 ft (10 m) between the shoreline borehole paths and 15 ft (4.6 m) between land borehole paths would be required to minimize interference.

The shoreline HDD operation will occur in a temporarily cleared work area of approximately 100 ft by 150 ft (23 m by 46 m) for large HDD operations; the work area for small HDD operations will be about 15 ft wide by 50 ft long (4.5 m by 15 m) such that it can be done alongside a roadway. Setup for the HDD boring in most cases will be located a minimum of 50 ft (15 m) from stream and wetland areas. Boring equipment setups will not be staged in wetlands. Generally, small (6 ft [1.8 m] x 6 ft [1.8 m] x 4 ft [1.2 m]) sump pits may be excavated at the drill entry and exit points to accumulate drilling fluid and associated drill spoil to be pumped into tank trucks.

To address the potential risk in HDD activities of an inadvertent return (i.e., the unexpected leakage of drilling fluids [consisting largely of bentonite clay] through unidentified weaknesses in the soil), the HDD contractor for each installation will provide and implement a Drilling Fluid Management Plan. The Drilling Fluid Management Plan will identify the fluid handling, recovery, recycling, and disposal procedures and equipment. The HDD contractor will also implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan (Attachment 1 of the PADEP/USACE Joint Permit Application submitted in January 2016); this plan identifies procedures for monitoring for fluid release, containing a fluid release if it occurs, and cleaning up any fluid losses. Prior to construction, meetings will be held with the authorizing agencies to review these plans.

Drilling fluid solids (bentonite clay) and cuttings will be contained and settled in tanks or sediment traps and subsequently disposed of at an approved offsite facility. Water used in the drilling fluid will be recovered and reused after filtering out cuttings, and then disposed at an approved facility. Excavated soils will be temporarily stored onsite during construction and will be used to restore the site to its previous grade once the drilling process has been completed, or transported for disposal/reuse at an approved location. The disturbed areas will be restored to their original grade and seeded with an appropriate seed mix for natural revegetation.

2.4 Underwater Cable Description

2.4.1 General Facility Location and Description, Underwater Cable

The underwater cable route (referred to as Lake Segment or Underwater Segment) for the +/-320-kV HVDC transmission line would extend approximately 35.4 mi (57.0 km) within Lake Erie from the U.S./Canada border to the proposed landfall location in Erie County (see Figure 2.1-1). A 500-m (1,640-ft) route corridor was initially identified for the underwater HVDC cable route (250 m on either side of the centerline shown on Figure 2.1-1). The cable alignment has been refined to approximately a 100-m (328-ft) width in the route corridor as a result of the additional in-water surveys that occurred during 2015. The HVDC transmission cables would transition from the landfall location into Lake Erie via borings through bedrock installed by HDD methods. Three short trenches will be excavated in the bedrock (primarily shale) from the exit of each of the three HDD bores at approximately kilometer post (KP) 103.4. The three trenches will merge into one trench, which will continue through the bedrock to the softer lakebed material where the sediment overlay is deep enough that burial by jet plow or water jetting can be utilized (approximately KP 102). The underwater transmission cables are generally sited to maximize the system's operational reliability while minimizing the costs and potential environmental impacts caused during construction, operation, and maintenance.

The underwater HVDC transmission cables will be solid dielectric extruded insulated HVDC cables (Figure 2.3-1), which will be deployed with a fiber optic cable. An extruded lead moisture barrier with a polyethylene jacket will be used to protect the insulation system. To protect the cable and provide additional strength during installation, an armoring system consisting of one layer of galvanized wires with bedding layers will be installed over the polyethylene jacket. Each cable will be approximately 6 in (15.2 cm) in diameter and weigh approximately 41.9 lb/ft (62.4 kg/m). The two underwater HVDC transmission cables and the fiber optic cable will be bundled together during installation to minimize disturbance and external electrical and magnetic fields.

The cables will be buried in the lakebed to protect the cables from damage due to shipping traffic, fishing activity, and ice scour. Typical burial depths in areas where the cable will be installed by jet plow or water jetting range from 3 ft to 10 ft (1 m to 3 m). In the approximately 0.9-mi (1,500-m) long area where the cables will be installed in trenches within bedrock from the end of the HDD borings to the softer lake bed sediments, the typical burial depths will be approximately 6 ft (1.8 m). No existing utility crossings have been identified for the proposed transmission cable route in the U.S.

2.4.2 Construction Methods, Underwater Cable

Marine route surveys have been completed and installation engineering is being performed to evaluate the route position in order to avoid shipwrecks, existing pipelines or other utilities to the extent possible, and to refine construction methods. The general sequence for installing the underwater HVDC transmission cables will be as follows:

- Install HDD conduit;
- Perform pre-lay grapnel run; and
- Install cable in lakebed (in trenches within bedrock and via jetplow or water jetting methods in softer sediments).

2.4.2.1 Install HDD Conduit

The shoreline crossings at Lake Erie will also be completed by three separate HDD bores, one bore for each HVDC cable and one bore for the fiber optic cable. It is currently estimated that the HDD will exit the lake in Pennsylvania approximately 2,000 ft (600 meters) from shore, at a water depth of approximately 18 ft (5.4 meters)(while HDD bores can be drilled further than this, there are limitations to how far an underwater cable can be pulled through an HDD bore). It is expected that the distance between bores at the exit will be approximately 33 ft (10 m).

The rocky and steep nature of the bluffs will require an HDD operation with special attention to preventing fluid releases into the nearshore area. Prior to drilling operations, three offshore sump pits will be excavated (in rock) where each HDD bore will exit (one bore for each HVDC cable and one bore for the fiber optic cable). Each pit will be approximately 20 x 10 x 7 ft (6.1 x 3.1 x 2.1 m) and is designed such that it could contain approximately 10,000 gallons of bentonite if there was an unexpected discharge. Any bentonite that is discharged will be contained at the bottom of the sump (bentonite clay has a specific gravity greater than water). Divers/video cameras will monitor the sump, and should bentonite be discharged, divers will employ a submersible pump to recover the bentonite slurry into tanks that are located on the support barge. The use of this system minimizes the amount of disposal required and minimizes potential impacts to water quality from the release of bentonite. The drilling mud will then be returned to shore (in the tanks) for upland disposal.

While the borehole is being completed, the conduit pipe is assembled on land and floated out onto the lake and pulled into the borehole from the water to the land side terminus of the HDD bore. The method used for this installation will depend on topography and geotechnical investigation. If the soils are too hard for forward reaming tools, a method that allows access from both sides may be required.

As mentioned in Section 2.3.2.5, to address the potential risk in HDD activities of an inadvertent return (i.e., the unexpected leakage of drilling fluids [consisting largely of bentonite clay] through unidentified weaknesses in the soil), an Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan will be implemented at each location where HDD work is performed. This plan describes how to monitor for, identify, contain, and remediate releases of drilling fluid. Among other elements, the monitoring program will consist of visual observations in the surface water at the targeted drill exit point and monitoring of the drilling fluid volume and pressure within the borehole. Visual observations of drilling fluid on the surface or in nearby water, or excessive loss of volume or pressure in the borehole, would trigger response actions by the HDD operator, including halting drilling activities and initiating recovery of released bentonite clay.

At the land side terminus of the HDD bore, a pit will be excavated to contain any drilling fluids for later pumping out and disposal and to act as a start point for the cable burial. The HDD installation of the three bores (two for the power cables and one for the fiber optic cable) will take three months. Clear access to the end of the bore is required during the HDD operation, together with calm lake waters and low wind speeds. Therefore, the lake HDD is required to occur during summer (between June and September)

2.4.2.2 Perform Pre-Lay Grapnel Run

The purpose of a pre-lay grapnel run is to locate any immovable obstructions, such as large boulders, and to remove any smaller obstructions such as fishing gear, rocks, or wood. During this process a grapnel chain is towed along the lake bottom. The grapnel will penetrate the lake bottom to a depth of about 3.3 ft (1 m), depending on sediment type. If an obstacle were encountered, the barge would stop and send a diver to the bottom before the obstacle would be brought to the surface for disposal. Debris recovered and brought to the surface would be disposed of at an upland facility. If an object is too large, or not movable, the location would be recorded and the route adjusted to avoid the obstacle during the cable installation. It is expected that such route adjustments would be accommodated within the 100-m corridor described in the PADEP/USACE Joint Permit Application submitted in January 2016.

2.4.2.3 Install Cable

At the Erie landfall, bedrock is either exposed or very close to the surface for a substantial distance out to deeper water (about 1.3 miles). In this nearshore area, a trench will be excavated in the bedrock (primarily shale) from the exit of the HDD bore at approximately kilometer post (KP) 103.4 to the softer lakebed material where the sediment overlay is deep enough that jet plow burial can be utilized (approximately KP 102). A trench would be excavated in the bedrock approximately 6 ft (1.8 m) below the natural top of the bedrock; and, the width would be about 4 ft (1.2 m). Any sediment overburden above the bedrock trench would first be excavated and sidecast. A barge-mounted drill will then drill 4-inch stemmed charge blast holes to a depth of 4 ft below planned excavation grade. The holes will be packed with low-level Hydromite emulsion explosive and detonated. The blasted rock will be removed by a barge-mounted excavator and side cast. The trench in the bedrock will be bedded and backfilled with a sand, gravel, or rock (originating from an on-land source). Drilled and excavated material will be side cast on the lake bottom.

Beyond the nearer shore areas underlain by shallow bedrock, cable installation will be conducted using a towed jet plow or by water jetting, likely using a remotely operated vehicle (ROV). Jet-plowing is a very common technique for burying submarine cables and uses the combination of a plow share and high pressure water jets to fluidize a trench in the lakebed (see Figures 2.4-1 and 2.4-2). The installation process would be conducted using a dynamically positioned vessel and towed plow device that simultaneously lays and buries the underwater transmission cables in a trench.

Figure 2.4-1 Photograph of a typical jet plow.

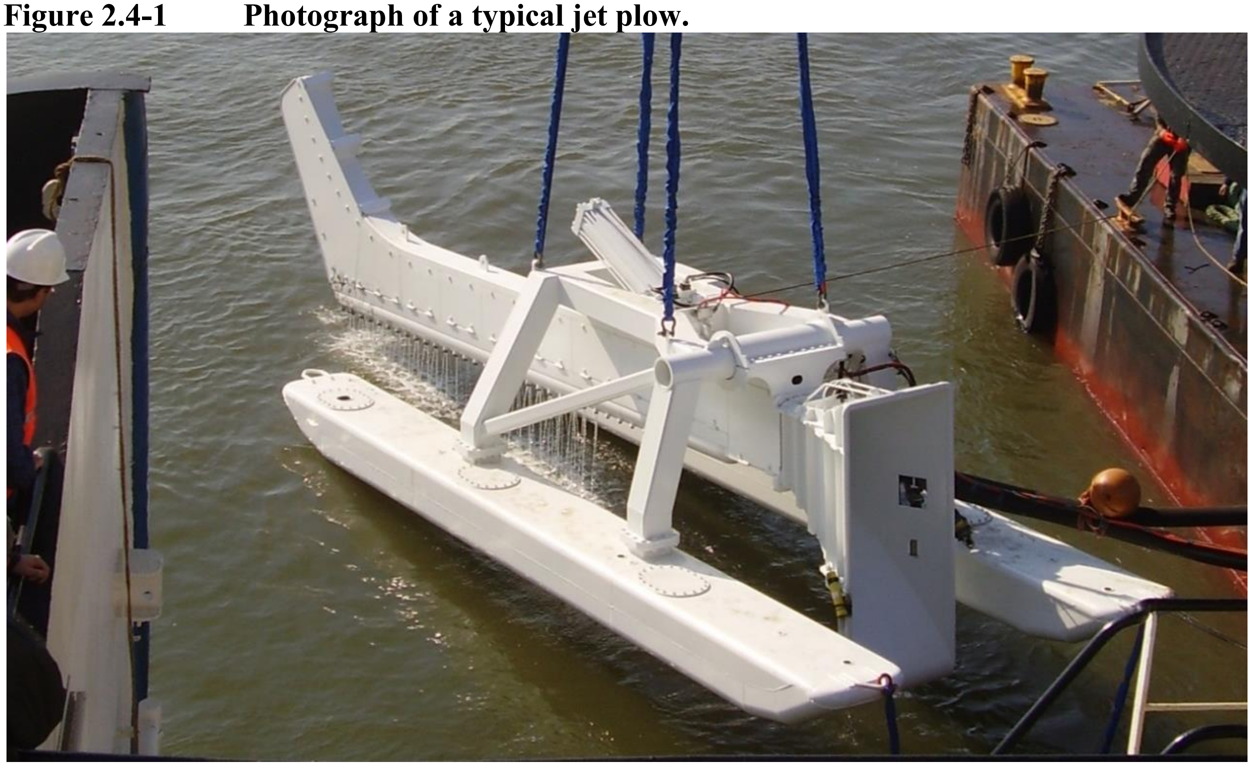
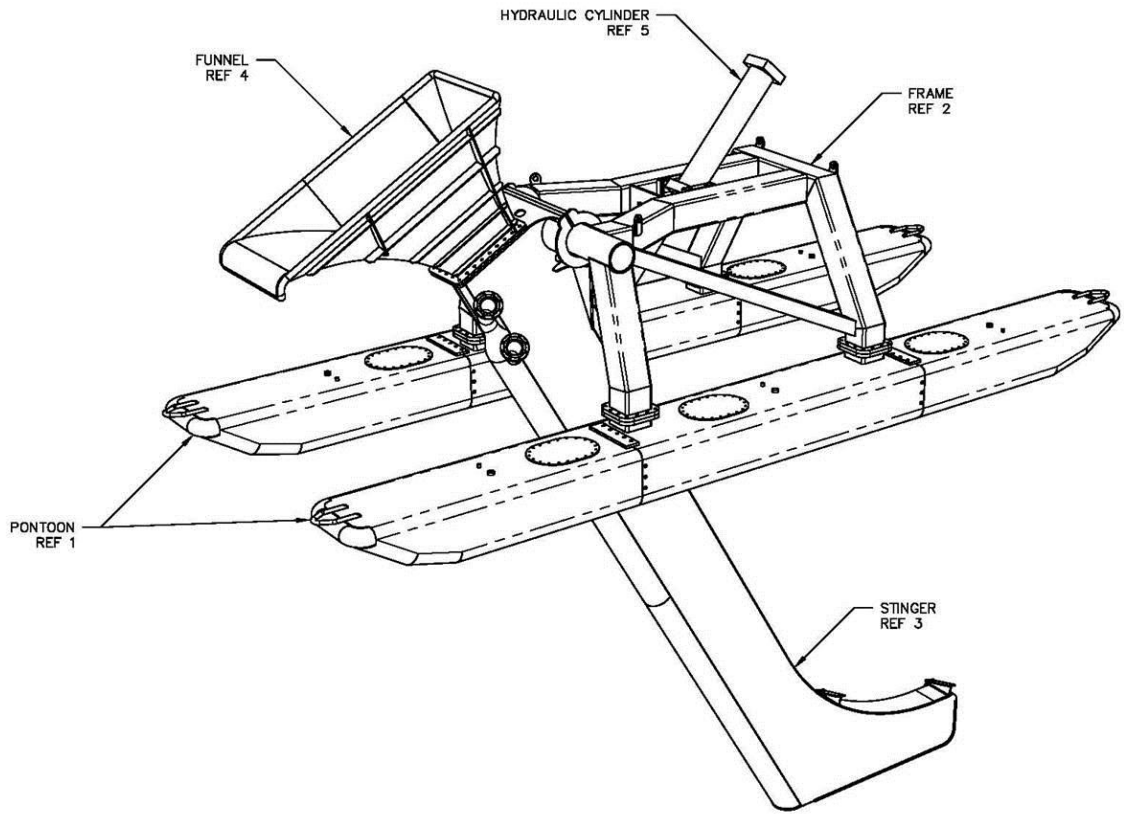


Figure 2.4-2 Diagram of a typical jet plow.



Water jetting methods are similar to jet-plow installation methods in that both use water to fluidize sediment within the cable trench to facilitate cable burial. However, the jet-plow is supported on the lake bed by pontoons or skids and pulled along the sediment surface. The very soft sediment in the deeper areas of Lake Erie (approximately between KP 15-55[5]) may not support the weight of the jet-plow. Water jetting tools or ROVs are neutrally buoyant and often self-propelled, moving just above the lake bed and pre-laid cable. Unlike the jet-plow, there is no mechanical force used to pull the plow through the sediment and water jetting relies solely on the weight of the cable to sink through the fluidized sediment to the desired burial depth.

No utility, pipeline, or other submerged infrastructure crossings have been identified along the U.S. portion of the Project's proposed underwater cable corridor.

Cable laying is a continuous procedure. The majority of material required for the cable installation will be transported and stored on the installation vessel; although, it cannot carry enough cable to complete the entire route. A cable transport barge will, therefore, be used to carry the remaining cable. In the unlikely event the cable installation must be abandoned due to extreme weather conditions, the cable will either be surface laid along the route, or in extreme

[5] The Canada/U.S. border is at KP 47, so water jetting may occur in U.S. waters from approximately KP 47 – 55.

cases, the cable cut. Following return of appropriate weather conditions, the cable will then be retrieved, spliced as necessary, and the installation process will continue.

The cable installation in the U.S. and Canadian waters would occur over a 2.5 year period. In the first year, HDD and bedrock trenching would be conducted. During the second year, the pre-lay grapnel run and cable installation would occur, including jet plowing or water jetting in soft sediments. These activities are expected to occur between May and November each year. Jet plowing will proceed at about 0.9 – 1.2 miles per day (1.5 – 2.0 km/day).

2.5 Transmission System Operating and Design Features

The following sections outline general information about proposed system operation, some of the protective measures included in the cable system design, and information regarding repair measures that will be undertaken if the cable system sustains damage.

2.5.1 System Operation

The Project will be operated in accordance with the established engineering and technical criteria of the IESO and PJM as well as the mandatory Reliability Standards of the North American Electric Reliability Corporation (NERC). In the U.S., the Project will be placed under the functional control of PJM. Market rules established by these system operators will govern transactions utilizing Project facilities. Coordination between the IESO and PJM will determine the direction and quantity of electricity flow through the Project. Because the Project is a DC facility, PJM can dispatch energy flow over the Project, matching operational and commercial decisions while eliminating the possibility of any unintended power flows.

2.5.2 Electromagnetic Compatibility Limit

The Erie Converter Station will also be designed in accordance with the applicable standards for Electromagnetic Compatibility Limits and will not exceed the design criterion for interference levels. No operational impacts on communication systems would be expected because the transmission cables would not create induced voltages or currents that could impact communications equipment such as marine radios, remote telephones, and cellular telephones. The transmission cables are designed with outer metal layers and would not create an external electric field. Insulated cables do not have corona discharge and are not independent sources of radio, telephone, or television interference.

2.5.3 Relay Protection

Both the AC and HVDC cable systems will be protected by high-speed protection systems at the Erie Converter Station. Protection of the AC interconnection facilities will be designed in accordance with the requirements of the interconnected utility.

2.5.4 Damage Repair

While it is not expected that the cable would be damaged (e.g., it would be armored and underground/in the lakebed), it is possible that over the expected minimum 30-year lifespan of the Project the transmission cables could be damaged, either by human activity or natural processes. Before operation of the Project begins, an Emergency Repair and Response Plan (ERRP) would be prepared to identify procedures and contractors necessary to perform maintenance and emergency repairs. The typical procedure for repair of a failure within the underwater and underground portions of the Project route is described as follows:

- Underwater Transmission Cable Repair - In the event underwater cable repair is required, the location of the problem would be identified and crews of qualified repair personnel would be dispatched to the work location. The damaged portion of the cable will first be cut underwater, and a portion of the transmission cable would be raised to the surface. A new cable section would be spliced in place by specialized jointing personnel. Once repairs are completed, the transmission cable would be laid back onto the lakebed and reburied using a water jetting device or covered with concrete mattresses. This repair would result in an additional length of cable that would be placed on the lakebed, with the excess cable forming a U-shaped loop (bight) to the side of the original cable alignment. The additional width of the loop (perpendicular to the original cable alignment) will be approximately equal to the water depth at the repair location.
- Underground Transmission Cable Repair - In the event underground transmission cable repair is required, the location of the problem would be identified and excavated, qualified personnel would remove the damaged portion of the cables, and a new cable section would be spliced in. Once repairs were completed, the transmission cable and splices would be reburied.

The time required to repair a damaged cable may vary due to such factors as the nature and the amount of damage, location in the lake, and weather conditions. If the damage occurs when the lake is frozen, an icebreaker may be necessary to move some of the ice, or alternately, it may be necessary to wait for the ice to melt.

2.6 Project Schedule

Project construction is anticipated to start, at the earliest, in the later part of 2017 after receipt of all required construction permits, and will take approximately 2.5 years to complete, with an anticipated in-service date in the fourth quarter 2019. The project schedule may be adjusted due to market conditions as a result of the competitive solicitation process for capacity on the line, and/or the timing of the formal engineering design process, and/or the permitting process.

3.0 ALTERNATIVES ANALYSIS

3.1 Introduction

Projects subject to the individual permitting process by the USACE under the Clean Water Act (CWA) must comply with Section 404(b)(1) guidelines (40 C.F.R. Part 230) for discharge of dredge and/or fill material into waters of the U.S. The Guidelines generally require applicants to demonstrate there is no "practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem" and which "does not have other significant adverse environmental consequences" (40 C.F.R. § 230.10(a)). The Guidelines consider an alternative practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes" (40 C.F.R. § 230.10(a)(2)).

The "404(b)(1) Alternatives Analysis" assesses alternatives from which the "least environmentally damaging practicable alternative" (LEDPA) is determined. The list of alternatives from which the LEDPA is selected is created after the overall purpose of the project is identified, as only those alternatives which meet the project's overall purpose are considered. In addition, per 25 Pa. Code Ch. 105, the alternatives considered included alternative converter and substation (switchyard) locations, underwater and underground routing, proposed construction techniques to minimize adverse environmental impacts, and design (i.e., technology). The geographic scope of the alternatives considered is determined by the project purpose and would include locations typically considered in similar projects. The level of review required under a LEDPA analysis depends on the nature and severity of the project's impact on the environment. Many of this Project's impacts have been already eliminated or mitigated as a result of the Commonwealth of Pennsylvania's regulatory requirements and the proposed construction BMPs.

This Alternatives Analysis is for the U.S. portion of the Project only.

3.2 Screening Process

The Applicant evaluated several route, converter station, and landfall alternatives in relation to the Project's purpose, need, and geographic requirements, as well as the practicability and environmental consequences of each alternative. Figure 3.2.-1 presents the existing substations (POIs), converter station locations, and initial routes and landfall options that were evaluated. Figure 3.2-2 shows the alternative routes considered within the Lake Segment. Figure 3.2-3 is an overview of the underground alternatives. The screening and analysis of alternatives occurred sequentially in three phases:

1) Initial screening for alternatives;
2) Desktop analysis; and
3) Field investigations and environmental analysis.

The initial screening process involved the review and evaluation of various potential route alignments, taking into consideration the following principal factors and constraints summarized in Table 3.2-1.

Figure 3.2-1 Overview of alternatives evaluated.

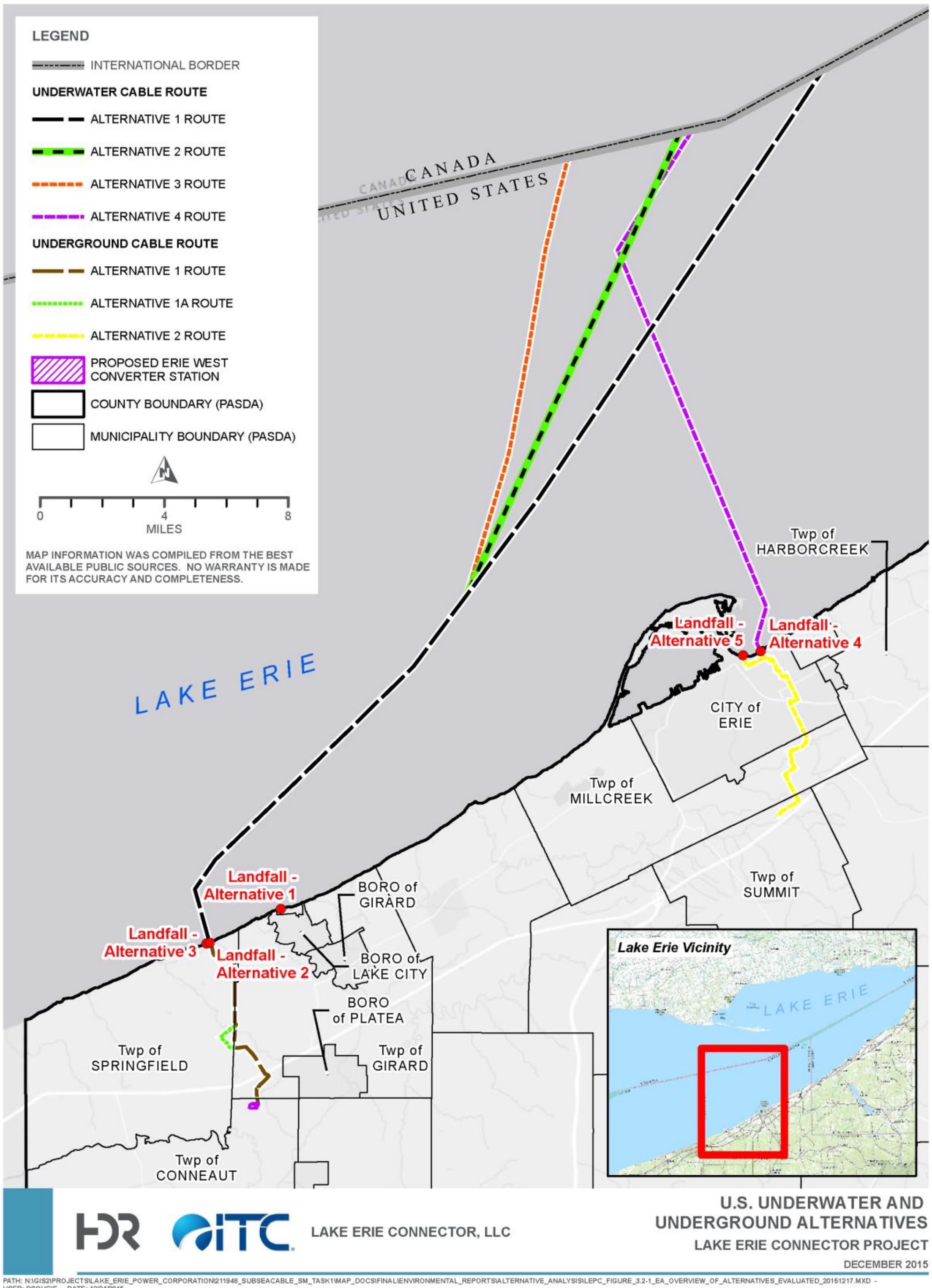


Figure 3.2-2 U.S. underwater alternatives.

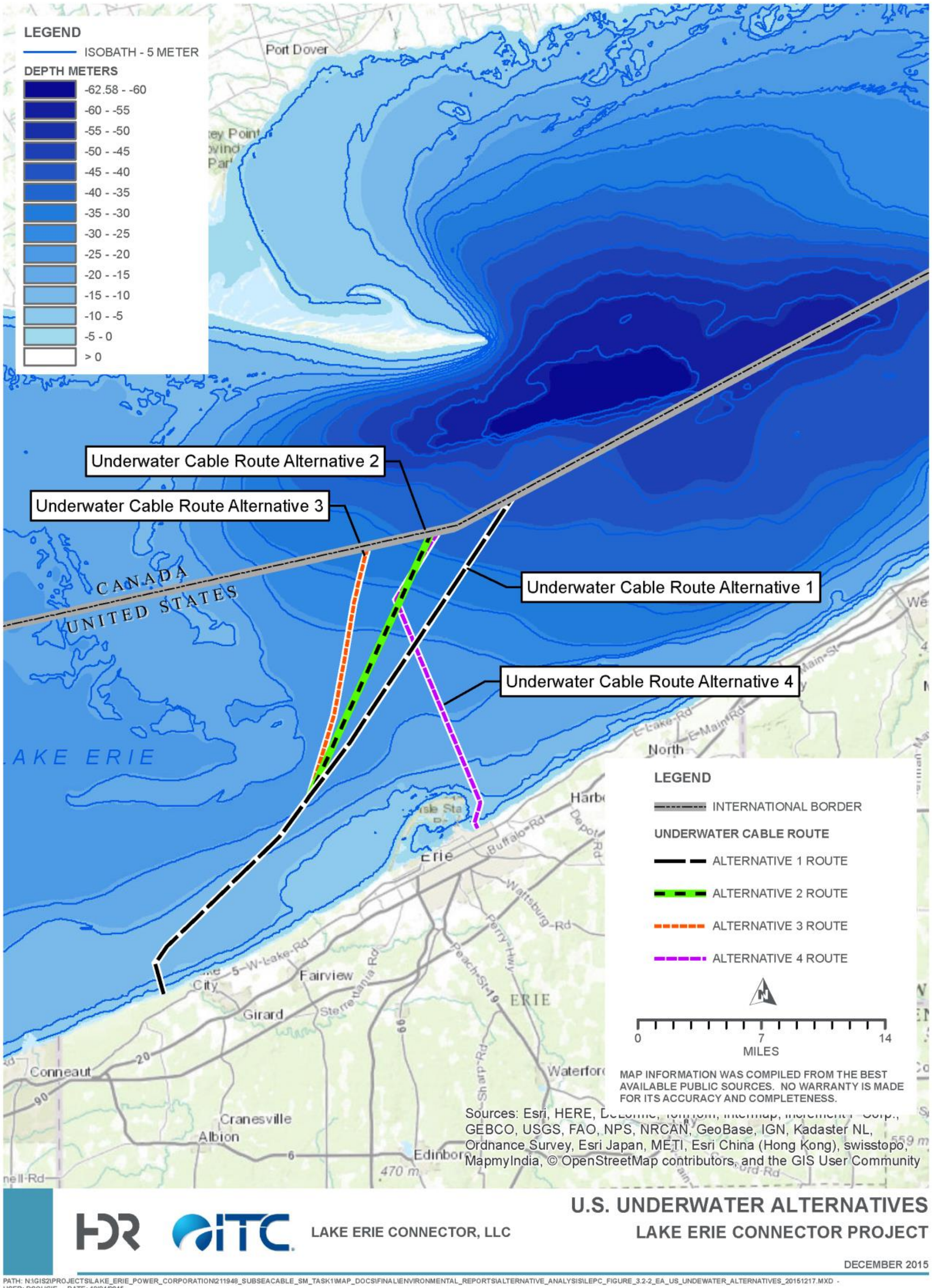


Figure 3.2-3 U.S. underground alternatives.

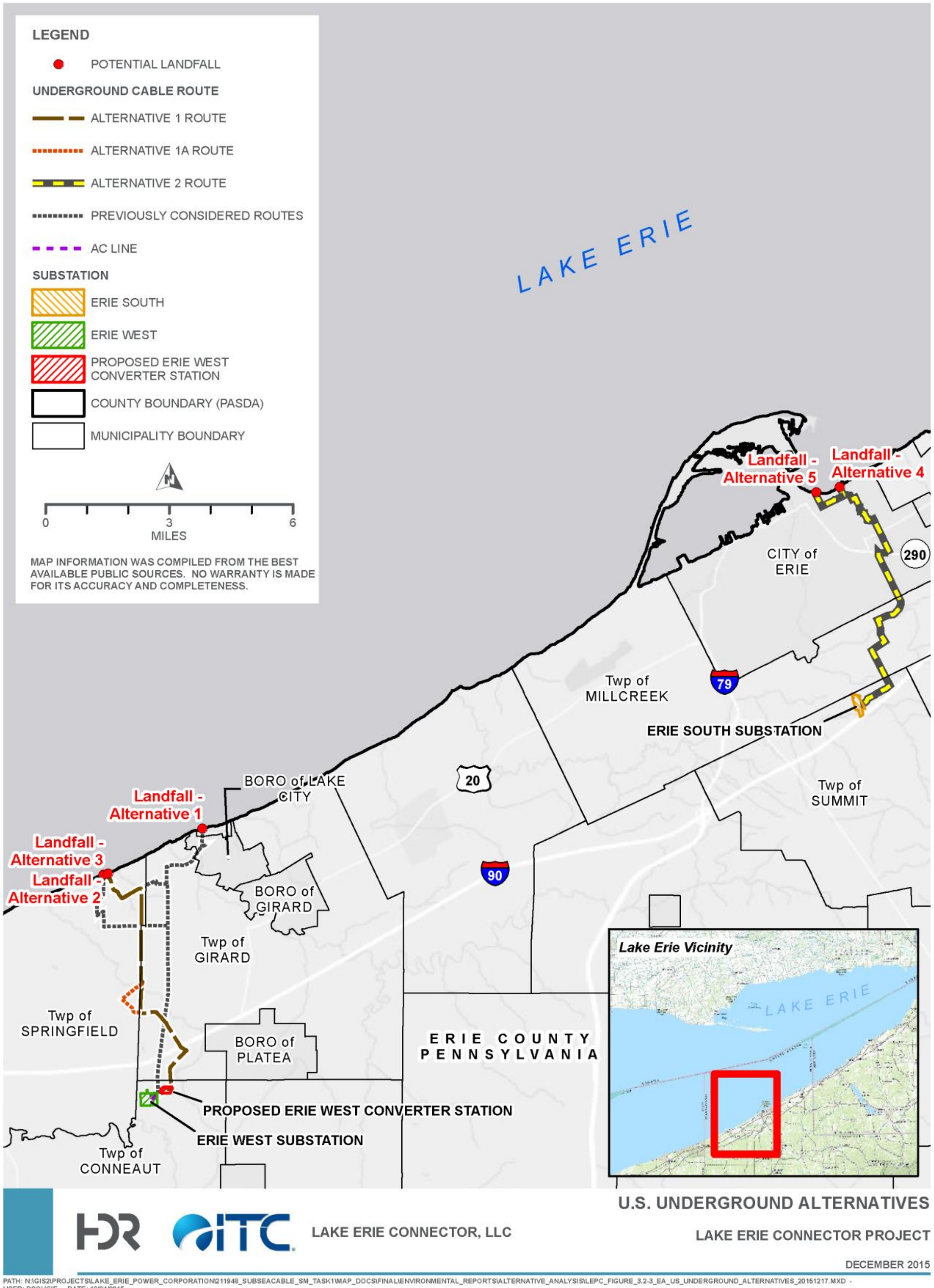


Table 3.2-1 Initial screening criteria for alternatives.

Evaluation Category	Criteria	Basis for Criteria
Purpose	Must meet Project purpose.	An alternative must achieve Project purpose.
Existing Technology*	Must use proven technology.	An alternative's technological methods for transmission must be tested and proven to minimize the risk of failing.
Logistics**	Must not require extraordinary technical effort to overcome site conditions or pose difficult-to-overcome constructability issues.	Must not require complex or significant additional means to overcome difficult access or site conditions or require engineering solutions that may not accommodate long-term performance.
	Must be located outside areas having incompatible land use plans or existing incompatible land uses that could pose a risk to the transmission system.	Displacing or adversely affecting existing or planned development is likely to encounter significant regulatory hurdles, as well as political and public opposition.
	Must be located entirely within the Commonwealth of Pennsylvania.	The purpose of the Project is to develop a controllable HVDC submarine and underground bi-directional merchant transmission facility that will interconnect the Independent Electricity System Operator (IESO) in Ontario to the PJM markets in the U.S. to facilitate the transfer of electricity, improve reliability, and diversify supply portfolios for both markets.
Cost	Must not be unreasonably expensive to the Applicant, based on costs of similar merchant or participant-funded transmission projects.	The cost of each alternative must be reasonable in the terms of not being substantially higher that the costs of similar merchant or participant-funded projects. As a *merchant* transmission line, the Applicant does not have captive wholesale customers and guaranteed rate recovery.

* In terms of ensuring that the cable technology is tested and proven, only HVDC cable technology is considered in this analysis. HVDC has the ability to transmit large amounts of power over long distances with lower capital costs and with lower energy losses than HVAC. The main advantage of HVDC transmission over HVAC is the ability to control power flow and lower transmission line losses. In addition, an HVAC cable system needs three cables, whereas an HVDC cable system only needs two. When connecting two different electrical systems, HVDC is typically selected as it is asynchronous and can adapt to almost any rated voltage and frequency.

**For the purposes of this analysis, logistical factors may include the following: engineering constraints, utility and other public infrastructure, topography and geology, conformance to federal and state laws, social feasibility, regulatory hurdles, and public and political opposition. The evaluation of logistics also considers whether an alternative is "available" to the applicant. Legal restrictions that prohibit site development are also considered in determining whether an alternative site is available.

After the initial screening, taking into consideration the geographic, engineering, and POI constraints, the Applicant completed a desktop analysis on the practicable alternatives using available GIS data to evaluate each alternative's potential impacts to sensitive land uses, wetlands, fisheries, residential areas, navigation channels, cultural resources, and hazardous waste sites. Preliminary routes were developed to avoid sensitive environmental features and to take advantage of existing ROWs. Table 3.2-2 summarizes the criteria that were used during the desktop analysis.

Table 3.2-2 Summary of desktop analysis criteria.

Project Segment	Criteria
Substation Locations	• Availability of interconnection points (breaker positions) at the substation, or the capability to add interconnection points. • Capability of existing circuits connected to the substation that could accommodate the additional capacity of the proposed Project, or the need for system upgrades. • Proximity of a potential converter station site to the substation and an approximation of expected environmental impacts from a potential converter site. • Accessibility to the substation property for the HVAC transmission cables from the converter station.
Converter Station and landfall locations	• Avoidance of critical environmental features (i.e. critical habitat, wetlands, fish spawning areas, cultural resources, contamination, land use and noise, and traffic). • Proximity to the HVDC transmission cable route to minimize environmental impacts, neighborhood disruption (i.e., disturbances, interruptions, or changes), and costs associated with the cable connections to the converter station. • Size: Sufficient land available for the converter station facility (approximately 6 acres [2.4 hectares]). • Consistency with, and potential impacts on, land uses in proximity to the converter station site as well as willing landowners. • Constructability (i.e. slope and topography) and cost. • Minimization of cable route lengths. • Availability of suitable landfall locations (i.e. those that minimize environmental impacts and are within 10 miles of the substation). • Access to land (ROW) to make the landfall..
Underwater Route	• Bathymetry - preferred route minimizes extreme changes in slope and water depths. • Sediment type and quality – preferred route to target fine- to coarse-grain sediments that are sufficient depth to meet target cable burial depths while avoiding pockets of contaminated sediments. • Ice scour – preferred route minimizes potential for ice scour.

Project Segment	Criteria
	• Navigation channels and anchorage areas – preferred cable route avoids crossing navigation channels and anchorage areas where there is increased potential for anchor drag. • Impacts to water quality – preferred route would minimize the overall length of the route to minimize water quality impacts. • Cultural resources – preferred route to avoid all known submerged shipwrecks and other cultural resources listed or potentially eligible for listing on the National Registry of Historic Places. • Sand mining/dredge disposal areas- preferred route to avoid mining and or dredge spoil areas. • Existing infrastructure – avoid and/or minimize number of infrastructure crossings. • Sensitive aquatic habitats – preferred route would minimize the overall length of the route to minimize impacts to aquatic communities and avoid sensitive habitats.
Underground Route	• Topography - preferred route minimizes extreme changes in slope. • Real estate availability and ROW – preferred route follows existing ROW. Due to use of existing ROW and roadway, additional impacts from vegetation management are minimized during operation and maintenance. • Sediment type and quality – preferred route to avoid known Superfund Sites or sites designated as hazardous. • Cultural resources – preferred site would avoid known locations of historic or archaeological resources on or potentially eligible for listing in the National Register of Historic Places. • Existing Infrastructure – avoid and/or minimize number of infrastructure (i.e. roads, bridges, and culverts) crossings. • Wetlands and floodplains- preferred route would avoid and/or minimize impacts to wetlands and floodplains. • Sensitive terrestrial habitats – preferred route would minimize the overall length of the route to minimize impacts to terrestrial communities, wildlife species, and avoid sensitive habitats. • Land use, noise and visual – preferred route will be underground so the Project does not detract from existing aesthetics in the surrounding region. The preferred route will minimize impacts to sensitive buildings such as hospitals, schools, and churches.

Once a preferred route was identified, it was further investigated in the field by environmental (i.e., biologists, land use planners, and cultural resource specialists), engineering, and real estate personnel. After the initial field investigations, preferred route alternatives requiring additional study were identified based on substation location, real estate acquisition potential for converter station locations, environmental features, and engineering requirements.

3.3 Alternatives Analyzed

This Section describes the Alternatives that were analyzed as potentially practicable alternatives as defined by the Section 404(b)(1) Guidelines. Practicable alternatives are defined by the Guidelines to include, but are not limited to (i) Activities which do not involve a discharge of dredged or fill material into the waters of the United States …; (ii) Discharges of dredged or fill material at other locations in waters of the United States" (40 CFR .§ 230.10(a)(1)). An alternative is practicable if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of the overall project purpose (40 CFR § 230.10(a)(2)).

With the identification of two potential POIs at Erie West and Erie South Substations, several alternatives were identified as the practicable alternatives for additional investigation and are discussed below. Please note although the No-Action Alternative does not meet the Project Purpose and Need, it is included in the Alternatives Analysis per the Section 404(b)(1) Guidelines. In addition, several alternatives were identified during the desktop analysis and eliminated from evaluation. These are summarized in Section 3.3.7.

3.3.1 Substation Locations

At the outset of the Project, the Applicant commissioned a feasibility study of potential existing substations in Erie County that could serve as a viable POI for the Project. This evaluation considered the availability of interconnection points (breaker positions) at the POI or the capability to add additional interconnection positions. Sites where there was insufficient space for Project interconnection equipment were eliminated.

The study identified two potential substations, Erie West and Erie South, which warranted further consideration as potential POIs (Figure 3.2-1 and 3.2-3). Erie West is located in a rural section of Conneaut Township, Erie County, while Erie South is located in a suburb area just south of the City of Erie in Summit Township. These two substations were the only substations considered, as they were the only sites which met the 345-kV transmission system requirements, were located within 15 miles of Lake Erie in Pennsylvania, and would permit interconnection of the IESO and PJM transmission systems. All routing alternatives subsequently considered were based on interconnecting with one of these two locations.

The Erie South Substation would require construction through much more populated residential and commercial areas than the Erie West Substation. In addition, the Erie South Substation would require identification of a landfall near the Erie harbor and beaches in close proximity to the Presque Isle State Park. The two landfall locations identified in connection with the Erie South POI option are industrial sites which may have poor sediment quality and the route would have to cross a navigation channel.

The Erie West Substation is located in a less-populated area with fewer sensitive receptors. Due to constraints discussed above and negotiations with Penelec and land owners in close proximity to the substations, Erie West POI was selected as the Preferred Substation Location.

3.3.2 Landfall Locations

Five potential landfall locations were considered during the initial screening process (Figure 3.2-1) (Appendix B): (1) Lake Erie Community Park just north of the Borough of Lake City (1C); (2) Private lakefront property in Springfield Township approximately 1,178 ft west of Erie Bluffs State Park (1A); (3) Private lakefront property in Springfield Township approximately 720 ft west of Erie Bluffs State Park (1B); (4) Former International Paper property on the lakeshore, north of East Lake Road and east of Hess Avenue; and (5) Erie Port Authority property near the public boat launch at the foot of East Avenue. Alternatives (1)-(3) are associated with the Erie West interconnection option, and Alternatives (4) and (5) would be associated with the Erie South interconnection options. These alternatives were each evaluated as discussed in following paragraphs.

Landfall Alternative 3 is the only alternative that meets the Project Purpose and Need and minimizes the overall environmental impacts to the greatest extent practicable by providing the shortest underground route which will reduce cost, engineering constraints, and potential environmental impacts including avoiding known environmentally and culturally sensitive areas of the Elk Creek access area and Erie Bluffs State Park.

Alternative 1- Lake Erie Community Park: This is a private park that is at the end of West Park and Edge Park Drives. The Park is surrounded by residential development which includes seasonal and year-round residents. The park is dominated by maple, beech, and oak trees. Due to engineering and environmental constraints including ROW access and to avoid greater environmental impacts due to tree cleaning and sensitive habitats, this landfall location was no longer included in the evaluation. In addition, this landfall location would require crossing Elk Creek and include the disruption of a public recreation area. This alternative was determined to be not practicable and not environmentally acceptable.

Alternative 2- Private Lakefront Property Springfield Township approximately 720 ft west of Erie Bluffs State Park: Due to property access constraints (i.e., lack of ability to procure necessary landowner agreements), this alternative landfall was eliminated as not practicable.

Alternative 4 – Former International Paper Property: This Property is located north of East Lake Road and east of Hess Avenue. Due to the long history of industrial use in the area and around this property, the likelihood of potential hazardous substance concerns is higher. Due to the following constraints and potential environmental impacts associated with industrial properties, Landfall # 4 was eliminated from further evaluation as not practicable and not environmentally preferable:

- Erie South Substation is not the preferred POI.
- An underwater dredge disposal area approximately two miles northeast of the Presque Isle peninsula.
- Water intake pipes and sewer outfall pipes in the vicinity.
- The dredged shipping channel from Lake Erie into Presque Isle Bay.

Alternative 5- Erie Port Authority: This property is near the public boat launch at the foot of East Avenue. Due to the long history of industrial use in the area and around this property, the likelihood of potential hazardous substance concerns is higher. Landfall #5 was eliminated from further evaluation as both not practicable and not environmentally preferred due to the following constraints and potential environmental impacts associated with industrial properties:

- Erie South Substation is not the preferred POI.
- An underwater dredge disposal area approximately two miles northeast of the Presque Isle peninsula.
- Water intake pipes and sewer outfall pipes in the vicinity.
- The dredged shipping channel from Lake Erie into Presque Isle Bay.

3.3.3 Converter Station Locations

Approximately 6 acres of land will be needed for the converter station site, which will consist of a building approximately 370 ft by 110 ft (110 m by 35 m) with a main building footprint of 1 acre (0.4 hectares) and a height of approximately 60 ft (18 m) and a fenced yard area with electrical equipment and pole-mounted lines. Additional acreage will be needed for an access driveway, stormwater management facilities, and construction laydown areas.

A total of 10 potential properties were identified for the converter station location based on availability of land having the appropriate size, zoning, and topography, with landowners willing to sell. Three of these properties were identified to the west, south, and northeast sides of the Penelec Erie West Substation. Appendix B includes a larger scale map of the properties considered for the Converter Station site in the vicinity of the Erie West Substation. The remaining seven properties were identified in close proximity to the Erie South Substation; however, due to land acquisition and environmental impacts, only one option related to the Erie South Alternative was selected for further evaluation during the desktop analysis and is identified in Appendix C. After the desktop analysis and the decision to drop the Erie South Substation from evaluation, this converter station location was eliminated from further analysis.

Two of the converter station properties near the Penelec Erie West Substation, the south and west properties, were eliminated from further consideration during initial screening based on unachievable lease agreement terms/negotiations, available and limited ROW, and engineering constraints (i.e. additional railroad crossings).

The preferred parcel for the converter station near the Penelec Erie West Substation is approximately 7 miles from Lake Erie and meets the minimum acre threshold and is in close proximity to the existing Erie West substation so the length of the HVAC transmission lines to connect the converter station to the substation is minimized. In addition, no protected species or critical habitats were identified on the site. No historic buildings, structures, districts, or objects previously listed in or determined eligible for inclusion in the National Register are located at the preferred site.

Based on 2014 wetland delineations conducted by the Applicant and U.S. Geological Survey (USGS) mapping, there are no streams on the preferred converter station property. Per National Wetland Inventory (NWI) and Natural Resources Conservation Service (NRCS) mapping and delineations conducted in 2014 and 2015, there are potential wetlands on the selected site, but there is sufficient acreage outside of mapped hydric soils and NWI mapped wetlands such that development of a converter station site may be possible with minimal impacts and/or capability to implement onsite mitigation.

3.3.4 Underwater Route Alternatives

The selection of the route corridor across Lake Erie was based on the Erie West and Erie South Substation locations and associated potential landfall locations. With the landfall location established in Canada in Nanticoke, a general corridor through the center of Lake Erie was initially identified. Four route alternatives within Pennsylvania waters were identified (Figure 3.2-2) (Table 3.3-1). Alternatives 1-3 are potential routes for the Erie West Substation and Alternative 4 is a potential route for the Erie South Substation.

- Alternative 1: Alternative 1 crosses through the center of the Lake and is approximately 35.4 miles (57.0 km) in length. Based on existing sediment and surficial geology data, cable installation would include jet plow and a short length of rock trenching as the cable approaches landfall. Rock trenching and jet plow installations would occur within approved construction windows.

- Alternative 2: This route is slightly further west than Alternative 1 as it crosses through the center of Lake Erie. It is approximately 31 miles (50 km) in length. However, the thickness of unconsolidated sediment in this area is unknown. Due to the existing sub bottom conditions, cable installation would include rock trenching an area longer than Alternative 1 which would result in additional environmental impacts.

- Alternative 3: This is the most western route. It is 29 miles long (47 km); however, it avoids the Long Point Escarpment and preliminary information indicate that the thickness of unconsolidated sediment in this area is sufficient for cable burial.

Approximately 14.7 miles (23.7 km) offshore of Springfield Township, Alternatives 1, 2, and 3 meet and follow the same route along the Pennsylvania Channel to the landfall location (Figure 3.2-2) and one underground alternative.

- Alternative 4: This route begins and follows Underwater Alternative 1; however, at KM 63 it veers off and onto a perpendicular route towards shore and Erie, Pennsylvania. This is the most easterly route.

Alternative 1 was selected as the preferred underwater route as it takes advantage of deeper water depths while avoiding steep slopes and ice scour areas, the substrate along the route is comprised of fine-grain sediments as it crosses the U.S./Canada Border and then sand and silt as it approaches the Pennsylvania Channel, and these sediment types are more appropriate for cable installation using a jet plow and minimizes rock trenching. This route also avoids aggregate dredging areas.

In December 2014, a preliminary Marine Route Survey was conducted along the Long Point Escarpment and near shore of the preferred landfall location, west of Erie Bluffs. A second Marine Route Survey occurred in 2015 to collect additional geophysical and geotechnical data along the preferred route and to confirm that the current preferred route maximizes the avoidance of siting constraints and minimizes potential environmental impacts. Based upon a review of the survey data, the alternatives analysis was updated and confirmed the selection of Alternative 1 as the preferred route.

Table 3.3-1 Comparison of Lake Segment alternatives.

Criteria	Alternative 1:	Alternative 2:	Alternative 3:	Alternative 4
Route Length	35.4 mi	31.2 mi	29.3 mi	18.5 mi
Infrastructure Crossings	0	0	0	0
Geological Constraints (Bedrock)	1.0 mi	1.0 mi	1.0 mi	Unknown
Water Depth	0 to 140 ft	0 to 120 ft	0 to 110 ft	0 to 120 ft
Dredging, Sand Mining, Debris Areas	0	0	0	0.5 mi
Navigation Channels and Anchorage Areas	0	0	0	0.25 mi
Cultural Resources (known shipwrecks within 1,000 ft)	0	0	0	0
Acres of Core Habitat and Supporting Landscape from statewide PA Natural Heritage Program and Erie County Natural Heritage Inventory (linear feet crossing)	0.8 mi	0.8 mi	0.8 mi	1.8 mi
Fishery Habitat (i.e. spawning and nursery areas littoral areas % of the route < 20')	1.5	1.1	1.7	5.4

3.3.5 Underground Route Alternatives

The selection of practicable alternatives for the underground route was based on landfall and substation locations (Figure 3.2-3) (Table 3.3-2). Once those were established, upland corridors were defined and then revised to the following alternatives.

3.3.5.1 Underground Route Alternative 1

Alternative 1 is 7.1miles long and takes advantage of existing ROW along state roads and local roads in addition to crossing private property (Appendix B). Appendix B shows wetland conflicts that were identified during the 2014 field surveys and from NWI mapping and soils listed as hydric on NRCS soils mapping. As the underground portions of the Project route consist of previously disturbed or existing roadway ROWs, the wetlands within these areas tend to be of lower value than those in less-disturbed or non-disturbed areas because the composition of the vegetation and structure of these areas have adapted to the routine vegetative maintenance activities conducted in these areas. In addition, construction within or adjacent to existing roadways should limit disturbance to existing riparian buffers.

Wetland and stream field investigations for Alternative 1 were completed from August 4, 2014 through August 8, 2014, November 5 and 6, 2014, December 22, 2014, April 15, 2015, September 11, 2015, September 28, 2015, and December 22, 2015. A total of 22 wetlands including nine Palustrine Forested Wetland (PFO), two Palustrine Scrub-Shrub wetland (PSS), ten Palustrine Emergent Wetlands (PEM) and one Palustrine Unconsolidated Bottom (PUB) wetlands were identified. The only permanent impacts to wetlands are expected within the permanent corridor of the Project, where vegetative management activities will be conducted to prevent the establishment of deep-rooted vegetation in order to protect the cables from dry soil conditions and damage. For non-forested wetlands, the majority of these are already subjected to regular mowing and the potential application of herbicides. In these areas, the ROW maintenance planned for the permanent ROW will be consistent, if not identical, to vegetative control measures already in place, so no loss of existing wetland functions or values is expected, and, therefore, there would be no permanent impact. In areas of forested wetlands, construction of the Project would result in a conversion of forested wetland habitat to scrub-shrub wetland habitat.

In terms of temporary impacts, it is expected that forested and non-forested wetlands will be encountered within the construction corridor. However, original surface hydrology in disturbed wetland areas will be reestablished by backfilling the trench and grading the surface to pre-construction contours. Trenches in wetlands will be backfilled with native wetland soils to the extent practicable and a layer of native topsoil will be installed. The Applicant will seed the ROW to establish temporary cover and stabilize soils, at which point wetlands will then be allowed to revegetate naturally. Emergent wetland vegetation is expected to return quickly following construction (approximately 1 to 2 years). The woody species within forested wetlands in the construction zone would be expected to return more slowly naturally, so the Applicant will be proposing tree plantings in these areas.

Appendix B also identifies potential stream crossings per USGS mapped perennial or intermittent streams (i.e., blue lines on USGS 7.5 minute topographic quadrangles), although it is recognized that there may be other watercourses that are regulated under 25 Pa. Code Chapter 105. In addition, during the Applicant's field survey in 2014, a total of 15 waterbodies were found within the Alternative 1 and Alternative 1A corridor which included 11 perennial streams, 3 intermittent streams, and 1 pond.

It is recognized that much of the Alternative 1 alignment is within the Crooked Creek watershed, which is identified in 25 Pa. Code Chapter 93 as a high quality (HQ) watershed. However, since the Erie West site itself is within the Crooked Creek watershed, it is not possible to avoid construction within the Crooked Creek HQ watershed altogether. In order to minimize impacts, waterbody crossings at high quality streams along the ROW will typically be constructed using the HDD method.

3.3.5.2 Underground Route Alternative 1a

This route overlaps with Alternative 1. However, at the intersection of Townline and Ridge Roads this Alternative turns onto Ridge Road for 0.2 miles, crosses underground for 0.2 miles to the end of Main Street, follows Main Street for 0.2 miles, then follows south on Tubbs Road for 0.4 miles, then follows Springfield Road for 0.2 miles where it rejoins Alternative 1. The alignment follows Springfield Road , crosses US Interstate 90 and proceeds along East Springfield Road for 1.6 miles. The alignment then follows Lexington Road for 1.2 miles to the proposed converter station location. The proposed Erie Converter Station is located in Conneaut Township in Erie County, Pennsylvania (Figure 2.2-3).

Alternative 1a is almost the same as Alternative 1; however, it deviates in one area (Figure 3.2-3). In this area, the route runs parallel to U.S. 20 with a waterway/culvert crossing. There is no room in the highway ROW for construction, and the slopes involved will be very difficult to install the cable across. This area will require complicated installation methods and additional ROWs outside of the road ROW.

3.3.5.3 HVAC Alternatives

The Erie Converter Station will interconnect with the existing electrical power systems at the nearby Erie West Substation POI (Figure 2.2-3) through underground HVAC cables. The 345-

kV AC interconnection would measure approximately 2,082 ft (635 m) in length. Two potential HVAC routes for connecting the converter station to the Erie West substation were reviewed during the desktop analysis. Coordination with the land owner and field investigations will be conducted in Spring 2015. Alternative 1 leaves the converter station at the south west corner of the property and follows an existing overhead transmission line corridor to the Erie west substation. Alternative 2 leaves the converter station property at the same location as Alternative 1; however, it travels east where it intersects with Lexington Road. It then travels south along Lexington Road and turns west onto the access road to the substation.

3.3.5.4 Underground Route Alternative 2

Alternative 2 terminates at the Erie South substation. The underground portion is approximately 7 miles within city street ROWs. The Applicant focused on existing and former (i.e. abandoned) ROW for alternative underground routes (Appendix C). One potential route alternative was identified for the desktop analysis. Note that this route alternative has several different variations which use different street ROW, particularly within the City of Erie where streets parallel to the route shown were also considered. The final selection of the route would depend largely on coordination with municipal officials and utility owners with the goal of minimizing conflicts with traffic and utilities. Maps of the proposed routes for Alternative 2 are in Appendix C.

As with the case for Alternative 1, the underground route alternatives and variations were based on availability of ROWs. However, in contrast to Alternative 1, much of the route for Alternative 2 is an urban setting, characterized by densely developed city blocks, city streets with sidewalks and urban landscape features, and many existing underground and aboveground utilities. Except for a few large tracts (such as the former International Paper property), the use of private property for ROWs along the Alternative 2 route is impractical due to a multitude of property owners from which easements must be obtained. Therefore, Alternative 2 must use local street ROWs for much of the route.

Alternative 2 poses significant engineering constraints due to the density of surrounding development. While the City of Erie may be willing to permit such use of City street ROWs, siting will likely require substantial complications to identify a route which avoids or minimizes conflicts with existing infrastructure, including underground water, sewer, gas and other utilities, street poles, building structures, and other features. Rerouting to avoid these obstacles would result in a commensurate increase in the construction duration and costs. In addition, there will be additional impacts to the public during construction due to potential road closures, noise, and presence of construction vehicles.

For Alternative 2, wetland and stream crossings are identified in Appendix C mapping. South of the City of Erie, there are potential wetlands identified on either NWI mapping, or soils listed as hydric on NRCS soils mapping. Appendix C also identifies potential stream crossings per USGS mapped perennial or intermittent streams (i.e. blue lines on USGS 7.5 minute topographic quadrangles). South of the City, stream crossings exist along the route for Mill Creek and its tributaries, as well as tributaries to Walnut Creek.

For the most part, impacts to wetlands and streams might be minimized by constructing the transmission cables within or adjacent to the roadway itself, on the existing roadway embankment, or between roadway ditch lines. Avoidance would not be feasible, however, where there may be water resources within the limits of the roadway right-of-way, for example a wetland area that abuts a roadway embankment. As with Alternative 1, impacts to the streams and the majority of wetland would be expected to be temporary in nature due to proper construction techniques and restoration measures.

Alternative 2 presents significant engineering challenges which will result in environmental impacts and increase the duration of the construction schedule. Because Alterative 2 is within city streets, there are a number of existing utilities (i.e. water, gas, etc.) which will have to be either crossed or avoided. This would result in collocation of utilities or require relocation of utilities, resulting in additional air quality, traffic, and noise impacts. In addition, crossings would require a greater level of surface restoration and increased traffic control which would impact the public.

While there is a significant cost associated with the acquisition of ROWs for the project, the increased cost of design and construction within highly developed areas for Alternative 2 far outweighs the cost for ROW acquisition associated with Alternative 1. Because Alternative 2 would result in unavoidable impacts (i.e. numerous street closures, construction traffic, and noise) and the Erie South Substation was determined as an not practicable POI, Alternative 2 was eliminated as impracticable and also not environmentally preferable.

Hence, Alternative 1 was selected as the preferred route. Table 3.3-2 summarizes the underground alternatives.

Table 3.3-2 Comparison of underground alternatives.

Criteria	Alternative 1	1a	Alternative 2
Total Length (ft)	37,623	40,245	38,928
Acres of Wetlands within 50' of route segment from 2014 and 2015 Field Surveys and NWI	12.1	11.0	0.1
Acres of Wetlands within 100' of route segment from 2014 and 2015 Field Surveys and NWI	27.7	25.7	0.5
No. of Stream Crossings from 2014 and 2015 Field Surveys, Pennsylvania watercourses (PAMAP) and National Hydrography Dataset.	13	13	3
No. of Park Crossings	0	0	0
No. of Road Crossings	13	15	41
No. Infrastructure Crossings (rail)	2	2	3
No. Infrastructure Crossings (bridges)	1	1	0
Acres of Core Habitat and Supporting Landscape from statewide PA Natural Heritage Program and Erie County Natural Heritage Inventory within 50' of route segment	51	53	50
Acres of Core Habitat and Supporting Landscape from statewide PA Natural Heritage Program and Erie County Natural Heritage Inventory within 100' of route segment	90	102	105
Land Uses; sensitive receptor areas (i.e. hospitals, schools)(within 500 ft)	0	0	2 schools
Cultural Resources (known cultural resources within 500 ft)	3	3	2 historic areas
No. of Hazardous Waste Sites within 500' of route segment	0	0	10

3.3.6 No-Action Alternative

The purpose of the Project is to develop a controllable HVDC submarine and underground bi-directional merchant transmission facility that will interconnect IESO and PJM. The Lake Erie Connector will be the first direct energy transmission interconnection between the IESO and PJM. The Project will enhance power system reliability and increase market efficiency while supporting energy and environmental policy goals. The Project will also provide economic benefits in Pennsylvania including tax revenues over the course of the Project's lifetime and the creation of construction and operations jobs.

The No-Action Alternative provides a baseline against which the potential environmental impacts of the Proposed Action can be evaluated. Selection of the No-Action Alternative would preclude the construction and operation of the Project. Consequently, any environmental and community impacts associated with constructing the proposed Project would be avoided. In addition, the following benefits would not occur:

- A new energy interconnection to meet growing demands in the PJM service region;
- Enhancing power system reliability and providing improved access to markets
- The creation and preservation of in-state jobs during construction and operations;
- Increased local income tax and property tax revenues in Erie County;
- Contribute to Pennsylvania's ability to meet its energy demands and mitigate impacts of retirements of power plants;
- Contribute to the development of energy resources by providing the ability to tap into clean energy generation in Canada to help support electric demand in Pennsylvania; and
- Strengthened grid availability from bi-directional intertie that will facilitate import or export transfers of surplus power.

3.3.7 Alternatives Considered but Eliminated

The Applicant evaluated alternatives that were eliminated during the initial screening process and are summarized in (Table 3.3-3). In 2011, prior to the Applicant acquiring the Project, an alternative POI located in Ashtabula County, Ohio, was considered. However, it was initially eliminated because the route was longer, which would have resulted in greater environmental effects for the underwater cable route, and the route would be less cost effective. It is not included in this alternatives analysis because it does not meet the purpose and need of the proposed Project. During the feasibility stages of this project, cable technology, including type of cable and its capacity, was reviewed. Different cable capacities were considered; however, as they did not meet the project Purpose and Need they were eliminated during the initial screening process. As discussed above, this project includes a 1,000 MW, +/-320-kV, HVDC cable system and a short distance of 345-kV HVAC cable. The target system capacity of 1000 MW was selected as the most cost-effective HVDC transmission system available with current technology. This is the maximum power transfer that can be expected using solid dielectric cable and Voltage Source Convertor (VSC) technology. Additional power transfer using the same technology would require parallel installations for both the convertor station and cable systems, greatly increasing project impacts and cost. The available alternate technologies are higher cost, require additional space, and have higher potential environmental impacts and were, therefore, eliminated from consideration early in project development.

Table 3.3-3 Summary of alternatives considered and eliminated after initial screening.

Alternative	Description	Selection
Technologies		
New Overhead HVAC Transmission	Site and permit overhead HVAC lines.	Does not meet Project Purpose and Need. HVAC requires upland transmission corridors. Distance is too far for HVAC technology, will result in higher losses, and will not provide power flow control. Existing corridors are used to capacity and an overhead route around Lake Erie would be much longer. New corridors are difficult to site in populated areas.
Underground via Railbanked Railroad ROW	Former Bessemer and Lake Erie Railroad ROW that has been "railbanked" under the National Trails System Act. Once the route connected with the railroad ROW, the route would follow that until it reached the Erie West Substation	Eliminated based on unacceptable risks associated with installing the HVDC cable underground within the railroad ROW and uncertainty in acquiring landowner agreements; potential risks of requirements for future relocation of electric line associated with conditions placed on railbanked ROW. For these reasons, this alternative was determined to be not practicable to meet project purpose and objectives of providing a long-term reliable method of interconnecting the PJM and IESO grids.

3.4 Least Environmentally Damaging Practicable Alternative (LEDPA)

Under the Clean Water Act §404(b)(1) guidelines, applicants must demonstrate that there is no "practicable alternative to the proposed discharge which would have less adverse impact on the aquatic ecosystem" and which "does not have other significant adverse environmental consequences." (40 C.F.R. § 230.10(a)). The Guidelines consider an alternative practicable "if it is available and capable of being done after taking into consideration cost, existing technology, and logistics in light of overall project purposes." (40 C.F.R. § 230.10(a)(2)). In accordance with the Section 404(b)(1) Guidelines, the Applicant evaluated several alternatives to the Project described in the Sections above. Each of these alternatives was assessed for overall practicability based on existing technology, logistics, costs, and environmental impacts to select the preferred route, landfall location, and converter station site, which collectively represent the LEDPA.

3.4.1 Preferred Route

Under the preferred Alternative, for the U.S. portion of the HVDC underwater cable, the route begins in the middle of Lake Erie at the U.S./Canadian Border and travels 35.4 mi (57.0 km) and makes landfall in Springfield Township in Erie County, Pennsylvania, via a HDD through the lake bluff west of Erie Bluffs State Park. From the HDD exit pit, the HVDC underground route will follow an existing private property path and driveway for 0.6 miles to West Lake Road (State Route 5) where it heads east for 0.5 miles; the alignment then heads south and follows Townline Road, crossing into Girard Township for 2.3 miles to an intersection with Ridge Road (US Route 20). At Ridge Road the underground route crosses into a forested area and then follows a farm road for 0.7 miles to Springfield Road, which it follows for 1.6 miles. Then the alignment follows Lexington Road for 1.2 miles and, leaving Lexington Road, crosses private property for 0.1 miles to the proposed converter station location, Erie Converter Station, located in Conneaut Township in Erie County, Pennsylvania. The Erie Converter Station will interconnect with the existing electrical power systems at the nearby Erie West Substation POI through underground HVAC cables. The HVAC route would be approximately 2,082 ft (635 m) in length (Figure 2.2-3) as it leaves the converter station at the south west corner of the property and follows an existing overhead corridor to the substation.

3.4.2 Summary of Construction Techniques

Appendix A depicts the proposed construction techniques for cable installation for the underwater and underground routes. Additional details regarding construction techniques are discussed in Section 2. Construction techniques were selected to minimize environmental impacts and BMPs will be used per Permit requirements.

For the underwater segment, it is anticipated that a cable installation would occur using a jet plow in fine- and coarse-grain sediments or by water jetting. These sediment types are found along the majority of the route. In areas of shallow overlaying sediments and those areas of bedrock (approximately 0.9 mile offshore), a trench may be excavated in the bedrock (primarily shale) from the exit of the HDD bore to the softer lakebed material where jet plow burial can be utilized.

For the underground segment of the HVDC transmission line route, the two cables within the transmission system would typically be installed along with a fiber optic cable by either laying directly in an excavated trench or in a concrete-encased PVC conduit duct bank with a minimum 3 ft (0.9 m) of cover. Prior to construction, erosion and sedimentation BMPs will be implemented along wetland boundaries in these areas to prevent the movement of sediment from work areas and stockpile areas along the roadway.

Trenchless construction methods may be utilized in other locations where open trenching is less appropriate due to either physical constraints (roadway or railroad crossings) or environmental constraints (certain wetland and stream crossings). There are two types of trenchless installation that could be used in construction of the Project: Jack & Bore and HDD methods. The equipment used and type of operation would vary depending on the length and depth of the installation.

3.4.3 Summary of Environmental Impacts

The following paragraphs summarize the potential environmental impacts of the Preferred Route. Additional information on the affected environment and environmental consequences for the underwater route can be found in Section 4 and Section 5, respectively. Section 6 discusses the Cumulative Impacts of the Project.

3.4.3.1 Water Use and Land Use

Due to the relatively small footprint and short duration of project construction, effects on the recreational and fishing uses of and navigation in Lake Erie are expected to be localized, temporary, and negligible. During operation of the project, the magnetic field from the cable will be too low to impact navigation and will not cause compass deflection in the main shipping channels. Compass deflection could occur in the segment of the route that is near the shore of the lake where it is unlikely that a compass would be needed for navigational purposes.

For the Underground Segment, the Applicant will avoid or minimize traffic disturbances by using traffic details, construction signs and barriers, and notifying the local community in advance of any known road closures and detours. In addition, effects to roads and rail crossings will be minimized by using Jack & Bore techniques, thus avoiding most crossings by open trenching. No impacts to recreation opportunities are anticipated from the construction or operation of the proposed Project.

3.4.3.2 Geology and Soils

Sediment disturbance in the lake and soil disturbance on land will result from Project construction. Total disturbance of all in-water activities would result in a temporary only disturbance of approximately 12.7 acres, and a permanent disturbance of 2.0 acres, consisting primarily of the areas excavated for the three HDD sump pits, the cable trench in the bedrock, and the associated sidecast rock.

The landside elements of the Project involve disturbance temporary and permanent impacts to wetlands and streams as described in Section 5.3.2. The disturbance on land includes temporary work spaces such as laydown yards (13.4 acres), Erie Converter Station property (21.4 acres), and work spaces required for construction ROW (41.3 acres). On-land disturbance components include temporary (only) impacts to wetlands (0.8 acres), permanent impacts to wetlands (1.0 acres), temporary impacts to streams (0.2 acres), permanent impacts to streams (less than 0.01 acres), and temporary impacts to floodplains (4.3 acres).

3.4.3.3 Water Resources and Quality

Effects on water resources and quality would be limited to construction and maintenance activities, and these effects are discussed in Section 5.1. Wetland resources have been identified within the proposed underground cable route and Erie Converter Station property. Wetlands in the proposed project have been substantially influenced by adjacent roadways, fields, and other developed features. Temporary impacts to wetlands are expected to occur during the construction and maintenance activities associated with the proposed Project. The cable route is proposed to occur primarily in existing public roadway ROWs and existing driveways, thus minimizing effects to wetlands. The temporary (only) and permanent limit of disturbance to wetlands is estimated to be 0.8 and 1.0 acres, respectively. Temporary impacts may occur as part of repair or vegetation maintenance activities, but impacts would be localized and the affected area would be restored. Most of the wetlands located within the regularly maintained corridor would be restored. Where encroachments cannot be avoided, temporary impacts may be minimized by use of HDD or other methods, and in any event, disturbed areas will generally be restored under a PADEP- and USACE-approved mitigation plan.

The majority of the proposed transmission cable route follows existing roadway ROWs in order to minimize impacts to surface waters and other resources. The impacted waterbodies are shown on the resource maps in Appendix A and in Table 5.3-3 . Ground disturbance would occur during cable installation from clearing and waterbody crossing methods. The use of HDD crossing methods will be implemented for waterbodies and wetlands located in the high-quality watershed. Open trenching, cofferdams, or flume and pump around systems will be utilized for other waterbody and wetland crossings. Erosion and Sedimentation Control Plans will be developed and BMPs will be used to avoid impacts. The USACE and PADEP will approve the crossing techniques by approving the Joint Permit Application. Waterbody and wetland crossings will be designed to minimize potential impacts.

A number of vessels will be involved in Project construction. A Spill Prevention Plan designed specifically to prevent spills during lake operations will be developed. Cable installation in Lake Erie will be conducted using a jet plow or by water jetting in the deepest portion of the lake. Burial of the cable may affect water quality by temporarily resuspending sediment and potentially causing localized migration of heavy metals in the basin or water column. The Applicant conducted modeling to evaluate the potential mixing and dispersion of sediment and other constituents resuspended during the cable installation process for the proposed jet plow or water jetting installation method. Low concentrations of trace metals and organic chemicals are present in Lake Erie sediments; and the eastern basin of Lake Erie (where the Project is located) has the lowest level of contamination in sediments in the Lake Erie Basin.

During the construction and installation process, HDD would occur at the Lake Erie landfall location. HDD operations have the potential to release drilling fluids to the surface through inadvertent returns. Because drilling fluids consist largely of a bentonite clay-water mixture, they are generally considered non-toxic. To prevent or minimize this potential effect, prior to HDD operations a sump pit will be constructed in the bedrock at each exit point of shore to lake transition. The purpose of the exit point sump pit is to contain suspended sediments to the interior footprint of the sump pit during the exit point excavation, contain drilling fluids at the lower end of the excavation for recovery (as described in the next paragraph), and disposal at an approved upland facility.

The HDD contractor will also implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan (Attachment 1 of the PADEP/USACE Joint Permit Application submitted in January 2016). This plan identifies procedures for monitoring for fluid release, containing a fluid release if it occurs, and cleaning up any fluid losses.

3.4.3.4 Aquatic Resources

Habitat containing large/rocky substrates off the shores of Pennsylvania offer spawning and nursery habitat for such species as lake whitefish, rainbow smelt, emerald shiner, spottail shiner, fathead minnow, channel catfish, stonecat, trout-perch, white bass, smallmouth bass, rainbow darter, johnny darter, yellow perch, walleye, and freshwater drum (Goodyear et al. 1982). As fish are mobile and in-water construction activities will take place in a small portion of Lake Erie, helping to minimize project effects to aquatic resources. Additionally, the proposed Project will use HDD methods near shore and would avoid disturbance of the nearshore area where spawning, feeding, and rearing is most common among a variety of species.

Due to the frequent high-energy wave action and the presence of exposed bedrock along the nearshore area of Lake Erie, aquatic vegetation is scarce to non-existent (Rathke 1984), and, therefore, construction activities from the proposed Project are not expected to result in any impacts to aquatic vegetation. Lakebed disturbance from construction activities could result in a direct impact of the benthic or epifauna community; crushing or injuring benthic invertebrates, including mussels in the path of the jet plow or water jet, in areas of bedrock trenching, and in the footprint of the HDD exit sump pits. HDD, trench excavation, and jet plowing would disturb bottom sediments which could become resuspended, especially during jet plow or water jetting operations. The amount of explosives and blasting technique required for bedrock trenching will be limited to the extent possible to avoid noise and vibration impacts on fish, and impacts will be minimized by utilizing a boring/stemmed charge method. Some displacement of fishes from the active construction footprint of the Project will occur, but will be limited in spatial extent at any given time. Overall, the impacted area is expected to fill in and recolonize from recruitment from nearby, unaffected areas of the lake. Recovery for benthic communities varies, ranging from several months to several years, depending on the type of community and type of disturbance (DOE 2013).

3.4.3.5 Terrestrial Resources

The construction of the project will disturb habitat along the Project ROW. Vegetation removal and the direct reduction of some wildlife habitat could result in the direct displacement of species, including birds, mammals, reptiles, and amphibians; however, the acreage of permanent forest disturbance associated with the Project is very small. Because the project is primarily constructed along existing roads, these effects will be minimized.

3.4.3.6 Protected and Sensitive Species

Threatened and endangered species that may be within the Project area include Indiana bat, northern long-eared bat, and bald eagle. However, no significant impacts are expected during construction, operation, or maintenance of the Project. The Project is not expected to affect cisco, eastern sand darter, or lake sturgeon, the three species of concern identified by the Pennsylvania Fish and Boat Commission (PFBC), or bank swallows, a species of concern identified by the USFWS. Rare plant surveys along the proposed Underground Segment were performed in spring and summer 2015 to identify any occurrence of state-listed species. The survey indicated that no species listed by the PADCNR were identified. The results of these surveys were provided to the PADCNR. On December 4, 2015, the PADCNR provided PNDI clearance, along with recommendations to prevent the spread of invasive species that will be followed.

3.4.3.7 Cultural Resources

The Applicant recognizes that the formal National Historic Preservation Act Section 106 process has not been initiated. However, in advance of the process, the Applicant has initiated studies to identify historic properties along the Project's alignment. The Applicant conducted a Phase IA Study of the proposed transmission cable route in 2014 and a Phase IB in 2015. During the Phase IB, additional archeological sites were found along the centerline and at potential staging areas. Engineering options will be evaluated, in consultation with PHMC, to avoid adverse effects to these sites.

The Phase 1A study also evaluated the in-lake elements of the Project. All previously confirmed shipwrecks have been avoided by at least 100 m. Further, the Applicant performed a Marine Route Survey in 2015 to identify bottom conditions, shipwrecks, existing utilities, and other features along the proposed marine route. The marine route survey included a combination of equipment and approaches including side-scan sonar, single-beam bathymetry, and magnetometer surveys to facilitate identification of potential shipwrecks. The results of the marine route survey were reviewed by a marine archaeologist to identify anomalies or potential shipwrecks along the Project's marine route. No shipwrecks or other archaeological resources were identified along the marine route. Therefore, construction activities associated with the marine cable route are not expected to have any effect on historic or archaeological resources.

3.4.3.8 Aesthetic and Visual Resources

During construction of the proposed Project, there would be temporary impacts to the visual character of the viewshed. Because the transmission line will be installed in the lakebed and underground, there will be no permanent visual impacts expected from the operation of the proposed Project other than from the presence of the Erie Converter Station. A visual simulation of what the Erie Converter Station would look like is provided in Section 5.8.

3.4.3.9 Climate, Air Quality, and Noise

The Project will not significantly affect climate or air quality. An air quality permit application to the PADEP will be required for the emergency generator on site. Construction of the Project will result in elevated noise levels during construction of the Project. These effects will be temporary, lasting only during construction. The Applicant conducted a study of the sound propagation and impacts associated with the operation of the proposed Erie Converter Station. A model of noise produced by equipment at the Erie Converter Station during normal operations would not adversely affect the sensitive receptors located closest to the facility.

3.4.3.10 Public Health and Safety, Hazardous Materials and Waste, and Socioeconomics

The Project will not affect public health and safety, hazardous materials and waste, or socioeconomics.

3.4.3.11 Infrastructure

During construction of the Underground Segment of the Project, local infrastructure will temporarily be affected. These effects would primarily be temporary impacts to traffic. Disturbances during construction may include limitations on property access due to road detours and construction equipment/activities. No other local infrastructure would be adversely affected by the construction or operation of the Project.

3.4.3.12 Land Use and Traffic

Construction of the underground route of the proposed Project would result in temporary impacts to existing land uses and traffic along the proposed Underground Segment. Disturbances to land use during construction may include limitations on property access due to road detours and construction equipment/activities. However, these disturbances would be limited to the duration of construction in that immediate area and are anticipated to be short (i.e., less than a week in each area). Because the transmission line along the underground route will primarily be buried within the road ROW, disturbances to local traffic may occur during construction. The Applicant will avoid or minimize traffic disturbances by using traffic details, construction signs, and barriers and notifying the local community in advance of any known road closures.

No formal recreation sites are located within the underground route of the proposed Project, and, therefore, no impacts to recreation opportunities are anticipated from the construction or operation of the proposed Project. Permanent land use impacts will occur in areas where the transmission line route requires easements, restricting future land development within the easement area. However, since the transmission line has been located substantially within road ROWs, the impact on future land development is expected to be minimal. There is no zoning in Conneaut Township, where the Erie Converter Station location is located. Construction and operation of the proposed Project is expected to be consistent with relevant land use comprehensive plans for the Erie County and Springfield, Girard, and Conneaut Townships.

3.4.3.13 Environmental Justice

No Environmental Justice communities or populations are located within the proposed Project area and area of concern as defined by the PADEP Environmental Justice Public Participation Policy. Construction of the Underground Segment of the proposed Project would be relatively short in duration (i.e., less than 6 months); therefore, no lasting or significant effects on the population in general, including minority or low-income communities, are anticipated from construction activities.

4.0 AFFECTED ENVIRONMENT

Section 4 provides a characterization of the existing environmental conditions within the proposed Project area, including the Lake Segment, the Underground Segment, and the Erie Converter Station.

4.1 Water Use and Land Use

4.1.1 Lake Segment

4.1.1.1 Recreation and Fishing

The Lake Erie watershed is home to over 11 million people. It supports a large freshwater fishery and provides many recreational and tourism opportunities including swimming, fishing, and boating (Lake Erie LaMP 2012). Lake Erie has over 63 miles of shoreline in Pennsylvania and 735 square miles of surface water within its Pennsylvania boundaries (PFBC 2014a). There are a number of shoreline-based recreational sites in general proximity to the Project, and these are discussed below in Section 4.1.2, Underground Segment.

With its long shoreline, Lake Erie is easily accessible for recreational anglers because it can be accessed by boat, shore, and pier. A USFWS and U.S. Census Bureau report, *2006 National Survey of Fishing, Hunting and Wildlife-Associated Recreation*, shows that Lake Erie is the most popular of the Great Lakes for recreational fishing (USFWS and USCB 2006). In 2006, there were approximately 526,000 anglers on Lake Erie, which accounted for 37 percent of the Great Lakes anglers (USFWS and USCB 2006). A total of 4,651 Lake Erie fishing days were recorded (USFWS and USCB 2006).

Lake Erie boat angler creel surveys have been conducted since 1993 to estimate sport fishing activity in Pennsylvania waters of Lake Erie. In 2007, 573 interviews were conducted (PFBC 2008). Total open lake effort was 336,863 hours, most of which was in the central basin (PFBC 2008). Figure 4.1-1 shows the locations of the three basins referred to in these creel surveys, and as included in Table 4.1-1. Results indicated that boat anglers targeted walleye, yellow perch, smallmouth bass, and steelhead trout. Most of the open lake boat effort was directed at walleye (51 percent), yellow perch (35 percent), smallmouth bass (6 percent), and steelhead trout (5 percent). Boat anglers caught 13 different types of fish, 9 of which were harvested. Most of the catch was comprised of yellow perch (61 percent), white bass (13 percent), walleye (11 percent), sheepshead (6 percent), and white perch (5 percent; Table 4.1-1). Most of the fish harvest was comprised of yellow perch (82 percent) and walleye (16 percent; PFBC 2008).

Section 4.4.1 includes information on commercial fishing.

Figure 4.1-1 Lake Erie basins.

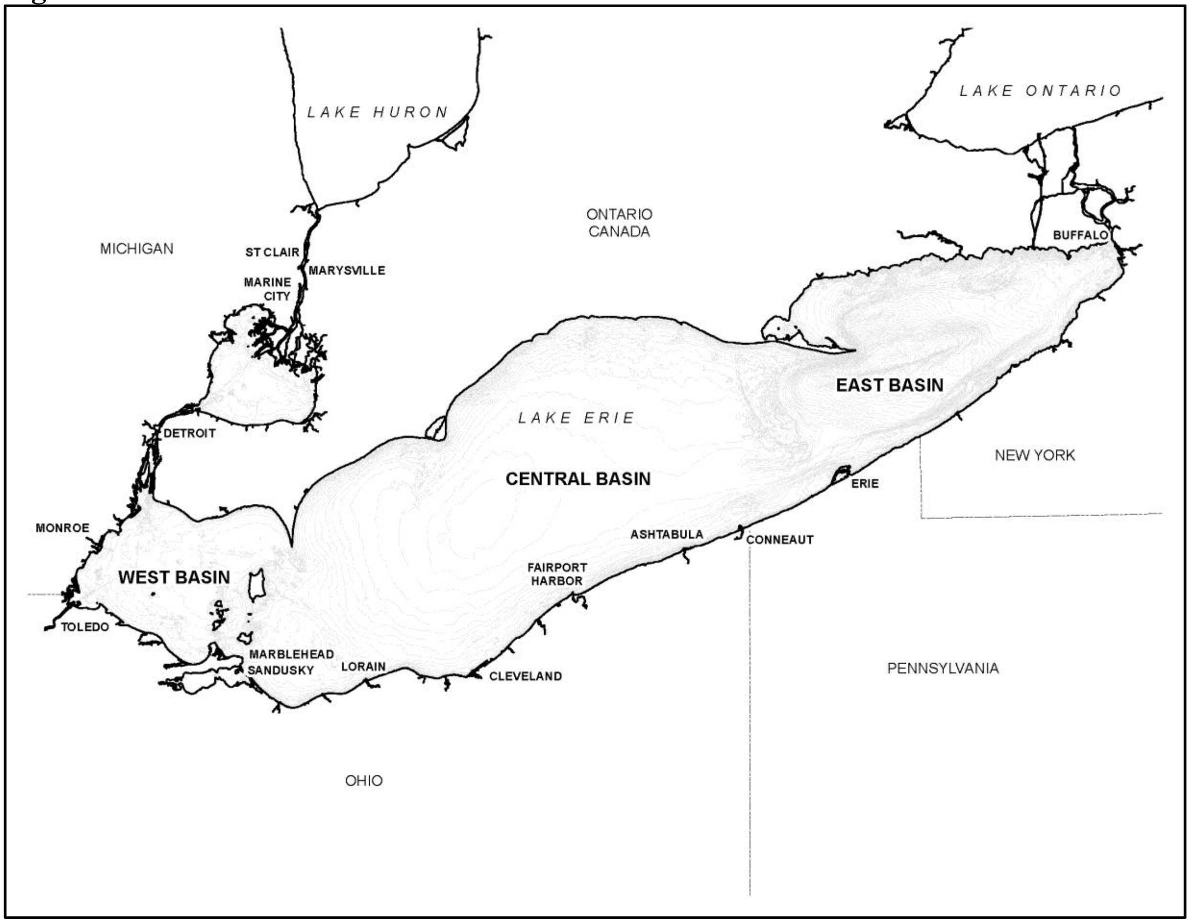


Table 4.1-1 Estimated catch and harvest of fish in central and eastern basin and total open lake waters of Lake Erie by angler landings during 2007.

	Central Basin		Eastern Basin		Total Open Lake	
Number of Interviews	**462**		**111**		**573**	
Effort (hours)	**266,653**		**70,210**		**336,863**	
	Catch	**Harvest**	**Catch**	**Harvest**	**Catch**	**Harvest**
Yellow perch	407,940	355,677	56,941	54,233	464,881	409,910
White bass	71,712	2,290	28,202	396	99,915	2,686
Walleye	74,332	68,700	11,102	10,247	85,434	78,946
Sheepshead	36,346	0	6,674	0	43,020	0
White perch	26,936	2,565	11,791	1,408	38,727	3,972
Round goby	10,243	0	7,803	400	18,046	400
Smallmouth bass	5,639	82	4,177	259	9,816	341
Steelhead	4,893	2,879	529	83	5,422	2,962
Rockbass	1,395	0	764	173	2,159	173
Channel catfish	314	0	0	0	314	0
Largemouth bass	256	0	0	0	256	0
Rainbow smelt	151	25	0	0	151	25
Lake trout	0	0	38	0	38	0
Total	**640,157**	**432,218**	**128,021**	**67,199**	**768,179**	**499,415**

Source: PFBC 2008

4.1.1.2 Navigation

Lake Erie is the shallowest of the Great Lakes and the only one with a lake floor above sea level (NOAA 2014b). The deepest part of the lake is generally at the east end while the island region in the western part of the lake is the shallowest. Lake Erie is fed at the northwest end by water from Lake Huron via the St. Clair River, Lake St. Clair, and the Detroit River. The only natural outlet of the lake is at the northeast end through the Niagara River. The Welland Canal bypasses the falls and rapids of the Niagara River and provides a navigable connection to Lake Ontario. The waters of Lake Erie east of Long Point are part of the St. Lawrence Seaway and are under the navigational control of the Saint Lawrence Seaway Development Corporation, a corporate agency of the U.S. and the St. Lawrence Seaway Management Corporation of Canada (NOAA 2014*a* and 2014*b*).

Designated shipping lanes are located within central Lake Erie and these are part of the main Great Lakes shipping route. Principal ports on Lake Erie are Buffalo, New York; Erie, Pennsylvania; and Conneaut, Ashtabula, Fairport Harbor, Cleveland, Lorain, Huron, Sandusky, and Toledo, Ohio (NOAA 2014*b*). The Port of Erie is located on the southern shore of Lake Erie, approximately 16 miles (26 km) east of the proposed Project landing point, in the City of Erie. It is naturally sheltered by an approximately 6.2-mile(10 km)-long peninsula called Presque Isle. The Port of Lake Erie is the only port on the lake in Pennsylvania (World Port Source 2015). It has a deep draft commercial harbor, which is authorized for depths of 29 ft in the entrance channel and 18 to 28 ft in the harbor (USACE 2014). The harbor was last dredged in 2001, when approximately 220,000 cubic yards of material was removed. Prior to this effort, the harbor was last dredged in 1998.

The Port of Erie includes a large dry dock and crane, a modern full-service shipyard, deep-draft docks, warehouse space, and other commercial commodities (World Port Source 2015). It was estimated that for a 5-year average (from 2007 to 2011), 767,000 tons of material has been shipped and received at this port (USACE 2014). Shipped and received commodities include aggregates, sand products, limestone, and other miscellaneous products (USACE 2014). The port is also utilized for various recreational activities including sport fishing and boating.

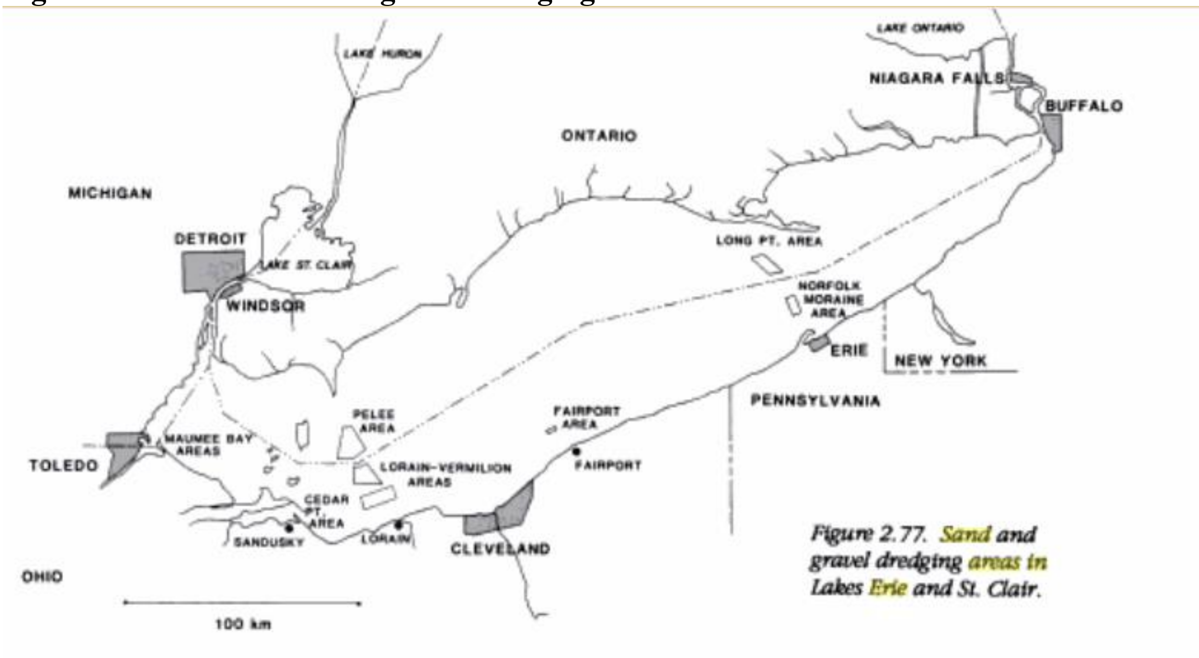
In addition to the navigational channels, gillnets, impounding nets, and trap nets may be encountered and potentially create a hazard to navigation throughout the lake, particularly in the nearshore areas of the lake as those waters are intensively fished with nets (NOAA 2014*a* and 2014*b*).

4.1.1.3 Mineral Resources

There is a substantial amount of natural gas and oil below Lake Erie. In the U.S. portion of Lake Erie, it is estimated that 46.1 million barrels of oil, 3.0 trillion cubic f of gas, and 40.7 million barrels in natural gas are undiscovered (USGS 2006). However, the estimated oil deposits are in Ohio and less than a quarter of the estimated gas and natural gas deposits are in the Pennsylvania portion of Lake Erie (USGS 2006). The presence of shallow gas at or near the lake floor surface along the proposed Project route may be encountered within the Pennsylvania channel, between Kilometer Post (KP) 75 to KP 102 (Figure 2.1-1; CSR 2014, CSR 2015). No offshore oil and gas drilling in the Great Lakes has occurred in U.S. waters, and offshore drilling in Lake Erie has been federally banned since 2005 (Congressional Research Service 2008).

Pennsylvania has designated a large offshore area (Norfolk Moraine) north of Erie for commercial sand extraction and Erie Sand and Gravel Extraction holds permits from PADEP and the USACE for extraction of sand and gravel within that designated area. (Bolsenga and Herdendorf 1993; Permit number: E25-041, USACE permit number 2006-1413). Sand and gravel have many commercial and construction uses, especially as an aggregate in concrete. This bar extends from Erie, Pennsylvania to Long Point, Ontario (Bolsenga and Herdendorf 1993; Figure 4.1-2)

Figure 4.1-2 Sand and gravel dredging areas in Lake Erie and St. Clair.



Source: Bolsenga and Herdendorf 1993

4.1.2 Underground Segment

4.1.2.1 Land Use

This section discusses land use in the general vicinity of the proposed Project (i.e., the townships crossed by the underground route).

Along the majority of the underground route, the transmission cables will primarily be buried within road ROWs. There are two areas along the underground route where the transmission cables will not be installed along the road ROW: 1) approximately 3,953 ft through a wooded area between the Lake Erie landfall and West Lake Road/Route 5; and 2) approximately 3,885 ft between Ridge Road/Route 20 and Springfield Road. The transmission cables would be installed outside of road ROWs in certain areas to avoid existing infrastructure (i.e., bridges, culverts), sensitive natural resources (i.e., wetlands, waterways), or to account for the limitations of the cable installation, such as turning radius. There are seven locations where the route will briefly leave the adjacent road ROW to account for turns on to new roads encountered along the route. Detailed route maps are provided in Appendix A.

Land use in the vicinity of the underground route generally consists of rural, low-density residential and agricultural lands. The existing land use of the Erie Converter Station site consists of an agricultural field with a wooded area on the western third of the property. There is no zoning in Conneaut Township where the Erie Converter Station is located.

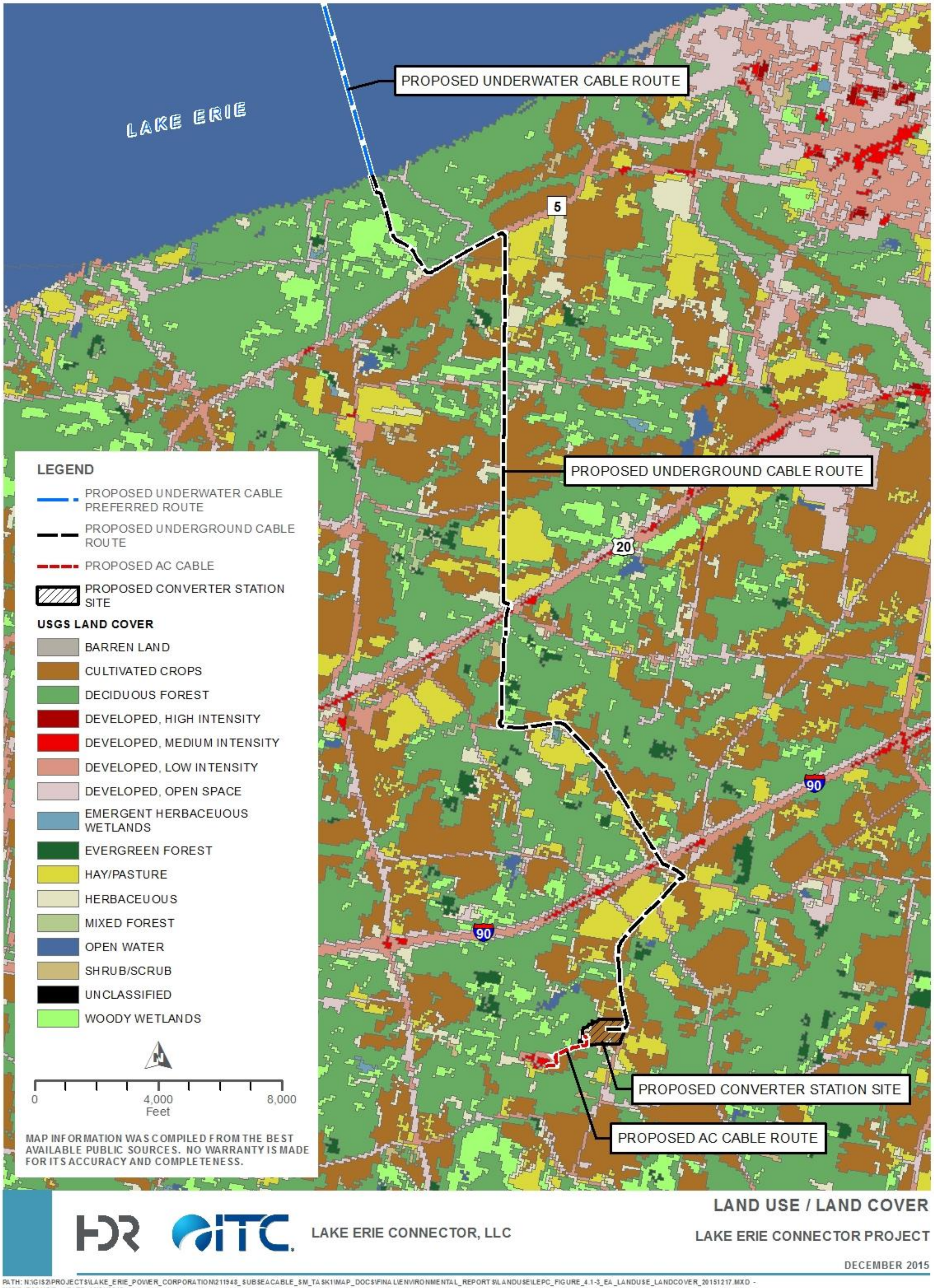
Primary land cover types along the underground route are described in Table 4.1-2 and Figure 4.1-3.

Table 4.1-2 Primary land cover types.

Underground Route Section (Option 1)	Primary Land Cover
From the Lake Erie landfall south through a wooded area across the CSX railroad and along an existing dirt road to West Lake Road (Route 5).	▪ Deciduous Forest ▪ Woody Wetlands ▪ Developed, Low Intensity
From West Lake Road east to Townline Road.	▪ Developed, Low Intensity
From along Townline Road south to Ridge Road (Route 20).	▪ Cultivated Crops ▪ Hay/Pasture ▪ Deciduous Forest ▪ Woody Wetlands ▪ Developed, Low Intensity ▪ Developed, Open Space
Across Ridge Road and south through an undeveloped area to Springfield Road.	▪ Deciduous Forest ▪ Cultivated Crops ▪ Woody Wetlands ▪ Shrub/Scrub
From Springfield Road south to Interstate 90.	▪ Deciduous Forest ▪ Cultivated Crops ▪ Hay/Pasture
Across Interstate 90 to East Springfield Road to Lexington Road.	▪ Developed, Low Intensity ▪ Developed, Open Space ▪ Cultivated Crops
From Lexington Road to the proposed Converter Station.	▪ Cultivated Crops ▪ Hay/Pasture ▪ Deciduous Forest ▪ Woody Wetlands ▪ Developed, Low Intensity
Proposed Converter Station	▪ Cultivated Crops ▪ Woody Wetlands ▪ Deciduous Forest

Source: USGS 2001.

Figure 4.1-3 Primary land use/cover types along the underground route segment.



Property ownership along the underground route includes private property as well as municipal/state property (i.e., along roadways and interstates) and railroad property (railroads crossed by the proposed Project).

No places of worship, schools, or health care facilities were identified along the underground route.

4.1.2.2 Recreation

The underground route for the proposed Project is not sited within the boundaries of any formally designated recreational areas. Two state parks are located in Erie County: Erie Bluffs State Park and Presque Isle State Park. Shoreline-based recreational sites within five miles of the Project are listed in Table 4.1-3.

Table 4.1-3 Shoreline recreational sites within 5 miles of the Project area.

Recreational Site	Location	Distance from landfall location
Lake Erie Community Park	Lake City, Pennsylvania	2.6 mi (4.1 km)
Erie Bluffs State Park	North Springfield, Pennsylvania	120 ft (37 m)
YMCA Camp Fitch on Lake Erie	North Springfield, Pennsylvania	1.6 mi (2.6 km)
Virginia's Beach Lakefront Cottages & Camping	North Springfield, Pennsylvania	2.1 mi (3.4 km)
Camp Lambec	West Springfield, Pennsylvania	2.8 mi (4.5 km)
State Game Lands Number 314	East Springfield, Pennsylvania	4.5 mi (7.3 km)
Uncle John's Elk Creek Campground	Lake City, Pennsylvania	2.1 mi (3.3 km)
Pine Lane Campground	Springfield, Pennsylvania	0.7 mi (1.2 km)
Elk Creek Access Area	Lake City, Pennsylvania	1.8 mi (2.9 km)
Raccoon Park	East Springfield, Pennsylvania	4.3 mi (6.9 km)

The Project's Lake Erie landfall is located approximately 120 ft (37 meters) from the western boundary of Erie Bluffs State Park. Erie Bluffs State Park encompasses 587 acres along the Lake Erie shoreline in western Erie County, twelve miles from the city of Erie. The park includes one mile of shoreline, 90-ft bluffs overlooking Lake Erie, Elk Creek – a shallow stream steelhead fishery, several plant species of conservation concern, an uncommon oak savannah sand barren ecosystem and forested wetlands. Recreation activities in the park include picnicking, boating, fishing, hunting, hiking/walking, and sightseeing with amenities such as picnic tables, a pavilion, and a boat launch suitable for small motorized watercraft, kayaks, and canoes (PADCNR undated*a*).

As shown in Table 4.1-3 above, various camps are located along the Lake Erie shoreline, the closest of which are Pine Lane Campground and the YMCA Camp Fitch located approximately 0.7 and 1.6 miles, respectively, from the Lake Erie landfall location.

4.1.2.3 Land Use Plans and Policies

Bluff Recession and Setback Program

Municipalities in Pennsylvania bordering Lake Erie are required to adopt ordinances implementing the Pennsylvania Bluff Recession and Setback Act, which regulates land development activities along Bluff Recession Hazard Areas adjacent to Lake Erie. Such regulations are enforced through the process of obtaining zoning variances for construction activities on the bluffs. The Project will be constructed in accordance with 25 Pa. Code Chapter 85 Bluff Recession and Setback regulations and corresponding provisions in the Springfield Township Zoning Ordinance. The Project is applying for a "variance" under the Springfield Township bluff recession provisions to allow certain construction activities to occur within the setback zone, but utilization of the HDD construction methods have been designed to protect the bluff resources.

Erie County Comprehensive Plan

Under the Pennsylvania Municipalities Planning Code (MPC), counties are required to prepare and adopt a comprehensive plan. The MPC defines a "County Comprehensive Plan" as "a land use and growth management plan prepared by the county planning commission and adopted by the county commissioners which establishes broad goals and criteria for municipalities to use in preparation of their comprehensive plan and land use regulation." The Erie County Comprehensive Plan contains the following sections: Transportation Plan, Housing Plan, Citizen Survey, Demographic Study, Land Use Plan, Natural and Historic Resources Plan, and Community Facilities and Utilities Plan. The comprehensive plan is required to be updated every ten years. With many of the sections last updated between 2003 and 2008, Erie County is currently in the process of updating the plan. The Project is consistent with the Erie County Comprehensive Plan.

Subdivision and Land Development Ordinances

The MPC authorizes counties and municipalities (cities, boroughs and townships) to adopt a subdivision and land development ordinance, thus enabling local review and approval of proposed plans for development. In the absence of a subdivision and land development ordinance adopted by the municipality, the county may adopt and administer a subdivision and land development ordinance. There are 38 municipalities in Erie County, 26 of which have enacted their own subdivision and land development regulations. The Erie County Subdivision and Land Development Ordinance (SALDO) applies to the remaining 12 municipalities.

Springfield and Girard Townships have both municipal zoning ordinances and subdivision and land development ordinances. Therefore, in Springfield and Girard Townships, land development requires county review and municipal approval. Conneaut Township (where the Erie Converter Station is to be located) does not have municipal land use ordinances; therefore, the Erie County SALDO applies and a land development plan approval from Erie County will be required for the Erie Converter Station.

Farmland Preservation Program

The Erie County Farmland Preservation Program protects viable agricultural land by encouraging the formation of Agricultural Security Areas in rural municipalities and by acquiring Agricultural Conservation Easements on property whose owners are interested in preserving higher value agricultural lands. Agricultural Security Areas have been established in order to encourage, promote, preserve, and protect normal farming operations, and Agricultural Conservation Easements prevent the development of the land for any purpose other than agricultural production and related agricultural activities. A summary of the acres of farmland in the Farmland Preservation Program within the townships traversed by the underground route of the proposed Project is included as Table 4.1-4.

Table 4.1-4 Farmland preservation program acreage in the project townships.

Township	Agricultural Security Areas		Preservation Farms	
	Acres	Percent	Acres	Percent
Springfield	2,538	10.6	82.67	3.3
Girard (including Platea Borough)	4,679	20.8	3,654	78.1
Conneaut	2,014	7.3	0	0

Source: Erie County, undated.

Pennsylvania Outdoor Recreation Plan (2009-2013)

The 2009 version of Pennsylvania's State Comprehensive Outdoor Recreation Plan (SCORP) entitled *Pennsylvania Outdoors: The Keystone for Healthy Living*, is divided into two sections. The first section presents the findings of four original research efforts conducted for the plan. The second section presents 28 programmatic and 5 funding recommendations and action steps that were developed from the research findings and from extensive public and stakeholder input. The plan does not include recommendations specific to the vicinity of the Project's underground route (PADCNR 2009). The plan is currently in the process of being updated and was expected to be complete by the end of 2014; however, the plan has not yet been published.

Coastal Zone Management Act

The Pennsylvania Coastal Resources Management Program (CRMP) protects and controls development along the shoreline area of Lake Erie between Ohio and New York. The CRMP addresses major coastal resource management issues of state, federal, and local concern. The regulatory authority of the CRMP is centered on the Dam Safety and Encroachment Act, Floodplain Management Act, Bluff Recession and Setback Act, Clean Streams Act, as amended, and the Air Pollution Control Act, as amended. The coastal zone includes the area from the international boundary with Canada and the CSX Railroad located at Station 436+00 (Appendix A).

The Coastal Zone Management Act (CZMA) states that the placement of water obstructions and encroachments, such as the cable, could result in degradation or destruction of tidal or freshwater wetlands, or impact the bed of Lake Erie. However, this Project has been designed to minimize such impacts, including impacts to wetlands and to the lake bed.

The Pennsylvania CRMP includes a series of policies to address protection and conservation of the coastal zone. As detailed in the CZMA Consistency Form submitted as part of the PADEP/USACE Joint Permit Application Process (submitted in January 2016) construction and operation of the Project will be consistent with each of the Pennsylvania CRMP's policies, and a determination of consistency with the Coastal Zone Management Act is being requested as a part of the Joint Permit Application.

4.2 Geology and Soils

4.2.1 Lake Segment

This section addresses the geology, topography and physiology, soils and sediments, bathymetry, and, where applicable, geological hazards such as seismicity, slope stability, and liquefaction associated with the proposed Project route. Data for this section are drawn from the USGS, the NRCS, survey reports and background research, and in-water field studies conducted by the Applicant's consultants (CSR 2015; see Appendix K), and other surveys and academic sources. Sediments are discussed for the aquatic portions of the proposed Project, which includes the entire Lake Segment.

4.2.1.1 Sediments

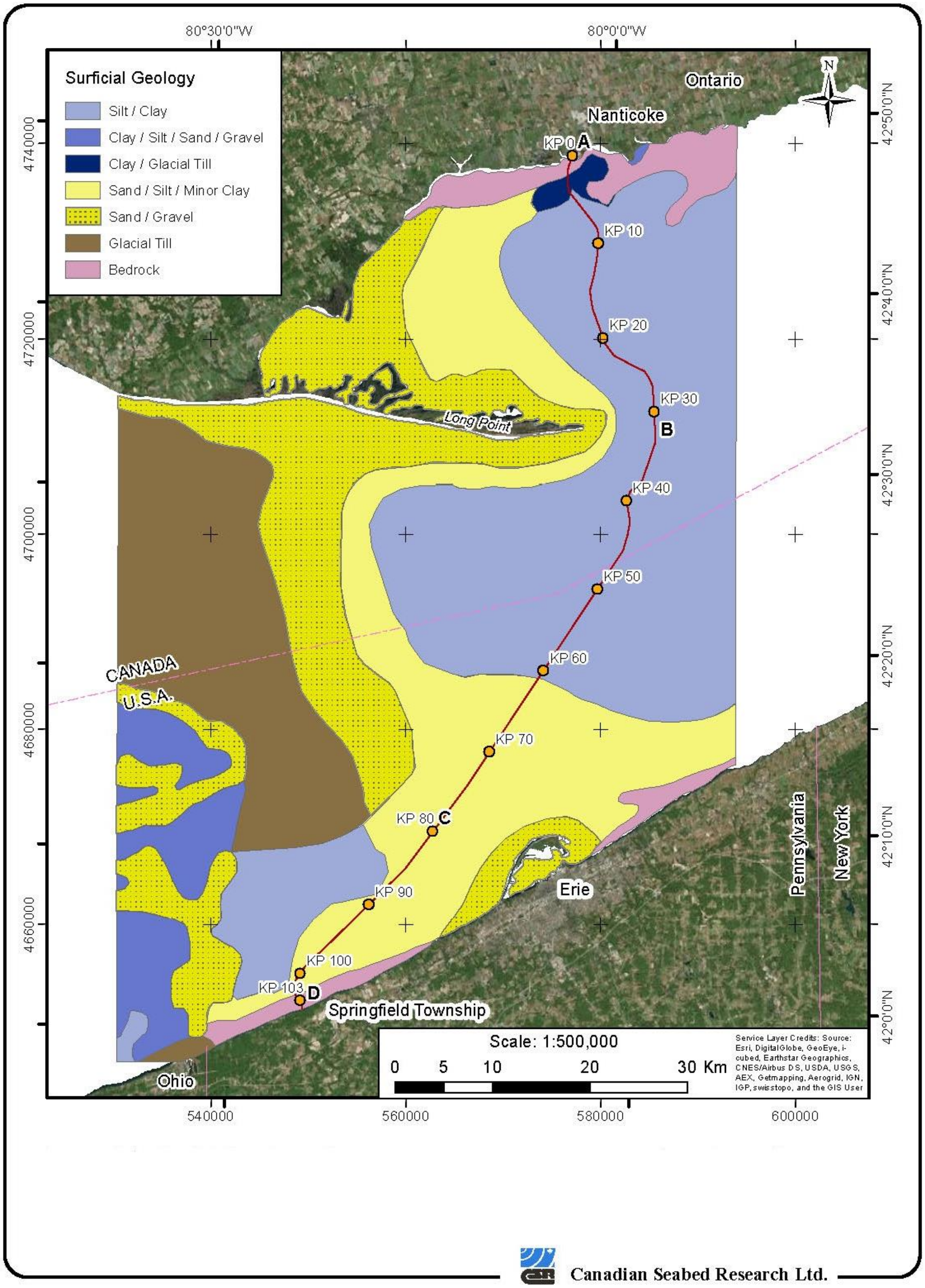
Surficial sediments along the proposed transmission line route in Lake Erie are primarily fine-grained with some sections of glacial till and bedrock. Beginning from the U.S./Canadian border at approximately KP 47 to KP 61, the transmission line route will cross primarily silt/clay and sand/silt (Figure 4.2-1). The surficial geology results of the 2015 geophysical survey (CSR 2015) were similar to what is shown in Figure 4.2-1, with the primary difference being silt/clay, as opposed to sand/silt, was found from KP 61 to 77 and KP 80 to 86 (geophysical panel maps are found in Appendix K). Glacial till within the nearshore areas also includes gravel, cobbles, and boulders. An area of bedrock is also encountered near the U.S. cable landfall location from approximately KP 102.0 to the shoreline (KP 103.8). Slopes and elevations vary along the route, with some sections of steeply sloped sediments. Nearshore, the sediment occasionally occurs in pockets over bedrock (CSR 2014, CSR 2015).

According to Schneider et al. (2001), sediments in the Great Lakes generally represent a primary sink for contaminants and can act as a source through resuspension and subsequent redistribution. Sediments in various parts of Lake Erie are contaminated with varying levels of cadmium, mercury, and other trace metals. According to Marvin et al. (2004), the highest concentrations of mercury in sediments of Lake Erie are observed in offshore depositional areas characterized by fine-grained sediments. Marvin et al. (2004) found that there is an apparent spatial distribution in contamination in Lake Erie with decreasing concentrations from the western basin to the eastern basin and from the southern area to the northern area of the central basin, which is located westerly of the proposed transmission line route. For a more-detailed discussion of sediment contamination, please refer to Section 4.3 and 4.12.

4.2.1.2 Bedrock Geology

Lake Erie owes its underlying existence to the presence of a basin or lowland that originated long before the Pleistocene Ice Age began about 2 million years ago. This lowland was the valley of an east flowing river, known as the Erigan River, that some geologists speculate was the downstream portion of the preglacial Teays River (Hansen 1989). This valley was deepened and enlarged by a series of major glacial advances during the Pleistocene. After final retreat of the ice, the land surface began to rise or rebound as it was released from the weight of the glacier, but the rebound was relatively slow. The moderately slow rise of the land in the area of the Niagara outlet created a consequent rise in the water level in the Erie basin. By about 500 to 4,000 years ago, lake levels were perhaps only about 30 ft below that of modern Lake Erie. According to Hansen (1989), modern Lake Erie formed 3,500 to 4,000 years ago when the drainage outlet through the Niagara Gorge was free of glacial ice. A 10- to 20-ft (3 to 6.1 m) rise in lake levels occurred about 2,600 years ago when the upper Great Lakes again began to drain through the Erie basin. Following this rapid rise there has been a continued slow rise of the water level that has brought Lake Erie to its current mean level of 572 ft (174.3 m) above sea level (Hansen 1989).

Figure 4.2-1 Generalized geological map of the of the proposed transmission line route in Lake Erie.



Source: CSR 2015

The proposed transmission line is located within the Lake Erie basin, which is underlain by middle Paleozoic sedimentary rock, composed of limestones, dolomites, shales, and sandstones (Herdendorf 2013). The Lake Erie basin lies in the Central Lowlands Physiographic Province, which is bordered to the north by the Laurentian Uplands and to the south by the Appalachian Plateau. Geologists have named 62 bedrock formations that crop out in the states and province which surround Lake Erie (Bolsenga and Herdendorf 1993). According to Bolsenga and Herdendorf (1993), the central and eastern basins of Lake Erie are underlain by nonresistant shale, shaly limestone, and shaly sandstone of the Upper Devonian age, which dip gently to the southeast. Inland along the south shore of Lake Erie, eastward from Cleveland, Ohio, the Portage Escarpment, composed of mostly of Mississippian sandstone, rises 300 ft (100 m) above the level of Lake Erie and forms the northwest front of the Appalachian Plateau (Bolsenga and Herdendorf 1993). Much of the south shore of Lake Erie is a wave-cut bluff composed of hard, black shale (Ohio Formation) of the Upper Devonian age. Eastward from Erie, the south shore bluffs reach elevations up to 100 ft (30.5 m) above the lake. Unconsolidated deposits composed of gray, glacial till, overlain with light brown lacustrine silt and sand, mantle the rock surface and form the upper portion of the cliffs located along the lake (Bolsenga and Herdendorf 1993).

4.2.1.3 Surficial and Subsurface Features

Canadian Seabed Research (CSR) (2015) reports that the presence of sub-surface gas in Lake Erie post-glacial sediments have been interpreted from sub-bottom profiler and sidescan boomer data. The origin of the near-surface gas in the area may originate from shallow, decomposed organic material or from deeper underlying bedrock formations. The burial and subsequent decomposition of organic material could account for significant amounts of sub-surface gas (CSR 2014, CSR 2015).

Bedrock fractures or faults have been observed on seismic reflection records within Lake Erie. There is no evidence of mass movements such as slumping or sliding within Lake Erie. Patches of wave-formed ripples occur in shallow areas where the bottom is sandy (CSR 2014, CSR 2015). Ripples may also be formed in deeper water as a result of bottom currents. Ice scours have been observed by CSR (CSR 2014, CSR 2015) and others throughout Lake Erie. Scouring of the seafloor generally occurs where pressure ridges form. Ice scouring is discussed further in Section 4.3.1.2. The lake bottom within the areas surveyed is locally heavily influenced by the presence of mussel accumulation. The mussels occur in beds or patches which are easily visible on sidescan sonar records. The species are likely zebra and quagga mussels (CSR 2014, CSR 2015).

4.2.1.4 Seismicity

The Project is located in a stable continental region within the North American Plate and, as a consequence, has a relatively low rate of earthquake activity (Natural Resources Canada 2013). Unlike plate boundary regions where the rate and size of seismic activity is directly correlated with plate interaction, the Project is located in a part of the stable interior of the North American Plate and seismic activity in areas like this seems to be related to the regional stress fields, with the earthquakes concentrated in regions of crustal weakness (Natural Resources Canada 2013). The occurrence of seismic events in the eastern Lake Erie basin area has been small in magnitude. This region has a low-to-moderate level of seismic activity when compared to the more active seismic zones to the east (e.g., along the Ottawa River and in Quebec) (Natural Resources Canada 2013). According to Natural Resources Canada (2013), in the past 30 years, on average, 2 to 3 Richter magnitude 2.5 or larger earthquakes have been recorded in the southern Great Lakes region which includes the Project area. Reported moderate-sized seismic events (Richter magnitude 5) have occurred in this region, all of them in the U.S.: (1) in Attica, New York, 1929; near Cleveland, Ohio, in 1986; and near the Pennsylvania/Ohio border in 1998 (Natural Resources Canada 2013). In addition to these recorded seismic events in the vicinity of the Project area, the Pennsylvania Department of Conservation and Natural Resources (PADCNR) (Undated*c*), reports six seismic events with a Richter magnitude of:

- 3.0 located below Long Point Bay in 1930;
- 2.1 located 9 miles north of Erie in 1998;
- 3.2 located approximately 8 miles northwest of Erie in 1934;
- 2.9 located approximately 5 miles southwest of Erie in 1921;
- 2.5 located approximately 11.5 miles south of Erie in 1990; and
- 2.5 located approximately 3.4 miles north of Lake City, PA, in 1999.

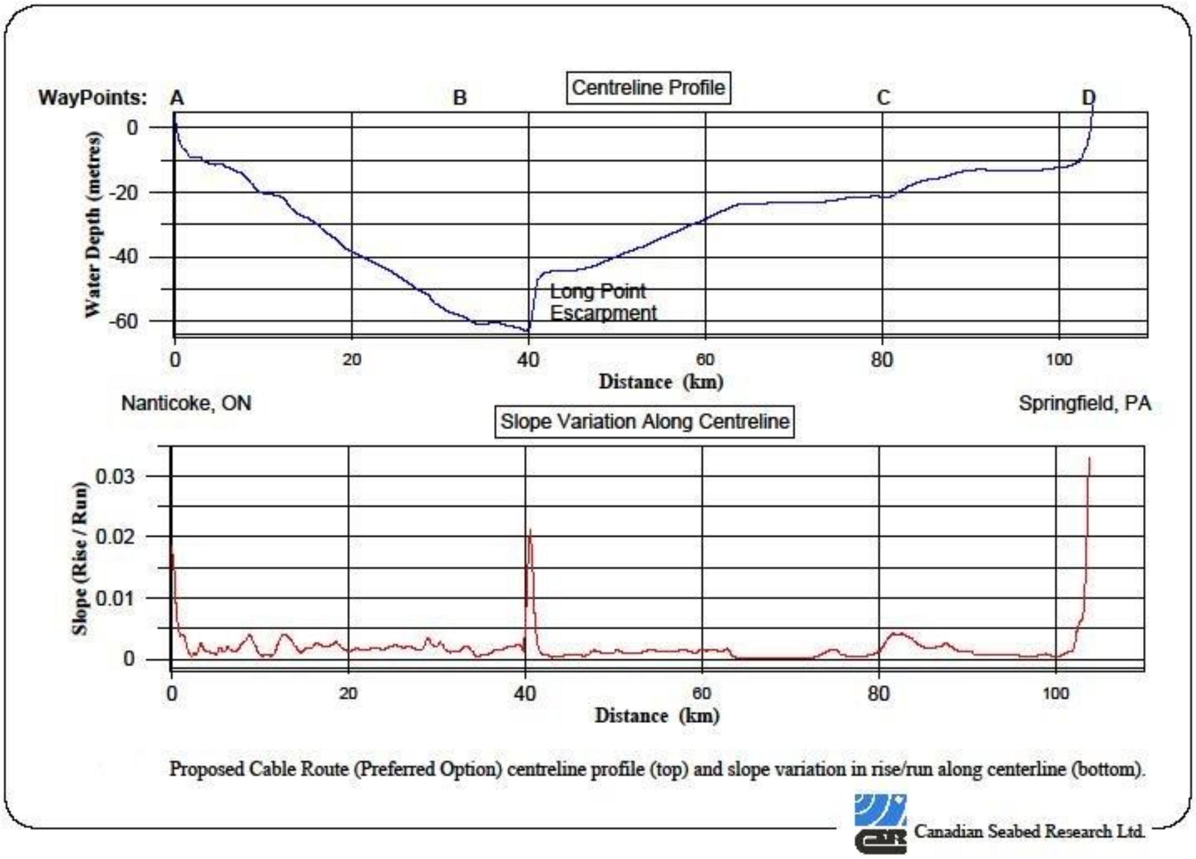
A number of known faults cross the Lake Erie basin, including one in the vicinity of the City of Toledo, Ohio, and one that originates in Lake Ontario and extends southward close to the cities of Niagara Falls and Welland into Lake Erie (Great Lakes Basin Commission 1975).

Additionally, an east-west trending fault occurs parallel to the shoreline, extending from offshore of the community of Port Bruce westward to Lake St. Clair. There is an additional, smaller fault traceable on the surface near the community of Highgate (northeast of Point aux Pins) oriented in a north-south direction (Ontario Geological Survey 1991).

4.2.1.5 Bathymetry

Of the Great Lakes, Lake Erie is the fourth largest (9,700 mi^2; 25,000 km^2) in area and the smallest (116 mi^3; 484 km^3) in volume (CSR 2014, CSR 2015). Lake Erie measures approximately 240 miles (388 km) long and 57 miles (92 km) wide, with a mean depth of 62 ft (19 m) (Bolsenga and Herdendorf 1993). Lake Erie's depth profile located along the Lake Segment of the transmission line route is shown in Figure 4.2-2. The eastern basin is relatively deep and bowl shaped and a large area of the eastern basin lies below 100 ft (30 m). According to Bolsenga and Herdendorf (1993), the deepest sounding (210 ft [64 m]) is located approximately 8 miles (13 km) east-southeast of the tip of Long Point, Ontario. Water depths along the proposed transmission line route in Lake Erie range from the shoreline to approximately 205 ft (62.5 m).

Figure 4.2-2 Depth profile: Lake Erie Connector Lake Segment.



CSR conducted surveys during 2014 and 2015 to further evaluate the bathymetry of the Lake Erie lake bed relative to the proposed Project corridor. The surveys conducted by CSR collected single and multi-beam echosounder and sidescan sonar data to evaluate the lake bed bathymetry.

The lake floor along the preferred cable route is relatively flat with slopes generally less than 1%. Lakebed slopes of more than 1% occur in localized areas near the American landfall. The maximum water depth along the preferred route is 210 ft (64 m) (CSR 2015).

4.2.2 Underground Segment and Converter Station

4.2.2.1 Physiography and Topography

The Underground Segment and proposed Erie Converter Station are located within the Eastern Lake Section of the Central Lowland Province. The Eastern Lake Section consists of a series of northwest-sloping, low-relief ridges that generally extend parallel to Lake Erie. These ridges are made up of unconsolidated surficial materials, generally consisting of sands and gravels, which were deposited during the most recent deglaciation of the area about 18,000 years ago (PADCNR Undated*c*). Originally, the ridge bordering Lake Erie sloped gently into the lake; however, erosion of the shoreline has caused the lake-land interface to move southeastward so that today there is a steep bluff adjacent to Lake Erie. Local relief in the Eastern Lake Section is less than 100 ft (30.5 m) and generally half of that. Elevation of the Eastern Lake Section is 570 ft (173.7 m) at Lake Erie and rises southward to a height of 1,000 ft (304.8 m) (PADCNR

Undated*c*).

4.2.2.2 Geology

The Underground Segment is underlain by Devonian-age argillaceous shale and siltstone. At the Erie landfall, the bedrock is mainly composed of Upper Devonian formations Girard Shale and/or Northeast Shale. The Girard shale is generally an ashen grey flaky shale while the Northeast shale is medium grey with thin siltstone and fine-grained sandstone interbeds. The northeast shale lies in a band along the Lake Erie shoreline. The unit thins and narrows to the west and is not exposed at the Ohio State line. The Girard shale overlies the Northeast Shale and ranges in thickness from 50 to 200 ft (15.2 to 61 m). It forms a band roughly parallel to the Lake Erie shoreline widening and thickening to the west (CSR 2014, CSR 2015). The shale occurs at the mean water level (Knuth 2001; Amin 1989; and D'Appalonia 1978; all cited in CSR 2015).

The proposed Erie Converter Station lies in the Chadakoin Formation, and this formation consists of light-gray to brownish siltstone, fine-grained sandstone, medium-gray shale, and conglomerate, and commonly contains marine fossils. Bedding in the Chadakoin Formation is well developed in most places and is generally less than 2 inches (5.8 cm) thick with a maximum thickness of approximately 300 ft (91.4 m) (PADCNR Undated*c*).

The road ROWs along the proposed Project route in the Underground Segment are composed of disturbed geology and soils that were altered by activities such as excavation, grading, and filling during roadway construction.

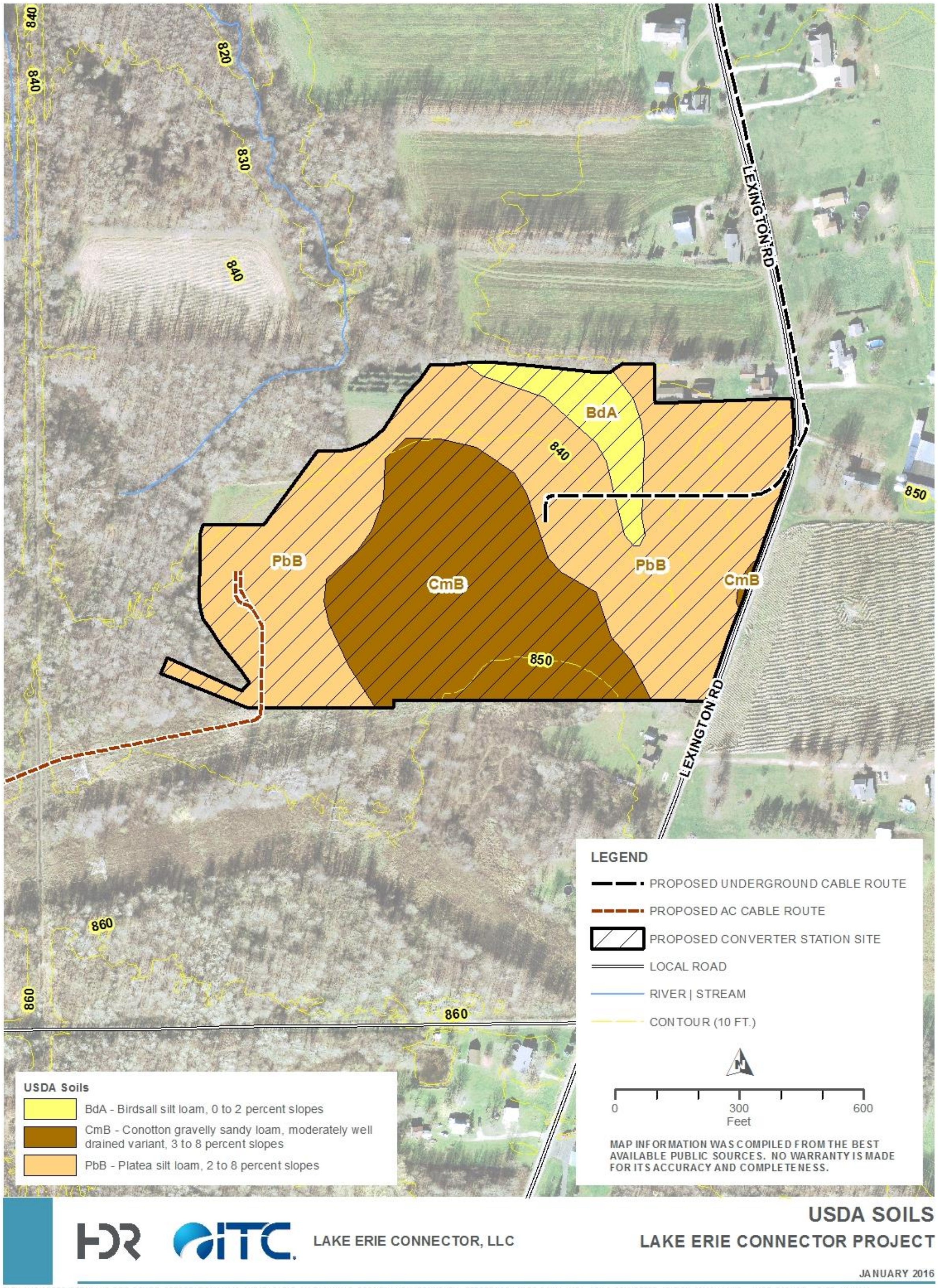
4.2.2.3 Soils

Soils within the Underground Segment are primarily sandy near Lake Erie with gravelly and sandy soils occurring on beach ridges. Soils are finer textured where they are developed on lake clays and silts and or till (Tomikel and Shepps 1967). Some soils within this section of the transmission line route are frequently flooded, and hydric soils are present. For a detailed overlay map of soils present along the Underground Segment see Appendix D.

The underground cable systems will be primarily built within road ROWs. The remainder will be on private property, for the most part adjacent to existing driveways. The soils in these areas have been compacted and previously disturbed as a result of prior construction associated with roadway development. The developed nature of these areas eliminates any significant geological or soils concerns. Existing soil characteristics at the Erie Converter Station site were examined more closely, due to that site's undeveloped character.

The soils at the Erie Converter Station site (Figure 4.2-3) include Platea silt loam, Conotton gravelly sandy loam, and Birdsall silt loam. The Platea soils are somewhat poorly drained and generally occur in uplands, the Conotton soils typically occur in troughs or swales and are moderately well drained, and the Birdsall soils are inextensive and occur in small, level to gently sloping areas and very poorly drained to poorly drained and are silty and deep (USDA/NRCS 2013; USDA 1960).

Figure 4.2-3 Converter station site soil survey.



Platea silt loam (PbB; 2 to 6 Percent Slopes) is characterized as a prime farmland soil if it is drained, and this soil type typically occurs on end moraines and ground moraines at elevations ranging from 750 ft (228.6 m) to 1,350 ft (411.5 m). The parent material consists of loamy till. Depth to restrictive features for this soil is reported to be more than 80 inches (203.2 cm); it is a somewhat poorly drained soil, with a runoff class of very high. Depth to water table is reported to be approximately 6 inches (15.2 cm) to 12 inches (30.5 cm) (USDA/NRCS 2013).

Conotton gravelly sandy loam (CmB; 3 to 8 Percent Slopes) is a variant differing from other Conotton soils in being only moderately well drained instead of well drained. These soils occur in troughs or swales that lie between or at the bases of beach ridges. These soils are considered among the best soils of the lake plain for growing vegetables and fruits. The parent material of the Conotton variants is made up of alternate layers of sand and gravel mixed with some silt and clay. This material was derived from acid shale bedrock and also from sandstone and granite of glacial origin. These soils have a firm, compact layer that is moderately permeable to air and water. This soil has uniform slopes and the surface drainage is good and the internal soil drainage is rated as moderate (USDA 1960).

Birdsall silt loam (BdA; 0 to 2 Percent Slopes) soils are level to nearly level and surface and internal drainage are very poor. During wet seasons, shallow water remains in depressions within this mapped soil for several weeks. This soil, unless improved by drainage, is best suited to permanent sod or woodland. With adequate artificial drainage, this soil can be used in a rotation that includes row crops. This soil has a severe limitation to wetness (USDA 1960).

4.2.2.4 Prime Farmland

Prime farmland is protected under the Farmland Protection Policy Act (FPPA) of 1981. Prime farmland is defined as land that has the best combination of physical and chemical characteristics for producing crops and is also available for this use. The land could be cropland, pasture, rangeland, or other land, but not urban built-up land or water. The FPPA is intended to minimize the conversion of farmland to nonagricultural uses. The FPPA also ensures that federal programs are administered in a manner that, to the extent practicable, will be compatible with private, state, and local government programs and policies to protect farmland. The implementing procedures of the FPPA and NRCS require federal agencies to evaluate the adverse effects (direct and indirect) of their programs on prime farmland and farmland, and to consider alternative actions that could avoid adverse effects. According to the FPPA, this evaluation is not applicable to non-federal activities on private or non-federal lands where federal assistance for farmland conversion is not requested (7 CFR Part 658) (DOE 2013). No federal assistance is requested for this Project.

According to USDA/NRCS data, approximately 41.2 acres (16.7 hectares) of land identified as having prime farmland soil are within the impact area of the Project route along the Underground Segment (USDA/NRCS 2013). However, a majority of the soils being impacted by the proposed Project are within existing road ROWs; therefore, these lands are currently disturbed and are not available for agricultural use.

Approximately 21.4 acres (8.7 hectares) of land within the Erie Converter Station site have been identified as having prime farmland soil (USDA 2013). Given the requirement of locating the Erie Converter Station adjacent to or in near proximity with the Erie West Substation and the lack of suitable alternative sites for the Erie Converter Station, impacting these particular farmland soils is unavoidable.

4.2.2.5 Seismicity

See Section 4.2.1.4.

4.3 Water Resources and Quality

4.3.1 Lake Segment

Lake Erie receives most of its inflow (approximately 90%) from the three upper Great Lakes (Superior, Michigan, and Huron) via connecting waterways from southern Lake Huron. These waterways include the St. Clair River, Lake St. Clair, and the Detroit River. Overflow from Lake Erie's eastern basin drains via the Niagara River to Lake Ontario. A bedrock sill at the head of the Niagara River is the principal control of the lake level (CSR 2015).

The lake is naturally divided into three distinct basins with different average depths: the western basin (24.1 ft, 7.4 m); the central basin (60.1 ft, 18.5 m); and the eastern basin (79.3 ft, 24.4 m) (GLFC 2003; Lake Erie LaMP 2011; as cited in IJC 2013). The proposed Project is located in the eastern basin. The lake warms rapidly in the spring and summer and can freeze over in winter. The central and eastern basins thermally stratify every year, with the shallow hypolimnion of the central basin often becoming anoxic. Thermal stratification in the central basin normally occurs below 15 meters from June to September (Herdendorf 1984). The eastern basin summer thermocline is approximately 10 meters and persists from early summer to November. The hypolimnion can exceed 40 meters in thickness (USEPA 2014b).

Lake Erie's shoreline is approximately 1,402 km (871 mi) long and the drainage basin is 58,800 km^2 (about 22,700 mi^2). The basin covers parts of Indiana, Michigan, Ohio, Pennsylvania, New York, and Ontario (CCGLHHD 1977; as cited in IJC 2013). The Lake Erie subbasin is the most densely populated of the watersheds of the five Great Lakes, with 17 urban areas with populations over 50,000 (Lake Erie LaMP 2011; as cited in IJC 2013).

The hydraulic residence time is a measure of how quickly water quality will change in response to changes in contaminant loadings. In Lake Erie, the residence time for a non-volatile conservative substance in Lake Erie is estimated to be a little over 2 years (Quinn 1992). Therefore, water and contaminants move through Lake Erie quickly.

Water quality standards in Pennsylvania are established in 25 Pa. Code Chapter 93. The water quality standards consist of the designated uses of the surface waters of Pennsylvania, along with the specific numerical and narrative criteria necessary to achieve and maintain those uses and an antidegradation policy. Statewide water uses are established in 25 Pa Code §93.4 and include aquatic life, water supply, and recreational uses. All sections of Lake Erie in Pennsylvania except Outer Erie Harbor and Presque Isle Bay are designated for Cold Water Fishes (CWF) (25 Pa. Code §93.9). CWF are protected for the "maintenance or propagation, or both, of fish species including the family Salmonidae and additional flora and fauna which are indigenous to a cold water habitat."

The water quality status of Pennsylvania's waters is summarized by using a five-part categorization. These represent the level of use attainment and can range from Category 1 (all uses met) to Category 5 (impairment by pollutants requires a total daily maximum load [TMDL]). All waterbodies are placed in one of these categories, where different segments of the same waterbody may appear on more than one list. Lake Erie is identified as Category 5 waters, which are impaired for one or more designated uses by any pollutant and constitutes inclusion on Section 303(d) list and development of a TMDL (PADEP 2014). In 2010, Lake Erie was listed as impaired for fish consumption and recreational uses due to unknown PCB and pathogen contamination, respectively (PADEP 2014).

4.3.1.1 Historic Water Quality

Over the past century the Great Lakes have undergone dramatic changes in water quality, chemistry, flora, and fauna. Lake Erie is a classic example of how profoundly human activity can affect the structure and function of an ecosystem. The degradation of Lake Erie started perhaps in the early 1800s with massive forest cutting, construction of sawmills and dams, and draining of wetlands (Pira et al. 1998; Ratti and Barton 2003; and Burlakova et al. 2014). The Great Lakes Water Quality Agreement of 1978, signed by Canada and U.S., started an extensive binational effort to reduce and eliminate sources of pollution to Lake Erie, including bans on sale of phosphate detergents, improvements in organic waste collection and treatment systems, and reduction in industry discharges (Burlakova et al. 2014).

Nutrients

Historically, nutrient enrichment (i.e. eutrophication) has been an ongoing problem in Lake Erie, causing algal blooms and resulting in subsequent oxygen depletion. From the 1950s to the 1970s, oxygen depletion was recorded throughout the hypolimnion of the central basin (USEPA 2014b). The eastern basin also experiences oxygen depletion (LaMP 2009). Phosphorus was identified as the primary nutrient leading to eutrophication and the Great Lakes Water Quality Agreement (GLWQA) of 1978 was established as a binational phosphorus abatement program to restore water quality in the Great Lakes. By the 1990s, phosphorus concentrations were half of their former levels in the western basin, with smaller improvements in the central and eastern basins (Lake Erie LaMP 2009). Despite efforts to reduce phosphorus concentrations, algal blooms continue to occur in Lake Erie (Lake Erie LaMP 2009). Offshore algal blooms are most prevalent in the western basin, with less significant problems in the central and eastern basins (Lake Erie LaMP 2009).

Based on the 2012 GLWQA interim objectives for total phosphorus (TP), load targets have been established for the different Lake Erie subbasins. The target is 10 µg/L for the eastern basin. Often TP concentrations do not meet targets, especially in the spring. In 2007, average spring TP concentrations were 29 µg/L, 12 µg/L, and 17 µg/L, for the western, central, and eastern basins, respectively (Lake Erie LaMP 2009). In the summer, both the eastern and central basins are usually at or below their water quality target and have been for the past decade with few exceptions; whereas summer TP concentrations in the western basin are often above the water quality target and seem to exhibit a higher variability than either the central or eastern basins (Lake Erie LaMP 2009). The Lake Erie shoreline was also identified as impaired for recreational use due to pathogens from an unknown source in 2010 (PADEP 2014).

Turbidity

Lake Erie receives the highest sediment load of all the Great Lakes (Richards 2011; as cited in LEIA 2012). The western basin is especially turbid because of large sediment loads from the Detroit, Maumee, and Portage rivers, wave resuspension of silts and clays from the bottom, and high algal productivity (Herdendorf 1984). The Maumee River discharges more tons of sediment per year than any other tributary to the Great Lakes, much of which is transported during storm events (LEIA 2012). The water in the eastern basin is the least biologically productive and turbid of all three basins (Herdendorf 1984).

Barbiero and Tuchman (2004) found spring and summer turbidity has decreased substantially since zebra mussel colonization in the eastern basin. They found spring turbidity between 1990 and 1997 were approximately half those of the pre- *Dreissena* period (mean = 1.0 and 1.9 NTU, respectively), and have further decreased since 1999 (mean = 0.65 NTU).

Heavy Metals

Over the past century, discharges of liquid and solid waste from industrial, agricultural, and domestic sources have introduced toxic substances into the waters of the Great Lakes, including Lake Erie (USEPA 2014c). Lake Erie is surrounded by 17 urban areas and the agricultural sectors of southwestern Ontario, and part of Ohio, Pennsylvania, New York, and Michigan. It also receives water from the Detroit River and Lake St. Clair, whose shores are home to many manufacturing and processing plants.

Atmospheric deposition has also been identified as a major source of heavy metals to the Great Lakes Basin, and it has been postulated that air currents from Mexico, and even as far away as Russia, go through the Great Lakes Basin bringing airborne chemicals and pollutants (Morreale 2002). The International Joint Commission estimates approximately 50 percent of all lead entering Lake Erie comes from the atmosphere. Approximately 200 tons of mercury is deposited in the basin each year, primarily from waste incinerators and chlorine production (Henry 1994; SOGL 1999; Skinner 2002; as cited in Morreale 2002).

There have been numerous studies conducted on metals in Lake Erie, but many of these pre-date the establishment of the 1997 binational strategies, which aimed to mitigate environmental impacts associated with toxics (USEPA 2014a). Recent surveys on metal contamination have been conducted in Lake Erie by Marvin et al. (2004). Marvin et al. (2004) found concentrations of metals often decreased from the western basin to the eastern basin of Lake Erie (Table 4.1-4). Contaminant concentrations are often dictated by particle size and bathymetry. In Lake Erie, concentrations of mercury were shown to increase from shallow nearshore coarser sediments outwards into deep water where finer sediment have been deposited (Thomas 1972; Thomas and Jaquet 1976; Rossmann 2002; as cited in Marvin et al. 2004). Sampling of surficial sediments in Lake Erie, including the eastern basin, during 1997 is shown in Table 4.3-1. Levels of cadmium, copper, lead, zinc, and mercury were lower in the eastern basin then in the western and central basins (Marvin et al. 2004; Table 4.3-1). Surface water concentrations of mercury are much lower and were generally within the range of 0.00011 µg/L to 0.0005 µg/L in the eastern basin in 2006 (USEPA 2009).

Table 4.3-1 Metal concentrations of surficial sediments in Lake Erie collected in 1997 (Marvin et al. 2004).

		Cadmium (µg/L)	Copper (µg/L)	Lead (µg/L)	Zinc (µg/L)	Mercury (µg/L)
Lake-wide	Average	1.2	36	41	161	0.0187
	Minimum	0	3.1	4.4	24	0.006
	Maximum	4.4	68	105	320	0.940
Western basin	Average	1.4	41	44	175	0.402
Central basin	Average	1.4	38	46	175	0.167
Eastern basin	Average	0.45	27	22	112	0.069

Organic Contaminants

There are limited data available on organic chemicals in Lake Erie. In 2006, 14 of a possible 21 organochlorine compounds were detected in Lake Erie (USEPA 2009). Surveys have shown that concentrations of most organochlorine compounds are below the most stringent water quality guidelines with the exception of α-chlordane (USEPA 2009). Marvin et al. (2004) studied polychlorinated biphenyls (PCBs) concentrations in Lake Erie surficial sediment in 1997. PCBs, although banned or highly restricted in almost all industrial and commercial uses, remain a major cause of contamination in the Great Lakes due to their high persistence and toxicity. PCBs were first reported in the Great Lakes in the late 1960s, but concentrations have decreased markedly in the decades following their phase-out in the 1970s. The lake-wide average concentration of PCBs in Lake Erie surficial sediments has decreased three-fold from a 136 ng/g in 1971 to 43 ng/g in 1997 (Painter et al. 2001; as cited in USEPA 2009). Marvin et al. (2004) found the slightly higher lake-wide average PCB concentration in Lake Erie, which was 98 ng/g, with values ranging from approximately 2 ng/g to 245 ng/g. The average concentrations in the western, central, and eastern basin were 161 ng/g, 97 ng/g, and 36 ng/g, respectively (Marvin et al. 2004).

In Lake Erie, the distribution of organic contaminants, including PCBs and organochlorine pesticides, were similar to that of mercury where concentrations were higher in deeper water where fine sediment was dominant as opposed to shallower shoreline areas (Painter et al. 2001; Marvin et al. 2002a; 2002b; as cited in Marvin et al. 2004). Although PCB concentrations have declined substantially in Lake Erie (Painter et al. 2001; as cited in Marvin et al. 2004; Hites 2006), the fish consumption use of Lake Erie was listed as impaired due to PCBs in 2010 (PADEP 2014) and there is an existing fish advisory in Lake Erie for PCBs (PFBC 2015).

2015 Geotechnical Analysis

Sediment cores were collected along the proposed cable corridor along the Lake Erie lakebed during August to October 2015 as part of the geotechnical survey. The sediment sampling provided two basic types of information: the physical characteristics of the sediment; and the chemical characteristics of the sediment[6]. These samples from along the proposed cable route were obtained in order to assess the potential environmental impacts associated with the proposed cable installation; and to confirm or adjust the construction/ installation approach for the cable. A summary of the 2015 Lake Erie sediment data is presented in Appendices E and L. As the PADEP water quality standards are based on the dissolved form of the metals, the 2015 Lake Erie sediment metals particulate data were converted to dissolved concentrations using metal specific partition coefficients. Based on this analysis, all the sediment dissolved metals concentrations calculated from the 2015 data were much less than the PADEP water quality standards, even if those values were released into the water column (Appendix E).

4.3.1.2 Ice Scour

Ice frequently covers Lake Erie (USEPA 2014c). Ice formation begins in the shallower, western basin in mid-December and progresses to the deeper, eastern basin during the second half of January (Assel 1999). The western basin typically freezes over each winter and the central basin occasionally freezes over (Hendendorf 1984). The eastern basin rarely freezes over, but is often covered by drift ice from other basins (Hendendorf 1984). Ice in the eastern basin may reach a thickness of 8 to 12 inches by the end of January and can be 16 to 20 inches thick by the end of February (NOAA 2014*c*).

NOAA and Great Lakes Environmental Research Laboratory have been monitoring and documenting Lake Erie ice cover since the early 1970’s (NOAA 2014*c*). This information suggests a relatively large portion of Lake Erie freezes annually, but there have been years when less than half of the lake froze (Figure 4.3-1).

As portions of the lake freeze, ice features can be moved by wind and wave activity. This can result in the accumulation of ice features in Lake Erie, especially along the windward shores. As a result, relatively large ice features can form, and their keels can scour the bottom of Lake Erie in water depths up to 82 ft (25 m) and penetrate soft sediments, resulting in large sub-scour horizontal and vertical sediment deformations to approximately 6.6 ft (2 m; Grass 1984 cited in Bolsenga 1992; Lever 2000; Nixon et al. 1995 cited in CSR 2015). The frequency of ice scouring within Lake Erie is generally highest in water depths of approximately 33 ft (10 m). At water depths greater than 33 ft, the frequency of ice scouring tends to decrease (CSR 2014, CSR 2015).

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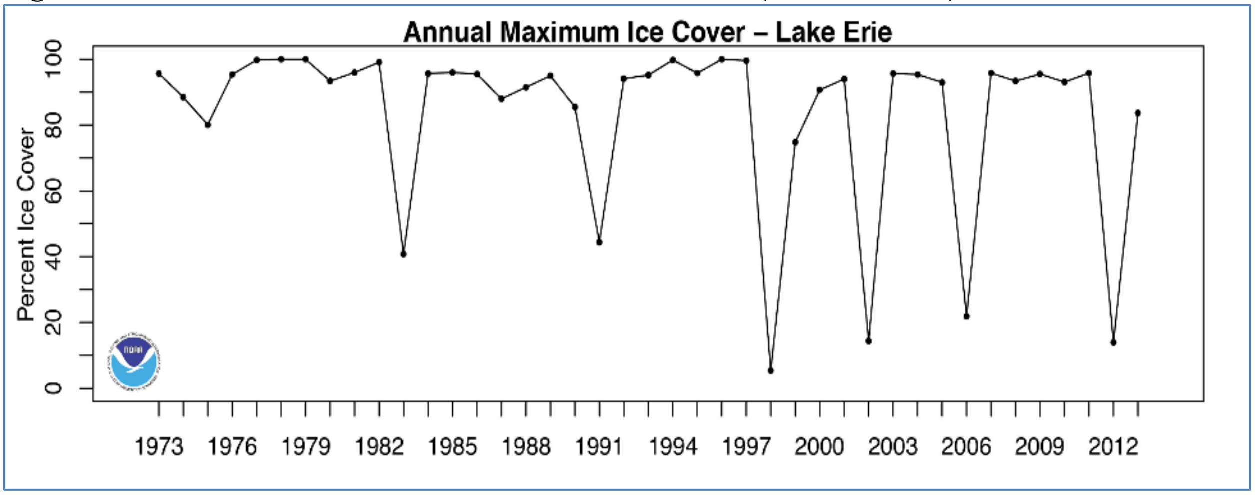
[6] Sediment cores were analyzed for the following constituents: arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, TOC, ammonia-nitrogen, total petroleum hydrocarbons (TPH), total PCBs, and phosphorus (sorbed and pore water).

Figure 4.3-1 Annual maximum ice cover in Lake Erie (NOAA 2014a).



4.3.2 Underground Segment and Converter Station Site

Waters of the U.S. are defined in the federal Clean Water Act, as amended. Under Section 404 of the Clean Water Act, the USACE asserts jurisdiction over (1) traditional navigable waters, (2) wetlands adjacent to navigable waters, (3) non-navigable tributaries of traditional navigable waters that are relatively permanent where the tributaries typically flow year-round or have continuous flow at least seasonally (e.g., typically three months), and (4) wetlands that directly abut such tributaries. Under the Pennsylvania Clean Streams Law, PADEP regulates water quality in relation to “waters of the Commonwealth,” which are broadly defined to include all rivers, streams, creeks, rivulets, impoundments, ditches, water courses, lakes, ponds, springs and other bodies of water, whether natural or artificial.” Under the Dam Safety and Encroachments Act, PADEP regulates water obstructions and encroachments located in, along, or across, or impacting the course, current, and cross-section of any watercourse or body of water, including any natural or artificial land, pond, reservoir, swamp, marsh, or wetland.

4.3.2.1 Wetlands

In 2014 and 2015, the Applicant conducted wetland delineation surveys within the underground corridor of the Project, and the results are summarized here. A total of 13.2 acres of wetland were delineated within the Project area, based on a wetland survey corridor of 75 ft to either side of the road centerline (this represents total survey corridor of 150 ft and extends beyond the Project vegetation management ROW)[7]:

All wetlands were classified as Palustrine Emergent Wetlands (PEM), Palustrine Scrub-shrub (PSS), Woody Wetland Forests (PFO) or a mixture of these classifications. Wetlands identified during field surveys are detailed in Table 4.3-2 and shown in the resource overlay maps provided in Appendix A.

[7] Ditches that met the three parameters defining a jurisdictional wetland (i.e. presence of hydrology, hydric soils, and hydrophytic vegetation) and were hydrologically connected to a wetland or stream were identified as a wetland.

Table 4.3-2 Wetlands identified.

Unique Identifier	Dominant USFWS Classification[1]	Associated Stream	High Quality Watersheds	Proposed to be Crossed by the Project	Delineated Acres
WPA-KAS-001	PFO	Abutting SPA-KAS-001 (UNT to Lake Erie)	No	Yes	0.32
WPA-KAS-002	PFO, PEM	Adjacent to SPA-KAS-001 (UNT to Lake Erie)	No	Yes	PEM: 0.34 PFO: 3.92
WPA-KAS-004	PFO	Adjacent to SPA-KAS-006 (UNT to Lake Erie)	No	Yes	3.91
WPA-KAS-012	PFO	Abutting Unidentified Stream (UNT to Crooked Creek)	Yes	Yes[2]	1.64
WPA-KAS-018	PEM	Abutting to UNT to Crooked Creek	Yes	Yes	0.66
WPA-KAS-028	PEM, PSS, PFO	Abutting SPA-KAS-016 (Crooked Creek)	Yes	Yes[2]	PEM: 0.27 PSS: 0.17 PFO: 0.27
WPA-KAS-029	PEM, PSS	Abutting SPA-KAS-017 (UNT to Crooked Creek)	Yes	Yes[2]	PEM: 0.11 PSS: 0.03
WPA-KAS-030	PEM	Isolated	Yes	Yes[2]	0.03
WPA-KAS-034	PEM	Abutting SPA-KAS-020 (UJNT to Crooked Creek)	Yes	Yes	0.02
WPA-KAS-035	PEM	Abutting SPA-KAS-021 (UNT to Crooked Creek)	Yes	Yes	0.13
WPA-KAS-036	PFO	Abutting SPA-KAS-026 (UNT to Crooked Creek)	Yes	Yes	0.32
WPA-KAS-040	PEM	Abutting Crooked Creek	Yes	Yes	0.54
WPA-KAS-041	PEM	N/A	Yes	Yes	0.55
WPA-KAS-042	PFO	N/A	Yes	Yes	0.59

Notes:
1. Palustrine Emergent (PEM), Palustrine Scrub-shrub (PSS), Paulustrine Forested (PFO), Unnamed Tributary (UNT).
2. Wetland will be crossed by the proposed cable or is located within the cable route corridor. However, the

HDD or Jack & Bore construction method will avoid all impacts to the wetland.

The areas adjacent to most wetlands consist of existing public roadway ROWs. Two segments will be adjacent to existing driveways associated with private properties: (1) Lake Erie landfall to Route 5/West Lake Road, and (2) the preferred route extending from Route 20/Ridge Road to Springfield Road. The hydrology in this area has been altered and the wetland boundaries were often defined by the edge of the soil fill associated with the roadway embankments. These wetlands were dominated by woody wetland forests, scrub shrub wetlands, alder thicket, and palustrine emergent wetlands.

Woody Wetland Forests are found from the landfall location to Route 5/West Lake Road. Red maple (*Acer rubrum*) comprises the most abundant tree in this forest type. Other trees include sycamore (Platanus *occidentalis*), green ash (*Fraxinus pennsylvanica*), and American elm (*Ulmus americana*). Dominant shrubs included silky dogwood (*Cornus amomum*), common elderberry (*Sambucus nigra*), spicebush (*Lindera benzoin*), and the invasive exotic multiflora rose (*Rosa multiflora*). The most abundant herbs include orange touch-me-not (*Impatiens capensis*), sensitive fern (*Oenoclea sensibalis*), wood nettle (*Laportea canadensis*), skunk cabbage (*Symplocarpus foetidus*), clearweed (*Pilea pumila*), black bulrush (*Scirpus atrovirens*), Virginia wild rye (*Elymus virginicus*), riverback wild rye (*Elymus raparius*), smooth goldenrod (*Solidago gigantea*), wrinkle-leaf goldenrod (*Solidago rugosa*), hop sedge (*Carex lupulina*), bottlebrush sedge (*Carex lurida*), fowl manna grass (*Glyceria striata*), lizard's-tail (*Saururus cernuus*), and short-hair sedge (*Carex crinita*).

Scrub-shrub Wetlands are found toward the southern end of the route in two locations. The scrub shrub wetlands are located along stream crossings of Lexington Road. Dominant shrubs in this wetland include pussy willow (*Salix discolor*), diamond willow (*Salix eriocephala*), buttonbush (*Cephalanthus occidentalis*), and silky dogwood. Dominant herbs include narrow-leaved cattail (*Typha angustifolia*), orange touch-me-not, sensitive fern, skunk-cabbage, Virginia knotweed (*Polyganum virginiana*), and black bulrush.

Alder Thicket is found in one small area near Lake Erie on the northern-most portion of the route. Speckled alder (*Alnus incana*) comprises the dominant shrub observed in this plant community. Silky dogwood and pussy willow are also present. Dominant herbs are common horsetail (*Equisetum arvense*), coltsfoot (*Tussilago farfara*), and black raspberry (*Rubus occidentalis*).

Palustrine Emergent Wetlands are the dominant type of wetlands located throughout the underground route. Most emergent wetlands are located in the vicinity of streams and the species composition varies. Species include reed canary grass (*Phalaris arundinacea*), an invasive exotic, is the most abundant species in some wetlands. Other species observed include black bulrush, sensitive fern, swamp milkweed (*Asclepias incarnata*), Joe-pye-weed (*Eupatorium fistulosum*), orange touch-me-not, rice cut grass (*Leerizia orzoides*), and broadleaf cattail (*Typha latifolia*).

4.3.2.2 Surface Waters

Fifteen streams and one pond were delineated within the survey corridor which encompasses the proposed Project underground route, including the alternative route section. These streams are listed in Table 4.3-3 and shown on the resource maps provided in Appendix A. The streams located at the northern end of the Project are unnamed tributaries to Lake Erie. The remaining streams include Crooked Creek and unnamed tributaries to Crooked Creek.

The unnamed tributaries to Lake Erie are classified as coldwater fisheries (CWF) and migratory fishery passageway (MF) (25 Pa. Code Ch. 93). CWF are waterbodies where fish and associated aquatic flora and fauna prefer colder waters (trout species are included in CWF) and MF are waterbodies where fish (those having anadromous, catadromous, or similar life histories) migrate through flowing waters to their breeding habitats (Walsh et al. 2007).

Crooked Creek and its tributaries are identified as high-quality, coldwater fisheries (HQ-CWF) and MF. HQ waterbodies are subject to the special protection antidegradation provisions of Pennsylvania's water quality regulations (25 Pa. Code §§93.4a-93.4c). Crooked Creek and associated tributaries are also approved trout waters and trout are stocked upstream of the proposed stream crossing location (PFBC 2014*b*). The streams are not classified as state designated Wild and Scenic Rivers. None of the streams in the Project area have been identified by the PADEP as impaired for water quality (PADEP 2014).

Table 4.3-3 Waterbodies identified.

Unique Field Identifer[1]	Waterbody	Watershed Hydrologic Unit Code	Stream Type	Chapter 93 Classification[2]	Class A Wild Trout Waters[3], Wild or Scenic River[4], Streams that Support Natural Reproduction of Trout[5]	Stocked Trout or Approved Trout Waters[6]	Potential USACE Classification[7]	Bank-to-Bank Width (feet)	Ordinary High Water Mark (feet)
SPA-KAS-001	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	23.7	0.67
SPA-KAS-002	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	5.1	0.50
SPA-KAS-004	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	5.1	0.33
SPA-KAS-005	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	10.0	1.00
SPA-KAS-006	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	5.2	2.00
SPA-KAS-016	Crooked Creek Crossing #1	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	8.0	1.00
SPA-KAS-016	Crooked Creek Crossing #2	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	30.0	1.00
SPA-KAS-017	UNT to Crooked Creek	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	1.0	0.17
SPA-KAS-018	UNT to Crooked Creek	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	3.3	0.17
SPA-KAS-020	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	3.7	0.50
SPA-KAS-021	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	3.5	0.50
SPA-KAS-025	UNT to Crooked Creek #1	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	6.9	0.17
SPA-KAS-025	UNT to Crooked Creek #2	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	4.9	0.17
SPA-KAS-025	UNT to Crooked Creek #3	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	3.3	0.17
SPA-KAS-026	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	4.0	0.50
SPA-KAS-027	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	2.0	0.25
SPA-KAS-030	UNT to Crooked Creek	Crooked Creek; 041201010701	Ephemeral	HQ-CWF, MF	No	Yes	Non-RPW	2.0	0.25
SPA-KAS-031	UNT to Crooked Creek	Crooked Creek; 041201010701	Ephemeral	HQ-CWF, MF	No	Yes	Non-RPW	0.5	0.25
PPA-KAS-002	-	Crooked Creek; 041201010701	Pond	HQ-CWF, MF Watershed	No	No	-	-	-

Notes: UNT = unnamed tributary HQ-CWF = high quality, coldwater fisheries MF = migratory fishery passageway RPW = relatively permanent water

1. Unique identifier assigned to feature during field surveys and correlates with mapping nomenclature.
2. Chapter 93 Classification based on Chapter 93 Water Quality Standards available at: http://www.pacode.com/secure/data/025/chapter93/chap93toc.html. Accessed August 2014.
3. Class A Wild Trout Waters are based on the PA Fish and Boat Commission's Class A Wild Trout Waters created December 16, 2013. Available at: http://fishandboat.com/classa.pdf. Accessed August 2014.
4. Wild and Scenic Rivers based on the National Wild and Scenic River System available at: http://www.rivers.org/. Accessed August 2014.
5. Natural trout producing waters are based on the PA Fish and Boat Commission's Stream Sections Supporting Natural Reproduction of Trout. May 2014. Available at: http://fishandboat.com/trout_repro.htm. Accessed August 2014.
6. Approved Trout Waters are based on the PA Fish and Boat Commission's Regulated Trout Waters website available at: http://fishandboat.com/fishpub/summary/troutregs_sw.htm. Accessed August 2014.
7. Jurisdictional classification must be confirmed by USACE.

4.3.2.3 Groundwater

Groundwater consists of subsurface hydrologic resources and is estimated to be more than twice as abundant as the amount of water that flows annually in the Pennsylvania's streams (Penn State 2014). As water infiltrates the ground, it reaches a saturated layer of sand, gravel, or rock called an aquifer. Aquifers may occur a few feet below the land surface, but they are more commonly found in Pennsylvania at depths greater than 100 ft (Penn State 2014). The Underground Segment is located within the Lake Erie watershed, which is largely underlain by unconsolidated sand and gravel aquifers found at depths ranging from 20 and 200 ft, and which can yield 100 to 1,000 gallons per minute (Penn State 2014).

No water lines occur along the Project route, with residences getting their water from private wells.

4.3.2.4 Floodplains

A floodplain is an area of land adjacent to a river or stream that experiences occasional or periodic flooding. It includes a floodway, which consists of a stream channel and adjacent areas that actively carry flood flows downstream, and the flood fringe, which are areas inundated by the flood but do not experience a strong current. The Federal Emergency Management Agency (FEMA) is responsible for mapping and delineating floodplains and determining the flood risk for susceptible areas. FEMA defines flood zones on Flood Insurance Rate Maps (FIRMs) by geographic areas based on levels of flood risk. A 100-year floodplain is determined based on the area with an approximately 1 percent or greater probability of flooding per year and corresponds to the FEMA Zone A (FEMA 2014a).
Within Pennsylvania, the PADEP directly regulates activities within floodways and certain types of activities in the 100-year flood fringe area, while municipalities regulate most activities within the flood fringe beyond the floodway. Floodways are determined in one of two ways. Many municipalities have flood insurance studies and maps prepared by the FEMA which indicates floodway boundaries. In the absence of any FEMA-determined floodway along a watercourse, the floodway is assumed to extend 50 ft landward from the top of each streambank, unless evidence to the contrary is provided and approved as defined by 25 Pa. Code Chapter 105.1.

Coastal flooding around the Great Lakes is primarily caused by storm surges and waves, but is also dependent on other conditions including lake levels and ice cover. The current FIRMs for Lake Erie are dated. Therefore, the Great Lakes Coastal Flood Study was conducted by the USACE, FEMA, Association of State Floodplain Managers (ASFPM), and state partners to update flood hazard maps (FEMA 2014b). This study may result in delineation of new Special Flood Hazard Areas, designation of Zone VE (coastal high-hazard areas subject to inundation by the 1-percent-annual-chance flood event with additional hazards due to storm-induced velocity wave action greater than 3 ft in height) (FEMA 2014b).

4.3.2.5 Riparian Buffers

A riparian buffer is defined as a BMP that is in an area of permanent vegetation along surface waters. Pennsylvania's 25 Pa. Code Ch. 102 rules governing erosion and sedimentation control require maintenance of riparian buffers where earth disturbance activities requiring an NPDES permit are conducted within 150 ft of a special protection (high quality or exceptional value) perennial or intermittent river, stream, lake, pond or reservoir. Portions of the Project involve placement of underground transmission line facilities across (under) waterways within the Crooked Creek watershed that are classified as High Quality (HQ) waters, and are therefore potentially subject to the provisions of 25 Pa. Code §102.14 relating to riparian buffers. However, §102.14(f)(2) specifically provides that certain activities are allowed within a riparian buffer "when authorized by the Department", including "(i) [c]onstruction or placement of … utilities or other structures" and "(ii) [w]ater obstructions and encroachments …." The Project involves activities that are eligible for the exceptions set forth in §102.14. As set forth in the PADEP/USACE Joint Permit Application filed by the Applicant in January 2016, the Project's stream crossings have been designed to minimize impacts through use of construction methods (e.g., HDD drilling) to avoid or minimize impact to the riparian buffer areas, and by installations within existing road rights-of-way.

Pennsylvania Act 162 of 2014 amended the Clean Streams Law to allow applicants additional options for meeting Ch. 102 buffer requirements. Act 162 also provides that where a project requiring an NPDES permit triggers the riparian buffer requirement (e.g., involves disturbance within 150 ft of an HQ or EV stream or lake), and the earth disturbance is also within 100 ft of any surface water (stream, lake, or wetland) certain offsetting measures must be implemented.

4.4 Aquatic Habitat and Species

4.4.1 Lake Segment

This section discusses aquatic habitat and species in the Lake Segment. Protected and sensitive species are discussed in Section 4.6.

4.4.1.1 Fisheries

Fish communities and their habitats in Lake Erie have been radically changed over the last 150 years by a series of cultural stresses imposed by mankind. These stresses have included intensive and selective commercial fishing, watershed and shore erosion, nutrient loading, invasion of new species, and stream destruction and marsh drainage (Hartman 1973). Overall, the lake fertility has increased measurably, average water temperature has increased, phytoplankton density and composition has been modified, summer dissolved oxygen deficits have increased, and fish and benthic macroinvertebrate communities have been altered (Hartman 1973). Most waters in Lake Erie are classified seasonally as cool water (68 to 80°F [20 to 28°C]), while coldwater habitat (less than 68°F [20°C]) occurs only in the eastern basin and in a limited depth range offshore in the central basin (Ryan et al. 2003).

The fishes of Lake Erie are a mixture of coldwater and warmwater species (Van Meter and Trautman 1970). The most dramatic changes in the Lake Erie fish community have been the loss of many highly valued native species and the invasion and proliferation of exotic (non-indigenous) species (Ryan et al. 2003). Affected species include lake trout (*Salvelinus namaycush*), sauger (*Sander canadensis*), and blue pike (*Stizostedion vitreus glaucus*). Native lake trout were once abundant in the eastern basin but have been rare since 1940 and are considered extirpated, with the exception of recent lake trout restoration efforts supported by stocking programs. Species such as cisco (also called lake herring; *Coregonus artedii*) approached extirpation, while species such as lake whitefish (*C. culpeaformis*) and lake sturgeon (*Acipenser fulvescens*) were severely reduced in numbers. The cisco fishery collapsed in the

1920s and recovered somewhat in the mid-1940s, but the species is now extremely rare. Lake whitefish populations declined to very low numbers leaving a remnant population that recovered in the mid-1980s. Lake sturgeon declined by the turn of the 20th century and abundance has remained very low, although recent information suggests that the sturgeon population may be recovering. As populations of native predators, planktivores, and benthivores declined, exotic fishes such as rainbow smelt (*Osmerus mordax*), round goby (*Neogobius melanostomus*), white perch (*Morone americana*), and alewife (*Alosa pseudoharengus*), proliferated and remain present in relatively high numbers (Hartman 1973; Ryan et al. 2003; PFBC 2008). Other popular game fish species found in the lake include the native brook trout (*Salvelinus fontinalis*), which are found spawning in a few coldwater tributaries and are occasionally found in the open lake. Other salmonid species that have been stocked into the lake and its tributaries include coho (*Oncorhyncus kisutch*), chinook (*O. tshawytscha*), and Atlantic salmon (*Salmo salar*), as well as brown (*S. trutta*) and rainbow trout (*O. mykiss*) (Hartman 1973).

In 1982 the USFWS published an atlas of fish spawning habitat in the Great Lakes, including Lake Erie. This document indicates that suitable spawning habitat is present throughout the near shore Pennsylvania waters of Lake Erie for several fish species. Habitat containing large/rocky substrates off the shores of Pennsylvania offer spawning and nursery habitat for such species as lake whitefish, rainbow smelt, emerald shiner, spottail shiner, fathead minnow, channel catfish, stonecat, trout-perch, white bass, smallmouth bass, rainbow darter, johnny darter, yellow perch, walleye and freshwater drum (Goodyear et al. 1982). Table 4.4-1 displays important Lake Erie fish species origins, spawning locations, and pre- and post-1800 abundances.

Table 4.4-1 Summary of spawning habitat requirements and changes in abundance of selected species of Lake Erie fish.[1]

Common Name	Scientific Name	Origin[2]	Spawning Location[3]	Abundance[4]	
				Pre-1800	Recent
Lake sturgeon	*Acipenser fulvescens*	N	T	C	R
Alewife	*Alosa pseudoharengus*	NI	T, N	NP	C
Gizzard shad	*Dorosoma cepedianum*	NI	T, N	NP	A
Goldfish	*Carassius auratus*	NI	T, N	NP	C
Common carp	*Cyprinus carpio*	NI	T, N	NP	A
Golden shiner	*Notemigonus crysoleucas*	N	T	C	R
Emerald shiner	*Notropis atherinoides*	N	N, O	C	R
Spottail shiner	*N. hudsonius*	N	N	C	R
Bluntnose minnow	*Pimephales notatus*	N	T	C	R
Fathead minnow	*P. promelas*	N	T	R	R
Quillback	*Carpiodes cyprinus*	N	T, N	R	R
White sucker	*Catostomus commersoni*	N	T	C	R
Black bullhead	*Ameiurus melas*	N	T, N	R	C
Yellow bullhead	*A. natalis*	N	T, N	C	R
Brown bullhead	*A. nebulosus*	N	T, N	C	R
Channel catfish	*Ictalurus punctatus*	N	T	C	R
Northern pike	*Esox lucius*	N	T, N	C	R
Muskellunge	*E. masquinongy*	N	T, N	C	R
Rainbow smelt	*Osmerus mordax*	NI	T, N	NP	C
Cisco (lake herring)	*Coregonus artedi*	N	N	A	R
Lake whitefish	*C. clupeaformis*	N	T, N	C	R
Lake trout	*Salvelinus namaycush*	N	N	C	R
White perch	*Morone americana*	NI	T	NP	A
White bass	*M. chrysops*	N	N	A	R
Pumpkinseed	*Lepomis gibbosus*	N	N	C	R
Bluegill	*L. macrochirus*	N	N	C	R
Smallmouth bass	*Micropterus dolomieui*	N	N	C	R
Largemouth bass	*M. salmoides*	N	T, N	C	R
White crappie	*Pomoxis annularis*	N	N	C	C
Black crappie	*P. nigromaculatus*	N	N	R	R
Yellow perch	*Perca flavescens*	N	N	A	C
Sauger	*Stizostedion canadense*	N	T, N	C	E
Blue pike	*S. vitreum glaucum*	N	ND[5]	A	E
Walleye	*S. vitreum vitreum*	N	T, N	C	C
Freshwater drum	*Aplodinotus grunniens*	N	N	A	A

[1] Source: Koonce *et al*. (1996);
[2] N = native species; NI = non-indigenous species;
[3] T = tributary; N = nearshore; O = open lake;
[4]A = abundant; C = common; R = rare; E = extinct or extirpated; NP = not present.
[5]ND = No data.

The fisheries of Lake Erie are managed on a cooperative basis by the five states and provincial agencies through the Lake Erie Committee (LEC) (Ryan et al. 2003). The Joint Strategic Plan for Management of Great Lakes Fisheries (Joint Plan) directed each lake committee to prepare a set of fish-community objectives for their respective Great Lakes. The LEC uses information collected by the states and provinces to make management decisions, including the PFBC.

The PFBC conducts June and September gillnet and October trawl surveys annually to provide an index of perch and walleye populations in Pennsylvania waters of Lake Erie. These surveys provide data on recruitment, age, length, weight, sex, maturity, and diet. Yellow perch catch rates have shown relatively stable populations and generally healthy annual recruitment, while walleye catch rates show a slight decline (7% decrease) in the population from 2006 to 2007 (PFBC 2008). The PFBC also conducts annual coldwater gillnet surveys in August with the primary target being lake trout to monitor the success of their stocking program. Burbot and lake whitefish are also frequently captured in these sampling events, and results in 2007 have shown a catch rate higher than the 18 year average (PFBC 2008). Results of the 2007 fall trawl assessment indicated an increase in the abundance and diversity of forage fish. The catch rates were highest among emerald shiner (48%), round gobies (20%), yellow perch (14%), and rainbow smelt (11%). Total forage fish density was 32% higher than the 20-year average (PFBC 2008).

There was only one licensed commercial trap net fisherman in Pennsylvania as of 2007. Prior to 1996, gillnetting was allowed and the commercial fishing effort and harvest was much greater (PFBC 2008). Quotas set by the PFBC restrict yellow perch and walleye harvests. The total 2007 trap net landings were 42,468 pounds for all species, which was dominated by yellow perch (55%) and white perch (16%). This was an increased trap net harvest from years prior, but is much lower when compared to 445,000 pounds per year average between 1991 and 1996, when gillnetting was permitted. Table 4.4-2 displays the amounts of commercially harvested fish by species between 1991 and 2007 (PFBC 2008).

Table 4.4-2 Annual commercial harvest in pounds, Pennsylvania waters of Lake Erie –gillnetting not allowed after 1996.

Year	Walleye	Smelt	Yellow perch	White sucker	Redhorse	Carp	Catfish	Bullhead	Drum	Burbot	White perch	White bass	Lake whitefish	TOTAL
1991	10,296	86	159,352	9,211	3,409	10	60	10	13,733	33,382	52,638	895	300,882	584,100
1992	14,548	46	77,267	5,014	2,540	45	52	15	21,866	22,210	25,701	620	205,133	375,057
1993	29,990	11	28,976	10,557	1,105	0	76	16	11,535	4,197	16,879	834	269,080	373,256
1994	28,205	1	58,765	15,945	3,529	0	476	210	25,316	12,059	47,937	686	350,309	543,438
1995	42,138	0	30,754	12,719	1,717	75	351	23	22,774	30,945	32,892	4,461	169,747	348,596
1996	81	0	5,340	4,125	1,580	0	6,848	872	234	2,262	235	96	2	21,771
1997	193	0	7,398	3,223	766	96	3,806	626	1,117	8,910	1,628	386	1,597	29,696
1998	417	0	5,281	3,544	1,283	132	2,125	972	628	8,963	701	113	3,496	27,655
1999	229	-	2,905	1,864	566	-	1,877	619	677	7,943	201	670	670	20,220
2000	183	-	5,950	862	436	-	1,269	861	567	3,529	379	338	-	20,214
2001	73	-	2,702	755	287	-	601	594	381	4,359	427	43	-	10,222
2002	43	-	2,030	508	142	-	452	18	389	5,177	489	19	25	9,292
2003	129	-	5,050	856	467	-	73	30	936	1,821	408	88	93	9,951
2004	501	-	7,753	1,402	348	-	72	286	1,486	2,401	459	110	91	14,909
2005	830		15,228	3,461	2,111		880	868	3,050	2,238	3,844	154	563	33,227
2006	2,818		20,517	3,091	2,734		292	617	2,775	1,723	4,565	221	363	39,716
2007	1,880		23,471	2,052	1,897		159	362	3,486	1,088	6,618	771	684	42,468
MEAN	8,167	10	27,204	4,821	1,439	26	1,207	415	6,717	9,507	11,836	608	81,378	161,873

Source: PFBC 2008

More recently, the Coldwater Task Group (CWTG), a technical group under the LEC, has provided findings of recent commercial harvests for lake whitefish and burbot in Lake Erie (CWTG 2014). Lake whitefish harvest levels were among their lowest levels since before this species started to recover after the 1980s, due to poor recruitment rates. All commercially harvested lake whitefish were from Ontario and Ohio waters. Burbot catch rates have also dropped in Pennsylvania, New York, and Ontario over the last several years, and recruitment appears to remain low (CWTG 2014).

The New York State Department of Environmental Conservation (NYSDEC) submits annual reports of fisheries surveys conducted in the eastern basin of Lake Erie to the LEC that are publically available for recent years (NYSDEC 2014). These surveys have found very successful year classes for walleye in 2003, 2010, and again in 2012, which is contributing to an adequate walleye abundance and sport fishery in the lake currently. Smallmouth bass and yellow perch populations in the eastern basin continue to thrive, although yellow perch recruitment was lower than normal between 2011 and 2013 (NYSDEC 2014).

The NYSDEC also monitors lake trout populations in the New York waters of Lake Erie's eastern basin (NYSDEC 2014). Stocking has occurred in the lake since 1978, and overall abundance in the eastern basin was relatively high in 2013, similar to previous years. No evidence of natural spawning of lake trout has been observed during the more than 30 years of restoration efforts, and adult survival (age 7+) remains very low, which is primarily attributed to sea lamprey predation (NYSDEC 2014, CWTG 2014). Sea lamprey wound rates and nesting surveys indicate that additional control measures are necessary to manage the impact of this invasive species on native fish populations. Other salmonid populations (i.e., steelhead, rainbow trout, and brown trout) remain stable and support a quality sport fishery through stocking programs and natural recruitment of steelhead. Chinook and coho salmon are no longer stocked by NYSDEC in Lake Erie due to low stocking success rates of these species (NYSDEC 2014).

PFBC has expressed particular interest in steelhead, as well as three state-listed species that are discussed in Section 4.6.1.2. A large salmonid species, steelhead trout are the anadromous form of rainbow trout (*Oncorhynchus mykiss*). Native to the cold waters of the western United States, this species has been introduced into cold waters throughout the country (Ohio Department of Natural Resources [ODNR] no date). The PFBC stocks more than one million steelhead trout into Lake Erie every year (Vargason 2013). Adult steelhead can inhabit cool lakes, estuaries, or oceanic habitats; in lakes, they feed on various planktonic and benthic invertebrates as well as larval fish and fish eggs (USDA 2000). Steelhead spawn in cobbled and graveled habitat of the coldwater tributaries of Lake Erie in the fall, but are found in the lake during the summer months (ODNR no date). Available data suggest that both non-anadromous rainbow trout and the anadromous steelhead trout are capable of movements from 10 km to more than 50 km in distance (Nature Serve 2014).

Prey fish surveys comprised of trawling, sonar surveys, predator diet studies, and lower food web monitoring have been conducted in the eastern basin of Lake Erie for about 20 years (NYSDEC 2014). Rainbow smelt were once the dominant forage species; however, prey species diversity increased around 2000 when round goby and emerald shiner abundances increased dramatically. More recently, the exotic round goby populations have decreased, and native emerald shiner populations have plateaued at lower levels, while smelt populations have been increasing. Recent bottom trawl surveys in New York indicate that trout-perch and several clupeid species also comprise significant portions of the forage fish biomass in Lake Erie

(NYSDEC 2014).

4.4.1.2 Benthic Macroinvertebrates

Historically, the distribution, composition, and abundance of benthic communities have been considered to be excellent tools for assessing trophic trends in aquatic systems. Benthic fauna form stable aggregations that integrate and reflect environmental and biological conditions over long periods of time, and changes in the benthic community may be reflected in the presence or absence of indicator species, species associations, and relative abundance (Pira et al. 1998). Table 4.4-3 lists benthic macroinvertebrates found in the nearshore waters of Lake Erie's eastern and central basins.

Table 4.4-3 Benthic macroinvertebrates found in nearshore eastern and central basins Lake Erie.

	Eastern Basin[1]		Central Basin[2]
	1974	**2001**	**1995**
Planaria	X	X	X
Hydridae	X		X
Namatoda	X	X	X
Branchiura	X		X
Oligochaeta	X	X	X
Hirudinea	X	X	X
Isopoda	X	X	X
Amphipoda	X	X	X
Chironomidae	X	X	X
Trichoptera	X	X	X
Ostracoda			X
Dreissena		X	X
Quagga			X
Sphaeriidae	X	X	X
Gastropoda	X	X	X

Source:
[1] Ratti and Barton 2003
[2] Pira et al. 1998

Lake Erie possesses several traits that make it excellent Unionidae (freshwater mussels) habitat. Lake Erie is a shallow eutrophic lake with good nutrient concentrations throughout, and much of the sediment is soft, consisting of silt with scattered sand bars that allows for suitable burrowing habitat for many lotic species of Unionids (Herdendorf 1987; Haag 2012; Prescott 2013). Unionids were once common throughout open and nearshore waters of Lake Erie (Table 4.4-4) (Nalepa et al. 1991; Schloesser and Masteller 1999; Crail et al. 2011), but the zebra mussel (*Dreissena polymorpha*) and quagga mussel (*D. bugensis*) were introduced into the Great Lakes in the mid-1980s (Prescott 2013) via the ballast of shipping barges and has since caused the native mussel populations to become virtually extirpated within the Great Lakes (Schlosser and Nalepa 1994; Edsall and Charlton 1997; Schlosser and Masteller 1999). In lentic and very slow moving lotic habitats, the Unionid shells provide a stable and hard substrate for dreissenid mussels to attach and become established, and as a result, the many dreissenids attached to one Unionid contributes to death by starvation for the Unionid (Prescott 2013). However, a study conducted by Crail et al. (2011) indicated native Unionids are still present in Lake Erie despite abundant dressenid populations. *Leptodea fragilis* and *Pyganodon grandis* appear to be common in some nearshore zones based on live animals found or on numerous fresh shells washed up along the shore. Additionally, evidence of 14 other species also suggests that the Unionid communities of Lake Erie may be present even if in low abundance (Crail et al. 2011).

Table 4.4-4 Unionids historically found in Lake Erie.

Species	Open Water Sites		Nearshore Western Lake Erie[3]	Presque Isle Bay[4]	
	1930-1982[1]	1991[2]	2007-2009	1990-1994	1995
Amblema plicata	L	X	L	L	X
Elliptio dilatata	L	X		L	X
Fusconaia flava	L	X		L	X
Lampsilis cardium	L	X		L	X
Lampsilis siliquoidea	L	X		L	X
Lasmigona complanata	D		L		
Lasmigona costata				L	X
Leptodea fragilis	L	X	L	L	X
Ligumia nasuta	L	X	L	L	X
Obliquaria reflexa	L	X	FD		
Obovaria subrotunda	L				
Pleurobema sintoxia	L				
Potamilus alatus	L	X	L	L	X
Potamilus ohiensis		X			
Ptychobranchus fasciolaris				L	X
Pyganodon grandis	L	X	L	L	X
Quadrula pustulosa	L	X	FD	L	X
Quadrula quadrula	D		L	L	X
Strophitus undulatus	L				
Toxolasma parvum	L		L		
Truncilla donaciformis	L		FD		
Truncilla truncata	L		L	L	X
Uniomerus tetralasmus	D				
Utterbackia imbecillis	D		L		

Source: [1] = Nalepa et al. 1991; [2] = Schloesser and Nalepa 1994; [3] = Crail et al. 2011; [4] = Schloesser and Masteller 1999
Note: L = live; D = dead; FD = fresh dead; X = no live specimens found

Historical and recent data indicate that the Lake Erie benthic community underwent significant changes during each decade of the last half-century. During this time, the community showed signs of recovery following the ecosystem restoration that occurred as a result of the pollution and nutrient abatement program and then experienced major structural and functional changes after dreissenid (i.e., exotic zebra mussels) introduction (Burlakova et al. 2014). Data analysis (Burlakova et al. 2014) indicated that there was a significant temporal trend in the benthic community structure from 1963 to 2012 due largely to the *Dreissena* invasion, which appeared to have a larger effect on the benthic community over the last half-century in comparison to all other environmental changes in the lake.

4.4.1.3 Aquatic Vegetation and Avifauna

Aquatic vegetation along the Lake Erie shores in Pennsylvania is scarce due to frequent high-energy wave action and the presence of exposed shale bedrock (Rathke 1984). In addition, exposed shale bedrock substrates preclude the growth of submerged aquatic vegetation, and although aquatic vegetation surveys are not regularly conducted in the Pennsylvania waters of Lake Erie, Rathke (1984) did not observe any submerged aquatic vegetation in any Lake Erie nearshore monitoring sites. Filamentous algae, however, colonizes the exposed bedrock in Lake Erie, comprised of various species such as *Cladophora glomerata, Ulothrix zonata,* and *Bangia atropurpurea.* Cladophora, or green algae, is most common in more shallow and eutrophic areas of Lake Erie, such as the western basin and the north shore of the eastern basin (Rathke 1984). Due to deeper waters and lower temperatures in the eastern basin and waters of Pennsylvania, toxic algal blooms are not common (Shalaway 2014).

Wild birds are known to frequent the shorelines of Lake Erie. Historical bird survey records from 1974 identified 103 different bird species within the Erie Bluffs State Park (Lake Erie Region Conservancy 2008). This park is east of the proposed underground segment. The previous section provides a list of the Avifauna found near the shores of Erie County. Waterbirds, raptors, and shorebirds utilize Lake Erie and the near shore areas as a part of their life cycle. The western basin of Lake Erie is a critically important location for migratory birds as nesting or stopover locations.

4.4.1.4 Terrestrial Species that Use the Lake Segment

Terrestrial species occurring along the proposed Project route may also use habitat in or over Lake Erie along the Lake Segment of the Project. A wide variety of songbirds, hawks, and owls could occur over Lake Erie, including various species of passerines, raptors, wading birds, and game birds that use upland, wetland, or riparian habitats. Mammals that could occur over Lake Erie include Indiana bat (*Myotis sodalis*), northern long-eared bat (*M. septentrionalis*), eastern red bat (*Lasiurus borealis*), and hoary bat (*Lasiurus cinereus*) (PGC 2013a; PNHP 2012). More detail is provided regarding terrestrial species and their habitats in the next section.

4.4.2 Underground Segment and Converter Station

The fish communities in the streams that would be crossed by the Underground Segment likely include species from both the coldwater and coolwater communities (Table 4.4-5). Streams classified under the coldwater community may contain populations of brook trout (*Salvelinus fontinalis*) and brown trout (*Salmo trutta*). None of the streams crossed by the Project are listed as wild trout/natural reproduction, or Class A Wild Trout waters. Most of the streams in question are stocked trout fisheries. The coldwater fish community is typically less common in urbanized streams than in watersheds with natural land covers (Walsh et al. 2007). Fish in the coolwater stream community are habitat generalists and generally pollution tolerant. This community type may represent small, coolwater streams that occur in agricultural landscapes. The habitat for the coolwater stream community represents an important transition between cold headwater streams and warm larger streams (Walsh et al. 2007). In addition to fish, streams crossed by the Underground Segment would also include a benthic macroinvertebrate community.

Table 4.4-5 Potential stream fish communities in waterbodies crossed by the proposed Project.

Coldwater		Coolwater	
Common Name	***Scientific Name***	**Common Name**	***Scientific Name***
Brook trout	*Salvelinus fontinalis*	Blacknose dace	*Rhinichthys atratulus*
Mottled sculpin	*Cottus bairdii*	Longnose dace	*Rhinichthys cataractae*
Brown trout	*Salmo trutta*	Creek chub	*Semotilus atromaculatus*
Rainbow trout	*Oncorhynchus mykiss*	Brown trout	*Salmo trutta*, stocked
		White sucker	*Catostomus commersoni*
		Redside dace	*Clinostomus elongatus*
		Fathead minnow	*Pimephales promelas*
		Pearl dace	*Margariscus margarita*

Source: Walsh et al. 2007

4.5 Terrestrial Habitat and Species

4.5.1 Underground Segment

4.5.1.1 Vegetation and Habitat

Habitats along the Underground Segment include sparsely vegetated beach, agricultural vegetation, wetland communities, and mixed deciduous broadleaf terrestrial forests.

The Great Lakes Region sparsely vegetated beach occupies the sand or gravel shores from the normal water line to the upper limit of winter storms. The substrate is very unstable and subject to wave action and ice scour. The vegetation is sparse, usually less than 25% total cover. The most characteristic species are American beachgrass (*Ammophila brevigulata*), sea-rocket (*Cakile edentula*), Canada wild-rye (*Elymus canadensis*), silverweed (*Potentilla anserina*), and cocklebur (*Xanthium strumarium* var. *canadense*).

The agricultural vegetation along the underground route varies based on crop or fallow field. The areas surveyed included vineyards, corn fields, soybeans, shrubs for landscaping (boxwoods, goldthread, Arborvitae, etc.), and fallow fields. The portion of the Project that falls within the Lake Plain region of Erie County is heavily dominated by the production of fruits and vegetables (PNHP 2012).

The upland mixed deciduous broadleaf terrestrial forests of Erie County are dominated by a variety of species, including beech (*Fagus grandifolia*), tuliptree (*Liriodendron tulipifera*), white ash (*Fraxinus americana*), basswood (*Tilia americana*), sugar maple (*Acer saccharum*), oaks (*Quercus spp.*), white pine (*Pinus strobus*), eastern hemlock (*Tsuga canadensis*), mockernut hickory (*Carya tomentosa*), shagbark hickory (*C. ovata*), red maple (*Acer rubrum*) (PNHP 2012). Shrubs include northern arrowwood (*Viburnum recognitum*), southern arrowwood (*V. dentatum*), maple-leaved viburnum (*V. acerifolium*), smooth serviceberry (*Amelanchier laevis*), shadbush (*A. arborea*), mountain laurel (*Kalmia latifolia*), hornbeam (*Carpinus caroliniana*), hop-hornbeam (*Ostrya virginiana*), witch-hazel (*Hamamelis virginiana*), and spicebush (*Lindera benzoin*). The herbaceous layer is highly variable. Representative species include wild-oats (*Uvularia sessilifolia*), false Solomon's-seal (*Smilacina racemosa*), may-apple (*Podophyllum peltatum*), pipissewa (*Chimaphila maculata*), teaberry (*Gaultheria procumbens*), Indian cucumber-root (*Medeola virginiana*), blue cohosh (*Caulophyllum thalictroides*)—on richer sites, wood ferns (*Dryopteris spp.*), and hayscented fern (*Dennstaedtia punctilobula*) (Fike 1999).

Because the transmission cables would be installed underground along existing local and state highways, forested habitat along the ROW most commonly exists as successional or shrubby forest edge or agricultural. The proposed Project route would cross several streams (Section 4.3.2.2) and as a result, some riparian habitat is expected to occur within the Underground Segment.

Significant natural communities in the Underground Segment are regulated by PADEP, USACE, and PADCNR and include the wetland communities (i.e., emergent wetlands, scrub shrub wetlands, and forested wetlands; Section 4.3.2.1), waterbodies (Section 4.3.2.2), floodplains (Section 4.3.2.4), riparian buffers (Section 4.3.2.5), and communities that contain threatened or endangered species (Section 4.6).

The Underground Segment overlaps several significant natural communities of disturbed forests, deciduous hardwood forests, mesic hardwood forests, northern hardwood forests, woody wetland forests, scrub-shrub wetlands, alder thicket, palustrine emergent wetlands, old-fields, hay fields, and agricultural fields.

The Applicant identified and mapped habitat along the terrestrial portions of the proposed Project construction corridor using aerial photography, field observations, and available databases. Ecological communities and land cover types that have been identified within portions of the Underground Segment construction corridors are presented in Table 4.5-1.

Table 4.5-1 Avifanua found near the shores of Erie County.

Common Name	Scientific Name
Pied-billed grebe	*Podylimbus podiceps*
American bittern	*Botaurus lentiginosus*
Great egret	*Ardea alba*
Great blue heron	*A. herodias*
Least bittern	*Ixobrychus exilis*
Green heron	*Butorides striatus*
Black-crowned night-heron	*Nycticorax nycticorax*
Tundra swan	*Cygnus columbianus*
Canada goose	*Branta canadensis*
Green-winged teal	*Anas crecca*
American black duck	*A. rubripes*
Mallard	*A. platyrhynchos*
Redhead	*Athya americana*
Greater scaup	*A. marila*
Lesser scaup	*A. affinis*
Common goldeneye	*Bucephala clangula*
Bufflehead	*B. albeola*
Bald eagle	*Haliaeetus leucocephalus*
Northern harrier	*Circus cyaneus*
Peregrine falcon	*Falco peregrinus*
Yellow rail	*Coturnicops noveboracensis*
King rail	*Rallus elegans*

Common Name	Scientific Name
Virginia rail	*R. limicola*
Sora	*Porzana carolina*
American coot	*Fulica americana*
Killdeer	*Charadrius vociferus*
Greater yellowlegs	*Tringa melanoleuca*
Lesser yellowlegs	*T. flavipes*
Spotted sandpiper	*Actitis macularia*
Upland sandpiper	*Bartramia longicauda*
Semipalmated sandpiper	*Calidris pusilla*
Dunlin	*C. alpina*
Bonaparte's gull	*Larus philadephia*
Ring-billed gull	*L. delawarensis*
Herring gull	*L. argentatus*
Common tern	*Sterna hirundo*
Forster's tern	*S. forsteri*
Black tern	*Chlidonias niger*
Belted kingfisher	*Ceryle alcyon*

Source: Research Planning Institute (RPI) et al. (1985).

4.5.1.2 Wildlife

Terrestrial fauna are represented by a variety of mammals, amphibians, reptiles, birds, and invertebrate species. Erie County's invertebrate species greatly outnumber its vertebrate species, but the distribution and ecology of these species is poorly known. The species common to Erie County and the Project area include white tailed deer (*Odocoileus virginianus*), gray and fox squirrels (*Sciurus carolinensis, S. niger*), raccoon (*Procyon lotor*), white-footed mouse (*Peromyscus leucopus*), deer mouse (*P. maniculatus*), striped skunk (*Mephitis mephitis*), Virginia opossum (*Didelphis virginiana*), red fox (*Vulpes vulpes*), coyote (*Canis latrans*), northern short-tailed shrew (*Blarina brevicauda*), eastern chipmunk (*Tamias striatus*), eastern cottontail (*Sylvilagus floridanus*), woodchuck (*Marmota monax*), porcupine (*Erethizon dorsatum*), meadow vole (*Microtus pennsylvanicus*), and meadow jumping mouse (*Zapus hudsonius*). Wetlands and waterways play a major role in providing habitat for Erie County's mammals. It is not uncommon to find multiple species of shrews, rodents, weasels, and bats, as well as sign of larger mammal species in these habitats. The ermine (*Mustela erminea*), mink (*M. vison*), least weasel (*M. nivalis*), and long-tailed weasel (*M. frenata*) can be found foraging along wetlands and waterways where prey items are abundant. Also tied to aquatic environments is the star-nosed mole (*Condylura cristata*), muskrat (*Ondatra zibethicus*), and beaver (*Castor canadensis*) (Pennsylvania Natural Heritage Program 2012).

A total of 394 species of wild birds are known to occur in Pennsylvania, including 186 species that regularly nest in the state (LERC 2008). The proposed Project route would make landfall adjacent to the Erie Bluff State Park shoreline of the lake, which encompass the Erie Bluffs Coastline Natural Heritage Area (NHA), Erie Bluffs West Swamp NHA, Erie Bluffs East Swamp NHA, and Erie Bluffs Sand Dune NHA. Historical records indicate a five-month survey in 1974 of the former Coho site, now Erie Bluff State Park, produced a list of 103 different bird species (LERC 2008). Bird species such as American woodcock (*Scolopax minor*), red-headed woodpecker (*Melanerpes erythrocephalus*), winter wren (*Troglodytes troglodytes*), and black-billed cuckoo (*Coccyzus trythropthalmus*) have been observed breeding in the Erie Bluffs State Park area (LERC 2008). Additionally, Presque Isle State Park (located 15 miles to the east of the Project) is recognized by the National Audubon Society as one of the several Important Bird Areas (IBAs), and provides excellent waterfowl and other shore bird species habitat along the shores of Lake Erie where more than 325 species of birds have been identified to occur within the park (LERC 2008). Table 4.5-1 lists avifauna found in this area.

4.6 Protected and Sensitive Species

Protected species are species that are protected under federal or state laws. Terrestrial and aquatic threatened and endangered species are animals and plants protected under the federal Endangered Species Act (ESA) (16 U.S.C. 1531 *et seq*.) or Pennsylvania's Endangered Species Regulations that are expected to occur in the proposed Project area.

In Pennsylvania, four different federal and state agencies have the primary responsibility for administering the rules and regulations for the protection and management of threatened and endangered species and other species of special concern. The PFBC is responsible for fish, reptiles, amphibians, and aquatic organisms; the Pennsylvania Game Commission (PGC) is responsible for wild birds and mammals; and the PADCNR is responsible for programs relating to the Commonwealth's native wild plants, terrestrial invertebrates, significant natural communities, and geologic features. At the federal level, the USFWS is responsible for federally listed, proposed, and candidate species under the federal ESA.

Discussions with the PFBC, PGC, PADCNR, and USFWS regarding the potential impact of the proposed Project on federally and state-protected species and their occupied habitats have been ongoing since May 2014. The Applicant has been consulting with these agencies to obtain information about protected species and develop measures to avoid or minimize impacts. On July 28, 2014, the Applicant submitted a request for a Pennsylvania Natural Diversity Inventory (PNDI) review for the Project. Following changes to the transmission line routing, on January 23, 2015, the Applicant submitted an update for the Project to the PFBC, PGC, PADCNR, and USFWS requesting review of potential impacts on rare, threatened, and endangered species and is awaiting agency input.

In a letter dated March 23, 2015, the PGC screened the Project for potential impacts to species and resources of concern under PGC responsibility, which includes birds and mammals only. The PGC records indicate that no known occurrences of species or resources of concern under PGC jurisdiction occur in the vicinity of the Project.

In addition to federally and state-listed threatened and endangered species, there are other protected species along the proposed Project route. A number of species of birds along the proposed Project corridor are protected by federal laws including the Migratory Bird Treaty Act (MBTA) and the Bald and Golden Eagle Protection Act (BGEPA). The MBTA prohibits the take of migratory birds, including any species also listed under the ESA. Likewise, the BGEPA prohibits the taking of bald and golden eagles (*Haliaeetus leucocephalus* and *Aquila chrysaetos*, respectively).

Consultation with the USFWS, PFBC, and PADCNR and these discussions are summarized in Section 5.6, Environmental Consequences, Protected and Sensitive Species. The Applicant is continuing to coordinate with PFBC regarding federally and state-protected species.

4.6.1 Lake Segment

4.6.1.1 Federally Listed Species

Based on consultations with the USFWS, no federally listed aquatic endangered, threatened, or candidate species are identified in proximity of the proposed Project route. Indiana bat, northern long-eared bat, and bald eagle are terrestrial species that could occur along the Lake Segment. These species are discussed in more detail in Section 4.6.2.

4.6.1.2 State-Listed Species

In a letter dated September 16, 2014, the PFBC noted the following species of concern with regard to the Project: cisco, lake sturgeon, and eastern sand darter, all of which are state-listed endangered species. During a conference call between the Applicant, its consultants, and PFBC representatives on August 28, 2015, PFBC staff stated that they were not concerned about Project construction effects on lake sturgeon and cisco, given PFBC's review of additional information received regarding Project construction activities. PFBC stated they were concerned about potential effects of Project construction to eastern sand darter during their spawning period of June and July. Based on those and subsequent discussions, the Applicant commissioned preparation of a draft Biological Assessment to evaluate potential effects to the eastern sand darter (Appendix J).

In this section, information on the three species of potential concern (cisco, lake sturgeon, eastern sand darter) is presented.

Cisco

Cisco are a small, slender member of the whitefish group of the Salmonidae family with trout, salmon, char, and whitefish (Michigan Natural Features Inventory [MNFI] 2014). They occupy pelagic (open water) habitat in lakes, are a coldwater species, and usually form large schools in mid-water of the central and eastern basins of Lake Erie. Cisco feed primarily on plankton, but may also consume crustaceans, insects, insect larvae, fish eggs, and other invertebrates, as well as small fish on occasion (Ebener et al. 2008; NatureServe 2014; and ODNR 2014*a*).

Cisco congregate in schools and move into shallower waters during late fall and early winter to spawn. Spawning often occurs in shallow water (1-3 meters deep) over gravel, rock, or sand, but also may occur pelagically in midwater (Great Lakes). After spawning the adults return to deep water after the ice melts (NatureServe 2015; ODNR 2014*a*). Cisco hatch in early in the spring after ice out (MDNR 2015)., which is typically April in Lake Erie (NOAA Great Lakes Environmental Research Laboratory 2009). Larvae spend their early stages of development swimming and feeding near the surface in May and June (Ebener et al. 2008).

Lake Sturgeon

Lake sturgeon live in larger rivers and lakes, including Lake Erie. This is the only sturgeon species endemic to the Great Lakes basin and is the largest freshwater fish indigenous to that system. Their primary habitat is the bottoms of large, clean, freshwater rivers and lakes. Within a given "home range," lake sturgeon move from shallow to deeper waters in the summer, to shallow waters in the fall, and back to deeper waters in the winter (NatureServe 2014; PNHP

2014*b;* USFWS 2014*b*).

Lake sturgeon typically occur near shore in 15-30 ft depths, though some larger adults have been found at depths of 140 ft. Lake sturgeons are benthivores, feeding mainly on small invertebrates such as insect larvae, crayfish, snails, clams, and leeches obtained from the bottom. Feeding is accomplished by probing the sediments with the ends of sensitive barbels dragging lightly over the bottom. Upon contacting food, the tubular mouth is protruded and the food is sucked in along with sediments. The sediments are screened out through the gills with the food retained within the crop (NatureServe 2014; PNHP 2014*b;* USFWS 2014*b*).

Lake sturgeon is an extremely long-lived species, not reaching sexual maturity until 7 to 25 years of age. Females spawn once every 4 to 9 years and males spawn once every 2 to 7 years. Spawning occurs in water ranging from 1 to 15 ft deep, along rocky shorelines of lakes, in wave action over clean gravel shoals, rocky ledges and around rocky islands (USFWS 2015, MDNR 2015, NatureServe 2015, Scott and Crossman 1998). Spawning occurs from early April to June, although spawning is temperature dependent (preferred temperature is 53 to 64° F) (GLIMDS 2015; MDNR 2015; USFWS 2015, PNHP 2014*b*). The black eggs stick to rocks and logs and hatch in 5 to 10 days. The tiny young are nourished by a yolk sac for another 10 to 20 days, then-like adults-they feed on small bottom-dwelling animals (PNHP 2015). Within 12 -14 days of hatching, the fry are 1 inch long and have fully developed mouths and barbels (GLIMDS 2015). Growth rate of lake sturgeons varies throughout its range and depend on the temperature, food availability, and water quality (NatureServe 2014; PNHP 2014*b*; USFWS 2014*b*).

Eastern Sand Darter

The eastern sand darter is a very long, narrow fish of the Percidae family with other darters and perches, and occurs throughout much of the United States and into southern Canada. Eastern sand darters are typically 2-3 inches long, sometimes up to 3.5 inches (ODNR 2015). The eastern sand darter mainly eats midge larvae, as well as other dipteran larvae, and mayfly naiads, oligochaetes, and cladocerans. They are apparently a visual feeder, typically concealing itself in sand with only the eyes and snout protruding and darting out to capture prey (NatureServe 2014; ODNR 2015; Pennsylvania Natural Heritage Program [PNHP] 2015).

Eastern sand darters have been reported to be exclusively associated with sand substrates (from studies in streams) and the presence of silt-free sand beds are important to this species (Daniels 1993). In lakes, the eastern sand darter preferred habitat is sandy shoals (Scott and Crossman 1998). They are known to utilize clean sandy shoals along lakeshores, although this species has also been found in depths of 15 m to 20 m and greater in Lake Erie (PFBC 2015, Grandmaison et al. 2014, PFBC unpublished). Spawning in Pennsylvania waters generally occurs during June and July (Criswell 2013), but it may be somewhat later in the Great Lakes (PNHP 2015). Spawning has not been observed in the wild (Adams and Burr 1994), but it has been observed in aquaria where they utilized sandy substrates for mating and egg deposition that is similar to their general habitat preferences. Spawning was observed in aquaria to occur multiple times over the season, with a male and female paired, using their tails to dig in the sand and deposit a single, slightly adhesive, fertilized egg at each spawning location (Adams and Burr 1994). Eggs hatch in less than a week after being laid (NYNHP 2015).

Within Lake Erie, eastern sand darters have been reported along wave protected clean sandy beaches, in shallow bays, and in the island region (PNHP 2015, Van Meter and Trautman 1970). Criswell (2013) reported that eastern sand darter was found in the Pennsylvania portion of Lake Erie on clean, sandy shoals. Langlois (1954) reported it from sandy shoals at the narrows of Middle Bass Island, and noted that some were captured at a beach on South Bass Island in 1952. It occupies unconsolidated, sandy bottom along the shoreline of Presque Isle in waters 1-5 ft in depth (NatureServe 2015). Rob Criswell (pers. comm.) noted the collection of 15 to 20 eastern sand darters in Lake Erie (via trawl) at depths of 12 to 15 meters, circa 1996-1997 (Grandmaison et al 2004).

To aid in development of the Applicant's Biological Assessment (Appendix J), PFBC reviewed bottom trawl data in the Pennsylvania section of Lake Erie between 1975 and 2013 for records of eastern sand darter. Most of the trawling was conducted in the fall (October and November) for the purpose of evaluating percid (walleye and perch) recruitment. Sampling occurred in water depths of over approximately 40 ft (pers. comm., C. Murray, PFBC, November 10, 2015).

PFBC conducted 366 trawls between 1985 and 2013, and eastern sand darters were collected during 7 of those 26 years (Table 4.6-1).

Table 4.6-1 PFBC bottom trawling effort in Lake Erie and density of eastern sand darters captured, 1985-2013. Source: PFBC unpublished.

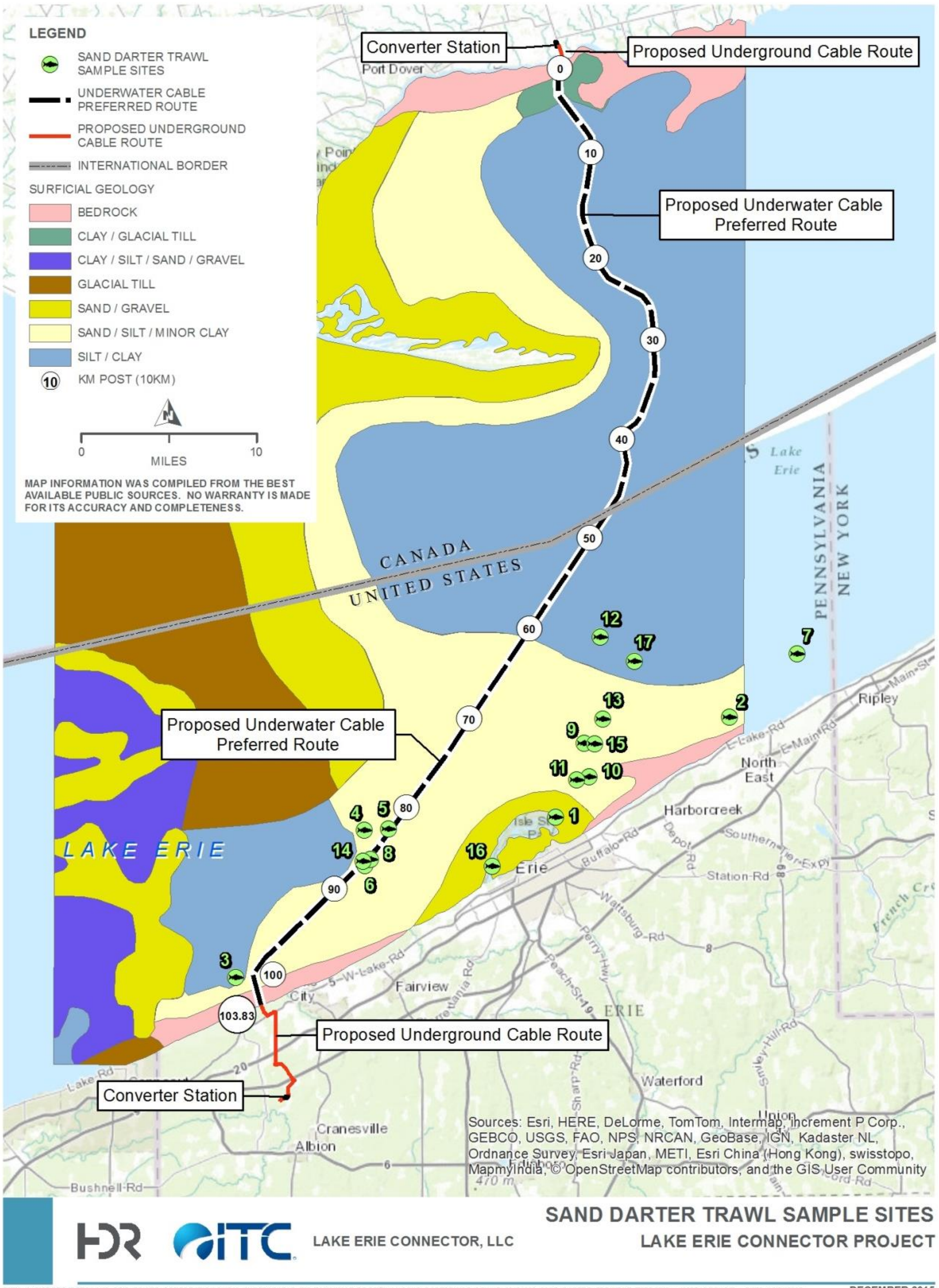
Year	No. trawls	Average e. sand darter/hectare	Year	No. trawls	Average e. sand darter/hectare
1985	13	0.00	1998	22	0.00
1986	17	0.00	1999	15	0.65
1987	28	0.98	2000	15	0.00
1988	17	0.00	2001	8	0.00
1989	13	0.00	2002	21	0.00
1990	9	0.25	2003	13	0.00
1991	15	0.00	2004	8	0.00
1992	16	0.05	2005	11	2.54
1993	9	6.69	2007	12	0.00
1994	15	0.00	2008	5	0.00
1995	19	0.12	2009	11	0.00
1996	16	0.00	2012	26	0.00
1997	2	0.00	2013	10	0.00
			Average	14.1	0.43

In evaluating the trawl data further for trawls in which eastern sand darters were collected, including trawls conducted back to 1975, 62 eastern sand darter were captured during this 39-year period during 17 bottom trawls (PFBC unpublished) (Table 4.6-2 and Figure 4.6-1; the sample site numbers from the table match the sample site numbers on the figure). Contrary to life history information from the literature summarized above, eastern sand darters were collected in deep areas, up to 90 ft. One of the 62 eastern sand darters sampled (1.6%) was captured in June or July, the potential spawning period of interest for this assessment (June 11, 1992 when one sand darter was collected in 66 ft of water over sand/silt/minor clay substrate, approximately 10 miles east of the proposed Project route).While the majority of eastern sand darters (59 of 62; 95.2%) were captured in September to November (PFBC unpublished), it should be noted that trawl sampling was rarely conducted in the spring and summer (pers. comm., C. Murray, PFBC, November 10, 2015).

Table 4.6-2 PFBC trawl sample sites in the Pennsylvania Section of Lake Erie where eastern sand darter were captured, 1975 - 2013. Source: PFBC unpublished.

Sample Location	Number Collected	Date	Entity	Notes (depths in ft)
1	1	10/4/1975	PSU	Lake Erie, Erie Co., at Presque Isle
2	1	11/14/1983	PFBC	Lake Erie, East Basin; Station: NE; Depth: 17.55; 10 min. trawl
3	1	5/21/1987	PFBC	Lake Erie, Central Basin; Station: CROOKED C; Depth: 43; 10 min. trawl
4	1	11/2/1987	PFBC	Lake Erie, Central Basin; Station: WC; Depth: 66; 10 min. trawl
5	1	11/2/1987	PFBC	Lake Erie, Central Basin; Station: WC; Depth: 60; 10 min. trawl
6	5	11/2/1987	PFBC	Lake Erie, Central Basin; Station: WC; Depth: 45; 10 min. trawl
7	4	11/16/1987	PFBC	Lake Erie, East Basin; Station: FREEPORT; Depth: 55; 10 min. trawl
8	1	10/22/1990	PFBC	Lake Erie, Central Basin; Station: WC; Depth: 50; 10 min. trawl
9	1	6/11/1992	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 66; 30 min. trawl
10	8	10/14/1993	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 52; 10 min. trawl
11	18	10/14/1993	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 49; 10 min. trawl
12	1	10/15/1993	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 90; 10 min. trawl
13	1	10/19/1995	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 60; 10 min. trawl
14	4	9/28/1999	PFBC	Lake Erie, Central Basin; Station: WALNUT; Depth: 52; 15 min. trawl
15	2	10/28/1999	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 60; 15 min. trawl
16	1	8/8/2001	PFBC	Lake Erie Drainage: Presque Isle Bay
17	11	10/28/2005	PFBC	Lake Erie, East Basin; Station: NNE; Depth: 96; 10 min. trawl

Figure 4.6-1 Trawl sample sites where eastern sand darter were captured in Pennsylvania. Data source: PFBC unpublished



The PFBC eastern sand darter data was overlain on a surficial geology base map (Figure 4.6-1). As suggested in the literature, most eastern sand darter reflected in the PFBC data were associated with sandy substrate (76% found over sand/silt/minor clay), while 21% were found over silt/clay and 2 eastern sand darter (3%) were found over sand/gravel. The surficial geology results of the 2015 geophysical survey (CSR 2015) were similar to what is shown in Figure 3.1-1, with the primary difference being silt/clay, as opposed to sand/silt, was found from KP 61 to 77 and KP 80 to 86 (geophysical panel maps are found in Appendix K).

The majority of years sampled resulted in zero or one eastern sand darter captured. However, during three years, eastern sand darter captures were larger with 12 captured in 1987, 27 in 1993, and 11 captured in 2005. Although the eastern sand darter had not been reported in recent years from the Pennsylvania portion of Lake Erie (Criswell 2013, PFBC unpublished), they were collected in 2015 sampling, though results are not yet available (personal communication, Charles Murray, PFBC, November 10, 2015). For the years sampling effort data are available from 1985 to 2014 (a 29-year period, Table 4.6-1), a total of 366 trawl samples (10 minute tows) resulted in the capture of 60 eastern sand darters or an average of one sand darter in six trawl samples. Distribution was not uniform with only 17 of the 366 trawls capturing eastern sand darters (one in 22 samples) and the remaining 349 of those trawl samples captured none (PFBC unpublished). Using an estimated trawl wingspread of 5.44 meters average annual density estimates varied from 0.0 to 6.69 eastern sand darters per hectare, with a long-term average density of 0.43 eastern sand darters per hectare from 1985 through 2013. Average density estimates of one or more eastern sand darter per hectare occurred in only three years: 1987 (0.98/hectare), 1993 (6.69/hectare), and 2005 (2.54/hectare)(Table 4.6-1).

Based on this available data, it would appear that eastern sand darter distribution in Lake Erie is both spatially patchy and persists with a predominantly low recruitment rate with an occasional stronger year class at approximately 10 year intervals on average.

Other Species

Because the Lake Segment of the Project is entirely underwater, the only terrestrial species expected to occur within this part of the Project area are bird and bat species. The Indiana bat is also state-listed and the bald eagle is protected under the Pennsylvania Game and Wildlife Code (but considered a recovered species) and these species could occur in the Lake Segment. The state status of the northern long-eared bat is candidate rare (CR) (PNHP 2014*c*). These species are described in more detail in the following section.

4.6.2 Underground Segment and Converter Station

The PADCNR indicated that plants, terrestrial invertebrates, natural communities, or geologic features under PADCNR's responsibility are located in the Project vicinity (associated Pennsylvania Natural Diversity Inventory (PNDI) Number: 22406). Additional review by the PADCNR was requested on January 23, 2015, to include areas where the proposed Project route was modified since initial surveys were conducted. Methods to avoid and minimize impacts to significant resources will be implemented to the extent practicable.

In a letter dated March 23, 2015, the PGC screened the Project for potential impacts to species and resources of concern under PGC responsibility, which includes birds and mammals only.

The PGC records indicate that no known occurrences of species or resources of concern under PGC jurisdiction occur in the vicinity of the Project. Responses from the USFWS and PFBC are discussed in the Section 5.6, Environmental Consequences, Protected and Sensitive Species.

4.6.2.1 Federally Listed Species

Federally listed or protected terrestrial species or those proposed for federal listing that could be encountered in the terrestrial portions of the Underground Segment include the Indiana bat, northern long-eared bat, and breeding bald eagles (USFWS 2014*b*). Bank swallows (*Riparia riparia*) have also been identified as a species of concern by the USFWS in consultation for the Project. The USFWS has not designated or proposed designation of critical habitat for any threatened or endangered species occurring along the Underground Segment. Potential effects to these species are discussed in Section 5.6.1.

Indiana bat

The Indiana bat is currently listed as endangered under the ESA, as amended (USFWS 2007*a*). In Pennsylvania, the Indiana bat is listed as endangered and is protected under the state Game and Wildlife Code and is also considered a "priority species" within Pennsylvania's Wildlife Action Plan (PGC 2013). Historically, in Pennsylvania, the Indiana bat was known to occur at only eight hibernation sites, all of which were natural caves. Indiana bats are now known to hibernate in 18 sites within 11 counties in Pennsylvania. Based on surveys conducted by PGC biologists, the USFWS estimates that about 1,000 Indiana bats hibernate in Pennsylvania. Nine Indiana bat summer maternity sites have been found in seven Pennsylvania counties and there have been mist-net captures in summer habitat in four counties (PGC 2010). According to the PGC (2010), no known hibernacula and/or summer live-captures have been recorded in Erie County.

Indiana bats can travel hundreds of miles after dispersing from hibernacula in the spring. Groups of female bats form maternity colonies in the crevices of trees or under the loose bark of dead trees (DOE 2013). During the fall breeding season, female bats can number from 50 to 100 individuals in a single tree. Maternity colonies typically roost during the day, but little is known about the foraging or roosting behavior of Indiana bats at night (Murray and Kurta 2004 *as cited in* DOE 2013).

Bat roosts and maternity colonies could be associated with a variety of forested community types adjacent to the Project route. Bats forage on flying insects along river and lake shorelines, in the crowns of trees in floodplains, and in upland forests. Indiana bats prefer to forage and travel along the forest-air interface of the forest canopy or along forest edges/hedgerows (USFWS 2007*a*).

In the immediate vicinity of the Project road ROWs, much of the habitat consists of disturbed open lands and secondary forest lacking suitable habitat for bat roosts; however, several forested riparian areas located within or adjacent to the Underground Segment, contain tree species with the potential to serve as maternity or roost trees.

Northern long-eared bat

The northern long-eared bat was listed as threatened under the ESA on April 1, 2015, with the listing becoming effective on May 4, 2015. Critical habitat has not been identified for the species. There are limited data on population trends for the northern long-eared bat; however, all reported occurrences of the species are marked by small populations that are in decline (Schmidt 2001). According to the PNHP (2014*c*), the northern long-eared bat occurs throughout Pennsylvania, but has been found in relatively low numbers.

The northern long-eared bat is found across much of eastern and north-central U.S., and all Canadian provinces from the Atlantic Ocean west to the southern Yukon Territory and British Columbia (USFWS 2013). According to the PNHP (2014*c*), no historic or current records are known for the northern long-eared bat in Erie County.

The northern long-eared bat spends winters hibernating in caves and mines, preferring hibernacula with very high humidity. During the summer months, the northern long-eared bat prefers to roost singly or in colonies underneath bark, in cavities, or in the crevices of live or dead trees (USFWS 2013); these types of habitat features are found in the proposed Project area. Based upon this species' habitat preferences during winter and summer, it can be assumed that these bats could occur in similar or the same areas indicated for the Indiana bat along the proposed Project route. As noted above, in the immediate vicinity of the Project road ROWs, much of the habitat consists of disturbed open lands and secondary forest. Several forested riparian areas located within or adjacent to the Underground Segment contain tree species with the potential to serve as maternity or roost trees.

Breeding begins in late summer or early fall when males swarm near hibernacula. After a delayed fertilization, pregnant females migrate to summer colonies where they roost and give birth to a single pup. Young bats start flying 18 – 21 days after birth, and adult northern long-eared bats can live up to 19 years (USFWS 2013).

Northern long-eared bats emerge at dusk and fly through the understory of forested hillsides feeding on moths, flies, leafhoppers, caddisflies, and beetles. They also feed by gleaning motionless insects from vegetation and water (USFWS 2013).

The most severe and immediate threat to the northern long-eared bat is white-nose syndrome. As a result of this disease, numbers have declined by 99 percent in the northeast. Other significant sources of mortality include impacts to hibernacula from human disturbance. Loss or degradation of summer habitat as a result of highway or commercial development, timber management, surface mining, and wind facility construction and operation also contribute to mortality (USFWS 2013).

Bald eagle

The bald eagle was delisted by the USFWS in 2007; however, there is a post-delisting monitoring plan in place for the species, as required by the ESA (Section 4(g)(1)). In addition, the bald eagle is protected under the BGEPA and MBTA; therefore, it is included here as a federally protected species.

Bald eagles thrive around bodies of water where adequate food exists and human disturbance is limited (Wakeley and Wakeley 1983). Nesting eagles are particularly sensitive to human intrusions or disturbances, and such activities can compel eagles to abandon a nest. Bald eagles are wholly North American, and currently are found in every state except Hawaii, as well as throughout Canada. Eagles prefer undisturbed areas near large lakes and reservoirs, marshes and swamps, or stretches along rivers where they can find open water and their primary food, fish. The breeding habitats of bald eagles can perhaps be summarized simply; they require an adequate supply of moderate-sized to large fish, nearby nesting sites, and a reasonable degree of freedom from disturbance during the nesting period (Johnsgard 1990; PGC 2013*d*).

According to the PGC (2013*d*), Pennsylvania's nesting bald eagle population has increased steadily and dramatically in recent years, roughly 15 percent annually. In 1990, there were 8 active nests; 48 in 2000 and by 2006 the number cleared 100 for the first time since DDT decimated Pennsylvania's nesting bald eagle population in the 1950s and 60s. In 2008 the state's nesting eagles numbered more than 150 pairs. Bald eagles are known to breed in all but six of Pennsylvania's 67 counties: Green, Lehigh, Potter, Union, Venango and Washington (PGC 2010). Based on the USFWS list of known or likely county occurrences of federally listed species, there is a potential that bald eagles could occur in Erie County (USFWS 2014*c*).

According to consultation with the USFWS, bald eagles, especially juveniles, do use the Lake Erie Bluffs extensively. Approximately four miles west of the Project is State Game Lands 314, commonly referred to as the Roderick Wildlife Reserve. Up to 50 bald eagles at a time have been recorded in winter. However, they are mobile and presumably their loose gatherings are flexible in where they gather, as long as there are some undeveloped areas remaining. They are often noted around the mouths of creeks, presumably because of higher prey available in these areas (Zimmerman 2014).

Bank swallow

Bank swallows are protected by the USFWS under the MBTA. Bank swallows inhabit the 90-foot bluffs located in the vicinity of the landfall location and in the bluffs within Erie Bluffs State Park east of the landfall location. The muddy and sandy banks provide the swallows with suitable nesting habitat where they dig holes in the vertical substrate. Swallows typically form nesting colonies loosely clustered together and are generally present in Pennsylvania anytime between late April and early August (USFWS 2014).

4.6.2.2 State Listed Species

In addition to its federal listing, the Indiana bat is also state-listed as endangered. The state status of the northern long-eared bat is candidate rare (CR) (PNHP 2014), and the bald eagle is listed as a threatened species and is protected under the Game and Wildlife Code. Existing information on state-listed plant species along the Project route was provided to the Applicant by PADCNR, along with a list of protected plant species that might potentially be encountered. Plant surveys along the proposed Underground Segment by a qualified botanist will be performed in spring and summer 2015 to identify any occurrence of state-listed species. In a letter dated February 19, 2015, the PADCNR requested surveys be conducted for the following sensitive species: northern water-plantain (*Alisma triviale*), small begger-ticks (*Bidens discoidea*), large toothwort (*Cardamine maxima*), soft-leaved sedge (*Carex disperma*), log fern (*Dryopteris celsa*), variegated horsetail (*Equisetum variegatum*), pumpkin ash (*Fraxinus profunda*), umbellate hawkweed (*Hieracium umbellatum*), larger Canadian St. John's-wort (*Hypericum majus*), Virginia blue flag (*Iris virginica*), Richardson's rush (*Juncus alpinoarticulatus ssp. nodulosus*), small-headed rush (*Juncus brachycephalus*), lupine (*Lupinus perennis*), common hop-tree (*Ptelea trifoliata*), Shumard's oak (*Quercus shumardii*), pineland pimpernel (*Samolus parviflous*), and great-spurred violet (*Viola selkirkii*). The results of these surveys will be provided as a supplement to this EA.

In a letter dated March 23, 2015, the PGC stated that no impact is anticipated to the species or resources of concern under their review. Consultation with the PFBC is ongoing and is described in Section 4.6.1.2, which addresses State Listed Species for the Lake Segment.

4.6.2.3 Migratory Birds

Regarding migratory birds, most of Pennsylvania is overlapped by migration flyways for waterfowl, shorebirds, and birds of prey. Warblers and other songbirds generally pass through the state in high numbers as well. Although the terrestrial habitats along Lake Erie provide breeding and wintering habitat for only a limited number of bird species, these areas might represent suitable stopover habitats for numerous other bird species migrating through the region.

Migrating birds of prey that are expected to pass over the Project include osprey (*Pandion haliaetus*), bald eagle, northern harrier (*Circus cyaneus*), sharp-shinned hawk (*Accipiter striatus*), Cooper's hawk (*Accipiter cooperii*), red-shouldered hawk (*Buteo lineatus*), broadwinged hawk (*Buteo platypterus*), red-tailed hawk (*Buteo jamaicensis*), American kestrel (*Falco sparverius*), and peregrine falcon (*Falco peregrinus*). On rare occasions, northern goshawk (*Accipiter gentilis*) and golden eagle could also pass through the Project area (PGC 2013*e*).

Typical bird species found along open or shrubby forest edges adjacent to old fields, agricultural lands, or ROWs along the Underground Segment impact area include blue-winged warbler (*Vermivora pinus*), brown thrasher (*Toxostoma rufum*), Eastern towhee (*Pipilo erythrophthalmus*), rose-breasted grosbeak (*Pheucticus ludovicianus*), black-billed cuckoo (*Coccyzus erythropthalmus*), and gray catbird (*Dumetella carolinensis*) (PGC 2001), which are all covered under the MBTA. The Project area offers little habitat for species that are intolerant of disturbance and active land management.

4.7 Cultural Resources

4.7.1 Lake Segment

4.7.1.1 Regulatory Compliance and Resource Setting

The National Historic Preservation Act of 1966 (NHPA)[8] requires consideration of cultural resources in the federal agency planning process. Section 106 of the NHPA (Section 106)[9] directs federal agencies to take into account the effects of their undertakings on historic properties and to afford the Advisory Council on Historic Preservation ("ACHP" or "Council") a

[8] 54 U.S.C. § 300101 *et seq.*
[9] 54 U.S.C. § 306108

reasonable opportunity to comment in regards to such undertakings.

The regulations implementing NHPA § 106 (36 CFR Part 800) define "historic properties" as any precontact or historic period district, site, building, structure, or individual object included in or eligible for inclusion in the National Register of Historic Places (National Register). This term includes artifacts, records, and remains that are related to and located within historic properties, as well as properties of traditional religious and cultural importance that meet the National Register criteria established by the Secretary of the Interior for evaluating properties for inclusion in the National Register (36 CFR Part 60). In accordance with the criteria, properties are eligible if they are significant in U.S. history, architecture, archaeology, engineering, or culture. The quality of significance is present in historic properties that possess integrity of location, design, setting, materials, workmanship, feeling, or association and:

A. That are associated with events that have made a significant contribution to the broad patterns of our history; or
B. That are associated with the lives of persons significant in our past; or
C. That embody the distinctive characteristics of a type, period, or method of construction, or that represent the work of a master, or that possess high artistic values, or that represent a significant or distinguishable entity whose components may lack individual distinction; or
D. That have yielded or may be likely to yield information important in prehistory or history.

The implementing regulations defined in 36 CFR Part 800 are intended to accommodate historic preservation concerns with the needs of federal undertakings through a process of consultation among agency officials, federally recognized Indian tribes, State Historic Preservation Officers (SHPO), Tribal Historic Preservation Officers, and other parties, including the public, as appropriate. The regulations at 36 CFR Part 800 describe the requirements for:

- Identifying historic properties that may be affected (directly and/or indirectly) by an undertaking;
- Assessing the effects of an undertaking on historic properties; and
- Seeking ways to avoid, minimize, or mitigate adverse effects on historic properties through consultation.

4.7.1.2 Cultural Context

There is a long and detailed body of research regarding the precontact and historic use of Lake Erie and its environs, including archaeological investigations and historical studies. Key events of the precontact and historic periods have been summarized to provide an overview of cultural and historic resources potentially located in the vicinity of the proposed Project.

The precontact cultural history of northeastern North America is conventionally divided into three broad, sequent, and overlapping cultural/chronological episodes known as the Paleoindian, Archaic, and Woodland periods (LERC 2008; Quinn 1999). The following summary briefly discusses these periods in northwestern Pennsylvania and the Commonwealth's Lake Erie Watershed.

Precontact Period

Lake Erie and the drainage system across northwestern Pennsylvania are in large part the result of continental glaciation which ended approximately 14,000 – 12,000 years before present (B.P.) (Buyce and Vento 1999). Evidence south of Erie county suggests that ice lobes associated with the first three classic Pleistocene glacial advances/stages (i.e., Nebrasksan, Kansan, Illinoian) covered Erie County, but the subsequent Wisconsinan glacial stage effectively removed, redeposited, or buried the record of these earlier glacial advances. The Last Glacial Maximum (LGM) of the Wisconsinan stage occurred approximately 24,000 B.P. (DeSimone 2014), and the retreat of the ice sheet from the LGM resulted in the deposition of a series of parallel glacial moraines in the Erie Basin. As the ice retreated, a series of pro-glacial ice- or moraine-dammed lakes occupied the basin. The retreating ice created new lower outlets which caused lake levels to fall rapidly and repeatedly (Buyce and Vento 1999). At least 14 separate ancient lakes in the Erie Basin have been identified. The changes in lake levels resulted in the development of a series of strand lines around the margin of the lake, with older beach ridges occupying a higher topographic elevation (Buyce and Vento 1999). These exposed strand lines form the characteristic bluffs that are prominent topographic feature of the Great Lakes.

By about 14,000 B.P., lake levels were established approximately 130 ft below their present level (Stothers and Abel 2001). After the glaciers melted, isostatic adjustment raised the Niagara River outlet and caused lake levels to increase (Buyce and Vento 1999). Gradual infilling of Lake Erie occurred at different rates across the basin, but research indicates that water levels in certain areas (such as Sandusky Bay) apparently continued rise into the nineteenth century (Stothers and Abel 2001). Thus, many precontact period sites that are typically found in “terrestrial” environments (such as on the margins of Lake Erie and its tributary streams) may have been inundated during centuries of rising lake levels (Stothers and Abel 2001).

Northwestern Pennsylvania was probably suitable for initial human colonization at the end of the Pleistocene, approximately 13,500 – 11,500 B.P. Most Paleoindian sites in the Northeast and the Commonwealth of Pennsylvania typically consist of a sparse lithic assemblage that includes fluted projectile points, end scrapers, gravers, and blades (Quinn 1999). High-quality non-local materials have been recorded at Paleoindian sites in Ohio and northwestern Pennsylvania, suggesting that Paleoindian groups may have returned regularly to known sources of lithic raw material (e.g., chert outcroppings). Paleoindian subsistence patterns in the Northeast relied heavily on caribou and migratory game (Quinn 1999; LERC 2008). Landscape analyses of Paleoindian sites suggest that they appear to cluster on glacial features, such as valley outwash trains situated on post glacial lakes, swamps, streams, and rivers. Many of these features would have been present on the margin of Lake Erie, and some have likely been inundated by lake level rise. Stray fluted points have been reported along the Erie Coastal Plain, and a Paleoindian component has been reported to exist (although not verified) at the Penelec site located approximately 0.2 mi from the proposed centerline of the transmission cable.

The Archaic period (10,450 – 2,950 B.P.) in northwestern Pennsylvania represents a period of gradual transition. The final retreat of the glaciers at the end of the Pleistocene resulted in warmer and drier conditions across northwestern Pennsylvania that supported a more temperate mixed deciduous-coniferous forest and essentially modern fauna (Quinn 1999). As Quinn (1999) notes:

Early Archaic cultural patterns are generally viewed as elaborations of earlier Paleoindian ones, without significant discontinuities in subsistence practices, settlement patterns, or lithic technology. Exceptions to the considerable continuity between Paleoindian and Early Archaic stone tool technology include the introduction of projectile point types presumably more suited to the ambush of white-tailed deer and an increasing reliance on locally available lithic resources.

The Middle Archaic is poorly understood in northwestern Pennsylvania and apparently underrepresented in the archaeological record (Quinn 1999; LERC 2008). Late Archaic sites from the region reflect an increasing cultural diversity and cultural elaboration. Sites from this period include seasonal base camps, and special purpose loci used for hunting, fishing, gathering, food processing, and raw materials (Quinn 1999; LERC 2008). Overall, the Archaic period is viewed as a period of population growth and expansion, and diagnostic materials spanning the entire Archaic period are reported at sites across Pennsylvania's Lake Erie Watershed (Quinn 1999; LERC 2008).

The Woodland period (2,950 B.P. – 400 B.P.) in northwestern Pennsylvania is characterized by the emergence of ceramic vessels, incipient horticulture, semi-permanent settlements, and the development of complex mortuary ceremonialism, trade networks, and political systems (Quinn 1999). At least three Early Woodland cultural complexes are represented in northwestern Pennsylvania, each with diagnostic projectile point types and ceramic vessels. These complexes suggest cultural ties to other regions, including the Ohio River Valley, western and central New York, the Genesee River Valley, and southern Ontario (LERC 2008).

Middle Woodland groups in northwestern Pennsylvania apparently participants in the Hopewell Interaction Sphere, part of a broad Hopewell tradition centered in the Midwestern and southeastern U.S. (Quinn 1999; LERC 2008). Quinn notes that "Hopewell-related sites are typified by ceremonial centers, mortuary mounds, and ceremonial artifacts often fashioned from exotic raw materials." The most significant Hopewell-influenced sites documented in the region are located south of the Lake Erie Watershed in the Allegheny River Valley (Quinn 1999; LERC 2008).

By the Late Woodland a territorially distinct culture had emerged on the southern margin of Lake Erie. The eponymous Lake Erie Plain (or Erie) culture extended from the Niagara Frontier region of New York, west through Pennsylvania to near Conneaut, Ohio. The Erie were semi-sedentary horticulturalists who also relied heavily on fishing. Large Erie or proto-Erie sites have been identified in Erie County, Pennsylvania and Chautauqua County, New York (Quinn 1999). Among these sites are semi-permanent and fortified villages and a large ossuary. The Erie appear to have favored long-term habitation sites located along Pleistocene strand lines and bluffs overlooking Lake Erie. Numerous smaller sites with Erie or proto-Erie affiliations that may represent fishing stations have also been identified on the Lake Erie Plain (Quinn 1999). These sites could have been utilized during seasonal spawning runs and have been found at or near the outlets of Walnut Creek, Elk Creek, and Twelve Mile Run in Erie County. Other Erie sites have been reported on the bluffs overlooking Presque Isle Bay in Erie County and at the mouth of Chautauqua Creek in Chautauqua County, New York (Quinn 1999).

Early historical accounts by Jesuit missionaries to the region report that the Erie suffered catastrophic defeat at the hands of the Iroquois in the mid-seventeenth century. The Erie may have impeded the Iroquois from hunting beaver in the Ohio River Valley, effectively limiting their ability to trade with the French (Quinn 1999). In 1654, a large force of Onondaga and

Mohawk warriors destroyed several Erie villages, and took numerous captives. What was left of the Erie sought refuge with the Susquehannock or was absorbed by the Seneca (Quinn 1999). The Seneca subsequently expanded their territory west from their heartland in the Genesee River Valley, and by the end of the seventeenth century, controlled most of the area south of Lake Erie (Quinn 1999; LERC 2008).

Historic Period

European nations were quick to recognize the significance of the Great Lakes and the Ohio River Valley to the North American fur trade (Thomas 1999). Western Pennsylvania proved to be strategically important, as it afforded access to both Lake Erie and the headwaters of the Ohio River (Thomas 1999). Seeking to consolidate control over the upper Ohio River Valley, the French dispatched Captain Pierre Joseph Céleron de Blainville to assert French territorial claims in the region in 1749. Thomas (1999) writes that "the Céleron expedition travelled via Lake Ontario, the Niagara portage, Lake Erie, Lake Chautauqua, and Conewango Creek to its confluence with the Allegheny River at present-day Warren, Pennsylvania, and thence to the Ohio." Céleron was by no means the first European to travel by boat across the Niagara-Erie Frontier, and he encountered English fur-trading stations during his expedition to the Ohio (Thomas 1999). English fur-trading stations were reported on Lake Erie, and south at Venango, the Allegheny River at Buckaloons (near Warren, Pennsylvania), and at the site of "the Point" in the present-day City of Pittsburgh.

In an attempt to consolidate control over the Ohio River Valley and the Great Lakes, the French built a series of fortifications at strategic points in western Pennsylvania, including Fort Presque Isle on Lake Erie, Fort Le Boeuf on French Creek, Fort Machault at Venango, and Fort Duquesne at the confluence of the Allegheny and Monongahela rivers in Pittsburgh (Thomas 1999). At the outset of the French and Indian War in 1754, the French controlled the headwaters of the Ohio River and northwestern Pennsylvania. In 1758 English forces attacked and burned Fort Duquesne, effectively breaking the French stranglehold on the region. More English successes followed, and the French razed their remaining line of forts in 1759 during their retreat to Detroit (Thomas 1999). Many of the forts were rebuilt by the English, but suffered continued attacks from the French and their Indian allies. As summarized by Thomas (1999):

Although the French were removed, hostilities continued in western Pennsylvania with raiding parties of Iroquois and their allies harassing the English frontier forts. In 1763, the hostilities culminated in a general attack known as Pontiac's Uprising. Forts Presque Isle, Le Boeuf, and Venango were burned and Fort Pitt was under attack until Colonel Bouquet raised the siege. Although the English had regained control of the upper Ohio Valley by 1764, the outlying forts were never rebuilt.

More intensive Euro-American settlement of present-day Erie County began following the 1794 Battle at Fallen Timbers which led to a cessation of hostilities with Native Americans (Thomas 1999). However, at the start of the War of 1812, Erie was still a remote and densely wooded settlement with a population of around 500 inhabitants (Erie Maritime Museum [EMM] undated; Ware 2013). The U.S. Navy understood the importance of controlling Lake Erie to secure the Northwest Territory and open vital supply lines during the War of 1812. Shipwrights, blacksmiths, and other laborers and craftsmen were recruited from across the Commonwealth to support construction of a fleet of ships in Erie. In March 1813, U.S. Navy Commodore Oliver Hazard Perry took command of the fleet that eventually included four schooners and two brigantines, the *Lawrence* and *Niagara* (EMM undated). On September 10, 1813, the British and American fleets met at the Battle of Put-In-Bay near present-day Sandusky, Ohio. Commodore Perry defeated the British at Put-In-Bay in a pitched and harrowing battle that earned him the moniker "the Hero of Lake Erie." The defeat of the British fleet secured the Ohio River Valley for the Americans and significantly weakened British naval strength for the remainder of the conflict (EMM undated).

By the early nineteenth century, the Great Lakes had become the most important single transportation system in the U.S. (Hyde 1979). The opening of New York's Erie Canal in 1825 connected the American Midwest to the Atlantic Coast, creating an enormous growth in shipments of lumber, grain, coal, and manufactured goods (Hyde 1979). With the increase in shipping came an increase in shipwrecks. The relatively shallow depth of Lake Erie means that winds create massive and rough waves that can quickly sink even large vessels. Of an estimated 8,000 shipwrecks in the Great Lakes, approximately 2,000 are thought to be located in Lake Erie (Nass 2010). These shipwrecks include merchant, military and recreational vessels (Nass 2010).

At the end of the nineteenth century, Erie had become a significant manufacturing center in its own right. As a port city and developing railroad hub, Erie was ideally situated for industrial growth. Heavy industries producing metal casings, steam engines, paper products, industrial tools and machinery developed in Erie, attracting significant numbers of Eastern European, German, Italian, and Irish immigrants seeking jobs in factories (French and Weber 1984). Commercial fishing also continued to be a significant industry in Erie as well, enduring until the 1960s when industrial pollution of Lake Erie limited the fishery. Industry across the northeastern U.S. declined in the 1960s, and Erie suffered the economic impacts of reduced demand for domestically produced iron, steel, and heavy machinery. Erie emerged from the economic downturn as a regional tourist destination, attracting visitors to Presque Isle State Park during the summer months. Today, other important economic drivers and employers include the General Electric Company transportation plant, Erie Insurance Group, a significant plastics industry, several colleges and universities, and two major hospital systems (Erie Regional Chamber and Growth Partnership undated).

4.7.1.3 Summary of Phase IA Study

Study Methods

In 2014 and 2015, the Applicant conducted cultural resources studies to identify known and reported archaeological and historic resources within the vicinity of the proposed transmission cable route. The Applicant retained Hartgen Archeological Associates, Inc. (Hartgen) of Rensselaer, New York, to conduct a Phase IA Literature Review and Archaeological Sensitivity Assessment (Phase IA Study) of the Project's proposed alignment, including both the underground and Lake Segments of the route. The Phase IA Study included a walkover and visual inspection of the terrestrial section of the proposed transmission cable route and a review of the Pennsylvania Historical and Museum Commission's (PHMC) Pennsylvania Archaeological Site Survey (PASS) files and Cultural Resources GIS (CRGIS) database. The Phase IA Study also included a review of existing environmental, land use, soils, and geology data, as well as a review of historic maps, regional and local histories, previous cultural resources studies, and documentary information regarding reported shipwrecks. To better define landforms with the potential for subsurface archaeological deposits, David J. De Simone, PhD of De Simone Geoscience Investigations conducted a geomorphological assessment of the Project's proposed route and the location of the proposed Erie Converter Station. The geomorphological assessment was included as a component of the Phase IA Study to better characterize the archaeological sensitivity of the transmission cable alignment and Erie Converter Station. The Phase IA Study was conducted in accordance with the PHMC Bureau for Historic Preservation's (BHP) November 2008 *Guidelines for Archaeological Investigations in Pennsylvania* (PHMC-BHP Guidelines)

An area of potential effects (APE) as defined at 36 CFR § 800.16(d) has not yet been determined for the Project. However, consistent with the PHMC-BHP Guidelines, the Phase IA Study encompassed an area approximately 1 mile (1.6 kilometers) on either side of the centerline of the proposed transmission cable route, as well as the proposed location of the Erie Converter Station.

Summary of Study Results

The PHMC-BHP does not maintain a formal database of shipwrecks in the Commonwealth, and information on shipwrecks in Lake Erie is not available from the CRGIS (K. Heinrich, PHMC-BHP, personal communication, October 2013). Based on discussions with the PHMC-BHP, the most comprehensive information regarding shipwrecks in the Pennsylvania portion of Lake Erie is generally available from books and databases for recreational divers. Data were collected from several sources to identify reported shipwrecks within Lake Erie, including:

- Benjamin Ford, PhD, a maritime archaeologist and Great Lakes specialist at the Indiana University of Pennsylvania;
- Information from the PADEP's Interstate Waters Office; and
- Publicly available resources such as *Erie Wrecks East* (Wachter and Wachter 2007).

Two reported shipwrecks were identified within a one-mile radius of the Project's proposed route. The wreck of the *Charles Foster* is located approximately 2,000 ft from the centerline of the proposed transmission cable route and five miles northwest of Presque Isle State Park. The *Charles Foster* was a 229-ft-long wooden schooner barge built in 1877. It was carrying iron ore and being towed by the steamer *Iron Duke* when it went down on December 8, 1900 during a storm. The *Charles Foster* may have been struck by a rogue wave and the entire crew was lost. It presently lies on a silt bottom, and the iron ore cargo has caused the vessel sides to splay outward (Wachter and Wachter 2007).

Another known wreck is located approximately 1,950 ft from the centerline of the proposed transmission cable route near the U.S./Canadian border. In 1963, a fishing trawler reported the wreck of a sailing vessel lying on a silt bottom at a depth of approximately 105 ft or 17.5 fathoms. Wachter and Wachter (2007) refer to the site as the "17 Fathoms Wreck" due to its approximate depth below the surface of Lake Erie. Little is known about the 17 Fathoms Wreck. Wachter and Wachter (2007) report that there is evidence that a fire occurred onboard the vessel; however, the name, origin, or other details of the vessel remain unknown.

In addition to these known shipwrecks, a number of unverified wrecks may also be located in the vicinity of the proposed transmission cable route.

There are no known or reported precontact period archaeological sites located offshore along the marine portion of the route. Nearshore surficial geology ranges from bedrock at the location of the Pennsylvania landfall to sand, silt, and clay further offshore. The bedrock extends approximately 1.3 miles offshore and is either exposed or overlain by thin deposits of silt/sand/gravel. The presence of nearshore bedrock suggests a low archaeological sensitivity for the Pennsylvania landfall.

The results of the Phase IA Study were summarized in Hartgen's June 2015 report entitled *Phase IA Literature Review and Archaeological Sensitivity Assessment: Lake Erie Connector Project* (Phase IA Report). In the Phase IA Report, Hartgen recommended that the Applicant conduct a remote sensing survey along the proposed marine cable route to identify potential shipwrecks and/or other cultural features.

The Phase IA Report was submitted to the PHMC-BHP, the Seneca Nation of Indians (SNI) and the Tonawanda Band of Seneca Indians (TBSI) for review in June 2015. By letter dated July 27, 2015, the PHMC-BHP noted that the Phase IA Report met the PHMC-BHP Guidelines and concurred with Hartgen's recommendations for additional testing. Neither the SNI nor the TBSI provided a response to the Phase IA Report.

4.7.1.4 Summary of Marine Route Survey Archaeological Analysis

Study Methods

In 2015, CSR conducted a geophysical survey of the proposed marine route using sidescan sonar and a magnetometer to identify bottom conditions, shipwrecks, existing utilities, and other features. CSR's marine route survey encompassed 250-meters on either side of the proposed centerline of the marine cable route and included the 35.4-mi-long section of the route extending from the U.S./Canada border to landfall in Erie County. The results of the marine route survey were reviewed by Hartgen's maritime archaeologist to identify potential shipwrecks or other cultural features from the U.S./Canada border to landfall in Erie County.

Summary of Study Results

The results of the Marine Route Survey Archaeological Analysis were presented in Hartgen's *Marine Route Survey Archaeological Analysis Study Report: Lake Erie Connector Project* (Marine Archaeological Report) submitted to the PHMC in January 2016. In preparing the report, Hartgen reviewed sidescan sonar data to identify potential shipwrecks or other cultural resources on the lakebed. A total of 42 anomalies were initially identified within CSR's 500-meter-wide survey corridor through a review of sidescan sonar data. Hartgen identified 40 meters (131 feet) on either side of the centerline of the underwater cable route as a suitable buffer to avoid adverse effects on shipwrecks or other cultural resources. This buffer distance is based on similar HVDC cable installations in the northeast, and is considered appropriate to avoid impacts to any buried portion of a shipwreck that may be on the lakebed and could be identified through remote sensing (personal communication, Wm. Brian Yates, New York State Office of Parks, Recreation, and Historic Preservation, May 15, 2012). Of the 42 anomalies identified within CSR's marine route survey corridor, six were determined to be (a) located within 40 meters of centerline of the proposed underwater cable route, and (b) exhibiting physical features that may indicate the presence of an historic shipwreck. A review of marine magnetometer data in conjunction with sidescan sonar images indicated that none of the six anomalies represented shipwrecks or other archaeological resources. Therefore, construction activities associated with the marine cable route are not expected to have any effect on historic or archaeological resources.

4.7.2 Underground Segment and Converter Station

4.7.2.1 Regulatory Compliance and Resource Setting

Regulatory compliance and resource setting are discussed in Section 4.7.1 of this EA.

4.7.2.2 Overview of Cultural Context

The culture-historical context is presented in Section 4.7.1 of this EA.

4.7.2.3 Summary of Phase IA Study

Study Methods

Phase IA Study methods are discussed in Section 4.7.1 of this EA.

Summary of Study Results

Based on the Phase IA Study, Hartgen identified 22 previously reported archaeological sites within one mile of the centerline of the Project's proposed terrestrial route. These sites are listed in Table 4.7-1. None of the sites presented in Table 4.7-1 have been listed in or determined eligible for listing in the National Register.

Table 4.7-1 Previously reported archaeological sites within one mile of the Project's proposed underground segment.

PHMC Site No.	Other Site No.	Site Name	Period*	Description from PASS Files and CRGIS	Proximity to Project
36ER0057	GI-5	Billings #1 / Sand Flats	P	Village from Transitional/Woodland yielding Susquehanna broadspear, grit-tempered pottery, stemmed and side-notched points	0.5 mile
36ER0106	--	Lucas-A	P	Debitage	Adjacent (opposite side of the road)
36ER0107	--	Lucas-B	P	Chipped stone tools, debitage	Adjacent (opposite side of the road)
36ER0108	--	Lucas-C	P	Meadowood, chipped stone tools, debitage	Adjacent (opposite side of the road)
36ER0113	--	Steele-A	P	Chipped and ground stone tools, debitage	0.8 mile
36ER0114	--	Steele-B	P	Chipped stone tools, debitage	0.8 mile
36ER0118	Fvw-16	Incompet ent (incompl ete?)	P	Camp with Susquehanna broad point, scrapers, knives, cores, flakes. Possibly Early Woodland.	1.0 mile
36ER0120	Fsw-1	Penelec	P	Plano-like, Otter Creek/Big Sandy, and Adena points, thought to be Late Paleoindian, Middle Archaic, and Early Woodland. Known only from collector interview.	0.2 mile

PHMC Site No.	Other Site No.	Site Name	Period*	Description from PASS Files and CRGIS	Proximity to Project
36ER0127	--	John Pauline	P&H	1838 house on a knoll with lithics on ground surface, local tradition has it as an Indian mound	0.05 mile
36ER0160	--	Boy Scout Camp	P	Woodland, Contact Period, Chipped stone tools, pottery trade beds	1.0 mile
36ER0161	--	Elk Creek Terrace	P	Late Archaic and Woodland period, chipped and rough stone tools, pottery	1.0 mile
36ER0162	--	Elk Creek Site	P&H	Multicomponent site on the Elk Creek floodplain, most intensively used in Late Woodland when it may have been a satellite to a village west of the creek.	1.0 mile
36ER0218	--	Elk Creek 2	P	No info.	1.0 mile
36ER0219	--	Elk Creek 3	P	No info.	0.7 mile
36ER0301	--	Eagle's Point Village	P	Village spanning Early Archaic to Late Woodland periods, yielding Lecroy or Lake Erie bifurcate, Kirk corner-notched, Lamoka, Levanna, Madison points. Site form refers to Quinn, Adavasio, Pedler & Pedler 1998 (Mercyhurst Archaeological Institute 1998). Because of the coincidence with the Elk Creek Site (36ER162), this may be in error.	0.1 mile
36ER0313	--	Erie Bluffs #1	P	Non-diagnostic lithics, sand & rock-tempered pottery, Middle to Late Woodland.	0.6 mile
36ER0314	--	Erie Bluffs #2	P	Non-diagnostic lithics, ground stone artifacts.	0.8 mile
36ER0004	--	Wright #4	P	Earthwork	0.9 mile
36ER0089	--	Kemecik	P	No info.	0.9 mile
36ER0130	--	Hetz	P	Rock hearths/fire pits with celts and hammerstones.	0.9 mile
36ER0302	--	Oxbow	P&H	Historic scatter with stone debitage, several diagnostic stone tools.	0.8 mile
36ER0303	--	--	P	Late Archaic point with chert debitage and cracked rock.	1.0 mile

*Period: P=Precontact, H=Historic, P&H=Multi-component precontact and historic.

A review of PHMC-BHP files revealed only one building or structure listed on the National Register or previously determined eligible for the National Register located near the Project. In all, 25 additional properties have been inventoried within one mile of the Project (Table 4.7-2). This includes the U.S. Route 20 concrete bridge (c. 1951) over Crooked Creek, which has been determined "not eligible" for the National Register. A circa 1855 building at the intersection of Springfield Road and Nieger Road was inventoried but not evaluated; however, it has since been demolished and no longer extant. A cluster of sixteen additional properties were inventoried in the nearby hamlet of East Springfield. The PHMC-BHP website also contains a list of properties within a one-mile search radius of the Project whose locations are unknown or unmapped. A review of existing documentation regarding these properties indicates that three are along U.S. Route 20 (Ridge Road), two along East Main street, and one along U.S. Route 5 (West Lake Road). All but the West Lake Road property have been determined "not eligible." The West Lake Road property has been determined eligible but according to the current information is located over 0.5 mile west of the underground cable route.

Table 4.7-2 Previously inventoried buildings and structures within one mile of the Project's proposed underground segment.

Key #	Township	Property Name	Description	Address	Status	Proximity to Centerline of the Underground Cable
015742	Springfield	Dallas Smith House	ca. 1840/ ca.1860	Middle Road	Undetermined	.20 miles west
015874	Girard	William Cudney House	ca. 1837/ ca.1840; Greek Revival	Route 20	Undetermined	.10 miles east
015883	Girard		ca. 1855 building; demolished	Nieger Road	Undetermined	.01 miles
133559	Springfield		Concrete bridge; ca. 1951	West Ridge Road	Not Eligible	Within
133490	Girard		Concrete bridge; ca. 1951	West Ridge Road	Not Eligible	.34 miles east
015873	Girard	Fredrick E. Blair House	c. 1840 building	West Lake Road	Eligible	Precise location unknown
--	Springfield	Sixteen additional properties located within the hamlet of East Springfield, over 0.9 mile to the west				
	Springfield and Girard	Six additional properties, three along Ridge Road, and two along East Main Street, and one along West Lake Road have been inventoried but their precise locations are unclear				

During field activities conducted in 2014, Hartgen identified one additional building, the John Pauline House, which appears potentially eligible for inclusion in the National Register. The John Pauline House is located at least 200 ft from the Project and is surrounded by a broad landscaped lawn. The John Pauline property is further separated from the underground route by trees and vegetation lining the steep banks of Cross Station Road.

As described in Section 4.7.1 of this environmental assessment, the Applicant submitted the Phase IA Report to the PHMC-BHP, SNI, and TSNI in June 2015. The Phase IA Report included detailed recommendations for additional Phase IB Archaeological Field Investigations (Phase IB Investigations) including subsurface testing along sections of the underground route and at the Erie Converter Station location. Specifically, the Phase IA Report recommended Phase IB testing along those portions of the Project's cable route that will not be placed directly in the roadbed or previously disturbed areas, including the Erie Converter Station site and laydown areas. Archeological field testing was not recommended for the HDD and jack & bore areas as they will be installed well beneath cultural bearing soil strata.

By letter dated July 27, 2015, the PHMC-BHP concurred with the recommendations in the Phase IA Report. Neither the SNI nor TBSI provided a response to the Phase IA Report.

4.7.2.4 Summary of Phase IB Study

Study Methods

In 2015, Hartgen conducted Phase IB Investigations at the locations identified in the Phase IA Report and at additional areas of potential ground disturbance identified during furtherance of engineering and design process. In total, Hartgen hand-excavated approximately 1,700, 0.5 meter by 0.5 meter shovel tests along the proposed underground segment of the Project, laydown areas, and at the proposed Erie Converter Station site. Field investigations were conducted in accordance with the PHMC-BHP Guidelines.

Summary of Study Results

The results of the Phase IB Investigation were presented in Hartgen's *Phase IB Archaeological Field Investigation: Lake Erie Connector Project* (Phase IB Report). As described in the Phase IB Report, a total of four archaeological sites were identified along the underground cable route and staging areas. These sites include a multi-component precontact and historic period site, two small precontact period sites, and one historic period site. Table 4.7-3 summarizes the four archaeological sites and management measures proposed by the Applicant.

Table 4.7-3 Archaeological sites identified during Phase IB Investigations

Site	Location	Site Type	Proposed Measures
Lake Erie Connector 1	West Lake Road (Route 5)	Multi-component (precontact and historic)	Avoid by HDD installation
Lake Erie Connector 2	West Lake Road (Route 5)	Precontact	Evaluate engineering options in consultation with PHMC, Indian tribes, and stakeholders to avoid adverse effects on the site
Lake Erie Connector 3	Staging Area	Precontact	Avoid ground disturbance at the location of the site within the staging area
Lake Erie Connector 4	Lexington Road	Historic	Evaluate engineering options in consultation with PHMC, Indian tribes, and stakeholders to avoid adverse effects on the site

4.8 Aesthetic and Visual Resources

4.8.1 Lake Segment

The Underwater Segment of the proposed Project extends 35.4 miles through Lake Erie from the border with Canada in the middle of the lake to the landfall location in Pennsylvania. The Lake Erie viewshed in Pennsylvania includes shoreline bluffs, beaches, and Presque Isle Bay, in addition to the manmade features such as the city of Erie skyline. Nearshore landscapes in Pennsylvania include woodlands, meadows and crop lands, and vineyards.

4.8.2 Underground Segment and Converter Station

The primary scenic views in the vicinity of the proposed Project include Lake Erie located north of the underground route of the proposed Project. Additional resources in the viewshed include areas of wooded forests, agricultural land, and low-density residential development. The Erie Converter Station site is surrounded on the north by agricultural fields, woods, and residential properties; on the west by woods; on the east by Lexington Road and agricultural fields; and on the south by woods and residential properties. The existing Penelec Erie West Substation and associated aboveground transmission line corridors are located approximately 2,082 ft (635 m) southeast of the proposed Erie Converter Station site.

The underground transmission cable route of the proposed Project would primarily follow existing road ROWs, with the exception of two locations: from the Lake Erie landfall to West Lake Road (Route 5); and from Ridge Road to Springfield Road. A portion of the underground route (approximately 2,800 ft) will be buried along the road ROW of West Lake Road (Route 5). Route 5 is part of the 518 mile Great Lakes Seaway Trail scenic driving route that follows the shores of Lake Erie, the Niagara River, Lake Ontario, and the St. Lawrence River in New York and Pennsylvania. One of the first roads in America to be designated as a National Scenic Byway, the Great Lakes Seaway Trail includes unique historical locations and cultural heritage sites in addition to outstanding views and scenic vistas (Seaway Trail Inc. undated).

4.9 Climate, Air Quality, and Noise

4.9.1 Lake Segment

4.9.1.1 Climate

The Northeast Regional Climate Center (NRCC) tracks temperature, precipitation, and snowfall for the Erie area and for Erie International Airport. Table 4.9-1 presents 1981-2010 Normals data from the NRCC for average maximum, minimum, and average temperatures and average total precipitation by month for the Erie Area.

Table 4.9-1 Monthly climate normal (1981-2010) – Erie area.

Month	Total Precipitation Normal	Mean Max Temperature Normal	Mean Min Temperature Normal	Mean Avg Temperature Normal
January	2.95	33.7	20.8	27.2
February	2.39	35.5	21.1	28.3
March	2.95	43.8	27.5	35.7
April	3.33	56.1	38.1	47.1
May	3.44	66.6	48.2	57.4
June	3.76	75.7	58.4	67.1
July	3.54	79.8	63.5	71.7
August	3.47	78.6	62.5	70.5
September	4.61	71.9	55.8	63.8
October	4.05	60.8	45.3	53.0
November	3.93	49.9	36.6	43.3
December	3.74	38.1	26.6	32.4

Source: NRCC 2014

Erie County has a humid continental climate zone, with Lake Erie having a significant influence on climate. Evaporation causes about 10-15 percent greater humidity over the Great Lakes than inland. In the winter, this moisture interacts with the cold air masses moving south from Canada, resulting in a “snow belt” or lake effect snow with colder temperatures and heavier snow fall. This moisture also results in cloudy weather throughout the year and warm summer temperatures are moderated by cooling breezes over the lake. Monthly precipitation averages 2-3 inches with overlake precipitation being approximately 4-5 percent less than precipitation on the land (Bolsenga and Herdendorf 1993).

4.9.1.2 Air Quality

Air quality statistics collected in 2012 in Erie County are summarized in Table 4.9-2 with NAAQS reference values. Based on the data collected in 2012 (shown in Table 4.9-2), Erie County was in attainment for all criteria pollutants with the exception of 8-hour ozone.

Table 4.9-2 Erie County air quality statistics, 2012.

County	CO 8-hr (ppm)	NO_2 AM (ppb)	NO_2 1-hr (ppb)	O_3 8-hr (ppm)	PM_{10} 24-hr (µg/m3)	$PM_{2.5}$ Wtd AM (µg/m3)	$PM_{2.5}$ 24-hr (µg/m3)	SO_2 1-hr (ppb)
Erie County, PA	1	6	31	0.082	32	11.2	25	19
NAAQS	9	53	100	0.075	150	12	35	75

Source: USEPA

CO – Carbon monoxide; highest second maximum non-overlapping 8-hour concentration.

NO_2 (AM) – Nitrogen dioxide; highest arithmetic mean concentration.

NO_2 (1-hr) - Highest 98^{th} percentile 1-hour daily maximum concentration.

O_3 – Ozone; highest fourth daily maximum 8-hour concentration.

PM_{10} – Particulate matter; highest second maximum 24-hour concentration.

$PM_{2.5}$ (Wtd AM) - Highest weighted annual mean concentration.

$PM_{2.5}$ (24-hr) - Highest 98th percentile 24-hour concentration.

SO_2 – Sulfur dioxide; highest 99th percentile 1-hour daily maximum concentration.

Notes: Data from exceptional events are included. The reader is cautioned that this summary is not adequate in itself to numerically rank counties according to their air quality. The monitoring data represent the quality of air in the vicinity of the monitoring site and, for some pollutants, may not necessarily represent urban-wide air quality.

4.9.1.3 Noise

Noise is defined as unwanted sound. Sound is made up of tiny fluctuations in air pressure. Within the range of human hearing, sound can vary in intensity by more than one million units. A logarithmic scale, known as the decibel (dB) scale, is used to quantify sound intensity and to compress the scale to a more manageable range. Sound on Lake Erie within the Project’s Lake Segment is generally generated by natural sources, such as wind and waves, and by man-made sources, such as boat and barge traffic. There are no statewide noise limits that control noise emitting sources on Lake Erie within the Lake Segment route. Springfield Township has a local zoning ordinance containing a noise related provision, as described below in Section 4.9.2.3.

4.9.2 Underground Segment and Converter Station

4.9.2.1 Climate

A description of the climate within the proposed Project area is included in Section 4.9.1.1.

4.9.2.2 Air Quality

A description of air quality in the Project area is included in Section 4.9.1.2.

4.9.2.3 Noise

Pennsylvania does not have a statewide noise limit; although some municipalities in Pennsylvania have noise ordinances. The proposed Project reaches landfall in Springfield Township and proceeds in a southerly direction through Girard Township, and Conneaut Township. Conneaut Township has no relevant noise regulations. Girard Township generally prohibits “Any use of or activity upon property that, by reason of flames, smoke, odors, fumes, noise or dust, unreasonably interferes with the reasonable use, comfort and enjoyment of a neighbor's property or endangers the health or safety of the occupants of a neighboring property or endangers the health and safety of Township residents and/or the users of Township public streets, property or facilities” (Girard §133-4(F)). Pursuant to the Springfield Township Zoning Ordinance (§506.7), “Noise which is determined to be objectionable because of volume or frequency shall be muffled or otherwise controlled, except fire sirens and related apparatus used solely for public purposes, which shall be exempt from this requirement. Objectionable noise levels shall be construed as being those in excess of 60 dB at the property line.”

The majority of the Underground Segment of the proposed Project is located along road ROWs in an area of Erie County that is predominantly rural residential and agricultural. The proposed Erie Converter Station is located in a generally cleared, rural landscape with wetland and forested areas surrounding the site. The existing soundscape for the Underground Segment and the Erie Converter Station location include natural sources, such as wind, vegetation rustle, and wildlife noises; transportation noise sources from passing trains and automobile noise; and farm-related noise from equipment and animals. Noise associated with the operation of the existing Penelec Erie West substation, located approximately 2,000 ft southwest of the proposed Erie Converter Station site, is also part of the existing regional soundscape.

4.10 Public Health and Safety

4.10.1 Lake Segment

Enforcement of boating laws and regulations, along with providing for safety on Pennsylvania waters, is the responsibility of the PFBC’s Waterways Conservation Officers. U.S. Coast Guard Station Erie is located on Presque Isle State Park, and its missions are search and rescue, law enforcement, and homeland security. On Pennsylvania waters, boating Safety Education Certificates are required to operate a personal watercraft for persons born on or after January 1, 1982, to operate boats powered by motors greater than 25 horsepower. The PFBC encourages all boat operators to obtain boating education training. Potential hazards on Lake Erie include vessel accidents.

4.10.2 Underground Segment

Potential hazards along the Underground Segment include motor vehicle accidents, train crossings at roadways, movement of heavy equipment used for agriculture, and road maintenance activities.

4.11 Infrastructure

4.11.1 Lake Segment

Infrastructure consists of the systems and physical structures that enable a human population in a specified area to function. Infrastructure is wholly human-made, with a high correlation between the type and extent of infrastructure and the degree to which an area is characterized as urban or developed. The availability of infrastructure and its capacity for expansion are generally regarded as essential to the economic growth of an area. The infrastructure components discussed in this section include utilities and solid waste management. Utilities include electrical power supply, water supply, stormwater drainage, communications systems, natural gas, liquid fuel supply, and sanitary sewer and wastewater systems. Solid waste management primarily relates to the availability of collection and processing systems and landfills to support a population's residential, commercial, and industrial solid waste needs.

No utilities or commercial infrastructure systems intersect with the proposed Project Lake Segment. The following paragraphs describe infrastructure that could be identified near the Lake Segment.

While a number of natural gas production areas occur within Canadian waters, none occur in the U.S. portion of Lake Erie. No substantial infrastructure of the following types have been identified within the Lake Segment: electrical systems, stormwater management, communications, liquid fuel, sanitary sewer, and solid waste management.

Drinking water systems that have intakes in Lake Erie include the Erie City Water Authority, which use approximately 45 million gallons per day (EWW 2013) and Aqua America (formerly Ohio American Water Company) service for the Ashtabula District (Aqua America 2015). The Erie City Water Authority has two water intakes (EWW 2013) located more than 4 miles away from the Project. The Ashtabula District is based in Ohio. While their specific intake location is not specified, intakes supplying water to Ohio are well outside the potential area of impact associated with the Project. No industrial water intakes have been identified in the vicinity of the Project.

No sewer line crossings have been identified on the lake bottom in the vicinity of the proposed Lake Segment. The City of Erie Sewer Authority discharges effluent to Lake Erie via two outfalls, for a total outfall of 165 million gallons per day (Erie 2003). North East Borough Sewer Authority has one outfall to Sixteen Mile Creek which then travels to Lake Erie (Erie 2003).

4.11.2 Underground Segment and Converter Station

Infrastructure systems and lines that intersect with the proposed LEC Project route (i.e., crossings) in the Underground Segment and vicinity of the Converter Station are described in the following paragraphs.

4.11.2.1 Road and Railway Crossings

The Underground Segment requires crossing two railroads, the Chicago and Lakeshore Lines operated by CSX and the Buffalo / Cleveland Line operated by Norfolk Southern. Together these lines provide the bulk of Class I rail freight service between Chicago and Buffalo (Erie 2012). CSX's line carries approximately 113 million gross tons a year and runs approximately 70 trains a day. Norfolk Sothern's line carries approximately 27 million gross tons a year and runs approximately 25 trains a day (Erie 2008). Amtrak passenger rail service from Chicago to Albany operates along CSX Lakeshore Limited Line tracks, with service once a day in each direction (Erie 2012).

The Project will have several road/highway crossings: Lexington Road up to four times, Interstate 90, Ridge Road (Route 20), and West Lake Road (Route 5). In addition, much of the route may be within the cartway of Springfield Road and Townline Road, both of which are township roads. Interstate 90 is a four-lane highway that serves as the primary east-west highway in Erie County as well as a national freight corridor. The interstate transmits ten to fifty million tons of truck freight through Erie County per year (Erie 2008).

4.11.2.2 Electrical Systems and Buried Utilities

No substantial underground electrical systems have been identified within the Underground Segment, although the route may encounter underground services serving individual properties. Instances of aboveground electrical infrastructure such as overhead electrical power transmission and distribution lines are possible within the proposed Project route. The proposed route crosses under First Energy high voltage transmission lines at approximate Station 208+00. The Erie West Substation is located approximately 2,000 ft southwest of the proposed Erie Converter Station site

4.11.2.3 Water Supply Systems

No water lines occur along the Project route (Erie 2003).

4.11.2.4 Solid Waste Management

No landfills are located near the proposed Project. The Fairview Site II site for land application of sewage sludge operated by Albion Borough Municipal Authority (PASDA 2015a) is located about one mile away. No waste management sites identified within over five miles of the Project impact area.

4.11.2.5 Stormwater Management

The Underground Segment crosses existing stormwater management infrastructure, including several roadway culverts, swales, and ditches. The culverts range in size from 24 inch diameter corrugated pipes to a 10 ft by 20 ft concrete box culvert. The ditches and swales vary widely in size and shape depending on their location relative to the roadway. Most of this stormwater management infrastructure is located within the roadway right-of-ways, where it is owned and maintained by PennDOT, in the case of Lexington Road, Interstate 90, U.S. Route 20, and Pa. Route 5, or by the respective Township, in the case of all the other public roads. Reference is made to the Erie County Stormwater Management Plan (Erie 2010) which identifies only a limited number of stormwater management problem areas in the Project area. None of the problem areas identified in that plan are close enough to the Underground Segment to be affected by the Project.

4.11.2.6 Communications

Some underground communication lines occur along railroad ROWs that the Project route will cross. Overhead phone lines also occur adjacent to the roads along the project routes.

4.11.2.7 Natural Gas Supply

Some natural gas lines occur in the vicinity of Ridge Road/Route 20.

4.11.2.8 Liquid Fuel Supply

No substantial liquid fuel systems have been identified within the Underground Segment (NPMS 2015).

4.11.2.9 Sanitary Sewer and Wastewater Systems

There are no sanitary sewer systems along the proposed route. Instead, houses in the area have on-lot sewer systems.

4.12 Hazardous Materials and Waste

4.12.1 Lake Segment

The Lake Segment of the proposed Project is approximately 35 mi in length through the U.S. waters of Lake Erie. The transmission cables will be buried in the lakebed along the majority of the Lake Segment of the proposed Project.

According to the NOAA Charts for Lake Erie, the underwater route in U.S. waters does not cross any disposal or dump areas. Sediments in Lake Erie are contaminated with varying levels of cadmium, mercury, and other trace metals. Marvin et al. (2004) found that there is an apparent spatial distribution in contamination in Lake Erie with decreasing concentrations from the western basin to the eastern basin, and from the southern area to the northern area of the central basin, which is located west of the proposed transmission line route.

4.12.2 Underground Segment and Converter Station

The Underground Segment crosses beneath two railroad lines. Railroad ROWs are generally areas with a significant potential for environmental contamination including herbicides; creosote, arsenic, and coal ash, petroleum products, fossil fuel combustion products, and metals (Rails to Trails, undated).

No factories, landfills or recycling centers, gasoline stations, or automotive repair shops were identified along the Underground Segment route. However, a few gasoline pumps were observed approximately 50 ft from Lexington Road on a private property. It is unknown whether these pumps are operational and have associated underground storage tanks. No storage tanks were identified at this address or others along the Underground Segment of the proposed Project in the PADEP Bureau of Environmental Cleanup and Brownfields Storage Tank Database.

No hazardous waste sites were identified along the Underground Segment of the proposed Project. The closest Superfund site to the Underground Segment is the Lord-Shope Landfill located on Pieper Rd in Girard Township, approximately 2 miles from the proposed transmission cable route. Based on the USEPA's site progress report, this site is not anticipated to impact the Underground Segment of the proposed Project (USEPA 2014c).

During construction, cable installation activities will include trenching and excavation of soils to a depth of approximately 6 ft below grade. No known areas of soil or groundwater contamination along the Underground Segment have been identified from readily available information.

4.13 Socioeconomics

4.13.1 Population

Based on the 2010 Census, Erie County is the 14th most populous county in Pennsylvania, with a population of 280,566. Between 1990 and 2010, the Commonwealth of Pennsylvania, Erie County, and the townships traversed by the proposed Project experienced modest growth, with the exception of Conneaut Township where the population more than doubled (USCB 2010). Population growth was significantly slower between 2000 and 2010, in part as a result of two economic recessions. A summary of population data for the U.S., Pennsylvania, Erie County, and the townships traversed by the underground route is provided in Table 4.13-1.

Table 4.13-1 Population summary for the U.S., Pennsylvania, Erie County, and the townships traversed by the underground route, 1990-2010

Location	1990[1]	2000[1]	2010[1]	Percent Change 1990-2000	Percent Change 2000 to 2010	Percent Change 1990 to 2010
United States	248,709,873	281,421,906	308,745,538	13.2	9.7	24.1
Pennsylvania	11,881,643	12,281,054	12,702,379	3.4	3.4	6.9
Erie County	275,572	280,843	280,566	1.9	-0.1	1.8
Springfield Township	3,218	3,378	3,425	5.0	1.4	6.4
Girard Township	4,722	5,133	5,102	8.7	-0.6	8.0
Conneaut Township	1,938	3,908	4,290	101.7	9.7	121.4

Sources: USCB 1990, 2000, and 2010.
[1]Information obtained from centennial census.

4.13.2 Employment

Erie emerged as a regional tourist destination, attracting visitors to Presque Isle State Park and Erie Bluffs State Park during the summer months. Important economic drivers and employers include the General Electric Company transportation plant, Erie Insurance Group, a significant plastics industry, several colleges and universities, and two major hospital systems (Erie Regional Chamber and Growth Partnership undated).

According to 2009-2013 estimates from the American Community Survey, more than 56 percent of the population 16 years and over in Erie County is employed (Table 4.13-2). This is consistent with estimates for the U.S. and Pennsylvania. The largest percentage of the civilian labor force in Pennsylvania and Erie County is employed in the educational, health, and social services industry, with the second and third largest percentages employed in the manufacturing industry and the retail trade industry, respectively (USCB 2013). Generally consistent with national and state level estimates, approximately 4.5 percent of the civilian labor force in Erie County is employed in the construction industry (USCB 2013). A complete breakdown of employment by aggregate industry is shown in Table 4.13-3.

Table 4.13-2 Estimates of employment status for the population 16 Years and over for the U.S., Pennsylvania, and Erie County, 2009-2013.

Employment Status	United States		Pennsylvania		Erie County	
	Estimate	%	Estimate	%	Estimate	%
Population 16 years and over	246,191,954	-	10,310,404	-	225,638	-
In labor force	158,197,577	64.3	6,503,761	63.1	140,676	62.3
Civilian labor force	157,113,886	63.8	6,496,409	63.0	140,593	62.3
Employed	141,864,697	57.6	5,914,876	57.4	127,586	56.5
Unemployed	15,249,189	6.2	581,533	5.6	13,007	5.8
Armed forces	1,083,691	0.4	7,352	0.1	83	0.0
Not in labor force	87,994,377	35.7	3,806,643	36.9	84,962	37.7

Source: USCB 2013.

Table 4.13-3 Estimates of employment by industry for the U.S., Pennsylvania, and Erie County, 2009-2013.

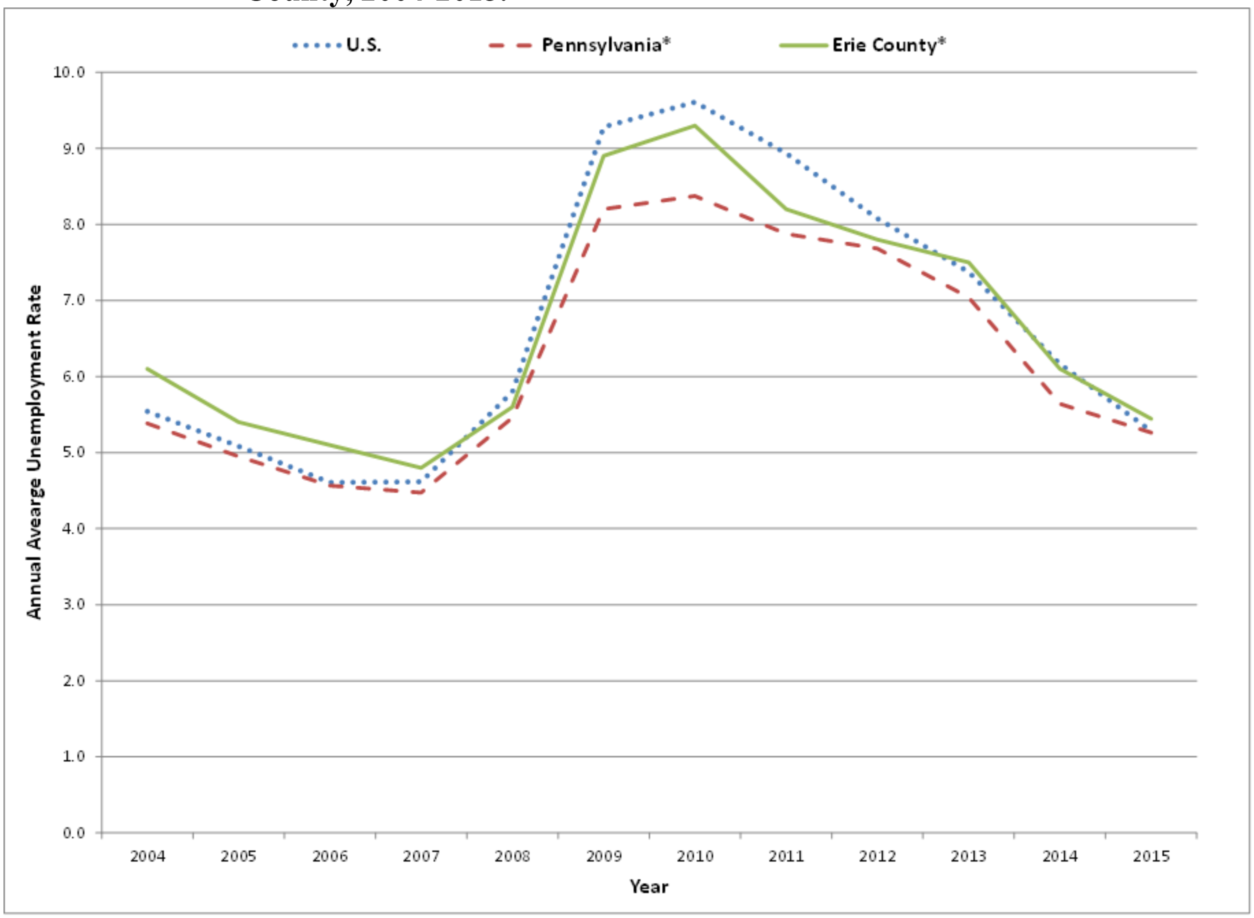
Industry	United States	Pennsylvania	Erie County
Civilian employed population 16 years and over	**141,864,697**	**5,914,876**	**127,586**
Agriculture, forestry, fishing and hunting, and mining	1.9%	1.4%	1.0%
Construction	6.2%	5.7%	4.5%
Manufacturing	10.5%	12.4%	18.1%
Wholesale trade	2.8%	2.8%	2.5%
Retail trade	11.6%	11.8%	11.6%
Transportation and warehousing, and utilities	4.9%	5.1%	3.7%
Information	2.2%	1.8%	1.5%
Finance and insurance, and real estate and rental and leasing	6.7%	6.5%	5.3%
Professional, scientific, and management, and administrative and waste management services	10.8%	9.7%	6.4%
Educational services, and health care and social assistance	23.2%	25.9%	27.8%
Arts, entertainment, and recreation, and accommodation and food services	9.3%	8.2%	9.7%
Other services, except public administration	5.0%	4.7%	4.8%
Public administration	5.0%	4.2%	3.1%

Source: USCB 2013.

Between 2004 and 2013, the annual average unemployment rates for the U.S., Pennsylvania, and Erie County were lowest in 2007 and highest in 2010, with an overall increase over the decade of approximately 2 percent (Figure 4.13-1). According to the National Bureau of Economic Research, the most recent recession began in December 2007 and ended in June 2009. Compared alongside the recent recession, unemployment rates for the U.S., Pennsylvania, and

Erie County were lowest prior to the recession (2004-2007), were highest during and immediately following the recession (2008-2010), and have been trending downward since 2010. In 2015, the annual average unemployment rates for Pennsylvania and Erie County were 5.3 and 5.4 percent, respectively[10]. However, the 2015 data are preliminary and do not include the month of December.

Figure 4.13-1 Annual average unemployment rate for the U.S., Pennsylvania, and Erie County, 2004-2015.



Source: BLS 2015.
Note: * The 2015 data are preliminary and do not include the month of December.

4.13.3 Taxes and Revenue

Erie County had total revenues for governmental activities of $288.3 million in 2013, of which 65 percent was from operating grants and contributions, 24 percent was from property taxes, and 10 percent was from charges for services. The county also had total revenues of $34.4 million in 2013 from business type activities, of which 97 percent were from charges for services (Erie

[10] The Pennsylvania and Erie County 2014 unemployment rates are based on data from January through November 2014.

County Finance Department 2013).

4.13.4 Housing

Based on the overall length of the Underground Segment of the proposed Project (approximately 7 miles), the construction period duration is expected to be relatively short (i.e., about 6 months for constructing the cable along the entire Underground Segment). Therefore, short-term rental accommodations for construction workers who are not already residents of the region would most likely be needed during construction of the proposed Project. At least 55 lodging accommodations are available in Erie County (Visit Erie 2015). Additionally, it is estimated that there are approximately 9,500 vacant housing units in Erie County, representing approximately 8 percent of total units; although, it is not anticipated that workers for the proposed Project will need long-term rental accommodations (i.e., apartment and housing rentals) (USCB 2013). A summary of housing unit characteristics for Erie County is included in Table 4.13-4.

Table 4.13-4 Estimated housing data for Pennsylvania and Erie County, 2009-2013.

Subject	Erie County	
	Estimate	Percent
Total housing units	119,175	100.0
Occupied housing units	109,675	92.0
Vacant housing units	9,500	8.0
Homeowner vacancy rate	1.7	-
Rental vacancy rate	6.0	-

Source: USCB 2013.

4.14 Environmental Justice

Executive Order 12898, "Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations," provides that "each federal agency shall make achieving environmental justice part of its mission by identifying and addressing, as appropriate, disproportionately high and adverse human health or environmental effects of its programs, policies, and activities on minority populations and low-income populations."

In order to determine whether a proposed action is likely to have disproportionately high and adverse human health or environmental effects on low-income populations, minority, or Indian tribes, demographic data available from the Bureau of the Census (USCB) can be used to identify the composition of the potentially affected population. Geographic distribution by race, ethnicity, and income, as well as a delineation of tribal lands and resources, should be examined. Minority populations are populations identified in census data as Hispanic or Latino, Black or African American, Native Hawaiian and other Pacific Islander, some other race, or two or more races. Low-income populations are families that are living below the U.S. poverty level.

Minority and low-income populations in the Underground Segment of the proposed Project were identified using USCB Census tract data. Three Census tracts were identified along the 7-mile route of the proposed Project Underground Segment. A summary of race, ethnicity, and poverty characteristics for the Census tract located within the Underground Segment as well as for Erie County and Pennsylvania from the 2010 USCB is included in Table 4.14-1. No Indian Tribe Reservation or Land is located within the vicinity of the Underground Segment of the proposed Project.

Table 4.14-1 Race, ethnicity, and poverty characteristics, 2010.

	Census Tract PA049010101	Census Tract PA049010202	Census Tract PA049010103	Erie County	Pennsylvania
Total Population	3,425	5,522	2,079	280,566	12,702,379
Percent White	97.6	97.9	97.4	88.2	81.9
Percent Black	0.4	0.3	0.2	7.2	10.8
Percent Hispanic	0.9	0.9	0.9	3.4	5.7
Percent Asian	0.1	0.2	0.8	1.1	2.7
Percent Native (American, Indian, Alaska Native, Hawaiian Native, etc.)	0.1	0.4	0.7	0.2	0.2
Percent One Race, Other	0.3	0.2	0.3	1.1	2.4
Percent Two or More Races	1.5	1.0	0.6	2.1	1.9
Total Percent Minority Population	3.3	3.0	3.5	15.1	23.7
Percent Population below Poverty Level	14.52	5.63	12.10	16.07	13.06
Median Household Income	$41,544	$57,059	$44,438	$45,249	$52,267

Source: USA.com 2015.

In addition to the federal executive order, PADEP has adopted and implements the "Environmental Justice Public Participation Policy" (EJ Policy). The EJ Policy states that the area of concern shall be defined as an area extending one-half mile beyond the boundary of the proposed activity. Pursuant to the policy, an Environmental Justice Area is defined as an area of concern with a 30 percent or greater minority population or 20 percent or greater at or below the poverty level (as defined by the USCB) based on applicable census tracts. No Environmental Justice Areas are located in the area of concern for the proposed Project.

5.0 ENVIRONMENTAL IMPACTS

Section 5.0 includes a discussion of the anticipated and potential impacts from the construction and operation of the Project on the existing environmental resources identified in Section 4.0.

5.1 Water and Land Use

5.1.1 Lake Segment

The proposed route was selected to avoid areas of anthropogenic use such as dredge disposal locations, aggregate extraction areas, designated anchorage areas, and dredged navigation channels. The Project does not affect public water system intakes in Lake Erie.

5.1.1.1 Recreation and Fishing

Construction and maintenance activities could temporarily affect recreational and commercial usage within the transmission cable corridor, including recreational boating, sport fishing, and commercial fishing. An exclusion zone around the cable installation vessel of approximately 1 km would be established during construction or maintenance activities. Navigational restrictions, coupled with use of relatively large construction vessels (barges), could become a hindrance for passing vessels. Sport fishing and commercial fishing opportunities could be prohibited or affected if fish become temporarily displaced within the immediate vicinity of the proposed Project.

Burial of the cables will minimize effects to recreation and fishing uses. Recreational boaters may be required to avoid the immediate vicinity of the construction area for the proposed Project. However, due to the relatively small footprint and short duration of Project construction, effects on the recreational and fishing uses of Lake Erie are expected to be localized, temporary, and negligible.

5.1.1.2 Navigation

The underwater cable would extend 35.4 miles (57 km) in Lake Erie from the U.S./Canada border to the proposed landfall location in Erie County. The proposed Project would temporarily increase the amount of Lake traffic during construction and maintenance activities.

The HVDC submarine cables will be manufactured in Europe and will be transported by boat to Rochester, NY. The freighter will transit the Atlantic Ocean and access Lake Ontario via the Saint Lawrence Seaway. The freight vessel is restricted from entering Lake Erie due to the size limitations of the Welland Canal. The high voltage cable and fiber optic cable will be transferred in segments to smaller barges for transportation through the canal.

For deployment of the cable, the following vessels are expected to be employed:

- Cable laying barge, approximately 290 ft x 90 ft (88.4 m x 27.4 m);
- Transportation barge for the HVDC cables, approximately 250 ft x72 ft (76.2 m x 21.9 m);
- Two support tugs;

- Crew boat; and
- Small outboard powered craft (minimum of three).

It will take approximately 4 to 6 weeks to install the cable in U.S. waters (3 to 4 months total for deploying the cable in U.S. and Canada waters). Additionally, an exclusion zone around the cable installation vessel of approximately 1 km would be established during construction or maintenance activities. Navigational restrictions, coupled with use of relatively large construction vessels (barges), could become a hindrance for passing vessels. The Applicant will develop a Vessel Traffic Management Plan, and, prior to starting Project construction activities, the Applicant will coordinate with the USCG local district to issue a Notice to Mariners. The contractor will post standard day shapes and lighting in accordance with the regulations concerning vessels limited in their ability to maneuver.

Other vessels using Lake Erie could potentially anchor in the Project vicinity. The likelihood of anchor snag along the Project cables depends largely on the depth of anchor penetration, which is affected by a number of variables including the type of anchor used, water depth, and substrate characteristics (Sharples 2011). Anchors are primarily used in high traffic areas by mariners (i.e. port entry) and any use within the cable route would likely be infrequent because they will not be located near any port entry areas or USCG designated anchorage areas. Recreational vessels could anchor within the Project vicinity, but these anchors are generally relatively small and the potential impacts to buried cables would likely be minimal. The Project will be marked on navigation charts, which will warn mariners of the presence of the cables.

Sharples (2011) analyzed the potential threats of anchors to buried electrical submarine cables to determine recommended burial depths for electric submarine cables. Based on the available research, Sharples (2011) concluded that the acceptable burial depth for electric submarine cables is 3 to 6 ft (1 to 2 m) in areas where ship traffic is not prominent and does not require specialized maneuvering (i.e., port entry areas), but adjustments should be made based on sediment type and protective devices should be used where necessary. For the proposed Project, cables will be buried 3 to 10 ft (1 to 3 m) in the lakebed to minimize the potential for snagging of anchors or fishing gear. The cable will be armored to prevent cable damage should an encounter occurs.

A compass is sensitive to the horizontal component of the geomagnetic field. Exponent (2015*a*) investigated whether the DC magnetic field induced by the proposed transmission line would affect a boater using a compass to navigate. For a boater in 5 meter-deep water directly over the transmission line, the anticipated compass deflection resulting from transmission line magnetic field effects is less than 1 degree. The HDD segment of the Lake Segment is approximately 0.37 mi (600 m), and the burial depth in the HDD section would vary from approximately 1 to 30 meters. Modeling indicates that at shallow burial depth (1 meter), a short segment of the HDD portion could result in a larger maximum compass deflection (77 degrees) directly above that section. However, that condition would occur only in a very limited area, in a location near the point where the HDD exits to the lakebed. Other than at the HDD exit, the magnetic field from the cable will be too low to impact navigation and will not cause compass deflection in the main shipping channels. Also, this segment of the route is at the shore of the lake, where it is unlikely that a compass would be needed for navigational purposes (Exponent 2015*a*).

5.1.1.3 Mineral Resources

Within U.S. waters, aggregate dredging areas are located north of the preferred cable route over the Norfolk Moraine or Long Point – Erie Ridge. The permits for this aggregate area allow for dredging of coarse sand, gravel and glacial till. The proposed Project transmission cable route is sited to avoid these areas.

5.1.2 Underground Segment and Converter Station

Construction of the underground route of the proposed Project would result in temporary impacts to existing land uses and traffic along the proposed Underground Segment. Disturbances to land use during construction may include limitations on property access due to road detours and construction equipment/activities. However, these disturbances would be limited to the duration of construction in that immediate area and are anticipated to be short (i.e., 3 to 4 days at any one location; one week for a vault location). Because the transmission line along the underground route will primarily be buried within the road ROW, disturbances to local traffic may occur during construction.

The Applicant will avoid or minimize traffic disturbances by using traffic details, construction signs and barriers and notifying the local community in advance of any known road closures. Construction activities, including traffic management and paving restoration will be coordinated with the PennDOT, the respective townships, and adjacent property owners, as appropriate, to minimize traffic disruption during installation. Construction activity will generally be conducted during daytime hours, unless night construction is requested by state or local officials to avoid significant impacts to traffic or equipment deliveries. Transportation of construction equipment and materials will be coordinated with Pennsylvania Department of Transportation, applicable local townships, and law enforcement authorities depending on the location.

Construction of the proposed Project will require six laydown areas for construction equipment and supplies (Table 2.3-1, Appendix A). It is anticipated that construction laydown areas will have minimal and temporary effects on land use, and would be limited to the duration of construction activities.

The majority of the Underground Segment of the proposed Project will be installed within the road ROW; however, two portions of the underground route will be installed within wooded areas: from the Lake Erie landfall to the CSX railroad crossing, and from Ridge Road to Springfield Road. In addition, there are seven locations where the route will briefly leave the adjacent road ROW to account for turns on to new roads encountered along the route (see Appendix A for locations). Construction of the proposed Project within wooded areas would require localized clearing.

At locations where larger scale HDD is being used (e.g., where the borings are made from the land to underwater segment), work areas of approximately 100 ft by 150 ft (30 m by 46 m) will be temporarily cleared. The work area for small HDD operations (e.g., for borings for shorter distances under smaller streams) will be about 15 ft wide by 50 ft long such that it can be done alongside a roadway. Setup for the HDD boring in most cases will be located a minimum of 50 ft (15 m) from stream and wetland areas. Generally, small (6 ft [1.8 m] x 6 ft [1.8 m] x 4 ft [1.2 m]) sump pits may be excavated at the drill entry and exit points to accumulate drilling fluid and associated drill spoil to be pumped into tank trucks. All areas affected by construction of the

Project will be restored as soon as possible, and reopened for local traffic. Areas within the permanent transmission line ROW (up to 50 ft wide depending on soil conditions) will remain clear from vegetation having large root systems. Because the transmission line is being installed in most cases under roadways and the road ROW, the amount of vegetation clearance outside of existing road ROW will be limited.

No formal recreation sites are located within the underground route of the proposed Project and, therefore, no impacts to recreation opportunities are anticipated from the construction or operation of the proposed Project. Permanent land use impacts will occur in areas where the transmission line route requires easements, restricting future land development within the easement area. There is no zoning in Conneaut Township, where the Erie Converter Station location is located. Construction and operation of the proposed Project is expected to be consistent with relevant land use policies for the Pennsylvania, Erie County, and Springfield, Girard, and Conneaut Townships.

5.2 Geology and Soils

5.2.1 Lake Segment

The cable would be buried within the entire Lake Segment, potentially impacting geology and soils along the cable route.

5.2.1.1 Sediments

Major storms, despite their infrequent occurrence, are responsible for most of the resuspension and transport of fine-grained sediments in Lake Erie (Lick et al. 1994). Lake scour also contributes to the suspension and transport of sediment.

A pre-lay grapnel run will be undertaken to locate and remove any obstructions along the transmission line route. Since the grapnel would penetrate the lake bottom to a maximum depth of 1 m (3 ft), it would cause a temporary but negligible disturbance of the underlying sediments and terrain during construction activities. The cable-plowing techniques used to install the transmission line would induce localized fluidization and resettling of soils. The jet plow would be about 15 ft wide, with skids 36 ft long and 2.7 ft wide. The plow share is about 12 inches wide. The jet plow would be fitted with hydraulic pressure nozzles that create a downward and backward flow within the trench, allowing the transmission cables to settle into the trench under its own weight before the sediments settle back into the trench. For the deepest part of the route, from the Canada/U.S. border at KP 47 to approximately KP 55 (up to about 14 percent of the U.S. Underwater Segment), water jetting may be used instead of a jet plow. As mentioned in Section 2.4.2.3, water jetting methods are similar to jet-plow installation methods in that both use water to fluidize sediment within the cable trench to facilitate cable burial. A jet-plow is supported on the lake bed by pontoons or skids and pulled along the sediment surface. Unlike the jet-plow, there is no mechanical force used to pull the water jet through the sediment and water jetting relies solely on the weight of the cable to sink through the fluidized sediment to the desired burial depth. Jet plow and water jetting operations in U.S. waters would result in a temporary disturbance of approximately 12.5 acres. Total disturbance of all in water activities (e.g., bedrock trench excavation, discussed in the next section) would result in a temporary only disturbance of approximately 12.7 acres and a permanent disturbance of 2.0 acres, consisting primarily of the areas excavated for the three HDD sump pits, the cable trench in the bedrock, and the associated sidecast rock). Following construction in the sediment areas of the lake bed, the lake bed bottom is expected to be restored to its original conditions (e.g., sediment), resulting in no permanent impacts within that area.

The route was selected to minimize the length of cable within areas of bedrock, glacial till, and boulders. Sediments would be suspended in the water column and displaced, and the disturbed sediment naturally backfills into the trench. Depending on the sediment particle-size composition, approximately 70 to 80 percent of the disturbed sediment would be expected to remain within the limits of the trench under limited water movement conditions, with 20 to 30 percent of suspended sediment traveling outside the footprint of the area directly impacted by the cable plow (DOE 2014). Smaller sediment particles (e.g., silt, mud, and clay) would remain in suspension longer than larger particles and, thus, could be transported farther from the original site of deposition depending on the currents within the lake. Colloidal and flocculated materials in particular will remain suspended and will travel further down current before resettlement. The extent of the turbidity plume generated would depend on the amount of sediment disturbed, the grain size, and the mass of the disturbed sediment particles, along with construction methods and ambient lacustrine (lake) conditions (DOE 2013).

Sediment concentrations in the turbidity plume could be initially high, and rapidly decrease with distance. Resettling of sediment grains could result in a localized change in surficial sediment texture and grain size. The plow does not deposit any new or nonnative sediment or fill material into the trench. The Applicant conducted modeling to evaluate the potential mixing and dispersion of sediment and other constituents resuspended during the cable installation process for the proposed jet plow or water jetting installation method, and these results are discussed in Section 5.3.

No impacts on sediments from the operation or maintenance of the transmission line would be expected, as the transmission line would be designed to be maintenance-free. Emergency repair activities could require the transmission cables to be unearthed; these activities would result in impacts on sediments similar to, but less than, those described for construction and negligible because they would be intermittent, only occur when required, and would be of a shorter duration.

5.2.1.2 Bedrock Geology

At the lakeshore landfall, bedrock is either exposed or very close to the surface for up to approximately 1.2 miles (2 km) out to deeper water. In this nearshore area, depending on the final geology, a single trench would be excavated in the bedrock from the exit of the HDD bore to softer lakebed material where the jet plow burial can be utilized. Bedrock trenching operations in U.S. waters, including excavating the three HDD sump pits, would result in a temporary and permanent disturbance of approximately 1.9 acres. The trench will be bedded and backfilled with a sand and gravel mixture (originating from an on-land source). Blasting will need to occur along the portions of the cable route in bedrock for cable installation (see section 5.4.1.1 below for discussion of procedures and mitigation measures). The route was selected to minimize the length of cable within areas of bedrock.

No impacts on geology from the operation, inspection, and emergency repairs of the transmission line are expected.

5.2.1.3 Seismicity

Construction of the Project would not increase the risk of seismic hazards. The Project is located in a stable continental region within the North American Plate and, as a consequence, has a relatively low rate of earthquake activity (Natural Resources Canada 2013). Operation of the Project would not increase the risk of seismic hazards. During a seismic event, which would be rare, it is possible that damage to the transmission line could be sustained. The buried transmission line could shift and deform slightly with ground movements associated with seismic events.

5.2.1.4 Bathymetry and Scour

In areas of soft sediment, a jet plow would be used to bury the transmission cables within Lake Erie (or by water jetting in the deepest portion of the lake). In areas of bedrock, the excavated trench will be filled with sand and gravel. The plow share is about 12 inches wide, and the trench will naturally backfill with sediment.

To evaluate the potential effects of ice scour, CSR (2014, 2015) summarized the following studies of ice scour in Lake Erie conducted by Grass (1984). During a 1980 survey, infilled ice scours were observed in 16 to 20 m water depth within the Pennsylvania Channel area, 7 – 9 km offshore (the Pennsylvania Channel looks extends off the south shoreline of Lake Erie and the Lake Segment crosses at approximately KP 80 [CSR 2014, CSR 2015]). During a survey in 1981 new scours were observed in the same area oriented sub-parallel to the shoreline in 17 to 22 m water depth. The new scours were 3.5 to 4.5 km long, 10 to 60 m wide and <1 m deep. Scour termination berms were observed indicating a scouring direction to the east. In 1982 a third survey was conducted over the same area. The new scours observed in 1981 were obliterated, troughs were infilled and berms were completely eroded. New scours, which formed during the winter of 1981-82, were visible. These scours were oriented east-west at the location of a very high ice ridge. Eight ice scours ranging in depth from 0.1 to 0.5 m were identified in U.S. waters near the Erie landfall. These represent all scours with measurable depth identified by Grass in this area during the 1981 and 1982 surveys (Lever, 2000 cited in CSR 2015). Based on these ice scour studies it was recommended that the cable be buried in water depths < 25 m to protect it from ice damage. A conservative burial depth was 1 to 1.5 m in hard soil and bedrock and from 2 to 3 m in soft soil.

CSR (2014, 2015) also reviewed a summary of surveys conducted in 1995, which occurred from the Ohio-Pennsylvania border 50 km to the southwest. Ninety six new scours were identified within 14 to 16 m water depth along the survey line with a maximum scour depth of 0.6 m. Scour orientation was sub-parallel to parallel to the shoreline. Of the 50 km, 15 km was over glacial lacustrine sediment while 35 km was post-glacial cohesive sand and silty clay with shear strength of approximately 20 kPa and higher (Lever, 2000). These sediments are interpreted to be similar to those within the Pennsylvania Channel where the proposed cable route is located. Ice scours were also identified from the 1992 and 1993 data; however, the scours were infilled so a reliable depth measurement could not be made (CSR 2014, CSR 2015). Similar findings of ice scour occurred from review of other surveys in the eastern basin (CSR 2014, CSR 2015).

CSR (2015) conducted an ice scour survey in 2014 and 2015 and located 12 scour areas in U.S. waters. Within American waters the majority of ice scours observed (83%) are interpreted to have formed recently. Two older scours occur in water depth 20 to 24 m. The 10 ice scours interpreted to have formed recently occur in water depths ranging from 13 to 20 m and have a maximum scour depth of 1.4 m. The majority of recent scours are 4 to 20 m wide and have scour depths ≤0.3 m. Ice scours formed in this area of Lake Erie are prone to rapid degradation due to sediment transport. Studies by Ontario Hydro in the 1980s illustrated new ice scours were formed within the Pennsylvania Channel annually. Typically, these news scours were obliterated, troughs were infilled and berms were completely eroded, within a one year period CSR (2015).

The lakebed along the proposed cable route is susceptible to ice scour from approximately KP 62 to land fall (approximately KP 103.8). Therefore, the Applicant will bury the HVDC cable at sufficient depth to mitigate against ice scour in those areas of the route that are susceptible.

No impacts on bathymetry would be expected from operation or inspection of the transmission line as it would be designed to be maintenance-free. Emergency repair activities could require the transmission cables to be unearthed; these activities would result in changes to bottom stratigraphy of Lake Erie similar to, but less than, those described for construction activities and would be negligible because they would be intermittent, only occur when required, and would be of a short duration.

5.2.2 Underground Segment and Converter Station

5.2.2.1 Physiography and Topography

Trenching would be required for installation of the transmission line, resulting in temporary and localized changes in surface grading. Following cable installation, disturbed areas would be graded to match the original topography and to be compatible with local drainage patterns. Emergency repairs of the transmission line would result in impacts similar to, but less than, those described for initial construction activities because there would be a smaller area disturbed for a shorter duration.

5.2.2.2 Geology

Since no blasting is being proposed within the Underground Segment, no impacts to existing geologic features will occur as a result of Project construction or operation.

5.2.2.3 Soils

Construction activities would temporarily disturb approximately 76.1 acres, much of which lies within existing road rights-of-way. There is a potential for increased erosion and sedimentation resulting from vegetation removal, trenching, soil stockpiling, and backfilling required to install the cables. That potential will be addressed via implementation of BMPs consistent with state regulations, an approved erosion and sedimentation control plan and an NPDES Permit for stormwater associated with construction activities. Soils adjacent to the trench would be compacted under the weight of construction equipment. The construction of the Erie Converter Station would significantly increase the impervious surfaces at that site. Compacted soils and increased impervious surfaces would result in decreased soil permeability, which could alter local drainage patterns and impede stormwater infiltration.

The proposed Project would involve soil disturbances of more than 1 acre (0.4 hectares) within a high quality watershed, and therefore, would be required to obtain an Individual Permit under the NPDES Permit for Stormwater Discharges Associated with Construction Activities. Erosion and increased sedimentation in stormwater runoff would occur in active construction areas, but would be managed in place with BMPs as described in an Erosion and Sedimentation Control Plan (E&SC Plan). The E&SC Plan would follow PADEP Erosion and Sediment Pollution Control Program Manual (PADEP 2012), which specifies BMPs for addressing erosion and sedimentation control, and would be approved by PADEP. Applicant-proposed measures that would be implemented to minimize impacts on water quality would include use of erosion and sedimentation control and stormwater BMPs during transmission line installation. In the special protection watersheds (HQ or EV), more stringent criteria are to be used to design the BMPs for the site. Nondischarge alternatives are to be used wherever possible. If during a 2-year/24-hour storm event it is not possible to avoid increasing the rate or volume of runoff from disturbed areas to a special protection watershed, Antidegredation Best Available Combination of Technologies (ABACT) BMPs must be used to the fullest extent possible. BMPs with moderate sediment removal efficiencies (e.g., barrier/riser sediment traps) are ABACT for HQ watersheds. BMPs with high sediment removal efficiencies (e.g., compost filter sock) are ABACT for HQ and EV watersheds. The Project has been designed and will be implemented to meet the ABACT requirements. The Erie Converter Station and the transmission line will be installed in accordance with an approved E&SC Plan and the Stormwater Management Plan, and proposed BMPs are discussed in Section 5.3.3.2, Surface Waters.

The underground cable systems will be installed primarily within road ROWs; however, two segments of the underground route will be installed within wooded areas: from the Lake Erie landfall to the CSX railroad crossing, and from Ridge Road to Springfield Road. In addition, there are seven locations where the route will briefly leave the adjacent road ROW to account for turns on to new roads encountered along the route (see Appendix A for locations). Construction of the proposed Project within wooded areas would require localized clearing. The areas outside the road ROW will be located on private property mostly adjacent to existing driveways. The soils in these areas have been compacted and previously disturbed as a result of prior construction associated with roadway development. Therefore, no significant impacts on soils would be anticipated.

After installation of the underground transmission line, the trench would be typically backfilled with the same soils that were originally excavated during construction. In selected areas, low thermal resistivity material, such as well-graded sand, stone dust, or fluidized thermal backfill (controlled density low strength concrete) may be used. Excavated soils will be temporarily stored onsite during construction and will be used to restore the site to its previous grade once the installation has been completed, or transported for disposal/reuse at an approved location. The disturbed areas will be restored to their original grade and seeded with annual rye-grass to allow for natural revegetation.

HDD or Jack & Bore technology would be utilized in locations where open trenching is less appropriate due to either physical constraints (e.g., in the case of roadway crossings), environmental constraints (e.g., in the case of certain wetlands and streams), or at the transition points between land and Lake Erie. Seven HDD and six Jack & Bore crossings would occur at the roads, railways, and streams/wetlands shown in Table 5.2-1 (see Appendix A for locations of each HDD or Jack & Bore crossing).

Table 5.2-1 Location of HDD and Jack & Bore crossings.

Approximate Stationing	Crossing Method	Avoidance Reason
100+00 – 101+00	Jack and Bore	Lexington Road
115+00 - 120+00	HDD	Wetland WPA-KAS-028, Stream SPA-KAS-027, , Stream SPA-KAS-016 #1,; Lexington Road (State Route 3015)
124+00 - 126+00	HDD	Wetland WPA-KAS-029, Stream SPA-KAS-017;
158+00 - 159+00	Jack and Bore	Lexington Road (State Route 3015), Springfield Road
166+00 - 168+00	Jack and Bore	Interstate 90, WPA-KAS-030
205+00 - 210+00	HDD	WPA-KAS-012
245+00 - 255+00	HDD	Stream SPA-KAS-025
272+00 - 277+00	HDD	~~019~~Stream SPA-KAS-016 #2, Stream SPA-KAS-022
278+50 - 280+65	Jack and Bore	Ridge Road (U.S. Route 20)
328+50 - 330+00	Jack and Bore	Norfolk Southern Railroad
416+00 – 424+00	HDD	Stream SPA-KAS-002, Archaeological Site, West Lake Road
436+50 - 437+00	Jack and Bore	CSX Railroad
463+30 to Lake Exit Pit	HDD	HDD of the bluffs

Use of HDD or Jack & Bore would reduce impacts on soil erosion and sedimentation when compared to traditional trenching techniques. HDD drilling fluid, which is mostly water with bentonite clay added, could be absorbed by fractures in the formation being drilled, and could reach the surface through vertical fractures caused by drilling, known as inadvertent drilling fluid release. Prior to commencement of HDD operations each HDD contractor will provide a Drilling Fluid Management Plan. The Drilling Fluid Management Plan will identify the fluid handling, recovery, recycling and disposal procedures and equipment. The HDD contractor will also implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan, which identifies procedures for monitoring for fluid release, containing a fluid release if it occurs and cleaning up any fluid losses. See Section 2.3.2.5 for a description of the fluid handling and containment methods.

The Applicant estimates that approximately 570 cubic yards (436 cubic meters) of drill cuttings would be generated for disposal at the Lake Erie HDD water-to-land transition area. An inadvertent return at terrestrial sites could increase sedimentation, and at aquatic sites turbidity levels could increase (discussed further in Section 5.3, Water Resources and Quality) HDD drill sites will be graded, holes filled, and drill fluids and cuttings hauled off to an approved upland disposal site. All equipment and fencing will be removed.

Routine ROW mowing or tree-clearing activities could expose soil to erosion from wind and water, resulting in soil erosion and sedimentation. Such activities would be short-term in duration, but would occur multiple times over the operating life of the transmission line.

Emergency repairs of the transmission line could result in increased erosion and sedimentation that are similar to, but much less than, those described for construction activities. A smaller area would be disturbed for a shorter duration during emergency repairs and soils would be retained onsite without the use of best management practices (BMPs).

In addition, vegetation along the ROW would be maintained to prevent the establishment of trees and their associated deep root systems close to the transmission line.

5.2.2.4 Prime Farmland

According to USDA/NRCS data, approximately 76.1 acres (30.0 hectares) of land identified as having prime farmland soil are within the Underground Segment Project impact area and the Erie Converter Station site and the construction laydown areas (USDA 2013). Some of the soils are mapped as prime farmland, but have been previously disturbed and are not currently available for agricultural purposes. According to the Farmland Protection Policy Act (FPPA), soils designated as prime farmland do not include land that is already in or committed to urban development, or land that occurs in existing easements (i.e., ROWs) purchased on or before August 4, 1984 (7 CFR Part 658.2).[11] A majority of the land that would be directly impacted by construction activities in the Underground Segment would be within existing roadway ROWs. Some deviation areas (i.e., minor deviations of the proposed Project route from established road ROWs could cross areas used for agriculture, but the transmission line corridor would only be installed on the edge of such land.

No impacts on prime farmland would be expected from operation, transmission line ROW maintenance, and emergency repairs. Vegetation in the ROW would be limited to stable low-growing vegetation with shallow root systems so as to not interfere with the transmission line, and vegetation maintenance (e.g., trimming or removal) would occur in the ROW, most of the transmission line would be within existing road ROWs where vegetation has been previously disturbed due to existing vegetation maintenance activities. The majority of land in the proposed transmission line ROW is not currently used as farmland. Given the requirement of locating the Erie Converter Station adjacent to or in near proximity with the Erie West Substation, and the lack of suitable alternative sites for the Erie Converter Station, impacting these particular farmland soils is unavoidable.

5.2.2.5 Seismicity

Construction of the Project would not increase the risk of seismic hazards. The overall probability for seismic activity in the Underground Segment is low (USGS 2014; USGS 2011). Operation of the Project would not increase the risk of seismic hazards. During a seismic event, which would be rare, it is possible that damage to the transmission cables could be sustained. The Erie Converter Station would be built to conform to seismic hazard standards appropriate for the area.

[11] The prime farmland mapping used for this analysis is based on interpretation of soil types taken off aerial photography and not field surveys, which may have resulted in slightly incorrect soil type boundaries. As such, this could result in some land in the roadway ROWs being designated as prime farmland when it is not being used as such or is reserved for other uses. Additionally, the FPPA does not apply to federal permitting for non-federal activities on private or non-federal lands, such as the Lake Erie Connector Project.

5.3 Water Resources and Quality

5.3.1 Lake Segment

Effects on water resources and quality would be limited to construction and maintenance activities. As noted in Section 5.1.1.2, a number of vessels will be involved in Project construction. A comprehensive Spill Prevention Plan designed specifically to prevent spills during lake operations will be developed.

During construction and maintenance activities, the transmission cables would be buried at depths likely to range from 3 ft to 10 ft (1 m to 3 m) in jettable material. Low concentrations of trace metals and organic chemicals are present in Lake Erie sediments; and the eastern basin of Lake Erie (where the Project is located) has the lowest level of contamination in sediments in the Lake Erie subbasin. Burial of the cable may affect water quality by temporarily resuspending sediment and potentially causing localized migration of heavy metals in the basin or water column. The Applicant conducted modeling to evaluate the potential mixing and dispersion of sediment and other constituents resuspended during the cable installation process for the proposed jet plow installation method (HDR 2015). Five representative in-lake sites were selected for analysis, three of which were located in the U.S. MIKE3 Flexible Mesh (FM), a three-dimensional hydrodynamic and water quality model, was used for analysis. The water quality modeling was completed to show the concentration increases associated with the cable installation for the following parameters: total suspended solids (TSS); total phosphorus (TP); dissolved phosphorus (DP); arsenic; cadmium; chromium; copper; lead; nickel; zinc; and mercury. Model results were compared to existing PADEP criteria, which included short-term (acute) and long-term (chronic) criteria for metals (HDR 2015).

The results from the water quality modeling (HDR 2015) show that minimal water quality impacts would be associated with the cable installation in Lake Erie and they are limited to temporary impacts that would occur locally within a four-hour timeframe after jet plowing occurs. The model calculated that TSS, TP, and DP concentration increases would reach a temporary peak concentration at the point of installation and then decrease rapidly. At the three U.S. locations evaluated with the water quality model, the TSS concentrations were calculated to be 116, 104, and 208 mg/L above background lake levels at 2-3 meters above the lake bottom at KM post 53, 70, and 95, respectively. Estimated TSS concentration increases due to the cable installation are <3 mg/L above observed background lake TSS levels at a distance of 100 meters from the point of installation and within 5-11 meters above the lake bottom. Temporary TP and DP concentration increases due to the cable installation are estimated to be <0.005 mg/L at 100 meters from the point of installation and within 4-8 meters of the lake bottom. The DP re-introduced during cable installation represents <0.001% of the total external annual phosphorus inputs to Lake Erie based on recent loadings rates. All model-calculated dissolved metals concentration increases were less than the associated method detection limits (MDL) and much less than acute and chronic dissolved WQS (HDR 2015).

Based on the new 2015 Lake Erie sediment data, the proposed method of cable installation may include post-lay burial of the cable using water jetting methods along the U.S. portion of the route from the Canada/U.S. border at KP 47 to approximately KP 55, rather than simultaneous lay and burial of the cable using jet-plow methods, due to the very soft sediment (i.e., fine sediment with high porosity) encountered along this segment of the cable route. Due to their similarities, prior studies have considered the rate of sediment resuspension from water jetting or jet-plowing to be similar or the same for the purpose of modeling sediment plume and dispersion from cable installation (Jiang et al. 2007). In the water quality modeling completed, 30% of the cable trench volume was assumed to resuspend into the water column during cable installation based on readily available data sources and other modeling efforts. This assumption appears valid regardless if water jetting or jet-plowing is used based on prior studies and the nature of both installation methods (e.g., water jetting may require additional passes but the ROV does not disturb the lake bed like jet-plowing)(HDR 2015).

HDR compared the new sediment data collected along the proposed route during the Applicant's geotechnical survey, to that used in the prior modeling[12], to assesse the changes to the projected Project-related water quality impacts based on the most recent sediment data. A detailed analysis of the new 2015 Lake Erie sediment data, indicates that most of the water quality model inputs used were conservative (i.e., model input sediment concentrations used were greater than the recently measured concentrations from the 2015 Lake Erie sediment data; or model settling rates used were the same or less than those calculated with the recent data). Therefore, the previous water quality modeling results are still applicable and conservative, indicating that minimal water quality impacts are associated with the proposed cable installation in Lake Erie and are limited to temporary construction related impacts that would occur locally within a four hour timeframe (HDR 2015). For the few locations where the new 2015 Lake Erie sediment metals data were greater than the original model inputs, the calculated dissolved metals concentrations are still less than the PADEP water quality standards. For dissolved phosphorus, the total mass re-introduced to the water column due to the proposed cable installation would be less if using the new 2015 Lake Erie data as compared to the model inputs (HDR 2015). The water quality modeling report is included as Appendix E, and provides more detail regarding the modeling approach and the model results.

The grapnel would penetrate the lake bottom to a maximum depth of 3 ft. It would cause a temporary disturbance of the underlying sediments along the transmission line route where the jet plowing or water jetting will occur.

In areas requiring blasting, the blasting contractor will drill blast holes at 2.5- to 4-ft intervals, on alternating sides of the trench. Blasting mats will be placed over the blast holes, which will help minimize suspension of blasted material. Any mobilization of fine sediments would be limited in duration and areal extent and would be expected to be considerably less than what was modeled for the jet plow operations in soft sediments (preceding discussion) because the blasted bedrock material would have larger grain size and would settle quickly.

Prior to the cable installation process, borings would be drilled via HDD to cross the Lake Erie shoreline. HDD installations require the use of drilling fluid to stabilize the borehole and transport cuttings. Drilling fluid consists mostly of water with bentonite clay added, drilling fluid is considered non-toxic. The bentonite clay could become suspended in the lake or disperse during HDD activities; this is most likely to occur near the bore entry and exit points. If released

[12] The sediment data used in the May 2015 modeling effort was based on historical physical and chemical characteristics of lake bottom sediments available when the modeling was completed.

into the water column, drilling fluids could result in impacts on the adjacent aquatic resources, including increases in turbidity.

The HDD contractor will provide a Drilling Fluid Management Plan. The Drilling Fluid Management Plan will identify the fluid handling, recovery, recycling and disposal procedures and equipment. To control fluids, sump pits will be constructed in the bedrock at the exit points of the shore to lake transition at Erie, Pennsylvania. The pits would be located approximately 2,000 ft (600 m) from shore, at a water depth of approximately 18 ft (5.4 m). The purpose of an exit point sump pit is to contain suspended sediments to the interior footprint of the sump pit during the exit point excavation, contain drilling fluids at the lower end of the excavation for recovery (as described in the next paragraph) and disposal at an approved upland facility. Each pit would have a storage capacity of approximately 10,000 gallons.

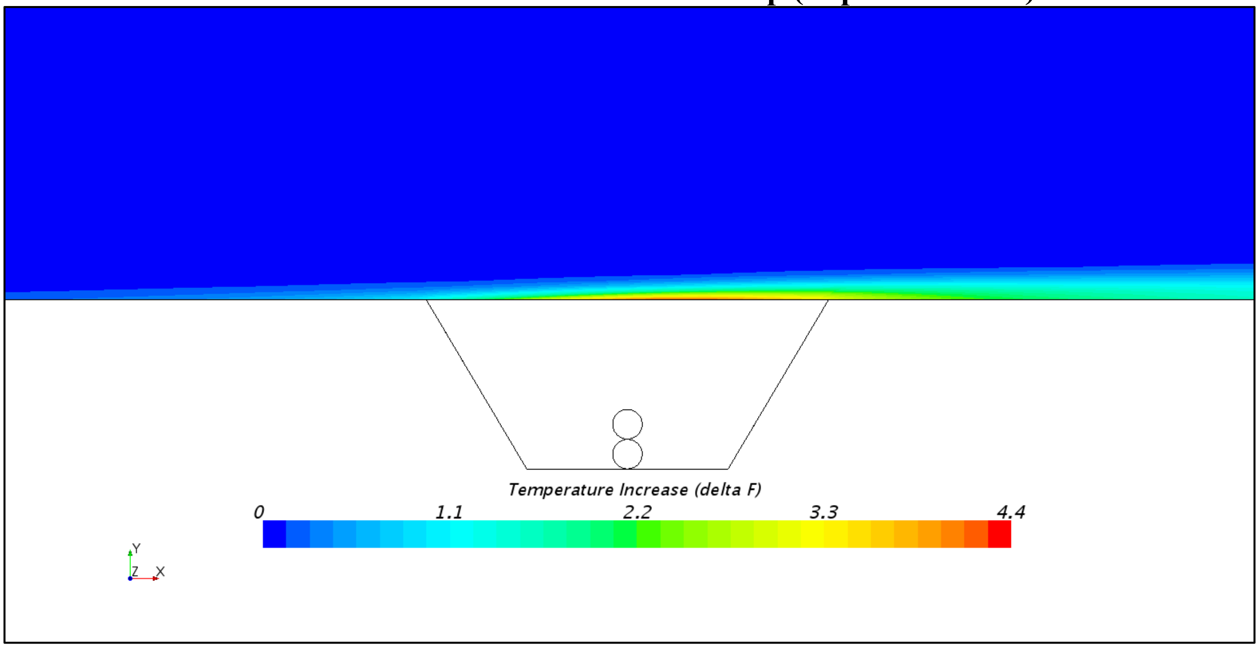
As bentonite clay has a specific gravity greater than water, it will pool in the lower end of the sump pit next to the exit point. Divers will recover the bentonite using an underwater hydraulic pump. The collected water bentonite mix will be pumped into tanks on the drill support barge. The slurry will be disposed of as per applicable permit requirements at an approved upland facility. While fluid will be circulated during operation, the peak volume of fluid will occur during the last stage of installation, pipe pull-back. As the pipe is pulled into the borehole the drilling fluid inside the borehole will be displaced. The estimated volume of drilling fluid that would need to be displaced is 51,000 gallons. As the pipe is pulled in from the lake to the land, the majority of the displaced drilling fluid will be forced to the land side of the HDD bore where it will be recovered and stored for upland disposal. While the majority of the fluid will be forced to the land side, sufficient storage capacity for the entire displaced volume of fluid will be available on each side of the borehole.

During HDD operations the fluid pressure during drilling and reaming activities has the potential to force the fluid into pre-existing weak spots in the soils, potentially working to the surface and resulting in an inadvertent fluid release. While drilling fluid seepage associated with inadvertent returns is most likely to occur near the bore entry and exit points where the drill head is shallow, inadvertent releases infrequently occur at other locations along the directional bore path. The HDD contractor will implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan documenting the planning and operational procedures for the monitoring, reporting, containment, and cleanup of inadvertent releases associated with the Project, should they occur. In the event of an inadvertent release in water, a dive team will immediately be called on to contain the fluid release. Once the fluid is contained drilling will continue and remediation will begin. The drilling fluid recovered will be disposed of at an approved upland facility.

Once the cables are installed and operational, no water quality effects will occur from normal operations. Heat can be generated as electricity moves through the cables, which could disperse into surrounding sediments and ultimately result in the localized warming of water. The Applicant calculated thermal effects to water quality from operation of the Project (Exponent 2015*b*, Appendix G). Using a set of conservative variables in terms of soil thermal properties and water velocity, the largest increase in temperature was found to be approximately 4.4°F (2.4°C) at the water/soil interface on the lakebed. The point of highest temperature increase was found to be approximately 9 inches (23 cm) in the downstream water flow direction from the cables' centerline. The physical extent of the so-called "warm region" is very limited (Figure 5.3-1). For example if one were to move vertically by only 4 inches (10 cm) from the point of highest temperature increase on the lakebed, the temperature increase would drop to a mere

0.2°F (0.1°C) (Exponent 2015*b*). Changes in water temperature are expected to be negligible and quickly dissipate, and the presence and operation of the transmission line would therefore not be expected to cause significant impacts to water temperature.

Figure 5.3-1 Calculated thermal effects of Project transmission line: bedrock trench shown is 3 ft wide at bottom and 2.5 ft deep (Exponent 2015*b*).



5.3.2 Underground Segment and Converter Station

5.3.2.1 Wetlands

As discussed in Section 4.3.2.1, wetland resources have been identified within the proposed underground cable route. Wetlands in the proposed Project have been substantially influenced by adjacent roadways, fields, and other developed features. Temporary impacts to wetlands are expected to occur during the construction and maintenance activities associated with the proposed Project. Since the cable route is proposed to occur in mostly in existing public roadway ROWs and existing driveways, no significant changes in hydrology would likely occur and no wetlands would be permanently altered.

The selected location and layout of the Erie Converter Station will be built close to the existing Penelec Erie West Substation to minimize impacts to wetlands. There are wetlands in the wooded area on the western third of the Erie Converter Station property. However, the woods and wetlands are not proposed to be disturbed, with the possible exception of minimal disturbance associated with the underground AC cables to the Erie West Substation POI. The post-construction stormwater management plan for the Erie Converter Station will include features such that no increase in peak flow or peak volume will be associated with the permanent structure, therefore no substantial changes to hydrology will result. Temporary construction laydown and staging areas are identified in Table 2.3-1 and locations are shown in Appendix A.

A summary of temporary and permanent impacts by type of wetland is provided in Table 5.3-1.

Soils and vegetation will be disturbed within temporary wetland impact areas to accommodate project construction, including trenching to install the cable or temporary installation of timber matting for vehicle and equipment access. All disturbance within emergent (PEM) wetlands is considered temporary since these wetlands will be restored after construction is completed and the new emergent vegetation will allow for the same pre-construction function and value in these areas. Permanent wetland impacts primarily involve the conversion of forested (PFO) wetlands to a PEM or scrub-shrub (PSS) condition after construction is completed. Long term maintenance of the cable will require these impacted wetland areas to remain unforested. In addition, approximately 0.02 acres of cable will be installed underneath some PEM wetlands through a HDD construction method. Although, this construction technique avoids the need to disturb and soil or vegetation in these wetland areas, they are considered permanent wetland impacts by the Pennsylvania DEP and are included in this summary. Mapped wetlands within and adjacent to the Underground Segment are listed in Table 5.3-2 and shown in the Project alignment drawings in Appendix A.

Table 5.3-1 Proposed impacts to wetlands associated with the Project.

NWI Type	Only Temporary Construction Impacts (acres)	Permanent Construction Impacts (acres)*
Palustrine Emergent Wetlands	0.8	0.02
Palustrine Scrub Shrub Wetlands	0.0	0.0
Palustrine Forested Wetlands	0.0	0.99
Total Impacts	0.8	1.01*

* The calculation of permanent PEM wetland impacts shown in the table above includes areas where cable will be installed beneath wetlands by an HDD method. This calculation is provided in accordance with guidance provided by PADEP staff. However, the functions and values of the wetlands above the HDD borings are not expected to be impacted and their will be no ground disturbance in the wetlands. The Dam Safety and Encroachments Act and Chapter 105 rules require permits for placement of structures in, along or across any wetland. The statute and §105.18a do not specify that one must describe a project that goes under a wetland as having a permanent impact on that wetland.

Table 5.3-2 Potential wetland effects associated with the Project.

Unique Identifier	Dominant USFWS Classification[1]	Associated Stream	High Quality Watersheds	Proposed to be Crossed by the Project and Impact Type	Delineated Acres	Proposed Impact Acreage
WPA-KAS-001	PFO	Abutting SPA-KAS-001 (UNT to Lake Erie)	No	Yes, Tree Clearing	0.32	0.07
WPA-	PFO, PEM	Adjacent to	No	Yes, Tree	PEM: 0.34	PEM:

Unique Identifier	Dominant USFWS Classification[1]	Associated Stream	High Quality Watersheds	Proposed to be Crossed by the Project and Impact Type	Delineated Acres	Proposed Impact Acreage
KAS-002		SPA-KAS-001 (UNT to Lake Erie)		Clearing	PFO: 3.92	0.01 PFO: 0.7
WPA-KAS-004	PFO	Adjacent to SPA-KAS-006 (UNT to Lake Erie)	No	Yes, Tree Clearing	3.91	0.4
WPA-KAS-012	PFO	Abutting Unidentified Stream (UNT to Crooked Creek)	Yes	Yes[2]	1.64	0.0 0.01[3]
WPA-KAS-018	PEM	Abutting UNT to Crooked Creek	Yes	Yes	0.66	0.3 0.01[3]
WPA-KAS-028	PEM, PSS, PFO	Abutting SPA-KAS-016 (Crooked Creek)	Yes	Yes[2]	PEM: 0.27 PSS: 0.17 PFO: 0.27	PEM: 0.0 PSS: 0.0 PFO: 0.0
WPA-KAS-029	PEM, PSS	Abutting SPA-KAS-017 (UNT to Crooked Creek)	Yes	Yes[2]	PEM: 0.11 PSS: 0.03	PEM: 0.0 PSS: 0.0
WPA-KAS-030	PEM	Isolated	Yes	Yes[2]	0.03	0.0 0.01[3]
WPA-KAS-034	PEM	Abutting SPA-KAS-020 (UJNT to Crooked Creek)	Yes	Yes	0.02	0.0
WPA-KAS-035	PEM	Abutting SPA-KAS-021 (UNT to Crooked Creek)	Yes	Yes, Trenching	0.13	0.01

Unique Identifier	Dominant USFWS Classification[1]	Associated Stream	High Quality Watersheds	Proposed to be Crossed by the Project and Impact Type	Delineated Acres	Proposed Impact Acreage
WPA-KAS-036	PFO	Abutting SPA-KAS-026 (UNT to Crooked Creek)	Yes	Yes	0.32	0.0
WPA-KAS-040	PEM	Abutting SPA-KAS-019 (Crooked Creek)	Yes	Yes	0.54	0.2 0.01[3]
WPA-KAS-041	PEM	N/A	Yes	Yes	0.55	0.1 0.01[3]
WPA-KAS-042	PFO	N/A	Yes	Yes	0.59	0.01

1. Palustrine Emergent Wetlands (PEM), Palustrine Scrub-shrub (PSS), Woody Wetland Forests (PFO), Unnamed Tributary (UNT).
2. Wetland will be crossed by the proposed cable or is located within the cable route corridor. The HDD construction method under USACE regulation will avoid all impacts to the wetland.
3. According to guidance provided by PADEP staff, impact calculation includes the area where the cable will be installed beneath the wetland by HDD construction method.

Temporary impacts may occur as part of repair or vegetation maintenance activities but impacts would be localized and the affected area would be restored. In areas where the cable is co-located with roads, the municipality's regular road berm maintenance would protect the cable. Most of the wetlands located within the regularly maintained corridor would be restored to the same value and quality as pre-construction conditions.

As mitigation for the relatively limited areas of wetlands and other aquatic habitat that would be permanently impacted, the Project has submitted a conceptual mitigation plan that proposes development of replacement wetlands. The proposed wetland compensatory mitigation plan includes the proposed creation of approximately 2.13 acres of PFO wetlands, restoration of 2.27 acres of PFO wetlands, enhancement of 0.69 acres of PEM wetlands, preservation of 0.23 acres of upland forest buffer, and establishment of an 0.02 acre stormwater treatment area within the same watershed as the Project (Crooked Creek-Frontal Creek Lake Erie Watershed [HUC: 04120107]). The proposed 5.34 acre wetland mitigation site will be preserved in perpetuity with a conservation easement or restrictive covenant. A conceptual mitigation plan is provided in Section T of the PADEP/USACE Joint Permit Application submitted in January 2016.

5.3.2.2 Surface Waters

The majority of the proposed transmission cable route follows existing roadway ROWs in order to minimize impacts to surface waters. The impacted waterbodies are summarized in Table 5.3-3 with details for each crossing shown in Table 5.3-4 (waterbodies are shown on the resource maps in Appendix A). Six laydown areas have been identified (see Section 2.3.2.1). Ground disturbance would occur during cable installation from clearing, trenching, and HDD or Jack & Bore activities. These activities could result in erosion and subsequently impact the water quality of nearby surface waters. During clearing activities, approximately 12.4 acres (5.0 hectares) of forested area would be cleared to accommodate construction activities. Trenching would occur in approximately 2,500 ft (762m) increments along the proposed cable route. In order to minimize erosion, spoil should be stockpiled at least 50 ft (15 m) from wetland edges or streams to the extent logistically possible, and approved BMPs would be implemented in each instance. Trench backfilling would immediately follow the cable installation and restoration would occur within a few days.

HDD or Jack & Bore would be used for longer crossings where open trenching is inappropriate. As opposed to trenching, HDD has the potential for inadvertent returns, when drilling fluids leak through an unidentified weakness or fissure in the soil. This could cause drilling fluid to become suspended or dispersed in water or on land. The HDD contractor will implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan (Attachment 1 of the PADEP/USACE Joint Permit Application submitted in January 2016); this plan describes how to identify, contain, and remediate releases of drilling fluid. Impacts on water quality from this activity would be minimized by building sump pits at the entry and exit point to contain drilling fluids from normal operations and following the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan.

Table 5.3-3 Proposed impacts to waterbodies*.

Stream Type	Only Temporary Impacts (crossing width - linear ft)	Only Temporary Impacts (crossing width - square ft)	Permanent Impacts (linear ft)	Permanent Impacts (square ft)
Ephemeral	321	161	0	0
Intermittent	43	129	19	25
Perennial	1,239	7,185	98	131
Total Impacts	1,603	7,475	117	156

* The calculation of permanent waterbody impacts shown in the table above includes areas where cable will be installed beneath waterbodies by an HDD method. This calculation is provided in accordance with guidance provided by PADEP staff. However, the functions and values of the waterbodies above the HDD borings are not expected to be impacted and their will be no ground disturbance adjacent to or within the waterbodies. The Dam Safety and Encroachments Act and Chapter 105 rules require permits for placement of structures in, along or across any body of water. The statute and §105.18a do not specify that one must describe a project that goes under a waterbody as having a permanent impact on that waterbody.

Table 5.3-4 Potential waterbody effects associated with the Project.

Unique Field Identifer[1]	Waterbody	Watershed Hydrologic Unit Code	Stream Type	Chapter 93 Classification[2]	Class A Wild Trout Waters[3], Wild or Scenic River[4], Streams that Support Natural Reproduction of Trout[5]	Stocked Trout or Approved Trout Waters[6]	Potential USACE Classification[7]	Bank-to-Bank Width (feet)	Ordinary High Water Mark (feet)	Crossing & Proposed Method	Proposed Impacts (linear feet)	Anticipated FEMA mapped Floodplain or DEP regulated Floodway Impacts (acre)
SPA-KAS-001	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	23.7	0.67	Yes, Open cut, flume, or dam and pump	925.9	1.70
SPA-KAS-002	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	5.1	0.50	Yes, HDD	42.0[9]	0.02
SPA-KAS-004[8]	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	5.1	0.33	Yes, Open cut[8]	50.5	0.31
SPA-KAS-005[8]	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	10.0	1.00	Yes, Open cut[8]	50.6	0.13
SPA-KAS-006[8]	UNT to Lake Erie	Turkey Creek-Frontal Lake Erie; 041201010702	Perennial	CWF, MF	No	No	RPW	5.2	2.00	Yes, Open cut[8]	51.4	0.12
SPA-KAS-016	Crooked Creek Crossing #1	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	8.0	1.00	Yes, HDD	52.1[9]	0.02
SPA-KAS-016	Crooked Creek Crossing #2	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	30.0	1.00	Yes, HDD	72.0[9]	0.49
SPA-KAS-017	UNT to Crooked Creek	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	1.0	0.17	Yes, HDD	0.0	0.05[10]
SPA-KAS-018[8]	UNT to Crooked Creek	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	3.3	0.17	Yes, Open cut[8]	43.3	0.09
SPA-KAS-020[8]	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	3.7	0.50	Yes, Open cut[8]	60.0	0.00
SPA-KAS-021[8]	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	3.5	0.50	Yes, Open cut[8]	50.6	0.12
SPA-KAS-025[8]	UNT to Crooked Creek #1	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	6.9	0.17	Yes, HDD	163.6[11]	0.26[11]
SPA-KAS-025[8]	UNT to Crooked Creek #2	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	4.9	0.17	Yes, HDD	--[11]	--[11]
SPA-KAS-025[8]	UNT to Crooked Creek #3	Crooked Creek; 041201010701	Intermittent	HQ-CWF, MF	No	Yes	RPW	3.3	0.17	Yes, HDD	--[11]	--[11]
SPA-KAS-026[8]	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	4.0	0.50	Yes, Open cut[8]	50.2	0.12
SPA-KAS-027	UNT to Crooked Creek	Crooked Creek; 041201010701	Perennial	HQ-CWF, MF	No	Yes	RPW	2.0	0.25	Yes, HDD	0.00	0.01[10]
SPA-KAS-030	UNT to Crooked Creek	Crooked Creek; 041201010701	Ephemeral	HQ-CWF, MF	No	Yes	Non-RPW	2.0	0.25	Yes, Jack and Bore	0.00	0.04
SPA-KAS-031	UNT to Crooked Creek	Crooked Creek; 041201010701	Ephemeral	HQ-CWF, MF	No	Yes	Non-RPW	0.5	0.25	No	0.00	0.81
PPA-KAS-002	-	Crooked Creek; 041201010701	Pond	HQ-CWF, MF Watershed	No	No	-	-	-	No	0	0

Notes: UNT = unnamed tributary HQ-CWF = high quality, coldwater fisheries MF = migratory fishery passageway RPW = relatively permanent water

1. Unique identifier assigned to feature during field surveys and correlates with mapping nomenclature.
2. Chapter 93 Classification based on Chapter 93 Water Quality Standards available at: http://www.pacode.com/secure/data/025/chapter93/chap93toc.html. Accessed August 2014.
3. Class A Wild Trout Waters are based on the PA Fish and Boat Commission's Class A Wild Trout Waters created December 16, 2013. Available at: http://fishandboat.com/classa.pdf. Accessed August 2014.
4. Wild and Scenic Rivers based on the National Wild and Scenic River System available at: http://www.rivers.org/. Accessed August 2014.
5. Natural trout producing waters are based on the PA Fish and Boat Commission's Stream Sections Supporting Natural Reproduction of Trout. May 2014. Available at: http://fishandboat.com/trout_repro.htm. Accessed August 2014.
6. Approved Trout Waters are based on the PA Fish and Boat Commission's Regulated Trout Waters website available at: http://fishandboat.com/fishpub/summary/troutregs_sw.htm. Accessed August 2014.
7. Jurisdictional classification must be confirmed by USACE.
8. Streams will be crossed by placing duct bank beneath the culvert crossing of the stream. If the culvert is in poor condition, the culvert will be replaced and the stream will be diverted via flume, pump around, or cofferdam. Total linear feet of impacts and estimated floodway impacts for all three crossings of SPA-KAS-025 are included for crossing #1.
9. Based on guidance provided by PADEP, the impacts to regulated wetlands listed in this table include the area of HDD crossings underneath the wetlands. However, such HDD crossings involve no disturbance of the wetlands; and the functions and values of the wetlands crossed under by HDD method are not affected.
10. Waterbody will not be crossed by the cable, but LOD project indicated floodway impacts.
11. Meander stream that is crossed by the cable route centerline three (3) times in a short segment of the proposed route. Impact calculations are combined and presented as one.

The proposed Project would involve soil disturbances of more than 1 acre (0.4 hectares) within a high quality watershed, and therefore, would be required to obtain an Individual Permit under the NPDES Permit for Stormwater Discharges Associated with Construction Activities. Erosion and increased sedimentation in stormwater runoff would occur in active construction areas, but would be managed in place with BMPs as described in an E&SC Plan. The E&SC Plan would follow PADEP Erosion and Sediment Pollution Control Program Manual (PADEP 2012), which specifies BMPs for addressing erosion and sedimentation control, and would be approved by PADEP. Applicant-proposed measures that would be implemented to minimize impacts on water quality would include use of erosion and sedimentation control and stormwater BMPs during transmission line installation. In the special protection watersheds (HQ or EV), more stringent criteria are to be used to design the BMPs for the site. Nondischarge alternatives are to be used wherever possible. If during a 2-year/24-hour storm event, it is not possible to avoid increasing the rate or volume of runoff from disturbed areas to a special protection watershed, Antidegredation Best Available Combination of Technologies (ABACT) BMPs must be used to the fullest extent possible. BMPs with moderate sediment removal efficiencies (e.g., barrier/riser sediment traps) are ABACT for HQ watersheds. BMPs with high sediment removal efficiencies (e.g., compost filter sock) are ABACT for HQ and EV watersheds. The Project has been designed and will be implemented to meet the ABACT requirements.

The Erie Converter Station and the cable will be installed in accordance with an approved E&SC Plan and the Stormwater Management Plan. Onsite BMPs will be used before, during and after the earth disturbance activity. The BMPs contained in the Project's proposed E&SC Plan for the Erie Converter Station include:

- Rock construction entrance with wash rack to prevent soil loss from traffic leaving the site.
- Compost filter sock will be placed downgradient of the disturbed areas to prevent the transportation of sediment offsite. Sediment will be removed from the filter sock when accumulations reach one half the height of the sock.
- Diversion channels will be constructed to divert runoff from upgradient areas around the construction site.
- A conveyance channel will be constructed to convey runoff from the construction site to the proposed sediment basin. This channel will be converted to a vegetated swale as a post-construction stormwater management BMP.
- A sediment basin will be constructed to collect, treat, and discharge onside runoff water from disturbed areas.
- Erosion control mulch blankets will be installed on a permanent slopes 3H:1V and steeper.
- Riprap aprons will be installed at all storm drainage pipe outfalls (except where a level spreader is used).
- Vegetation stabilization consists of final grading, topsoil placement, seeding, and mulching. Permanent vegetation stabilization will be applied to all earth-exposed areas that are not otherwise covered with gravel, pavement, buildings, etc. If weather conditions are favorable, permanent seeding will take place within 7 days of final grading being achieved. Otherwise, temporary seeding and mulching will be implemented until conditions become favorable for the establishment of permanent vegetative cover. Temporary seeding and mulching will be applied to earth-exposed areas where earthwork is delayed or stopped for a period of 4 or more days. Temporary vegetative

stabilization will be maintained until earthmoving recommences, or until the temporary vegetative stabilization is replaced by permanent vegetative stabilization.

- Weighted sediment filter tubes are proposed downgradient of Diversion Channel D and the proposed driveway culvert outlet. Weighted sediment filter tubes are tube-shaped devices filled with nonbiodegradable filter materials for longevity and reuse. Weighted sediment filter tubes may be placed in areas of concentrated flow in lieu of rock filters if installed according to manufacturer's recommendations and the details shown on the E&SC Plan drawings. When the area tributary to a tube has been stabilized, an undamaged tube may be removed and used at another location. Where the total length is greater than the length of individual tubes, place multiple tubes with overlap of 12 inch minimum (or as specified by manufacturer).

Riparian Buffer Areas

As noted, portions of the Project involve placement of underground transmission line facilities across (under) waterways within the Crooked Creek watershed that are classified as High Quality (HQ) waters, and are therefore potentially subject to the provisions of 25 Pa. Code §102.14 relating to riparian buffers. As set forth in the PADEP/USACE Joint Permit Application filed by the Applicant in January 2016, the Project's stream crossings have been designed to minimize impacts through use of construction methods (e.g., HDD drilling) that avoid or minimize impact to the riparian buffer areas, and by installations within existing road rights-of-way.

Within the Crooked Creek watershed, with limited exceptions, the Project has been designed to avoid disturbance within 150 ft of Crooked Creek and tributary streams within the Crooked Creek watershed. One exception occurs at the Erie Converter Station site, where the limit of disturbance is less than 150 feet of Stream SPA-KAS-029, although none of the disturbed area that is within 150 feet of that stream involves earth disturbance within 100 feet of any stream, wetlands, or other surface water. With respect to this situation at the Erie Converter Station site, a riparian buffer equivalency demonstration is provided with the NPDES Permit application, but no offsetting measures are required under Pennsylvania Act 162 of 2014, 35 P.S. §691.402(c)(2). There are also several exceptions along the cable route, but for each of the limited areas where disturbance is proposed within 150 feet of a stream, the disturbed area is within an existing roadway or road right-of-way which will be restored to existing conditions. Since the land surface will not be permanently altered at any of these riparian areas along the cable route, no riparian buffer equivalency demonstration or offsetting is proposed.

5.3.2.3 Groundwater

Construction activities, including trenching, would generally occur within 6 ft (1.8 meters) of the surface and would not likely result in significant impacts on the aquifer. During the HDD process, drilling fluid, a combination of water and bentonite clay, is used to stabilize the sides of the borehole and carry the cuttings out of the borehole. Bentonite clay is a naturally occurring mineral that is nontoxic and is denser than the water. If drilling fluid is spilled during HDD activities, the bentonite clay particles would become trapped (via absorption) by the soil and would aggregate within soil pore spaces. The HDD contractor will implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan (to identify, contain, and remediate releases of drilling fluid, in the event that such releases occur. The monitoring program would consist of visual observations in the surface water at the targeted drill exit point and monitoring of the drilling fluid volume and pressure within the borehole. Visual observations of drilling fluid on the surface or in nearby water, or excessive loss of volume or pressure in the borehole would trigger response actions by the HDD operator, including halting drilling activities and initiating cleanup of released bentonite clay. Therefore, significant impacts on groundwater are not anticipated from HDD operations.

5.3.2.4 Floodplains

Floodplains exist within the proposed Project area at stream crossings. Temporary disturbance to approximately 4.3 acres of floodplain areas would occur during cable installation from clearing, trenching, and HDD activities, including clearing of vegetation, ground disturbance, and related construction activity. To minimize impacts on floodplains during construction, BMPs such as erosion and sedimentation controls and restoring pre-existing ground grading, would be implemented and the area would be restored within a few days after cable installation. Also, a number of floodplain crossings would use HDD methods, which would avoid disturbance of the floodplain.

Once construction commences, no permanent above-ground alterations or new impervious surfaces would occur that could impact flood storage, infiltration, or flooding hazard. Because the transmission line would be buried, there would be no permanent effects on the FEMA mapped floodplains or the PADEP regulated floodways from construction of the proposed Project. The elevation and profiles of floodplains will be restored to pre-existing conditions. During operations there is no impact on water levels or the potential flood mitigation capacity of the floodplain. Therefore, effects from operation and maintenance of the terrestrial portion of the transmission line are not expected to occur.

5.4 Aquatic Habitat and Species

This section discusses potential environmental effects to aquatic habitat and species. Potential effects to protected and sensitive species are discussed in Section 5.6.

5.4.1 Lake Segment

The proposed Project in U.S. waters will cross primarily silt/clay and sand/silt, and approximately 1.3 mile of bedrock (Figure 4.2-1, CSR 2015). The near shore waters consist of the bedrock habitat and the softer sediments are found in the deeper waters of the proposed Project route.

In the first year, HDD and bedrock trenching would require between three to four months. During the second year, a pre-lay grapnel run and the cable installation would occur, with jet plowing in soft sediments along the lake bottom (or by water jetting in the deepest portion of the lake). Prior to excavating the trench, a grapnel run would occur along the route. The purpose of a grapnel run is to locate any immovable obstructions, such as large boulders, and to remove any smaller obstructions such as abandoned fishing gear, rocks or wood. During this process a grapnel chain is towed along the bottom by a self-propelled barge. The grapnel will penetrate the lake bottom to a maximum depth of 1 m (3 ft), depending on sediment type. If an obstacle were encountered, the barge would stop, drop anchor, and send a diver to the bottom, before the obstacle would be winched to the surface for disposal. Debris would be disposed of at an upland facility. If an object is too large, or not movable, the location would be recorded and the route modified to avoid the obstacle during the cable installation.

At the Erie landfall, bedrock is either exposed or very close to the surface for a substantial distance out to deeper water (about 1.3 mile). In this nearshore area, a trench will be excavated in the bedrock from the exit of the HDD bore to the softer lakebed material where the sediment overlay is deep enough that jet plow burial can be utilized. In installing a trench, any sediment overburden will be excavated and sidecast. A trench would be excavated in the bedrock would be approximately 6 ft (1.8 m) and the width would be about 4 ft (1.2 m). It is expected that a barge mounted drill will drill 4 inch stemmed charge blast holes to a depth of 4 ft below planned excavation. Additional blast holes will be required at similar intervals for the offshore sump pits will be excavated in the rock at the exit of the HDD (one bore for each HVDC cable and one bore for the fiber optic cable). Each of the three sump pits will be approximately 20 x 10 x 7 ft (6.1 x 3.1 x 2.1 meters). The holes will be packed with low level Hydromite emulsion explosive and detonated. The blasted rock will be removed by a barge mounted excavator and side cast. The trench will be bedded and backfilled with a sand and gravel mixture (originating from an on-land source). Drilled and excavated material will be side cast spread on the lake bottom. Approximately 20 to 30 stemmed charges arranged in a zig-zag drill pattern over a trench length of 30 to 40 ft (9 to 12 m) will constitute an individual charge or “shot”. One shot would occur per day. This pattern would yield an approximate daily advance rate of 40 to 50 ft per day (12 to 15 m per day). Therefore completion of the blasting portion of the Project, assuming shots would occur on consecutive days, would require approximately 130 days during the May to November timeframe.

The second phase would be installation of the transmission cables by the use of a towed jet plow. This very common technique for burying submarine cables and uses the combination of a plow share and high pressure water jets to cut a trench in the lakebed. The installation process would be conducted using a dynamically positioned cable ship and towed plow device that simultaneously lays and embeds the underwater transmission cables in a trench. A dynamically positioned cable ship or barge would use thrusters as a propulsion system to tow the plow without the use of anchors. The jet plow would be about 15 ft wide, with skids 36 ft long and 2.7 ft wide. The plow share is around 12 inches wide.

For the deepest part of the route, from the Canada/U.S. border at KP 47 to approximately KP 55 (up to about 14 percent of the U.S. Underwater Segment), water jetting may be used instead of a jet plow. As mentioned in Section 2.4.2.3, water jetting methods are similar to jet-plow installation methods in that both use water to fluidize sediment within the cable trench to facilitate cable burial. However, the jet-plow is supported on the lake bed by pontoons or skids and pulled along the sediment surface. Unlike the jet-plow, there is no mechanical force used to pull the plow through the sediment and water jetting relies solely on the weight of the cable to sink through the fluidized sediment to the desired burial depth.

Excavation of the trench in U.S. waters (both bedrock and in sediment) would result in a temporary only disturbance of approximately 12.7 acres. Many of the water quality modeling efforts for similar projects that have undergone regulatory review and gained regulatory approval have used a jet plow sediment release fraction of between 25 and 30 percent for similar fine-grained sediments as present in Lake Erie[13]. Because 70 to 75 percent of the sediment in the jet plow or water jetting trench would return to the trench, no fill would be added to the trench. A depression would be expected to occur in the lake bottom over the installed cable, and the contours of the lake bottom would be expected to return to pre-installation conditions through natural deposition to the lakebed. Thus, the only permanent disturbance to the seabed would be the presence of the two 6-inch cables and the telecommunications cable.

HDD operations have the potential to release drilling fluids to the surface through inadvertent returns. The HDD contractor will implement the Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan. Because drilling fluids consist largely of a bentonite clay-water mixture, they are generally considered non-toxic. While drilling fluid seepage associated with inadvertent returns is most likely to occur near the bore entry and exit points where the drill head is shallow, inadvertent returns infrequently occur at other locations along the directional bore path.

5.4.1.1 Fish

Sediment Disturbance

HDD, the grapnel run, trenching, and low level blasting would disturb sediment and, in areas of soft sediment, increase turbidity in the water column resulting in a temporary, short term indirect impact to fish along the proposed Project route. Construction disturbance would displace the available food sources directly within the footprint of the disturbed areas and result in a temporary, short-term impact to the local fisheries. In general, fish are highly mobile species and would be able to avoid any direct impacts from construction activities, as well as moving into nearby, unaffected area of the lake to seek refuge and to feed or spawn. Turbidity can have an effect on all life stages of fish. Increase in sedimentation could cause pelagic eggs to sink to the bottom and smother demersal eggs, reduce growth rates and increase mortality in larvae, and cause gill abrasion resulting in reduction of oxygen absorption in juveniles and adults (Berry et al. 2003). Diversity and production of fish species in the nearshore waters is higher than in offshore waters (Edsall and Charlton 1997). However, the bottom composition along the Pennsylvania shoreline is dominated by bedrock and therefore, the nearshore construction activities from the proposed Project will result in minimal increase in sedimentation.

As described in Section 4.4, habitat containing large/rocky substrates off the shores of Pennsylvania offer spawning and nursery habitat for such species as lake whitefish, rainbow smelt, emerald shiner, spottail shiner, fathead minnow, channel catfish, stonecat, trout-perch, white bass, smallmouth bass, rainbow darter, johnny darter, yellow perch, walleye and freshwater drum (Goodyear et al., 1982). If lake trout do attempt to spawn in Lake Erie, it would be in similar large rocky substrates mentioned above; however, no evidence of natural spawning of lake trout has been observed during the more than 30 years of restoration efforts (NYSDEC

[13] Due to their similarities, prior studies have considered the rate of sediment resuspension from water jetting or jet-plowing to be similar or the same for the purpose of modeling sediment plume and dispersion from cable installation (Jiang et al. 2007).

2014, CWTG 2014). The majority of this nearshore spawning and rearing habitat will be avoided by the use of HDD for approximately the first 2,000 ft from the U.S shore, where spawning, feeding and rearing is common among a variety of species. CSR (2015) confirmed the extent of bedrock from the HDD bore to be approximately 0.9 mile (1.5 km), with some pockets of post glacial sand located toward the northern extent of the bedrock. Some limited spawning habitat may exist over the bedrock area and pockets of post glacial sand found near the northern extend of the bedrock on the U.S. side. Fish will likely avoid this area during construction activities and move to adjacent similar habitats for spawning. In addition, the small spatial extent of the impact in this area will have little to no population level effect on the spawning any fish species in the area. The remaining Project route in U.S. waters primarily occur over post glacial sand/silt, lacking aquatic vegetation, rock shoals or other structural habitat features that fish utilize for spawning (CSR 2015). Minimal spawning effects may occur to species that utilize fine or sandy substrate, such as the eastern sand darter. These effects are discussed in greater detail below, including within a draft Biological Assessment for the eastern sand darter (Appendix J).

It is also important to note that many of the fish species described in this report spawn in nearshore areas, primarily in spring, so the utilization of HDD methods in the near shore areas will limit impacts to spawning fish populations. Long term impacts associated with bedrock blasting or excavation may include increased spawning habitat where sidecast rock is dispersed in nearby areas currently predominated by silt and sediment.

In the deeper waters (greater than 10 m [32.8 ft]) of Lake Erie, where the bottom substrate is dominated by sand, silt, and clay, the jet plow would bury the cable and the trench will begin to backfill immediately with the disturbed sediment resulting in an increase in localized turbidity. As discussed in more detail in Section 5.3.1, results of the Applicant's water quality model (HDR 2015, Appendix E) show that minimal water quality impacts would be associated with the cable installation in Lake Erie and they are limited to temporary impacts that would occur locally within a four hour timeframe after jet plowing or water jetting occurs. The model calculated that TSS concentration increases would reach a temporary peak concentration at the point of installation and then decrease rapidly. TSS concentration increases due to the cable installation are <3 mg/L above observed background lake TSS levels at a distance of 100 meters from the point of installation and within five to eleven vertical meters of the lake bottom (HDR 2015). Construction impacts would be temporary and disturbance associated with construction would be minimized at any one location. The grapnel would penetrate the lake bottom to a maximum depth of 3 ft. It would cause a temporary disturbance of the underlying sediments along the transmission line route where the jet plowing or water jetting will occur.

Construction activities may have other short- and long-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, the bottom feeding fish species (i.e., catfish and sturgeons) would be the primary species attracted to feed as a result of the Project construction. The excavated material through bedrock habitat will be side cast spread along the lake bottom and result in a long-term beneficial impact on fish and benthic communities. Areas of shelter, structure, or cover often are often used by fish for protection from predators (Johnson and Stickney 1989). The crevices between the sidecast rock would provide protection from large predators for the larval and some juvenile fish species. Additionally, it is likely that some sediment would accumulate on the stones and in-between the crevices and would be expected to be colonized by local epifauna community, and therefore, would provide potential food source for the fish community.

HDD Inadvertent Return

In the event that drilling fluids from the HDD operations are released into the water column, these fluids could become suspended in the lake or disperse. If released into the water column, drilling fluids could result in impacts on the adjacent aquatic resources, including increases in turbidity. Measures to prevent or minimize this potential effect include constructing sump pits at the HDD lake exit point to contain drilling fluids; removal of drilling fluids, and implementing an Inadvertent Fluid Release Prevention, Monitoring, and Contingency Plan, and are discussed in further detail Section 5.3.1.

Blasting

As discussed in Section 2.4.2, the cables will be buried in the lakebed by a jet plow or water jetting to protect the cables from damage due to shipping traffic, fishing activity, and ice scour (or by ROV water jetting in the deepest portion of the lake). At and near the Springfield Township, Pennsylvania landfall, bedrock under the lake bed is either exposed or very close to the lake bed surface, preventing cable burial via jet plow. Due to these geological constraints, a trench will need to be excavated by confined stemmed blasting in the bedrock (primarily shale) for approximately 0.9 mile (1.5 km) from the exit of the HDD bore (approximately 2,000 ft [610 m] from the shoreline) to softer lake bed material where jet plow burial can be utilized. Stemmed charges will involve explosive materials placed into holes drilled into the substrate. CSR (2015) confirmed the extent of bedrock from the HDD bore to be approximately 0.9 mile (1.5 km), with some pockets of post glacial sand located toward the northern extent of the bedrock.

The stemmed charge approach to blasting is designed to minimize aquatic impacts. Stemmed charges focus propagation of shock forces into the substrate rather than into the water column, thereby increasing the efficiency of fracturing rock or consolidated materials while minimizing potential impacts to aquatic life and water quality. The trench would have a depth of approximately 6 ft (1.8 m) below the natural top of the bedrock, which includes bedrock and any overlying mud and silt, and would have a width of approximately 4 ft (1.2 m). This method of blasting was selected to minimize potential impacts to the aquatic community, compared to detonations in open water, which would produce both higher amplitude and higher frequency shock waves than contained detonations. The preferred technique of stemming charges has been demonstrated to reduce pressures and lower aquatic organism mortality than the same explosive charge weight detonated in open water (Hempen et al. 2007, Nedwell and Thandavamorthy 1992). The reduced impacts of stemmed charge/subterranean explosions versus mid-water explosions were illustrated by Traxler et al. (1992), who reported no mortalities or observable injuries among largemouth bass, bluegills, and channel catfish held in cages placed directly above and at distances between 7.6 and 91.4 m (25 and 300 ft) from shot holes containing 4.5 and 9.1 kg of dynamite. Their experiments were conducted in a freshwater reservoir in Texas.

A barge-mounted drill will drill 4-inch (10-cm) diameter blast holes to a depth of 4 ft (1.2 m) below the planned excavation grade. Additional blast holes will be required at similar intervals for the offshore sump pits and will be excavated in the rock at the exit of the HDD (one bore for each HVDC cable and one bore for the fiber optic cable). Each of the three sump pits will be approximately 20 x 10 x 7 ft (6.1 x 3.1 x 2.1 meters). The holes will be packed with low-level Hydromite emulsion explosive, stemmed and detonated. The blasted rock will be removed by a barge-mounted excavator and side cast on the bottom. The trench will be bedded and backfilled with a sand and gravel mixture (originating from an on-land source). According to the preliminary blasting plan, approximately 20 to 30 stemmed charges arranged in a zig-zag drill pattern over a trench length of 30 to 40 ft (9 to 12 m) will constitute an individual charge or "shot". One shot would occur per day. This pattern would yield an approximate daily advance rate of 40 to 50 ft per day (12 to 15 m per day). Therefore, completion of the blasting portion of the Project in the U.S., assuming shots would occur on consecutive days, would require approximately 130 days from May to November.

Limited fine sediments are expected to be released into the water column following blasting. Large rock material will be side cast along the route. Any increase in turbidity following blasting is expected to be minimal and will settle quickly.

Blasting and bedrock excavation would cause temporary impulse noise and ground-borne vibration. The applicant evaluated the effects of blasting on fish, and this report is included as Appendix I. This report includes a review of existing studies and research, which is not included in this EA, but the analysis of the potential effects is summarized below. The noise from these activities would potentially have direct effects on nearby fish, if present. Blasting can cause fish mortality, physical injury, auditory tissue damage, permanent and temporary threshold shifts, behavioral changes, and decreased egg and larvae viability (Hastings and Popper 2005). The duration of temporary loss varies depending on the nature of the stimulus, but, by definition, there is generally recovery of full hearing over time (Popper and Hastings 2009).

For this Project, the potential for blasting impacts to occur along the proposed underwater cable route comprised of bedrock was assessed by estimating the extent and duration of the sound pressure level and shock wave associated with the proposed blasting, and comparing these estimates to published guidelines and effects thresholds for fish species that have published criteria. Setback distances specify the distance from the explosive source at which overpressure and particle velocity levels would fall below thresholds at which detrimental impacts on free swimming fishes (overpressure) or fish eggs (particle velocity) are anticipated to occur (Kolden and Aimone-Martin 2013). The resulting setback distance using the proposed charge weights, guidelines outlined in the blasting impact analysis for this Project (Appendix I) are shown in Table 5.4-1.

Table 5.4-1 Setback distance for guideline criteria.

Criteria	Setback Distance
Overpressure (fish)	63.3 ft
Peak Particle Velocity (eggs)	53.1 ft

Source: Timothy 2013

Based on the review of existing literature and studies discussed above, the assumptions used to calculate the setback distance for peak particle velocity and pressure for this Project are conservative. Applying this approach to estimating potential impacts on fish takes into consideration the fact that high risk of lethal or permanent injury would be confined to the immediate vicinity of the explosion where compressive forces of the shock wave predominate. Injuries at greater distances are generally caused by negative pressures associated with overshoot of the gas bubble formed by the explosion and reflection of the shock wave from the water's surface (Popper et al. 2014). The 229 to 234 dB re 1 microPascal threshold for mortality recommended by Popper et al. (2014) corresponds to 40 to 70 psi or 276 to 482 kPa. Thus, the overpressure criteria (7.3 psi and 100 kPa) are very conservative. The potential for lethal impacts to fish would be expected to occur in a small footprint (less than 63.3 ft (19.2 m) from the blast location) surrounding an individual blast.

A single blast per 24 hr period would not be expected to induce strong avoidance responses. Following startle responses, which might last only for seconds to minutes, fishes would return to the general vicinity of the blast. Blasting events will not be long in duration with repeated exposures sustained over periods as long as hours to days. Repetitive detonations over relatively short periods of time, which will not occur for this project, would have a greater risk of TTS and behavior responses. However, for this project we do not expect this to be the case and anticipate a lower likelihood of physiological impact or prolonged behavioral response due to the blasting plan.

Blasting can cause mortality, physical injury, auditory tissue damage, permanent and temporary threshold shifts, behavioral changes, and decreased egg and larvae viability. However, based on the setback calculation for this Project, the extent of direct impacts and mortality is expected to be limited to 63.3 ft (19.2 m). Peak pressures and particle velocities decrease with distance from the detonation and therefore potential impacts are reduced as well, especially when considering the stemming methods proposed and described above.

A number of commercially, recreationally, or ecologically important fish species spawn in shallow Lake Erie habitats in spring and early summer. For example, yellow perch, white bass, walleye, alewives, rainbow smelt and spottail shiner all spawn over sandy, gravel, or rocky substrates in March through April and into May (Daiber 1953, Bodola 1966, Leach and Nepszy 1976, Madenjian et al. 1996, Roseman et al. 1996). In addition, lake sturgeon, which is provided protected status, spawns primarily in tributaries but potentially also over gravel shoals and rocky shorelines in April through early June when water temperatures are between 55 ^{o}F and 64^{o}F (GLIMDS 2015, Dick et al. 2006, Scott and Crossman 1998). Other species spawn during warmer months, including brown bullhead, channel catfish, pumpkinseed, and gizzard shad. Eastern sand darters spawn during June and July (Criswell 2013). Although the required duration of blasting precludes avoiding all potential conflicts with fish spawning seasons, the period from July through November would avoid the peak spawning periods of a majority of species. Starting in June would provide additional flexibility to accommodate severe weather and other unanticipated delays in daily blast schedules while maintaining maximum protection of fishery resources. Extending the work period into fall months would be less problematic from an overall fishery resource perspective because most fall-spawning fishes, such as various salmon species move into tributaries to spawn.

As the criteria also apply to fish habitat, there will be direct impacts to benthic habitats at the blast zone. However, following cable installation, that area is expected to recolonize from recruitment from nearby, unaffected areas of the lake. Recovery for benthic communities varies, ranging from several months to several years, depending on the type of community and type of disturbance (DOE 2013). Depth contours will be returned to pre-existing conditions by filling the trench with upland-derived material. Excavated coarse material will be side-cast and in the long-term provide relief and habitat structure that could offset any temporary disruption of fish access to nearshore habitats.

As discussed above, the setback distance for this Project (e.g., the area of potential impact) was calculated using the following criteria developed by the Alaska Department of Fish and Game. The criteria are summarized below:

The instantaneous pressure rise in the water column in rearing habitat and migration corridors is limited to no more than 7.3 psi where fish are present. Peak particle velocities in spawning gravels are limited to no more than 2.0 in/s (50 mm/s) during the early stages of embryo incubation before epiboly is complete.

The proposed blasting plan was developed using confined stemmed charges as a best management practice to reduce potential impacts to spawning and early life stages of fish species and to satisfy the above criteria. The use of a confined stemmed bore hole blasting technique rather than blasting in open water or at the surface effectively reduces blast forces transmitted through the water column horizontally, and the depth of the blast hole collar was noted to also influence effects. Charge weight was found to be related to the scales of effects, although not in a linear relationship. Implementation of delays between the onset of multiple blasts by installing blasting caps was found to mitigate effects as long as the delay duration exceeded 25 msec, and preferably 50 msec.

The Project may use additional impact avoidance techniques such as blasting mats, deployment of bubble curtains or measures to mobilize and clear fish from the immediate blast area. Because the present Project will involve blasting in areas where fish occupation will change on a daily and seasonal basis, it is impossible to predict with absolute certainty that no fishes will be impacted detrimentally. However, existing guidelines and studies heavily suggest that potentially detrimental impacts will be limited to within the calculated setback distance of 63.3 ft (19.3 m). Both Keevin (1998) and Koschinski (2011) recognized the need for cost/benefit analyses in the selection and execution of additional impact avoidance techniques. For example, implementation of bubble curtains, although known to be effective, have many logistical issues, including size (i.e., required linear dimensions to enclosed the entire blast), provision of adequate compressed air, system movement between blasts, and operational feasibility during periods of marginal or severe weather, that factor into their expense and utility. Given the present Project schedule and location, a bubble curtain is likely unwarranted because the minimum required deployment distance around the blast area would be equal to or greater than the calculated setback distance, and therefore provide little or no protection benefit to fishes beyond the setback distance.

<u>Conclusion</u> - The confined and stemmed blasting method was selected to minimize potential impacts. Stemming charges will result in substantially reduced peak pressures and lower aquatic organism mortality rates than comparable open water detonations (Hempen et al. 2007, Nedwell and Thandavamoorthy 1992). In addition, most impacts from noise would be either temporary or intermittent and it is expected that only a few individuals would be affected relative to the broadly dispersed stocks of any given species in Lake Erie. Of those species in the Project area, many individuals would be expected to react by moving away from noise sources. The amount of explosives used will be limited to the extent possible to avoid noise and vibration impacts on fishes. A detailed blasting plan, consistent with PADEP and PFBC requirements and including appropriate mitigation measures, will be developed prior to construction that will consider limiting noise impacts to fish and other aquatic organisms to the extent practicable (e.g., potential supplemental mitigation measures, including a blast design that minimizes shockwaves, use of blasting mats, deployment of bubble curtains or measures to mobilize and clear fish from

the immediate blast area).

With respect to recovery of fish habitat attributes and functions, the impacted area within the blasting zone is expected to be recolonized from recruitment from nearby, unaffected areas of the lake. Recovery for benthic communities varies, ranging from several months to several years, depending on the type of community and type of disturbance (DOE 2013). Some displacement of fishes from the active construction footprint of the Project will occur, but will be limited in spatial extent at any given time. Depth contours will be returned to pre-existing conditions by filling the trench with upland-derived material. Excavated coarse material will be side-cast and in the long-term provide relief and habitat structure that could offset any temporary disruption of fish access to nearshore habitats.

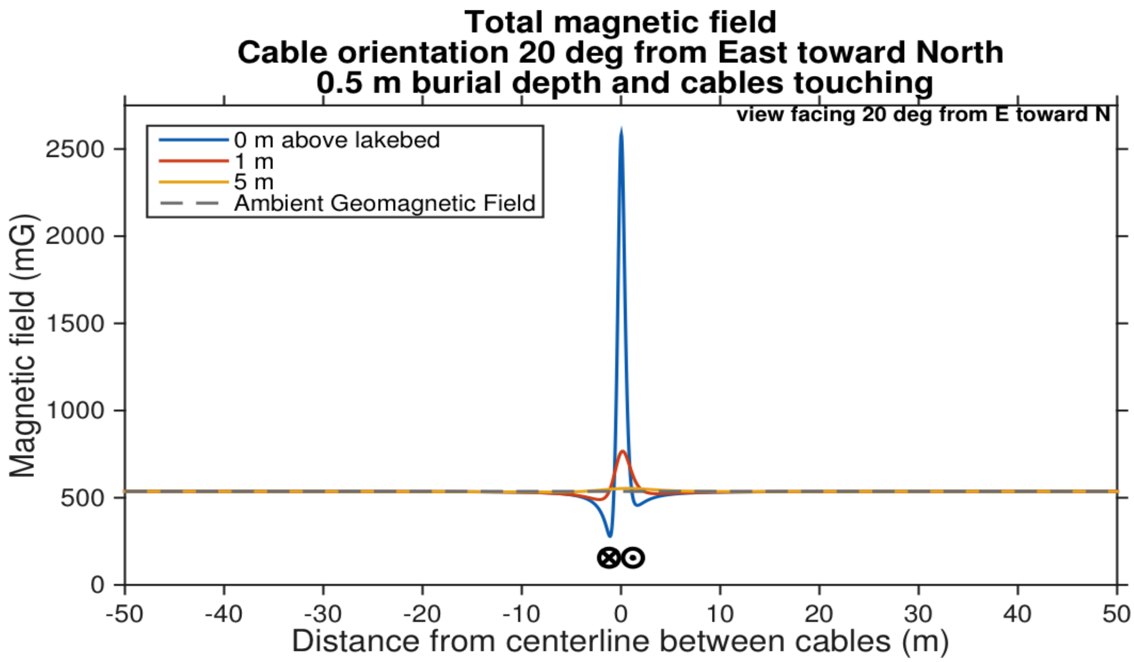
In summary, the potential for negative impacts on fishes and fish habitat can be minimized during blasting by meeting the criteria and using existing BMPs. It is anticipated that potential impacts to the fish community from blasting during construction will be temporary and do not pose a substantive risk to fish populations within the Project area due to their very limited spatial extent.

Electromagnetic Fields

Electromagnetic fields (EMF) occur in nature and also from anthropogenic sources. The earth's magnetic field, currents traveling through the earth's geomagnetic field, and different processes (biochemical, physiological, and neurological) within organisms are examples of natural sources of EMF. The geomagnetic field in the Project area is approximately 536 milliGausse (mG) (Exponent 2015*a*). The flow of electric current through transmission lines and power cables also results in the creation of EMF. Some aquatic species are sensitive to EMF and use these fields for detecting prey or migratory navigation.

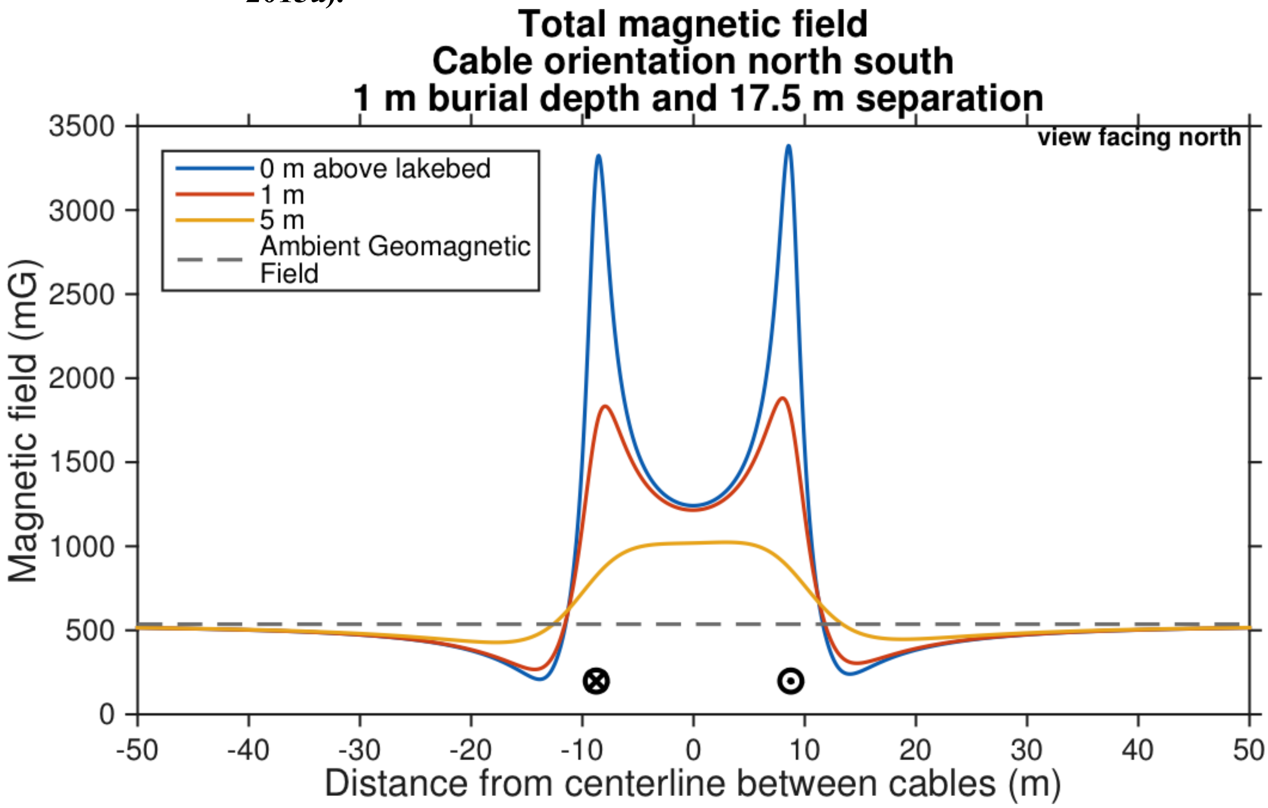
Unlike AC lines, HVDC technology involves direct currents, which create only static fields. The Project's HVDC cables will be shielded, which will virtually eliminate the static electric fields, leaving only static magnetic fields for consideration of potential impacts for this Project (Intrinsik 2014). The Applicant modeled the magnetic fields produced by the transmission line in Lake Erie to further evaluate potential effects of magnetic fields produced by the underwater cable system, and evaluated the potential significance for selected fresh water fish species based upon a review of the relevant literature (Exponent 2015*a*, Appendix F). Magnetic fields diminish very rapidly with distance, so it is only in the immediate vicinity of the transmission line that the magnetic field level will be appreciably different than earth's geomagnetic field (Exponent 2015*a*). The modeling for the bedrock trench or jet plow (soft sediments) portions of the transmission line route, assuming a burial depth of 0.5 meters, the peak field deviation (above the ambient geomagnetic field) is 2,047 mG, but drops to a value of -18 mG (3.3% reduction of the geomagnetic field) at a distance of 5 meters from the cable. Beyond 10 meters from the cable, the field deviation is less than 5 mG. This is a conservative estimate, as it is expected that the cable will be buried 1 to 2 meters for the majority of the route. For example, if the burial depth is 1.5 m, magnetic field level at the lakebed would be approximately 10 times lower (and would correspond to the red line shown in Figure 5.4-1)(Exponent 2015*a*).

Figure 5.4-1 Calculated magnetic field profile for cables strapped together, laid horizontally and oriented at 20° north of east and buried at a depth of 0.5 m (Exponent 2015*a*).



For the HDD portion of the cable (about 0.4 mi), assuming a burial depth of 1.0 meter, the magnetic field deviation (above the ambient geomagnetic field) is 2,846 mG and occurs at the lakebed (0 m) directly over the transmission line. This field is approximately 5.3 times larger than the geomagnetic field, but it diminishes quickly with distance. At a distance of 6.25 meters from the cable (15 meters from the centerline between the cables), the field deviation drops to -250 mG, representing a decrease in the total magnetic field to a value approximately 50% relative to the geomagnetic field. The field deviation decreases further still at larger distances and the overall field becomes nearly indistinguishable from the geomagnetic field at distances greater than 30 m from the transmission line. The burial depth in the HDD section will vary from approximately 1 to 30 meters. For a burial depth of just 1 additional meter, the magnetic field level at the lakebed would decrease by a factor of 2; at greater burial depths the magnetic field level would be even lower (Figure 5.4-2)(Exponent 2015a).

Figure 5.4-2 Calculated magnetic field profile for cables oriented north-south and buried at a depth of 1 m. The cables are separated by 17.5 m (Exponent 2015*a*).



The changes in the ambient geomagnetic field level will be largely limited to the area in the immediate vicinity of the cable. The highest calculated magnetic field level anywhere along the submarine portion of the route is approximately 3,382 mG (a deviation of approximately 2,846 mG from the ambient)(Exponent 2015*a*). This maximum magnetic field level (calculated on the lakebed, directly over the HDD cables) is approximately 0.08% of the general public exposure limit recommended by ICNIRP (Exponent 2015*a*).

Regarding the potential interaction of the change in the magnetic field with fish, a review was conducted of the maximum post-construction static magnetic-field exposures and the research on the behavioral, migratory, physiological, and early life-stage responses of freshwater fish to static magnetic fields. This analysis included species of concern in Lake Erie—cisco, eastern sand darter, lake sturgeon, and steelhead trout—and did not suggest that the Project would sufficiently change the ambient static magnetic field in the very small portion of Lake Erie habitat in the vicinity of the proposed cable, nor threaten the health or performance of these species. Except for one study involving an exposure unlike that associated with the operation of the Project, other studies reported no or very minor reactions to static magnetic fields more than ten-fold greater than those calculated for the LEC when operating at maximum power transfer loads. Regarding potential effects on migration, the change in the magnetic field is not a physical barrier and fish are known to use multiple sensory cues to guide behavior. In the studies reviewed, the responses were readily reversible. As for the electric field induced by fish movement through a static magnetic field, even an assumed high velocity of 1.38 m/s, some 10 times higher than reported, the Project was calculated to induce electric-field levels below the detection threshold of the only species of concern in Lake Erie with electrosensory capabilities[14]. In summary, the change in the static magnetic field associated with the operation of the proposed Project is too small to pose a threat to freshwater species of concern in Lake Erie (Exponent 2015*a*).

In addition, the calculations presented in the Applicant's modeling study were based on very conservative assumptions selected to yield the highest estimates of the change in the magnetic field. Because calculations presented in the report represent conservative estimates, in more typical conditions, the potential change to the background magnetic field environment is expected to be less than described (Exponent 2015*a*). Also, the Project is employing mitigation measures that will reduce magnetic field exposure: (1) use of certain types of cables to reduce emission of magnetic fields (e.g., HVDC transmission systems); and (2) burial of cables to reduce exposure on sensitive species (Intrinsik 2014).

In an email dated March 24, 2015, the PFBC requested additional information regarding an analysis of effects of EMF on hydroacoustic telemetry tags and receivers (the Great Lakes Acoustic Telemetry Observation System currently monitors fish migration in Lake Erie). The telemetry receivers are not close to the cable. In addition, the static magnetic field from the cable is like that of the earth and of similar intensity. These magnetic fields will neither interfere with the acoustic signals nor the receiver instrumentation (personal communication, Dr. William Bailey, Exponent, March 24, 2015).

Thermal Effects

As discussed in Section 5.3.1, Exponent has calculated thermal effects to lake water from operation of the Project (Exponent 2015*b*, Appendix G). Using a set of conservative variables in terms of soil thermal properties and water velocity, the largest increase in temperature was found to be approximately 4.4°F (2.4°C) at the water/soil interface on the lakebed. The point of highest temperature increase was found to be approximately 9 inches (23 cm) in the downstream water flow direction from the cables' centerline. As seen in the attached Figure 5.3-1, the physical extent of this temperature increase is very limited. For example if one were to move vertically by only 4 inches (10 cm) from the point of highest temperature increase on the lakebed, the temperature increase would drop to a mere 0.2°F (0.1°C) (Exponent 2015*b*). The presence and operation of the transmission line would therefore not be expected to cause significant impacts to water temperature. In conclusion, no significant impacts on fish species would occur from operation of the transmission system in the lake.

Essential Fish Habitat

There would be no impacts on Essential Fish Habitat because no Essential Fish Habitat has been

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[14] The Project cables will not directly produce an electric field that would influence aquatic life due to shielding around the conductors. An induced electric field, resulting from movement of charges in water or organisms through the static magnetic field will be produced. The maximum induced electric field is calculated to be approximately 466 µV/m, and diminishes quickly with increasing distance from the cables (Exponent 2015*a*).

designated within the Lake Segment. Potential effects to protected and sensitive fish species are discussed in Section 5.6.

5.4.1.2 Benthic Invertebrates and Aquatic Vegetation

Due to the frequent high-energy wave action and the presence of exposed bedrock along the nearshore area of Lake Erie, aquatic vegetation is scarce to non-existent (Rathke 1984) and therefore, construction activities from the proposed Project are not expected to result in any impacts to aquatic vegetation. Lakebed disturbance from construction activities could result in a direct impact of the benthic or epifauna community, crushing or injuring benthic invertebrates, including mussels in the path of the jet plow, in areas of bedrock trenching, and in the footprint of the HDD exit sump pits. Due to the design and operation of the jet plow, the disturbed sediment will begin to backfill the trench almost immediately. A depression in the lakebed over the installed cable is expected following construction, but the lakebed contours would be expected to revert to pre-construction conditions within three years (DOE 2013). A study conducted of a submarine DC cable in the Baltic Sea determined that benthic macroinvertebrate communities recovered within 1 year following the initial impact of DC cable system construction (Andrulewicz et al., 2003 *cited in* Exponent 2015*a*). A similar conclusion was reached from post-construction monitoring studies of the ±300-kV DC Cross Sound Cable in Long Island Sound (S. Wood, personal communication *cited in* Exponent 2015*a*).

Recolonization and epifauna community composition would depend upon the stability of the disturbed areas, the tolerance of benthic organisms to physical changes, and the availability of recruits. Overall, the disturbed sediment is expected to settle quickly out of the water column and epifauna community recruitment from nearby, unaffected areas of the lake. Recovery for benthic communities varies, ranging from several months to several years, depending on the type of community and type of disturbance (DOE 2013). As discussed above, the drill/excavated material through bedrock habitat will be side cast spread along the lake bottom and result in a long-term beneficial impact on fish and benthic communities. It is likely that some sediment would accumulate on the stones and in-between the crevices and would be expected to be colonized by local epifauna community. Additionally, the crevices between the stones would provide protection for the epifauna community from large predators.

Heat can be generated as electricity moves through the cables, which could disperse into surrounding sediments and ultimately result in the localized warming of water. As noted above, thermal impact modeling using conservative assumptions shows that changes in water temperature would be negligible and quickly dissipate. No significant impacts on invertebrate species would occur from operation of the transmission system in the lake.

5.4.1.3 Terrestrial Species within Lake Segment

Because the Lake Segment is entirely aquatic, the only terrestrial species that could be impacted would be birds and bats. Along the Lake Segment, construction activities would generally occur at distances greater than 2,000 ft (600 meters) from shore except in a few locations. Birds and bats that forage in habitats within this segment could temporarily be disturbed by the noise level fluctuations during construction. With an average installation rate of 0.9 to 1.2 miles/day (1.5 to 2.0 km/day) in soft sediment, noise levels would increase over baseline noise levels less than one day at any one location. Therefore, noise impacts associated with construction are unlikely to result in significant avoidance of bird and bat forage areas, reduction of communication ranges,

or interference with predator/prey detection during the short time period that construction equipment would be operating in a particular area. Potentially impacted birds and bats would be expected to resume typical activities following construction.
No significant impacts on terrestrial species would occur from operation of the transmission system in the lake. If necessary, emergency repairs could require localized vessel operation for a very short duration. Noise associated with these vessels could temporarily result in avoidance of bird and bat forage areas and bird nests and bat roosts adjacent to the proposed Project route.

5.4.2 Underground Segment and Converter Station

The proposed Underground Segment route would cross several waterbodies (See Table 4.3-3 in Section 4.3.2.2). The waterbody crossing techniques include HDD, Jack & Bore, and open trenching methods. The open trenching methods would temporarily result in soil compaction, erosion, loss of vegetation, or loss of the physical structure of the ecological community.

Potential effects to stream fishes and other aquatic stream organisms include direct habitat impacts to the small streams proposed for open trenching. Streams crossing techniques are identified in Table 5.1-5. However, these impacts are temporary and have a very small impact. BMPs will be utilized to maintain stream flows and limit effects from turbidity, such as entrainment within gills of stream fish or covering habitat with sediments. Open trenching could affect migratory fish attempting to migrate upstream to spawn; however, open trenching will take place in only very small streams where migratory fish are not likely to occur. Jack & Bore and HDD activities avoid the need to directly impact streams, resulting in no impacts to stream flows, water quality, or aquatic habitat and organisms. Noise from Project construction may cause fish to temporarily move away from the Project area. Slow moving mussels and invertebrates may be directly impacted during trenching operations, but due to the limited number of stream crossings, this effect would be negligible.

5.5 Terrestrial Habitat and Species

5.5.1 Vegetation and Habitat

During construction activities in the Underground Segment, impacts on vegetation would include permanent removal of vegetation and soil compaction. The majority of the Underground Segment would be installed and constructed within or adjacent to existing roadways, most vegetation is previously disturbed. The impacts associated with the tree clearing will be minimized from co-location within pre-disturbed road ROWs and predominately agricultural areas. The transmission cables would be installed outside of road ROWs in certain areas to avoid existing infrastructure (i.e., bridges, culverts), sensitive natural resources (i.e., wetlands, waterways), or to account for the limitations of the cable installation, such as turning radius. There are seven locations where the route will briefly leave the adjacent road ROW to account for turns on to new roads encountered along the route. Two areas of the cable will deviate from existing ROWs. The areas outside the road ROW will be located on private property mostly adjacent to existing driveways. Those particular forested and shrub areas will be permanently converted to herbaceous layers to clear trees and shrubs. A permanent vegetation management area of up to 25 ft on either side of the cable (dependent on soil conditions) is required for proper function of the cable. The trees and shrubs within this area need to be cleared so their associated root systems do not remove excessive moisture from the soils and prevent the cables from functioning properly. Therefore, approximately 12.4 acres (5.0 hectares) of forested area would be cleared along the Underground Segment, including at the Erie Converter Station site, along the cable route, and at construction laydown areas. The clearing associated with the construction laydown areas (2.6 acres [1.1 hectares]) would be allowed to return to pre-construction conditions, and therefore permanent clearing associated with project construction would be about 9.8 acres (4.0 hectares).

Soil compaction typically has an effect on vegetation by decreasing the rate of water infiltration into the soils, resulting in changes to the soil moisture regime and porosity and potential changes in soil structural characteristics. Construction equipment and foot traffic have the potential to spread invasive plant species as a result of ground disturbance and the introduction of invasive seed stock carried on the boots, clothing, or equipment of construction workers. The implementation of an Erie County Conservation District approved Erosion and Sedimentation Control Plan and a Stormwater Management Plan will demonstrate that the volume and rate of runoff will have no net increase, thus avoiding permanent impacts to the surrounding areas.

The proposed Project route in the Underground Segment would cross several waterbodies and wetlands. The crossing techniques of waterbodies and wetlands include horizontal directional drill, jack and bore, and open trenching methods. The open trenching methods would temporarily result in soil compaction, erosion, loss of vegetation, or loss of the physical structure of the ecological community.

Operation of the HDVC cable would increase the temperature of the soil above the HVDC cables. However, the temperature would quickly dissipate with increasing distance from the transmission line and appropriate amounts of water in the soil.

The permanent HDVC cable ROW would be maintained (woody vegetation would be trimmed or removed) to protect the buried HVDC cables and associated facilities. The goal of the vegetation management in the ROW would be to establish and stabilize low-growing vegetation with shallow root systems that would not interfere with the buried cable. In areas where the cable is co-located with roads, the municipality's regular road berm maintenance would protect the cable. Much of the habitat will revegetate and display highly disturbed characteristics, similar to the pre-construction characteristics.

Emergency repairs of the HVDC cable, if required, could result in the removal of vegetation. Vegetation would only be disturbed in the area of the repair site. The ROW would be restored following completion of the repairs and vegetation would be allowed to return to the pre-existing conditions. Any emergency repairs would occur within the ROW utilized for construction.

5.5.2 Wildlife

Noise associated with construction activities could temporarily result in reduced communication ranges for wildlife, interference with predator/prey detection, or habitat avoidance temporarily. Wildlife response to noise may vary. Wildlife that could potentially be affected includes bird species, reptiles, amphibians, and mammals. The Project's close proximity to roads and railroad ROWs means that there is already elevated and variable levels of ambient noise associated with road traffic and rail operations. Hence, wildlife species that cannot tolerate the noise disturbance are probably not dwelling in the area proposed for Project construction. Vegetation removal and the direct reduction of some wildlife habitat could result in the direct displacement of species, including birds, mammals, reptiles, and amphibians.

The Project's HVDC cables will be shielded, which will virtually eliminate the static electric fields, leaving only static magnetic fields for consideration of potential impacts for this Project (Intrinsik 2014). Because of use of HVDC technology, shielding of the cables, and burying the transmission lines underground, no effects to terrestrial wildlife would be expected. Operation of the HVDC line would increase the soil temperature, but because the maintained ROW is so small and within a pre-disturbed area, it is not anticipated to impact wildlife.

The land above the underground HVDC ROW would be permanently maintained as herbaceous vegetation, unless located under existing road pavement or shoulder areas. The majority of the proposed alignment is currently maintained on a regular basis; therefore, any additional clearing and herbaceous vegetation maintenance impacts would be minimal. Birds, reptiles, amphibians, and mammals would be temporarily displaced during construction. Significant habitat fragmentation impacts on wildlife are not anticipated because the permanent ROW is relatively narrow and co-located with pre-existing roads and other previously disturbed areas.

Emergency repairs of the HVDC cable, if required, could cause temporary impacts for a short duration to wildlife due to noise and disruption. The temporary impacts could include reduced communication ranges, interference with predator/prey detection, or habitat avoidance due to noise. The area that would be potentially impacted by emergency repairs would have been previously disturbed during the original construction of the Project.

Potential effects on protected and sensitive species are discussed in Section 5.6.

5.6 Protected and Sensitive Species

5.6.1 Lake Segment

5.6.1.1 Federally Listed Species

The Indiana bat, northern long-eared bat, and bald eagle are federally-protected species with a potential to occur within or in close proximity to the proposed Lake Segment of the Project. Because these species are primarily associated with the land portion of the Project, potential effects are discussed in Section 5.6.2.

5.6.1.2 State Listed Species

Cisco

Construction of the proposed Project will cause a direct disturbance to the lake bottom along the Project route of the lake. Cisco, a pelagic species, congregate in schools and move into shallower waters during late fall and early winter to spawn. Spawning often occurs in shallow water (1 to 3 meters deep) over gravel, rock, or sand, but also may occur pelagically in midwater. After spawning the adults return to deep water after the ice melts (NatureServe 2015 and ODNR 2014*a*). Cisco hatch in early in the spring after ice out (MDNR 2015), which is typically April in Lake Erie (NOAA Great Lakes Environmental Research Laboratory 2009). Larvae spend their early stages of development swimming and feeding near the surface in May and June (Ebener et al. 2008). Cisco spawning in the Great Lakes (late fall to early winter) often occurs in shallow waters 1-3 meters deep, but can also occur pelagically. Use of HDD avoids effects to shallows (water less than approximately 5 meters). Effects of excavating the trench in the nearshore bedrock will affect a small area relative to surrounding unaffected habitat. The Applicant's proposed in-water construction window of May to November will avoid effects to the peak cisco spawning season and hatching, which occurs in early spring after ice out. The proposed project installation would therefore not be expected to affect cisco spawning.

Lake Sturgeon

Lake sturgeon spawning occurs in water ranging from 1 to 15 ft deep, along rocky shorelines of lakes, in wave action over clean gravel shoals, rocky ledges and around rocky islands (USFWS 2015, MDNR 2015, NatureServe 2015, Scott and Crossman 1998). Spawning occurs from early April to June, although spawning is temperature dependent (preferred temperature is 53 to 64° F). The black eggs stick to rocks and logs and hatch in 5 to10 days (GLIMDS 2015; MDNR 2015; USFWS 2015, PNHP 2014*b*)). Use of HDD avoids effects to shallows (water less than approximately 5 meters [16.4 ft]) where lake sturgeon would spawn. Therefore, the proposed Project installation activities would not be expected to affect lake sturgeon spawning. In addition, effects of excavating the trench in the nearshore bedrock will affect a small area relative to surrounding unaffected habitat. Although lake sturgeon is a bottom dwelling species, it is also highly mobile and would be able to avoid any direct impacts from construction activities. Construction activities may cause a temporary, short-term disturbance to the lake bottom and displace the available food source. The trenched substrate and suspended sediments will be quickly deposited in the proximal area from the disturbed centerline of the proposed route and epifaunal recruitment will occur immediately after construction activities from nearby, unaffected portion of the lake.

Eastern Sand Darter

From a review of literature, as summarized in a draft Biological Assessment (Appendix J), eastern sand darter prefers nearshore or riverine sandy habitat, and utilizes fine sand sediments in areas of moderate flows. Because the nearshore area of Lake Erie along the Project route is primarily bedrock, the presence of eastern sand darter there is expected to be limited. Moreover, in a substantial portion of this nearshore area, cables are to be installed by HDD borings through the bedrock, with no lake bed impacts expected except at the point where the HDD segment transitions to trench installation. For these two reasons, the eastern stand darter would be expected to be minimally affected by construction activities in the nearshore portion of the route.

However, PFBC sampling has found eastern sand darter in deeper water where the predominant substrate is sand/silt, but outside of the spawning season. Given their sampling results, PFBC asked the Applicant to evaluate Project effects to eastern sand darter during June and July, which is the spawning season. The focus on spawning season reflects concern over the only life stage (egg and incubation) when mobility is reduced and vulnerability to Project construction activities could be increased. Based on available information, it is assumed that spawning habitat is the same habitat used during the remaining year.

The average density of eastern sand darter in Lake Erie, derived from the PFBC trawl surveys is 0.43 fish/hectare (Table 4.6-1). Total temporary disturbance of all in-water activities in the

Pennsylvania portion of Lake Erie, including the maximum offset distance for blasting activities (63.3 ft) to either side of the route in the nearshore bedrock area, would result in a temporary disturbance of approximately 23.0 hectares (56.9 acres)[15] and a negligible permanent disturbance, consisting primarily of the areas excavated for the three HDD sump pits, the cable trench in the bedrock, and the associated sidecast rock (estimated to be about 2 acres). The number of eastern sand darters that could be expected to occur along the portion of the cable route within this temporary disturbance footprint,, based on this calculated density, and with no consideration of spawning season, eastern sand darter preference for sand substrate, or that blasting would occur in increments of 40 to 50 ft (12 to 15 m) per day, would be 10 fish (0.43 fish/hectare x 23.0 hectares). To account for the pre-lay grapnel run, which would occur along the cable route prior to construction, to remove debris, this estimate would be doubled to 20 fish.

Despite this very low number of eastern sand darters expected to be encountered during construction activities, the Project evaluated lethal take anticipated during construction (or operation) of the Project. Lethal take was assessed by evaluating the effects on eastern sand darters from the Project (e.g. blasting effects, jet plow effects), with a consideration of the best available science, including habitat preference and species presence information.

Cable installation using an HDD method is proposed for the nearest 2,000 ft from the shoreline. This will avoid any disturbance of the nearshore area, and no lethal take is expected to result from this installation method.

Blasting/trenching activities are proposed for approximately 0.9 mile from the HDD exit to areas of softer substrate where a jet plow can be deployed for burying the cable. Geophysical mapping of the nearshore area conducted for the Applicant in 2015 detected a thin and variable veneer of sand, gravel, and cobble over much of the bedrock in the reach where blasting will occur, and it is expected that this would not represent suitable spawning habitat for eastern sand darter. Some areas of deeper sand overburden occur over shallow bedrock for about 578 meters of the lakebed where blasting is planned, from approximately KP 102.0 to KP 102.5 and approximately KP 102.6 to KP 102.8 (see last panel map in Appendix C of the draft BA). Literature and PFBC data confirm that this species is found over sand and fine sediment in Lake Erie, not over bedrock, and Project blasting associated with trenching of bedrock not having a sand overburden near shore is not expected to affect eastern sand darter.

Four eastern sand darters could be expected to occur within the offset distance along the portion of the cable route, where blasting will occur and where there is an area of sand overburden. This estimate of effects of this temporary disturbance is based on the calculated density, and with no consideration of spawning season. The basis for this estimate is shown in Appendix J.

Once the substrates transition into finer substrates further offshore, jet plowing will be utilized to install the cables. The near shore substrates transition from primarily bedrock into sand, silt and minor clay substrates approximately 1.3 miles off the U.S. shoreline. As shown in Figure 4.6-1

[15] A more conservative estimate of disturbance was used for this assessment of effects to eastern sand darter (56.9 acres) than the temporary disturbance reported elsewhere in this document (14.7 acres) to account for potential disruption of fish by equipment and construction activities and not just actual bottom disturbance.

above, eastern sand darters have been collected in the PFBC trawl surveys near the proposed route in this area of finer substrates. However, the last time eastern sand darters were captured via trawling near the proposed route was in 1999, based on the best available data to date. The trawl data provided by PFBC reveals low densities and patchy occurrences of this species. If an area is encountered that has eastern sand darters present during jet plowing or the grapnel run in June and July, it is anticipated that there will be few individuals and they are expected to avoid the slow moving jet plow and the grapnel, since these fish are mobile and can find suitable habitats in the vicinity of the disturbed area to continue spawning activity, feeding, and other normal behavior. Results of the Applicant's water quality model (Appendix E) show that minimal temporary water quality impacts would be associated with the cable installation and are limited to a four-hour timeframe after jet plowing occurs. The model calculated that total suspended sediment (TSS) concentration increases would reach a temporary peak concentration at the point of installation and then decrease rapidly. Therefore, no lethal take is anticipated for the remaining proposed Project route.

While eastern sand darter spawning (June and July) has not been reported in the wild, general habitat preference in lakes has been reported as clean sandy shoals and beaches, and based on best available information we assume that spawning will occur in the same sandy habitat utilized the remaining year. PFBC trawl survey data shows that eastern sand darters occur over sand and other fine substrates in deeper waters of Lake Erie. Eastern sand darters are not known to utilize habitats consisting of bedrock, so blasting and HDD activities in such near shore bedrock areas should not affect eastern sand darter. HDD, which has the lowest potential for impact to fish species, would be used in the nearshore shallow waters, where the one potential point for impact would be the relatively small boring exit pit.

In summary, both literature and PFBC data confirm that eastern sand darter are found over sand and fine sediment in Lake Erie, not over bedrock. Therefore, eastern sand darters are not expected to occur along the Project route where bedrock trenching will occur, except for those [relatively limited] portions of the route that have a sand overburden; and for those small portions, it was estimated that 4 eastern sand darters could be killed during project blasting. Jet plowing and the grapnel run would cause a temporary disturbance of the underlying sediments along the transmission line route, resulting from temporarily suspended sediment. However, no lethal effects would occur from jet plowing or the grapnel run. The only potential effect to eastern sand darter would be if the jet plow or grapnel disrupts eastern sand darter eggs. The effect to eastern sand darter eggs is expected to be insignificant given the small width of the area disrupted by the jet plow compared to the available similar habitat in Lake Erie, and the short incubation period. If jet plowing and the grapnel should encounter a spawning site with incubating eggs, impact would be expected to be limited since spawning behavior is to lay eggs one at a time over an extended period of time and space (Adams and Burr 2004), suggesting only a small portion of total eggs would be encountered.

In summary, the potential effects of the Applicant's proposed Project installation activities between May and November is insignificant, consisting of potential take of four fish, and the Project is, therefore, not expected to affect eastern sand darter spawning.

5.6.2 Underground Segment and Converter Station

5.6.2.1 Federally Listed Species

Indiana bat

The Indiana bat has the potential to occur in Erie County during the summer. However, according to the PGC (2013*b*), no known hibernacula and/or summer live-captures have been recorded in Erie County. Construction noise could potentially affect the behavior of bats foraging or roosting in the area adjacent to the Underground Segment impact area; however, since these bats occur in proximity to active road ROWs, it is assumed that they are already habituated to noise level fluctuations. Therefore, Indiana bats are not likely to become displaced or abandon any unknown roosting areas.

Vegetation removal could result in the potential loss of suitable habitat for the Indiana bat. In the immediate vicinity of the road ROWs, however, much of the Project area and adjoining lands consists of disturbed open lands and secondary forest lacking suitable habitat for bat roosts. While some forested or open woodland habitats occur adjacent to the proposed transmission line, vegetation clearing would be conducted primarily within the road ROWs. There are few large trees within the construction corridor. To avoid killing or injuring listed bats, the USFWS requested that any trees that need to be removed should be cut between November 16 and March 31. If a seasonal restriction on tree cutting is implemented to avoid the inadvertent take of listed bats, the USFWS has determined that the effects of the Project are not likely to adversely affect the Indiana bat or the northern long-eared bat. This restriction would also help avoid impacts to other species that hibernate or migrate out of the Project area during wintertime. The Applicant will remove trees between November 15 and March 31. In a letter dated April 6, 2015, the USFWS stated that, based on the implementation of this seasonal restriction on tree cutting, the proposed Project is not likely to adversely affect the Indiana bat.

No significant effects from magnetic fields would be anticipated from operation of the transmission line. Buried cables, such as those proposed for the Project, would have no electric fields at the ground surface and the constant magnetic field would decrease with distance from the cable centerline (WHO 2012). While there is evidence that wildlife can detect electromagnetic fields, species behaviors would not be affected by relatively small changes in magnetic fields (AUC 2011 *as cited in* DOE 2013). Additionally, literature suggests that electromagnetic fields associated with transmission lines do not result in any adverse effects on the health, behavior, or productivity of animals (Exponent 2009 *as cited in* DOE 2013). Indiana bats might be able to detect magnetic fields; however, there is no evidence to suggest that the magnetic fields associated with the operation of the Project would result in any effects on the species (DOE 2013).

Most of the vegetation that would be impacted along the ROW during vegetation maintenance activities would consist of previously disturbed herbaceous and shrub cover. Vegetation along the transmission line ROW would primarily be managed by brush hogging and mowing or hand cutting. Potential effects from mowing on Indiana bats include noise and dust. Noise created by mowing could affect roosting bats in adjacent forests but several colonies of bats have been found near mowed ROWs of major roads and appear to not be affected by noise created by mowing and traffic (USFWS 2008b). In addition, noise and dust created by mowing would be experienced by roosting or foraging bats for a very short duration because mowers would pass quickly by any area having bats. Effects on the Indiana bat associated with emergency repairs of the transmission line in the Underground Segment, if necessary, would not be significant and would be similar to those occurring during construction, but would be for a shorter duration and disturb a smaller area.

Northern long-eared bat

Based upon this species' habitat preferences during winter and summer, it can be assumed that northern long-eared bats would occur in similar or the same areas indicated for the Indiana bat along the proposed Project route, including in the Underground Segment. There are no known hibernacula along the Underground Segment; however, construction noise could potentially affect the behavior of any bats foraging or roosting adjacent to the route. Because these bats occur in proximity to active road ROWs, it is assumed that they are already habituated to noise level fluctuations.

While vegetation removal could result in the potential loss of habitat for the northern long-eared bat, much of the habitat in the immediate vicinity of the existing road ROWs consists of disturbed open lands and secondary forest lacking suitable habitat for bat roosts. There are few large trees within the construction corridor, and most vegetation clearing would occur within the existing road ROWs. As a result of any loss of forest, northern long-eared bats might alter current flight paths between roosting and foraging habitat that, in turn, could increase their overall flights or they could fly over the construction corridor and continue to use previous foraging areas. However, the northern long-eared bat relies on and prefers edge habitat for safe foraging and movements to and from their roost trees to feed (DOE 2013). Therefore, the increase in edge habitat in the Underground Segment could benefit the northern long-eared bat. As discussed above, the Applicant will remove trees between November 15 and March 31 to avoid killing or injuring listed bats. In a letter dated April 6, 2015, the USFWS stated that, based on the implementation of this seasonal restriction on tree cutting, the proposed Project is not likely to adversely affect the northern long-eared bat.

The effects from operation, vegetation maintenance, inspection, and emergency repairs on northern long-eared bats would be the same as discussed above for Indiana bat.

Bald eagle

In a letter dated April 6, 2015, the USFWS stated that it is not aware of any bald eagle nests in the vicinity of the Project. During a meeting on March 26, 2015, the USFWS suggested that the Applicant look for bald eagle nests in the immediate vicinity of the HDD laydown are to confirm that there are no bald eagle nests in this area near the shoreline bluffs. The Applicant's consultant evaluated the area on April 16, 2015 and did not see any bald eagle nests. Nest trees typically include pine, spruce, fir, cottonwood, oak, poplar, and beech (DOE 2013). The Project primarily occurs within existing road ROWs where the vegetation is mostly low-lying herbaceous or scrub-shrub vegetation, and large deciduous or coniferous trees are generally not present, it is anticipated that bald eagles would not be present. Although bald eagles might fly over the route when they are traveling, it is likely that they would not use the habitats within the potential impact area except on a transient basis.

Buried cables, such as those proposed for the Project, would have no electric fields at the ground surface. Research indicates that some species of animals, including birds, are able to detect magnetic fields at levels that might be associated with transmission lines such as those associated with the proposed Project; however, detection does not imply that the fields could result in adverse impacts on the species' ability to forage, reproduce, and survive (AUC 2011 *as cited in* DOE 2013).

No significant impacts on bald eagle would be expected from any emergency repairs, if necessary. If required, impacts from repairs of the transmission line would be similar to those that would have occurred during construction, but would be for a shorter duration and would disturb a smaller area.

Bank swallow

Nesting habitat has the potential to occur along the bluffs of Lake Erie at the transition location from the Lake Segment to the Underground Segment of the Project. The nesting habitat consists of muddy and sandy banks of the 90-ft bluffs. The swallows dig holes in the vertical substrate and may form colonies of clustered nest cavities. The seasonal abundance and occurrence of bank swallows recorded in Erie County is from early May to late August (McWilliams 2014).The HDD construction method for placement of the transmission line from an insertion point located about 560 ft (170 m) south of the bluff, downward and then out under the nearshore bedrock areas of Lake Erie will avoid any disruption to the existing bluffs and any associated nesting cavities. One of the largest colonies of bank swallows in Pennsylvania is near the mouth of Duck Run, along the shoreline of Lake Erie (Knopf 2015). In addition to the HDD disturbance area location about 320 ft from the bluff and, it is also over 1,000 ft to the west of the mouth of Duck Run.

On March 26, 2015, the Applicant met with the USFWS to discuss the ways in which the Project development has incorporated construction details to minimize and avoid impacts to migratory birds. The USFWS followed up with a letter dated April 6, 2015. Through the use of HDD and work space location and design, the Applicant has satisfied the USFWS requirements to avoid impacts to the bluffs and consequently, nesting bank swallows. The USFWS does not believe a seasonal restriction on Project activities is necessary, and the USFWS does not believe the anticipated Project impacts are high enough to warrant the development of a habitat restoration plan for birds.

In conclusion, the proposed activities are located at a sufficient distance from the known bank swallow colonies and a sufficient distance from the preferred habitat, that the impacts to the bank swallows will not be significant. The Project is not expected to cause any harm to the species and will adhere to the conditions of the MBTA.

5.6.2.2 State-Listed Species

Lake sturgeon inhabit lakes and larger rivers and cisco are a pelagic species; therefore these two species would not be expected to occur in the streams crossed by the Underground Segment of the Project. Eastern sand darter would be expected to avoid the stream crossings during construction activities. Use of BMPs to avoid siltation or inadvertent returns from HDD operations will help minimize and the temporary and short term nature of the construction activities will minimize these effects.

Effects on any state-listed plants potentially occurring in the Underground Segment as a result of construction would not be ecologically significant, but would include soil compaction, vegetation disturbance, creation of dust, and local permanent loss of some plants. Surveys for were conducted by Environmental Solutions & Innovations, Inc. in May and July of 2015 to identify any known or anticipated state-listed plants that might occur in the Project area. No state-listed species were found on the Project site. In a letter dated December 4, 2015, PADCNR determined that no impact of the Project is likely, and that no further coordination with PADCNR is needed for the project. Soil compaction would decrease the rate of water permeating into the soil, resulting in decreased vegetation cover because of desiccation. Heavy equipment and foot traffic could damage plants (DOE 2013). The Applicant proposes several measures to avoid or minimize impacts on protected species, including state-listed plants, such as identifying all known locations on Project maps and in the field where protected plants may be observed based on available data. Dust-control strategies (e.g., watering down disturbed soil) would be implemented to minimize impacts from interference with pollination and photosynthesis on downwind vegetation.

Noise associated with construction of the transmission corridor could temporarily disturb and displace state-listed birds and other wildlife. Vegetation clearing could result in loss of habitat. As previously discussed, construction of the transmission line would occur in previously disturbed roadway ROWs. Since birds and other wildlife that occur in the ROWs would be habituated to noise and human disturbance and likely would not avoid the edge habitats created by the relatively narrow corridor, significant fragmentation effects would not be expected (DOE 2013). Additionally, most vegetation along the transmission line route is previously disturbed successional shrubbery or forest fringe habitat, which is subject to frequent disturbance (e.g., roadway maintenance operations).

No significant effects from magnetic fields would be anticipated from operation of the transmission line. Buried cables, such as those proposed for the Project, would have no electric fields at the ground surface (WHO 2012), and the magnetic field level at the ground surface directly above the transmission line cables in the ROWs would likely decrease with distance from the cable centerline. Electromagnetic fields have the potential to enhance the growth response in certain plant species; however, the effects of such on plants are inconclusive (DOE 2013). Research indicates that some species of animals are able to detect magnetic fields at levels that might be associated with transmission lines such as those associated with the proposed Project; however, detection does not imply that the fields would cause adverse effects on a species' ability to forage, reproduce and survive (AUC 2011 *as cited in* DOE 2013).

Vegetation clearing, vehicle and foot traffic, and the use of heavy equipment for vegetation maintenance activities or emergency repairs, if required, in the transmission line ROW can crush, kill, or damage state-listed plant species if they occur in the Project impact area. Vegetation along the ROW would be managed as detailed in an approved Post-Construction Stormwater Management Plan.

Vehicle and foot traffic associated with vegetation maintenance in the ROW and emergency repairs, if necessary, could disturb state-listed bird and animal species. Vegetation clearing and any other associated decreases in vegetation cover could result in habitat loss. However, no significant habitat fragmentation impacts would be expected to result from the Project because construction would occur within existing ROWs, which is fringe habitat primarily made up of previously disturbed vegetation. Individual species may be temporarily displaced; however, permanent displacement of an entire breeding population is unlikely because the habitat affected by construction of the proposed Project corridor only composes a small percentage of the habitat available in the region.

5.6.2.3 Migratory Birds

No significant effects on migratory birds would be expected from installation of the underground transmission line. In addition, development of an underground cable avoids a number of effects to migratory birds associated with overhead transmission lines (e.g., collision). However, potential effects on migratory birds and their occupied habitats include those resulting from noise and vegetation clearing (DOE 2013).

Most birds along the Underground Segment are expected to move into similar adjacent habitats during a typical construction period in any given location and return to the area after construction is completed. Disturbance could also result in parental abandonment of eggs or young in nests built in habitats immediately adjacent to the construction activities (DOE 2013). Permanent displacement of an entire breeding population is unlikely because vegetation clearing would largely occur along disturbed or fringe habitat (AUC 2011 as cited in DOE 2013). Tree clearing will be conducted between November 16 and March 31 as the USFWS requested to avoid impacts to bat species. This clearing window will also minimize impacts to birds. If nests are present, they will be from the previous season and birds will adjust. Birds are expected to move into similar adjacent habitats during a typical construction period in any given location and return to the area after construction is completed. Construction activity that takes place adjacent to uncut trees where nesting might occur is unavoidable, but would be temporary and for only one season. Cutting trees on frozen ground also reduces impact on wetlands/erosion potential.

Tree clearing along the edge of the route in within forested areas will be required for proper function of the cable. The affected habitat only composes a small percentage of the habitat available to migratory bird species in the region. Additionally, significant habitat fragmentation impacts would not be expected because construction would occur within or adjacent to existing, previously disturbed, ROWs and would impact relatively little forested habitat. If vegetation clearing is conducted during the breeding and nesting season (generally the spring and summer) impacts on migratory birds and bird nests along the route could occur. However, most of the vegetation that would be impacted would be in fringe habitat that is subject to frequent noise and emissions from road activities.

Impacts on migratory birds could occur as a result of ROW vegetation maintenance and emergency repairs, if necessary. Vehicle and foot traffic and the occasional use of heavy equipment could disturb birds (DOE 2013). Vegetation maintenance activities could result in habitat loss. If vegetation maintenance or emergency repair activities in the Underground Segment occur during migratory bird breeding and nesting season (generally the spring and summer) migratory birds and nests could be disturbed. Construction of an underground transmission line avoids operational effects to migratory birds associated with overhead transmission lines, and no significant impacts would be expected.

5.7 Cultural Resources

5.7.1 Lake Segment

The Project has the potential to effect historic resources in Lake Erie listed in or eligible for inclusion in the National Register. While there are no previously reported shipwrecks, precontact, or historic period archaeological resources along the proposed marine transmission cable route, the potential exists for previously unreported shipwrecks or archaeological deposits to exist along the Project's proposed alignment. Project construction has the potential to affect the integrity and character-defining features of such historic resources, should any be present within the Project's APE. Installation of the underwater HVDC transmission cables would include HDD, a pre-lay grapnel run, trench excavation, and cable installation using a towed jet plow in soft sediment (or by water jetting in the deepest portion of the lake) and trench excavation in bedrock. These techniques have the potential to effect shipwrecks or other previously unreported archaeological resources along the transmission cable marine route.

The Applicant recognizes that the formal National Historic Preservation Act Section 106 process has not been initiated. However, in advance of the process, the Applicant has initiated studies to identify historic properties along the Project's alignment. As discussed above, the Applicant conducted a Phase IA Study of the proposed transmission cable route in 2014 and 2015. The Applicant also performed a marine route survey in 2015 to identify bottom conditions, shipwrecks, existing utilities, and other features along the proposed marine route. The marine route survey included a combination of equipment and approaches including side-scan sonar, single-beam bathymetry, and magnetometer surveys to facilitate identification of potential shipwrecks. The results of the marine route survey were reviewed by Hartgen's maritime archaeologist to identify anomalies along the Project's marine route. A total of 42 anomalies were initially identified within the 500-meter-wide survey corridor through a review of sidescan sonar data. Hartgen identified 40 meters (131 feet) on either side of the centerline of the underwater cable route as a suitable buffer to avoid adverse effects on shipwrecks or other cultural resources. This buffer distance is based on similar HVDC cable installations in the northeast, and is considered appropriate to avoid impacts to any buried portion of a shipwreck that may be on the lakebed and could be identified through remote sensing (personal communication, Wm. Brian Yates, New York State Office of Parks, Recreation, and Historic Preservation, May 15, 2012). Of the 42 anomalies identified within CSR's marine route survey corridor, six were determined to be (a) located within 40 meters of centerline of the proposed underwater cable route, and (b) exhibiting physical features that may indicate the presence of an historic shipwreck. A review of marine magnetometer data in conjunction with sidescan sonar images indicated that none of the six anomalies represented shipwrecks or other archaeological resources. Therefore, construction activities associated with the marine cable route are not expected to have any effect on historic or archaeological resources.

The Applicant anticipates consultation with the PHMC-BHP, federally recognized Indian tribes, and other stakeholders through the Section 106 process to:

- Define an APE for the Project;
- Review the results of the Phase IA Study, Marine Route Survey Archaeological Analysis, and determine the need for additional studies to identify or evaluate historic properties that may be affected (directly and/or indirectly) by the Project;
- Assess the effects (if any) of the Project on historic properties; and
- Seek ways to avoid, minimize, or mitigate adverse effects on historic properties through consultation. A draft Unanticipated Discovery Plan is included in Appendix H.

5.7.2 Underground Segment and Converter Station

As discussed in Section 4.7.2.3, one historic building, the Fredrick E. Blair House, has been reported within one mile of the Project's proposed terrestrial alignment; however, the precise location of this resource is unclear from available PHMC-BHP files. During field activities conducted in 2014, Hartgen identified one building, the John Pauline House, which appears potentially eligible for inclusion in the National Register. This house is located at least 200 ft from the Project and is surrounded by a broad landscaped lawn. The John Pauline property is further separated from the underground route by trees and vegetation lining the steep banks of Cross Station Road. Ten additional historic buildings have been inventoried within one mile of the Project's proposed underground route, but the National Register eligibility of these buildings has not been determined.

The Project has the potential to affect historic properties listed in or eligible for inclusion in the National Register. The geomorphological investigation conducted in support of the Phase IA Study identified landforms including strand-lines, moraines, and stream crossings in the Project's vicinity that were favored by Native Americans and have a higher archaeological potential. Several map-documented historical structures were also identified in the Project vicinity. Installation methods for the terrestrial HVDC transmission cables include trenching, jack and bore construction, and HDD. These are ground-disturbing techniques that have the potential to affect buried archaeological deposits along the underground transmission cable route and at the Erie Converter Station location, should archaeological material be present. These techniques also have the potential to impact historic buildings and structures that may be located adjacent to the Project's terrestrial route or Erie Converter Station.

The Applicant recognizes that the formal Section 106 process has not been initiated. However, in advance of the process, the Applicant has initiated studies to identify historic properties along the Project's alignment. As discussed above, the Applicant conducted a Phase IA Study of the proposed transmission cable route in 2014 and 2015 and Phase IB Investigations in 2015.

Four archaeological sites were identified along the underground cable route and staging areas during the Phase IB Investigations conducted in 2015. As noted above, the Applicant has identified proposed measures to protect these sites (see Table 4.7-3) and anticipates consultation with the PHMC-BHP, federally recognized Indian tribes, and other stakeholders through the Section 106 process to confirm the appropriate measures to avoid adverse effects on these identified resources. The Applicant has also prepared a draft Unanticipated Discovery Plan for the Project which has been included as Appendix H.

5.8 Aesthetic and Visual Resources

5.8.1 Lake Segment

The transmission cables associated with the Lake Segment of the proposed Project will be buried in the lakebed. During construction of the Lake Segment of the proposed Project, there would be temporary impacts to the visual character of Lake Erie viewshed. From shore or via boats on Lake Erie in the vicinity of the construction activities, viewers would see the cable laying barge and support vessels. However, commercial and industrial ship and boat traffic is not an uncommon sight on Lake Erie and the presence of construction vessels would not appear uncommon. Use of HDD for the Project landfall will avoid both short term and long term aesthetic and visual impacts to the Lake Erie shoreline. Therefore, no permanent visual impacts from the proposed Project landfall are anticipated.

Because the Lake Segment of the transmission line will be installed in the lakebed, there are no permanent visual impacts expected from the operation of the proposed Project. In the event cable maintenance or repair is required subsequent to installation, there could be temporary visual impacts to the Lake Erie viewshed similar to those experienced during construction of the proposed Project.

5.8.2 Underground Segment and Converter Station

Construction activities along the underground route of the proposed Project would result in temporary visual impacts to the viewshed from the presence of construction equipment and activities along the Project route. Construction of the underground route within wooded areas may require local clearing to facilitate construction of the proposed Project, temporarily impacting the visual composition of that area. Subsequent to completion of construction, the impacted area will be allowed to revegetate, with the exception of the permanent transmission line ROW (up to 50 ft), which will remain free of vegetation with large root systems. Following construction, the underground transmission line will be unseen and will not result in any negative aesthetic or visual effects.

The Erie Converter Station will add a substantial, permanent aboveground feature to the viewshed area. An area of approximately 6 acres (2.4 hectares) is required for the Erie Converter Station with its surrounding equipment and access ways. In addition to the area occupied by the Erie Converter Station, additional area would be temporarily disturbed during construction for the laydown and to support construction efforts. The main building (converter hall) would be approximately 370 ft by 110 ft (110 m by 35 m) with a building footprint of 1 acre (0.4 hectares) and a height of approximately 60 ft (18 m) (Figure 2.2-2). The primary equipment installed outside of the building is anticipated to include circuit breakers, disconnects, surge arrestors, transformers, cooling equipment, and metering units. Security fencing will surround the Erie Converter Station area to prevent unauthorized access and to provide public safety. The Erie Converter Station is bound to the east and south by large wooded areas, which will help to minimize visual impacts of the Erie Converter Station from those directions. Residential houses exist north and west of the Erie Converter Station site. A buffer with planted trees is proposed for the east side of the Converter Station site, along the driveway to the Converter Station, and along the road next to the Converter Station. A visual simulation of what the Erie Converter Station would look like is provided in Figures 5.8-1 and 5.8-2), with views from the roadway, both before and after construction.

Figure 5.8-1 Visual simulation of Erie Converter Station – before construction.

Figure 5.8-2 Visual simulation of Erie Converter Station – after construction.

5.9 Climate, Air Quality, and Noise

5.9.1 Lake Segment

5.9.1.1 Climate

The Intergovernmental Panel on Climate Change's (IPCC's) Fifth Assessment Report indicates that changes in many physical and biological systems, such as increases in global temperatures, more frequent heat waves, rising sea levels, coastal flooding, loss of wildlife habitat, spread of infectious disease, and other potential environmental impacts are linked to changes in the climate system due to increased levels of atmospheric GHGs resulting from human activities (IPCC 2013).

No emissions of dust or other parameters to air are associated with installation of the HVDC cables other than the emissions, from the boat engines, which would emit GHGs, primarily in the form of carbon dioxide. Specifically, the following vessels would be used for constructing the Project in the lake:

- Cable laying barge, approximately 290 ft x 90 ft (88.4m x 27.4m);
- Transportation barge for the HVDC cables, approximately 250 ft x72 ft (76.2m x 21.9m);
- Two support tugs;
- Crew boat; and
- Small outboard powered craft (minimum of three).

Conventional measures would apply to provide compliance of ship exhaust to regulatory requirements. The release of anthropogenic GHGs and their potential contribution to global warming are inherently cumulative phenomena. The estimated GHG emissions associated with construction of the proposed Project would be extremely small compared to the emissions for the Commonwealth of Pennsylvania, the U.S., or the 54 billion tons of CO_2-equivalent anthropogenic GHGs emitted globally in 2004 (IPCC 2007). Any temporary increase in GHG emissions caused by the proposed Project would solely be associated with construction activities and would be *de minimis*.

5.9.1.2 Air Quality

Construction-related air pollutant and GHG emissions associated with the installation of the underwater segment of the proposed Project primarily would occur from diesel fuel-powered internal combustion engines. Construction vessels listed above would emit pollutants such as carbon monoxide, carbon dioxide, sulfur oxides, particulate matter, nitrogen oxides, and volatile organic compounds, including aldehydes and polycyclic aromatic hydrocarbons. Emissions associated with construction are not anticipated to exceed the General Conformity Rule *de minimis* thresholds established in 40 CFR §93.153(b) for individual pollutants.

Once installed and operational, the proposed Project transmission cable system is designed to be maintenance-free. However, periodic inspections of the underwater transmission cable route will be performed to provide proper function and protection of the transmission system. In the unlikely event that the transmission system is damaged, emergency repairs will be required. The activities associated with periodic inspections of the underwater transmission cable route or emergency repairs are anticipated to be short-term in duration.

Activities associated with the inspection and potential emergency repairs of the transmission cables in Lake Erie would produce a negligible amount of emissions. In the event emergency repair is required for an underwater cable and as part of the ERRP, appropriate vessels and qualified personnel would be used to minimize the duration of the repair activities. It is anticipated that equipment and vessels similar to those used in construction activities would be used for short periods as necessary for emergency repairs. Overall, emissions resulting from inspection and emergency repairs of the transmission cables along the Lake Segment of the proposed Project are not expected to cause or contribute to a violation of any federal or state ambient air quality standards.

5.9.1.3 Noise

Sound is characterized by amplitude (how loud it is) and frequency (pitch). The human ear does not hear all frequencies equally. In fact, the human hearing organs of the inner ear deemphasize very low and very high frequencies. The A-weighted decibel (dBA) is used to reflect this selective sensitivity of human hearing. This scale puts more weight on the range of frequencies where the average human ear is most sensitive, and less weight on those frequencies we do not hear as well. The human range of hearing extends from approximately 3 dBA to around 140 dBA. Table 5.9-1 shows a range of typical noise levels from common noise sources.

Table 5.9-1 Common noise sources and noise levels.

Sound Pressure Level (dBA)	Typical Sources
120	Jet aircraft takeoff at 100 ft
110	Same aircraft at 400 ft
90	Motorcycle at 25 ft Gas lawn mower at 3 ft
80	Garbage disposal
70	City street corner
60	Conversational speech
50	Typical office
40	Living room (without TV)
30	Quiet bedroom at night

Source: Rau and Wooten 1980

Pennsylvania does not have a statewide noise limit; although some townships in Pennsylvania have noise ordinances. The proposed Project reaches landfall in Springfield Township Pursuant to the Springfield Township Zoning Ordinance (§506.7), “Noise which is determined to be objectionable because of volume or frequency shall be muffled or otherwise controlled, except fire sirens and related apparatus used solely for public purposes, which shall be exempt from this requirement. Objectionable noise levels shall be construed as being those in excess of 60 dB at the property line.”

Noise-sensitive receptors for the Lake Segment of the proposed Project may include recreational boaters on Lake Erie and residences and public-use areas along the shoreline of Lake Erie. Erie Bluffs State Park is located on the shore of Lake Erie, and the proposed Project Lake Erie landfall location is within 120 ft (37 meters) of the western boundary of Erie Bluffs State Park. Other shoreline or near-shore noise-sensitive receptors in the general vicinity of the proposed Project (although greater than 600 ft from the proposed Project) include Virginia’s Beach

Lakefront Cottages and Camping, Camp Lambec, Camp Fitch, and Pine Lane Campground.

Within the Lake Segment of the proposed Project, the transmission cables would be installed beneath the lakebed of Lake Erie. Removal techniques for bedrock nearshore include backhoe excavation, hammering with a pointed backhoe attachment, or blasting. Blasting would cause intense impulse noise and ground-borne vibration and would be used where needed to remove hard rock in a manner that would involve less work, time and disturbance than rock-drilling, rock-breaking, or rock-hammering.

Any noise-sensitive receptor near the proposed cable route could be affected by noise depending upon the sound level of the Project-related sound source, the distance to the noise-sensitive receptor from the proposed Project, and the activity's relationship to existing noise levels. Effects of construction related noise on the lake, consisting of vessel activity and potential underwater blasting, will be temporary, and occur only during construction.

The blasting effort will involve only low-level charges in off-shore bedrock areas, and will be permitted through the PADEP Ch. 211 regulations and PFBC and will be conducted in accordance with PADEP and PFBC standards and guidance. Blasting and its noise and vibration effects on nearshore land uses and structures in the vicinity of the blasting would be managed by a Project-specific blasting plan, developed prior to Project construction. The blasting plan will include measures to mitigate the impacts of underwater blasting to fish in the general vicinity, such as blast design to minimize shockwaves, use of blasting mats, and the use of bubble curtains or other measures to mobilize and clear fish from the immediate blast area. Since the blasting effects are underwater, significant airborne noise effects are not expected. Potential impacts from in-water blasting on aquatic resources will be limited in duration and area, and are discussed further in Section 5.4.1.1.

Once installed and operational, the transmission cable will be buried in the lakebed of Lake Erie with no discernable long term noise impacts.

5.9.2 Underground Segment and Converter Station

5.9.2.1 Climate

A description of the environmental consequences of the construction of the proposed Project on climate is included in Section 5.9.1.1.

5.9.2.2 Air Quality

Construction-related air pollutant and GHG emissions associated with the installation of the Underground Segment of the proposed Project primarily would occur from diesel fuel-powered internal combustion engines on equipment such as backhoes, construction vehicles and trenching equipment. Emissions from construction equipment may include carbon monoxide, carbon dioxide, sulfur oxides, particulate matter, nitrogen oxides, and volatile organic compounds, including aldehydes and polycyclic aromatic hydrocarbons. Fugitive dust emissions would result as construction would largely take place on the unpaved shoulder and land adjacent to existing roads.

Given the construction activities required to bury the transmission cables, including site clearing, earth removal and fill, and HDD, particulate emissions would be generated directly from the fuel-fired engines and earth-disturbance activities. The amount of airborne dust generated from construction is relative to the amount of small particle silt and moisture found in the soil. Generally, the coarser the soil material and the higher the moisture content, the lower the amount of surface dust that will enter the air. Soils located within the corridor of the underground segment range from fine organic loam and sand to coarser gravel or other unconsolidated material. The drainage along the Underground Segment ranges from poorly to excessively drained. This area of Pennsylvania can have heavy snowfall and high rainfall, and, depending on the season in which construction would take place, the moisture content of the soil could be high. Consistent with 25 Pa. Code § 123.1, fugitive dust along the construction corridor will be controlled using, but not limited to, the following measures: use of water or other solution to control dust; application of water or suitable solutions on dirt roads, material stockpiles and other surfaces which may give rise to airborne dusts; and prompt removal of earth or other material from paved streets onto which earth or other material has been transported by trucking or earth moving equipment, erosion by water, or other means.

Shallow bedrock has the potential to be encountered along some portions of the terrestrial construction corridor. Dependent on relative hardness, fracture susceptibility, and expected volume of the material, rock encountered during trenching would be removed using conventional evaluation with a backhoe, hammering with a pointed backhoe followed by backhoe excavation. No blasting is planned along the Underground Segment.

All emissions associated with construction would be temporary and spread over the Underground Segment construction period. The air emissions resulting from construction of the proposed Project are not expected to cause or contribute to a violation of any federal or state ambient air quality standard, expose sensitive receptors to substantially increased pollutant concentrations, or increase the frequency or severity of a violation of any ambient air quality standard.

Once installed and operational, the proposed Project is designed to be maintenance-free. Post-construction activities within the Underground Segment would consist primarily of transmission cable inspections and emergency repairs, as required. Such activities would be short-term in duration. Regular inspections of the cables, in accordance with the manufacturer's specifications, would be performed to maintain equipment integrity. In the event of emergency repairs, equipment similar to those used in construction activities would be used for short periods during emergency repair activities as required.

Inspection and potential emergency repairs of the transmission cables in the Underground Segment would produce a negligible amount of emissions with no significant impacts on the regional air quality due to the sporadic small-scale nature and likely short duration in any given location.

An emergency generator, including a diesel engine, would be installed at the Erie Converter Station. The localized air emissions produced by this generator would be negligible and only occur during periodic testing of the unit or when temporarily operating during emergency conditions. It is expected that this emergency generator will be covered by a PADEP Pennsylvania General Plan Approval GP 9 for Diesel or No. 2 Fuel-fired Internal Combustion Engines. The operation of the proposed Project is not expected to cause or contribute to a violation of any federal or state ambient air quality standard.

5.9.2.3 Noise

Underground transmission cable installation along the proposed Project route (primarily within road ROWs) requires a range of site preparation and cable installation activities such as vegetation clearing, topsoil removal and storage, trench excavation, transmission cable delivery to the installation site, HDD, Jack & Bore, transmission cable installation and splicing, backfilling, and vegetation/site restoration.

As discussed in Section 4.9.2.3, Pennsylvania does not have a statewide noise limit, although Girard Township and Springfield Township have enacted municipal noise standards and Conneaut Township has not. Girard Township generally prohibits “Any use of or activity upon property that, by reason of flames, smoke, odors, fumes, noise or dust, unreasonably interferes with the reasonable use, comfort and enjoyment of a neighbor's property or endangers the health or safety of the occupants of a neighboring property or endangers the health and safety of Township residents and/or the users of Township public streets, property or facilities” (Girard §133-4(F)). Pursuant to the Springfield Township Zoning Ordinance (§506.7), “Noise which is determined to be objectionable because of volume or frequency shall be muffled or otherwise controlled, except fire sirens and related apparatus used solely for public purposes, which shall be exempt from this requirement. Objectionable noise levels shall be construed as being those in excess of 60 dB at the property line.”

Noise-sensitive receptors associated with the proposed Project may include recreational boaters on Lake Erie and residences and public-use areas along the shoreline of Lake Erie, as discussed in Section 5.9.1.3. Erie Bluffs State Park is located on the shore of Lake Erie, and the proposed Project Lake Erie landfall location is within 120 ft (37 meters) of the western boundary of Erie Bluffs State Park. Other shoreline or near-shore noise-sensitive receptors in the general vicinity of the proposed Project (although greater than 600 ft from the proposed Project) include Virginia’s Beach Lakefront Cottages and Camping, Camp Lambec, Camp Fitch, and Pine Lane Campground.

The existing soundscape for the Underground Segment route includes natural sources, such as wind, vegetation rustle, and wildlife noises, and transportation noise sources, especially the sound from periodic passing trains and automobile and truck traffic noise on Interstate 90 and local routes. Sound generated along the proposed Project route varies as some portions of the route are in rural settings and other portions are closer to railroads and highways where increases in sound levels occur. No schools, libraries, or hospitals have been identified within 600 ft (183 meters) of the transmission line centerline of this segment. Construction activities associated with the Underground Segment of the proposed Project could cause an increase in sound that is above ambient noise levels for short-durations. Noise from proposed Project construction activities would include equipment that is typically found at large-scale construction sites. A variety of sounds are emitted from graders, loaders, trucks, pavers, and other work activities and processes. Table 5.9-2 presents a list of construction equipment that is likely to be used for the proposed Project and associated noise levels that would result at a distance of 50 ft from their operating locations.

Table 5.9-2 Noise levels of typical construction equipment.

Equipment Description	Impact Device?	Acoustical Usage Factor (%)	Spec. 721.560 L_{max} @ 50 feet (dBA, slow)	Actual Measured L_{max} @ 50 feet (dBA, slow) (Samples Averaged)	Number of Actual Data Samples (Count)
Auger Drill Rig	No	20	85	84	36
Backhoe	No	40	80	78	372
Boring Jack Power Unit	No	50	80	83	1
Compactor (ground)	No	20	80	83	57
Compressor (air)	No	40	80	78	18
Concrete Mixer Truck	No	40	85	79	40
Concrete Pump Truck	No	20	82	81	30
Concrete Saw	No	20	90	90	55
Crane	No	16	85	81	405
Dozer	No	40	85	82	55
Dump Truck	No	40	84	76	31
Excavator	No	40	85	81	170
Flat Bed Truck	No	40	84	74	4
Front End Loader	No	40	80	79	96
Generator	No	50	82	81	19
Generator (<25KVA, VMS Signs)	No	50	70	73	74
Gradall	No	40	85	83	70
Grader	No	40	85	N/A	0
Grapple (on backhoe)	No	40	85	87	1
Horizontal Boring Hydraulic Jack	No	25	80	82	6
Jackhammer	Yes	20	85	89	133
Mounted Impact Hammer (hoe ram)	Yes	20	90	90	212
Pavement Scarifier	No	20	85	90	2
Paver	No	50	85	77	9
Pickup Truck	No	40	55	75	1
Pneumatic Tools	No	50	85	85	90
Pumps	No	50	77	81	17
Roller	No	20	85	80	16
Vacuum Excavator (Vac-Truck)	No	40	85	85	149
Vacuum Street Sweeper	No	10	80	82	19

Source: Federal Highway Administration, 2006

At the transition of the underwater cables from water to land and at infrastructure (i.e., road and railroad) crossings, installation would be accomplished through the use of HDD (or Jack & Bore at some road crossings) to minimize disturbance to the nearshore area and infrastructure. The typical stationary equipment at the HDD operations staging area would include drilling rig, support air compressor, electrical generator, backhoe, crane, and a mud makeup/recovery system.

Each of these equipment types would have an engine. As required by the Springfield Township ordinance noise provisions and other applicable regulations, this construction equipment would be equipped with appropriate mufflers.

Noise generated from the water-to-land HDD operation would be relatively constant for approximately 3 months, and would be slightly louder than typical construction noise levels (DOE 2007). Although the increase in noise levels in the immediate vicinity of the HDD operations would be relatively stationary as a result of the HDD activity, the increased noise levels would be temporary.

HDD operations at terrestrial HDD sites (e.g., stream crossings) would have slightly lower noise levels than the water-to-land HDD operation, as smaller equipment is used and operations would also be shorter in duration. At their source, the HDD drilling equipment would produce noise levels between 75 and 105 dBA, but noise levels will dissipate with distance and competing ambient noise (Black and Veatch, Undated). The Applicant will work with municipal officials to provide a construction schedule that attempts to minimize noise impacts, particularly during evening and nighttime hours, and that reduces the amount of time that construction noise might exceed local ambient noise criteria in Springfield Township. Unless required by transportation or local officials, construction activities will take place during daytime hours. The applicant will notify residents in advance regarding commencement of construction activities in residential areas near the proposed Project and will respond promptly to any noise-related complaints to determine if site-specific measures could be employed to reduce objectionable noise impacts. The applicant will also provide periodic updates regarding the construction schedule.

Construction activity with respect to the land-side transmission line and converter station will generally be conducted during daytime hours, unless night construction is requested by state or local officials to avoid significant impacts to traffic or equipment deliveries, or unless required by a particular construction techniques (such as HDD borings). The Applicant will coordinate surface restoration procedures with PennDOT, the appropriate townships, and (as applicable) the owners of private lands on which the underground transmission line is located. Construction of the Underground Segment of the proposed Project will cause a temporary increase in noise in proximity to the construction activity (3 to 4 days at any one cable installation location; 1 week for a vault location). Construction noise is usually made up of intermittent peaks and continuous lower levels of noise from equipment cycling through use. Within 50 ft (15.2 meters) of construction activities, construction equipment noise levels would range from approximately 70 to 90 dBA (Table 5.9-2). Such sound levels could result in speech or sleep interference in areas close to the operating construction equipment, but would dissipate quickly over distance from the actual construction work. Increased noise on adjacent roadways will also be generated by equipment deliveries or normal road traffic potentially being detoured to accommodate temporary work sites along road ROWs. The Applicant will work with landowners when noise complaints are received to develop site specific measures for reducing adverse noise impacts, including potential modifications to the timing of construction equipment use. The Applicant will also consider noise reduction measures including use of sound muffling devices on equipment, when available, to reduce noise output or propagation in the vicinity of residences where complaints are received. For construction work that needs to be a continuous operation, the Applicant will also consider noise reduction measures including use of sound buffers.

Construction of the Erie Converter Station would involve 12 to 18 months of site work and equipment installation, followed by 4 to 6 months of testing and commissioning work inside the

Erie Converter Station. The indoor design of the HVDC converter modules, at the Erie West Converter Station, located in Conneaut Township, would reduce audible sound associated with station operation. The primary equipment installed outside of the converter hall is anticipated to include circuit breakers, disconnects, surge arrestors, transformers, cooling equipment, and metering units. The facility will also have an emergency generator.

The Applicant conducted a study of the sound propagation and impacts associated with the operation of the proposed Erie Converter Station. A model of noise produced by equipment at the Erie Converter Station during normal operations would not adversely affect the sensitive receptors located closest to the facility.

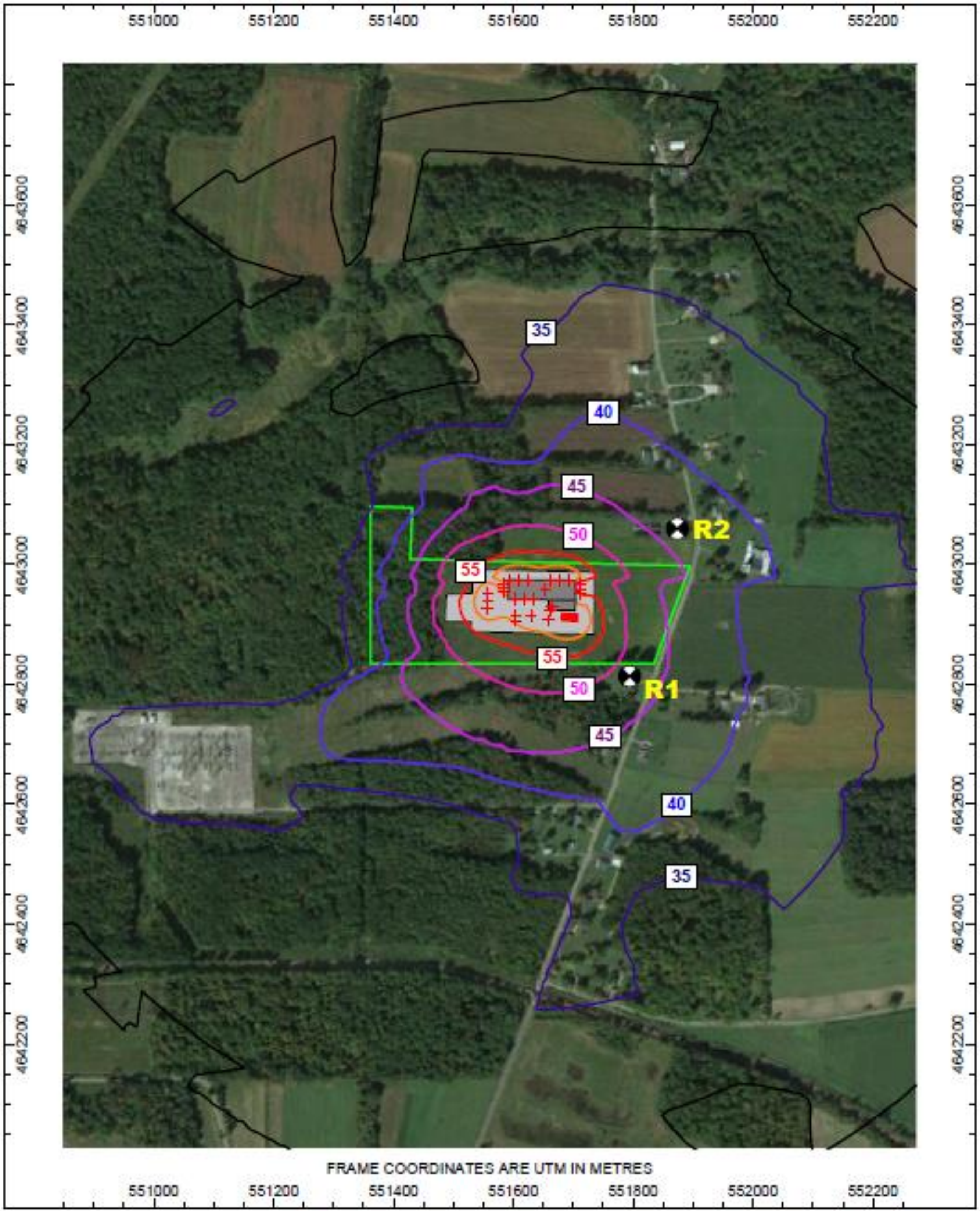
The Applicant commissioned noise control experts at HGC Engineering to measure ambient noise levels in the vicinity of the proposed Erie West Converter Station and to prepare a predictive sound level model regarding the potential propagation of sound from the proposed Converter Station to potential receptors in the vicinity.

The Erie West Converter Station has relatively few receptors of potential concern in the vicinity. North and south of the Converter Station site are agricultural fields. West of the site is a forested area. The Erie West Substation is located southwest of the Converter Station. As shown in Figure 5.9-1, the two closest residential structures are located along the western side of Lexington Road. Residence R1 is located approximately 380 ft southeast of the planned Converter Station building, and residence R2 is located approximately 560 ft northeast of the planned Converter Station Building. It should be noted that the applicant holds an option to acquire residence R2, such that it would not be an actual receptor if the Erie Converter Station is constructed. However, for purposes of sound level modeling and impact assessment, sound levels propagating to R1 and R2 were considered to provide a conservative "worst case" evaluation of potential impacts.

The model considered the sound levels generated by various equipment at the Converter Station. In normal operation, the most significant sound sources relate to the cooling fan system. That cooling fan system would consist of 11 banks of 9 coolers each. In operation, depending on ambient air temperature and Converter Station loading, the maximum number of banks operating would be 10 (with one spare redundant unit). Based on manufacturer information, the assumed maximum sound level generated by these banks would be 100 dBA at the source (with lower operating loads and ambient air temperatures expected to result in lower sound generation). The Converter Station would also to be equipped with an emergency generator, which would be utilized only rarely in the event of loss of electric power or for periodic testing.

The sound modeling sought to predict sound levels at 15 ft above the ground surface (the approximately height of a second story window), which is typically more exposed to sound sources that a ground story window. Figure 5.9-1 shows the sound contours for the area around the Converter Station, with the operation of all sound sources taken together, assuming maximum fan system operations without the emergency generator.

Figure 5.9-1 - Predicted Sound Levels (dBA) Without Emergency Generator



The modeling results indicate the predicted worst case sound levels at the nearest residences R1 and R2, as shown in Table 5.9-3.

Table 5.9-3 Noise model results: residences near Erie Converter Station.

Location	Model Assumptions	Predicted Sound Levels (dBA)
R1	All sound sources except emergency generator; max fan system operations	48
R1	With emergency generator	55
R2	All source sources except emergency generator; max fan system operations	44
R2	With emergency generator	44

There are no noise level limits established at the state or township level applicable to the Converter Station site. However, to place these values in perspective, at level of 45 dBA is typical of a small town residence, and 35 dBA is the sound level of a soft whisper heard at 6 ft. Ambient noise measurements taken by HGC in the area showed minimum one-hour equivalent sound levels less than 50 dBA during daytime hours and less than 40 dBA during nighttime hours.

Since there are no zoning or other noise restrictions in Conneaut Township or at the state level, the operational noise associated with the Erie Converter Station will comply with current local and state regulations.

Impacts from the generation of noise during operations, routine inspection, maintenance, and possible emergency repairs along the transmission line would be expected. The increase in sound levels resulting from routine inspection and maintenance activities would be short-term in duration. In general, the increase in sound levels related to inspection and maintenance activities would be associated with noise generated from vehicle traffic. Noise levels generated from emergency repair activities would be similar to those expected during construction, as shown in Table 5.9-2, but would only occur as required with less equipment, and be much shorter in duration and limited to the immediate area of repairs.

5.10 Public Health and Safety

5.10.1 Lake Segment

The Lake Segment of the proposed Project is located within Lake Erie; therefore, exposure of the public to construction activities is anticipated to be minimal. A temporary exclusion area of approximately 1 km will be established around the cable installation vessels and operating equipment on Lake Erie. Additionally, the public will be notified prior to commencement of construction activities.

Following construction, the cable would be buried 3 to 10 ft (1 to 3 m) and the public would therefore have no exposure to the Lake Segment of the Project. The transmission cables require no fluid for insulation and would be buried to prevent disturbance from anchor snags and unrelated operations in waterways.

5.10.1.1 Contractor Health and Safety

Construction of the Lake Segment of the proposed Project will require construction workers working from boats and ships as well as divers. Workers on the cable installation ship will be using heavy equipment and tools specifically designed for the purpose of installing underwater transmission cables. Specialized equipment would be necessary for the installation of the transmission cables in the Lake Segment. Construction personnel would be performing the work on vessels designed solely for the purpose of installing transmission cables. Operation of the aquatic installation equipment and vessels would be performed by personnel specifically trained to use this equipment. A Lake Traffic Management Plan detailing USCG regulations for safely operating vessels and requiring coordination with the USCG Waterways Management and Vessel Traffic Services would be developed to meet regulatory permit conditions regarding working over or near water.

Potential nearshore blasting activities and safety measures during such activities would be managed with a Project-specific blasting plan. Blasting activities will be performed by personnel specially trained to perform this type of work. Construction areas would be managed to prevent harm to the general public. The public would be notified prior to commencement of construction activities.

All construction workers for the proposed Project are responsible for following federal and state safety regulations and are required to conduct those activities that do not pose an undue risk to workers or personnel. Prior to commencement of Project operation, an Emergency Repair and Response Plan (ERRP) would be prepared that would identify procedures necessary to perform maintenance and emergency repairs. The ERRP would detail the activities, methods, and equipment involved in repairs and maintenance of the transmission system. Contractors would follow all guidelines detailed in the ERRP when conducting maintenance or repair activities. A Spill Prevention and Response Plan will also be developed.

Subsequent to installation and commencement of operation of the proposed Project, periodic inspections of the underwater transmission cable route will be performed to provide that the cables remain adequately buried/protected. Periodic underwater inspections will be performed by certified divers and/or a remotely operated camera. Additional maintenance or repair of the underwater transmission cables may also be necessary through the life of the Project and is expected to be performed by specially trained contractors working from a vessel potentially with the assistance of certified divers. Contractors would follow all guidelines detailed in the ERRP when conducting maintenance or emergency repair activities.

5.10.1.2 Electric and Magnetic Field Safety

The Project's HVDC cables will be shielded, which will virtually eliminate the static electric fields, leaving only static magnetic fields for consideration of potential impacts for this Project (Intrinsik 2014). A health risk would only be present if there is a hazard, a receptor and a pathway for exposure. The hazard needs to be present in sufficient amounts to negatively impact human health. This maximum magnetic field level (calculated on the lakebed, directly over the HDD cables) is approximately 0.08% of the general public exposure limit recommended by International Commission on Non-ionizing Radiation Protection (Exponent 2015*a*). Given the small magnetic field above the lakebed that would result from the Project, and the small distance from the cable in which the magnetic field would be elevated above the earth's magnetic field (5.4.1.1), there would be no negative effects to human health. In addition, because of use of HVDC technology, shielding of the cables, and burying the transmission lines in the sediment at the bottom of Lake Erie, a viable exposure pathway does not occur by which the general public will be exposed to magnetic fields at levels that represent a human health concern (Intrinsik 2014).

5.10.2 Underground Segment and Converter Station

Because the transmission line along the underground route will primarily be buried within the road ROW, disturbances to local traffic may occur during construction. The Applicant will coordinate work with PennDOT and township road authorities, and will seek to avoid or minimize traffic disturbances by using traffic details, construction signs and barriers and notifying the local community in advance of any anticipated road or lane closures.

Potential impacts to health and safety during construction activities for the proposed Project will be managed by following federal and state safety regulations.

Subsequent to installation of the underground transmission cables and prior to commencing operation, the transmission cable route will be appropriately marked and the location of the transmission cables will be provided to Pennsylvania One Call System, Inc. Inclusion of the Project location in the Pennsylvania One Call System database, will minimize or avoid accidental contact with the cables once they are buried underground. A fiber optic cable will be installed with the transmission cables and will be used for communications between the converter stations. In the unlikely event that the cable becomes damaged by external activities, the cable protection equipment will be designed to immediately shut down operation in order to protect life and equipment.

The underground transmission cables do not contain any fluid; thereby eliminating any potential health and safety risk from a discharge of insulating oil or similar fluid.

Operation of the Erie Converter Station would require limited amounts of hazardous materials and petroleum products for equipment (e.g., transformer oils, fuel for the generator). Electrical hazards could also occur at the Erie Converter Station. Public access to the Erie Converter Station will be restricted by locked perimeter fencing.

5.10.2.1 Electric and Magnetic Field Safety

The Project's HVDC cables will be shielded, which will virtually eliminate the static electric fields, leaving only static magnetic fields for consideration of potential impacts for this Project (Intrinsik 2014). In order to evaluate whether health impacts could result from EMF produced by this Project, an assessment of potential risks was conducted (Intrinsik 2014). Because of use of HVDC technology, shielding of the cables, and burying the transmission lines underground, a viable exposure pathway does not occur by which the general public will be exposed to magnetic fields at levels that represent a human health concern (Intrinsik 2014). There is a general scientific consensus that human health risk associated with EMF generated from submarine HVDC cables is negligible (Intrinsik 2014).

5.11 Infrastructure

5.11.1 Lake Segment

5.11.1.1 Electrical Systems and Buried Utilities

No impacts on existing electrical systems would be expected because no electrical system infrastructure is currently present. Operation of the Project will create a new energy transmission interconnection between the IESO and PJM energy grids.

The transmission cables would be designed to be relatively maintenance-free, with only the need for periodic inspections. The underwater transmission cables would include a polyethylene sheath extruded over an extruded lead moisture barrier to provide mechanical and corrosion protection. An armored layer of galvanized wires with bedding layers would provide additional protection for the underwater transmission cables.

5.11.1.2 Water Supply Systems

Temporary impacts on drinking water intakes are unlikely to result from suspended sediment entering the intakes during the installation of underwater transmission cables. In areas of soft sediment, the cables would be installed and buried using water-jetting plow techniques, which would result in localized sediment suspension and transport. Depending on the sediment particle-size composition, the majority (approximately 70 to 80 percent) of the disturbed sediment would be expected to remain within the limits of the trench under limited water movement conditions, with 20 to 30 percent of suspended sediment traveling outside the footprint of the area directly impacted by the plow. With higher currents, more sediment can be transported outside the trench area (DOE 2014). Modeling of the suspended sediment plume that would result from the jet plowing and water jetting, necessary to install the Project cable, has been conducted and is discussed in Section 5.11.2.3. From evaluation of these modeling results (HDR 2015) no impact to drinking water sources or distribution systems would occur as a result of the project construction (HDR 2015).

No operational impacts on water supply systems would be expected since the closest water intake in Lake Erie, serving the Erie City Water Authority, is over four miles from the Project landfall. Periodic surveys and scans associated with underwater inspections during Project operation would not create any sediment disturbance in the potential impact areas associated with existing drinking water intakes.

5.11.1.3 Stormwater Management

No impacts on stormwater management would be expected because the entire segment is underwater and no stormwater management infrastructure is present.

5.11.1.4 Solid Waste Management

HDD drill cuttings will be contained and settled in tanks or sediment traps, and disposed of at an approved facility. Rock excavated from trenching activities in the nearshore bedrock area will be side cast. A majority of the sediment from the jet plow and water jetting will naturally settle back in the trench.

No operational impacts on solid waste management would be expected because the transmission line itself would be designed to be relatively maintenance-free and, therefore, would not produce any solid waste.

5.11.1.5 Communications

No substantial communications infrastructure has been identified in the vicinity of the Project. If previously unidentified communications infrastructure were to be discovered along the proposed Project route during surveying or construction the protocol and BMPs similar to those described for Electrical Systems above would be applied.

5.11.1.6 Natural Gas Supply

Natural gas pipelines or infrastructure do not occur on the U.S. side of Lake Erie. No operational impacts on natural gas supply would be expected because the transmission system would not consume natural gas and would not be located over natural gas infrastructure.

5.11.1.7 Liquid Fuel Supply

Minimal amounts of liquid fuel would be consumed by construction equipment. No substantial liquid fuel pipelines or infrastructure have been identified within the Lake Segment. Negligible impacts on liquid fuel supply would be expected due to the minimal amounts of liquid fuel that would be consumed by boats and automobiles during inspections and potential emergency repairs of the transmission system. Inspection activities would be short-term in duration, but occur multiple times over the operating life of the transmission line. Emergency repairs would only occur on an as-needed basis.

5.11.1.8 Sanitary Sewer and Wastewater Systems

No substantial sanitary sewer or wastewater systems have been identified in the vicinity of the Project. No operational impacts on sanitary sewer and wastewater systems would be expected because the operation of the transmission system would not increase the generation of wastewater and would not cross any sanitary sewer and wastewater infrastructure.

5.11.2 Underground Segment and Converter Station

5.11.2.1 Road and Railway Crossings

In order to minimize impacts, special construction procedures will be used at the five Project road crossings and two railways crossings. Jack & Bore (open-face, cased auger borings), and in one case, HDD, will likely be used for the road and railway crossings with uniform, cohesive soils, although an elevated water table can result in the need to dewater the jacking and receiving pits. Closed face casing installation methods such as micro-tunneling may be required in certain areas with high water tables and non-cohesive soils to prevent running soil conditions.

Construction of the underground route of the proposed Project would result in temporary impacts to traffic. Disturbances during construction may include limitations on property access due to road detours and construction equipment/activities. However, these disturbances would be limited to the duration of construction in that immediate area and are anticipated to be short (i.e., 3-4 days; 1 week if vault location).

5.11.2.2 Electrical Systems & Buried Utilities

Impacts on existing electrical utility infrastructure may occur where such infrastructure is crossed by the proposed Project route. Each underground electrical crossing, if any, would be assessed to determine the most appropriate method of construction to avoid a conflict. Appropriate standard precautions will be taken when using excavating and cable installation equipment in the vicinity of overhead crossings. Planned system outages are not anticipated.

5.11.2.3 Water Supply Systems

No municipal water lines occur along the Project route. A limited number of private wells may be at low to moderate risk from temporary turbidity during construction, or interruption of water flow to the well due to the trenching. ITC has commissioned a study of these risks by professional geologists at Moody and Associates, Inc. All property owners along the Project route were provided the opportunity to have their wells analyzed for pre-construction water quality and quantity. Based on these analyses, Moody and Associates, Inc. has proposed measures which will be undertaken during construction of the cables to avoid, reduce, or mitigate the risk associated with interruption of water flow to those wells. The main body of the study report and the figures are included as Appendix M.

5.11.2.4 Stormwater Management

Potential impacts on stormwater management for the Underground Segment would occur where existing stormwater inlets or pipes would be crossed by the underground cable installation, primarily along roadway ROWs. Any stormwater drains or stormwater management features encountered would be restored to previous conditions if disturbed, or would be avoided by minor route alterations or via the use of HDD. The Applicant has developed a Post-Construction Stormwater Management Plan for the Erie Converter Station site, as required for required both by the Conneaut Township Stormwater Management Ordinance (SWMO) and 25 Pa. Code Chapter 102, relating to requirement for an NPDES Permit for Stormwater Discharges Associated with Construction Activities (Stormwater NPDES Permit). The Conneaut Township Supervisors, with the assistance of their appointed engineer, will review this plan for consistency with the Conneaut Township SWMO. The PADEP, with the assistance of the Erie County Conservation District, will review this plan as part of the process for issuance of the Stormwater NPDES Permit. Stormwater BMPs will be implemented as necessary to meet the volume control and water quality requirements, and peak rate requirements of the Conneaut Township SWMO and 25 Pa. Code Chapter 102.

5.11.2.5 Solid Waste Management

Impacts on solid waste management would be expected due to the generation and management of debris, such as excavated soil, brush, tree limbs, logs, slash and stump waste. During the installation of the terrestrial transmission cables, brush and tree limbs would either be chipped and spread in approved locations or hauled offsite for disposal. Timber would be removed as appropriate to be salvaged or disposed of at approved locations. Salvaged timber could be used during construction for wetland access, cribbing, retaining walls, firewood, saw logs, chipping, or other uses. Where sufficient marketable volumes exist, logs would be sold to a third party.

Slash and stump waste would be disposed of by chipping, hauling, and burial. Hauled slash and stump waste would be disposed of in a landfill or other suitable offsite locations with the approval of the landowner and all applicable permitting agencies. Stumps could be buried on private easements with landowner agreement and monitored after construction.

Any excavated soils would be temporarily stockpiled adjacent to the worksite or transported offsite if onsite storage is not possible. Excavated soils would not be disposed of in a landfill unless they are contaminated. Excavated soils and used drilling fluid disposed of in a landfill (if necessary) would contribute to a permanent reduction of landfill capacity.

5.11.2.6 Communications

Some underground communication lines occur along railroad ROWs that the Project route will cross. BMPs will be implemented to avoid impacts where the HVDC cable crosses these lines. The Underground Segment will also cross under overhead communications lines. However, the construction equipment would be managed in such a way to avoid disturbing these lines and any interruptions in service.

5.11.2.7 Natural Gas Supply

Some natural gas lines occur in the vicinity of Route 20. BMPs will be implemented to avoid impacts where the HVDC cable crosses these lines and the Applicant will coordinate closely with gas line owners to minimize any disruption to gas line operation.

5.11.2.8 Liquid Fuel Supply

No impacts on liquid fuel supply would be expected due to the minimal amounts of petroleum that would be required for construction equipment and vehicles. The amounts of fuel that would be needed are assumed to be a small percentage of the supply in the area. No substantial liquid fuel supply lines or infrastructure have been identified within the Underground Segment. Therefore, no impacts on liquid fuel infrastructure would be expected.

5.11.2.9 Sanitary Sewer and Wastewater Systems

There are no sanitary sewer systems along the proposed route. Instead, houses in the area have on-lot sewer systems. As noted, the majority of the proposed route is on public road ROW, and therefore, Project construction would not affect these existing systems. The Erie Converter Station will be manned and include a potable water well and a sewer leach field on site.

5.12 Hazardous Materials and Waste

5.12.1 Lake Segment

Construction equipment will likely require the storage, use, or handling of liquid fuels, solvents, oils, lubricants, and hydraulic fluids. Appropriate spill prevention and containment measures for hydraulic fluids or fuels will be applied during construction.

The transmission cables do not contain any hazardous fluids, thereby eliminating any potential for sediment or water contamination from the cables themselves. The Lake Segment of the proposed Project is not anticipated to generate hazardous materials or waste during construction or operation.

5.12.2 Underground Segment and Converter Station

Construction will require heavy equipment fueled by hydraulic fluids, diesel, and/or gasoline. Appropriate spill prevention and containment measures for hydraulic fluids or fuels will be applied during construction. Construction crews will have spill response absorbent pads and spill response procedures in construction vehicles.

No areas of contamination have been identified along the Underground Segment of the proposed Project. If any contaminated media is identified during trenching and excavation activities associated with installing the Underground Segment of the transmission cables, further evaluation, soil sampling, and notification of appropriate authorities will be performed in accordance with local, state, and federal regulations. Soils generated during trenching and excavating will be reused onsite or hauled offsite to be used as fill material, unless contaminated media is identified, in which case the contaminated media will be properly disposed of, according to applicable regulations.

Construction of the proposed Underground Segment will involve boring at some locations using HDD methods, which do not involve the use of any hazardous materials or creation of hazardous waste. The underground transmission cables do not contain any hazardous fluids, thereby eliminating any potential for soil or groundwater contamination from the cables themselves. Any oils or hazardous waste generated by operation and maintenance of the Erie Converter Station will be managed and disposed of according to the applicable regulatory requirements. Preparedness Prevention Contingency plans have been prepared and will be implemented for the Underground Segment and Erie Converter Station. Wastewater generated by facility staff at the Converter Station will be disposed of at an onsite leach field installed during Project construction, and will not include the disposal of hazardous substances.

5.13 Socioeconomics

5.13.1 Population

Installing the Project facilities, including the Erie Converter Station, is anticipated to take approximately 2.5 years. It is anticipated that only a small number of specialized workers would temporarily relocate to the area; therefore, the construction of the proposed Project is not expected to noticeably affect the population of Erie County or nearby townships.

Subsequent to completion of construction, it is anticipated that the operation and maintenance of the proposed Project is expected to generate 10 permanent jobs. Therefore, operation and maintenance of the proposed Project is not anticipated to noticeably affect population of Erie County or the nearby townships.

5.13.2 Employment

Construction jobs that would be generated would be primarily related to the construction industry. The Project will create a number of temporary and permanent jobs. For example, construction of the Erie Converter Station will result in 125 temporary construction jobs during peak construction activities, and an additional 185 non-construction related temporary jobs. Additional temporary jobs will be created for construction of the underground and underwater cables. Because the underground route is primarily located within the road ROW, additional workers outside of the construction industry, such as police details, may be required during construction of the Project and would likely be available from the existing local workforce.

Full time permanent jobs created for operating the Erie Converter Station would be 10 full time jobs. Additionally, local contractors could be hired to provide periodic maintenance services and vegetation management along the transmission line ROW.

5.13.3 Taxes and Revenue

During construction, the proposed Project may contribute to a local increase in taxes and revenues as a result of expenditures for building materials, construction equipment, worker wages, and purchases of goods and services. The operation and maintenance of the proposed Project is anticipated to contribute to a local increase in taxes and revenues as a result of real estate transfers, property taxes, and fees for property easements.

5.13.4 Housing

Construction of the proposed Project is anticipated to be limited in duration, resulting in the need for short-term accommodations such as hotels, motels, cabins, etc. Therefore, no noticeable impacts to the local or county housing market are anticipated from construction of the proposed Project.

The transmission lines will be buried along the underground route, the majority of which is primarily within the road ROW. Once the Project is completed, the construction area will be restored by the applicant. In areas where the transmission lines cannot be buried within the road ROW, it may be located on private property requiring an easement. Therefore, future land use restrictions within the easement will be necessary. Landowners will be compensated for any potential impacts on property values caused by easement restrictions.

Given the small number of new jobs created to operate and maintain the Project, no noticeable impacts to the local or county housing market are anticipated.

5.14 Environmental Justice

No Environmental Justice populations are located within the proposed Project area and area of concern defined by the PADEP Environmental Justice Public Participation Policy.

Construction of the Underground Segment of the proposed Project would be relatively short in duration, lasting about 6 months total and about 3 to 4 days at any one location (one week for a vault location). Therefore, no lasting or significant effects on the population in general, including minority or low-income communities, are anticipated from construction activities.

No existing residences or businesses would be permanently displaced by the construction or operation of the proposed Project. Because the transmission cables along the Underground Segment of the proposed Project would primarily be buried within road ROWs, the proposed Project would not result in long-term loss of economic viability of farms, ranches or other businesses. Potential human health and environmental effects on minority and low-income communities from the construction and operation of the proposed Project would not be considered disproportionately high and adverse.

6.0 LONG TERM AND CUMULATIVE EFFECTS

In accordance with NEPA policy, the proposed Project has been analyzed to determine what cumulative impacts may result regionally from the "incremental impact of the action when added to other past, present, and reasonably foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions", including impacts that can result from "individually minor but collectively significant actions taking place over a period of time" (40 CFR § 1508.7). The analysis in this section identifies potential cumulative impacts relative to other known and foreseeable actions within the Project's impact area and region. The identification of potential cumulative impacts is focused primarily on how the Project relates additively to other similar regional energy projects and infrastructure development projects within the overall project area. Cumulative impacts to the same resources discussed in Sections 4 and 5 are presented in Section 6.2.

The predicted environmental resource impacts associated directly with the Project construction (short term) and operation (long term) are identified in Section 5 of this report. In summary, these include discrete impacts that are for the most part temporary in nature and linked to the Project construction effort. Once completed and operational, the Project facilities (other than the Converter Station) will be buried and maintained within the cable route, both in the Lake Segment and the Underground Segment. The proposed six-acre Erie Converter Station is the only aboveground facility and it is at the southern end of the Project route. All areas cleared along the Underground Segment to allow for cable installation will either become revegetated, or revert to their adjacent roadside site conditions as they appeared prior to construction. Some revegetated areas will be converted from a forested landscape to a field or scrub/shrub environment, to allow for long term Project maintenance and emergency repair access. Impact avoidance and minimization measures will be incorporated into the Project construction and operation programs to protect existing resources during construction and ensure their future integrity after construction is completed.

Information regarding existing and future planned development projects was obtained through research of local, county and state data and planning documents, as well as review of local business development and media sources. Although no significant developments are currently planned within a mile of the proposed Project route, there are regional projects, as presented and summarized below, that are noteworthy when considering potential cumulative impacts to the region. Upon review of these planned projects, the Lake Erie Connector Project should be a minimal contributor to the environmental impacts within the local or regional setting, particularly through the limited amount of permanent impacts to physical and land use features within the potential Project impact area.

6.1 Existing and Planned Developments

The following regional projects have been identified in this section because they are generally large projects that are more similar in scale to the proposed Project. These potential projects involve commercial and industrial site development within a relatively broad construction footprint, unlike the linear corridor associated with the Project. As such, the nature of the temporary and long term environmental impacts associated with these potential projects is quite different and the post-construction effect on the environment generally produces a much more significant change to existing local conditions. The information presented below is based on our current understanding of the development features from credible sources.

Lake Erie Energy Development Corporation (LEEDCo) Project Icebreaker: A six-turbine offshore wind demonstration project planned for the Ohio waters of Lake Erie. Its location will be approximately seven miles north of downtown Cleveland. Project Icebreaker is supported by the Mayor of Cleveland (Frank G. Jackson) and President and CEO of Cleveland Foundation (Ronn Richard). LEEDCo developed the conceptual design of an offshore wind turbine foundation through a U.S. Department of Energy (DOE) competition and was awarded $2.8 million from DOE to complete the detailed engineering. LEEDCo plans to fabricate, construct, and install Project Icebreaker in Spring 2017 and Fall 2017 and plans to commission North America’s first freshwater offshore wind project in 2018. (Kowalski 2014; LEEDCo 2015).

Erie County Convention Center Authority: Plans proposed for a $150 million overall development of the Erie municipal bayfront. The project is supported by Erie Mayor, Joe Sinnott. Current ongoing bayfront projects include hotel construction, bayfront pathways, and redevelopment plans for the 12.5-acre former GAF property, to include park, apartment and town houses, a hotel, a year-round marketplace, restaurants, and a parking garage (Destination Erie 2015; Flowers 2015).

On-Dock and Port-Served Industrial Property: DevelopErie controls 70 acres of industrial land on dock at the Port of Erie and has developed 12 port access roads; acquired 270 acres of rail serviced property in Albion and Conneaut Township in Erie County with direct rail connections to water ports on Lake Erie in Ohio and the Ohio River in Pennsylvania. DevelopErie serves as an agent for the Conneaut Port Authority in the effort to leverage and diversify the port’s freight capability through terminal and industrial development (DevelopErie 2015).

Lake Erie College of Osteopathic Medicine (LECOM) Senior Living Center: A $42 million five-story skilled nursing facility being built on land south of Millcreek Community Hospital in Erie. Construction is underway and nearly complete with the facility expected to open in 2015. This project was endorsed by the Pennsylvania Department of Public Welfare (DPW), Millcreek Health System and Erie County Council on behalf of Pleasant Ridge Manor (LECOM 2013).

Gannon University Expansion of Athletic Center: A $12.5 million renovation and expansion of the student recreation and athletic facility that will upgrade and modernize the existing facility and add a new indoor synthetic turf field house; a two-story expanded cardio, strength and fitness area; spaces for the school’s new acrobatics and tumbling program and its existing wrestling program; a varsity weight room; multipurpose rooms; a Performance Center; and lounge area. (Attwood 2013).

Erie Insurance Expansion: Two buildings acquired by Erie Insurance, the former CF Adams building and the Pennsylvania National Guard Armory, will be renovated and a technical learning center will be built. The renovation will result in the creation of the Erie Insurance Heritage Center, additional office space, and a three-story building that will be a hands-on learning facility for adjusters, loss control, underwriting and agents. Renovation and construction of this LEED certified facility were scheduled to be completed by the end of 2014 (YourErie 2013).

Other Regional Energy Developments: Currently, there is some ability to transmit electricity between Canada and the U.S., with the existing points of interconnection occurring in New York, Michigan and Minnesota. Presently, there is no capability of directly exchanging electric energy across Lake Erie into the PJM grid. The Applicant is not aware of any similar planned developments involving the installation of transmission capacity that would connect the grid in Ontario with the PJM grid in the U.S. The offshore Icebreaker wind power project proposed north of Cleveland would provide a new regional power source, but likely link to the existing utility grid in the Cleveland metropolitan area. Once the Project is operational it may influence the development of other future energy delivery facilities or increase the potential for other development in the PJM service territory that must rely on reliable power availability to be viable.

6.2 Cumulative Impacts to Resources

The following is a summary of the potential cumulative impacts that may result from the Project construction and operation, in relation to the current and anticipated developments identified in Section 6.1. In general, there are no significant long-term physical impacts associated with the proposed Project that would adversely impact the long term regional environment or negatively influence the possibility of future development of other projects within the local or regional area. This includes the projects described in Section 6.1 as well as future, unknown regional development projects. By introducing new, reliable electrical power to the regional utility service territory, the Project operation could foster the potential for considerable development in the long run in areas not currently considered economically viable for certain types of development. The type of development that may cumulatively occur is not possible to predict, but the potential for future development would be enhanced by the Project.

Environmental resources analyzed and discussed in Sections 4 and 5 and that are subject to negative long term Project impacts are limited for the most part to portions of the Underground Segment of the Project, including the new Erie Converter Station. Short term cumulative impacts caused during the construction period will occur in context with other construction efforts proceeding at the same time. The Project location is a considerable distance of several miles from the other identified project development sites, and as a result there is minimal potential for multiple construction activities causing overlapping cumulative effects on local or regional resources. By burying the cable throughout the Project route, the applicant has designed the Project in a manner that minimizes the long term alteration of existing environmental resources and land or water uses, and thus avoids any significant contribution to the cumulative effects that would be created by the development of the multiple projects identified in Section 6.1.

The existing resources potentially impacted by the Project and the contribution of those impacts to the cumulative, regional environmental impacts associated with the collective developments discussed in Section 6.1 are summarized below:

<u>Water and Land Use</u>: The incremental environmental effects from the Project construction and operation are not anticipated to result in a significant cumulative impact on existing or future land or water uses when combined with other existing or reasonably foreseeable future projects in the region. During construction, the presence of construction vessels and equipment in and on the lake and at the shoreline HDD area will not significantly contribute to regional impacts on current water uses on the lake or preclude other water-based activities from taking place concurrently. The Applicant will coordinate with other water-based users to proactively

communicate its construction schedule in order to avoid any potential conflicts or temporary cumulative impacts with other users. On land, there will be temporary impacts on existing land use associated with the installation of the Underground Segment cable within the existing road corridor. Construction vehicles and equipment will temporarily disrupt existing vehicle traffic flow and impact some adjacent landowners. Crossing of wetlands and waterbodies to install the cable will temporarily add to the cumulative regional impact on these resources, but once site restoration is completed there will be a very minor long term impact to regional wetland and surface water resources associated with the temporary only impact of 0.8 acres and permanent impact of 1.0 acre of existing wetlands. Given its locational distance from other regional construction activities potentially occurring at the same time, the Project construction effort should not negatively impact or conflict with other water or land uses occurring in the region, nor significantly add to the cumulative impact on these resources. In contrast to other planned industrial and commercial developments that would involve construction and development activities and permanent alterations to stormwater runoff and drainage patterns close to or along the Lake Erie shoreline (i.e., Erie County Convention Center Authority municipal bayfront development and the DevelopErie industrial improvements), the use of an HDD cable installation method avoids direct impacts to the Lake Erie shoreline area.

Once installed, the underwater cable within the Lake Segment will be buried and not create any cumulative impact to the existing underwater environment, lake currents or lake use within Lake Erie. Likewise, once the cable along the Underground Segment is buried and post-construction restoration occurs, there will be no significant long term impact to current water or land uses within the Project ROW, except for the permanent wetland loss mentioned above and the change in land use associated with the Erie Converter Station site. The Erie Converter Station will be located approximately 1,500 ft from the existing Erie West substation, which cumulatively adds a second nearby utility facility to an otherwise rural area.

<u>Geology and Soils</u>: During construction, temporary soil removal within the Underground Segment and the HDD entry points of the Lake Segment will temporarily affect existing geology and soil resources. These impact areas will be stabilized upon Project completion and the resultant long-term impacts to existing soils and geologic resources will not contribute significantly to the cumulative regional impact on these resources. The Project will also not affect any future aggregate dredging and removal activities occurring in the lake to the west of the Project Lake Segment. In comparison, if built, the commercial and industrial development projects included in Section 6.1 would potentially involve excavation and civil site work that would permanently alter soils and existing contours on a broader, long term scale and add new impervious areas to the regional landscape. The Project will not result in any new impervious area nor remove and replace existing soils with the exception of the Erie Converter Station development footprint. This six-acre development site and related, adjacent stormwater treatment area will be a minor contributor to the cumulative effects on regional geology and soils. Use of construction related BMPs and long term stormwater management measures will minimize these effects.

<u>Aquatic and Terrestrial Habitat and Species</u>: The potential impacts to the aquatic lake environment and associated fish and aquatic species will be temporary and occur during the construction period only. Once buried in the lake bottom, the long term impact on aquatic habitat and species will be negligible. With the exception of the Icebreaker offshore wind energy project, the regional projects identified in Section 6.1 are each land based developments. Those proposed projects that are located near the Lake Erie shoreline and the proposed Icebreaker

offshore wind energy project would potentially impact aquatic habitat through the introduction of stormwater runoff into the lake and through the existence of six offshore wind turbines and related underwater infrastructure. In contrast, there will be no long term cumulative effects on regional aquatic habitat and species in Lake Erie associated with the Project.

Vegetation and soil removed to accommodate Project construction along the Underground Segment will temporarily alter terrestrial habitat, and where the underground route segment is located away from existing roads the change in vegetation will add to the cumulative alteration of terrestrial habitat. This specifically involves the approximately 3,000-ft segment of the underground route between landfall and where it meets Route 5 and turns northeast. This currently forested area will be altered to become a cleared area with a grass, or scrub/shrub environment that is maintained to provide reasonable access to the buried cable in an emergency. These long term impacts to existing terrestrial habitat would be minimal and would not significantly contribute to the amount of cumulative terrestrial habitat impacts associated with the developments stated in Section 6.1.

<u>Protected and Sensitive Species</u>: Construction and operation of the Project will cause no significant contribution to the cumulative impact on regional protected species within either the Lake Segment or the Underground Segment of the Project. Some loss of forested habitat between the Lake Erie shoreline and Route 5, as well as between Route 20 and Springfield Road, will permanently remove a narrow corridor of trees that could potentially serve as avian and bat habitat for protected species. In addition, vegetative clearing associated with the development of the new Converter Station will permanently alter the existing landscape, but protected species will not be displaced. Permanent loss of regional forested habitat associated with the other developments identified in Section 6.1 may be much greater where new areas are being cleared and replaced with pavement or structures. In comparison, the Project impacts on protected species will be a very minor contributor to the permanent, cumulative alteration of available habitat for protected species regionally. Also, the developments identified in Section 6.1 are located so far away from the proposed Project that they would likely not cause significant impacts on the protected and sensitive species identified as potentially present in the Project area.

<u>Cultural Resources</u>: Cumulative impacts on existing cultural resources caused by the Project will be minor. In addition, Project-related surveys that identify shipwrecks and other lake bottom cultural resources will add to the collective cultural knowledge base for Lake Erie. Other regional developments will be subject to federal and state regulation of existing and potential cultural resources, requiring minimization and potentially mitigation of impacts. The incremental effect from the Project on the existing cultural landscape will be a minor contributor to the cumulative changes in cultural resources caused by planned or unplanned future developments. Given the linear nature of the Project, particularly within Lake Erie, additional knowledge concerning regional cultural resources that results from Project related studies would enhance the cultural database and historical perspective in a regionally significant manner.

<u>Aesthetic and Visual Resources</u>: The Converter Station is the only above-ground structure in the Project area that will alter the regional visual landscape, with the exception of the permanent tree clearing that will occur in a narrow segments along the Underground Segment route. These long term visual impacts would create a minimal effect on the cumulative aesthetic resources within the Project area or adjacent local region. During construction there will be temporary visual impacts caused by the presence of construction vehicles and equipment and earthwork at the construction site. This could cumulatively contribute to visual impacts caused by any other local

construction or clearing activity that is scheduled at the same time. Any such impact would be localized and temporary. The addition of the new Converter Station approximately 1,500 ft from the existing Erie West substation, cumulatively adds a second nearby utility facility to the visual landscape in an otherwise rural area. From a regional aesthetic perspective, the burial of the Project facilities and co-location of the underground segment primarily within an existing roadway corridor allow the Project to fit harmoniously with the existing rural nature of the regional setting and the undeveloped conservation land in adjacent Erie Bluffs State Park. Development of the commercial and industrial projects noted in Section 6.1 would have a significantly greater impact on regional aesthetic resources.

<u>Noise</u>: Temporary construction noise will be generated by the Project, as discussed in detail in Section 5.9. Noise will occur periodically throughout the construction process, primarily as a daytime event. The duration of construction and associated vehicle noise impacts will be greatest at the Erie Converter Station site (where 12 to 18 months of site work and equipment installation is anticipated) and noise generated by the construction effort will likely be loudest in association with the Lake Erie shoreline HDD effort over a three-month period. The Applicant will coordinate closely with local officials and landowners to minimize the instance of concurrent or conflicting construction activities by other local parties that could compound potential noise impacts and present other logistical conflicts. Any long-term noise associated with the operation of the Erie Converter Station would cumulatively be added to the noise generated by the existing Erie West substation, approximately 1,500 ft away. The Project's contribution to the cumulative long-term noise impact within the general vicinity of the proposed Converter Station and existing substation would be limited to a minimal impact on a very small number of potential residential receptors. There would be no cumulative impact associated with the potential noise generated by the construction or operation of the projects described in Section 6.1, particularly given the long distances between project sites.

<u>Public Health and Safety</u>: The construction and operation of the Project would be conducted in compliance with OSHA and related local, state and federal safety regulations. The Applicant places a high priority on public health and safety and will ensure that proper procedures are in place prior to construction activities to minimize the risk of accidental injury. Burying the Project cables, which are shielded, greatly minimizes the potential long term risk to local public health and safety. Signage and security measures at the Erie Converter Station would deter access to high voltage equipment and close-range exposure to electromagnetic fields. Local and regional dig-safe procedures would serve to prevent accidental underground cable encounters. There is no anticipated cumulative effect on the health and safety of the regional population that would be caused by the Project in combination with any currently known or reasonably foreseeable future development projects. The addition of new electrical power to the regional utility grid could serve future unplanned development activity within the electrical service territory. It is possible that some of these future regional developments might have an impact on public health and safety, either positively or negatively.

<u>Infrastructure</u>: The presence of both the Lake Segment and Underground Segment will limit development of additional infrastructure projects within the immediate vicinity of the Project development footprint, but will not preclude the co-location of adjacent linear facilities or the perpendicular crossing under or over the cable route. No additional infrastructure or modifications to existing regional infrastructure will be needed to install or operate the Project. When added to the projects under consideration that are identified in Section 6.1, and in combination with other water-based and land-based infrastructure currently in place, the Project

would have a very minor effect on the cumulative regional infrastructure as it currently exists. However, the addition of a considerable amount of new electricity to the regional utility grid would provide for future regional development throughout the electrical service territory. The cumulative impact of adding new, reliable power to the region over a long period of time could foster future infrastructure development to provide power to existing and future market areas and generally increase the potential for development where it currently has a low potential to occur.

Hazardous Materials and Waste: Some hazardous materials (hydraulic fluids, diesel, gasoline) will be necessary to conduct Project construction activities, but proper precautions regarding the storage and use of these materials will be integrated into the Project construction plan. In addition, there are no known hazardous materials present along either the Lake Segment or the Underground Segment routes and the installed cable facilities will not contain any hazardous materials. Consequently, the cumulative environmental effect associated with the Project and other planned or foreseeable regional development projects will be negligible.

Socioeconomics: The Project will create temporary construction-related jobs and permanent jobs to operate and maintain the facility. At its peak, construction of the Erie Converter Station will result in 125 temporary construction jobs, and an additional 185 non-construction related temporary jobs. Full time permanent jobs created for operating the Erie Converter Station and maintaining the Project cables would be 10 full time jobs. Additional temporary jobs will be created for the construction of the underground and underwater cables. The socioeconomic impact of the Project, particularly during construction, could add to the cumulative need for construction jobs and equipment if other large-scale developments, such as those identified in Section 6.1, are built in the same timeframe. Current information on the timing of other planned or foreseeable development projects does not indicate that qualified staff would be unavailable to construct the Project as currently scheduled. Long term impacts to the regional economy from employment will be relatively small and not contribute significantly to the cumulative economic environment.

However, the significant addition of new, reliable energy delivered to the regional electric service territory because of the Project operation would significantly add to the cumulative availability of regional energy. The positive long term effects on commercial, industrial and residential utility customers will be significant and long term. The positive effects from increased electrical availability and distribution throughout the region would cause a long term cumulative impact on the potential for future development, including increasing the viability both of planned and unplanned projects.

Environmental Justice: There are no environmental justice populations present within the proposed Project area and no areas of concern, as defined in the PADEP Environmental Justice Public Participation policy. Consequently, neither the construction nor the operation of the Project contributes to the cumulative impact on any EJ population within the overall region.

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APPENDICES

APPENDIX A

ITC LAKE ERIE CONNECTOR: UNDERGROUND SEGMENT ALIGNMENT MAPS

APPENDIX B

U.S. UNDERWATER ALTERNATIVES AND UNDERGROUND ALTERNATIVE 1

APPENDIX C

U.S. UNDERWATER ALTERNATIVES AND UNDERGROUND ALTERNATIVE 2

APPENDIX D

UNDERGROUND SEGMENT – USDA SOILS MAPS

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APPENDIX M

WATER WELL ASSESSMENT

(Main body of the study report and figures)